PUBLIC DOCUMENTS OF MAINE:

1905

BEING THE

ANNUAL REPORTS

OF THE VARIOUS

DEPARTMENTS AND INSTITUTIONS

For the Year 1904.

VOLUME I.

AUGUSTA
KENNEBEC JOURNAL PRINT
1905

GENERAL VIEW OF THE CAMPUS, UNIVERSITY OF MAINE.

AGRICULTURE OF MAINE.

THIRD ANNUAL REPORT

OF THE

COMMISSIONER OF AGRICULTURE

OF THE

STATE OF MAINE.

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DEPARTMENT OF AGRICULTURE.

To the Honorable Governor and Executive Council of Maine:

In compliance with chapter 204 of the Public Laws of 1901, I herewith submit my third annual report as Commissioner of Agriculture of the State of Maine for the year 1904.

A. W. GILMAN, *Commissioner.*

AUGUSTA, January 1, 1905.

ANNUAL REPORT OF THE COMMISSIONER OF AGRICULTURE.

In reviewing the agricultural situation for the past year we are impressed with the importance of this industry to our State. The agricultural interests of Maine are among the foremost interests of the State. In the year 1903 we harvested 1,240,230 tons of hay, and the amount of grain and potatoes raised approximated 24,000,000 bushels. More than 17,000,000 bushels of potatoes were raised in that year, the crop being exceeded by that of only three states in the Union,—New York, Pennsylvania and Michigan. The crop of 1904 was still larger, reaching nearly 20,000,000 bushels. The estimated value of the livestock on April 1, 1904, was $14,136,062, and the annual dairy products of the State alone are valued at nearly ten million dollars.

We are glad to note an awakening of interest in agricultural operations, and believe that interest needs to be still further aroused. The time seems to be ripe for a widening of agricultural efforts. Our farmers should employ all the machinery available, to increase the output of the farm and decrease the cost of production. We have endeavored to impress upon them at our farmers' institutes that they should see that every acre of the farm is doing its utmost. The farming should be made intensive first, and afterwards extensive as far as the farmer is able to extend his operations to advantage. Each individual farmer should study his own situation and use as much capital, machinery, commercial fertilizer and labor as he believes can be profitably invested, to increase his income and add to the fertility of his acres, making them more rich in available plant food. A careful study of the nature of the soils should be made, in reference to the particular crops for which they are best adapted, and also of the requirements of those crops in regard to culture and plant food, in order to grow them intensively.

Most of the crops during the past season yielded an abundant harvest. The hay crop was fully up to the average and of good quality. A large yield of potatoes of excellent quality was secured, and they are not affected by rot to any great extent. It has been demonstrated that potato culture can be carried on as profitably and successfully in the central portions of the State as in the northern portions. Experimental fields that have been raised under our observation warrant the above statement. The season was not very favorable for the corn crop, it being a partial failure in many sections. Of late years corn has been an uncertain crop for the farmers of Maine, on account of the cold seasons, but we believe that it is one of the valuable crops, and farmers should by no means be discouraged in the raising of corn. Corn is King. If it does not fully develop, it is worth all that it cost for green fodder. There is a difference of opinion among the farmers of the State in regard to the best method of curing this crop. The majority, however, if they have large fields, have adopted the system of cutting it for the silo. It is easily harvested in this manner, is always relished by the stock, and is the most desirable and cheap succulent food that we can furnish them for winter feed.

A good crop of apples was harvested. These were usually of good color and keeping qualities, but of small size.

The low prices of many farm products during the fall and winter have been a source of discouragement to some farmers; but the farmer who keeps persistently on his course, raising products of the best quality, and carefully studying economy in production, will find that there will always be a market for his products and that, taking one year with another, he will realize a satisfactory income.

During the past season our attention was called to a new menace to our orchard interests in the form of that dangerous pest, the brown-tail moth. Early in the spring a letter was received from Clarence M. Weed, State Nursery Inspector of New Hampshire, stating that one of his deputies had found that this insect had passed over the river at Kittery and was present in two small pear orchards in that town. We immediately wrote to the director of the Experiment Station at Orono, asking that a competent entomologist be sent to investigate the matter. Early in April Miss Edith M. Patch, entomologist for the Station, visited Kittery and vicinity and reported that the small pear orchards and scattering pear trees in the village were badly infested with winter nests of the brown-tail moth. Nests were also to be found, to some extent, on cultivated and wild cherry trees in the vicinity, elms along the street and apple trees. The infested district, as far as she was able to judge, could be enclosed in an area of one-half mile square. After consultation with the Pomological Society, and with their co-operation, the matter was presented to the Governor and Council and authority was given to the Commissioner of Agriculture to use such means for the destruction of the pest as the emergency seemed to demand. The services of Mr. G. A. Thompson, deputy nursery inspector of New Hampshire, were secured. Mr. Thompson procured the assistance of men who were also accustomed to the work, and in co-operation with the officials of the town of Kittery, a systematic and thorough campaign against the pest was organized. The selectmen and citizens of the town manifested great interest in the matter, doing all in their power to aid us, and practically all of the winter nests were secured and burned, thus preventing any serious injury during that season. During the latter part of the summer several reports were received that the moths were present in large numbers at the Navy Yard in Portsmouth and were finding their way into some of the towns in the southern part of the State; also that they were being carried by boats to some of the coast cities and towns. We fear that this pest will be a serious menace to our State the coming season unless measures are taken to control it.

OUR DAIRY INTERESTS.

The dairy industry still holds its place in the foremost rank among our farming industries. From April 1, 1903, to April 1, 1904, there was an increase in the number of cows as reported by the local assessors to the State assessors, of more than 6,000. There has been an advance in the quality of our dairy products and an improvement in methods, due to a large extent to the untiring efforts of our Dairy Instructor. The work of the Instructor during the past year has been carried on systematically, by counties. He has visited the creameries and cheese factories, giving information and assistance in the work and co-operating with the managers for better products and cheaper production, thus bringing better prices to the producer. He has also visited the patrons and private dairymen, testing milk and cream when desired, giving aid and instruction, and trying in every way to improve the dairy practices and assist in producing a more uniform product and one that will bring a higher price in the market. A better relation is being established between the producer and manufacturer, and there is a growing tendency towards co-operation along all the lines of this industry. The report of the Instructor will appear in this volume.

FARMERS' INSTITUTES.

The farmers' institutes held during the past year have been generally well attended, and a good interest has been manifested. The interest in these meetings and applications for them are continually increasing. This class of meetings is especially instituted as a medium through which to reach the farmer who has passed the age when he can attend an agricultural college or other institution. The absence of agricultural instruction in our elementary schools makes it of more importance that the farmer receive definite information regarding improved methods of agriculture and the principles which lie at the foundation of progress in agricultural practice. It is the purpose to take the latest discoveries or developments in scientific agriculture and place them before the common farmer in such a manner that they may be thoroughly understood; also to give the farmers the practical experience of those who have been most successful in agricultural lines, and the stimulation resulting from contact with each other and a discussion of their work. An endeavor is made at all times to have the subjects of practical interest to the localities in which the meetings are held. While the publications of the office may reach a larger number of people in the aggregate, in our opinion more direct and immediate benefits can be given to the farmer through the institutes, as the publications must be of a general nature, while the institute lecturer who is successful will grasp local conditions and help the farmer to understand how to apply the principles and practices he is trying to teach. The question box has been given a more prominent place in the institutes during the past year than heretofore. This feature seems to add interest to the meetings, bringing out information on subjects which immediately concern the farmers.

Forty-two institutes have been held, located in all the counties of the State. The following are among the subjects which have been treated: Dairying, Fruit Culture, Fertilizers, Soil Making and Preservation, Corn Culture, Potato Culture, Pork Production, Poultry Culture, Soil Cultivation, Plant Life, Agricultural Education, General Farming, Stock Raising, Sheep Husbandry, and The Farmer's Home.

The speakers from out of the State have been as follows: Prof. F. W. Rane, Durham, N. H.; Prof. J. L. Hills, Burlington, Vt.; Prof. S. T. Maynard, Northboro, Mass.; David S. Kelsey, Hartford, Conn.; C. E. Chapman, Ithaca, N. Y.; C. B. Hoyt, Sandwich, N. H.; Prof. F. W. Taylor, Durham, N. H.; and P. M. Harwood, Boston, Mass.

The institutes have been aided much by the practical, successful agricultural people of the State. As they are so familiar with the conditions and circumstances which must be thoroughly understood in order to obtain the best results, they play an important part in the farmers' institutes. The press has also rendered much assistance in calling attention to these institutes and in arousing the people to the necessity for a better education on these subjects with which they are coming in contact every day. Their words of encouragement have strengthened the agricultural sentiment for improved methods and more thorough work.

AGRICULTURAL SOCIETIES.

A good degree of success was attained by the agricultural societies of the State in their annual fairs the past season. The exhibitions were generally of a high character. We note a disposition on the part of the officers of most of these societies to adopt the suggestions that we have offered in relation to making the fairs more educational. The State has a right to expect that the exhibitions shall be made of real value. Further effort is needed to elevate the standard of the exhibitions and increase the practical benefit derived from them. There is an opportunity for these fairs to do a great work in the education of the farmer. In many instances the premium list might be revised with profit, cutting down the number of classes and increasing the premiums on economic value. As the financial success of these exhibitions depends in so large a measure upon the weather conditions, we would suggest that it would be wise for the societies to establish a sinking fund into which a portion of the profits in good years might be paid to meet the deficiency that is sure to come in bad years.

The following figures show the business of these societies for the year 1904:

Number of horses and colts exhibited	1,495
Number of neat cattle exhibited	5,928
Number of sheep exhibited	1,092
Number of swine exhibited	501
Number of poultry (coops) exhibited	2,441
Amount of premiums and gratuities awarded	$22,457.24
Amount of trotting purses	20,773.87
Per cent of premiums and gratuities to total awards,	52
Per cent of State stipend	38.9
Number of societies receiving stipend	44

ENFORCEMENT OF LAWS.

Any suspected violation of the laws which it is the duty of the Commissioner of Agriculture to enforce, which has been reported to the office, has been promptly investigated.

The State Dairymen's Association at its annual meeting in Auburn, Dec. 13-15, discussed the dairy laws and found them deficient in giving the Commissioner of Agriculture proper authority to thoroughly protect the dairyman's product from imitation and adulterated butter. The Association will recommend some new laws and such changes in existing laws as in their judgment are necessary to better protect the interests of the dairymen of the State.

The law of 1903 in relation to commercial feeding stuffs has been productive of much good. The feeding stuffs brought into the State have been of higher order and a purer quality, and but very few cases of adulterated feeds have been brought to the notice of the Commissioner since this law was passed. The dairymen and feeders of Maine have expressed themselves as being largely benefited by this law.

PUBLICATIONS.

The publication of our quarterly bulletin has been continued. The demand for this bulletin and the commendations that we have received would indicate that it is highly appreciated by many of the farmers. Special pains has been taken to make it of value to the large number of farmers which it reaches. Articles have been contributed to it by some of the best informed and most progressive agriculturists in the country, as well as by many of our most practical farmers. The condition of the growing crops in their season has been carefully reported.

The requests for the annual report of this department have increased in number during the past year. We have been unable to supply the demand with the number at our disposal. Many urgent requests for back numbers have been received, and the supply of nearly all these is entirely exhausted. Any persons having duplicate copies would confer a favor by sending them to the office.

INDUSTRIAL AND AGRICULTURAL EDUCATION.

In this, our annual report, we wish to again emphasize the importance of agricultural instruction in the public schools of Maine. A sentiment in favor of industrial and agricultural education is growing steadily. Maine is becoming each year more of an agricultural state. It is destined to be the great agricultural district of the East. The State Dairymen's Association at its annual meeting in Auburn, Dec. 13-15, adopted the following resolution: "Resolved, that this association favors such legislation as will provide for industrial education for those who are being trained in the normal schools to become teachers in the schools of Maine."

That great organization, the State Grange, put itself on record at its last annual meeting as strongly favoring a more extended education along these lines. The citizens of the State at large are becoming more thoroughly convinced that education in the line of the pursuits which are to be followed will do much towards fitting the youth to become citizens of usefulness, and that an industrial education will aid much in the development of the State. Our State, in its agricultural development, will keep abreast with her sister states only so far as the same amount of attention is paid to her educational needs in that direction. We are each year growing more firm in the opinion that our normal schools can never do their best and fullest duty to the State untll they furnish an agricultural course. This question will, we trust, be considered the present winter by the State Educational Department, and it is hoped that the persons who have this matter in charge will see their way clear to give this branch of education the attention it should receive.

INSTITUTE PAPERS.

SOIL MAKING AND MANAGEMENT.

By JOSEPH L. HILLS, Dean Agricultural Department, University of Vermont.

> "To him who in the love of Nature holds
> Communion with her visible forms, she speaks
> A various language."

To the farmer who dwells in her very habitation, who greets her in farm, field and forest, who notes her sad as well as her joyous moods, to him more than to any other man "she speaks (her) various language;" and, alas, too often to eyes which see not and ears which hear not. Such an intercourse ought to be not only an inspiration to higher thought, but also—seen from the sordid but necessary view point of dollars and cents—a source of financial profit as well, for he who works understandingly outstrips him who is ill informed. The farm hand who knows how a mowing machine is built is more likely on that account to use it well. And, similarly, the farmer who has some concept of soil geology, soil chemistry, soil biology and soil physics is far more apt to practice soil economics.

Too often but little thought is given to the soil. The very word spells contamination to many, to think of it breeds contempt. The phrases "as common as dirt," "as cheap as dirt," are frequent in our mouths. The words are not synonymous. Dirt is "matter out of place;" soil, the great mother of us all, for whom we should have respect and love rather than the reverse.

Neither farmer, chemist, physicist, biologist, geologist, nor all the scientists and all the workers in the world put together can tell us all there is to be known about the soil. They have each contributed something to the telling of the story. We know more about it today than we did yesterday; and since we are learning more rapidly today than ever before we are sure to know more about it tomorrow than we do today. Not only do we know more about the soil than we used to, but, knowing more about it, we know better how to use it, as well as how not to use it. We know better than did our fathers or our grandfathers how to doctor a sick soil, and better how to keep it from getting sick. We know more, as it were, about soil medicines. We see more clearly the results of abuse and ill treatment. We have learned more about the fitness of some soils for certain services and of other soils for different ones. In other words, broadening knowledge as to the origin and making of soils has led to more intelligence in their use.

Let us then with much brevity—for many months are given to the study of this matter in our agricultural colleges—outline something of what the geologist, the chemist, the biologist and the physicist have to say as to soil making and soil management. Obviously much must be omitted and much very inadequately treated.

What does the geologist tell us as to soil making? He tells us that soil is born of rock, that the grittiness of soil is caused by the small rock fragments which make up from 90 to 98 per cent of its dry weight. The only difference of much account between some barren soils, such as beach sands and brick clays, and some rocks, such as sandstone and slate, are that the one is powdered and the other is compressed. Sandstone and slate were both far back in the countless ages which have elapsed since the world was born, simply sand and clay, which, through pressure, heat and other agencies, have turned into stone. And one can now see at many points the opposite processes going on, the sandstones and clays disintegrating, breaking down, decaying and forming sands and clays.

Another indication of the rock origin of soil is found in the fact that the soil everywhere rests on rock. This rock blanket, as the soil has well been called, may be as thin as the flimsiest of summer blankets or thousands of feet deep, as in some parts of China; but sooner or later, if one goes deep enough, is found the underlying rock. The two—soil and rock—are really one, differing in many ways to be sure, but still one.

There have been two kinds of forces at work in the making of soil from rock; forces acting from within and forces acting from without. The internal agencies, such as volcanoes, earthquakes, hot springs and the like, were very important factors in soil making when the world was young, and the rock crust thinner than it is today, and when, too, their mighty power was less restrained than it is now, when the solid rocks are unknown miles in thickness. The external agencies, the effects of heat and of cold, of wind and of wave, of water and ice, of frost and snow, of flood and rain, of solution and of transformation; in short, the multitudinous direct or indirect effects of the weather have been at work for ages, are working today and will continue to work until time shall be no more. They are the great rock destroyers, the great world renewers, the mighty soil makers. Each blow they strike of itself counts but little, but they never cease in their work. No eight-hour day limits their energies. The volume of the work they do and have done is stupendous in the gradual wearing away, breaking and crumbling of the exposed rock forming the basis or mineral portion of the soil.

The weather's work is easily seen in every direction. The gullied field, the crumbling cliff, the rotting stone, the fractured boulder, the seamed and cracked precipice face, the deep groove of the canon tell the story. Countless home illustrations which might be cited tell the tale of the weather's work. To the trained eye the configuration of a landscape is eloquent as to the manner of its making.

So homely and common a thing as a stone wall illustrates the weather's doings. Whenever stone has lain exposed to the weather for a long period of years it shows this disintegrating effect more or less. Some kinds show it slightly, others greatly. The outside will be apt to be notably softer than the interior. It will chip off readily, perhaps even crumble in the fingers; it may be rusted a bit. But the inside of the stone will be found hard and unchanged. It is this softened material which falls off and to pieces, decays as it were, and forms the basis of soil.

How does the weather rot these stones? In the first place water dissolves out some of the rock constituents, particularly lime and iron. This honeycombs it and enables the water to penetrate the rock better. Then when this water freezes it expands and tends to split the rock or put it under a stress and to open more crevices for more water to enter, to freeze again, to exercise more expansive force, and cause more breakage. Thus gradually, in the countless years of time, exposed rock surfaces tend to crumble and form soil.

You have all seen the rounded pebbles and rocks lying in the bed of the brook. They are never angular, like other stones, but are always smooth and rounded. How came they thus? Through the wearing effect of rock grinding against rock, of pebbles against pebbles, as they are borne onwards by the current of moving water. This wearing away or erosion of the pebbles or other material occurs wherever water flows with much speed. Since matter is indestructible, the eroded or rubbed off material is borne away in solution as mud to settle along the banks of the stream or be borne to sea.

In times of heavy rains, freshets, overflows, etc., much actual soil already made is thus transferred as well as new soil made. This mixture of new and old material, eroded by the force of the stream and borne on the muddy current, overflows, fertilizes and makes new many a river meadow. In fact, it is this frequent addition of alluvial (water made and borne) soil which makes the overflowed meadows eternally fertile. It was in this way that the flood plains of our rivers were formed. The river water, laden with eroded soil, carried its load without depositing it where the current was swift; but when the long, low levels were reached and the velocity of flow slackened, the load was dropped; and thus, as the years went on the flood plains or flowed meadows formed.

The eroding power of water makes both for good and for evil. It both builds and tears down. Oxbows are built up in part at the expense of the soil on the other and concave side of the river. In sections where through an injudicious use of the one crop system and through inattention to animal husbandry the humus content of the soil becomes seriously diminished, the soil is apt to become gullied or washed and to lose much of its surface material by way of the rivers. This condition is a serious menace to southern agriculture, but is relatively unimportant in New England.

Much of New England's soil is actually a product of King Edward VII's domains. How can this be? Countless ages before that genial monarch or any of his predecessors of that name were born, perhaps before man was created, a great sheet of ice, many thousands of feet in thickness, came sweeping down over the Northern Hemisphere. All New England, New York, and the Middle and Far West north of the Ohio and Missouri (speaking roughly) were covered by this great ice cap. We do not know why it came, or, having come, why it did not stay. But come it did and go it did. Its course has been traced; the limits of its journey have been defined; its handwriting in the great book of nature has been deciphered. The stone walls that encircle New England fields are a mute testimony of the ice sheet's passage. Many a New England farmer's boy, straightening up with aching back from the task of picking stones from field and meadow has wondered how there came to be so many, many millions of stones scattered over his father's farm. They came down riding on the glacier from northern Canada.

If you look at a cut in the earth in many parts of the State, a railroad cut for instance, or a stream bank, you are apt to find that the soil is of a coarse, pebbly character. Its pebbles, rocks and boulders—for some will be quite large—are generally different in character from the solid or bedrock on which the soil rests. They may be made up of several different sorts of stone, granite, limestone or sandstone for instance, but they are a mixture and largely unlike the regular rock of the country. In other words, they are foreigners, emigrants from Canada by the glacial route rather than the Grand Trunk or Canadian Pacific.

This glacier moved slowly over the country, up hill and down dale, over mountain top and in the valley's depths. And New England's surface rocks were ground to dust in God's great mill of which the glacier was the upper and the whole Earth the nether stone. They were rubbed, crushed, powdered and made into soil which was picked up here, transported hither and thither and dropped there. The great glacier, in short, was a rearranger and shifter or nature.

There are glaciers in plenty today. Greenland and Alaska, for instance, are full of them. The former, in fact, is covered by one great glacier. And they are doing there today what they did here ages ago. The writer has clambered over one of the great Canadian glaciers in British Columbia, has seen its lower layer laden with dirt, with the fragments of rock which are its rasping and grooving tools, making it, as has well been said, like a huge sandpaper. He has seen the river emerge from the foot of the glacier, white as milk with the finely pulverized rock, ground by the glacier's pressure as fine as the finest flour. He has seen at its foot and on each side, hundreds of acres of rocks, pebbles and boulders scattered in confusion, the debris of the glacier, just such rocks as have kept New England farmers' boys from getting lazy.

Now the great glacier of prehistoric times, though it covered, rasped and scarified the whole countryside, did not leave every acre in the same condition. As the ice melted, as of course it finally did, for it did not run backwards up north again, it laid down for good and all its burden of dirt and clay and rock flour. When this great melting came, different areas were differently topdressed as it were, some with a thin layer of soil and some with a deep one and some with none at all, the bare bedrock being exposed. On some farms but few and on others a great many rocks were dropped. Considerable hills were thus formed in some places. Martha's Vineyard and Nantucket, off the Massachusetts coast, Bunker Hill and Dorchester Heights of Revolutionary fame in Boston are glacial hills.

Then, too, the vast streams of water which flowed from the melting glacier were factors in the sorting of rock and soil. They carried off a large share of the finer particles and left the coarser ones. Many of the clay banks and gravel beds of today are glacier formed. The hills and plains of southeastern New England are hills and plains largely because of glacial debris and glacial water sorting.

Hence it is that where the glacier has been the soil is not apt to be "strong" as the farmer calls it. It is not as readily tilled as the stone free soils of the prairies, but it is seldom "exhausted," common notions to the contrary notwithstanding. New England soils properly tilled can yet bear harvests for centuries to come.

What has the chemist to say as to the soil? He says in the first place that he has not learned all there is of soil. He cannot, for instance, today, analyze soil and, with certainty, prescribe for its needs. He can, however, tell us something as to the make-up of the soil and give us some conception of its needs. He tells us that there are some seventy or more elements, but that only fourteen of these enter into the plant's bill of fare. Plants are rather particular beings. They insist that their bill of fare shall be a complete one. They sulk and, indeed, starve to death if any one or two of these be omitted. So far as is now known, every one of these elements is essential to plant growth. Four of them are derived from the air and ten from the soil; eight of them are non-metallic and six of them are metals. The air-derived elements are carbon, hydrogen, oxygen and nitrogen, all non-metallic; while the ten soil-derived elements are phosphorus, silicon, chlorin and sulphur, which are non-metals, and potassium, sodium, calcium, magnesia, iron and aluminum, which are metals. He tells us, too, that more than ninety-five per cent of the entire structure of the average plant is air derived. Every living plant contains much more water than any other constituent, some lettuce, for instance, carrying as high as 96 per cent. A large part of the material other than water is composed of carbonaceous matter, which is readily destroyed by fire. The directly soil derived material is represented by the ashes, which, though they constitute but a small proportion of the total weight of the plant, are absolutely essential to its growth.

Had we time and space it were of interest, perhaps, to tell the story of all of these fourteen elements, to tell the wonders of carbon, found pure in the diamond or in the graphite of the lead pencil, of the wonderful way in which coal (more or less pure carbon) is formed; of silicon, which forms with oxygen the backbone or skeleton of the world; of aluminum, that wonderful light, non-tarnishing metal which bids fair to revolutionize some of our industries. It does not seem necessary, however, for the reason that, while these elements are of interest, ten of the fourteen exist in every soil in such large quantities that it is inconceivable that they will ever become exhausted. There are four of these elements, however, which do become more or less readily exhausted from the soil and which, on this account, ought to be well understood by every one who has to do with agriculture.

Nitrogen, phosphoric acid and potash enter so largely into plant growth and are so apt to become more or less lacking in available forms in soils, that they form the main ingredients in commercial fertilizers and are justly called the deficient constituents of plant food. Lime is also worth studying, but space prevents. The chemist does not know it all, but he cannot tell all he knows in a nutshell.

NITROGEN.

Nitrogen is a colorless, tasteless, odorless gas. It comprises about four-fifths of the air and is a principal ingredient of flesh, milk, etc. It is useful in agriculture when united with other materials, in order, as it were, to bind it. When in the gaseous state only a few forms of plant life, the legumes or pod bearing plants, can make use of it. When it is combined with other elements in mineral or organic materials it is more or less available to all plants. Nitrogen is used on the soil in three forms, as nitrates, as ammonia salts and in organic matter. The first two of these are soluble in water, diffused readily through the soil, and therefore, are immediately available to plants, being taken up by the plant roots. The nitrates form no insoluble compounds with soil constituents and may be easily lost by leaching. The ammonia salts are less readily lost. The nitrogen derived from organic matter is insoluble in water and more or less quickly available according to its source.

Speaking broadly, plants assimilate nitrogen only in the nitrate form. It is necessary, therefore, that such as is present as ammonia or in organic matter be transformed into the nitrate shape before it can become of use. This change is brought about through the agency of bacteria, small living plant organisms found in the soil in great numbers, the process being known as nitrification.

If nitrogen is freely applied in fertilizers or is present in plentiful quantities in the soil, its effect is generally shown by a vigorous dark green leaf growth and by a somewhat retarded flower and seed formation. If available nitrogen is relatively lacking either in the soil or in the added fertilizer, a somewhat more scanty foliage than occurs under better conditions, one of a rather lighter green, is grown. The seed, moreover, is apt to mature rather earlier than usual. One may by careful observation judge somewhat as to the crop needs in this manner.

PHOSPHORIC ACID.

Phosphoric acid is a combination of two elements, phosphorus and oxygen, the latter a gas and the other a yellowish, waxy solid. It occurs in animal bones and other debris, in various mineral deposits, and in soil and ores. Like nitrogen it is useful in agriculture only in the combined state. The poisonous phosphorus or the virulent acid can only be used when they are united with other materials as binders. In bones it is combined with lime and organic matter, in the rocks, ores and soils, with lime, iron, alumina and magnesia. The salts or combinations are known as phosphates of lime, iron, alumina or magnesia, as the case may be. It occurs in the soil in a relatively insoluble form but is applied in fertilizer as soluble, reverted or insoluble phosphoric acid. The first named, soluble phosphoric acid, is soluble in water and readily taken up by the plant roots. The second, reverted phosphoric acid, while insoluble in water is usually sufficiently soluble in the acids of the soil and plant roots to nourish the latter. Being largely if not entirely assimilable by the plant roots, it is nearly as serviceable as the "soluble." The two together are termed "available" phosphoric acid. The third, insoluble phosphoric acid, is insoluble in water but is readily dissolved by strong acids, and it is but slowly taken up by the plant roots. The rate of its assimilation depends largely on the nature of the phosphate. The phosphoric acid from bone is much more readily used than that from rock, since the decay of the organic matter honeycombs it and puts it in a favorable condition for solution. That from rock, on the other hand, even though ground to an impalpable powder, resists solution almost indefinitely, except on very peaty soils or those containing much humus.

The phosphates, like the nitrates, are distributed throughout all soils, but available forms, in quantities sufficient to promote a large crop growth, are often lacking. This is particularly true in grain growing regions since grain is a heavy user of this ingredient. Seeds and fruit contain more phosphorus than does any other part of the plant. They do not develop normally and the plant fails to mature unless a fair supply of this element is available. Phosphorus acts in a manner opposite to nitrogen in this respect. Phosphoric acid liberally applied early in the season, unless its effect be counteracted by plentiful supplies of nitrogen, hastens maturity. Plump, full seed indicates plenty of available phosphoric acid while a shrunken seed or its failure to set may be due to its paucity. One may judge somewhat in this manner as to crop needs.

POTASH.

Potash is a combination or union of a silver-white metal, potassium, with the gas oxygen. It is a constituent of many minerals and rocks, which, on decomposing, crumble into small particles and furnish potash compounds to the soil. Thus it happens that potash is a common soil ingredient; but it is one which is tightly locked up in combination with silicic acid (the main ingredient of sand) and hence is but slowly available to the plants. Most plants, moreover, draw heavily upon the potash supplies of the soil. Hence it is not uncommon for plant life to show the effects of an insufficient supply of this constituent. The ashes of plants are rich in this ingredient. It is this material, united mostly with carbonic acid, which is leached by water from wood ashes forming the well known "lye." Potash exists in minerals, rocks and soils; in vegetable material and its ashes; and in special potash minerals or salts. The rock or soil potash is all insoluble and but slowly available; the vegetable potash is insoluble but available on the decay of the plant structure; that derived from ashes is largely soluble and highly desirable; while that obtained from the special salts (which furnish the bulk of the potash of the commercial fertilizers) is all soluble and all immediately available for plant purposes.

Potash bears a close relation to the starch, sugar and wood building function of the plant. Starch is formed in the leaves of the plant through the agencies of the sunlight and the chlorophyll or green coloring matter. But starch is insoluble and cannot pass through the plant tissues. In some way not thoroughly understood it becomes sufficiently changed so that it can permeate the cell walls and thus be transferred to and accumulate in fruit, stalk, root or tuber, where it becomes insoluble again.

While the way in which this transference is brought about is not thoroughly comprehended, it is known that potash plays an important part therein and also, that this ingredient aids in the original formation of the starch. Since sugar is probably formed from starch the relationship of potash to its formation is obvious.

Starch, also, is the mother substance of the wood. If it forms slowly the wood growth is inadequate. Starch occupies a very similar relation to the sugar, pectin and pectose bodies of the fleshy portions of fruit. Hence the relationship of potash to this matter.

How may these three elements be best supplied? In three ways,—from the clover seed sack, the feed sack and the phosphate sack. They may be worked out of the soil by cultivation and the like, but they are brought onto the farm best in these ways.

The clover seed sack increases the plant food content of the soil in two ways. Clover roots bring plant food from lower soil levels to the upper ones. They run deep into the soil and translocate plant food into the stubble. The plant also gathers nitrogen from the air through bacterial agencies. In fact, a clover crop when removed, leaves the soil better than it found it.

The feed sack, if it contains the right sort of feed, may greatly add to the plant food content of the manure. Cottonseed, linseed and gluten meals, the distillers' grains and the wheat offals are rich in plant food. Such purchases of feed as are made should be made with reference to their service as manure makers.

The phosphate sack is all right in its place; but much of the purchase is haphazard, ill advised and at exorbitant prices. The trouble is that farmers often buy low grade goods rather than high grade ones. Low grade goods are almost always the most expensive and the least serviceable.

The chemist could, like the brook the poet writes about, "run on forever," but his fellow scientists, the biologist and the physicist, want to have their say and we must listen to them.

What has the biologist to say as to the making of soil? Biology is the science of life, both plant and animal life, big and little. Its votaries tell us that the soil is alive, full of bacterial life; that in one sense the soil we usually think of as inert and lifeless is as much alive as we are. The bacteria, which permeate agricultural soils in such immense numbers as to be beyond the power of man to grasp their multiplicity, are minute plants, so small that the highest power of the miscroscope is needed to see them. They are omnipresent and, some of them, almost omnipotent. They are found all over the world, they swarm in all sorts of places. Earth, air and water teem with them. And they do a mighty work in the world, being, as it were, nature's scavengers. The larger plants, like corn and potatoes, take the simple forms of matter, water, carbonic acid, nitrates, etc,. from air and soil and build therefrom the more complex forms, sugar, starch, protein and the like. The smaller plants, the bacteria, reverse this process, reducing the more complex forms to the simpler ones again, thus completing the cycle. The bacteria, then, are necessary forms of life; they perform an important function, and the life of man and beast could not continue were it not for the friendly offices of some forms.

There are a great many different kinds of soil bacteria. Concerning many of them we know but little, while of others we have some information. There are more particularly three classes in which we are interested, because considerable is known as to their manner of work and because of the importance of the results of their life processes. These are the classes which may be termed the nitrifyers, the denitrifyers and the nitrogen gatherers.

The term nitrifyers is used to describe those bacteria which are concerned with preparing nitrogen for plant uses. We have hitherto seen that plants can only absorb nitrogen when it is soluble and when in the shape of nitrates. If, however, all the nitrogen in the soil were soluble, it would ages ago have passed to the subsoil and out in drainage waters. There is, however, only a small proportion of soluble nitrogen in arable soils at any one time, and the prime function of the nitrifyers is slowly to render insoluble nitrogen soluble and ready for plant uses. When one considers the relatively small amount of this element ordinarily present in soil, the large drafts most plants make upon this scanty supply, and the many avenues of loss, he appreciates the better the importance of the work of the nitrifyers.

The denitrifyers are mischief makers. So, too, under some circumstances, are the nitrifyers. The latter are sometimes, but the former are always causing trouble. Their work consists more particularly of driving nitrogen off into the air, usually as the elemental gas, a condition in which it is of no use to anybody or any plant save the legumes.

The nitrogen gatherers are very helpful little fellows. They are the producers, while the nitrifyers are the modifyers and the denitrifyers, the spendthrifts. The gatherers accumulate nitrogen from the air and get it into plant structure.

They grow in union with clover, alfalfa and the sundry legume or pod bearing plants, forming on their rootlets little bunches or nodules—the dwelling place of the bacteria. They, working in unison with the clover and kindred plants, are able to fix the aerial nitrogen into the tops and stubble of the crops. A clover plant which is growing luxuriantly, will be found to carry on its roots a great many tiny branches, about the size of a pin head. These are the residences of the nitrogen catching bacteria, which, when thus lodged, are able to help the clover get aerial nitrogen, and to enrich its structure and increase its feeding value.

Now the question arises, How may the nitrifyers be helped and their opposites, the denitrifyers, hindered? How may one promote nitrogen gathering?

So far as the soil is concerned we do not know any too much about the means of favoring or hindering the first two. Underdrainage and good tillage, however, are trump cards to play in this game. The denitrifyers work best when air is excluded, as it is in a water logged soil; and the nitrifyers do their best work when they have plenty of air. So drainage which draws out water and pulls air into a soil, and tillage which opens up and loosens soil texture, are helpful. Barnyard manure usually carries considerable quantities of nitrifying organisms and when used seeds the soil. Liming is also of service since it serves to sweeten the soil and make it a better medium for bacterial growth.

In the matter of the gatherers, however, we can do quite a bit. We can grow more clover, more alfalfa (in some sections, perhaps not in Maine), more peas and the like. We can use lime or ashes to "sweeten" the soil and "bring in" the clovers. We can inoculate the soil with soil from fields where legumes have succeeded or with the cultures from Washington. In these several ways we can encourage the increase of the nodule forming bacteria, and thus augment the nitrogen supply of the soil. A nitrogenous commercial fertilizer or rich, barnyard manure are hindrances rather than helps as these nitrogen gathering bacteria do not work any harder than they have to, and, in the presence of ample supplies of available nitrogen, do not multiply rapidly. They become lazy under these circumstances, just as mankind does when surfeited with plenty.

What does the physicist say of the soil? He tells us of the water, heat and air relations of the soil. He points out the reasons for tillage and for under-drainage. He advances several reasons for tillage, saying that it is serviceable, first, to water the crop; second, to fertilize the crop; third, to aerate the soil; fourth, to set the roots rambling; and fifth, to arrest robbers, that is, weeds.

How does tillage water crops? Corn, potatoes and the like take water in only by the roots. They absorb capillary water only, that is to say, water which is drawn upward from lower level, as a rule, in much the same manner as oil is drawn up through a wick. Crops use an immense amount of water, from 250 to 500 pounds to the pound of dried fodder. If water be deficient, crops are stunted as a consequence. If but 125 to 250 pounds be available, only a half pound instead of a pound is grown. Hence the necessity of water conservation. Inter-tillage, the cultivation, or weeding as it is commonly called, of the crop in June and July, saves water. It breaks and clogs the capillary tubes and the water which otherwise would be evaporated from the surface of the soil and serve no purpose whatsoever would in a large measure be saved, just an inch or two below the surface, just where and when the roots are eager for it. The great service of the cultivator and hoe, then, is not to kill weeds but to save water. Too deep cultivation should be avoided, lest the root hairs be cut and more damage than good be done. A morning's careless tillage may give the crop so serious a setback as to spell the difference between success and failure, profit or loss.

How does tillage fertilize crops? A spoonful of granulated sugar dissolves in a cup of coffee more quickly than does a cube. There is as much sugar in the one case as in the other, but the one is finer than the other and presents more surface to the liquid; hence its quicker solution. Similarly with the soil. The finer the soil the quicker the solution of its plant food; and the quicker and the more its plant food is dissolved, the better and larger the crop. In other words, the cultivator in fining a soil causes it to present a larger surface to the soil waters, increases its ability to become dissolved and hence augments the availability of the soil constituents. Thorough tillage is often a better fertilizer than are the contents of a phosphate bag.

How does tillage aerate the soil? By opening it up to the air, ventilating it, and bettering its root environment. The roots ramble more widely, reach and appropriate more plant food, and the crop grows more vigorously.

And finally, How does tillage serve as a policeman? It arrests the growth of weeds. Weeds are simply "plants out of place," robbing the plants in place of food and drink. The earlier in life these robbers are killed the less will be their thefts. Most farmers think of intertillage only as a means of combating weeds. This is an important but not its most important function. Emphatically, "there are others."

The physicist has much more to say, but the limits of this article are already exceeded. He, like his fellow scientists, magnifies his calling and looks upon his contribution to the story of the making and the make-up of the soil as an important one. And so it is; and so is that of his associates. The up-to-date tiller of the soil should be on speaking terms, as it were, with all four of these men; should appreciate their several view points; should read, mark and inwardly digest what they have to say and be thus the better equipped to farm his acres intelligently. Our forefathers, less well informed than we, have bequeathed to this generation of New Englanders a soil that is much the worse for wear. They knew not what they did when they depleted their lands. Science had not then thrown that light upon agricultural operations that it has today. On us, however, the obligation rests more heavily. It is "up to" us to improve New England's soils, to pass them on in better shape than we received them. The question is simply, Shall they become impoverished or be improved in our hands? The causes of the one and the means of the other are well understood. The one is readily preventable and the other is economically attainable. Let us not merit the just reproach of those who succeed us by leaving to them a heritage of barren acres. Let us rather cause "the desert to blossom as the rose." *Noblesse oblige!*

SOME PROBLEMS IN APPLE GROWING.

By SAMUEL T. MAYNARD, Northborough, Mass.

The problems of the fruit grower in Maine, as I understand them, are not unlike those we have to solve in Massachusetts. With us the situation is about this; we are producing large crops of apples and other fruits, but we are realizing but little profit from these crops except in special cases, i. e., when by especial skill on the part of the grower or by the especially favorable condition of the soil, a crop of unusual quality is produced. We—the average fruit growers—are trying to solve the problem as to why there is not more profit in fruit growing. The condition of the fruit market I would explain in this way. We are not producing what the people want. We have the best markets in the world. Our people can afford to pay and do pay the highest prices for choice products, but other fruits are put into our markets in such perfection to compete with our apples, pears, peaches, etc., that if we do not offer fruit of high grade they will buy oranges, grapes, bananas, pineapples, or fine grades of canned or evaporated fruits. We in New England are not doing business on the best business principles. We are producing fruit of too poor quality. There will, of course, be more or less poor or second quality fruit in every orchard, which if put into the market will affect the demand and the price for the best grades and we have no other way of utilizing this grade of fruit as they do in many other sections by canning and evaporating. In some seasons this grade will average one-half of the crop or more and the markets do not want this product in a fresh state and it will not sell except at so low a price as to leave no profit to the grower. Another difficulty the fruit grower must meet is that he has nothing to say about the price at which his product is sold. The fruit dealers get together and decide what they will pay for the fruit and as only one buyer is found in each section or locality the grower must sell at his prices or ship to some commission house and take whatever they choose to return.

In every other kind of productive industry the producer can, in a large measure, determine what the price will be before his products are made and can regulate the cost so as to leave some profit. In no other business is the producer so much dependent upon the conditions of wind and weather and the manipulation of commission men and brokers, and after a large investment for fertilizer and labor his crop fails or prices are so low that it does not pay the cost of production. Yet notwithstanding this condition of affairs, fruit growing will average fully as profitable as any other line of agriculture or horticulture.

From this point of view it is plain that the greatest problem which confronts the New England fruit grower is how to grow better fruit, or how to utilize the low grades of our crops so as not to put them into the markets to compete with choice fruit from other fruit growing sections of the world.

HOW TO GROW BETTER FRUIT.

Young trees in a vigorous condition produce the best fruit, though old trees if made to grow rapidly will often produce good fruit of brilliant color and fine quality.

In Massachusetts, and I have no doubt it is the same in this State, if we would cut down *one half* of our old trees—those producing undesirable varieties or where the trunks are unsound—and give what attention we now give to the whole to those remaining we would produce much better fruit than we now do and perhaps as large quantities of marketable fruit and this at a very much less cost.

SELECT SUITABLE SOIL.

Good apples and pears cannot be grown on thin soil without a very large amount of plant food. Strong, rich land must be selected for the best results. The manufacturers might as well expect to make their business profitable if located where the supply of raw material or power is scarce or must be transported a long distance and at great expense.

THE NEW ORCHARD.

No one should plant a new orchard without first deciding if the land is suitable. If there are old trees of large size upon the land it will be safe to expect good results. Strong No. 1 two-years-old trees are the best for planting. These should be carefully pruned before planting, cutting back all roots that are more than one foot long and paring smooth all that are badly broken or torn. A good bed of fine rich soil should be made in which to plant the tree. If the land can be plowed from twelve to eighteen inches deep, using the trench plow following the common plow, this will be the best possible preparation, and holes just large enough to hold the roots only need be dug. If the land cannot be plowed large holes must be dug—three to four feet across—and an abundance of rich loam be provided in which to set the tree. If one has rocky land of the right kind—strong, rich and producing an abundance of grass or undergrowth—turf culture offers a means of making the apple crop profitable at a small cost.

It must be kept in mind, however, in this system that the trees *must* be made to grow vigorously if large and fine fruit is to be produced, whether under cultivation or turf culture. Under the latter condition young trees will not start as vigorously as when frequently cultivated and it will take several years longer to obtain large crops of fruit unless a mulch of manure, straw, coarse hay or other material is used about them. The common practice of taking a crop of hay and one of fruit from the land without putting back enough plant food for both crops is a most ruinous one. We cannot get something from nothing even in apple growing. The more economical we are of labor and the more skill we put into our work the more we get out of it.

PRUNING.

While the tree is young the pruning required is little, and that simply directing the head so that it shall be a full, well rounded form, yet with every branch free from contact with its neighbors. A close head is desirable for protection of the main branches and trunk from the hot sun but only so close that when loaded with fruit it will open just enough to let in a good amount of sunlight and air. Hot sun shining on the bare branches during the summer impedes the flow of sap and causes sprouts to grow upon the trunk and main branches while the main branches soon become weak and have yellow, sickly foliage. The common practice of removing these sprouts or suckers only increases the injury and we cut away weak or dead branches until, as is seen in most old orchards, the leaves and fruiting branches are so high in the air that it costs more to gather the little fruit that is borne than it is worth. A low head must be encouraged by heading in from the top and allowing now and then a young vigorous sprout to grow to fill up and renew any open spaces there may be in the tree. From a business standpoint a low tree is a necessity. All of the work in caring for it, spraying, thinning, harvesting, etc., can be so much more cheaply done, and there is less danger of loss from high winds blowing off the fruit or the trees being broken down by ice and snow. In pruning old trees the rule should be followed of "never removing a branch unless for a good reason." We may thin out when the head becomes too close, or head in to force the growth into the lateral branches but little or no other pruning is needed. All wounds made in pruning must be protected from decay by painting with a good preservative like linseed oil paint which is always handy or easily obtained. Two coats should be applied to large cuts, one when first made and a second when the first coat has become thoroughly dried.

FERTILIZERS FOR THE ORCHARD.

If one has an abundance of stable manure this will supply the nitrogen which supports the growth of leaves and branches of the tree, but potash and phosphoric acid which tend to develop the fruit must be added. These may be in the form of wood ashes, or sulphate or muriate of potash and acid phosphate. The amount of these elements to be used must depend upon the condition of the trees and the soil in which they are planted. On thin soil and with trees making a slow growth a layer of manure three inches deep as far as the branches reach supplemented by from 10 to 50 pounds of wood ashes per tree, according to its size, will be needed. Or, if used alone, 5 to 20 pounds of fine ground bone and 2 to 8 pounds of sulphate of potash. Another formula that will give good results is 3 to 5 pounds of nitrate of soda, 5 to 10 pounds of acid phosphate and 2 to 8 pounds of sulphate of potash, the larger amount for very large trees or those in poor soil. The best time to apply the potash and bone or acid phosphate is during March but the nitrate of soda need not be applied until the middle of April or early May. These materials need not be mixed, but each element may be applied separately. All fertilizing material should be scattered evenly as far as the branches extend.

HARVESTING AND STORING.

Unless we are very active and our trees are low branched this is a very expensive work. Light, strong ladders of several lengths must be ready, and baskets holding from a peck to one-half bushel with a jointed handle or bail and hooks for holding these to the ladder round or branches of the tree. If the weather is good and help abundant the fruit may be packed in barrels in the field, but if help is not abundant the fruit should be picked and put into some cool place as quickly as possible. Never put in piles under the trees if it can be avoided. A very good sorting table is made by the body of a low down handy or runabout wagon with a piece of matting, canvas or a horse blanket on the bottom. This can be readily moved from place to place in the orchard, the sorter standing at the tail-board sorting and putting into barrels as picked. A cool place for storing may be made by opening the doors and windows of a clean barn or house cellar on cold nights and closing them during the day time. After this has been done several nights the temperature will be down so that the fruit will be kept at a more even low temperature than in any other place except one cooled by ice or chemicals. The sooner apples or other fruit are placed in a low temperature after picking the better and longer they will keep.

SORTING AND PACKING.

As previously stated we must not put our poor or second grade of fruit into the market to compete with the better grades if we can avoid it. It is beyond question that the best time and way to dispose of this product is by thinning it out when the size of hickory nuts instead of allowing it to grow to the injury of the better fruit and picking and sorting it over and finally throwing it away. By thinning the strength of the tree is improved, insect pests are destroyed and succeeding crops will be better and more cheaply cared for. On low headed trees this work can be quickly and cheaply done but on the average old orchard the cost of thinning together with the cost of harvesting will leave but little or no margin of profit. If all of the poor fruit is disposed of as described the work of sorting is reduced to throwing out small fruit, i. e., under two and one-half inches in diameter. Grading as to size is not now demanded in any of our markets but the day is not far distant when we shall sort and grade our apples in the same way as oranges that now come to our markets.

PACKAGE FOR APPLES.

Our people are very slow in adopting the box as the package for our fruits. The barrel has some advantages but these are far outweighed by those of the box. No standard size has been adopted in any large apple growing section unless it be California. The size most nearly suited to the small consumer will no doubt soon be adopted. The peck, half bushel and bushel sizes will be better undestood by the majority of the consumers and should be adopted rather than those designated by weights, as 20 pounds, 40 pounds, etc.

MARKETING.

The local market is to be first considered. Supply your own markets first, because the package is to be returned, then the large towns, and after this the cities, unless one has a large crop to dispose of. Cold storage houses have become a necessity in modern fruit growing and these should be controlled by the grower and not the commission man, if we would secure control of the apple market.

AGRICULTURE FOR THE PUBLIC SCHOOLS OF MAINE.

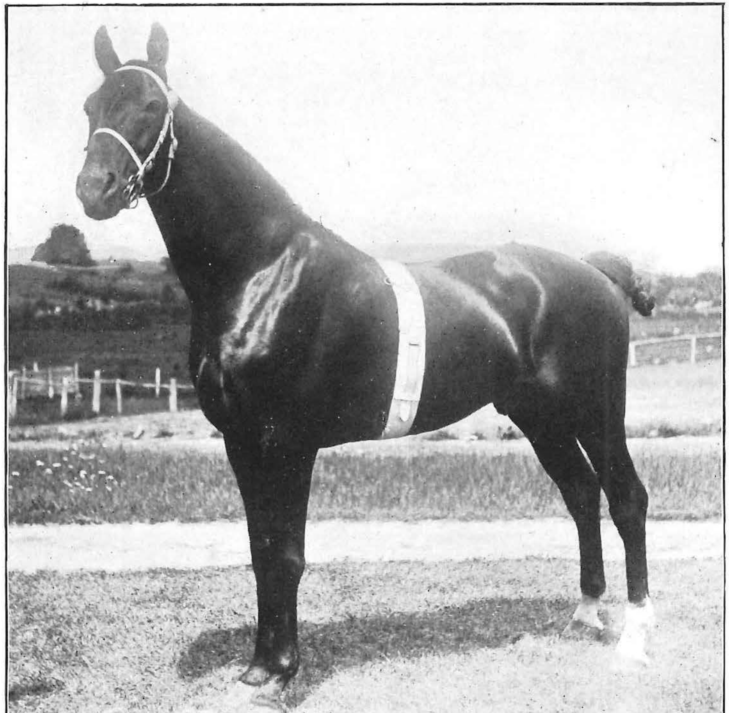
By David S. Kelsey, Hartford, Conn.

Applied science is no longer a matter of mere machinery, of delicate instruments and laboratories. Farming is as much a science as anything; it is also a profession. The possibilities of applied brains, of specializing, and of scientific and professional skill, are fully as great in agriculture as in any other vocation. Success is as sure, permanency surer, and as an endowment for one's posterity it is unequaled.

But a scientific farmer must be trained; and the word "education" has not always stood for training. Sometimes it has stood for "information" (the poorest kind of education), but certainly a farmer must be trained—in power of perception, in memory, imagination and reason. Right education also leads to culture. The cultivation of *right* tastes, beliefs, habits and vocations, ought to be the aim of education and training for the young. Question: Does our present system of public school education do this? Does it even aim to?

But before condemning let us look at home. Your child has tastes, habits, beliefs, memory, powers of perception and of reason. Do these display the work of home-training rather than of school? Whatever may be said against our *system,* nothing can be said against the teacher as an individual; she is enthusiastic—almost an idealist—and will grasp at anything that gives promise of aid in her work. Any criticism of the system, therefore, must strike higher than the teacher as an individual. Hon. John D. Long said "Legislation begins at home." So does reform, and not till the people—you and I—the "common people," as Lincoln calls them, rouse themselves will our system of public education fit our needs as it should.

To paraphrase Prof. Willet M. Hays' excellent article in a recent number of the Review of Reviews:—A century ago our entire system of education from primary to college classes aimed at "finish." Now a new system is necessary; special, rather than general education is demanded. Neither can we educate



Aristo, 3610. Imported French Coach Stallion, 5 years old. Property of Elmwood Stock Farm, Lewiston Junction.

the man first, and make a specialist of him afterwards. Another old-time system of training, the apprenticeship, is fast disappearing and will hereafter become more and more inadequate. From these statements may be deduced the warning that our educational system needs re-adjustment at the bottom and middle; the better to serve those who drop out before or during the high school. Prof. Hays says "Our scheme of education has taught the city things, rather than the country things, and by ignoring the farm and the farm-home, our greatest industry, farming, and our best institution, *the farm-home,* have been discredited."

Financial changes will ultimately drive capital to the purchase of landed estates. This will immediately reduce the number of middle-class farmers and increase the number of small or tenant-holders. To counteract this tendency we must so train the farmer that his brains and labor will mean to him more capital; that is, render his productive power higher.

"Our modest farm-homes stand as our strongest political bulwark. Homes and farms worked by the owners are the best places to breed vigorous people, alike for city and country. Our education scheme is not doing all it might to build up our country life, and the time is ripe for a change. We need to evolve a branch of our educational system which shall be specially helpful in building up our farm-homes, our farming, our rural affairs, and our country life generally."

A prominent lecturer truthfully stated to his class that to conduct a farm properly requires a knowledge of more facts and more principles than to successfully conduct a bank. Is it not right, therefore, that the *boy* get an early start toward these facts and principles, particularly when it is information which he eagerly relishes?

This does not mean, nor should we advocate, teaching the science of agriculture in the public schools; it does mean, though, what Prof. Bailey of Cornell is insisting on, the correlation of agricultural facts and principles with the "three R's" and all other subjects in primary school work. It means "teaching the real things of life." It means, if you please, another "bread and butter" subject. But why not? The most potent thing in the average life is *work! How to make that* *work yield most* is the most potential question. As Prof. Mutchler said before this winter's meeting of the Connecticut Board of Agriculture, "The game of life *must* be played," and the "rules of the game" (nature's laws) are relentless. Fit the youngster, then, to *win* in this battle of life, and let the demand for this come from the farmers themselves, and at once. It is now two years since the Association of New England Colleges at its annual convention at Boston passed a recommendation that these subjects be incorporated in the primary course. They have discovered ahead of us that the best foundation for an education is a cultivated power for observation of concrete phenomena rather than of abstract facts. Like most of our institutions, our public schools are the product of growth, but of late years have rightly been subjected to severe criticism that they have not kept pace with the demands of the people. To the "three R's we added science, literature, and art. Music and drawing have also become fixed parts of the primary and grammar school courses. Following these, particularly in the upper grades, have gradually entered industrial subjects. First, manual training, elaborated to almost every form of wood and metal working craft, serving the place of old apprenticeship; and, in the large cities, such practical business subjects as bookkeeping, banking, typewriting, shorthand, etc. All these are good. They have been the growth of a need and demand, but why should the *greatest* manual trade, the *greatest* business, yea, the very foundation of business and industrial progress and prosperity—agriculture—be left out?

This question is being asked forcefully and with increasing frequency. It is also being answered in Missouri, where the subject of agriculture, promoted by the State Agricultural College, is now firmly established as a required branch in the regular public school system of the entire State. This subject includes the training of the teachers, (A) in the regular normal courses, (B) in a special annual summer school, (C) in their county institutes, (D) to some extent in specialized supervision. Every normal school of Missouri now has a professor of agriculture. The special summer session has just closed its seventh year. More than one thousand teachers have been trained, and eighteen thousand Missouri children are receiving instruction in elementary agriculture and horticulture. All this is eminently practical, and great enthusiasm has been awakened, as manifested by the fact that some seventy teachers have actually attended the Missouri College of Agriculture, and their work done in these courses has been accepted by the superintendent of public instruction for a state certificate. Nor is Missouri alone. The same question is being answered in Indiana, where teachers of agriculture—an absolutely new profession—are being prepared at Winona Lake. Last year this school had an enrollment of upwards of one hundred, and backed by more than 400 acres of land, is bound to be a great uplift to the agriculture of the state.

New York state has popularized this movement, organizing from Cornell University Agricultural Experiment Station home "clubs," the present enrollment being 26,000, and the past numbers amounting to over 40,000—one-fifth of all the farmers of the Empire state. Nearly 20,000 of these have completed the course. Beside this, the state has a winter course at the college and the following correspondence courses: Farmers' Reading Course; Farmers' Wives' Reading Course; Nature Study Course (for teachers); Junior Naturalist Course (for the public school pupils); and a Home Nature Study Course (for village residents).

In Tennessee, at the State University of Knoxville, an eminently practical course of instruction in agriculture, husbandry, poultry work, dairying and horticulture is now open to any young man or woman sixteen years of age, in the hopes that teachers may thus avail themselves to respond to the popular demand for these things as a part of the routine school work.

In Vermont, New Jersey, North Carolina, Minnesota, Illinois, and in several other states this work has come forward at such pace that today there are in the states more than 400 schools offering such courses. And yet the Provinces are far ahead of the states. For instance, in neighboring New Brunswick the preparatory stages have been long passed; schools have been provided, teachers trained, and the elements of agriculture are actually being taught from regularly adopted text-books in every grade above the second. This eminently practical material is entitled "Graded Books in Nature Lessons," by Prof.

Brittain, of the Provincial Normal School at Fredericton. They are accompanied by a teachers' manual, and approved by the honorable minister of agriculture, Ottawa.

The State of Maine is ripe for such a step, but it must be taken in the right way. To "adopt" the subject of agriculture before those who are to teach it are adequately trained, can only give the subject another set-back, and delay progress and final success. Before this can be done, there should be agitation, discussion, and interchange of ideas by the people. The grange should take it up. The State, as a whole, should move in this direction as a popular step.

Prof. L. H. Bailey of Cornell, addressing the annual meeting of the National Educational Association, at Boston, upon "The Duty of the Schools to Common Life," dealt with our whole educational system and its relation to the coming demand for agricultural training of the child. He exclaimed: "Children should be taught *things* and not *books*. They should begin with subjects that they know and particularly understand, and proceed later to those which are more abstract. Greek and Latin are no more divine than cabbage or potatoes."

With all this true, it is time that the people themselves—they who are to receive the direct benefit of these progressive changes—should come forward and make their demand.

Maine needs more agriculture. She is a State of many natural resources, but the one to outlast, outwear, and outweigh all others is her agriculture which is to be.

At any time when it may be assumed that Maine is ready for the question, elementary agriculture can be quietly and successfully launched as a part of the regular curriculum of the primary and grammar schools by providing: first, for a teacher of agriculture—that is, an agricultural course—in each of her normal schools. Second, by following this up for a series of years, with regular instruction: (a) in the subject matter, and (b) in the methods of practical agriculture and horticulture, at the regular Teachers' Institutes throughout the State. This latter is really the more important of the two, for it reaches the teachers who are beyond the pale of the normal school, the instructors who are actually in the field and in the harness. Third, and last, adequate text-books should ultimately be provided, accompanied by a carefully graded teachers' manual. I say "last" because the beginnings of this subject do not require a text-book in the hands of the pupil. To repeat Prof. Bailey, "Children should be taught *things* and not *books*." Even the teacher will not need a book beyond the guiding manual, once she has a grasp of the subject matter and methods for her particular grade; and all this is best provided by the normal instruction.

SUGGESTED OUTLINES OF A COURSE.

For the first two years the regular kindergarten lessons and oral instruction periods should include several hundred interesting objects of nature; such as will cultivate the powers of observation, comparison, imagination, and reflection. A drawing lesson involving the difference in leaf form between that of maple leaf and the mulberry is not robbed of its art value. Nor the language lesson which aims to describe the stages of development of the tulip.

Beginning with the third year, regular prescribed lessons should be taken up, upon which a pupil can be examined and graded at the end of each half-year. Look upon the third year as the real introductory period. Instead of exhaustive study of such subjects as land, water, plants, animals, soils, tillage, fertilizers, etc.—all of which are entirely proper when begun later—"dabble," if you please, in a variety of suggestive experiments. One school of mixed grade studied and worked out in a satisfactory manner in a twenty-week's term all of the following, which might well be handled by a third-grade class: Sand, versus soils; moisture, heat, and air; light in relation to these; juices, saps, gums, and ashes of plants; drifts, deposits by water; actions of frost; sub-soil, spring water and under drainage; moisture and temperature tests; seed germination tests; clay puddling, flocculation; leaf mould, mulching, humus; condensation, cloud and dew formation, etc.; rain gauge, hail and snow; evaporation; pollenation.

All these, beside innumerable ideas about grating, geology, pomology, zoology, and botany; about flowers and grass and trees and animals and birds and insects, in feeding, breeding, and building—to the end of the chapter.

The healthy child "takes" to all this as naturally as a duck to the pond, and it is much better than a cut-and-dried text-book, both for the teacher and the child; far more developing for both, far more practical in results, and, best of all, interest instead of being deadened by "lessons" is aroused in a natural way.

Beginning with the fourth or fifth year, or in a mixed school, with the upper classes, more serious study can be taken up. It may begin about as follows: (1) On land: former condition of the earth, its age, geologic facts, formation of hills and valleys, formation of soils, water as an agent, action of running water, action of rain, action of frosts, composition of soil, sand, gravel, peat, loam, and humus. The atmosphere: its ingredients, water evaporation, carbonic acid gas, and other impurities, temperature, causes of winds, of rain, of fogs, mist, clouds, snow, hail, dew, frost, and storms.

Plants: Vegetable life, fertility of sods, conditions of growth, relation of warmth, moisture and oxygen, chemical changes, cell life, plant foods, capillary action, root, stem, fruiting, botany.

Animals: Relation to nature, chemical composition, practical uses, foods of, feeding economy, nutritive ratio, care, kindness, uses.

Chemical substances: Classification of matter, the fourteen common elements, atoms, molecules, etc., alotropic forms, organic matter, chemical action, acids, bases and salts. Cohesion, adhesion, porosity, organic and inorganic combustion, oxidation, respiration.

Tillage of the soil: Cultivation, decomposition, fertility and aeration, moisture supply, effects of tillage, capillary water, under drainage, cropping, weeds, rotation.

Fertility: Plant chemistry, effect of culture, plant foods, fertilizers, nitrification, potash, phosphoric acid, sources of fertility, prepared fertilizers, guano, lime, marl, gypsum, and salt, suitable dressings, chemistry and application.

UPPER GRAMMAR OR HIGH SCHOOL.

In these grades a direct and close connection should be made between these subjects of practical agriculture and horticulture and the leading facts and *principles* of the natural sciences, including physical geography, geology, zoology, botany, astronomy, physics, and chemistry.

The above arrangement is the most natural and sequential. Simple forms of text-books on those subjects can be made the basis of interesting lessons for any class above the fourth grade of school.

THE TEACHERS' MANUAL.

The most important and difficult department of this problem is the *furnishing of explicit directions to the teacher.* As said above, these are best given in personal oral instruction to her *by a specialist teacher,* which instruction should be divided into actual information upon the subject-matter in hand and pedagogical training in the methods of presentation to classes. The successful teacher is so constituted that whatever she knows—be the same more or less—she knows it exceedingly well; therefore, provision must be made by which exact sources of information may be furnished her, as well as the way to impart.

SUGGESTIONS TO TEACHERS.

First, let it be understood that agriculture is eminently a teachable subject, and second, that in this subject the *theory and practice go together,* at one and the same time. Third, that there is no difference between teaching the fundamental principles of farming and those of arithmetic, geography or grammar.

Again, most boys and girls get no educational training except that given them in the public schools. What, therefore, the school lacks the pupil lacks—and that for life.

Do not be afraid of a new subject; you will enjoy it yourself. "Do it heartily as unto the Lord." You do not need to "know much" about agriculture; if you keep one step ahead of your pupils, this position, coupled with your educational training, will make you the best of teachers. Take the pupils right into the field, train to observation and gain facts by actual experiment. Reject any text-book that binds you to certain courses of procedure, or that has no adequate glossary. Encourage pupils to perform experiments themselves. First-hand work gives power. Nature is a shy and silent teacher, but the greatest pedagogue in Christendom.

The above outlines are arranged in logical order, but you should feel free to teach each topic in the *season* that best suits it.

OUTLINES OF A TEACHERS' MANUAL.

Chapter I. Plants.

Plant Eggs, Seeds—Plant Babies, Germination—Plant Growth: Sap, Cells, Root, Hairs—Plant Parts: Stalk, Leaf, Bloom, Fruit—Plant Propagation—Plant Tramps, Weeds—Plant Enemies: Diseases, Insects—Plant Foods.

Chapter II. Soil and Tillage.

Origin—Structure—Texture and Parts—Moisture—Drainage—Tillage—Humus—Feeding.

Chapter III. Crops.

Grass—Trees—Grains—Garden Vegetables—The Potato—Corn—Hay—Silage.

Chapter IV. Fruits.

Annuals, Strawberry—Briar Fruits—Shrub Fruits—Grapes—Apples—Other Tree Fruits—Nursery Work—Pruning—Spraying—Fruit Foods.

Chapter V. Domestic Animals.

Pets—Poultry—Cattle—Horses—Sheep, Goats and Swine—Bees—Feeding.

Chapter VI. The Dairy.

Milk as a Food—The Cow's Care—Cream and Butter—Cheese—Chemistry of Souring, etc.

Chapter VII. The Home.

Light and Air—The Well—Cellar—Sanitation—Ventilation—Grounds.

Chapter VIII. Miscellaneous.

Rotations—Money Crops—Diverse Crops—Tools—Fences—The Wild Birds—School Gardens—The Larger Life.

Chapter IX. Appendix.

References (Books, Etc.)—Tables—Glossary—Index—Suggestions—Reading Course—Model Lessons (each grade).

The above is in no wise intended as a treatise. Many of the topics are but *touched* upon. Yet what *is* said is clear, simple, and to the point—intended to awaken and stimulate interest.

SHEEP HUSBANDRY.

By Charles B. Hoyt, Sandwich, N. H.

A sheep in the Holy Scriptures is the chosen symbol of purity and the gentler virtues, and stands as a type of redemption for fallen man. The calling of the shepherd has been from time immemorial. From the Arctic circle to the equator we find sheep roving over barren mountains, through sandy deserts and in fertile valleys; subsisting upon every variety of eatable forage, nibbling the grasses, cereals, weeds and clover; browsing leaves and bark from stunted forest shrubs; cropping aromatic and bitter herbs. No animal presents so great a variety of size, form, color or covering, except possibly the dog. We find them of every color from white to black. Their size may be dwarfed or massive; their horns long, or spiral, flat or straight, or they may have none at all. Sheep were first kept for milk, next their skins were used as clothing, later wool was regarded as the all-important factor. In the East, to some extent, they are still used as a beast of burden. In these modern times the most enlightened nations hold sheep as essential to the manufacturing interests and farmers regard them as one of their staple products. The best of clothing is made from their wool. Its flesh is a favorite food for the rich and poor alike.

The Spanish Merino were first brought to this country about 1800 when wool was of primary importance. Their hardy nature, their peaceable disposition, their superior quality of wool, adapt them for any climate or care and insure for them a good return whether we live under the burning sun of the tropics or in the frozen region of the North; but with mutton as the chief source of income from the flock, the larger English breeds are sought.

In order to be successful in the management of sheep we must study their habits, their restless, timid disposition. To us they will look for protection and care and to us, when rightly managed, they will give a good return in the materials to clothe and feed the body. The axiom that "The eye of the Master fattens" is nowhere truer than in the sheepfold; with it, no line of stock raising will bring to the farmers of Maine a better return, and without it, loss, discouragement and failure are sure to follow.

In order to be successful we not only need to know the business but it is essential that we start right. Let the breed to be selected be hardy and adapted to your conditions and surroundings. If we want a race horse we can begin with a common cart horse and by persistent and careful breeding raise the horse we want, but experience tells us it is much easier and less expensive to start with a race horse as the foundation. In point of hardiness for your locality we consider the Southdown second only to the Merino, but any of the black-faced sheep, like the red baldwin apple, the white potato or the yellow legged poultry, are a sort of trade mark that brings us better returns. It is true the Cotswold, the Dorset, the Leicester and the Irish have been and are today raised profitably by New England farmers as well as the Downs. While in 1861 nearly all our sheep were grade Merinos, today more than 80% are English breeds or native stock.

A few years ago they told us that it was no use for New England to try to raise sheep, except a few to keep the weeds down in our fence corners; that the sheep industry had gone forever to the great grazing states of the West and South. Let us pause and study that statement. Here the soil, climate and general conditions when coupled with our nearness to market give to the New England farmer great advantages. Here in Maine 90% of your farms are well adapted to successful sheep husbandry. In the West twenty-five years ago vast tracts of government land was used for sheep grazing. Today it is being utilized for crop production. Its rapid advance in value has added expense to the sheep industry. Formerly there was no limit to their pastures. Today they are required to buy their land, to fence it and restrain their flocks, hence their number is on the decrease, to your advantage. There are other advantages in the keeping of sheep besides the cash that comes from the sale of the lambs and wool. The deterioration of our pastures is a source of discouragement to the farmer. While this is partly due to the constant cropping, it is quite largely due to the weeds and bushes coming in to crowd out the choicest grasses that the dairy cow requires. The sheep will utilize the weeds and bushes that other animals have rejected, and eating them give the grasses a better chance. In the apple orchard no better method of treatment at small expense can be adopted than to make it a part of your sheep pasture. With the sheep feeding close to the trunks of the trees, eating the sprouts and grasses, the breeding places of the borers and enemies of the fruit trees, devouring the windfalls, the wormy and unripened fruit lying around under the trees, and enriching the soil, we can hardly calculate their value.

Fifty years ago the spinning wheel and hand loom were in daily use and the first lesson taught in housewifery was the art of spinning and weaving. Fifty years ago the average amount of wool used by each individual was four pounds, today it is 8.3 pounds. By careful, systematic breeding we have doubled the weight of the sheep and its fleece and thribled its value as mutton, still we find ourselves today unable to supply the demand. With a tariff of 11 cents on first, 10 cents on second and 7 cents on third grades of wool, and with a duty of from 50 cents to $2.00 on mutton and lambs we find Canada, Australia and the isles of the sea sending to United States thousands of dollars worth of wool, mutton and lambs annually.

The question as to the ability of the United States to raise all the varieties of wool needed can be settled when we remember that we have 24 degrees of latitude, with altitudes ranging from the semi-tropical to those of perpetual snow, with a soil so rich and varied that it presents all the possibilities of the old world except the strictly tropical and absolutely polar regions. We can, therefore, produce without limitation the Merino, the mutton breeds of Great Britain, and the coarser types from Mexico, or from Asia, Africa and the Southern Hemisphere. From what farm animal do we get so quick or so many returns? We have the dressing for April, the wool for June, the lambs for August, and the mutton for winter. Each sheep annually produces fifty cents worth of dressing, a lamb worth $3 and wool worth $2 at the cost of about $1.50 for the food furnished. New York, Philadelphia, Boston and the larger cities are paying fancy prices to the farmer who is engaged in raising hot-house lambs. From 25 to 40 cents a pound is being paid from Christmas to Easter for fat lambs weighing 50 pounds or more. These can be grown in from two to three months with proper care and management. The sheep pen should be warm, light and well ventilated; the food rich and nutritious. The lambs should be born in November. With our sweet hill-side pastures and pure springs of water we have little to fear from disease. In the winter sheep should be kept clean and dry and be fed in the open shed with plenty of air and sunlight, whole turnips clover hay and coarse salt. Then with pure water and with the noses occasionally smeared with tar during the summer, we shall keep them healthy and productive. Our fences should be built before turning them to pasture. Brush, barb-wire or boards can be used. It should be thick and of about 3 feet in height. The village cur dog is the only menace to successful sheep husbandry and with the right to shoot any dog found worrying our flocks we can find some comfort even though it come too late. The summer boarder brings the market to our very door. Five sheep can be pastured on each acre of land. Our hay can be supplemented with rape for fall feed and the silo for winter. They require less care than other farm animals, and that, too, during the winter months when we value our labor the least. They bring us the quickest and best returns, if we love our work and will intelligently handle them.

The care of sheep is an interesting and fascinating business and can be enjoyed by the most refined. There are some unpleasant things to do, like sitting up nights to care for lambs, or shooting a neighbor's dog that is annoying or injuring our flock, but every business has its drawbacks. Had we a law that would compel the owner to keep his dog upon his own premises, the same as we are obliged to keep our flocks and herds, sheep, as a farm animal beyond a question would be the most desirable, the most profitable of all.

Five-year-old half-blood French Coach Colts produced at Elmwood Stock Farm, Lewiston Junction.

ORCHARD MANAGEMENT.

By F. W. RANE, New Hampshire College, Durham, N. H.

We must learn and realize that the plant has life and appreciates good care and food for best results, like the animal. When neglected it may not disturb us like the squealing of the pig or the kicking and pawing of the hungry horse; nevertheless, its usefulness for best results is impaired and the conditions that might bring success are impossible.

With comparatively few exceptions our fruit trees are very indifferently cared for. Considering their commercial importance they are one of our great sources of income. If we can get such large returns for so little effort what may be expected when we exert ourselves to do more for plants? With an equal amount of capital invested, and care, labor and attention given it, the average orchard crop will be productive of greater returns than the same expenditure devoted to live stock in New England. This statement is not made to disparage the live stock industry, but to emphasize what may be expected in orcharding.

TILLAGE.

The object of the orchard in the first place is to produce fruit. If we are to expect tree growth when the tree is young and a sustaining productive growth when mature, we must render the conditions favorable for such results. Just how much and often cultivation is needed, and the best means of obtaining it, kinds of implements to use, etc., are open questions. Results are what we are after. If one person can demonstrate that his orchard is more productive than others, we should look into his method of tillage and satisfy ourselves how closely it can be applied to our conditions. The nature of the soil is of great importance in considering this question. One soil may require constant cultivation or tillage in order to get desirable tree growth; while another with comparatively little attention may be very responsive. As a rule, however, it is an exceptional orchard that gives satisfactory results without receiving occasional tillage. Some lands, in fact many in New England, are too rolling for continuous tillage. This would result in the washing or gullying out of the land and the loss of our best surface soils, which should be prevented. Where the land is level this is another matter and can be practiced. On lands only moderately rolling and on others where only certain portions are liable to wash, a crop of some kind could be sown, known as a cover crop, which answers well in keeping the soil from washing throughout the fall and winter. On rolling land washing can largely be prevented by cultivating the soil crosswise with the contour of the hill. Where the wash is liable to be heavy even if this is done, if a plowed furrow is run along the contour several rods apart, the distance depending upon the steepness of the slope, this will largely overcome the trouble. The benefits from cultivation will usually be large. A prominent pomologist has written: "If tillage and timely effort are good for corn, and peach trees, and blackberries, they ought also to be good for apple trees."

This whole subject of tillage, as I look at it, is to be settled by one's good judgment. In order to have good judgment we must first study the problems themselves. In the first place, orchards need attention for results. The question of tillage can be overdone as well as neglected. There is such a thing as rushing tree growth. Too frequent tillage and carrying it too late into the season are possible errors. There is little use of checking the enthusiasm over more tillage here in New England as *the land knows* it will be years before we get enough of it; but there are instances where people have in the past been so zealous over the subject that their results were mainly experiences of what not to do. The tree should make its largest and best growth during the early or fore part of the season. If we continue our cultivation until late in the season and at frequent intervals, as in the spring, the trees will not have ripened their wood or had time to prepare themselves for living through our severe winters. It is as important that we check the results of tillage, therefore, at this season of the year, as it was to utilize it in the spring. At the last cultivation, therefore, which is usually at the height of the maximum growth near midsummer, we sow some crop in the orchard. This crop will prevent the soil from washing, mulch the ground and hence protect the roots in winter, check excessive growth, mature the wood and when plowed under, give plant food and humus to the soil.

Cover crops are of two kinds, those which have the power of taking nitrogen from the air, called leguminous crops, and those that do not. To the first class belong the beans, peas, clovers and vetch. To the latter class belong cereals or grains, among them being oats, rye, corn, buckwheat, etc. While the cereals are not as valuable from the standpoint of plant food they do, however, hold the snow in winter and by rotting on the ground, or plowing under, they improve the physical condition of the soil. Too much nitrogen in an orchard is considered detrimental, as it gives growth instead of fruitfulness. Young orchards need plenty of growth and leguminous crops are valuable for growing in them.

My method of renovating old orchards resulting from experiments has been to break up the soil in the spring, and then after preparing it well, plant dwarf peas or bush beans in rows. This allows frequent cultivation, and the pods pay well for the labor. When the crops are picked the vines are plowed under, and the land is sown to some cover crop. These come off early so that the cover crop has time to get well established. This same treatment can again be followed the next year, or until the orchard is in good condition.

THE HITCHINGS METHOD. (MULCHING SYSTEM).

In discussing methods of tillage I desire to call attention to the care of orchards, particularly the apple orchard, by the Hitchings method. The writer visited the estates of the late Mr. W. H. White, at Pittsfield and Gilmanton, N. H., where about ten thousand (10,000) apple trees have been set during the past two seasons. Mr. White spent some time looking into the business of apple growing, and not only visited the various fruit sections of the country, especially Western New York, but engaged many noted growers to come to his farms to suggest methods of handling his orchards. He became deeply interested in Mr. Hitchings of Western New York, whose system of orchard culture has of late years received much attention. After visiting the Hitchings orchards and having Mr. Hitchings come to New Hampshire to examine his soils personally, Mr. White became convinced that this was the system best adapted to New England.

This system is carried out as follows: The land for orchards is selected as usual, and the trees are mulched with the grass or vegetation that is cut in the orchard, beginning when the trees are young by mulching only as far as the root growth naturally extends, and increasing the radius as the tree grows larger; in this way the soil has nothing taken from it other than tree growth, as the vegetation decays and remains above the tree roots. The expense of cultivation, which is the heaviest outlay under the clean culture method, is eliminated. One person can cut the hay and mulch the trees at little expense, while to cultivate the orchard at frequent intervals throughout the growing season is quite an outlay.

The good effects from cover crops in preventing washing or gullying out of the soils, etc., already discussed, apply with equal force here. The young orchards set by Mr. White withstood the very severe dry season of last year as well as any cultivated orchard. Trees set on land that had not been cultivated for many years and simply fertilized with ashes and mulched, made growths of from nine to twelve inches. I am not prepared to say that the Hitchings method is the one to follow, but it does seem to have many advantages that look reasonable if judiciously handled. It is, at least, worthy of further consideration. If it proves to be practical, it is likely to revolutionize our whole idea of apple growing in New England.

In concluding this discussion of tillage, I desire to emphasize the remark made at the beginning,—the object of the orchard is to produce fruit.

PLANT FOOD. (FERTILIZERS.)

No prescription can be written for feeding all fruit trees, as there are so many varying conditions. About all that can be done is to review the subject in order that the reader may comprehend the main principles, and thereby, mould them into their practical application. The feeding of plants is not unlike the feeding of animals. We do not feed horses and swine on the same diet; each is known to do best under its own particular treatment. We must first become acquainted with the plants we are to feed, and when their habits and needs are understood, anyone with good judgment can husband them. A good florist understands his plants and knows their wants; a good fruit grower needs a similar knowledge of the plants he is to depend upon for success.

To feed fruit trees intelligently we must ascertain what the soil in which they are growing is capable of doing for them, and if it needs assistance, supply it. The three elements liable to be deficient are potash, phosphoric acid and nitrogen. If the trees are making rapid growth, have deep green foliage and mature their wood, we may reasonably infer that their needs are satisfied. If, however, they begin to show sluggish growth, and the foliage turns yellowish, we may infer that they are receiving insufficient food. If the soil is not mellow and friable it should be made so. A coarse and lumpy soil can be improved by growing some rank growing cover crop, as cow peas or rye, or by the use of farm manures, plowing them under in spring. When working about the trees in spring a few handfuls of ground bone and wood ashes spread about the roots and worked in with a hand implement will prove beneficial. It often happens that orchards upon reaching bearing age are growing too rapidly, and show little inclination to fruit. This is largely the case when too much nitrogen is present. This condition can be checked by allowing the orchard a rest for a season without cultivation, or if cultivated, using non-nitrogenous cover crops, and applying fertilizers containing potash and phosphoric acid only. These latter ingredients are heavily drawn on when the trees begin to bear. It is estimated that an average crop of apples removes eleven pounds of nitrogen, nearly one pound of phosphoric acid and sixteen pounds of potash per acre.

Commercial fertilizers are commonly used for bearing orchards. When used in rich soil the results are quite marked, but when applied to young trees in comparatively poor soil, they are not as valuable as good barnyard manures. No rule can be given for the proper application of fertilizers per acre for successful orcharding. Every soil is necessarily different from every other, as regards physical, mechanical and chemical properties. From a study of the soil in question it is thought that with the aid of the following tables one can judge from previous experience as to what should be considered a liberal application.

APPLE.

(1) 50 to 100 lbs. nitrate of soda; or
(2) 40 to 80 lbs. sulphate of ammonia; or
(3) 80 to 160 lbs. dried blood.

(1) 300 to 600 lbs. bone-meal; or
(2) 200 to 400 lbs. dissolved bone-meal or bone-black; or
(3) 250 to 500 lbs. dissolved rock.

(1) 100 to 200 lbs. muriate; or
(2) 100 to 200 lbs. sulphate; or
(3) 400 to 800 lbs. kainit; or
(4) 1,000 to 2,000 lbs. wood ashes.

For pounds of different materials per tree, divide each by 50, and sow it broadcast under each.

Practically the same amount of fertilizer is recommended for the pear and quince as for the apple. The stone fruits, as cherries, plums, peaches, etc., are given a little heavier dressing of nitrogen and phosphoric acid, but not quite so much potash. Grapes require the same as apples, only about twenty pounds less of potash per acre. Small fruits, as currants, gooseberries and raspberries, require about the same as grapes, but more nitrogen.

Too much nitrogen is to be avoided as the tendency will be to run to growth rather than fruit. The potash may be applied in the fall, also one-half the phosphoric acid; but the remainder should be applied in spring. Potash is generally considered the most important constituent, since fruits withdraw much larger quantities of it than the nitrogen or phosphoric acid.

TRAINING THE TREES.

Whether to start the limbs high or low on fruit trees depends upon the kind of fruit under consideration, and even different varieties of the same kinds. Some varieties have natural drooping habits, and will require higher trunks than others which grow more erect. The Burbank plum, for example, has a very umbrella-like top, and when laden with fruit bends to the ground, and hence needs a comparatively long trunk. Many other varieties of plums have a naturally upright growth, and it is an advantage to start the head rather low. With apple trees four to five feet is considered about right, depending again upon the character of the variety. Peaches are headed comparatively low, from twelve to eighteen inches at setting. It is more difficult to work the soil about low-headed trees, and it is thought that the circulation of air is checked, thus favoring fungous diseases as well. High heading also has its faults in that the fruit is not so easily harvested; the trees are more likely to break down; the damage from windfalls is greater and the expense in pruning and spraying is larger. It is advisable to visit orchards and get ideas of this question before purchasing one's trees. If we have in mind the form and shape desired and start with the right kind of a tree, it is a simple matter to form the head as desired.

PRUNING.

The only intelligent way to get at this subject is to begin with the young tree the first year it is set, and then each season thereafter cut out the branches not needed. This work is probably most easily done during the dormant season. Where this is done each season no large limbs that are not needed will get in and only an occasional broken or dead limb of any size will be taken out. Summer pruning, or the rubbing off or destroying of buds that come out on the trunk or branches of vigorous trees should be practiced. The time to do this is before their leaves are fully expanded. Before attempting this, however, one must familiarize himself as to which are superfluous shoots and fruit spurs. Fruit spurs are rubbed only when one desires to thin the fruit. Shoots that are inclined to go beyond the line of symmetry should be pinched. Summer pruning is not practiced as much as it might be to advantage. It is limited to rubbing off and pinching in, but will greatly eliminate the labor of annual pruning, if done properly.

Pruning properly done will encourage the normal development of the fruiting habit. It favors branching and it is a common observation that trees diverted by branching are the ones most likely to form flower buds. The upright or vertical shoots should, generally speaking, be discouraged. When sufficiently thinned, leaving an open and at the same time well formed tree, we can expect results, other things being equal.

Pruning is a remedy to overbearing, and hence is expected to approximate annual bearing. Spasmodic and overpruning will unbalance the tree, and is likely to do more harm than good. Going into an old orchard and cutting out firewood is not pruning as we should know it. The trees should never have been allowed to have reached the stage where this is made necessary. Where these conditions do exist much good can be accomplished in renovating a portion of the numerous limbs each year. Where limbs are not over an inch in diameter, as should be the case in annual pruning, they will quickly heal over or doctor themselves. The cut should be made close to the base so that no stub shall remain. On large limbs, of course, it is quite another question, and cutting off at right angles will leave far less exposure and give less chances for decay.

THINNING FRUIT.

The practice of thinning fruit is continually growing in favor with our best growers of orchard or tree fruits. By picking off a portion of the fruit when immature, that remaining grows to a larger size. The resulting crop may not necessarily be larger in bulk, but the product will be much superior. Thinned fruit is usually all first grade. Where thinning is practiced, the exhaustive results coming from overcropping are lessened, and hence annual bearing is favored.

Some varieties have the tendency to overbear and thinning regulates this. Always remove the inferior specimens, leaving the better ones. It is a good practice to wait until the damages from the most troublesome insect pests have appeared, as the plum curculio, codling moth, etc. Then those affected are taken first. Peaches and plums are always thinned for best results, but the thinning of apples is not so commonly practiced, and the results to come from it will depend upon varying conditions. From experience I should defer thinning apples until they are the size of a walnut (hickory nut), for the apple has a tendency to thin itself up until about this size. It costs to thin fruit, but the resulting fruit is of a superior grade, and the expense of picking inferior fruit is eliminated at harvesting time. Do not neglect this part of fruit growing.

SPRAYING ORCHARDS.

The spraying of fruit trees for both insects and fungous diseases is being better understood and more commonly practiced each year. Everyone should learn to distinguish the difference between spraying to destroy insects and spraying to prevent fungous diseases. The Bordeaux mixture serves to check fungous diseases, while the other sprays containing arsenic are used for destroying insects. They are applied together when both insects and fungi are prevalent.

There are many good spray pumps on the market, and the only precaution is, do not make the mistake of getting one too small to do effective work. Generally speaking, get one of the kinds that have force enough to throw a good strong stream to the top of a large tree from a wagon. These are usually mounted on a barrel.

Nearly every state experiment station has published bulletins giving spraying directions which are sent free for the asking.

WINTER PROTECTION.

The best and first thing is to select hardy varieties for northern conditions. Stop cultivation early so that the trees will have sufficient time to fully mature before severe winter weather sets in. A cover crop sown at last cultivation assists in maturing the wood early by withdrawing moisture from the trees, and it keeps the soil from washing. Trees planted on well drained soils are not as liable to heave out in winter. A slight rounding up of the soil about the tree will carry away the surface water and obviate any danger from water standing about the trunk. This is particularly true with young trees. A wire screen of small mesh placed about young trees to the height of eighteen inches will lessen the danger from mice in winter. A common practice is to tramp the snow down about the trees after each heavy storm. This renders the conditions unfavorable for the mice to attack the trees from below. Trees need protection in winter until they are of fairly good size. One example was called to my attention where mice fairly destroyed a young and thrifty apple orchard that had come well into bearing. Rabbits are equally troublesome at times, and they should be fed, destroyed, or the trees protected against them.

PICKING THE FRUIT.

In order to work to advantage picking conveniences should be devised. Where trees are not over fifteen feet high, a step ladder made of three legs, hinged at the top, and of light but durable construction, and hence easily portable, is invaluable. It is equally useful in thinning fruit. For taller trees light ladders running to a point at the top are convenient, as they can be easily placed against branches and in the exact places desired. For very tall trees extension ladders are to be preferred. When a tree is well pruned, a picker can usually get through it, and pick a large portion of the crop by standing upon the branches. A light and nimble person is to be preferred for the outer limbs, and if he wears tennis or rubber-soled shoes, the injury will not be so great to the tree.

Each kind of fruit requires very careful and painstaking handling to keep well. So important do cold-storage men regard this that they prefer to purchase the fruit on the trees and import their own help that they may feel sure the fruit is to be handled right. This is true of apples. If it is true with them, it is vastly more important that peaches, plums and the other more delicate fruits be given equal consideration. Many patent picking devices have been placed upon the market, but other than to pick the stray apple or fruit out of reach, they are of little value.

Fruit growers are following the practice more and more, of lessening the time between picking and getting the fruit on the market. If apples are to go into cold storage, they are picked and shipped at once, as in this way the decaying germs do not have time to get established. Peaches that go direct to the market and are sold in their fresh condition are what people want. Grapes well ripened and freshly picked from the vines are far superior to those shipped from long distances, and can always be made to command the market, if well grown.

Methods of packing might be discussed, but hardly come under the subject of this paper.

The orchardist should provide himself with the best literature in relation to his work. Secure bulletins and books coming from responsible authors on pomological problems and supplement this by other reading, of which there is any quantity to be had; thus one's interest can be kept up, provided one has the instincts for success to begin with. We must not look only at the commercial side either, for while this is commendable and essential, that person who takes genuine enjoyment and pleasure in fruit growing will be the more likely to succeed. One can often learn more in a day by visiting markets, other growers, or by attending fruit meetings, by making a trip to the State Experiment Station, by attending a short lecture course at the State Agricultural College, etc., than he would get by years of studying out the problems by himself. It is a similar example to that of the man whom it took thirty years to make his standard of butter, and then it fell short of the product taught to be made at a dairy school which took but a few weeks.

Orchard management is a problem of its own, and if intelligence, thought and systematic work be given it, few industries can surpass it for a successful occupation.

PRACTICAL POULTRY POINTERS.

By C. E. CHAPMAN, Ithaca, N. Y.

The time was when a speaker on this industry would be allowed but a few minutes at an institute, and then only when he could be sandwiched in somewhere between the more *important* subjects; but now the greatest interest and enthusiasm is aroused when the hen is under discussion, of all the farm problems.

The magnitude of the industry is but little understood except by those who have looked into it. The value of the poultry products of the United States is four times greater than that of the gold and silver mined.

In Maine, in some sections, it produces more money than anything else. The advantages that this industry has are that the products, both meat and eggs, are always salable, always wanted, and always sell at a profit; that these products are light and easily delivered to the market or railroad office, that one can locate back inland, far from town on cheap land, without being handicapped, and that a poor man can start in business without running in debt so deeply he can never get out. The returns come in quickly, and the first year.

A person incapacitated by age or ill health from doing heavy muscular work can care for fowls. It is a work that children of botn sexes can do, and in which women, from their natural (mother) instinct, are peculiarly successful. I am acquainted with a lady who has furnished a house. bought a horse and vehicles, and pays the girl from the proceeds of her turkey money.

The price of these fowls has been almost prohibitive for several years, and the inducements to engage in their culture are large. Her methods may be of interest.

"When taken from nest put mother and brood in a yard and feed her shelled corn so she will not be hungry or uneasy. Do not give little ones anything for two days, then feed sparingly of white bread moistened with milk. Let mother go in field, bringing her back to yard at night. Examine young, and if crop is full, do not feed. Give a little cracked wheat if they

An 8-year-old Grimes Block. Southwest Missouri. Photograph from H. P. Gould, Agricultural Department, Washington.

need it. Turkeys are killed by too much feed. By the time the mother has been brought back a week, she will have formed the habit and come back without looking after her. No other care is needed except a little grain thrown on the ground so they can get a little before starting out each morning. Fed in this way they will not injure growing crops, and be of great benefit by cleaning the field of insects."

In Maine there is a great deal of "free range" on the hills that should be devoted to turkey-raising. Some men are too stingy, some are too poor, to give their wives a hundred dollars each year to spend; but all can give them a chance to earn it for themselves.

The poultry house may cost $10.00 to $2,500, but its value will depend on two things—warmth and dryness, without which there can be no great egg production or long continued health among the fowls. Corn is more expensive than lumber, and a hen with a frosted comb does not lay. Some advocate colder houses, but it is always found that they are keeping some of the heavier breeds or else are not getting a large yield.

At Horse Shoe Farm we have a two-story hen house that cost seventy-five cents per hen, and is a labor saver. Personally, I think it is the most practical one I have ever seen. It faces south and extends into a bank on the west end, giving an entrance into the upper floor on a level, while entrance to lower part is from ground on south side.

This arrangement gives yards either side wanted, on east and north, so a team can be driven to either door to unload feed or when cleaning is done.

A trench was dug and graded so water would drain off at lower corner, and a small drain laid. We then filled it with broken stone nearly to top, and laid a wall of stone and mortar a foot above the surface, but it should be no farther than can be banked with earth. This gives, when a cement floor is put in, a rat proof, wind proof, frost proof and moisture proof foundation.

On the top of the wall a 2 by 8 plank was set in mortar. Boards of proper length to fit the various heights of the wall and bring them level at top were cut out of inch boards, a foot wide. These pieces were placed on end, and bottom nailed to the plank. Each board acts as a post, and no frame was needed.

A 2 by 8 was held in place and the tops of the boards nailed to it; this made the plate. Studding was set in two feet apart, and was one inch by eight, so it came out even with inside of plate and sill.

An ordinary roof of rafters and shingles was made, then the whole room and roof were ceiled with ½-inch basswood, second class, that cost $10.00 per M., matched and planed.

The space was filled with buckwheat shucks as fast as we ceiled. Any dry, light, fine substance would answer for this purpose, that is not a conductor of cold. Coal-ashes, dirt, etc., are not good. The object is to prevent frost on the walls which will show when the inside surface becomes colder than the air in the building. The building was battened on the outside, and is 7½ feet high on each floor. Joists were put in on top of the plate and nailed to some of the rafters, which stiffens the building and makes a place to lay a few loose boards to hold a supply of straw. The "attic" was piled full of straw; this makes the building warmer, and absorbs any moisture rising from below. When straw is needed to litter the floor, it can be pulled down readily.

The inside arrangement should be as simple as possible. The few windows which are on the south side are double sashed, and only large enough to light the place. A curtain to drop down at night inside will prevent radiation of heat outward to a great extent. Wire netting on inside of window will prevent fowls from breaking the glass.

The roosts are suspended by wires and do not touch each other or the side of the building, and are in the farther end. If lice are found, throw away the poles and put in new ones.

The droppings drop on the floor and are kept in place by a foot-wide board set on edge across the narrow way, just outside the poles, which forms a box on the floor. This box is kept two-thirds full of dry material and absorbs the moisture. By this method the drudgery of daily cleaning is done away with; and once a month is plenty often enough. With a large flock this is a great saving of labor bills.

A partition is built along the north side, and is three feet wide, extending two-thirds the length. This alley is used to store feed in, contains feed trough, water and shell holders, and is always clean so that lady visitors will not befoul their clothing, or frighten the fowls when the eggs are gathered.

The partition is made by nailing a 2 by 4 to the floor; to this short posts, 18 inches long, are nailed, and another 2 by 4 nailed on their tops. Laths are nailed to this frame perpendicularly, and two inches apart so the fowls can stick their heads through into the alley like cows in stanchions. A foot-wide board is placed flat on top of this frame, and six-inch boards nailed on to this board, making a long trough the whole length of the alley. This is divided off by short pieces put in a foot apart, forming nests. These pieces are a foot wide, and set on edge. Another 2 by 4 is nailed across the inner edge of these pieces to hold them, and wire netting is put on from this piece to roof above. A cover is put on these nests on alley side, and hinged to back piece.

The hens can enter the nests from back side, but cannot pass through into the alley. By lifting the cover, the eggs are gathered without going among the fowls.

A "V" shaped trough is fastened close to the lath on alley side, and all soft feed, raw meat, grit, shells and water placed in it, which, while giving free access to them, prevents the fowls from wasting or befouling any of the material.

In the lower part one-third was set off by a cross partition for a store and cook room with feed trough in the room. A stove with boiler is there, and a chimney was put up of vitrified pipe, in two hours. It rests on the ground. The kettle has a tin cover with a small pipe extension connecting with the chimney to carry off the steam. Pipes from a spring bring water to this floor, and wood is piled in the corner. I cannot imagine any better, cheaper, or more convenient method.

The hen that gives greatest profit in New York is the one that produces the most eggs; but here in Maine I should think that owing to the high price of poultry meat it might be a combination, but I would urge attention to the point of keeping and selecting the best of your breed and of having that a full blood. A mixture of two breeds that require different feeds, care and temperature, is hard to control, and rarely so profitable.

The difference in producing capacity has been ably demonstrated by your own Prof. Gowell, and needs no comment, but I will mention an instance from New York. Mr. Wycoff raised the standard from 100 to 196 eggs by selecting the heavy, wedge-shaped, large-combed hens, and retaining of these those that continued to lay during moulting. His record of 196 eggs each from a flock of 600 has probably never been equaled. The care must be like some shows in New York City—continuous, but not spasmodic. It is not heavy, but rather light work, but it is to be done every day. The owner must be quiet and observing, and able to keep the flock in the "pink of perfection." He will weigh a hen once a week, and if she is falling off, feed richer food, or if too fat, make a more bulky food by adding bran. The method of feeding has as much to do with success as the composition of the ration.

Our present method is to feed a mixture of grain at night, covered up in the straw and fine chaff which always covers our floors six to eight inches deep. More is fed than they will eat up clean, so that they can go to work early in the morning without our getting out early.

In the morning they are given warm water or milk, if winter, and two quarts of grain per fifty hens, covered in the litter. Not getting all they want they keep at work all the time, until noon, when the cooked or warm feed is ready and is given them.

Ease and convenience for us and ceaseless industry on the part of the hens is thus obtained. Health, vigor and eggs are synonymous terms, and are only procured by paying for them in work, that is, exercise.

Our ration is, corn, oats, wheat and buckwheat in equal parts for whole grain, and 3-6 wheat bran, 1-6 corn, 1-6 oats, 1-6 meat, or oil meal or milk for mash at noon. Cut clover hay, green vegetables, raw meat, oyster shells, and dry road dust should be in constant use. Water should never be neglected, not only because the fowls need it, but because the egg is 75% water.

The highest profit comes from so growing the stock that one can have pullets laying in October and during winter, disposing of the cockerels at 1-pound weight, and the hens as fast as they stop laying in mid-summer, wintering nothing over one year old.

By keeping no males with the flocks so the eggs will be sterile, gathering them often, and sorting them for size and color to meet the demand of your market, you can easily raise the price from one to ten cents above the market quotations.

There is no farm industry that offers more inducement for plenty of study, fair profits, and an interesting profession than the keeping of hens for eggs.

THE FARMER'S HOME.

By F. W. TAYLOR, Professor of Agriculture, New Hampshire College, Durham, N. H.

If there is anyone who is entitled to a good comfortable home, the farmer is surely that one. The home is what the farmer exists to create, and the farm is for ministering to the home. The home does not exist for the farm and is not to be subordinate to it, as some seem to think.

Let us right in the start draw the distinction between "house" and "home." The house consists of the wood and the stone and the brick and the mortar which have been put together in various ways to form a shelter and afford conveniences for our daily work. The home of course means all this but it has a deeper and broader significance, higher and immaterial qualities enter into its makeup. It is a congenial abiding place of love, peace and affection. To some, I am sorry to say, home is the place where they eat and sleep and have their washing done. To others it is a place where vanity is gratified in making a show, and in building costlier houses and filling them with more expensive furniture than their neighbors can afford. This may be a home to some but to the most of us I do not believe it would be so interpreted.

To me, the ideal of home means the little house on the old farm, which father built largely with his own hands; it means the trees that cast their grateful shadows across the lawn in summer days and stay the howling winds of winter's storms; it means the vines which I have helped to plant and which cling to the unpretentious walls as if they loved them as I love them; it means the broad bay window through which streams the warm glow of the open fire to cheer the passer-by on winter evenings; it means the shout and laughter of voices when all have gathered for their evening work and pleasure,—father with his newspaper, mother with her mending, big brothers and sisters with their reading and fancy work, and the children with their toys and prattle; it means, and this most of all, the love and affection, the self-sacrifice and companionship of mother; it means the walls on which she has hung the pictures, the book-shelves and curtains she has arranged, the old treasures and curiosities she has collected; and of course it means the dining room with its long table and the well cooked meals that are spread there with her own hands about ten hundred times each year. Most of us love to eat, for it has been said, "That for man, the hungry sinner, since Eve ate apples, much depends on dinner."

Now, what about the farmer's home? What have I to say about it? I hope you will pardon me if I should scold a little because some of us fall short of having as good homes as we may have if we wish. It has been my good fortune to have traveled over this big country of ours from Maine to California and from the Great Lakes to the Gulf, and nowhere have I seen more beautiful and more homelike homes than right here in Northern New England. Yet we are lacking in not having the beauty that we might have about our homes. The fact is that our homes are usually more delightful inside than out; our good women know better how to make a home charming on the inside than we men know how to make it homelike on the outside.

Nothing so attracts the American traveler abroad as the great beauty of the English rural scenery, the perfect cultivation of the land, the splendid roads, the neat flowery hedges and the well-kept stone fences. It is true that English country homes represent the growth and culture of centuries aided by a most congenial climate, while in America, a comparatively new country, with a less favorable climate, combined with the hard conditions under which our forefathers worked, there has been little time, strength or inclination left for what has seemed the superfluous work of improving the home surroundings.

Nature has already done much for us. We have a rare combination of the wild and picturesque with our gently sloping hillsides and green, level meadows. It is true that nature will not replant the grand forest trees which we have cut down, but she will furnish a rich variety for us to transplant.

Before taking up any of the features which contribute to the inside of the ideal home let us look briefly at some of those outside. There are two or three well defined principles which should be regarded in planning the location of our farm buildings. First, as regards the public highway. To have farm buildings set away back from the highway is not an ideal location. It is much less lonesome for the women folks who have to spend a large proportion of their time in or at the house if they can see and recognize the passers-by on the road. It is more pleasant to live where one is easily accessible to his neighbors, and more pride will naturally be taken in keeping things in good order where they are frequently seen. Besides this there is less danger from marauding tramps near the highway than away from it.

Second, as regards drainage. The house should always be located several feet higher than the barn so that the drainage will be from the house to the barn and not vice versa as I have frequently seen. The house, too, should be so located that the prevailing winds will blow towards the barn. This is to avoid any of the offensive barn odors. The house should also be separated from the barn either by a sufficient distance or by other means so that the flies which breed in the manure piles are not likely to find their way to it.

The third principle to be regarded is the surrounding landscape and the best views to be obtained. Do not put the kitchen farthest to the rear of the house when the only fine view has its outlook from the front. A picturesque landscape which can be seen from the kitchen window will help the good housewife through many a tired hour.

One of the first faults that I wish to find is that we do not give room enough about our homes. Land seems to be plentiful as we ride about the country, yet some farmers begrudge a little of it to the house dooryard or lawn. Suppose a half acre is devoted to the dooryard,—an acre would be better, but let us take only half of it. If land is worth forty dollars an acre we will then have twenty dollars invested in real estate for the home surroundings. I am aware of the fact that it will require a good deal of time and muscle to go over this half acre once a week with a lawn mower. Muscle is a thing that is in great demand in the hay field and in the corn and potato patch from June to August, just when tne lawns most need mowing. Therefore, unless there are boys and girls about the house who can push the lawn mower, the better plan is to mow the larger part of the lawn three or four times during the season with the horse mower, leaving perhaps only one-fifth or one-tenth immediately around the house to be kept down with the hand machine.

I do not believe in having a lot of fancy shaped flower beds and urns scattered over the lawn. They require a large amount of work to be kept in good condition, and if they are not nicely kept they look worse than none at all. To my notion nothing so enhances the beauty of a dooryard as a nice, clean, green lawn with a few of our native flowering shrubs massed in groups in the corners and along the sides. Of course a good lawn requires considerable labor at first in the way of frequent mowing, renewed seed sowing, fertilizing and occasional rolling, but after it is once well established all that is necessary to keep it in condition is a sharp lawn mower.

But no matter how beautiful the lawn may be, the crowning glory of the homestead lies in the grand and noble shade trees. In setting out the trees around the home place the greater part of them to the north and west of the house. Plant the tallest ones farthest back, then shorter ones in front and at the edge of all plant the shrubs. If properly placed the trees will be found very beneficial in breaking off the wind and in the saving of firewood.

Just a word here as to what to plant. Go to your own forests and wild woods rather than to nursery catalogs for hints; the trees themselves will tell you what to plant. Of course there are some trees that grow so quickly, such as the maples and poplars, that it may be well to use a limited number of them even though they do not grow in your own woodlands.

Back of all the farm buildings should be the orchard, which should be so located that it will afford protection from the prevailing winds. By all means keep the orchard well set and properly trimmed. Nothing will indicate the thrift and tidiness of a farm home better than a well kept and well pruned orchard.

There is a popular opinion that vines on a house have a tendency to make it damp. This, however, is a mistake, as the leaves of the vines overlap like the shingles on a roof and keep the rain from reaching the walls. Either the evergreen English ivy or the deciduous Virginia creeper is a splendid adornment. Just a little here about the height of the farm house. Why should we build great high houses in the country? Land is plenty and cheap these days and why pile the home up room above room when it can just as easily be spread out? Of course a house ought to have rooms on the second floor for economy of roof, but stairs are evil things at best and the country housewife should get her exercise in other ways than climbing them too much.

There are some features of the inside of the farmer's home which are well worth considering also. One thing that we ought to have which we sometimes neglect is the open fire. A home with a sitting room without an open fire is not as pleasant as it might be. It ought to be a good big fireplace where logs could be burned. A fireplace is more than a comfort and luxury; it saves doctors' bills and makes the whole inside cheerful. There is nothing so grateful to a sick person as to lie and watch the fire, and no pleasure so much enjoyed by the old as to sit and dream as the sturdy sticks turn into clean white ashes again.

Another important adjunct to the home is the bathroom. A good location for it is over the kitchen or near it so that hot water may always be convenient. It need not be a large room, neither need it cost much, and I venture to say that any man who has once had it in his house would not do without it for several times the cost.

Another thing on which I should insist is plenty of light. Make the windows large and have lots of them. Have them so placed that when there is any sun it can reach the living rooms, do not try to keep it out for fear it may injure the carpets. Better have faded carpets with roses on the wife's cheeks than roses on the carpets and faded cheeks on the wife. Do not think any of the rooms of the house are too good for family use and are to be opened up only when there is a big party, a wedding, or a funeral. Keep the house open and the blinds up all the time, the day of musty parlors and spare rooms is past.

In no other home are the members of the family so dependent on their own resources both for recreation and improvement of the mind, as in the country home. People in the city, have the social party, the dance, the entertainment, the lecture and the theatre at which to spend the evenings. The farmer's family have these only in slight degree and on rare occasions. To offset these advantages, then, the farmer's home should have a fresh and abundant supply of good literature. Not only is a standard library necessary to the intellectual enjoyment of the farmer and his family, but he must have the best current literature. That, the farmers will generally say, we cannot afford,—books are cheap, but good magazines are expensive. I will tell you how a community of farmers supplied themselves with the best current literature. Sixteen farmers' families clubbed together and thus secured reduced rates. They took two copies of eight of the leading magazines. Dividing into two sections, these magazines were each read by eight families. This would make for each family, the average cost of one magazine, or about three dollars for the use of eight.

There has been more or less about women in what I have said, but I would like to know how you are going to talk about the farmer's home and not talk about the woman? Notice, I do not say *a* woman, but *the* woman. I have lived in hotels, boarding houses, and camps, but never did I think of these places as "home." It was not until I had learned to hear the music in that subtle chord which the poets call "love" and oddly and strangely as it seemed to me gotten the promise of *the* woman to be the life partner of my joys and sorrows that I began to think what a home really was. If I could leave but one word of advice with the old, cynical, incrustated bachelors and widowers, it would be that you shed at once your impenetrable armor of self conceit and give the flying darts of Cupid just half a chance.

The woman makes the home. The farmer's home begins with a woman and ends with a woman. May God bless her!

Rawson W. Fuller Orchard, Wilton. For description of this hillside orchard see article on "Opportunities in Apple Orcharding," page 69.

OPPORTUNITIES IN APPLE ORCHARDING.

By D. H. Knowlton, Secretary Maine State Pomological Society, Farmington, Maine.

As viewed by the writer, opportunities in apple orcharding in Maine offer no get-rich-quick scheme for a lazy man, nor do these opportunities offer extraordinary inducements for the capitalist who expects an investment to take care of itself. The opportunities are great, but they are for the man who is willing to work and for the capitalist who makes the best operating use of his investment. To both classes the opportunities are open and lie around in many Maine towns waiting for willing hands to improve them. These opportunities are not all advertised by the real estate agencies but may be learned about by a visitation to many rural towns in the State.

Over a large part of the State, soil and other conditions are found to be very favorable for the production of the finest apples grown in America. While these may not be as large as those grown in the West and South, they are of very close grain, highly colored, long keepers, and of sprightly flavor. A gentleman in charge of a Pacific fruit exhibition at Buffalo pointed with pride to his magnificent display of fruit, and then said, "Wife wants a Maine Roxbury Russet, and so do I. A man who ever ate Maine fruit doesn't want to eat such apples as these," pointing to the tables before him. Only a few weeks ago an Ohio dealer wrote me inquiring for Maine apples, remarking that he preferred to pay the extra freight over New York apples. I gave him addresses and he bought several carloads, at the price for which the same varieties were selling in Niagara county, N. Y.

Although real estate is advancing in Maine it is still very low. I am very sure there are thousands of acres of good orchard land within a dozen or fifteen miles of a railroad that can be bought at from ten to twenty dollars per acre. Many farms with buildings complete and with orchards already planted are offered at ridiculously low prices.

There is another favorable condition which should not be overlooked and that is nearness to market. A large part of the cities and towns are now supplied with apples by local growers, so that the surplus market is found in Europe and foreign lands. Several lines of steamers sail from Portland and Boston to Liverpool and London. The expense this year for shipping and selling apples over a large part of Maine is not far from $1.10 per barrel by way of Portland and $1.25 per barrel by way of Boston. These ports are the outlet of a very large part of the apples sold in European countries at the present time, and no doubt will be for years to come. Maine's nearness to these ports is equivalent to a profit over every barrel of apples exported from more remote regions.

Apple trees mature more slowly in Maine than in Missouri, but they are believed to bear fruit for more years after they once begin to bear. The Wealthy, and several other desirable varieties, will, under favorable conditions, begin to bear in six or seven years, and these varieties are recommended for fillers between later bearing varieties, to be cut out when the others are large enough to occupy the ground. Some think so much of the Wealthy that they are setting this variety for entire orchards, and it does seem a desirable thing to do.

In various ways the land after the trees are set may be turned to advantage. Small fruits may be raised among the trees when small. Corn, potatoes or other hoed crops on land easy to cultivate will keep the soil at work at a profit. At the same time the more cultivation among the trees the better it is for them. Where the land is rocky or too steep for cultivation, sheep or hogs may be pastured. A gentleman living in a village about seventy miles from Portland twelve years ago bought a wooded hillside for which he paid $650. He cleared the wood off at once so that the land stood him just $220. He set seedling apple trees among the stumps the next spring, and worked them over to the varieties he wished. The hillsides were covered with stumps and so steep there was no possibility of cultivating it, so he pastured sheep and hogs among his trees. The sheep and hogs grew while they enriched the land, and the owner had the benefit of the growth. He had one horse, and some of the manure from the horse was used upon the trees. In other words, the land all the time was raising something for the owner. The seventh year the trees began to bear and the ninth year bore 65 barrels, the tenth year 33 barrels and the eleventh year 500 barrels. The 500 barrels, without the barrels, he sold for $1.75 per barrel or $875. Last spring he sold this orchard, which contains 1,017 trees, for $2,850.

Another orchardist living less than fifty miles from Portland sold his 1904 apples on the trees for 50 cents per barrel. The price seemed very low indeed but he realized $500 net for his crop of apples. A hundred dollars was paid for taxes and all the expenses connected with the orchard, and the remaining $400 paid the owner six per cent interest on an investment of $6,666.66, and a year or two ago the whole farm was in the market for less than $5,000.

Although there are many instances where orchards in the State have paid liberal returns, I will refer to only one more illustration. One grower in Kennebec county in 1903 sold the apples from eight and one-half trees for $276, or an average of $32.47 per tree. A ten acre orchard of such trees would make a liberal income for a man in his old age.

These illustrations are suggestive to the young man who is looking for a good chance to make a comfortable living and lay aside something for a rainy day. It means work, but it is work in God's pure sunshine where fresh air and pure water are free to all. To a man with money to invest there is promise of a liberal return for every dollar invested, and for all well directed labor in the care of the orchard. These opportunities have long been overlooked by the public at large, but many Maine people know all about what these "Opportunities in Apple Orcharding" are, for they are "in it" themselves.

REPORT OF PROCEEDINGS

OF THE

State Dairy Conference

AND

SEVENTH ANNUAL MEETING

OF THE

Maine Dairymen's Association,

DECEMBER 13, 14, 15, 1904.

The Annual State Dairy Conference, under the control of the Maine State Dairymen's Association and Department of Agriculture, was held at Auburn, December 13, 14 and 15, 1904. Tuesday, December 13, was devoted to receiving and entering the dairy products and preparing the exhibition.

Wednesday, December 14.

ADDRESS OF WELCOME.

By Hon. HARRY MANSER, Auburn.

Mr. President and Friends: As a representative of the city of Auburn, it seems to me that an address of welcome is almost a superfluous feature on your program. We who know the character and sentiment of our citizens, their warm admiration for those factors and agencies that make for our future prosperity and for advancement in a sanitary and healthful condition of our people, who have some acquaintance with the objects of your organization and with the men who are concerned in furthering those objects, may well take it for granted, without the spoken word, that the municipality of Auburn and the good people who compose it are indeed glad to welcome you, and to know that of all the places and against all the counter inducements that might be offered elsewhere in this State, you have selected Auburn as your place of meeting.

It may not be amiss however for us, with due formality, to express our appreciation of your coming among us. Too often, I think, the Puritan instinct of repression of feeling to voice our good-will toward one another in our mutual relations in society is manifest. We are happy to greet the friends who have gone from us on their return visits. We are glad to welcome new industry. We are proud of the success of our native born sons, but are too prone to be afraid of overdoing by expressing those sentiments cheerfully and heartily. The glad hand, so long as it is not adopted for business purposes but is an expression of the warm heart, is a distinct factor in arousing the enthusiasm of the steady worker and renewing the courage of the faithful toiler. And so Auburn extends to you the glad hand. And be sure that its citizens have warm hearts, ready to encourage laudable enterprise, and are glad of an opportunity to share in the good things that you are to bring to their attention.

Now at the risk of trespassing on your good nature, I am reminded that an address of welcome from the public authorities of a municipality has some historical interest. It was not always that the people of a state or nation could come and go as they pleased. When the nations of the earth were at almost universal war, it was, of course, customary and necessary for them to protect their confines, and so for twelve hundred miles along the northern boundary of China is now crumbling to ashes what remains of that famous wall. It is twenty feet high, was broad enough for six horsemen abreast, and was built at a cost of half a million of human lives, simply to protect the Chinese from their neighbors, the Mongolians. Biblical history tells us that at the word of the Lord, the army of the Israelites, under Joshua, marched on seven successive days around the walls of Jericho, and that at the blowing of trumpets on the seventh day the walls fell down and the inmates were put to death by the sword. In London the grimy gateway, known as Temple Bar, separated the city proper, the domain of the Lord Mayor, from the territory that was under the jurisdiction of the sovereigns, and that sovereign could pass its portals only upon presentation of the keys by the Lord Mayor.

Now, friends, we need no Chinese wall. We here in Auburn are at peace with our neighbors in Turner, in Minot, and in Durham, and even in Lewiston. You have no occasion to march around our confines, fifty square miles in extent, by the way, blowing your trumpets, nor do we expect to be put to the sword by your conquest. And last, but not least, we have no Temple Bar, nor any other kind of bar, in Auburn, but we do assure you that everything is "open." I am glad to note that your meetings are open and public, and I trust that our citizens will avail themselves of the opportunities that you have afforded to them. Your addresses and your discussions cannot but be valuable, while your exhibits, both here and in the other hall, are certainly enlightening and educational.

We trust that your stay will be pleasant and profitable, and that you will not return to your homes disappointed at the accommodations you have found, or the usage you have received at our hands. Of course it is not for us to boast. This is not the place of which Oliver Goldsmith wrote, "Sweet Auburn, loveliest village of the plain," although perhaps we that live here think it has been well paraphrased in the line "Sweet Auburn, loveliest city of the twain." But we are willing that you should judge us for yourselves. We are a city of homes—not wealthy but moderately prosperous. Our business men like to do business, and I may take it upon my shoulders to inform you that if you should call upon them they will *do* you good.

Besides our legal lights we have our electric lights, and with the recent gigantic electrical development of seventy-five hundred horse power, we feel that we are now in a position to furnish power for all the creameries that you can establish; and we can furnish light for any hidden mysteries that may perplex you. And I do not know but I might add that we can furnish hot air for an indefinite number of speakers. But I must not make light of my subject any further, and will make my excuses for thus abusing your patience. But I do want to assure you of the hearty and cordial expression of our welcome that we give you, and may you as a dairy association, with your kindly godfather, the department of agriculture, never stop in your work of promoting good business, of furthering just laws, of fostering wise inventions, and of advancing the sanitary and helpful conditions of the people of our commonwealth. Our hearts and our homes are open to you, and may we all remember, as we are working toward our ideals and gathering material prosperity, to return thanks to Him of whom it is said, "The cattle on a thousand hills are His."

RESPONSE.

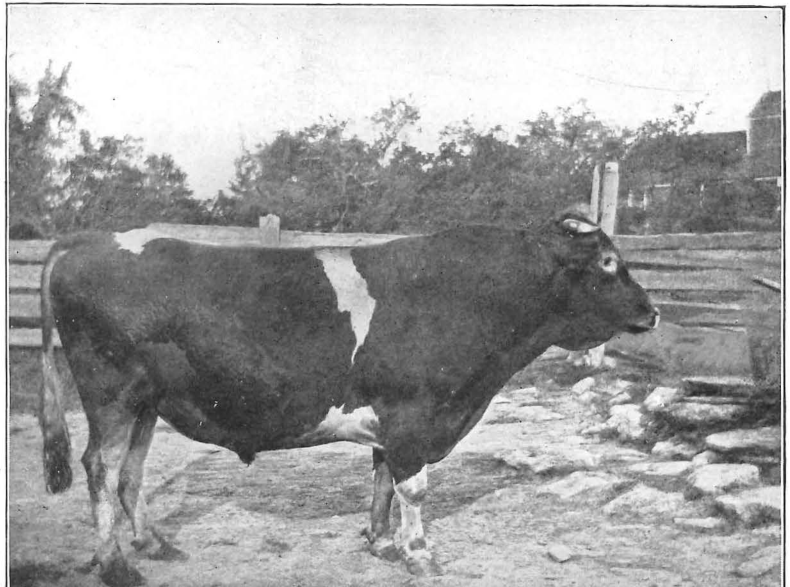
By Hon. A. W. GILMAN, Foxcroft.

Mr. President, Ladies and Gentlemen: I assure you that I am very glad that we are not living in those days when we were walled apart from our neighbors. We are living in the twentieth century, and we have an educational system, with freedom all over this broad land. We have so enlarged our boundaries, through the daily press and the telephone, that we in Piscataquis county, where I reside, regard the citizens of this city as our neighbors, as well as those of our own county. We expected that we should be welcomed to this city, and it affords us great pleasure to receive this cordial and hearty welcome.

The dairymen from all over this broad State have gathered themselves together here this beautiful morning, in the beautiful city of Auburn, to hold their annual conference and display their dairy products for your inspection. It is eminently fitting that the deliberations of this conference should have the benefit of the city people as well as the rural citizens. The dairymen are the producers of this grand exhibition. The consumers embrace the entire population. Everyone is interested in good butter, both the consumer and the producer; the consumer because it pleases his taste, the maker because it brings the highest price.

Mr. President, I wish to refer to some figures. I may confine myself to notes in relation to them, that I may be accurate, so you will pardon me if I turn to my paper. The legislature, at the request of the State Dairymen's Association, made an appropriation for and appointed a State dairy instructor, whose duty it should be to familiarize himself with the dairy industry, and to foster and protect it and give instruction in all of its various branches. He assisted in organizing the Creamerymen's Association, and co-operating with their patrons since their organization, they have produced articles of a more uniform standard and of a higher order. Dairying is on the increase. We are producing nearly ten per cent more products this year than last year, and more last year than in former years. The dairy instructor has done much toward increasing, encouraging, and protecting this industry. Under his direction the standard is being advanced. This is the largest department of agriculture. This is the department which is doing more toward increasing and developing our farms than either of the other departments. I wonder how many of this audience fully appreciate its magnitude, the amount of business that it is doing, the capital that is employed and the employment that it gives to men. The annual products of the dairy of Maine are more than eight million dollars. In this city alone, the Turner Center Dairying Association and its branches have paid the patrons more than $90,000 a month for their products. Maine controls the great sweet cream trade of the east. Her reputation is established. But we must see to it that our farmers do more than simply maintain its excellency. The world is moving. The standards of excellency are advancing, and if we hold the best markets we must advance. We must increase our products as the consumption increases. We could double the cow population of Maine today with a greater profit to the individual cow than we are now receiving. We call this a great industry, and yet when we stop to consider, there is only about thirty per cent of our farmers that make dairying a specialty, and their herds only number about sixty or seventy per cent as much as the herds of Vermont.

It cannot be denied that Maine is an agricultural State, and if we would keep pace with our sister agricultural states, we must establish as high an agricultural education as they do. Minnesota's products are only about three times as large as ours, and yet they have six dairy instructors, and the assistant commissioner of agriculture devotes a large portion of his time to the work. Maine is destined to be the great agricultural district of the east, and she will develop at the same rate as her standard of agricultural education develops. Knowledge is power. There never was a day when so much attention was being given to the question of agriculture all over this broad land as at the present time. The president in his recent message to Congress—the



Guernsey Bull, Duke of Falmouth, No. 7437, Property of G. R. Whitney, Falmouth.

fifty-eighth Congress—dwelt at great length upon the subject. The board of agriculture of Massachusetts, at its winter meeting, discussed it with renewed zeal. The officers of this association, in making out their program for this occasion, assigned to Prof. Hurd the topic which he will discuss before you, "The Teaching of Agriculture in the Public Schools." While conversing with the State superintendent of schools recently, he said to me that the leading object of his trip to the South was for the purpose of investigating those public schools that are giving instruction in agriculture. The spirit of agricultural education is in the air, and I trust that at no distant day those that have charge of the educational department of this State will establish a complete and thorough system of agricultural education from the primary public schools of Maine to the University.

BETTER BUTTER.

By Prof. G. M. Gowell, Orono.

(Stenographic Copy.)

Mr. President and Friends: This subject that I have taken this morning, of better butter, I take because I deem it to be the most important one that can be considered at this or any other session. The success of the future of our work does not depend so much upon the magnitude of the work, as it does upon the quality of the work. Our efforts since we commenced improved dairying have been, all the way along, to induce people to engage in this special line of work, because we were aware that it offered better opportunities for marketing the products of the farm than any other line of animal husbandry could furnish. And at the farmers' institutes and public meetings, and through the press, everything has been done that could be done to encourage people to engage in dairying. And those of us who first took up the work because we liked it, and because we were enthusiastic in it, have been added to, in these later days, by other men who have been driven into the work because of the low market prices of all other products of the farm. Many men are engaged in dairying in this State now, not because they love dairying as an industry, but because they have been driven into it by the market conditions.

Now, men who engage in any line of work in which they are not in sympathy never give their best efforts to that work, and there is a great deal of work now being done in our State, in dairying, which is not of a high order. My friends, I know it is not a good thing when you go away from home, to give advice. But those of us who could get away from home for a day or two have come over here to have a heart to heart talk with each other about our business, and we must lay bare the facts and expose our weaknesses as well as our strength, and take as well as give, in the exchange of thoughts and expressions.

We are making a lot of good butter in Maine. We have a lot of people on the farms, in the valleys and on the hillsides, who are not here today. They are true dairymen and dairywomen and they are making butter equal to these samples you see exhibited here—golden, waxy butter. That butter is finding its market with the consumers in the villages and cities of our State, and it is being sent out from our railroad stations every week in little packages to consumers in other states. It is the best product that ever went out from an American farm—the product of these Maine dairies—because it represents more of the skill of minds and hands than anything else we have attempted to produce. But I query—notwithstanding the remarks made by the commissioner, regarding the advance in the quality of Maine butter—I query whether we are advancing. We are advancing in the quality of our private dairy products, but this other industry that has come in so recently, the sale of sweet cream to the cities and towns of other states, at a higher price than will result to us if we market that cream in the form of butter, has developed to such an extent, and has become such an absorbing line of work with most of our creameries, that our butter making is overshadowed, and you, as well as I, know that it is the good cream that is brought into the creameries, that is taken, separated, pasteurized, and prepared for the market. It is the better cream that is used for this purpose because this high priced market is an exacting one, and it will not tolerate the lower products of the farm. The poorer qualities of cream that are collected, those that are off in flavor, those that are advanced in acidity so that pasteurization cannot be successfully practiced—those qualities of cream are made into butter. We are making less butter that we formerly made and selling more cream than we formerly did, but the quality of butter that comes from our creameries today, I am very sure is of a lower grade than ten years ago, and this is wrong.

It can be corrected, but when we talk about improving the qualities of our butter we are talking about the most difficult question that we have ever considered. We may take a loaf of bread and trace its history. Made from wheat raised on the western plains, threshed and carried to the great mills, and there subjected to such a cleansing, cleaning, rubbing process that it loses its outer covering, and then the grain is ground and passed through mills by men clothed cleanly for the purpose, and in buildings devoted to this exclusive use, and put in bags without having ever been touched by the hand of man,—brought to our kitchen and then made into bread by our clean women, in clean kitchens, with clean utensils and clean clothes, and passed through the fire—the fire that cleanses man, even, of his sins.

Here is our bread. What is the history of our butter? Under what exacting conditions must the milk, the cream and the butter be treated in order to have the product compare in cleanliness with the bread? Instead of dealing directly with vegetable matter, we have in milk an animal product, secured from the living creature as a result of the food which she has eaten, digested and assimilated. The plant has been changed over into blood and the milk elaborated from it. Perhaps the intricate processes are beyond our comprehension, but the bare facts remain that the cow produces milk from the food she eats and yields it ungrudgingly to the man who milks her. Every cow is set to a separate gauge of work and rate of speed. Some give large quantities of milk, others give less; some put much fat into their milk, others but little. Some cows give good flavored milk from all kinds of food, others are easily disturbed by foods unfamiliar to them and yield gassy, bad-odored milk, until sympathy with the food is established.

While the cow has much to do with the quality of butter, the man who provides her environment and cares for her products has a far greater responsibility. In the old days winter dairying was not practiced. The cows went dry before housing time in the fall, and summer and autumn were the only seasons of butter and cheese making. I remember, in the home of my boyhood, in one of the most prosperous agricultural sections of the State it was the common custom all up and down the road for the girls to do the milking, out in the grassy pastures, morning and evening, while the men and boys were busy with the farm work. As proof that this was not regarded as an irksome task, I recall that the summer school teacher with her pink dress and white frock, with skirts tucked up and sleeves rolled back, sometimes took a pail and helped the rest of the girls that they might get done the earlier and afterwards all go on a romp together. Ah, the milk! Why shouldn't it be sweet and clean? Clean cows that had the green sward for their beds and the starry skies for their shelter.

But times have changed: the cow is no longer a summer worker and a winter boarder. Her work is incessant, milk making ceasing only when maternity with its demands is near at hand. She is the factor that is contributing most to a system of intensive and prosperous agriculture on worn soils. Upon her, more than aught else, depends the maintenance of rural New England homes and the repeopling of our half-abandoned farms. She is no longer the careless cow of our boyhood, our interests center in her in proportion to her contributions to our welfare. By careful planning, work, and patient waiting, man has created a new cow out of the old one and in order to maintain her in her present highly developed state he has arranged a new environment for her. She no longer shivers in the open, wind-swept barnyard in winter, nor stands curled up on the frozen manure in the tie-up in the dark barn.

The Maine cows, for the most part, live in warm, well-built barns in winter, and spend the nights there in summer, going to pasture only during the day time. The modern practices of mow feeding, soiling and graining, require the cow to be in the stall night and morning to take her rations. Intensive farming—and that is the only kind of farming we must practice if we are to live from the products of the brown soil of our farms—demands that all the manure be carefully saved and returned to the land that produced the food if we are to maintain or increase the productivity of our soils.

The typical barns of the State of Maine are distinctive features of our economical agriculture. The making and saving of farm manures was studied by every farmer for years, during the period of the decadence of our agriculture, and scheming developed the idea of barns with dry basements in which the voidings of the animals could be deposited, safe from loss by weathering and leaching until they could be applied to the soil. The barns of our State are our pride and the necessity for well arranged manure cellars is an established factor in Maine farming, not to be abandoned because of prejudice on the part of would be reformers who charge them with being great sources of contamination.

I certainly would much rather have the manure drawn from the barn to the field every day and have done with it, but our deep snows and rough weather make the handling and drawing expensive and losses from leaching are encountered.

We need not abandon our manure cellars in order to produce pure milk. They can be thoroughly and inexpensively ventilated by building four tight chimneys in each hundred foot barn, which shall extend from the top of the cellar to the peak of the roof where they shall discharge out-of-doors, through self-adjusting hoods. The shutters should be as tall as they can be made, and a foot and a half square or its equivalent.

The room in which the cows are kept should be neat and the air clean and the expense of keeping it so should not be so great as to make it impracticable. The cows on our modern farms are no longer milked in grassy pastures by immaculate maids. But as good milk as was ever milked in the summer pastures is being produced on hundreds of Maine farms, every day, winter as well as summer, and what is being done on some farms can be done on all of them, for a great expenditure of money is not needed.

Men who are engaged in dairying because they like the work and their animals, find it no hardship to sweep the barns, bed, curry and brush the cows and plan for every means that may help them in producing pure, clean milk. The willingness to do these essential things can never be true of the men who engage in dairying because there seems to be nothing else for them to do. They abandoned beef growing and sheep keeping when the prices were depressed, and engaged in dairying only as a makeshift, to be abandoned when something else which they are hoping for turns up. They allow their cows to be kept in dirty barns and milked by men in filthy clothes and with unwashed hands.

There are lots of these men. They are our neighbors—good respectable citizens, but they mistook the call that they thought they had when they assumed the ownership and not the guardianship of the cow. It is these men, it is these cows, in these barns that are contributing, not a small part, not a little quantity, but a great percentage of the cream that finds its way to the creameries in this State. I know you don't like this kind of talk, I don't like it myself, but it is the truth and it is time somebody talked about it in a way that can be understood. Can this thing be corrected? Can it be corrected in such a way that the correction can be adopted on the average farm of Maine? It is no use to advance a theory or present an impracticable plan. We must talk about something within reach of all people. Clean milk can be secured, from which clean cream and clean butter can be made. I will tell you how our boys do the work with the herd at the College. You may say, "You are working with the State's money, you can do what you choose." That thing is thrown at me almost every time I present these matters. It is not so. Our barns may be expensive, but they are not more so than those which other people have. They are ceiled and we keep them clean. Our cows are bedded, curried and brushed before milking. There is no feeding going on during the milking process. The men having done the chores that it is necessary to do, wash their hands, put on their clean milking clothes, take clean pails to the barn and there the clean cows are milked. Sometimes they are milked through absorbent cotton. This costs a little for material and it can never be used again, because it cannot be cleansed. Generally we milk into pails, the tops of which are about two-thirds covered by projecting rims, so that much of the top of the pail is not exposed to the dust that might fall in. The milk is turned into large cans with small necks, covered, and carried to the dairy building where it is strained and aerated for four minutes by pumping clean air through it by means of the Hill's Aerator. The air forced through the milk by this little bellows-like arrangement completely washes out the gases and animal odors that are more or less present in the newly drawn milk of every cow.

I wish you would put your noses over the edge of that vat of fifty gallons of milk during the process of aeration and take a good sniff of the gases and odors that are being driven off. The little pump costs about twelve dollars and it forces the air through the milk so thoroughly that it is agitated as though it were boiling over a brisk fire. The temperature of the milk in the vat after four minutes of aeration in summer is about ninety degrees. The gate of the aerating vat is opened and the milk runs slowly down the inclining sides of the Star Cooler—a distance of about two feet. The cooler is full of ice and water and in less than five seconds the temperature of the milk falls to less than sixty degrees. We have washed out the gases and taken out thirty degrees of heat from the milk. We have bottled that milk and kept it sweet for twenty days. Think of it! The milk of the cow, without pasteurization, without being subjected to heat, without any preservatives being added—the pure, sweet, clean milk of the cow—kept for twenty days simply because the gases were removed, because decomposition was stopped and because at the barn we had prevented the falling in of dirt, and many of the germs that cause decomposition. Now what was done there is simply within the reach of every milk maker in the State. We must have, for our foundation, clean milk from which to make clean butter. We can make it in no other way.

There are other things that enter into the production of better butter. The matter of feed is one. We feed turnips to our cows at the college, half a bushel a day, sometimes more, and we have no difficulty, although we are selling our milk and cream in rather a critical market. We simply feed the turnips after the cows are milked in the morning. We commence in the fall with one turnip a day for three days, then give two turnips a day for three days, then three and then four, and gradually work up to four quarts and eight quarts and then half a bushel, and this within about two weeks time. The changes take place so gradually that the cow comes in sympathy with the food without disturbance. She is able to take care of it. Introduce a ration of any new food all at once, even corn meal, and you so disturb the digestive organs of the cow that gases are generated and her body and milk become charged with them. Clover is one of the best cattle foods grown and yet I have seen cows so disturbed by being turned onto the second crop of it in autumn, that their milk was unfit for any use. Make changes slowly and carefully.

Another feature of the work that is causing a deal of trouble is the milk from the stripper cows. We have gotten the idea into our heads that we have got to save everything and spend nothing in order to live and prosper. It is not right. In the old days we did not want cows that were drones in winter; when we began to breed better cows we tried to breed them so they should milk all the year round. It was a common saying, that the cow must not be a boarder. She must work all the time and never go on a vacation, and consequently we would milk her around until within a month of calving. She had barely time for the little cells in the udder to dry and shrivel and get back into latent condition before they had to spring into activity again, and sometimes the cows did not go dry at all. We were anxious to get all from them we could. Let me say this,—we can get more milk from a cow by milking her ten months in a year and allowing her to go dry two months than by milking longer. She needs a period of rest and she will pay for it.

But the worst thing about it is that during the last two, three, four or five weeks of milking the cow, her milk becomes unfit for human food. She is nourishing the young foetus that she is carrying. Her energies are devoted to that principally, and her milk changes to such an extent that its flavors and composition are affected. I get a great many letters every year concerning this question. People say, "I churned four hours yesterday and when the butter came it was soft," or "I churned all day and it didn't come at all," or "It was off in flavor; it didn't sell. My customers refused it. What can be the matter?" Now, the milk of almost every cow—not all cows, but a great majority—becomes so affected in flavor during the last of the milking period that it is sufficient, even though you have but one stripper cow in the herd, to influence the flavor of the whole batch of butter from twenty cows. This is a matter of common observation. I know it must be common because of the many questions I receive regarding it. I always tell the parties to test the milk of each cow separately and see if there isn't one of them that is giving milk that is off flavor. And when they write to me again they always tell me they found one or more strippers, the milk from which was bitter. They keep that out and things are all righted. We must keep out the milk of the stripper cows if we are going to make good butter. Don't forget that.

I am not going to talk much longer, because there are three or four other men to follow me and discuss this question, but I want to call attention to two or three other things. Will it pay for us to do this? What is the inducement for us to take all this extra care that we must put in, in order to get good, clean milk? Clean milk is the source of good butter and from no other can good butter be made, no matter how great the skill employed. When we can do better work let us do more of it, but not until then. The whole north country is engaged in dairying. From here to the Pacific and clear to the South the people are thinking more about dairying than any other one line of work, and they are producing enormous quantities of butter and our people have become consumers to the extent that we export but little, hardly producing more than we need at home. People have been taught to use butter because more good butter has been produced than formerly; but consumers are becoming more critical every year, and we have got to look sharp in order to be able to satisfy the demand for good butter, for somebody is going to make it. If we here in New England with our grand pastures and water, and our clean New England people—if we haven't skill enough to make it, certainly the western men will do it. Mr. Coburn, secretary of agriculture in Kansas, has seen his state changed from beef raising to dairying in recent years, and in speaking of the dairy products of Kansas he says that not more than one-quarter of the entire butter product of the state of Kansas is used as it is manufactured, and that the other three-fourths is of so low a quality that it goes to the renovated butter factories and there passes through the furnace, is rechurned and recolored and then put upon the market as imitation, or as renovated butter. What does it mean? That we are not doing the worst work, but we must do better work. It is not a matter of indifference entirely with our people. It is from the lack of appreciation, and I doubt, my friends, if our department of agriculture can do better than to give an object lesson in this line. In fact, were I the commissioner of agriculture, I would construct a little light dairy room, about twelve feet square, and I would mount it on a low wheeled wagon and equip that with a sanitary milk pail and our sanitary dairy instructor, and I would put in a cream separator and a churn and then I would hook a pair of horses onto that little dairy room and haul it out here into every neighborhood in the State of Maine. I would show it to the men and I would call the women together and show it to them, for the touch of the woman is keener than the touch of the man, and I would call them in, and I would show the men at the barn how to milk, and I would show those sisters of ours how to treat that milk when it came to the dairy room, how to pasteurize it, how to make the ferments, how to use them, how to churn and finish the butter by pressure and not by friction. I would teach them the things they need to know and are willing to learn. If one instructor isn't enough for this then have half a dozen. If we will pull together we can show the legislature of our State that here is a great industry that needs its fostering care and we can secure as much money as is needed for the purpose. There is a great future before us, but our future depends on the quality of our work. We have been studying how to keep two cows to the acre and we have done it. We have kept nine cows on nine acres at the college, and on three acres of land we have kept six cows for a year. Intensive dairying brings the land under the plow, and it brings the cows to the barn. It necessitates, as every good farmer knows, the keeping of the cows in the stable so the manure may be available for growing crops. This means intensified dairying, filling the barns with cows and keeping them near the source of food. It has intensified our work. It has removed us from the summer pastures where the cows lay night and day on the sweet, short grasses. It brings them to barns, summer as well as winter, and in the winter we shut them up in close barns because we think we must keep them warm in order to have them devote all their energies to the production of milk. We shut them in those close rooms where they breathe over and over the exhalations from their own and each other's lungs, and their breaths become polluted with gases and those gases find their way to the milk glands and milk pail, and we carry that milk to the dairy, and is it fit for human food?

I consider that the worst thing that is taxing the dairyman of today is the lack of ventilation. I am not going to talk about the health of your cows, but the lack of ventilation as bearing upon the milk and butter they produce. I know a man with a well-kept barn who stored a load of commercial fertilizer in his barn one day—across the driveway from the cattle—and the next morning when he carried the milk to the dairy room the sharp, keen nose of his wife told her, and him, that something was wrong out at the barn. It will do it every time. The odor had passed through the cows into the milk pail. The milk was contaminated wholly by odors drawn in from the air through the lungs of the cows. It was done in no other way for this man is always well washed and wears a clean milking suit.

But we people in Maine are not the only dairy sinners. Last winter I spent a couple of weeks in a neighboring state, in one of the finest dairy sections of New England, where farms carrying twenty, forty and sixty cows are the rule and I found them shut into close, warm tieups that were like steam boxes. If I owned them I should expect every one of them to die sooner or later because of lack of ventilation, just as we all would die if we were shut into this room, with the windows and doors closed day and night from now until next spring.

Don't tell me that I am a sensationalist. Far from it. I see in this audience more than three men, who within the last six months have buried their herds of from fifteen to thirty pure-bred cattle. I do not mean that lack of ventilation is the only cause of tuberculosis but everybody knows it is a great promoter of it.

The things that we need most in our daily education are not lectures upon germs and bacteria, but we do need a season of the reign of good, clean, practical common sense in the handling of our cows and their products.

DISCUSSION.

Prof. S. C. THOMPSON—*Mr. President:* I know you are all very much interested in the talk which Prof. Gowell has given us. All that he has said concerns every one of us, and we ought to take hold of the ideas that he has given us, down to the care of the cow and the milk, the care of the cream, the manufacture of butter, and even the ventilation of the stables. All are important. Indeed there are too few of us who are studying these questions, perhaps, as we ought.

It occurs to me that there are two classes of poor butter in our State. Now I am talking about the poor butter, not because it is so large in volume, but because we want to know how we can better it. We have some dairy butter in this State which is being sold direct by the manufacturers to customers that stands very, very high. In fact, I believe we are going to find that the highest score today goes to a dairy. But we have another class of dairymen, who are keeping but few cows, that are not doing this work simply for the amount of money they are getting out of it. It is a sort of knitting work. They get the product of their cows in the form of milk and cream, and manufacture a little butter. Those people do not feel that they can spend the time to go into this question as deeply as Prof. Gowell has mentioned. It seems to me there is but one of two things for them to do. They must either study this question, keep more cows and make their butter better, or else they ought to do something with that cream besides attempting to make butter. If a person is not willing to make the best, he had better not attempt it at all.

I believe that with the creameries in our State scattered as they are, a farmer who has but two or three cows and who does not get a churning in less than a week, and sometimes ten days, had better let his cream go to a creamery at the end of two or three days, and the butter maker there take charge of it,—pasteurize it, use a starter and make it into a good quality of butter. It seems to me if we haven't interest enough—if we haven't cows enough—to do this work and do it as the professor has outlined, we had better sell our cream to some person who will take care of it. It may be that the creamery men feel that if this product comes to them they are going to get it in poor condition and consequently it is going to make a poor butter for them. I do not believe that is true. I am of the opinion that the patrons of our creameries, if they have but one or two, or four cows, if they will use the proper care,—if they will cool their cream thoroughly and keep it cold, can furnish cream which when it gets to the factory the operator there can pasteurize and with the use of a starter manufacture into a butter which will stand up very high in our markets. It is a pleasing thing for us who are interested in the dairy work of the State to hear Mr. Bent say tnat the quality of Maine butter is better today than it was ten years ago when he came to this State exhibition. It shows that there has been an improvement. It also means that there is a chance for still greater improvement.

I am glad that Prof. Gowell called your attention to the matter of stripper cows. At this time of year and a little earlier I have to hear a great deal about them. People are unable to make their butter come. They can see the particles of butter in the cream, but are unable to gather it, and thus lose the value of their cream. He gave you a remedy which I hope you will all remember and be able to tell your neighbors if you have an occasion.

He spoke to you about the travelling milk wagon. Now I believe with him that that would be a very nice thing, particularly if he is to deal with the women. I really believe that it could be made both pleasant and profitable. However, it occurs to me that there is plenty of work to do, if but one man is to do it. It may be profitable to have this work done in this way, doubtless it is, but we have still a great deal of work to do in order to satisfy the patrons of our factories, and we want to do it. The work along the line of getting a better feeling between the factory and its patrons it seems to me is the most important question to be considered at this time. It occurs to me that when one man has learned to measure his product himself, to know what he is sending to the factory, to know that the factory is sending him what belongs to him in his returns, he has accomplished, and we have accomplished, a great deal; because if a man feels that he is not being treated as he ought to be he is very apt to get discouraged and say that dairying doesn't pay.

To improve the quality of our butter is the one thing that we in Maine are striving for. The cream of the State of Maine has an enviable reputation; it stands at the head. And we are not going to admit that, with the exception of butter which is made out of poor cream, the quality of Maine butter is not as good as that of our sister states. But if we can bring the quality of Maine butter a little higher, if we can increase the revenue to our factories and the revenue to our farms, we are gaining for ourselves and our State more money with no more expense and no more outlay. So I say this question of better butter is something that interests every one of us, and I shall be glad indeed if all the people here present who are handlers of butter or handlers of cream will discuss this question as presented by Prof. Gowell, so that we shall get a great deal of benefit out of it.

R. W. ELLIS—I will say a word in regard to ventilation. I thoroughly believe in it, but not to the extent that a great many speakers and writers do. I don't believe it is necessary to ventilate an entire tie-up. I don't believe it is necessary to have a current of air drawing over the animals all the time, but I believe it is necessary that they should have pure air to breathe. The tie-up should be open in front, but if it is kept as clean as it ought to be, and the cows are bedded sufficiently with sawdust, I do not think there is any need of ventilation in the rear. They should have a sufficient amount of air at all times to breathe. If that is supplied, their wants are supplied, as far as ventilation is concerned.

THE WORK OF OUR ASSOCIATION.

By HON. Z. A. GILBERT, North Greene.

(Stenographic Copy.)

My subject is, "The Work of Our Association," and I shall discuss it in relation to what it should be and what we shall look for from it. This association, in the name of which we are assembled, was instituted for the purpose of promoting the dairy interests of our state, encouraging the extension of the business of dairying among the farmers, and at the same time aiding in improving the quality of the products turned out. Recognizing the power of combined effort, a few individual dairymen of our state organized themselves into this association and invited others to join with them in the purpose held in view. This method of combined effort in promoting the industry has been adopted in every dairy state in the Union, and therefore may be taken as an effectual means of reaching the result sought to be attained. For some years obstacles were encountered that prevented in a large degree carrying out the purposes held in view. The organization was kept up, but the influence it wished to put forth was retarded by unfortunate obstacles obstructing the way. On the reorganization of the agricultural affairs of the state by the legislature of 1901, steps were taken to have this organization recognized as a responsible body and placed, in common with other organizations connected with agricultural affairs, under the supervision of the Commissioner of Agriculture of the State. The section of the statute law by which we are now governed and under which this convention is being held reads as follows:

"Said commissioner shall in connection with and with the aid of the State Dairymen's Association, annually hold a state dairymen's conference for the exhibit of dairy products and appliances, wherein prizes for high merit and quality in butter and cheese may be offered, and may employ experts and lecturers to enhance dairy interests, but the expenses of the same shall not exceed the sum of five hundred dollars annually."

It is thus seen by this section of the law that no question can arise between the Commissioner of Agriculture and the Dairymen's Association as to the superiority of power, rights and obligations. In arranging for the annual convention and exhibition the commissioner and the association are a joint board of managers with no dstinction, one over the other, save that the commissioner is to pay the expenses out of the funds placed at his disposal. The law is so plain that none can misinterpret its meaning, hence no misunderstanding can arise concerning rights and responsibilities. The parties included in the specification of the law are required to work together in carrying out the obligations left in their charge.

With a clear understanding of the purposes of our association and the relative obligations to the higher agricultural authority of this state, the next step to consider is how best that purpose can be carried out. Individuals differ in opinions on the same matter, hence it would be unwise for any one of us to say "I am right and you are wrong." The work of the several dairy associations in the different states is along lines not very unlike in methods, and closely related to the order arranged for this meeting. This being the case, it is sound reasoning to claim that the plan here being carried on is the best known and is therefore all right. But this is not enough. We should advance. We should always be reaching forward to something better.

The first and foremost object of a meeting of this kind, and therefore of this association in its convention efforts, should be to draw out as many individuals as possible concerned with dairying, both those engaged in producing and those engaged in manufacturing the milk after it is made. This latter class—that is, those who are engaged in work at our butter factories, creameries, cheese factories and large dairies—we as an association have failed to reach in numbers desirable. Comparatively few of them have been drawn to these conventions, although we have that few somewhat enlarged at the present time, a gratifying improvement over past meetings of this kind. Now this is emphatically wrong. They are the very persons on whom the quality of the products sent out most of all depends. Let me say to these young men connected with our dairy industries, no one can learn the standard of good milk or cream, and especially of choice butter, and always stay at home. Remember that. You must get out and come in contact with cream, milk and butter of different shades of quality in order to distinguish the best. Quality is learned by comparison and a knowledge of it cannot be acquired by word of mouth or by the written page.

Then again, and worse still, the stay-at-home operator has learned a set way of manipulating his product, and that to him is the best way for the reason that he knows no other. He doesn't read and study the progress being made in the work—that is, too many of them don't—for the reason that to him his present way is the right way, and is therefore good enough. He needs to be drawn out to these conventions and shaken up by contact with what is being learned along these lines. Brother Hamlin and others come here to these conventions, capture the prizes and go home. They bring their butter and bring the butter that the other fellow makes, but do they bring that other fellow with them to learn how to make still better butter? Very few of them. These operators, I want to repeat, need to be brought out, and I am not sure but one of our sister states has taken the right course in requiring that no person shall operate a factory until he has graduated from a dairy school. I would enlarge that requirement somewhat to either a dairy school under the authority of some institution, or a dairy school in himself. A great deal can be accomplished by a thorough study of dairy literature and by taking note of the investigations going on in these lines.

It is not enough that we grow up a class of more intelligent dairymen; we want with them also better skilled operators to care for and handle the milk those dairymen turn over to their care. Some of our operators may think this language is too severe, but let me ask these young men to look over the situation in our state as seen in our fifty or more creameries, and tell me candidly if the operators at the creameries and factories are generally reading and studying as they work and striving thoughtfully to keep in touch with the knowledge that is gradually, yet surely, being acquired along the lines of milk and its products? There are fifty creameries in the State of Maine, and here present in this convention are perhaps a half dozen or less of the operators in those factories. To encourage a study of this work should be a leading effort of this association. How best to reach the class or the individual members desired in carrying out the dissemination of dairy knowledge becomes an important problem. On it largely depends the usefulness of the time and attention that the officers and members of this association are devoting to carrying on this work.

A correspondent of one of our New England agricultural journals two weeks ago devoted a cloumn to holding up the program of this meeting in comparison with that of another convention held last week in another state. One contains thirteen named speakers and the other but five, and this writer, not unlike some aspiring candidates during the political campaign when asked to state their views on certain important issues, twitters awhile over the comparison and lays the matter down without advancing his position. I am somewhat experienced myself in preparing programs and providing speakers for occasions related to the convention now being held, and I have no hesitation in claiming that the more speakers that can be enlisted from the ranks of those directly engaged in the subject matter under discussion, the greater will be the benefits going out from such a meeting. As a matter of fact, approximately the substance of what is fixed knowledge among us in this matter of milk and its products is to be found in the heads of the leading intelligent men who are engaged in the business of dairying. Brief essays, therefore, from such men, one on a particular branch on which a writer is well informed, others on still other branches, and so on to the extent of time allowed, each loaded with red hot shot and fired directly at the mark, will raise more interest, enlist more followers and carry more instruction to those who need it than long drawn out lectures freighted with multiplicity of words from a vocabulary unfamiliar to the farmers to whom it is directed and for whom it is intended.

The first object, therefore, of this association, is to interest as many as possible in dairy work. The answer given to a Sunday School superintendent in reply to the question how to interest the boys in the Sunday School was not far out of the way in saying "Give them something to do." The more men drawn in to take part in the exercises of the convention, the greater will be the influence going out from it. It isn't always the lecturer or instructor who is the farthest ahead of his hearers who will leave the most impressions in his wake, but rather is it the one who can lead us each time a little further on in our knowledge than we were before his effort. A knowledge of a subject is gained by gradual approaches and cannot be absorbed and assimilated by leaps and bounds. There are two classes of lecturers to make up a program of the character that has drawn this assembly together. One is known as the practical authority, or authority on practice, and the other as the scientific authority. Just to what extent to draw on one and discard the other is a question for deliberate decision. Just now there is a tendency with some of the organizations in the interest of agriculture to give the organizations over largely or chiefly to the management of that class of investigators that have recently jumped into well deserved prominence through the colleges of agriculture and the experiment stations. From the standpoint of the farmer this can hardly be endorsed in full measure. Intelligent farmers know what they want and are not entirely ignorant of the character of work that will most effectively reach the class they represent. It is not, therefore, a very illogical position to hold that farmers should control agricultural organizations and agricultural affairs.

Unfortunately there is a measure of disagreement between scientists and the men who work out their problems through the soil. The scientific investigator cannot quite understand the farmer, and cannot quite see why the farmer does not readily accept the conclusions clearly proved in his demonstrations and at once adopt them in his practice. As a result in their minds (though not always spoken) they deem the farmers slow of comprehension of what is to them so plainly for their best interest, and sometimes the hot-headed among them think these farmers are stupid. Here is an unfortunate stumbling block in the way of that complete sympathy which should exist between the two classes. I wish I might find words to clear away this obstacle and let light onto the position of the practical man, that the scientific investigator might see his position as it actually exists.

In illustration of the point I would make I will call attention to an experiment conducted by one of the Western states recently. To show what could be done the station went out and bought cows as they run, took them to the station farm, fed them on such foods as were grown on that farm and as were being grown by the farmers of the community, and brought out results far in advance of what the farmers of that section were accomplishing. The clear interpretation to the station was that any farmer, and substantially every farmer, could do similar work, taking his cue from that example. But this is not exactly so, and yet the scientific man cannot see it and does not see it.

An apt illustration along this line may be drawn from work in another line of production. A meeting of fruit growers was held in a town adjoining the place where we now are. To illustrate the spraying of fruit trees a professor from the station was present to give an example. He stated the benefits being realized from spraying trees, gave figures in proof and gave directions for carrying on the general matter of spraying, declaring it as necessary to insure results, and rounded off with the claim that no fruit grower could omit the spraying. An intelligent farmer present, having a small orchard in connection with his mixed farming, stated that if he had to give the repeated sprays represented in order to get some fruit, the orchard would have to be discarded. "But spraying will pay," replied the lecturer. True, yet what is in the way? Both these parties were right, yet there was a world of disagreement between them; the same between the scientist and farmer in other lines of work. The point lost sight of by the station investigator is that the farmers

—most of them—cannot introduce every practice and every appliance that the investigator through his experiments clearly shows and plainly proves will pay.

The farmer's capital is the land he owns and the day's works at his command and that are in him, and there is only so much of either. Dependent on that capital are himself and family and the demands of society. If his time in the early part of the season is largely spent in spraying the orchard he cannot plant his potatoes. And if he is spraying potatoes weeds will choke the corn. Meanwhile the demand on his capital cannot wait for a harvest coming only in the late season or perhaps not until the next year. The work must be put in the main where the returns will be prompt. No one questions but the investment in a superior sire with which to improve the quality of the herd will pay mathematically, actually, but he is out of the reach of the great mass perhaps, or at least a great measure of the dairymen and breeders of the state, for the reason that the investment required must be used where it will bring more prompt returns. And further, there is not enough of these improved animals at prices within the reach of the medium farmers to go around and supply them all. So investigators who are working out these problems and can show the proof of their accuracy so plainly must exercise patience in our behalf in the faith that the advanced knowledge they present will sooner or later be woven into our practice. It is for reasons such as I have just tried to make clear that progress is so slow, and not that we are stupid.

Fortunately our scientific investigators are ready and willing to aid this association in its efforts for the promotion of our dairy interests. We need their help, and we need the instruction they bring, and we must have it. Hence there is always room for theoretical instruction as well as practical, and both should always be found in the programs and I trust may always be able to work harmoniously together. The effort should always be to bring out the best that is known in everything bearing on the industry, hence these young men who are operating our creameries and on whom we are depending in large measure for what we are receiving out of our dairy business should feel themselves compelled to make all of the study, all of the investigation possible, and to put all reasonable efforts into the gaining of further knowledge of the business in which they are engaged. We wish, and this association should use every means within our power, not only to encourage them but to aid and assist them in every practical way. But it cannot be done on our part and in the full measure that is available so long as they withhold themselves from the presence of gatherings of this nature.

Another point, the offering of prizes at a convention exhibition is not always clearly understood. They should be looked upon purely as evidences of merit. We do not wish to encourage a class of show men in following our conventions for the money they can win. They will do the cause no good, hence there need be no effort at offering high prizes, but rather the aim should be to develop them into as many classes as seem called for. And let me say right here, the dairyman who attends a convention of this kind and makes an exhibit of his product and gets beaten is the person who should get the most possible out of the convention, and he can get the most possible if he makes the proper use of his defeat. Accept that defeat as a criticism on your own work and make an effort to do better the next time. I have greeted individuals here in connection with this meeting who started out to my knowledge years ago with an effort at making a choice product. They found themselves at the foot, but were they disheartened? Not at all. If that was their place they wanted to climb higher, and they appeared at the next convention with an improved product. Did they get to the top? Not by any means. It is a rugged way from the bottom to the top in connection with this matter of true merit in your work. It is a rugged way and it is only by continuous and possibly long continued striving that persons can climb that ladder. But we have them here, and today they are at the top. Through that persistent effort, through their labors to overcome defeats in a determination to learn the business and accomplish these results they have risen to where they are now found.

At some of the various conventions of late all special prizes have been ruled out, and I want to call the special attention of the management of this association to that feature. All special prizes, I mean those offered by business concerns in their individual interests, are ruled out. On a careful consideration of this matter I claim this action is a step in the right direction. It is giving business houses a great privilege to give them room and space and an audience to view their goods on occasions of this kind, and to give them the opportunity thus afforded of advertising the merits of their goods. Now everyone knows that the cause we have in charge is not advanced by a prize on butter made from cream separated by a DeLaval separator, colored with Alderney preparation, or even salted with Worcester salt. Each of these is important in its place. The superiority of the product is dependent on other factors than the make of the separator or the mines from which the salt is obtained. I am glad that many are beginning to see this matter in its true light.

REMARKS.

By Orrin Bent, Boston.

It used to be said that any kind of a boy would do to stay at home on the farm, but the best boy should be sent to the city, to work on the electric car or something of that kind and get just about enough to pay for his board and clothes; but this is changed, and we now understand that we want to keep the best boy at home. I enjoy coming to these dairy meetings. I believe that the boys and men who are at work on the farm should obtain all the instruction they can in the lines in which they are working, and these meetings will be of much value to them if they will accept the advice and instruction given. I have a friend who knows more in his line of business, the grocery business, than any other man I know of. He goes around selling goods to the retailers, and, as I say, he knows the business and he will tell the truth. And lots of people will take his advice and buy goods of him, and they are all right. Others will not. Because he likes to help and advise them, they will say, "You can't come here and tell me my business." They know it all and consequently will not be helped.

As I was coming up on the train the other night I saw a couple of gentlemen in the car and I saw they had badges on and were coming to the convention. I wondered who they were, as I had not seen them before. The next morning I found that one of them was Mr. Thompson, your Dairy Instructor, and I liked his looks. I have a pretty good judgment of human nature and I meet a great many people, and I thought that he was about the kind of man for that business. I have said several times that there ought to be a man appointed to go around to the dairies and creameries—the right kind of a man who would not antagonize them—and if they are doing wrong to help them. You may try ever so hard and be ever so willing, but if you do not know how to do a thing you cannot do it.

There is a right way and a wrong way to this business. Mr. Thompson, your Instructor, worked in the dairy room with me yesterday. I think he has a keen taste and good judgment, and I should say you had the right man in the right place. If any patrons have been found to be taking poor cream to a creamery I do not see why they should not let him tell them of it and try to mend their ways. Some might be a little offended, but I think this is the way to get at it.

I find the general average of your butter is fine. There is one man in Vermont who has got but one prize since I have scored there, about eight or nine years. The butter would average ninety-four and ninety-five right along, and that butter always went and suited. Whoever had it once wanted it again. Some people have had it for ten years, I think. It isn't the high flavor, but he makes it in just such a way. Now there is a great deal of your butter which is just about that way. It will score ninety-three, ninety-four or ninety-five. It is all right and your style of package and your style of print show improvement. I can remember when Maine butter was very poor. But you have improved, as they have in the West. We used to have the butter in hundred-pound oak kegs, sometimes two layers of salt and one layer of butter, and stained in two or three inches.. Now it is coming in all styles, put up as nicely as butter from anywhere else. I have heard some say that in scoring butter we did not dare to score above a certain point, because if it came to Boston we would have to pay more for it. I do not care where the butter comes from, if it is good. The way your butter is scoring it is fit to put anywhere. You are improving it. I shall be pleased to answer any questions that may be asked.

QUES. I notice two samples of butter that are marked with the same score, but one sample is very much lighter colored than the other. I would like to ask if any difference is made on account of the color or shade of the butter.

ANS. In the matter of color we allow quite a margin. I have customers who want butter rather light, and with others that light butter wouldn't do. In scoring last week I came across some butter that was too high colored for me, and I said "We shall have to score that off one point." But we soon came to another which was very nearly the same shade. I found about six or eight samples and one of them belonged to the president of the society and was made of Guernsey cream with no coloring. I couldn't very well go back on nature, so unless the butter is an exceptional color or is quite light, I do not take anything off.

QUES. I would like to ask what the standard of quality is in granular butter?

ANS. There is some guess-work in the judging of granular butter. We would choose the sample in which the granules are uniform in size and not too large.

THE OUTLOOK FOR THE MAINE FARMER.

By C. S. STETSON, Alta.

(Stenographic Copy.)

Mr. President and Friends: It is said that the man who causes two blades of grass to grow where but one grew before is a public benefactor; and the man or body of men who formulate and perfect plans by which they can conduct their business at the greatest margin of profit, without infringing on the rights of, or injuring anyone, are entitled to the gratitude of all people who are engaged in the same business. Now I believe that this Dairymen's Association of the State of Maine has done much in the past, and will do more in the future, to stimulate and inspire the dairymen of Maine to do more and better work than they have been doing.

The dairy products of this country are of vast magnitude. If I read the figures aright, the dairy products of this country sold last year for $477,500,000. Now just how much of these products were produced at a profit I don't know, but my observation and my experience tell me that some of the work was done for the fun of it, and some of it for the profit of it. A man who likes a cow, who knows a good cow as far as he can see her, and can go among his herd and talk to them and call them by their names and have them know him, and the man who is clean and patient and who knows how to feed a cow and takes an interest in the business had better engage in that line of work, and the man who doesn't had better do something else. There is scope enough and opportunity enough along agricultural lines for men to engage in any calling to which their inclinations lead them. Over in Aroostook County they tell us that they are raising potatoes and clearing from three to five thousand dollars per year; and I go over into Somerset County and find they are selling sheep there at from twenty-five to fifty dollars apiece; and over in Kennebec County we find a variety of farming. They have the finest herds of Jersey cows there, and Holstein cows, and other kinds of cows, and occasionally I see an Angora goat. I don't know just what profit they get from this last class of animals, but I want to say to you that a man had better engage in the line of work which he likes, for which he has an inclination, and in which he can make a success.

Now, for myself, I know so little about dairying and have had so little experience in dairying that I cannot presume to talk to you along that line of work. It would seem to me that there was some work along agricultural lines that I might talk to you about, and I thought I had something fixed that I might say to you this afternoon that would be of interest to you and that would be profitable to you, but I see before me a class of men who know so much more about this kind of work about which I had intended to talk to you that I feel that it would be the height of presumption in me to try to say anything. But I do believe that the man who owns a farm and who owns what there is around him, and the man who can go forth every morning looking on a part of God's green earth as his, is the most independent man on earth. And I believe that the man who takes the right view of the life of the farm is the man to engage in agriculture.

I believe we are educating our boys and girls off the farm instead of onto the farm. I know of men who are equipped with a high degree of intelligence, who have obtained a competence in their occupation, who are giving their boys an education today that is calling them to another line of work, and I think it is all a mistake. The sturdy manhood and womanhood of which we have been so proud in the State of Maine will become a thing of the past if present conditions prevail for any given length of time. Because the fathers and the mothers, the men who had a hard time in settling this country, the men who built the roads, who built the bridges, who built the schoolhouses, who made all the improvements, in fact the men who made it possible for us to enjoy what we are enjoying today, saw the dark side of the picture, and they felt that the life of the tiller of the soil was on a plane a little below that of any other calling. I do not believe it. There is a dignity attending the life of the tiller of the soil that attaches to no other occupation; and the man who is the true agriculturist, the man who appreciates his work at its true value, need not stand before any man with bowed head. He may look every man in the face, and know that he is the equal of any man so long as he respects himself and respects his occupation.

We are the producers, and these poor fellows down here in the city would have to starve if we didn't produce. There isn't any need of a farmer starving, because he can live independently of the city if he wishes to. But our interests are identical. We are to work together. And I say to you that I had rather be a farmer in the State of Maine, a tiller of the soil, than a member of any other occupation. Well, perhaps I might except the newspaper man, because we hear occasionally that the best fruits of the field and the garden are at times laid upon his table. I do believe that the press is doing as much as any one thing to forward, and to expand, and to make more profitable the interests of the agricultural people in the State. The members of the press in the State of Maine are men who are equipped with a very high grade of intelligence, and they are men who believe in Maine and who believe in its interests, and who believe in its agricultural interests; and they may be somewhat selfish in knowing that their interests are identical with ours, and that when we fail they cannot prosper. I wish to publicly express my gratification at the position the press of Maine nave taken in regard to the agricultural interests of the State during the past few years. They have been on the side of the farmer, and have worked for him to the very best of their ability.

Now, I believe we are making some mistakes. We are making a mistake when we try to make a man who is clearing $3,000 a year from raising potatoes believe that he can clear $3,500 a year by going into dairying. I don't believe he can do it, and we are wasting our time and money when we use it in any such way. In my opinion we are making a mistake when we exploit the idea that Maine dairy products are inferior in any way to those of any other state. The dairymen of the State of Maine are doing better work and more work every year than they ever did in the past, and I think we should claim, and then make our claim good, that the dairy products of the State of Maine are inferior to none others. If I have a cow to sell and I tell a man she is good for nothing, he is going to believe me every time.

I know full well that there are cases, and there are many of them, where the conditions are not what they should be in the barns and dairies; but I have been into many of the barns in the State of Maine during the past four or five years, and I want to say to you that we are steadily moving upward to a better idea of just what our dairy products should be. There are thousands and thousands of theories extant as to what we should do as farmers, and I believe we are just on the edge of things. We are just waking to the possibilities that are ahead of us. I know that a theory is a very good thing, and I know that a theory which can be put into practice is a better thing, but every man should have individuality. He should know what he is doing. The farmer of today must be conservative, but he must be aggressive. He must be ready at any and all times to marshal his physical and mental forces and deliberately forge ahead against all reverses. And we can do this.

I know that any man of average intelligence can go onto a farm today and make theories of his own. He can study the conditions by which he is surrounded. He need not apply to any man to tell him what he must do, but he can study those things out for himself. If there is too much acidity in the soil he can study out how to remedy that condition for himself. And if it needs humus, he knows just how to put it there.

The Commissioner of Agriculture during the last summer and fall has been going around over the state telling us just what we should do, and he has been doing a good work.

I believe meetings such as this, and the institute meeting such as it should be, will arouse an interest in the farmers of Maine to develop a broader and better and higher type of agriculture, and any man who waits at the foot of the ladder for somebody to hold the ladder for him to climb, will be at the foot when the time for climbing is past. A man must have ideas. He must also have ideals. The mere belief in an idea or an ideal never will become powerful in us as a farming community. We must live it. We must act up to it and know it. The man who works, who knows where and how and when to work and who lives by his work, is a king among men; and the man who acquires a competency by skill, by industry and by energy has an honest heritage, and it is something in which he has every right to be proud. It is the pride of industry and of integrity and of an honest endeavor to better the conditions by which he is surrounded.

In my opinion we are making a mistake when we make periodical pilgrimages to the city to deposit our surplus earnings in the savings banks. I suppose the most of you know how it seems and how it feels to have a good comfortable savings bank account, or any other bank account. I don't know much about it. But I believe we are making a mistake when we deposit our surplus earnings in any bank. Will not the farm that produced that surplus earning, will not the farm that has supported the family in comfort and with the luxuries of life and given us a surplus of a hundred dollars, give us better returns for that surplus than a bank? Will not that hundred dollars invested in that same business bring us in a larger rate of interest than will any bank in the State of Maine? I think we can invest our money in those things which tend to make us better agriculturists, in improved machinery, in all of those things by which we can do our work more cheaply and with greater profit than any bank will pay us. We can invest it in hired help if we can get it.

We can combine and invest it in making apple barrels instead of paying forty cents apiece for them, and save one-half the cost of the barrel.

I want to say to you, my friends, that all over this state, from one end to the other, there are men of a high degree of intelligence who can manage the interest of the farmer and of agriculture in just the way that it should be managed, but it is a sad fact that there is only one leader to a thousand men. I wish there were more, but it is so easy to trail, so easy to lean, so easy to follow. It requires grit, it requires stamina and backbone to stand squarely on our own feet and live manfully up to our own ideas when we believe they are right, even though they may not concur with the ideas of our neighbors and our friends.

Now the outlook for the farmer in the State of Maine it seems to me is bright. There are possibilities ahead of us as agriculturists that we have never dreamed of in the past. I hope you will not think it is egotistical if I cite a little of the work which I have done on my farm in the past two years. My mind runs back to the time when my father and two or three of my brothers and myself used to yoke up one yoke of oxen and two yoke of steers and hitch them to a large plow which required two men to handle it and go out to plow. We used to plow in the fall and the land we plowed was a clay subsoil and it was an immense job to get that team through and turn the soil over as it should be. And after it was plowed the action of the rain, the action of the sun and of the snow as it went off would run the edges of those furrows together and they would dry and be as hard as a floor. And I know that I have driven a team hitched to a spike-toothed harrow, as we used to call it, back and forth across that field until I wished I or the panting pair of oxen might die, because I couldn't see anything we were accomplishing. And I want to say to you that the results we obtained from that kind of tillage were not what we could wish. But one year ago last spring I plowed a piece of seven acres of that same kind of land, a clay subsoil, and I did it with one pair of horses, and when the ground was in just the right condition I put on the harrow, and a harrow of a different kind from that which we used years ago; and I know I kept that team going round and round and round until the horses fairly wallowed in the mellow earth.

Then we would go to the house and rest awhile and harrow it some more, until on any part of that field you could pick up the soil in your hands and it would run between your fingers like dry ashes and you could track a man going across it as easily as you could track him in light snow. Every inch of that soil was ready to receive and germinate seed, and when I mowed that grass this summer every swath of grass presented a solid wall of grass to the mower. You couldn't see into it one inch. I don't know how many tons there were to the acre, but I know that I didn't want any more. There was all I wanted.

The fertilizer I used on that field was 1,500 pounds of commercial fertilizer to the acre, and I believe that the results I obtained from that were due largely to the intensive and thorough cultivation of the soil. I believe also that what will apply to a grass crop will apply to any hoed crop. We must cultivate, cultivate, cultivate. As Uncle Solon Chase says, "put the harrer to going and keep it going." From that field of grass I have been feeding my cows since the middle of September upon a second crop of clover twice a day and I know that I raised that piece of grass at a large profit. I don't know of anything that comes so near to pasture feed as does a second crop of clover that is well cured.

It has been said that it is all wrong to try to keep a boy on the farm, but I want to say to you, my friends, that there is no calling in which we can place our boys where they will be so independent in the best and truest sense of the term as on the farm.

We point with pride to the men who have gone forth from our State who have attained wealth and rank and honor,—to governors of states, to members of the cabinet, to lawyers of high attainment, and to physicians and doctors of divinity. But what has become of that other class, thousands upon thousands of them, who have gone forth, that we have never heard from since? In my opinion a large per cent of this latter class would be immeasurably better off had they stayed right here on the old farm. They could have been more independent, they could have lived a broader life and a better life and could have made more money than they have in the callings in which they have engaged. The man who is the slave of a bell or whistle, and the bell or whistle the property of some other man, cannot be independent. Isn't the man who tills the soil more independent than that man? Isn't he more independent than the man who has to give up his job at the behest of any other? As one man recently said, in laying down his hammer he laid down his daily bread, and he also laid down the Christmas presents he was going to give his wife and little ones.

Now, my friends, I believe in Maine. I believe in the town of Greene. I live in that town, and I don't think there is another one in Androscoggin County equal to it; and I believe Androscoggin County is the best county in the State of Maine, and the State of Maine is the best state in the Union, and the United States is the best country in the world. And I think we should be ready at all times to say a good word for our occupation and for the place in which we live, and to do something to further the interests of the calling in which we are engaged. The world is all the time looking for men who do something, even though in doing something they sometimes make mistakes. The outlook for the farmer in this State is bright. In the soil there is locked a treasure to which we hold the key; and when we make the most of the opportunities by which we are surrounded, when we study conditions, when we study details, when we have an accurate system of book-keeping and as fast as the figures bring to light those factors which do not pay eliminate them, and develop those which do pay farther and farther, we shall meet with abundant success. And there is one grand good thing about farming,—when we find a thing that does pay we can enlarge and develop it almost indefinitely, and with the clear assurance that the earnings will keep pace with the expenses. And now, as we commence the work of a new century, as the sunrise gilds the hills of the future, let each and every one of us tillers of the soil remember that a part of the wonderful growth of agriculture in the State of Maine is ours, that we are a part of it, that there are responsibilities resting upon us, and there is a work for us to do that no other man can do.

STRAWS PICKED UP BY THE WAYSIDE.

By R. W. Ellis, Embden.

(Stenographic Copy.)

Mr. President, Ladies and Gentlemen: It is true I am an old dairyman, but I don't presume to know it all by any means. It is not the man who has been in the business the longest who knows the most about it, but it is the man who is the most earnest to learn and who is determined to learn. One man may learn more in ten years than another in a whole lifetime. What I shall say to you is perhaps of minor importance. I have talked to this dairy conference a great many times. What I shall say to you is what I have learned from my experience. I don't claim to say that you will find it exactly the same. You may not. But I shall tell it as I have found it.

I took a little trip around over the state this fall after I got the fall's work principally done. Brother Dyer had asked me before to name some part of the dairy subject that I would talk upon, but I couldn't seem to think of anything. But in going around as I did I picked up some straws. There were some things I saw on my way that set me to thinking, and I got a few ideas that I shall throw out.

The first will be fall feeding of mowing fields. That is not directly connected with the dairy business any more than general farming, but all dairymen are farmers, although farmers may not all be dairymen. When I started in life on a farm it was the custom in our part of the state, when the land was new, to feed our fields both spring and fall. The cattle were allowed to roam over the fields in the spring sometimes until nearly June, when we would put up the bars and confine them for five or six weeks to the pastures, and then, as our farms were mainly fenced up in small lots, we would clear one field of hay and turn our cows in. Our farms were really pastures except five or six weeks in the summer time. The land was new and it would stand that kind of farming. Our business was all done in the summer, especially our dairy business. But in the course of time we found that we were running out our fields, and we went, like Yankees, all one way and then all the other. We went to the other extreme of not turning a creature into the field at all, and a great many allowed grass to grow up and head out and fall down on the ground.

Well, if a man has fields that he can't easily cultivate, and wants to keep them in good condition in grass as long as he can, it is well enough to let some grass fall on the ground—let it come up and grow and fall down for a sort of top dressing—but it isn't a method that is profitable for farmers to follow. I don't believe that we can afford to dress our land with good feeding grass or hay—anything that will make good feed for cows. I believe that is a costly way to dress it. If we use fertilizer regularly we must occasionally plow under a crop to liven the soil and give it a proper amount of humus, but ordinarily I don't believe a farmer can afford to dress his fields with grass. It is worth more to feed, the resulting manure being put back on the fields.

In case there is a heavy second crop, it is a good idea to mow it all, but if there isn't a crop that would pay to mow I believe it is better to feed it. I saw a great many fields in my journey this fall in which there would be spots coming up and heading out where there would probably be a ton to the acre. It would hardly pay to go around and mow them, and where land isn't soft enough to poach I believe it is profitable to fall feed to a certain extent. I wouldn't fall feed to an extent that would lay the roots bare by any means, because a covering is needed to protect the roots and hold the snow. But I do believe in a certain amount of fall feeding. Where the ground is hard I believe the grass is worth a great deal more to us, especially to dairymen, to feed, than to lie there and bother the mower next year. If five hundred pounds of hay are allowed to lie on the ground, next year the mower and rake take it up and it is a nuisance rather than a benefit.

Next, we will consider the time and manner of applying dressing to the land. Travel through the country and you will see all kinds of methods. I believe thoroughly in the value of manuring. I believe every farmer in the State of Maine would be very much better off it he could get a year's manure ahead and have it to apply to his farm in the fall of the year, plowing it under and getting well ready for his spring's work the next spring, than to haul it out in the spring, for a good many reasons. It is a slow, tedious job to get dressing out, and how many times I have seen men work for a week perhaps, getting out dressing for a few acres of ground to plant with corn. All this time it would be in good shape to work and good shape to plant, and perhaps by the time they got it in condition to plant, the dressing hauled on and worked in, there would come a heavy rain and put them back, and then another, and I have repeatedly seen cases where men have failed to get in their crop of corn when if they had had the dressing in before it would have been all right.

Another thing, the ground in the spring of the year is usually soft and bad to get over. Ruts are made, and you can't haul the load that you can when the ground is hard and dry. In the fall you can drive almost anywhere you please, and you have an abundance of time. You have all the spare time from haying time until the ground shuts up. You can get out your dressing and plow it in a little at a time. Any time when you have half a day's leisure, hitch onto your manure spreader or cart and haul out some dressing and plow it in. There are a great many methods of hauling it out. Many farmers haul it out and pile up little piles all over the field, some for the purpose of spreading and plowing in, some for the purpose of letting it stay all winter. Well, I do think of all methods that the farmer ever practiced the most foolish one is to haul it out and pile it up in little piles and then go around and spread it. The man who goes around and spreads dressing from a little pile has to stoop down, and he begins and throws out around and doesn't look to see where his dressing goes. He gets it fairly even but never perfectly even. Now the more evenly we can get it distributed over the soil the better. If you don't have a manure spreader, spread directly from the cart. Where is the sense in dropping it out in little piles and then overhauling it a second time and spreading it out? If you are spreading from a cart you can stand right up and see where you are throwing it, and it is easier on the back and saves one handling. And if it is going to lie through the winter that is still worse, for every place where there is a pile will be so rich that the grass will lodge and become useless because of the richness of the soil, while the largest part of the goodness has washed out, and what is spread is pretty poor stuff.

I believe in fall manuring, and I believe it should be spread from the cart to save labor. Spread by a manure spreader by all means if you have one. And every man should own the whole or part of one, because there is no possible way you can spread it so evenly and so nicely by hand.

Another straw is one that was brought to me very forcibly this summer,—the proper time for cows to drop their calves,—the most profitable time for cows to come in. We have tried having our cows come in in the fall. I was unfortunate and lost some thirty cows this summer, and out of that thirty twenty-six were fall cows that dropped their calves from the last of August until the first of November. I started out to buy and I hadn't thought the matter over, but I supposed a large part of the dairymen of the state were doing the same as we were. But to my utter astonishment I found it very hard indeed to buy fall cows. Now when I first started in the dairy business there was no such thing known as winter dairying. All the butter that was made was made in the summer season. The facilities they had wouldn't admit of winter dairying, and of course they wanted to make all they could from their cows in the summer season, and they had them come in in the spring, along in February and March and sometimes in April, but generally in January, February and March, so the calves would get weaned off by the time they went out to grass and they would make a good lot of butter through the spring. In May, June and July more than three-fourths of our butter was made. Some butter was made through August and September and perhaps a little in October, and then the cows would go dry and they would keep them cheaply through the winter. That was the custom. There was always a drug in the butter market along in May and June. I never have known, from the time I started in, more than fifty years ago, a time that there was not a drug in the butter market in that season. It has been low and hard to dispose of. There were good reasons for it at that time. The butter was made in May, June and July largely, and butter made at that season of the year it is frequently impossible to keep in perfect condition through dog days. It had to be put onto the market and was put onto the market and brought a very low price. From eight to ten and twelve cents a pound was a good price at that time of year. The butter that was eaten in the winter was put down in June.

There was an excuse for that kind of farming then because the farmers couldn't do any other way. They hadn't the facilities or knowledge to make winter butter. That excuse doesn't exist today, but that same practice has kept right along. A majority of our dairymen today are following that same custom of letting their cows come in in the spring and it causes a surfeit of butter in June. There is always a dull time to get rid of butter, and it is sold for a very low price for two reasons,—because there is too much of it put on the market and because everybody knows it is hard to keep through dog days. I was talking with our creamery man the other day, and he told me that if the dairymen in his locality would practice fall dairying so as to give him an even supply of butter through the year he could pay his patrons at least a cent a pound more for the year, and he thought two cents, because he said he could not contract for any more butter than he could carry through the short season. "If I could be sure," he said, "of an even supply, I could contract the whole for twenty-three and twenty-four cents a pound, perhaps," but a large part of his butter he has to put onto the market and sell it for what he can get because he can't contract it, and it brings down the price of the whole lot. So the man who persists in having his cows come in in the spring is not only injuring himself but also his neighbor. He is reducing the price to all the patrons of the creamery alike.

A cow that comes in from September to November, according to my experience (remember this is my experience) will make ten per cent more butter in the year on the same kind of feed and the same amount of care than if she came in in March, April or May. There are a number of reasons for that. Cows that come in in early spring will give a good flow of milk when put on grass. They will give a good flow of milk through June, but when the feed begins to shorten and the heat of summer comes and the flies annoy them, they will certainly shrink down, and frequently one-half, and you cannot get them back. They have given you a good flow for perhaps four or five months a year, and they will give a small amount, say from twelve to fifteen pounds a day, clear along into the winter. They will give you that almost half the year, while if a cow comes in in September when you have plenty of green feed of all kinds, you can keep that cow up to the full flow, and when she comes to the barn give her good feed as we dairymen do in the winter time, and she will hold that flow right up until April. It is astonishing how those cows will run clear through the winter for five months. If they are in condition to start in at twenty to twenty-five pounds a day they will hold that right through the winter. They will give a good flow of milk from September to April. They will shrink then somewhat, but when they get out to grass they will give you a fairly good flow through June, and the period when they are dry comes in the heat of summer, with the flies and scarcity of grass, and when you are busy about your work, cutting your hay and grain. Dry them off then and they will rest through the summer season and will certainly give you ten per cent more than the same feed will produce if you have them come in in the spring, and your care and trouble comes when you can attend to it a great deal better.

I will say just a word about carrying cows from hay to grass and from grass to hay. There isn't nearly so much trouble—there isn't a great deal of trouble anyway—but there isn't so much in carrying them from grass to hay as there is from hay to grass in the spring. But I find one thing, it doesn't pay the dairyman to let his cows stay out to grass after the frost has killed the grass, I don't care what time in the fall it is. After the grass is killed by frost it is of no use to your cows, but is a positive detriment. When I was away this fall that was brought to my mind more forcibly than ever before. When I came home the cows were still running out. There was lots of feed, but it had been killed by frost. We had early freezes this year that killed it earlier than common, and the cows had shrunk up in flow very much, and I said to my son, "We can't afford to have the cows shrinking up this way." He said he was feeding them liberally from the barn, and they ought to do better on what he was giving them than they were doing. I said, "We will put them right in and not let them out another day." We didn't increase very much on the feed, but they began to increase very rapidly in milk, and they came nearly back to where they were before, but not quite. It is a positive fact that if you feed a cow a certain amount of hay and grain from the barn and let her out in the middle of the day into a field where there is a lot of frozen grass, she will like it and will fill up on it just as full as she can get, but will give less milk than she would on just the same amount of feed from the barn without going out and filling up with this "old fog," as we call it. It is a positive injury to them. So I say, just as soon as your feed is killed by the frost, and it doesn't make any difference what time of year or what season it is, you had better put your cows in the barn and keep them there and feed them from the barn.

I find the best method of getting cows from hay to grass in the spring, if the pastures are hard so they won't poach, is to begin to let the cows out about as soon as the ground is bare an hour or two a day on pleasant days and let them go around and begin to nibble the grass as soon as it begins to grow. Feed them in the barn just as though they didn't go out. Feed them in the barn until they eat less and less as the grass grows and they finally get their living from the grass and you don't have to feed them from the barn, and they never notice the change. It is like weaning a calf by degrees by giving them a little water and a little less milk, and increasing the water until it is all water and they never know when they are weaned. In the same manner the cows never know when they are changed from hay to grass. There is no scouring or anything of that kind. Some keep them in the barn until there is a full feed and then let them out, but it almost always works badly that way. The best way is to let them out a short time each day and take the grass as it comes along and fall off on the feed from the barn.

That is the last straw I have, and you will have to take it for what it is worth. I tell you that which has been my experience. But the most important of these straws is this one of having your cows come in in the fall of the year. I tell you, you stand in your own light tremendously if you keep them under the old system of having them come in in the spring. You don't get so much for your product and you don't get so much product. Under the fall system the amount is more and the price you get for it is more and your trouble is less. It comes when you can better afford to take care of your cows than you can through the season of harvesting your crops. You say if every man were to change over the same glut would be in the fall, but there would be this advantage about it,—in the fall of the year when the weather is cool it is easier keeping butter and there would be less difficulty in carrying it than in the spring when the weather is coming on hot and dog days commence. Then it is almost impossible to keep good butter.

COUNTRY LIFE, PAST AND PRESENT.

By George E. Fellows, President of the University of Maine.

The vast majority of people always have lived, and always will live, in the country. That this is the ideal is evident from all references in the early literature of all peoples. The Bible story of the Garden of Eden is evidence enough that the ideal of the earliest ages of men was the life in close touch with nature, and the earliest illustrations of unhappiness and trouble are drawn from contact with cities. If there had been any other ideal than this the Garden of Eden would have been, or would have been pictured as having been, a factory with humming wheels and whirring spindles, where the noise of industry shut out all other sounds. But, no, the ideal appears where the flowers bloom, where trees lift up their branches toward the blue sky, where rippling waters babble over the stony beds, and where birds are chirping to their mates. In all literature the happiest conditions are found where men's relations to each other permit this independent life in nature.

In looking at the country life of the past and the present we will, for obvious reasons, omit the consideration of the life of savages or of barbarous peoples, and consider only those who have, by their literature or traditions, contributed to the growth of present civilization.

First would come the peoples referred to in the Bible, patriarchs, prophets, Babylonians, Persians, Egyptians, and Greeks, and following along down the ages, the Romans, the Germans, the French, the English, and other European nations, and lastly the peoples on the western continents and Australia. An exhaustive study of this theme might well fill a good sized volume, but a few glances here and there will give us an idea of the changes that have been wrought by time, and will no doubt leave us with the feeling that present conditions are more desirable than any of the good old times.

The history of country life, if it were written, would be almost equivalent to the history of agriculture, for as soon as man was sufficiently civilized to live as a nomad in the patriarchal age he did not subsist alone by dependence upon his flocks and herds, but he began to practice agriculture. The vast tracts of land over which the patriarchs roamed with their flocks, were ordinarily common to all shepherds alike. In the summer they lived in the mountainous districts and in the winter drew back to the more sheltered valleys. While the vast flocks of sheep and goats seemed to constitute their wealth, they also possessed animals of the ox kind. We learn that Job, besides his vast flocks, had five hundred yoke of oxen which he employed in plowing, "and a very great husbandry." Isaac, also, was a farmer, "and sowed in the land of Gerar and reaped an hundred fold." The parable of the sower, which our Lord has left us, mentioned an increase of thirty, sixty or one hundred fold.

We have little direct information as to the manner of living of country dwellers in Bible times, but the inferences which we draw from illustrations given us, lead us to believe that the ideal of life in the country was constantly maintained. When the man went to Jericho he fell among thieves who stripped him of his raiment and left him half dead. The cities seem to have grown as necessary places for the exchange of products of the country. The Bible references to the agricultural wealth of Egypt lead us to look there for early development of country life. In times of famine Egypt could supply corn. Diodorus Siculus describes the skill of the farmers of ancient Egypt. He tells us that they understood the benefits of rotation of crops and adapted them to the soil and the season.

The literature of Greece which has been preserved deals with poetry, philosophy, history, and the fine arts, and shows but little concerning the agriculture of that country. Yet, although the country itself as a whole was unfavorable to agriculture, we find sufficient reference to the subject to learn that valleys and morasses were drained, that rocky surfaces were sometimes covered with transported soil, and that they possessed excellent breeds of domestic animals.

But among the Romans we have abundant literature upon the country life. Agriculture was highly esteemed and pursued with earnest love and attention. Sclegel in his history, informs us that in their foreign and military enterprises they were always eager to obtain possession of land, "for it was in land and in the products of the soil that their principal and almost only wealth consisted. They were a thoroughly agricultural people, and it was only at a later period that commerce, trades and arts, were introduced among them, and even then they occupied but a subordinate place." The classic Roman authors which are read in the colleges have given their finest work to the description of country life.

The Roman ideal is Cincinnatus, who was called from his plow to lead the nation, and who, when his work was done, returned again to peaceful country life. The Roman theater took every opportunity to contrast the amusements of town life with the disadvantages of country life. On the other hand, there was no period "of the history of the native Roman race when they did not show their contempt for the inhabitants of the city. It was a sort of tradition with them that the slaves of the capitol were useless creatures and that citizens who never left it were not much better."

The long series of Punic wars were supported entirely by drawing upon the wealth of the country proprietors, and at the close of this series when the whole territory, city and country alike, was impoverished, prosperity did not begin again until lands were subdivided and the population again drew its existence from the soil.

After the breaking up of the Roman Empire, down to the period of the French Revolution, the people of Europe were engaged in migratory and warlike expeditions, and the peaceful development of agriculture and country life was impossible. But agriculture was just as essential to the existence of humanity as ever, and agriculture must be pursued. Its pursuit was not a peaceful occupation as it had been earlier, and has been since.

The conditions brought about the growth of the feudal system. The men who tilled the soil could no longer live in quiet upon their own estates, but for protection attached themselves to some powerful and warlike leader, who would undertake, when necessary, to lead them in battle against an invader. In return for this leadership they themselves became his vassals. Through this period there grew up, all over the country, the gloomy stone castles of the lord, and clustered about them, the humbler dwellings of the tillers of the soil. It was unsafe for the latter to live upon the land which they worked, for at any time some neighboring baron might sweep down with his army of retainers to devastate the fields and murder the laborers. Therefore at night, all who cultivated the soil withdrew to the protection offered by the castle walls and went forth in the morning to a considerable distance for their daily labor.

The people who did the labor, who cultivated the soil, were considered as of absolutely no value to anyone but the particular lord whose vassals they were. Robbery was a recognized profession. After a careful study of this whole period one may well wonder how it happened that any interest in agricultural life could remain. It could not have but for two causes. One, most obvious, that even robbers could not carry their depredations so far as to completely exterminate those who tilled the soil, or the results would have reacted too heavily upon themselves. Another reason is that those who were in danger made a virtue of necessity and piously deeded their lands to the church, and agriculture was carried on by the inmates of monasteries. The piety of the titled marauders was sufficient to protect the domains of the church from devastation.

When one of us chances to be fortunate enough to enjoy the beautiful scenery along the Rhine, we see on every hilltop and inaccessible rock the castle of the robber barons of medieval times. Some of them are in a state of good preservation; some of them are in ruins. They are an indication and a reminder of nothing happy or progressive, and they serve the best purpose now as accessories to the landscape. Most of us have little idea of the number of these robber strongholds, during the middle ages. Indeed, after careful investigation, I can give very little idea, but it is true that with the definite intention of destroying the castles in France for some hundreds of years, and particularly during the French Revolution, there were, about twenty years ago when a survey was made, 24,000 still in good repair in France alone.

After the worst of the warfare of the feudal period had been passed, and it became reasonably safe again to live in the open country, the lot of the farmer was not a happy one. He did not own the soil upon which he labored, and the dues and taxes imposed upon him were so heavy that he must himself consume the inferior products in order that the best of the corn and the finest of the herd go to the overlord for dues.

These conditions contributed largely to the French Revolution. When, by this political upheaval, the large estates were confiscated by the popular assembly and sold in small holdings to individuals, the prosperity of modern France began.

In England the feudal system did not work such evil results as on the continent, but a similar system grew up of laborers and tenants on large estates. All the land legally belonged to the lord of the manor, and all the inhabitants had to submit to his jurisdiction. About a third of the tillable land was kept in the hands of the lord himself, and the remainder was divided among the farmers with whom also the lord shared whatever hay was grown upon the meadows, and the grass and acorns in the woodland. In return for this the farmers did not pay any money rent, but rendered him various services. The services may have been work upon the lord's own land. In addition a tribute was expected, such as some eggs, two or three capons on the three great feast days, or seed wheat once a year. A clumsy and unbusinesslike system, was it not? It is interesting to note the crops raised by the people under these conditions. Rye and oats furnished the food and drink of the great body of the people of Europe. Cultivated roots and herbs were then unknown in the agriculture of Britain. It was not until about the end of the reign of Henry VIII, that any salads, carrots or other edible roots, were produced in England.

It is utterly impossible, of course, in a brief address, to even hint at the style of living at many periods or in many places, or to give sufficient detail of any period to make it interesting. I can think, however, of no study which would be more profitable and entertaining for the farmer in his home in his leisure hours. or for the student in his college course than a history of agriculture among all the civilized peoples.

Just another brief picture of country life in England in the eighteenth century. The country life in its most favorable aspect was that of the lord of the manor, or of the gentleman who called himself a knight of the shire. The houses, though substantially built, were not kept in a state of repair and cleanliness such as would concur with our modern notions of decency and comfort. The rough fields, and stony, rutted lanes through which the mansion was approached, presented the greatest contrast to the carefully kept avenues and shaven lawns about the modern country residence. The chief points in the education of a gentlewoman of those days were cooking, and, if she were very ambitious, carving, a lesson being especially received from a master in this art. The chief duty of hospitality was for the lady to press her guests to eat until they were gorged, and the main care of the master of the house was to induce them to drink to excess. The roads during a great part of the year rendered visiting impracticable. The library of the great house generally consisted of a book of receipts, a book of law called the "Justice of the Peace," a volume of drinking songs, a book of sports, and possibly a tract or two against some antagonistic religion.

A contemporary writer has handed down to us a picture of a country squire which is not flattering to its subject. He says, "They seem born only for the destruction of game and the disturbance of their neighbors. They are mere vegetables which grow up and rot on the same spot of ground, except a few which are transported into parliament. Their whole life is hurried away in scampering after foxes, leaping five bar gates, trampling the farmer's corn, and swilling beer." Everywhere in the literature of the day the rural gentry are described as a coarse, overbearing, illiterate race, solely devoted to the stable, the kennel, and the bottle.

Travelling was well nigh impossible except for the very rich. A species of stage coach, called the Machine, occupied two days in going between Bath and London, a distance of about ninety miles. The fare was twenty-five shillings. Gentlemen who were above traveling upon public conveyances frequently advertised for a companion to join them in a post chaise. In that way they would divide the charges and diminish the chance of attack by highwaymen.

It is quite unnecessary to comment upon such conditions as these. We may complain of some of the present conditions, but should we not be ashamed to do so when we think for a moment of the inconveniences and discomforts endured by our grandfathers? The conditions of country life a century ago in this country may have been unpleasant as compared with the present, but they were not as bad as those to which we have alluded. Wherein, then, is the country life of to-day in this country superior to that of yesterday and elsewhere? To leave entirely out of account the most recent changes which make country life enjoyable, such as the rural free delivery, the farmers' telephone, the local trolley line, the daily paper, and a hundred other results of modern invention, I say leaving these entirely out of consideration, and they are enough in themselves, wherein do we find the cause for thrift, success and prosperity of the present day American farmer?

I believe it can be summed up in a single sentence. In the absolute ownership of comparatively small estates and the cultivation of these estates by their own proprietors. That is the condition that has constituted the prosperity of the whole of the North of the United States. It is the condition which is bringing a new prosperity in the South of the United States, where the great territories formerly cultivated by slaves are now broken up into smaller holdings cultivated by their owners.

As I have repeatedly said before in public, so far as my knowledge goes there is no place in the world which is so highly cultivated, where the individual people are so prosperous, where agriculture is in its best state, as in France. This condition, I have no hesitation in saying, has come about because of the careful working of very small pieces of land by individual proprietors.

The evils under which Ireland has suffered are largely caused by the land having been owned by absentees and worked with little interest and no profit by the poor peasants. There is a glimmer of hope for better days for unhappy Ireland. The latest land acts provide opportunities for the purchase of small portions of the great estates by those who actually work them. If the system results as anticipated, the unhappiness of Ireland in a few decades will cease.

It is a hopeful sign in our own country that the tendency toward the city is less than in the past few dozen decades. There is more interest in country life. The opportunity, however, for a growth in the right direction can better be realized if people obtain possession of only so much land as they themselves can cultivate or supervise personally than if there should be a tendency toward the accumulation of vast estates to be worked only by tenants. The personality of the owner should be stamped upon his possessions. Then prosperity will come to the country, and happiness to the home.

THE TEACHING OF AGRICULTURE IN THE PUBLIC SCHOOLS.

By Professor WILLIAM D HURD, University of Maine.

This annual meeting of the Maine State Dairymen's Association is an educational meeting from the time the first session began this morning until the meetings close tomorrow. We listen to eminent specialists in the different lines of agriculture, and we are told how to produce better stock, more sanitary milk, better butter, richer cheese. But in the midst of these interesting discussions it is right that we should cease for an hour or two and consider that greatest and best crop of the American farm and American home—the boys and girls—and how they may be benefited by education, or perhaps we had better say, how we may improve in some ways our educational system for them.

The discussion which I shall present to you does not confine itself entirely to the subject of agricultural teaching in our public schools, as the program would indicate, but deals rather with some of the questions considered most vital by prominent educators. It touches the problem of the city school, the village school and the rural school alike, but is chiefly concerned with the betterment and improvement of the country schools. I cannot more than touch upon a few of these but will endeavor in the time allotted, to tell you something of what is being done in different parts of the United States, what is possible in Maine, and the beneficial results to be obtained from giving such subjects a place in our public school curriculum. I have attempted to speak of these things in a rational, common sense way.

By many people, the teaching of Elementary Agriculture, Nature Study, or call it anything else you wish, is looked upon as a fad, and to such I will say in the beginning, that the teaching of these subjects and the problem of consolidation of our rural schools has passed beyond the experimental stage; in some of the places I shall mention the work has been carried on for eleven years. More than two-thirds of the states of the Union now carry out this work in some form and in not one single case are the people willing to discontinue it, but on the other hand they are, by additional private subscriptions, when necessary, aiding the movement so that it may be carried still further. There is confusion in the minds of many as to what these terms Elementary Agriculture and Nature Study mean. Personally, I believe that much of the trash that has been written under the name of "Nature Study" is simply a fad advanced by some enthusiastic people. "Nature Study in its true form is seeing what one looks at and drawing conclusions from what one sees." A little girl was asked whether or not she had seen that great constellation in the heavens commonly known as the Great Dipper, and she replied that she had seen it in her Geography. Nature Study is simply observation work and is perhaps adapted to small children, but the true value comes when you carry this observation into actually doing something; studying the habits and life history of plants, animals, birds and insects. When you do this, you are teaching the subjects which Elementary Agriculture is supposed to cover in the education of the child. The idea maintained for ages that to become an educated man or woman one must study the classics for years has given way to the belief that anything that causes a child to think and takes him or her into the activities of their everyday life, is just as much education as learning conjugations in Greek or Latin, providing that the same amount of mental exertion is made in the one case as in the other. And why not? Science is no more the mere classifying of objects, it is more and more every day the explanation of the things which take place in the natural world. The child whose life is made broader by knowing how to deal with nature, business and the home, will know better how to utilize this knowledge in so-called cultural studies; and should he leave the farm and move to the city, he will better serve the city in business and social life and the higher industrial life of the country.

I am not here for the purpose, nor will I attempt in any way, to malign the public schools and the work they have done in the past. American public schools are our rightly beloved institutions and any movement made to change them in any way should be most carefully considered. That the little red schoolhouse, immortalized in fable and story, has been a factor in training men capable of assuming and governing even the affairs of nations, is shown by the large number of illustrious names written on the pages of our history. The explanation most commonly offered for this superiority is, that the country child has been taught to do things and is able to surmount difficulties and prove equal to the occasion when obstacles are presented to him, by reason of the part he has taken in bringing himself up. We should not then look at the rural school as an unsuccessful educational factor, but considering its wholesomeness and past history, strive to build it into a still more perfect factor fitted to serve the constantly increasing demands of this life.

It is a beautiful thought to talk, to hear and to read of the spiritual and moral benefits derived from "living near to nature's heart," but most of us must receive a training which will enable us to do something in carrying our share of the business, the social, the moral and religious responsibility of the time. The pathway we travel gives sad evidence of the wrecks of men and women who knew, but could not put their knowledge into working shape. The mass of the people in the choice of life-work divides largely between the two occupations, agriculture and the mechanic arts. No matter in which class one finds himself, he must depend in a large degree on the products of the soil for daily sustenance, and the greater his knowledge of these things, the wiser his judgment is likely to be in other directions.

More than 95% of all the children in this country receive all the education they ever receive, in the rural and small village schools. It is this 95% that should concern us in our secondary education. The one, two or three per cent who enter the higher institutions of learning will take care of themselves, although much more able to do so and to live useful lives, if this earlier education has fitted them for that which comes later, and the best efforts we can make are none too good in the improving of these schools which educate the masses.

If there is any one present who is not familiar with the importance of agriculture as an occupation in this country, let me say that 65% of our exports are agricultural products.

Everyone will have to grant that the movement cityward has greatly changed the life in our rural communities. The causes of this are numerous and familiar to all and the best efforts of some of our most able citizens are being given in the attempt to relieve the social conditions in which our cities have suddenly found themselves. Surely the problem of the cities will not be solved by dumping the inhabitants of slum districts out onto the land in a helpless condition; we want our farming communities more rather than less respectable and prosperous.

Now what, if anything, has the country and small village school done to familiarize the boy and girl with country life and country living? The cities, realizing their condition have, at great cost, equipped their schools with manual training, and it has met the condition well. The study of agriculture to the country or village boy is what manual training is to the city child, and time and experience have shown that teaching the former to such children as are surrounded by rural conditions makes them just as able to meet their conditions as the latter does the city boy. The object in teaching agriculture in the public schools is not to make farmers any more than manual training is to make all city children carpenters or blacksmiths. But without answering the question myself, let me quote to you what some of the leading men of the time have to say about the inadequacy of the country school in meeting the requirements of the agricultural community. No less a person than General Francis Walker says the following of the education he received in the Massachusetts public schools: "I entered the schools of

Massachusetts at the age of five and left at fifteen to go to college. In all that interval I do not remember to have been set to any study or exercise which I could not have done just as well without hands, except solely for the convenience of holding a book and turning its pages, or writing on paper, slate or blackboard; which I could not have done just as well if afflicted with total blindness except solely for the greater difficulty of learning lessons by having them read to me; indeed, but for this, a blind boy would have had an advantage over me as being less subject to having his attention disturbed by surrounding objects. I do not recall any exercise which I could not have performed equally well without the use of hearing except only for the purposes of communication with the teacher; and indeed, a deaf child would but for that have had an advantage over me as being less subject to interruption from without."

The importance of farmers themselves taking a part in the education of their children, is well shown by the words of Dr. A. C. True, at the head of the United States Experiment Station, Washington, D. C. He says:

"When every industry is allying itself closely with the schools and seeking changes in the school systems which shall be of benefit to it, it will not do for agriculture to stand aloof from the educational movement of our times and attempt to run a twentieth century educational system on the basis of an eighteenth or nineteenth century system. The patrons of the schools, the farmers themselves, should take an active interest in their formation and help to adjust the public schools to the advancing requirements of agriculture."

W. M. Hays of Minnesota says: "Agricultural science, speaking broadly, is destined to become the most complete, the most complex, the most interesting, and the most useful science in the world, and our own America is in the lead in developing agricultural science and agricultural education."

Such opinions as these could be given almost without number and we are safe in assuming that the country and village school, while it may have met its conditions in the past, is not doing it now. The education of country children has been toward the city and by city people. The statistics of a certain state show that out of 13,204 young men who leave the schools annually, 66 enter the ministry, 66 study law, 72 medicine, and the remaining 13,000 take up some form of agriculture, and yet our education has been for the few. The far reaching effects of Senator Morrill's idea of the need of agricultural education in the future, are just beginning to be felt and the true worth of the man is just beginning to be known. The popular opinion that educating the boy causes him to leave the country is being disproved each year by our leading agricultural institutions. Most of the so-called objections to living in the country are now removed and a home along a leading highway with rural mail delivery, good roads, telephone and perhaps a trolley line at the door, is the ideal home of the future. We are then justified in urging young men and women to remain in the country, and will consider the work which is being done, and can be done, to make that life more complete and attractive to them. To even name different sections of the country would take the whole evening, so the number of places shown and described must necessarily be short.

This teaching of agriculture in the public schools has assumed several different forms, each of which seems best suited for the particular locality. It is interesting in passing to note that so far as investigation shows the first agricultural instruction given in this country was at Gardiner, Maine, between the years 1823 and 1831, and to Ezekial Holmes, the teacher, educator, statesman and benefactor, Maine owes much credit for its early development. This movement began about eighty years ago but until the last fifteen or twenty years, not much was done in this country, although all the leading European nations have had school gardens for years, there being more than 100,000 in the principal cities of Europe. The school garden may take the form of a garden eight by ten feet square for each pupil, where the common quick-growing vegetables and flowers are sown and cared for by the child under competent instructors, or the work may be directed toward beautifying the school yards and surroundings. The state of New York has used the latter method very extensively, more than 500 school grounds having been improved by the children and teachers.

Boston and vicinity have been very active in this work. The Geo. Putnam school at Roxbury, Boston Normal, Franklin and other schools have all successfully maintained school gardens. Two of the state normal schools, Hyannis and Framingham, have extensive courses in this work. At Hyannis the garden work is made the basis for numerous exercises in connection with mathematics and languages. The children write letters to seedsmen from which they purchase seeds, sell their produce, deposit the proceeds in a bank, make purchases and pay for them with checks drawn on their account.

Another most interesting thing near Boston has been the development of Hale House farm, under the direction of the Hale House settlement work. A few acres of land were purchased at Watertown and here boys who work during the day come to spend their nights in the cool, refreshing air of the country, and devote some of their time in learning to cultivate and grow vegetables, flowers and other crops.

The school gardens connected with the School of Horticulture at Hartford, Conn., have been famous for four or five years. This is the largest establishment of its kind in the country. Numerous other schools, both city and country, in that state are operating gardens of some kind where a child may be taught industrious habits, and lessons in thrift. Vermont besides having school gardens at different places has a practice school in connection with her normal school.

Providence and other towns of Rhode Island are carrying on this work.

The children's farm school located at DeWitt Clinton Park, New York City, has received so much mention in the press that it hardly seems necessary to describe it here. A vacant lot, in fact a dumping ground, was cleared of the rubbish, mostly by the labor of the children, and transformed into an ideal garden. The need of having such gardens as these can be clearly understood when we realize the conditions under which the children live.

In this garden in New York City a small farm cottage has been erected which is kept tidy and neat by the girls, and a brood of chickens and one pig named after the illustrious DeWitt Clinton, one time governor of New York, have been secured so that the children may become familiar with animals, as well as plants. It was my privilege to be connected in a small way with the garden during the first season it existed and could you have seen the eagerness and the earnestness these children, some of whom had never been outside the city, showed you would no longer have doubts as to the practicability and worth of the work. Columbia University, after observing this miniature farm, has recently started in connection with their teachers' college in New York City, a school garden, to serve both as a practice ground for prospective teachers and as an object lesson to Columbia's allied preparatory schools.

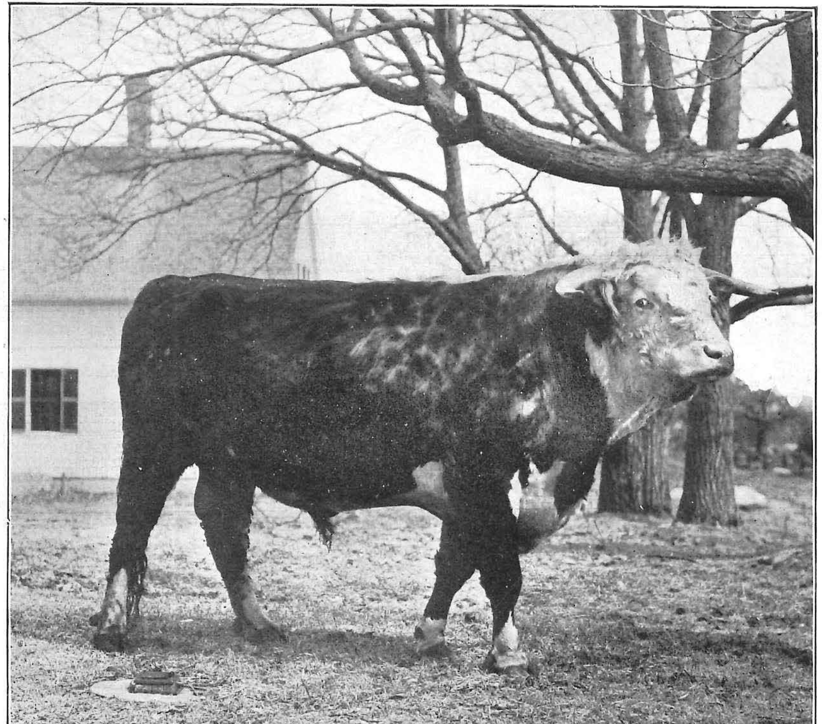
Maine has done very little toward the introduction of this work into her schools. The city of Bath has done some work. An attempt was made by the Horticultural Society two years ago to start a movement in this direction; and the teachers of the village of Orono did something last spring toward improving the school grounds, but without proper encouragement from the school officials and residents of the town.

In the South the Hampton Institute for Negroes and Indians at Hampton, Va., the Department of Agriculture at Washington, and Tuskegee Normal are the three most notable examples, although the work is carried on at many other places. When the work began at the former place many thought it a disgrace to work out of doors, but at the present time they all look forward with pleasure to the periods devoted to gardening. In all instances the movement has been so successful that plans have been made for broadening the work. In the middle and far West the states of Ohio, Indiana, Illinois, Michigan, Wisconsin, Missouri, Minnesota, California, Idaho, Utah, Wyoming and most of the others of that group all have some gardens in country as well as city schools. Of these states Minnesota has a perfectly organized system wherein agriculture is taught from the beginning in the rural schools, in centralized schools, in high schools, and finally the child receives the finishing touches in the State University toward which all the rest leads. Eighty per cent of the graduates here go back to the farm. The city of Cleveland, Ohio, has done much by distributing seeds. Something like 300,000 packages were given to the children of that city and were planted by them last year. And so this work is carried on throughout the country.

The city school garden gives the children something to do, keeps them out of the streets and teaches them useful things of a life which would be to them like a foreign country. To the country child it opens up the life he ought to know but seldom does. The practice in laying out the work, the patience shown in waiting for things to grow and materialize, learning to understand the things you see about you every day, the growing love for nature and things beautiful, the industrious habits formed and physical benefits coming from working and being in the open air, compared with simply presenting abstract thoughts to children make all the efforts that are made in this direction worth while.

While the schools were awakening to the opportunity offered them, some individuals and corporations have realized even before them the necessity of training boys especially, in this way. There are many examples where factories have undertaken the work themselves, and possibly two of the most notable might be briefly spoken of. These two are the National Cash Register Co. of Dayton, Ohio, and the work that has been carried out by the Youth's Companion.

About eight years ago Mr. Patterson, the president of the former concern, while traveling in the West met an elderly man who at one time had lived in Dayton. This man asked Mr. Patterson about thirteen young men, sons of prominent Dayton business men. Mr. Patterson knew these men and replied that twelve had died of drink and the thirteenth was staying in Canada with $800 of his (Mr. Patterson's) money. Mr. Patterson then asked himself the reason of their failures and his success, and finally decided that the latter was due to the industrious habits learned while living on a farm as a boy—habits not learned by the thirteen others. He decided from that moment to do something for the children of those employed in his factory. He organized a garden for the sons of these men. He had illustrated lectures on subjects of landscape gardening, home and civic improvement, and other interesting subjects given evenings for the benefit of the men and their wives. The success has been phenomenal. At one time employees would not build in the vicinity of the factory, preferring to go several miles away from the neighborhood where property cost four or five



Hereford Bull Leofwin No. 111975, imported by A. J. Libby, late of Embden, now owned by his son, A. D. Libby of Oakland.

times as much as it did there, in order that their children could be brought up amidst better surroundings. From a section which was at that time shunned, it has changed to one having well-kept grounds, paved streets, pretty cottages, vine-clad buildings, and other desirable features. And after eight years, Mr. Patterson says of the cost:

"It cost much in effort but little money. The factory owner, or householder who is eager to make his property something besides a smudge on the face of nature, who enjoys beautiful surroundings, and hates the dreary, who would rather be an influence for good than for evil, who ardently grasps an opportunity to develop the fine nature rather than let the coarse gain power, to such, man or woman, the cost is mostly in the enthusiasm with which the work is prosecuted."

The corporation before spoken of—that of the Youth's Companion—has instituted and carried out an interesting and valuable work in every state of the Union by offering prizes in the shape of pictures of historic interest, flags, and other suitable things to those schools showing a marked improvement in school grounds. They have issued and sent at great expense booklets of instruction to inspire and help both teachers and pupils.

Of their object in doing this work the Youth's Companion has this to say:

"To capture the citadel of the child's mind through sympathy, to lead pupils toward higher ideals of life and duty, to establish closer relations between home and school and state, to exalt purity of life and conduct, to strengthen the moral tone of the community, to make good men and women, to establish and dignify the profession of teaching, to make education attractive, to magnify the state and to meet the need for educated citizenship,—this is our mission."

Surely such efforts as these are grand and noble precepts, which our schools, too, should ever keep constantly before them.

The question can be raised and rightly so, as to how the teaching of agriculture can be accomplished throughout the country. Is it not an utter impossibility? This leads me to consider that other question which in connection with the one already spoken of is receiving so much attention, that of the consolidation of rural schools. I know there is a strong sentiment against the abandonment of the little schoolhouse. But, again, under the changed conditions before spoken c. many of our country schools have so few pupils that it is impossible to keep schools open a reasonable length of time out of each year. "Consolidation means the uniting of two, three, four or five small, weak schools into one which shall be large enough in numbers to be interesting, strong enough financially to afford a comfortable building and be presided over by one or more good teachers provided with reasonable facilities for work." This plan is now being practiced successfully in several counties of twenty different states. When I was a small boy in Michigan the country school which I attended had forty students and in winter fifty or fifty-five. Other nearby schools enrolled about the same number. Five years ago this same school and two others near it had about six scholars each. It is plainly evident that in such cases as this, and there are thousands of them, the remedy is consolidation. At first it was thought that it would be too expensive to transport children by wagon three or four miles, but one state which has a large number of consolidated schools answers this question in this way: "Wagons are cheaper than schoolhouses, horses are cheaper than fuel, and drivers cost less than school teachers." In this same state it has been found that each town saves from $150 to $500 a year in the cost of its schools. In many of the states the cost of maintaining the country schools is more per child than that of the city schools. In 1,000 rural schools in Michigan the cost of teaching each child per month was $4.16. In the same report on eighty-three other schools the cost per month for each pupil was $9.95, while the report states further that the cost of educating children in the city schools was $1.94 each per month. In Indiana in 1899, the cost of maintaining city schools was $7.07 per scholar while the cost of maintaining the country schools was $10.50 per each scholar.

The consolidation of country schools would mean, too, the securing of better teachers than can be secured at the salaries which are now paid. There are one thousand schools in Maine which enroll less than thirteen pupils. Do you know of the very small salaries these teachers receive? Superintendent Payson Smith of Auburn, in a report to the State Teachers' Association last month, said that the average salaries of women teachers in Maine was $6.90 a week, and that of male teachers $37.37 a month. You are paying to the men and women under whose care you place your boys and girls during the most critical period of the child's mental and moral development, a sum considerably less than you would pay to an expert office assistant; to the man who weaves the cloth you wear; the man who delivers your groceries; the man who works on your farm; or the man who cleans the streets. I ask, and leave the question with you, "Is this fair pay for the quality of the services rendered?"

Indiana has perhaps the best system of organized education in the country, and in that state the lowest salary paid to any teacher is $38.50 a month. The excellence of any school depends on the teachers. They should know the community, its soil, trees, vegetation and natural resources. They should be familiar with the social life, the home conditions, should be identified with societies, churches and their work, and they should be paid so that they can properly prepare themselves to make the conditions of life better in the communities where they teach.

The objections to consolidation, "That it costs too much, that the roads are too poor; that it is better for children to walk, that the value of farm land decreases where schools have been abandoned, that many teachers would be thrown out of employment, that children are taken too far from home, and that the influences that formerly surrounded the country school were to be destroyed," are not sustained by experience, but on the contrary, it is found that "the system costs less, that the children do not have to go to village high schools, that children are protected from offences to decency and morals which they encounter when alone on the road, better teachers may be employed, the cost of schooling is equalized, the number who attend school increases, property value increases instead of decreases," and it is the only way in which agriculture can ever be generally introduced into the public schools and is therefore a rational solution of the problems of agricultural education. In a most excellent paper read before the Cumberland County Pomona a few weeks ago Mrs. Sarah Mitchell of Pownal, after speaking of consolidation in Maine says:

"As a teacher I have known the ungraded and the graded school, having taught in country, town and city. As a mother

I know the ungraded school of today, and I feel that the ideal spot in which to educate a child is a well graded school with modern conveniences and apparatus for teaching, set down amidst the trees and fields, with ample playgrounds and earnest, faithful teachers."

In speaking of the work done in Winnebago County, Illinois, where the first consolidated school was carried on, a leading magazine says:

"If one man in a few years can instill new and vigorous life into a whole community, the less time we spend complaining about conditions and the faster we work the better."

The real question to us is, Do we need these things in Maine and are they practicable? I believe that what has already been said shows the necessity of this in Maine as a part of the educational system, and more than this, it is practicable and feasible. If so, then of what shall the studies consist and how shall they be taught? In the first place nature's laboratory, the rocks, the woods, the plants, the birds, the animals, the insects, all are at the very doors of our school buildings, so that the question of material for the work is at once answered. Elementary textbooks in agriculture have recently been published and could be adopted in the place of the readers now used. Do you not think that an interesting story could be written, for instance, about the life history of a butterfly? It's something a child sees every day, yet how many in a school could tell you the first thing about it? Do you not suppose that the child would be interested in collecting the larvae of this insect, keeping them and watching them spin their cocoons and finally would not the transformation into the beautiful many colored butterfly be watched with interest? Are there not simple yet useful lessons that could be brought to the child's attention covering each stage? The child could be told that the insect was given these colors for several purposes: perhaps to make itself conspicuous, in order to attract the opposite sex, or again for purposes of protection against enemies. A child would be interested to know the ways some moths and insects have in imitating twigs, leaves, bark, and other material in order to protect themselves against their enemies.

I would like to take up something in this line about an animal, a plant, and bacteria which are our helpers, but time forbids.

The children could be taught how plants grow and feed and what elements they use in making their growth. They could plant and care for vegetables and flowers planted in the school yard if individual gardens were not attempted. The germination of seeds could be watched and studied, teachers could take their pupils on field excursions, and useful information could be given them. They will watch with interest the visits of the bees on their two-fold mission of honey gathering and flower fertilization. The school grounds could be improved and made much more attractive than is generally found now.

When the school and the school grounds are made as attractive as the homes from which the children come you will have no trouble in keeping the children at school. Flowers should be found in every school yard, and the child should be trained to admire the beautiful. "Shabby, useless, ugly grounds are public nuisances. They are uninviting and give bad impressions to the child, which may afterwards reflect in home and business life." To stimulate this interest prizes might be offered for the most marked improvement shown in school grounds. The reason that so many school grounds are bare and neglected is not due to lack of appreciation of the beautiful, for where the homes are surrounded by trees and flowers the school yards are often found neglected; neither is it due to indifference. The real cause seems to be in the failure to see the need of beauty in education and the interest of the American boy in the world about him.

The difficulty here, as in other places, would be lack of teachers who are fitted to carry on this work, but if this education reaches the largest number the State should provide instruction for teachers. It should be taught in the normal schools, a person should be employed by the State whose sole work should be to travel from York county on the southwest to Aroostook county on the north visiting the schools, giving interesting talks to children, and instruction to teachers. Leaflets and circulars should be printed both for use of teachers and pupils and circulated in the schools, and the State University should, in its summer school and in its agricultural courses, train teachers to carry on this work.

But you will probably ask yourself this question, "After all this trouble is it worth while?"

The influence of the teaching of these subjects does not end when the child leaves the schoolroom. The desire to better things is carried to the home and he sets about to make the home more beautiful. Instead of remaining bleak, bare, forlorn and unattractive it is changed into a place of neatness, order and beauty, from which he is not apt to go at the first opportunity.

The work in civic and village improvement and therefore the final beautifying and making more attractive this land of ours is a logical outcome of the child's early training.

A St. Louis paper said in part regarding this phase of the subject:

"Ash heaps and bare spots of unsightly soil have been converted into flower beds and grassy lawns. Hideous board fences have been transformed into beautiful emerald walls. Never in the history of St. Louis have so many flowers adorned its yards. The sick in the hospitals have been cheered by them, churches and homes have been decorated with them. The children have learned to know and care for common things, and have a better understanding of nature." To briefly sum up, then, these points which have been hurriedly spoken of, the rural and village schools are not meeting the needs of the present time and the community.

Farmers' children should be given studies allied to farm life. A better understanding of farm life will tend to keep boys and girls on the farm. The future outlook for agriculture as a business is better than ever before. Children ought to be taught the dignity of labor, and how to use their hands to work.

Country schools are too small to do good work. Consolidation of them is successfully practiced. It makes possible the teaching of those things which surround the child in his every day life. Children ought to be taught something of the beautiful. They are interested in stories which treat of common things usually mysteries to them. Homes will be improved, our villages and cities will be more beautiful, sanitary and healthful, and better than all this,—the boys and girls, no matter where they live or what they do, who have a knowledge of these things will enter into their lives with a purer, sweeter, and nobler conception of what life really means. They will be stronger men and women, and more powerful factors in the upbuilding of the moral, religious, and social life in the community in which they are to live. It means happier homes, and more than all this the future strength of this great nation will depend, as it has with others in the past, on the true Christian character which dominates our every day life. In no place can we learn these true and helpful lessons so well as in God's teachings and revelations through nature.

After the evening lectures the audience adjourned to Odd Fellows Hall, where the second annual banquet was served by the association, and the dairymen and their wives and their invited friends of Lewiston and Auburn enjoyed a very pleasant social occasion. Toasts were responded to by prominent representatives of the different departments present and were greatly appreciated by all, as were the music by the orchestra, the solos and readings. This was one of the most enjoyable features of the meeting, and we trust has come to be a fixed event in our dairy conferences.

Thursday, December 15.

A business meeting of the Maine Dairymen's Association was called to order at nine o'clock A. M., for the election of officers and other business, president F. S. Adams presiding.

The secretary made the following financial report, which was accepted:

Balance on hand December 3, 1903	$61 48
Received from membership fees	44 00
	$105 48
Amount expended	$20 24
Paid treasurer in check	85 24
	$105 48

A committee on resolutions was appointed as follows: Dr. G. M. Twitchell, W. K. Hamlin, R. H. Libbey. The following resolution was presented by C. L. Jones, and referred to the committee on resolutions:

"*Resolved,* That this association favors such legislation as will tend to the fitting of teachers for industrial education in our schools."

The following report was submitted by the treasurer, and accepted:

Received of F. S. Adams	$21 85
Received from secretary	85 24
Order	20 24
	$127 33
Paid order, December 14, 1904	$20 24
Balance in treasury	107 09
	$127 33

Officers were elected as follows: President, F. S. Adams, Bowdoinham; vice-president, C. L. Jones, Corinna; secretary, L. W. Dyer, Woodfords; treasurer, Rutillus Alden, Winthrop; trustee, W. K. Hamlin, South Waterford; corresponding secretaries: R. D. Leavitt, Auburn; T. B. Bradford, Golden Ridge; M. W. Cressey, Gorham; C. E. Wheeler, Chesterville; J. A. Peters, Ellsworth; Otis Meader, Albion; O. Gardner, Rockland; A. C. Fossett, Bristol; J. A. Roberts, Norway; C. L. Jones, Corinna; F. W. Leland, East Sangerville; B. M. Patten, Topsham; H. B. Ellis, Embden; E. C. Dow, Monroe; A. E. Lincoln, Dennysville; F. B. Pike, Cornish.

Voted, That the president of the association, unofficially, be empowered to appoint a committee of five to look into the matter of a federation of the agricultural societies of the State, and if in their wisdom it seems fit, that without using the name of the Maine Dairymen's Association they be empowered to call a convention of the various associations and societies.

In accordance with the foregoing vote, the following committee was appointed by the president: Prof. Chas. D. Woods, L. W. Dyer, D. H. Knowlton, J. L. Lowell and R. D. Leavitt.

The committee appointed at the last annual convention to recommend changes in the by-laws of the association reported a draft of by-laws for consideration, which, after a slight amendment in article 2 was adopted. The amended draft is as follows:

Article 1. This organization shall be known as the Maine Dairymen's Association. Its object shall be to promote and improve the dairy industry of the State in all its branches.

Article 2. Any person may become a member of this association by the payment of one dollar and signing the constitution; and after that the annual dues shall be one dollar a year, and no member in arrears shall be eligible to hold office in the association, or vote at its meetings, or receive a report.

Article 3. The officers of this association shall consist of a president, a vice-president, secretary, treasurer, one trustee and a corresponding secretary in each county in the State. The president, secretary and the trustee shall constitute the executive board of officers. It shall be the duty of the president to preside at all meetings of the association, and at all public conventions held by the association, and in his absence this duty shall devolve upon the vice president. The secretary shall keep a true record of all proceedings of the association, and shall prepare, publish and distribute to members an annual report of the doings of the association for the current year; he shall hold correspondence with dairymen of our own and other states, and with kindred associations elsewhere, and make diligent inquiry and research into questions of interest to dairymen. The treasurer shall have charge of the funds of the association, and shall disburse them on the order of the executive board, and shall give satisfactory bond. The executive board shall have charge of carrying out the directions of the association, and shall arrange for and conduct the annual convention and exhibition in connection with the commissioner of agriculture. The corresponding secretaries shall act in connection with the secretary in securing and transmitting information in regard to dairy interests.

Article 4. The officers of this association shall be elected annually by ballot. The annual meeting for the election of officers shall be held on such date and at such place as the executive board shall decide, proper notice of the same being given.

Article 5. This association shall annually hold a dairy convention and prize exhibition at such time and place as the executive board may from year to year elect.

Article 6. This constitution may be amended at the annual meeting by a two-thirds vote of the members voting, notice of the intention of the same having been given in the call for said meeting.

Voted, That Rutillus Alden be selected as the member to represent this body in the Experiment Station Council.

Voted, That in case the committee appointed on federation of agricultural organizations decide to call a convention, the Dairymen's Association send its secretary, L. W. Dyer, to represent us at that convention.

Voted, That a full report of the Dairymen's Association meetings be printed with that of the commission of agriculture, and that the governor and council be asked to give us a bound reprint in such numbers as the executive committee of the association may deem necessary.

The following committee was appointed to take under consideration the communication received from the National Dairy Union in regard to oleomargarine laws: S. C. Thompson, G. M. Gowell and Z. A. Gilbert.

Voted, That the president, secretary, treasurer and trustee of this association, in conjunction with the commissioner of agriculture, be constituted a committee to represent the association in all matters of legislation touching the interests of dairymen.

The committee on resolutions presented the following resolutions, which were unanimously adopted:

Resolved, That the farmers and dairymen of Maine urge upon their senators and representatives in Congress to protect the dairy interests of the State and country, representing so vast a sum, by opposing in every way possible any attempt to modify or repeal the conditions of the Grout bill, so called, or reduce the tax on oleomargarine, and the secretary of this association is instructed to communicate, without delay, with each senator and representative the action of this association.

Resolved, That this association favors such legislation as will provide for industrial education for those who are being trained in the normal schools to become teachers in the schools of Maine.

Resolved, That this association again endorses the action of the last legislature in creating the office of dairy instructor, and also the appointment of Mr. S. C. Thompson as that officer, and recognizes that the results have fully justified the act of legislation. With the increased duties calling for such an officer, we respectfully ask the coming legislature to continue the appropriation for the next two years.

Resolved, That as dairymen of Maine we desire to express our appreciation of the faithful services of Major H. E. Alvord, chief of the dairy bureau at Washington, services which have continued for years and which only terminated with his death. In the removal of such men our national dairy interests suffer a great loss.

Resolved, That we express our appreciation to the citizens of Auburn for valued assistance in perfecting arrangements for this session, and especially for the complete success of the banquet.

Resolved, That we express our obligations to the railroads of Maine for continued favors by which the success of these sessions is secured, also to the hotels of Auburn for reduced rates.

G. M. TWITCHELL,
G. M. GOWELL,
For the Committee.

The committee appointed to consider the communication from the National Dairy Union reported the following resolutions:

Resolved, That in the move made by the oleomargarine manufacturers to secure a modification of our oleomargarine law, known as the Grout bill, we see great dangers to the dairy interests, and we hereby protest against any such change being made. And be it further

Resolved, That we recognize the National Dairy Union as being at the head in the fight for the protection of the dairy industry and that we pledge fealty to its support, and that our secretary be instructed to write to every creamery in the State urging them to give the organization their financial and moral support.

Voted, That the foregoing resolutions be adopted.

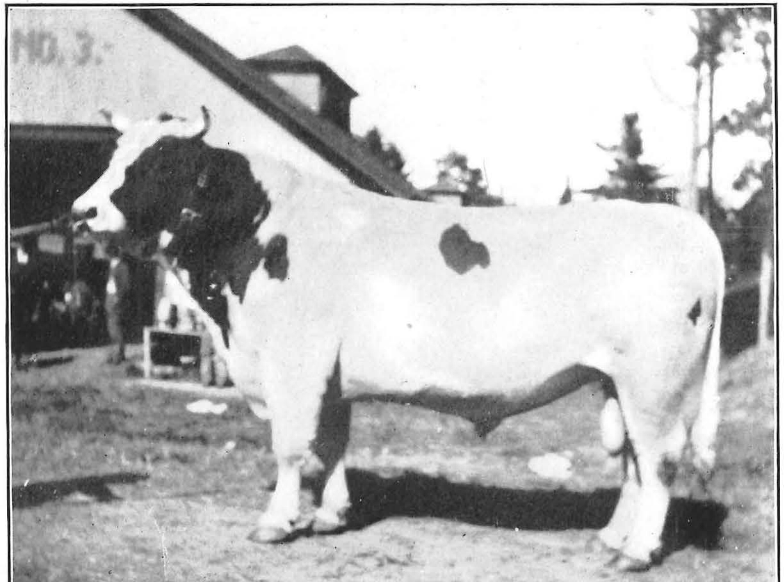
THE AYRSHIRE AS A DAIRY COW.

By Rev. E. F. Pember, Bangor.

Mr. President and Gentlemen: In view of my subject, you will allow me to begin by emphasizing the *fact* that the Ayrshire *is a dairy cow.* Whether in the highlands of Scotland, or in her new home in Canada or the United States, she has always been bred and fed and treated as a dairy cow. No other serious claim has ever been made for her, and indeed no other claim is necessary.

The so called "dual-purpose cow" does not really exist. Some people may tell us that she does, but I have never yet seen her. There are those who will claim this quality for the Ayrshire, but I shall not attempt it, because I do not believe it possible, and because my subject does not call for it.

In these days we employ our time and talents to produce, through stock breeding, the thing that we most desire. When we have made up our minds as to what we wish we do not for a moment doubt our ability to secure it. The laws of nature are most unfaltering and exact in their results. If we are seeking to produce speed in a horse we do select a "Percheron," and then breed to the same, or some other heavy draft horse, and expect our colt to trot or pace in record time. "Lou Dillion," "Dan Patch," "Major Delmar" or "Sweet Marie" were not obtained in that way. Ability to handle a heavy load easily, is one excellent quality; but speed, or victory on the race track, is quite another, and we have no right to expect both in one and the same horse. So among our cattle there are *two* distinct types, and types made more and more distinct by years of careful breeding. I refer to the beef type, and the dairy type: both good but entirely different. Visit the great cattle ranges of the west and southwest, and you will find hundreds and thousands of large, fine healthy beef cattle; the ideal type that supplies the markets of the world with juicy steaks, and luscious roasts. This result was not reached in a day, but after years of careful breeding with the beef type constantly in view, until the wild Texan cow was transformed into the thing sought after. Do not the cows on such a range give milk? Yes, just a little for a



Holstein Bull, Koningan Shepard Knight, 23472, Property of Carrabasset Stock Farm, North Anson.

few months each year, just enough to give the calf a good start. The calf is allowed to do his own milking, and is welcome to all that he can find. Beef is what the range owner is after, and beef is what he gets. Here you will find splendid specimens of short-horned Durhams, Herefords, Black and Red Poles and other cattle of this kind. They have done the work expected of them, and done it grandly. With years of breeding for this special end, with good pastures, with plenty of cheap corn to feed in final preparation for the market, these splendid specimens of solid flesh are well worthy of our admiration. They cannot be produced of better quality and at a lower price in the civilized world, the "beef trust" to the contrary notwithstanding.

All this does not interest us today, in this meeting, beyond the fact that New England and more especially Maine, must depend upon the *dairy type* and not the *beef type* in our cattle raising. We can raise good beef if we wish, as the magnificent exhibit at any of our fairs will prove; but we cannot make a business of producing beef and expect to do it at a profit. Our pastures are good, and our hay is good, but corn costs too much. Give us our dairy cow, and we can produce milk, cream, butter and cheese in vast quantities, and make good dollars out of the job. Let the western stockman raise beef, while we will keep the dairy cow, supply every family in our towns and cities with milk, run our creameries, and operate our cheese factories. To do this kind of business we have four distinct dairy breeds to select from, the Jersey, Guernsey, Holstein and Ayrshire. Someone may say that I have overlooked the "Brown Swiss," the "White Belted Dutch," and possibly others. Still I am very sure that the supreme effort of recent years in breeding for a dairy cow, has been spent on the four breeds that I have named. The result in this direction, with the thoroughbred herds, has been as clearly marked and as highly successful, in view of the object desired, as that reached by those who bred for beef. The breeders of the thoroughbred dairy cow have produced milk, and lots of it; good cream, butter and cheese and lots of it.

In warfare we have learned that it is not so much the gun as "the man behind the gun" that wins the victory. So, let us admit, right here, that a great deal of credit is due to the man or men who handle a certain breed of cattle, as well as to the breed itself. That is, we must realize that the whole result does not rest upon the name of the breed. Given either of the four dairy breeds named and some will make a splendid showing. The food, the care, the comfortable barn and the sensible treatment of the animal will all count for success. Under such favorable circumstances either of the leading breeds can be brought into prominence, and win a splendid victory for the dairy cow. While this is true, we must remember that the same herd if starved and abused, kept in a barn too cold for an arctic bear and too filthy for a hog to live in, will never startle the world with milk or butter records. For many a lazy, shiftless brute who goes by the name of a farmer, it will make but little difference as to the breeding of his cows, for he will make a failure anyway. But with our up-to-date, progressive farmer a good thoroughbred herd means something. It means just the difference between keeping Prof. Gowell's "251 egg hen," and the ordinary "biddy" that graces or disgraces the average farmyard.

Of course either of the dairy breeds can furnish friends and admirers by the score. This is very fortunate, indeed, for if we all wanted one kind of cow, there would not be enough to go around, and those we did secure would be very expensive.

I am very glad to speak to you this morning on behalf of the Ayrshire. I do it in full recognition of what other dairy cows have done, and are doing today. I would not take one leaf of laurel from the wreaths that any others have won; but I speak for the Ayrshire because she is my favorite. Because after a most careful study of the whole situation I decided to give her a place on "*Highland Farm*" fully satisfied that, all things considered, she is the best dairy cow that a farmer can own. While some of you who own prize-winning herds of other breeds will hardly agree with me in this claim, you will at least permit me to give you some of the reasons why I reached my decision, and why I hold this opinion today after several years of owning, breeding, and handling the Ayrshire. Hence I will name some of the qualities that the Ayrshire cows possess, and leave you to decide whether I claim too much for them.

1. They are handsome and of good size. You may remind me of the proverb, "Handsome is, that handsome does," and I fully realize that it is not always the largest or the handsomest

cow that gives the most milk or the best milk. However, if other things are equal, if we can have a herd of cows averaging more than 1,000 pounds each, and attractive in color and general appearance, we should certainly prefer them to a herd of less size, and unattractive to the eyes. In this, too, we must remember that a herd all of one kind will look far better to us than the usual mixture of cattle that we see upon our farms. I should prefer to have all one breed, if only for the looks. The color of the Ayrshire is "red of any shade, brown or white, or a mixture of these—each color being distinctly defined." Very few, if any, are to be found of solid color. The colors allowed are usually well mixed in irregular splashes, so that the Ayrshire in the barn, out in the pasture, or in the show pen makes a very pleasing appearance. In this, of course, individual taste can be met by a little care in breeding, and an entire herd nearly white, or one more nearly red or brown can be produced. But even more than the color, is the general appearance of a typical dairy cow. Her large handsome udder shows at once precisely what she was intended for. Even to a novice in the dairy business her general appearance clearly says, "You can depend upon me to fill your milk pail." By the way, the nearer that other breeds can come to producing the Ayrshire udder, the higher they will score in the show-pen. As Americans we may not have the love of the beautiful as well developed in us as we ought; yet any person or thing pleasing to the eye, commands our attention and awakens our interest. If a cow really is handsome she will command a little more attention, get a little better care, and hence produce better results. Other things being equal, if we are going to buy a cow, we are willing to pay more for one that is handsome in color and general appearance, and if we have her for sale, our customer is better pleased, and she commands a higher price. If we are going to win we must take pride in our own goods, and if our stock is really handsome it will be easier for us to proudly exhibit it anywhere.

2. The Ayrshire is an ideal dairy cow because she is strong and healthy. This statement deserves more than a passing mention, for if we are to produce an article of food, every customer, every consumer, will demand that our cows shall be healthy. They have a full right to make this demand, for no

matter how clean our barn may be kept, or how well our milk utensils may be cleansed, if our cows are not healthy there is untold danger.

In these days when tuberculosis and other ills are common among the cattle in our climate, it is a matter of vast importance that we shall secure only those animals that shall be just as free from disease as possible. We cannot exercise too great care in this matter. Our State shows a deep interest in this by appointing and supporting an efficient cattle commission, who strive earnestly to prevent the introduction or spread of any disease among our stock. If we had any criticism to utter it would be that the State should make larger appropriation, and thus permit the commission to do even more extensive work, that all know should be done. I do not say that the Ayrshire is never ill; but I do say that from her great natural strength and good constitution she is very rarely in need of a physician. Our good cold weather in Maine seems to suit her well, possibly serves as a tonic for her. She will drink cold water, of a winter day without shivering, and under conditions that trouble others very much, she seems to enjoy life hugely. She drops her calf easily and without help. She cleans promptly and with very few exceptions has no trouble with her udder. It is a great pleasure, yes, a supreme satisfaction, to find a cow with a bright eye, strong, firm step, and every outward indication of perfect health. I cannot drop this point without further emphasis as to its great importance. All possible effort to produce "certified" or "sanitary" milk will prove of no avail unless our cows can be perfectly free from disease. No farmer can expect to handle a dairy for profit if any considerable time and expense must be devoted to sick or imperfect cows. A healthy herd, that will save doctors' bills, will mean much to the farmer. Of course, with heavy milkers there is more or less danger of "milk fever." In this Ayrshire breeders have suffered some, never losing a poor cow, but always the best one. However, with the modern and prompt application of the "bicycle pump" we all hope to be saved from further serious loss. Even with the dread disease, tuberculosis, our Ayrshires have stood the test splendidly. A few years ago in the Vermont Experiment Station, out of 36 cows tested, 32 were condemned and killed—these were Jerseys, while two Jerseys and two Ayrshires in the herd got a certificate of good health.

So far as I know, the Ayrshire herds in Vermont, New Hampshire and Massachusetts, escaped the ravages of the terrible "foot and mouth disease" while many other valuable herds had to be killed. Possibly none of these were directly exposed to this disease, but if they were, I am confident that their natural good health would go a long way in the battle. Of course, very much will depend in any herd, upon the kind of barn in which they are kept, its ventilation, and sanitary arrangement, the food provided, and the care taken; but other things being equal, I am very confident that in the matter of good health the Ayrshire cannot be outdone. We need not expose her to hardship, as she has been in her native land; but we should be very glad to find a strong healthy cow that can live with us and remain healthy. After several years of history and experience in this country, no more perfect type of healthy cattle can be found than that shown by our hustling Ayrshires.

3. As would naturally be expected from what has been said, the Ayrshire is a *good feeder*. She has a good appetite, good digestion and is ready to eat almost anything that a cow ought to eat. This is a strong point in a dairy cow. Such a cow is only a machine for making milk, and as a machine for this purpose, she must eat plenty of food, and make good use of what she eats or she cannot produce. We may ever so carefully study the matter of feed, and decide what kind of ration will produce the best result, but our cow must have the ability and willingness to co-operate in the business. She must have the capacity and appetite to handle all this, and return it to us in the milk pail. Nothing more industrious in the pasture has ever been found among the cattle than the Ayrshire.

She does not spend one idle moment roaming about and looking for something better to eat. She eats eagerly and rapidly whatever the pasture affords, and when she is full, lies down and constantly chews her cud. Mr. Winslow, our secretary, says concerning this, "In the pasture she takes everything that comes in her way, good and poor. Having got her fill she unremittingly chews her cud, and that with a seeming nervous haste to get it finished, and when not actually taking in food is constantly chewing whether lying still or walking, and I have often seen them chewing while on the run." When in the barn this splendid appetite does not desert her, unless too closely confined and suffering from lack of exercise. A short time after feeding, her manger is usually clean; that is, she very promptly disposes of all the food that is within her reach. This is without doubt the reason why she always looks well, as though she were well fed, and is always ready to respond as a milker. No person has any right to expect good results, that is, a large flow of good milk, from poor food; but every one is pleased to have a cow make the best possible use of what is given her. One point constantly looked after by the Ayrshire breeder, and one of the standards of excellence is to have the cow "with ribs well sprung, giving large barrel capacity." The object is simple and plain. With this extra room to handle the food, it is possible for her to do the work that is expected of a first-class dairy cow. With the appetite and good digestion that the Ayrshire naturally furnishes, the result is precisely what we are looking for. She eats what we give her eagerly, as though she enjoyed life, and then rewards us as well as we have any right to expect from the ration we have furnished.

4. The Ayrshire is gentle and quiet to handle. This means much for the good of the cow, and for the comfort of those who take care of her. In the pasture she is easily fenced and most contentedly makes the best of her surroundings. With all thoroughbred stock there is more or less danger of producing a high-strung nervous animal—one easily excited, easily frightened, and disagreeable to handle. Many of the thoroughbreds of the dairy type run wild and can only be secured by shooting as you would a deer. This is especially true among the young stock where they are turned out to pasture and not seen or handled constantly. While both in Scotland and in this country the breeding has been conducted with care, the Ayrshire has never shown any of these severe nervous tendencies. Of course, she is too well bred to stand abuse or ill treatment without resentment, yet if she is handled quietly and gently as a dairy cow should be, she will show herself to be all that anyone could ask. She easily becomes a pet, and likes to be noticed and fondled, coming to you freely in the yard or pasture for this

purpose. Permit me to say just here that it pays to make a pet of any kind of stock that you own. The generations that follow will show the effect of this kind treatment, and reward you with still further gentleness and contentment. Especially is this true of the dairy cow. With the beef type we are not so particular, but with the cow that we must feed and handle and milk every day, we cannot afford to have her nervous, fractious and disagreeable. Make her a pet, and it will pay you, both in personal comfort and a fuller milk pail. Use the Ayrshire well and she will richly reward you in every way.

5. Without fear of criticism at the use of the word, I am going to say that the Ayrshire cow is intelligent. Many people may not be willing to give any cow a very prominent place in the line of intelligence, that is, such as shown by the horse or dog; yet I am sure that President Fellows, or Professor Gowell, will admit that they are frequently found worthy to go to college. Any who have handled cows know that there are fool cows, as well as fool people, and there are cows that show a great deal of sense—"cow sense," of course. It does make a great difference whether your cow easily learns the things you try to teach her, and then remembers what she has been taught, or whether it all has to be done over and over again. The Ayrshire will easily learn her place in the barn, and will always find her own stall promptly after she has been shown once or twice. She will quickly learn to lead or do anything that requires ordinary animal intelligence.

6. Let me say that the Ayrshire is an easy, comfortable cow to milk. Until some Yankee has been born, smart enough to invent a reliable milking machine, this part of the dairy work must be done in the good old-fashioned way, by hand. In Scotland the milking is very largely done by women, so that with their smaller hands no fault was ever found with the short teats of the native cow. When, however, they were brought to this country where the men do the milking, some complained of this as a defect in the Ayrshire cow. Attention being called to this it was an easy matter to remedy, so we soon find the American bred Ayrshire with a large, shapely udder, with teats of good size and well placed on the udder, so as to milk with comfort. As a rule she is an easy milker, rarely if ever leaking her milk,

yet parting with it in response to a very slight pressure of the hand. She gives her milk down promptly, and lets the milker have it in the shortest possible time. As an illustration of what I mean, I have a five-year-old cow at "Highland Farm" that either of my men agree to milk in two minutes when she is in full flow, giving ten quarts of milk at a milking. Of course this is an ideal milker, and no one could expect to find a whole herd like her. This quality means more than we are apt to admit. If our cows milk hard, and give their milk down slowly, or have imperfect udders, it will all take extra time, and that twice a day. We are looking everywhere for time-saving and labor-saving machinery, we are anxious to do everything in the easiest and quickest manner possible. Hence if we breed cows that will milk easily and quickly, they will be highly satisfactory to ourselves, and will thoroughly please anyone who purchases them.

7. In naming the qualities that I have thus far, I have tried to prepare the way to say that the Ayrshire cow will produce an unusually large quantity of good milk. Qualities named already help to make her an ideal dairy cow; yet the supreme point aimed at is the real production. It has been proven again and again in every test that she is second in *quantity* to none save the Holstein. Notice that I say *"quantity."* I will discuss the question of *quality* a little later. The Ayrshire is a very persistent milker, keeping up a good flow the year through. In many cases great care has to be exercised to let her go dry a little while before calving. Frequently they do not go dry at all, but this is an injury to the calf, and should be avoided if possible. Milk records enough have been made to fully prove my claim in this matter.

At the Pan-American Fair at Buffalo, in the dairy test of fifty cows for six months, the five Ayrshires gave nearly 2,000 pounds more milk than any other herd save the Holstein. When amount of food consumed and value of milk produced were considered the Ayrshire proved herself far superior to the Holstein, leading by a good margin in matter of profit. I purchased recently of the estate of Philip Moen, at "Ard-Na-Clachan Farm" near Worcester, Massachusetts, a cow known as "Iris of the Plain," with a milk record of 13,850 pounds, in fifty consecutive weeks.

Mr. Moen was a milkman, sending the product of his dairy into Worcester every morning, so this milk was not tested for "butter-fat." She is bred to a son of "Lady Fox," and the Ayrshire records show that Lady Fox had a milk record of 12,299 pounds of milk and 624 pounds of butter in one year. One of her daughters, "Lukolela," came very near to the high mark made by her mother, giving 12,187 pounds of milk in one year.

"Alice Douglass" made a record of 12,617 pounds. "Rena Myrtle" gave 12,172 pounds, and several others have produced over 12,000 pounds. When you realize what it means to produce over six tons of milk in one year, you must admit that this is quite a good milk machine, and quite an ideal dairy cow. If I had time this morning I could tell you of a long list of Ayrshire cows that have given more than 11,000 pounds of milk in a year. If we should set our mark at 10,000 pounds, a mark rarely reached by other breeds, we should find the roll too long to call at this meeting. Nine thousand, or even 8,000 pounds of milk is an immense quantity for one cow to produce in one year. When we take into consideration the fact that the average dairy cow used by our Maine farmers does not produce over 4,000 pounds of milk in a year, you can easily understand the advantage of a thoroughbred of the right sort. How long would a manufacturer continue to use a piece of machinery, after it had been demonstrated to him that another machine would do twice the work, and produce twice the amount of goods in a given time, at the same or less cost, then the one he was using? Yet this is precisely what many of our farmers are doing when they buy and keep the cheap, inferior cow of today. It certainly does not cost any more to feed a good cow that will make a good production of milk than it does to feed the average cow to be found in our farmers' barns. But someone asks, "Is there not a great improvement? Are not our farmers grading up their cows, and trying to keep something better?" Yes, I like to think that they are; yet they are so slow about it, and so many are apparently content with common stock, that I think the man was not far from right who said, what was needed was to "grade up our farmers."

8. In view of what I have already said about the quantity of milk that an Ayrshire will produce, I wish to say that she is an

ideal cow for the milkman. A man to raise and sell milk at a profit, must keep cows that will produce a large quantity of good milk. It must not be so thin and blue that he is charged with using his pump too freely, neither can he well use milk that will release the cream so quickly that the customer who gets the top of the can gets cream, and the rest skim milk. The Ayrshire milk is always rich enough to satisfy the milk inspector and rich enough to please any customer. "The cream being in small globules does not rise readily, and when cold, if poured two or three times back and forth from one can to another, will thoroughly remix and will not readily rise again, making a good milk to peddle and attractive to consumers because, even to the last poured out of a pitcher, it will retain its uniform richness." Those who have made a careful study of the matter, tell us further that the Ayrshire milk is especially adapted for food,—that children, or people with weak digestive organs can safely drink it. "The reason for this is that the butter fat and casein are evenly balanced and the curd is friable, making it easily digested." So we find many doctors ordering Ayrshire milk for their patients, many hospitals seeking a supply of this kind of milk, and families trying to buy even one Ayrshire cow that they may furnish their children with the right kind of food. The milkman who has a supply of this kind of milk, need never worry about customers. His Ayrshire herd will produce him more milk that will thoroughly please his customers than any other herd in existence. He will always find them to be the most profitable cows to keep for his purpose,—that is, they will produce a quart of good milk at less cost for food and care than any cow known to the dairy today. The milkman who has a supply of this breed of cows is to be congratulated.

9. I wish to emphasize the fact of the richness of the Ayrshire milk in total solids, and to say that she is a profitable cow for the farmer to keep who sends his milk to the cheese factory. Cheese making is not carried on as extensively among us as it ought to be. There is no reason why we cannot make as good cheese, and with as much profit as a farmer in New York. There are good reasons why we have not tried cheese making in Maine so thoroughly as they have elsewhere. But give us the right kind of cows and it can be done with profit. In Scotland, one

of the largest breeders of Ayrshire cows has two large herds, one of more than eighty cows where he makes cheese, and another of perhaps fifty cows where he makes butter. It is needless to add that he is a very wealthy man. In the cheese producing districts of New York and the West, the Ayrshire is fast finding a place, and her quality as a cheese cow is being recognized. To make good cheese you must have good milk. To make cheese at a profit you must have a large quantity of milk from the fewest possible number of cows. Believe me, here is where the Ayrshire is sure to win. She will never disappoint her owner at the milk pail, and when her milk is sent to the cheese factory she will furnish her share and more of good cheese for the market.

10. Last but not least, I wish to claim a place for the Ayrshire cow as a butter maker. In these days all tests are made on the basis of the butter fat to be found in the milk, and every cow is judged by the amount of butter that her milk will produce. No fault can be found with this plan, for even if the milk is to be made into cheese or used in the kitchen or on the table it must be reasonably rich in the quality that makes butter. The creameries pay for what they buy on the basis of the percentage of butter fat to be found in the milk or cream. This is an equitable test to be applied to any cow that comes into the dairy. While I have left this point to the last, do not imagine that it is because I hesitate to apply the "Babcock test" to the Ayrshire cow. When it is done and the figures are made, you will find as much butter, and as good butter as you can expect any cow to furnish. Apply the standard test rigidly and we will abide by the result. With the larger quantity of milk that an Ayrshire is sure to give, we have no right to expect that one quart of her milk will show as much butter fat as one quart taken from a cow that does not give half as much. That is, one quart of Ayrshire milk should not be expected to hold as much butter fat as one quart coming from either a Jersey or Guernsey. But remember that the larger quantity given by the Ayrshire will more than make the difference in the percentage shown. The total result will be all right. Two years ago Ayrshire breeders reported several of their cows as testing from 3.29 to 4.73% of butter fat. This represented sixty-five cows from seven herds

entered in a home dairy contest. The first prize for an individual cow was won by a cow making 514 pounds of butter in one year. The second prize cow produced 506 pounds. The prize winning herd of five cows produced 2,050 pounds of butter, or an average of 410 pounds each. While the percentage was not high, these cows gave over 10,000 pounds of milk each and were able to take their place with the very best butter cows to be found today. One year later a similar test of seventy-five cows showed that two cows produced over 400 pounds of butter each, and that forty-two made a record of over 300 pounds. The highest was 433 pounds and the second produced 425 pounds. Of course individual cows of any breed will at times show extraordinary production, but these records that I have furnished can be duplicated over and over again. "Lady Fox" with 624 pounds of butter in one year cannot be found in every herd, any more than that every Guernsey should be a "Mary Marshall," or every Jersey a "Brown Bessie" or "Loretta D."

The average dairy cow does not produce 200 pounds of butter in a year, hence when we can prove that general herds of our Ayrshires will average 300 pounds, we are certainly securing for them an honorable place as a butter cow. If we can breed for a little time with this quality especially in view, I have no doubt that we can show a much larger number of Ayrshires with a butter record of 400, 500, or 600 pounds in a year. In this as in everything, quantity is not all, butter must be of good quality or it cannot command a good market. People are making a demand for a superior article, and are willing to pay for it, and dairymen should be anxious to produce it. No butter of finer grain or more delicate flavor can be produced than that made with modern machinery and modern methods from an Ayrshire cow. Of course, it is understood that all that I have said thus far, has been only with the thoroughbred Ayrshire in view. While many farmers cannot own a herd of thoroughbreds, they can and do have high grades of great value and usefulness. Hence it will not be out of place for me to add just a word concerning Ayrshire grades, in closing. Dr. Twitchell is to tell us about "The Head of the Herd" this afternoon, so I will not trespass upon his territory, only to say that any farmer may grade up his herd if he wishes. Use a thoroughbred sire and the first result is half-blood stock. The next effort will make the herd three-quarters and long before this he will learn the value of good grading. The Ayrshire will produce a fine grade cow when crossed with any of the distinctly dairy breeds. The blood is strong enough to predominate in color, shape, disposition, constitution, milking qualities and the like. It is but fair to say that the best results so far as grades are concerned have been obtained by using an Ayrshire sire with a Jersey or grade Jersey herd. I do not take your time to discuss the reason for this, I only state the fact. Talk with almost any of the farmers, and they will tell you of a grade Ayrshire cow that they once owned, that gave the most milk and the best milk of any cow they ever saw. All this may be true, and if true there should be more such cows in Maine to-day. Intelligent efforts to produce high grade dairy cows will pay. But if grades are sucn a marked improvement in the herd, why be satisfied with anything short of the registered thoroughbred? They will cost just a little more in the first purchase, but no more to raise than the commonest stock, and the returns will soon put the balance on the right side of the ledger. With each added year of experience with the Ayrshire as a dairy cow, I am more and more convinced of her great value to the farmer, and sincerely trust that the day is not far distant when she will occupy the place and prominence in the dairy that her qualities so richly deserve.

PURE FOOD LAWS.

By DR. GEO. M. WHITAKER, Boston, Mass.

I regard it as a great compliment to be invited to address your association two years in succession and three times within four years. I thank you most heartily for the same, and assure you that I thoroughly appreciate it. I trust that I may not wear my welcome out.

I notice by the last census that Maine stands thirty-ninth among the states of the Union in land area. In population and in number of persons engaged in agriculture it gains nine points, and stands thirtieth. Your State gains one point and is twenty-ninth in number of persons per square mile, twenty-eighth in number of cows and twenty-seventh in number of cows per square mile. A jump of five points to twenty-second place is made in amount of milk produced, and the State is twentieth in amount of butter produced and eighteenth in amount of cheese produced.

In number of cows and amount of milk produced Maine stands second among the New England states. Speaking of the cream business, a publication of the dairy division of the national department of agriculture calls attention to sales of over four million gallons in four Western states at an average price of 54 cents, and says: "A different and notable case is that of the State of Maine; its creameries sold 755,845 gallons of cream at 71 cents per gallon, or $536,650, and this was considered more than half as much as the total butter sales of the State." The same publication says: "The State of Maine furnishes a good example of the changes in cheese making which have taken place in some sections during the last quarter century. Twenty-five years ago this state had sixty cheese factories and now it has sixteen."

The production of milk per cow in the state according to census figures has increased steadily every census decade from 229 gallons in 1850 to 574 gallons in 1900—being in gallons for each census year, 229, 252, 270, 314, 369, 574.

But for dairying to be successful the dairyman must have a broader knowledge than the mere technique of his business. He must know something of the form of governments under which we live, not only that he may be a good citizen in a broad way, but so that he can be able to look out for himself when it comes to legislation regarding his products or the spurious imitations thereof.

Therefore with your consent I will talk over with you at this meeting some of the principles underlying our forms of government, because, first, it is well to go back to first principles occasionally, in all occupations and professions, in order that we may get our bearings anew and see that we are continuing in the proper course. Again, these principles are frequently misunderstood. Since this subject has been on my mind I have been surprised to see how often this is true. Finally, the plan on which our governments are built has an important bearing on the question of food laws.

"Ye cannot serve two masters," says the good book, but residents of the United States live under two governments existing together at the same time, and even a republican form of government is to an extent a master.

The state and national governments are absolutely distinct from each other in their laws and in the machinery for enforcing the same.

Each government has entirely separate powers and limitations. We brag of the power of the United States. It compelled Spain to give freedom to the Cubans. It exerted a strong influence in compelling the open door in China. It sent mighty warships to Morocco when an American citizen was in jeopardy. Its suggestions are received with great deference in the capitals of the great world powers, of which it is one.

But were I to stagger along your streets the great American nation could do no more about it than the weakest infant you ever saw. This is because intoxication is an offence against state law and the national government has nothing whatever to do with it. But if I tampered with a mail box, or even one of your letters, national officers would be after me, and national courts would punish me, while the state would stand by and do nothing.

Though we live under two entirely distinct governments it was not always so. In the early history of this country there was only one authority. That was the state and the state was supreme. The different states. though having many interests in common, were each possessed of all the functions of independent nations and technically were as free from each other as are Japan and Russia.

But one day these independent commonwealths got together and consummated a deal—possibly we should call it a "merger" if it had been done in these latter days. As a result of that arrangement the states gave up all national prerogatives and created a central national government. To give the new federal government national powers the states abandoned some of the powers they had previously possessed and gave them to the new nation. But they expressly stipulated that all powers not specifically given up were retained by themselves.

This giving up something for the purpose of coming together in a strong union was only another illustration of the old principle that when even individuals organize they must give up some of their independence. It has been said that a failure to realize this is one reason why some farmers' co-operative enterprises do not succeed. The farmer's manner of life has developed his individuality to a marked degree, and when new conditions have made it advisable for him to give up a little of his independence and pull together with others, a difficult task is presented to him.

The document which names the rights and powers transferred by the states to the nation is called the constitution, and it deserves occasional careful reading by the fireside, in the grange and in the schools.

This is not the time or the place to go into an exhaustive discussion of constitutional questions generally, or a detailed statement of the relative rights, powers and limitations of the state and nation. I desire to call your attention to a few constitutional principles bearing on food laws. I do this the more readily because I know from my experience and observation that sometimes these are not understood. For instance, I have found some grocers who did not realize that we live under two governments, each possibly having laws bearing on the same food product, and that while they might scrupulously comply with one set, they might be violating the other. Within a few weeks complaint has come to me as a United States officer of violations of state laws, as if I had anything to do about that. In conversation with a leading lawyer a few days since I mentioned this paper which I was at work on at that time, and he said he didn't see that the national government could do anything about pure food laws. Not long since a successful newspaper man asked me whether the copyright law was a state or a national matter.

Now when you read the constitution of the United States you will find no allusion to pure food legislation. Section 8 of Article I enumerates the powers which the states gave up to Congress, but not a word about foods. Section 9 tells what Congress cannot do, but nothing about foods. Section 10 tells what the states cannot do, but nothing about foods. The tenth amendment to the constitution says: "The powers not delegated to the United States by the constitution and not prohibited by it to the states, are reserved to the states respectively, or to the people."

Among the powers given to Congress are the powers, "to lay and collect taxes, duties, imposts and excises, to pay the debts and provide for the common defence and general welfare of the United States, to regulate commerce with foreign nations, and among the several states......to issue copyrights and patents." In these few words is all the authority of the United States to legislate in the interests of pure foods. There is first, the taxing power; second, the right to regulate commerce with foreign nations; third, the right to regulate commerce among the several states; and fourth, to issue copyrights.

WHAT, THEN, CAN THE STATE DO?

Among the powers retained by the states was the right to regulate their internal affairs, prominent among which are health and police regulations. The state acting within its health and police authority can regulate even to the point of prohibition the traffic in poisonous, fraudulent and unwholesome products. In like manner it has complete jurisdiction over all under-standard or adulterated substances.

In carrying out this principle we find laws in many states prohibiting the sale of adulterated foods and drugs, or regulating the sale of some mixed products by allowing such sale if the fact is stated on the label.

For instance, in Massachusetts, imitation cheese, renovated butter, compound lard and some other substances can be sold if properly labelled. If cheese or butter contain boracic acid as a preservative, the fact and the proportions must be stated on the label, and if one sells skim-milk the can must be plainly labelled "skim-milk."

A state can also establish standards as has been done in Massachusetts in the case of drugs, milk and possibly other articles. In the case of imitation butter, commonly known as oleomargarine, many states have a prohibitory law. But what if some of these articles have come into the state from another state? Can the state—having given up the authority to regulate interstate commerce—exercise that right in any degree? Here is a case where the constitution is not quite clear, where there is a conflict, and the courts have been called upon to untangle the difficulty. They have decided that a state cannot prohibit the sale of an article brought into its jurisdiction from another state if that article is unadulterated and honest. The courts have further held that the states have a right to regulate the sale of a poison, for instance, even if it comes into the state by way of interstate commerce. In the case of a poison the state police, or health rights, rank ahead of the nation's right to regulate interstate commerce. Massachusetts could not prohibit the sale of Maine cream or milk, even if they compete with and injure Massachusetts farmers. Such a law would interfere with interstate commerce. But Massachusetts can constitutionally prohibit the sale of adulterated cream from any source, whether Massachusetts or Maine, and though such prohibition would interfere with the commerce of adulterated cream between Massachusetts and Maine. State rights override the power of the nation in such a case. When western dressed beef first came generally into the markets of the country it was viewed with much disfavor by farmers and others whose business it injured, and some states passed laws restricting its sale; but such laws were quickly declared unconstitutional by the national supreme court, which declared western dressed beef to be a wholesome, honest product and therefore a legitimate article of interstate commerce which the states could not touch.

The national supreme court decided that intoxicating liquors are legitimate articles of commerce, and that therefore a state prohibitory liquor law is an unconstitutional interference with interstate commerce as regards liquors brought in from outside of the state and sold in the original package.

Subsequently the national government, by act of Congress, gave back to the states the right to interfere with interstate commerce as far as intoxicating liquors are concerned. And now when they come into a state, whether in the original package or not, they are subject to the laws of the state, and your Maine law is constitutional regarding all liquors by reason of this special concession on the part of the nation. But a person in your state can send a letter to a Massachusetts dealer ordering the liquor for his own use, and it can be sent back to him by freight or express without a violation of the law. At least the courts say so in some similar cases in Massachusetts where Rhode Island liquor dealers are selling a considerable amount of contraband liquors "on orders" in Massachusetts, just over the line. This principle was of much trouble to us formerly in enforcing the prohibitory imitation-butter law, where there was a fiction of taking orders, transmitting them to Rhode Island, and delivering them in individual express packages from there. I recall one instance where an oleo dealer was doing business under the name of an express company, and when an order was taken one day it would not be delivered till the next day, when it ostensibly came from Providence, R. I. But although I knew that the goods came by freight in carload lots, I could not prove that any one particular package did. One day I set an inspector to watch the store to see that nothing was taken in, and the evidence of that inspector, backed by the evidence of the freight and express agents of the city, proved that no package had been received at the store from Providence between the time of taking the order and delivering the goods,—hence the sale took place in Massachusetts and the dealer was convicted.

When Massachusetts prohibited the sale of imitation butter which was at that time the common oleomargarine of commerce, the manufacturers of that product took to the national supreme court a case based on the sale of a tub of oleomargarine, colored yellow, manufactured outside of the state, on the claim that our law interfered with interstate commerce by prohibiting the sale of a legitimate article.

This case was an important and interesting one in several particulars. Upon the decision depended the anti-color laws of several states as well as our own, but it also concerned the broader question of honest foods generally and of state rights. The Massachusetts attorney-general in his argument for the constitutionality of the law said: "Because flour, beef and mutton are protected as subjects of commerce, must the same protection be extended to beans or chicory offered and sold as coffee, glucose as sugar or syrup, sulphate of lime as cream of tartar, cotton oil as lard, or cabbage leaves as tobacco? A recent work on the adulteration of food enumerates more than a hundred articles of common use which are constantly put upon the market with adulterations, some noxious and some merely worthless, varying in amount from one to eighty-five per cent. Has a state no power to protect its citizens against such subjects of commerce if they happen to come from over the line?" Another interesting feature of this case to those who had lived through the Civil War times or read about them, was the fact that Massachusetts was before the national supreme court asking for a decision that took the extreme state rights side of the case. The supreme court decided that our law was constitutional, answering the attorney-general's question with an emphatic "No." It said: "Can it be that the constitution of the United States secures to any one the privilege of manufacturing and selling an article of food in such a manner as to induce the mass of people to believe that they are buying something which in fact is wholly different from that which is offered for sale? Does the freedom of commerce among the states demand a recognition of the right to practice a deception upon the people?......We are of the opinion that it is within the power of a state to exclude from its markets any compound manufactured in another state which has been artificially colored or adulterated so as to cause it to look like an article of food in general use, and the sale of which may by reason of such coloration or adulteration cheat the general public into purchasing that which they did not intend to buy. The constitution of the United States does not secure to any one the privilege of defrauding the public."

Had the court decided differently persons whose greed for money overshadowed their moral sensibilities could flood any state with all kinds of adulterations and frauds, by sending them in from some other state.

But to show how extremely fine is the line between an article, the sale of which the state may regulate, and one which it may not, another case may be of interest. The state of Pennsylvania prohibited the sale of "any imitation or adulterated butter or cheese." This law was declared void, as "an interference with interstate commerce as applied to pure oleomargarine brought into the state and sold in original packages." The court explained that this decision did not affect the Massachusetts decision because the Massachusetts statute did "not prohibit the manufacture or sale of *all* oleomargarine, but only such as was colored in imitation of yellow butter......If free from ingredient or coloration that caused it to look like butter, the right to sell it in a separate and distinct form, and in such manner as would advise the consumer of the real character, was neither restricted or prohibited." This is pretty close reasoning but shows that the proviso in the Massachusetts law was all that saved it. Were this the last word on the matter we might be well concerned as to the safety of the anti-color law. But when the Grout bill was on its passage through Congress a few of us who had worked hard to get it there watched one section with much solicitude. The Grout bill is popularly known as the law which imposes a ten-cent tax on oleomargarine colored in imitation of butter. But section one, following the principle of the liquor law, places all oleomargarine which comes into any state subject to the laws of that state regardless of the fact that it is in the original package. State oleomargarine laws now stand not only on a narrow decision of the supreme court, but on an act of Congress which gives back to the states the right to regulate interstate traffic in oleomargarine.

Having shown that the state is absolutely supreme so far as controlling the sale of unwholesome, imitation, fraudulent, under-standard, deceptive or adulterated food products is concerned, what more do we want? Is not this enough?

In the first place, all states are not equally active in availing themselves of all their rights and powers. Secondly, all states do not have equally efficient state officers to enforce state laws. Thirdly, adulterated foods are sometimes found in the hands of innocent dealers who bought them in good faith of some manufacturer in other states, and it would be equity to punish the fellow who is morally guilty. And fourthly, many adulterated foods are imported. Those who have spent years in enforcing food laws have been sometimes embarrassed by the large amount of adulterated foods from out of the state.

What can the national government do to help the pure food question?

1st. Under the constitutional provision which gives Congress power to regulate commerce with foreign nations a law has been recently enacted and put in operation which prohibits the importation of articles adulterated with injurious substances, misbranded or falsely labeled as to the country of origin, and of such articles as would not be allowed to be sold in the country from which they are exported. This law has not been in operation long but it has accomplished much good. The enforcement of it is in the hands of the national agricultural department working in harmony with the treasury department. Already much of the trade in manufactured olive oils has been stopped, and Dr. Wiley says that any imported oil labeled "olive oil" may now be regarded as genuine. The importation of olive oil labeled "pure California oil" has also been stopped.

Under the same general provision of the constitution the agricultural department is inspecting all of the export meats and all of the export renovated butter. This does not concern pure foods in this country, but I mention it here as showing what the national government is doing in a broad way for the purity of foods.

2d. Congress in the exercise of its right to levy taxes may place them so as to work for the promotion of the interests of pure foods. Taxes on imports have for years been levied with a view to protect American industries, and the class of taxes called internal revenue can be so arranged as to protect producers of pure foods and the consumers.

In carrying out this power we find that Congress has taxed adulterated flour, filled cheese, oleomargarine and renovated butter, not so much for revenue as to promote honesty. The internal revenue tax of ten cents per pound on colored oleomargarine is the most notable of the uses of the taxing power of government to regulate or even prohibit the manufacture or sale of a fraudulent product, for this tax has completely suppressed the business in colored oleomargarine, and more effectually than state laws could have done the business. The oleomargarine interests attacked this law in the supreme court on the ground that the motive of the law was to kill an industry, rather than to raise revenue. But the court gave the manufacturers no comfort, saying it had no right to concern itself with the motives of the members of Congress; they have a right to select the articles on which to put revenue taxes, and they may make those taxes as high or as low as they please. If their motives are improper, that is for their constituents to settle and not for the court. It is a remarkable fact that some of the most prominent recent expositions of the principles underlying our forms of government have come from oleomargarine decisions.

The internal revenue laws not only impose a tax on these articles but in carrying that tax into effect there are provisions as to stamps, brands, etc., for the purpose of insuring the collection of the tax and as proof that it has been paid. These marks answer the further purpose of identification of the substance till it reaches the consumer and thus further promote honesty in the traffic in these articles.

3d. The power of Congress to regulate commerce among the states has been carried to an extent little dreamed of by the founders of the government, but largely because the nation has grown beyond their wildest dreams. Thus under this power we see an interstate commerce commission, and legislation even to the kind of coupling on freight cars engaged in interstate commerce. Under this same general power a national pure food law has been agitated for years and now seems likely to become enacted into a working law. A national pure food law has been endorsed by many agricultural bodies, but it is misunderstood by many. It does not mean that the nation can override the state in pure food matters, that it can come into your state and punish all adulterations of food, thereby saving you all further trouble. A national pure food law can regulate only products which are subjects of interstate commerce. But our country is getting so closely joined together by railroads and telegraphs, and our manner of life is broadening out so much, that many articles of daily consumption must now come to us through the channels of interstate commerce. Reflect for a moment how many of the food articles consumed in this state are not produced here, and all of these would come under the supervision of the national pure food law. Hence there are many food articles which could be looked after by the national officials and thus their work would prove an excellent supplement to the work of the state officers. Where state laws are insufficient, where their enforcement is lax, where motives of economy have prevented a state from making liberal appropriations for pure food purposes and in other ways a national pure food law will be of much service. Where there is a good state law well enforced the national law will be able to follow adulterated articles found by the state officers across state lines to the place of manufacture, and there punish the party who is morally guilty. In the enforcement of state laws possession with intent to sell is necessarily punished. The law would be ineffective if it did not hold guilty the person in whose possession adulterated goods are found. But sometimes there may be a hardship in this because the defendant may have purchased his merchandise in good faith of some wholesaler in whom he had confidence; but under the new law this class of hardships will be much mitigated.

The renovated butter law comes partly under the interstate commerce authority and partly under the internal revenue power of the government. There is not only a tax of a quarter cent per pound on the substance, but there is a system of inspection of factories and raw materials used, as well as some requirements relative to identifying marks and brands. This portion of the law is enforced by the department of agriculture working in harmony with the treasury department.

4th. Some attempt has been made under the national copyright law to provide for registering state trademarks, and under the interstate powers of the government to punish the improper use of these state trademarks and to regulate any false representations regarding any food product as to the place of its origin, as for example Vermont maple sugar, Maine Baldwins, Wisconsin cheese.

I have now gone over some of the principles underlying state and national pure food laws. The exact phraseology of those laws is another thing, and the enforcement depends on the men selected for the purpose and the appropriation given them. I hope the discussion has not been unduly dry. We should remember that such meetings as this are educational in their prime motive, being held largely at the expense of the state for the benefit of the public. I could have occupied a half hour with pleasantries and funny stories and entertaining platitudes, but such papers though often warmly praised at the time of delivery do not in my opinion fill the requirements of such a meeting as this. If, however, I have gone to the opposite extreme I am anxious to apologize before taking my seat. I wish to make this closing point: To some persons there appears an excess of food legislation on our statute books—too many laws, is a popular cry to-day in some quarters. But I do not believe that any producer of honest food products is troubled with too much food legislation and you will never hear any complaint from consumers at any excessive number or stringency of laws regarding those articles which they eat. Let us, therefore, look with disfavor upon any effort to relax any restrictions in the direction of pure foods, but rather press forward toward making it still more uncomfortable for those who would swindle producers by compelling them to meet an unjust competition, or those who swindle consumers by causing them to waste their money on dishonest, inferior or unwholesome products.

THE TWENTIETH CENTURY DAIRY FARMER.

By Dr. W. H. Jordan, New York Experiment Station.

(Stenographic Copy.)

I do not forget that you have a long program this afternoon, and shall endeavor to condense what I have to say into as brief a time as possible. I have not come to you to speak of technical matters, for I have been out of your state too long to discuss with you matters of practice, and so I shall address myself to-day to general considerations which I think it will be worth our while to consider.

My subject is "The Twentieth Century Dairy Farmer." You are the twentieth century dairy farmers, and you are in the midst of an environment greatly unlike the old. Permit me to point out some of the conditions which are peculiar at this time, as compared with former days. In the first place, you are called upon to maintain fertility in soils which for various reasons have been seriously modified from the soils with which the early settlers dealt. Now fertility, which is the basis of your work, is not a simple problem. I fear when I first began to do institute work in this state we taught the farmer that the maintenance of fertility was simply a matter of putting back into the soil that which we abstracted, and therefore our problem was solved in the bag of fertilizer. But we must abandon such a definition of fertility. What you take out of the soil and what you put back are simply single factors in fertility, and your problem is not only to look out for what the soil contains, but for the soil conditions. I am not going into that in detail. But your soil texture and your water supply are just as large factors—and sometimes I think larger—than the mere question of the presence of phosphoric acid and potash or nitrogen; so that your definition of fertility from now on, in the light of our best knowledge, must include much more than the fertilizer bag. It covers the whole question of soil management, and it is a complex matter.

You have new conditions to resist. I only need to mention them briefly. The Colorado potato beetle has traveled in upon you. You have fungus pests that the earlier men did not have to deal with, and you must meet them. Those pests impose upon you new apparatus, new methods, and conditions entirely unlike that of the old agriculture.

Then there has been the opening of western lands, which, combined with easy transportation, has placed the farmer of Maine in entirely different relations from a business point of view. There was a time when it made very little difference to the farmers in Maine hamlets what the farmers of Massachusetts were producing, or the farmers of Connecticut or New York. Your markets were local markets. Transportation was slow, and serious competition was not possible. To-day you are open to the sharpest competition, due to the bringing into cultivation of large areas of land and cheap and rapid transportation, so to-day you are sustaining competition in which the distribution of production will be to the advantage of those farmers who can put the most skill into their work, produce at the least cost and of the best quality. These conditions will absolutely determine whether Maine farmers or some others shall send cream to Massachusetts. The cheapness with which you can produce, and the quality of your product, both depending largely upon your knowledge and skill, will determine the measure of your success.

Then there is division of labor, which has modified the farmer's relations. The time was once, and I can remembor it in my own home, when a large number of industries were maintained on the farm and within the home,—the spinning wheel and the loom; but to-day somebody else is doing your spinning, somebody else is weaving your cloth, somebody else is doing a great variety of things formerly done in the farm home, and you are doing fewer things, and exchanging your comparatively limited products for what you must buy of the other man. What does that mean? It means specialties and specialists. You cannot get away from the inevitable trend of the development in our industries.

Again, as compared with the old, the farmer is buying largely, and he is buying in a complex market. The farmers of New York have six hundred brands of fertilizer to select from, and one hundred and fifty brands of feeding stuffs. These are exploited in the shrewdest and most insistent way. Certain manufacturing interests put the shrewdest and sharpest men they can find into the field to force upon the attention of the farmer, if you please, the products which they manufacture. It is a complex market. What does it demand? Good common sense won't lead you through it. Common sense is invaluable, but it needs special sense to get safely through the markets of to-day. In other words it needs special knowledge.

You are not only buying in a complex and difficult market, but you are selling to a critical market. I heard Dr. Whitaker at Herkimer say something about the sale of milk in three cities. Well, do you know what is being done? The bacteria are being counted in the milk which is shipped from the farm homes to the cities. There is being determined how much of the barnyard has adventitiously gotten into your milk. Not only that, but your milk is being analyzed to determine whether in some fit of abstraction or absent-mindedness you got hold of the pump handle. In other words you are going into the market to-day with milk which will be closely scrutinized. You are doing the same thing with butter.

I was struck by one fact while at the World's Fair. I was there several times, and scarcely tasted of a poor sample of milk during a great many days' stay in St. Louis; and as a rule the butter was of excellent quality in those restaurants where there was every temptation to supply cheap products. You will find throughout the entire country a standard of dairy products very unlike that which formerly existed. So, friends, you are going into a critical market, and that means specialists and special knowledge.

The farmer now has new instruments for use. I wonder if it has ever occurred to you to think of your college and experiment station as instruments of utility, created—or perhaps I had better say evolved—as necessary parts of the social organism. But these institutions will be useless to you unless you reach out and take hold of them and use them. I sometimes fear that in this swing of paternalism in this country, when the farmer is having done for him more than is done for any other class of people, the idea is gaining ground that somehow the farmer should have done for him those things which he ought to do for himself. Your experiment station will be useful to you in proportion as you reach out to it and take hold of it. It can never do for you its best until you demand of it its best by the hands which you extend. The effort must be mutual.

Now how shall the farmer meet this new environment? Well, you will consider it a very trite saying when I tell you, by intelligence. I do not mean that the farmer is to be merely an intelligent man. Farmers are intelligent men. The old farmer was. You pride yourselves upon what you know in these modern days; but I wonder a little whether you are any larger-brained men than some of those that sat around the big fireplaces in the big living rooms of the old-time farm country homes—men who dealt with the stern decrees of Providence, to whom a discussion of theological points was a delight, who reasoned severely, who thought seriously, who had high ideals, and who believed in an overruling Providence. I doubt a little whether we have any right in these days to boast when we compare ourselves with these men. But the difference between you and them must be this, that you know some things which pertain to to-day—things which deal especially with the problems of to-day—and there is no man who can be a farmer at his best in this twentieth century, who does not know some special things thoroughly. I don't mean that he shall be a scientist, but he must be able to make his way through the maze of modern things with discrimination and special intelligence. It is not necessary for me to say more in a general way.

Now I wish to ask this question. Where—from what source—shall the farmer draw this knowledge? We are proceeding to-day at a tremendous pace in what we call agricultural science, and to my mind the time has come when conservatism should utter some warning, or else disasters may come that will be commensurate with the speed at which we are traveling. Where shall the farmer go for his knowledge? I don't know that there is any need to-day of cultivating the faith of the public in science, or in scientific men. I sometimes think this faith has been over cultivated. But where will you go to get special knowledge on a special subject? If you wanted to know something about the principles or the practice of surgery, to whom would you go? To the surgeon, would you not? If you want to know something about the principles and practice of butter making, especially the practice, where will you go? To the expert butter maker possibly? In other words it is the rule to-day, and a safe and rational rule, to go for information to those persons who have given special attention and consideration to that which you wish to know about. It is rational to accept the utterances of the real men of science. Now I mean by men of science—and allow me to say right here that I am not pleading for any aristocracy of science—those men who have been trained in a particular way to know a particular thing. Moreover, a real man of science is first of all a man of intense truthfulness who will not intentionally deceive you. I believe I am as ready to trust the man of science to-day in the matter of good ethics as I am a man of any other class. He may deceive you because of a false interpretation of data, but he won't mean to.

Now why am I saying those things? Because we have so much of the popularization of science to-day, and so many men who are taking the name of science in their mouths and pretending to teach the public. I have great faith in the practical man in what he knows of his practice, but I will tell you frankly (and I say this with all respect to all men who are honest and well intentioned) I am getting about tired of hearing and seeing some of the most profound things in science and in knowledge interpreted by a man who was never trained in science, and who cannot think down to the fundamentals of science. There is need today on the part of the platform speaker and on the part of those who manage our press of a vastly more discriminating control of utterances than is taking place. Agricultural science has its dangers. It was in danger at one time in this country in certain quarters from political interference. That time has passed, practically. I think that in the State of Maine, and I say it to your credit and honor, you have never interfered with the work of science because of political expediency or considerations. Stay by that which you have practiced. And in no large part of the country is it true to-day I think, that men in political control are willing to very seriously interfere with the work of science. But agricultural science is in danger in this country, and always has been, because the work along this line is largely dependent upon public funds. When those who are pleading the cause of agricultural research go before a legislative body the first question is apt to be "What have you done, and what are you going to do?" It is true, I know, of the agricultural committees of Congress, and I suspect it is true of some committees in our state legislatures, that they want to be assured of something in the nature of value received. Now what is the tendency of this? It is to hurry science—hurry the man of research unless he stands like a rock. And what is the result of hurry? Premature conclusions. You can't safely hurry science. You can't hurry the development of safe and sound knowledge. Science is a plant that blooms in an atmosphere of reflective deliberation, and its growth and fruition cannot be hurried. We shall have to trust the man of science and put our faith in him and wait for him.

Science, too, is in danger of over popularization. Let me illustrate. And, by the way, my mind was turned in that direction by something I saw in the Lewiston Journal about an article that appeared in the Century magazine which refers to the recent work in soil bacteriology at Washington and those tubes full of germs that, according to the writer in the Century magazine, may be sent broadcast and take the place of fertilizer and good management, and be a sort of vicarious atonement for all the sins that have been committed against mother earth. We are in serious danger from impressions gained by such popularization of science—popularization by half informed men. We have had recently issued from the department of agriculture a bulletin, No. 22, (have you heard of it?) in which the apparent conclusion was that there is no soil of respectable character in the United States that does now, or ever will, need any addition of nitrogen, phosphoric acid and potash. I am not going to characterize the authors of that bulletin as half informed men; but that bulletin is to my mind an example of the dependence of agricultural research upon public funds, and of the hurrying of men of science. The science of today and of tomorrow and of all time must depend upon the most careful methods, the most prolonged deliberations, and the closest possible scrutiny of data. We need to return, possibly, to the day of conservatism.

Then there is quack science. I don't know whether I need say anything about that or not. I am afraid you will think I am riding a hobby because I have said so much about it. It is the science behind the bogus fertilizer, the food preservative, imitation butter and various other things. It is quack science. It is just the same kind of science that is behind the patent medicine, one bottle of which will cure every ill known to humanity. Look out for it. It is science distorted. It is science made to play a commercial part.

But the farmer must go somewhere else than to science for information. A very large part of that which he gets of value he gets from his own farm and the farms of his neighbors. I tell you, friends, the knowledge of to-day, what we know of modern agriculture will never take the place of personal study and endeavor. Don't put your faith wholly in what your experiment station does for you—what the institute speaker tells you. You still must study your farm and your neighbors' farms and reach out for information yourself.

Now just a few words more! Agricultural progress of to-day is to quite an extent a matter of social organization. I don't know that this is true of the farmers of Maine in latter years, but agricultural progress has halted because so many farmers have not subordinated themselves to the necessary social organization. Farmers are insubordinate in material things sometimes. Two farmers are orchardists; one man is a careful man and keeps the pests out of the trees. In the orchard of the other man pests abound unrestrained and that one farm is a breeding ground of trouble for the whole neighborhood. The latter orchardist imposes his laziness, his indifference, his insubordination to the public good, upon every neighbor he has. In the same way, one of the difficulties in dealing with these things which affect our business and social welfare is the fact that certain men in every community do not subordinate themselves to the needs and demands of their neighbors. That is true in those things pertaining to legislation and to social organization.

If the farmers of Maine could move as a body and in a spirit of generous compromise, they would be irresistible. I suspect the farmers of this State are better organized, and that you have less subordinate members than is true of some other states; and yet, if you were properly subordinated you would accomplish much more than you now do.

While the farmer should subordinate himself to the public good, there should also be the fullest expression of the individual. I am not dealing in paradoxes. There is no antagonism between those two statements, and I repeat that you should not only subordinate yourselves to the public good, but you should also give the fullest expression to yourselves as individual members of society. Do you know what the failure of individual expression means? It means social corruption and political corruption. Social and political conditions have a great deal to do with your prosperity and welfare. Conditions that existed in St. Louis awhile ago, that have existed ever since I can remember in the cities of Philadelphia and New York are largely due to the failure of the expression of the individual in political life; and if the citizens of the State of Maine wish to make themselves irresistible within their own borders, every man must put the best there is of himself into his social relations and make himself felt.

Now what is to be the test of all this that is going on? Mere change is not progress. There is no progress in mere complexity. The fact that your agriculture is more complex is not necessarily progress. Rapidity of movement is not progress essentially. I don't know that it makes any difference in one way whether a man rides on a stage coach or on the steam cars. It isn't so essential as we sometimes think it is. I doubt whether it makes any difference at all whether a man arrives in Chicago from New York in twenty-four hours or twenty-six. And yet we quote those sayings showing how rapidly we move and how much we accomplish in a short time as evidence of progress. The test is just this, and this is my closing word. Do these changes make for your welfare? Are you wiser? Have you more of life's satisfactions, have you less of life's burdens? If the new appliances of to-day, and the hurry of to-day, and the added power of to-day, simply make it possible for you to live a more strenuous life and do more business, with no more of recreation or satisfaction, with no higher thought, with nothing added to your homes but material gain, then you need not count modern conditions as making for human welfare. But I have faith to believe that the new things that have come into agriculture are contributing to its higher life and doing something in the way of progress for the rural communities.

THE HEAD OF THE HERD.

By Dr. G. M. Twitchell, Augusta.

Mr. President, Ladies and Gentlemen: Contrary to my usual custom I crave indulgence in reading this paper. The specific line of thought aimed at, in connection with the brief time allotted, necessitates the clearest possible statement in the most concise terms. The refining influences of our rapidly advancing civilization are purchased at tremendous cost. We realize this in some directions, but its universal application is not yet part and parcel of every life. Competition hedges, necessity forces and desire stimulates until we are startled at the rapidity of the moving currents of our daily life, the ever increasing volume of output, and the growing wish and will to do and have all that is possible of the good things of this world.

Out of this condition has grown the abnormal life of our animals as also of our products. The day has gone for us to discuss natural conditions. We are dealing with natural functions so unnaturally developed that only the highest skill of the critical feeder and caretaker can maintain the standard, yet we face 1905 certain that heavier exactions will be laid upon the shoulders of the man behind the plow or at the side of the cow. If we grasp the full significance of this we are in good mood to discuss the head of the herd, if not, that law of reversion which holds so tenaciously will manifest itself more and more as breeding progresses. It is an old and familiar saying that "the male is one-half the herd," but surely it is not his sex alone which proves the adage true, for to maintain that half, yes, to go further and dominate as every male should in reproduction, far more is required.

I want to ask that you carry my opening sentence with you as I attempt to present my thought, that is, that the refining influences of our present civilization have been purchased at tremendous cost, and make application of this as we discuss the head of the herd, because in order for the male to be the head he must not only through inheritance but surely by individuality possess and manifest the essential qualities of the head of the flock or herd.

We are today laying heavy burdens upon our dairy cows. Mr. Pope is asking his herd of thirty-six cows to give him a yearly cream yield per head worth one hundred and fifty dollars, and they respond.

Mr. Keene is asking his Holsteins to yield him individually ten thousand pounds of milk yearly and some have reached seventeen, while ten three-year-olds have passed the limit of his request. Dr. Moulton is asking his Maine State Jerseys to produce four gallons of six per cent milk daily on the second year after dropping a calf and certain ones have answered the call. So we might go on multiplying illustrations, but let me suggest that the refining of the natural instincts of different breeds to the point where such abnormal results are possible very greatly endangers that massive masculinity in the male offspring absolutely necessary for it to maintain itself as the head of the herd.

We must seek males, which, mated with these great producers, will maintain in their offspring the same high standard. Go through the untouched photographic reproductions of males to be found in stock and agricultural journals, covering the body and neck, leaving only the face exposed, and you will be surprised, as I have been, at the mild, benignant, cow faces which will be seen. These are not heads of great herds. It is a condition which confronts us and well may we theorize concerning it, for surely it will play a most important part in the economy of dairy work in the immediate future. To my mind here is a natural sequence following the prevailing habit of seeking for males, and insisting only on purity of blood and color. Big prices are paid for representatives of popular families without due regard to reproductive power, either through inheritance or individual characteristics.

Purity of blood, important as it is, must be backed by an ancestry of performers and supplemented by the certainty of power to transmit, in order to give prominence to any male.

I have indicated that this intensive, abnormal work has been necessary, and surely without it present production, either of individuals or herds, would be impossible, but do we not err, in that, while recognizing the value of the cow, we fail to place due emphasis upon this other factor in breeding. Pure bred sires have so persistently been urged that they occupy the field, surely in all good dairy sections, but purity of blood does not reach the vital point, important as it is. To it must be added that virile energy, what may be termed massive masculinity, which is also both the result of breeding and the fortunate gift to certain individuals, a more subtle force than blood, but absolutely necessary to enable the male to be the head of the herd.

I detract nothing from the credit due the great producers, and would lay increased emphasis upon the most rigid rules governing selection, care, feed, kindness and all the steps demanded for highest success, but here is a fact not to be overlooked, that the higher the standard of the present herd, the heavier the obligations resting upon the breeder who selects his male to be the head of the herd, and do his part in the production of calves which shall develop into cows superior to their dams. This is the objective point in all our efforts, or if not it is easy to foretell the end. If one keeps a male simply to insure new milch cows, he is not a breeder in any true sense of the term, and there can be no enduring results following such a reckless course, hence it is well sometimes that we discuss the head of the herd with reference to the special work he has to do.

It is no longer a simple problem which confronts the breeder of 1905, yet its very complexity renders it attractive to the student, and insures results to him who grasps and controls the work of the future.

If it be true that the marks of femininity seen so often in the faces of the male are due to the refining influence of progressive breeding towards larger production, it does not follow that this must be sacrificed and coarseness substituted in order to restore the outward signs of pronounced masculinity necessary for success in future operations, for all through the many families, of all the breeds, will be found individuals where the combined mental and physical forces are steadily being carried forward and the average of the growing herds increased. It simply means that purity of blood cannot be the chief dependence of breeders, that the individualism of each animal must be studied more closely, and always with the one purpose of maintaining, yes, of lifting the production of the members of the herd each successive generation.

If any criticism holds against present customs it is that the sharp study of blood lines, and the purchase of fresh blood because of what it represents in this one direction of production, must be relegated to its proper position where it stands second to the study of the positive and negative qualities of the individual animals as producers.

Do not for a moment think that I would lessen the importance of purity of blood or the necessity of familiarity with ancestors for generations back, but these do not insure the head of the herd; they simply tell of blood lines more or less popular and of promise of value as producers of quantity and quality in varying degrees, but not of virile energy.

The one point to which attention may well be directed is that which centres about what is familiarly termed the "nick" in breeding, that which is considered by so many the Simon pure element of chance, so that the man who has been fortunate in his matings until the per cent of blood of a given sire is so large in his herd that a change is necessary, realizes that the next step, the introduction of a fresh male, is largely experimental and always attended with great risk. To eliminate so far as possible this element of chance is the struggle with every live breeder, and success cannot be reached alone through skill in the selection of the females, but also through a clearer conception of the head of the herd, what it is and what it can do in the processes of reproduction towards strengthening the desired qualities wanted by the breeder.

I do not stand here with any thought of solving this problem, for its solution lies in the regions of the far off future, if it is ever reached, but as we have come thus far on our journey and realized so much, it is pertinent to raise the question as to the next step, even if no complete answer can be given. Out from the loins of breeding stock there have come noted sires which have been the founders of families, but they have not, as a rule, been the outcome of an intelligent purpose on the part of individual breeders, but the result of a happy union of blood lines and mental conditions. They stand as accidents, not in the purity of their blood, but in their marked ability to stamp certain characteristics upon their offspring so that at once a family has sprung up and for generations the form, color, and peculiar characteristics of that individual ancestor becomes a familiar sight.

Perhaps one of the most notable illustrations may be seen in the St. Lamberts, especially the Exile family, while the Holsteins present the same in the De Kols and the Shorthorns in the Cruikshanks. It is the fact which claims our attention and in the attempted solution of where the founders of these noted families derived their prepotency, we may find the next forward step for the breeder of today. Surely these bulls were noted for those essential qualities of masculinity which must claim more attention in the future than has been given in the immediate past. The question for the individual breeder to solve for himself is whether we shall rely upon this element of uncertainty in masculine power or through critical selection seek after control.

Is it possible through any study of blood lines and knowledge of individual traits, manifest in form, disposition and especially in those marks of masculinity, which when seen are unmistakable, to control in larger measure than to-day the quality of the offspring of our dairy cows? If your answer be *No*, then we fall back upon the study of blood inheritance and trust to the possible "nick" for improvement, but if there is a forward step which can be taken it surely is in the direction herein indicated, the strengthening of the essential qualities of masculinity in the heads of the herds.

One of our good breeders said not long ago, "I purchased a pure bred male from one of our well known breeders, out of a producing family, and he reduced the milk production decidedly in the first generation, his heifers all being inferior to their dams in productive capacity."

This bull was not the head of the herd in the sense that we must use the term if a steady forward movement in production is to be secured, yet the experience of this breeder varies but slightly from that of many others, and unless this element of chance is to be accepted without question then surely there is urgent demand for the open door into or towards positive control. I am well aware that the position aimed at is beyond the reach of practical demonstration, yet because of this there is the greater necessity for investigation and exploration that the hidden secret may sometime be found. Man must have dominion and that will never be complete in any direction until he has mastered the details and controls conditions. If the breeding has in so many cases been haphazard, there is surely abundant evidence on the part of the founders of the great families of a distinct purpose leading towards a fixed result, and if so many of the noted sires have been accidents, "the result of a fortunate nick," there surely has been a steady converging of blood lines towards a given centre leading to fixedness in individual characteristics. Is it not safe to claim that this has as frequently resulted from the study of the male as of the female side of the herd? And that the higher results have followed the application of the essential principle I am aiming at today, the selection of the bull for the *head of the herd?*

The claim so frequently made that it is impossible to maintain in breeding the general average of a selected herd, cannot be accepted as a safe standard even if it has so often proven true, and the steps to be taken to prove it false are those which the breeder of the future must follow whether or not they run in the established lines of breeding.

That the highway of progress does not run in the ruts of habit is one of the truisms to be accepted and its conclusions heeded.

Purity of blood does not, of itself, insure positive reproductive powers, therefore to build up a herd, to establish fixed characteristics along given lines and insure greater control in breeding, the study not only of blood lines but of individuals must receive sharper attention.

The purchase of fresh blood, males or females, solely upon pedigree, or family, is neither safe nor sound practice, yet it is the common rule with the great majority. Important as these are they need to be supplemented by individual inspection. Color of body, switch or tongue never insured reproductive power to any male, yet in so many, many cases the purchaser, knowing the breeder to keep only pure bred stock, asks only for a bull calf of squirrel gray or fawn color, hearty, rugged and healthy, out of a known producer. The conditions of the times, the sharp lines of competition already hinted at, necessitate a radical departure from such practices and a critical study of the head of the herd with special reference to the special work he is selected to perform, a work which so far transcends color, and beauty lines that it must be put uppermost if the high standard of present breeding is to be advanced. Important as these are in preserving uniform breed characteristics, and necessary as they are to help maintain enthusiasm on the part of the breeder, and approach to uniformity in the herd, yet the all-essential is the quality of the offspring along the higher lines of utility, and this can only be secured through the marked personality of the head of the herd, coupled with the blood of producing cows.

Value in breeding must ever be reckoned, not by phenomenal performers, but the general average of the entire product. We aim to lift the standard of the herd, not to win a prize in the lottery of breeding, else there is sure to be a failure at the end of the journey. How many bulls and heifers have sold for phenomenal prices simply because of the record made by a single member of the family, either male or female, yet these were never heard from afterwards. Whatever the cause for success in these exceptional cases or of failure with the great majority, they indicate a line of investigation of supreme importance to every aspiring breeder.

Accepting all that will be claimed by the extremist for purity of blood and for the mingling of blood lines possessing greatest value, there still remains the fact that success must rest largely upon individual characteristics and that virile energy and extreme masculinity in the heads of the herds must accompany all that inheritance can insure.

The head is emphasized for the reason that back of the shoulders we look for, and insist upon, the distinct dairy type, the open spinal column, wide rib, long and well sprung, good body, long quarter with absence of fat, the long, slim tail, that strength, yet at the same time flexibility of skin which speaks of quality, the flat bone of high grade and the well set rudimentaries with promise of udder development.

These we insist upon, but do we demand the stamp of virile energy in head and neck, the evidence of massive masculinity, that strong rugged head with horns well set, abundant room for brain development; a good, clean face of length and strength, with broad strong muzzle and lips, and large nervy nostrils? De we require an eye that stands out full and large and that at the first glance impresses with its sure sign of intelligence, will power, and quality, an ear well set, not large enough to be coarse neither so small as to indicate temper, a jowl broad, strong and spreading, yet cleanly cut at the throttle, and a neck of such strength and upward curve that it completes the picture and satisfies the purchaser and breeder?

Against this head set the mild, fine, short face, with small mouth, thin lips, a bright eye and a pleasant ear, and you have the cow face on the bull's shoulders. Success in breeding with such a male is a practical impossibility, yet we find such cases in altogether too many show rings and tie-ups. They came from great cows, yes, they could not well come from others and carry this stamp of refinement, but for the purposes for which they were created, as heads of herds, kept with an eye single to increased production, generation after generation, they must be failures because of unmistakable lack of ability to stamp positive virtues upon their offspring.

The bringing of a fresh male into a herd where every cow produces yearly 300 pounds of butter or 10,000 pounds of milk is a serious problem, one calling for the exercise of the greatest care and skill at the command of the breeder, yet how often do we find that this future head of the herd has been selected and purchased without being seen and solely upon a general description, laying special emphasis upon blood inheritance.

It has taken generations on the part of somebody to reach this high standard, yet because of the general leap-frog method in breeding, the foundation under the superstructure does not allow of wide variation or generalization, but calls for the most critical work at the hands of every breeder.

It is the next step forward which concerns us all and the general principles at issue with you dairymen, face every breeder of every class and variety of pure bred stock. Continuity in breeding along fixed lines, and rigid adherence to the established principles in selection, must ever be the rule, but to-day in view of what is seen so often, it is well to lay more emphasis upon the evidences of intense masculinity in the head of the herd.

Bear in mind that this in no sense can be construed into coarseness of structure of head, but rather that strength of character which attaches to a master and which must be present in order for control to be possible.

Right here I reach the point where we realize the importance of words, for unless one sees in the face of the male the evidence of potential energies which cannot be expressed in words, it is hardly possible that he can ever become the *head of the herd.*

The eye speaks a language of its own, yet its voice is clear to him who, with open vision, sees its varying expression; the ear, both in shape and size, tells of character and quality. The roomy nostrils devoid of meatiness, with strong, broad jaws and firm, well set lips, speak of determination. Each and every portion of the head voices its power and purpose, and when under balanced physical structure, backed by ample brain capacity, there can be realized the power of a well developed brain and unquestioned will; we read the story of virility and of masculinity and find here the head of the herd. As you refine the head and reduce the massiveness of the neck, there is sure to follow destruction of those essential qualities so desired and so necessary for success in breeding.

Coarse heads, flat heads, narrow heads, small or dull eyes, coarse ears; these are signs of brute force, bad dispositions, ugly tempers. Small horns, small ears, short faces, fine nostrils, narrow jaws and thin lips, even with a bright, intelligent eye, cannot insure prepotency in breeding.

The extremes desired are strength of character, positiveness of will, evidence of purpose and well balanced determination to do and conquer. Great men alone do great things and their greatness lies not in gross physical weight, in coarseness of features, but in the greater balance of mental powers, for throughout the whole animal kingdom dominion is mental, not physical. So, too, the great bull alone can perpetuate himself, can stamp the essential qualities of his greatness upon his offspring, can do service for humanity along the higher line for which he was created, and to own or use a great producing bull should be the objective point with every breeder not entirely satisfied with the work of to-day, and who realizes the necessity for more complete control in the work of the future through more critical selection of the head of the herd.

ECONOMIC DAIRY FEEDING.

By CHAS. D. WOODS, Director Maine Agricultural Experiment Station.

Economic usually means successful dairy feeding. There are three elements in the problem, the cow, the food, the feeder. As I first thought of the problem this order seemed correct, but reflection showed that the man in his relation to the cow was more important than the feed, and still further consideration has convinced me that the man is by far the most important factor in successful dairy feeding.

THE DAIRYMAN.

To be successful the dairyman must be enthusiastic in his calling. But this is not enough. Some of the most unsuccessful ball players I have ever seen had enthusiasm enough for the whole team. The successful feeder must love the cow, but not every lover makes a good husband, or husbandman for that matter. The successful feeder of dairy stock must have enlightened understanding in addition to his enthusiasm and love for his calling. Just as the successful man in any other business, calling or profession is ever striving after fuller comprehension of his affairs, so the man that would be successful as a dairyman must be ever on the alert for all that science and improved practice can bring. In no other occupation is there greater need for all the powers of mind than in this, the most complex and involved of all the farm problems.

The enthusiastic man may convince himself that his herd is all right, and without having weighed a single milking may say that his cows averaged 10,000 pounds of milk during the year. In the closing days of the campaign preceding the last election a city paper claimed that one of the political parties had distributed a certain number of thousands of tons of campaign documents, but when it was pointed out that this weight was in excess of the world's production of paper in a year, the thoughtful man had doubts regarding the accuracy of the figures.

The man who desires to be successful will know how much his herd gives in a year, not only in pounds of milk, but in pounds of butter fat as well. The man who raises a cow from a calf may love her so that he will think her the best animal in his herd, just as a proud father may think that his boy is the best scholar in the class. A little careful observation may show that both are at the foot instead. The man that thinks a pair of scales and twice daily weighings of milk, and at least a monthly test of the butter fat of each cow is too much bother may be a successful feeder, but the chances are against him. The man to be a successful breeder and feeder must be ready to take all pains to know the truth regarding his business and be ready to accept the facts whether they are as he would like to have them or not.

THE DAIRY COW.

The good dairy cow must be bred for production. Here as elsewhere blood will tell. There will be an occasional good milker without good ancestry, and there will be an occasional poor milker from good ancestry, but in the long run, like has a strong tendency to produce like. The hero sometimes arises from very unexpected parentage and a coward sometimes comes from good stock, but in general the thoroughbred, be it man or cow, takes the front rank. I am not here to tell you the points of a dairy cow,—you know them better than I do. But the good cow will usually have good ancestry and the extraordinary cow always has.

The building up of a dairy herd is a matter of years. While it is true that with money enough one can buy animals of high capacity, it is rarely true that this can be done economically. With sufficient money a great university like that of Chicago can be created off-hand. But most great institutions, and as some think the best institutions, are the product of generations. From small beginnings, with care in breeding and rigorous selection, a family of cows of high production can be evolved that will pay their owners well for the care and time bestowed.

Since most men must depend upon the cows they have as the starting point in building up a herd, the first thing to be done is to know exactly what the cows are doing. Twice daily recording the weights of the milk and testing a two days' sample of the milk once or twice each month will make it possible to know at the end of each lactation period exactly what the cow has done. Such knowledge will usually show that some cows of the herd do not pay for their feed. Obviously these are not the ones to keep and are certainly not the ones from which to breed.

While most men will have to use the best of the cows they have as the foundation for their herd formation, this is not true regarding the male. A well bred, prepotent male can be had by any breeder, and indeed, must be had, if he aims to become an economic feeder of dairy stock. Such an animal at the head of only a very ordinary herd will so put his impress upon the progeny that the character of the herd will be transformed. If when it is time to breed his daughters, another male of equal type from another strain is used, and equal pains are taken to breed from only the best of the cows, the resulting herd will be of high type, and for all purposes other than sale may be the equal of the best registered strains. If good registered animals can be used for the foundation all the better. But even then the same care should be taken to breed from only the best of the cows. There is many a cow with a pedigree that lacks performance. Not all the descendants of the Pilgrim Fathers are saints, and some very excellent cow mothers have occasion to blush for their daughters.

THE FOOD.

It is hardly necessary to state that the food is a fundamental requisite of production. That nothing comes of itself is as true of cattle feeding as anything else. Life is a wonderful transformer but it is not a creator. The so-called vital force is merely a new and different manifestation of other forces and forms of energy. The energy of the food may be changed into animal force and animal production, but this is always effected at a loss. There is much truth in the statement so frequently made, that the dairy animal is a machine. But it is only a partial truth; she is in fact much more than even a very complex machine. The dairy cow uses the food she eats for many purposes. The construction and repair of the body, the maintenance of animal temperature and other normal functions of the body are obtained from the food. This food is necessary to the animal life, but is unproductive. It is only the food which is provided in excess of these maintenance demands that brings returns and hence is truly productive. It takes a certain amount of fuel to bring the water in a boiler to the point of turning into steam. In a sense, this amount of fuel is wasted, is unproductive, for while the water is just on the point of becoming steam and capable of doing work, it is incapable of accomplishing anything. But supply more fuel and the hot water becomes steam and the engine has the needed power for work. It was the extra fuel that was productive. It is much the same with the dairy animal.

It requires a certain amount of food to maintain life. In a sense this is wasted food; but provide extra food and she turns it into production. It would therefore seem to be to the advantage of the feeder to supply all of this extra food that the cow can consume and maintain health, for it is on this extra food, and the extra food alone, that the profit in feeding comes. It requires a certain number of tons of coal per hour to drive a steamship at the rate of ten miles per hour, and it may double the coal requirements to force the same ship at the rate of twelve miles per hour. In the same way a few pounds of extra food may result in producing a certain amount of milk or butter fat or whatever it may be the feeder is after, but there comes a point above which the extra food fails to give adequate return. This is the difference between maximum and profitable production. In many of the great milk and butter records the increased yields went beyond the point of profitable production. The lessons of the St. Louis Fair on production emphasize that the secret of success is to develop each individual cow to her greatest capacity, and to her limit of profitable production. If it happens that a particular cow will not turn the food into the product the owner wishes; if she will fatten when he desires milk production, it is largely his fault, for he is not breeding along the proper line.

The subject of cattle feeding is a broad one and the chemist can only lay down general principles. The right application in each case must depend upon the intelligence and care of the feeder. Merely another incident of the fact that it is "the man behind the gun." Specific rules to cover all cases and conditions are not known, nor are they possible or even desirable. There is no "best ration" for milch cows or other animals. Different breeds and different individuals of the same breed differ widely in their demands for food and the profitable use to which they can put the nutrients it supplies. It is with such facts as these in mind that the following suggestions deduced from experiments and experience are to be taken and applied.

Food serves the two-fold purpose of building and repairing the body, and furnishing the needed energy for work and maintenance of animal temperature. Protein alone can be used for purposes of construction. All the tissues of the body, blood, bone, milk, flesh, etc., depend upon protein for their formation. Because of this fact protein is sometimes called the plastic material or the tissue former. But this tells only half of the story, for the protein not only can furnish energy but part of the energy is always thus supplied. The fats and carbohydrates are, however, the chief and the most economical sources of energy. The value of the nutrients as sources of energy may be measured by their heats of combustion. In burning, a pound of fat will give about two and one-fourth times as much heat as a pound of protein or a pound of carbohydrates.

The value of a food can be measured by the amount of digestible protein it contains and by the heat of combustion or fuel value of its digestible dry matter; and in the discussion which follows the value of food materials will be thus measured.

FEEDING STANDARDS.

In discussing the question of feeding standards it will be simpler because more familiar to give special attention to the cow and her needs. Milk from the same cow may vary in composition from day to day within narrow limits, but there seems to be no ground, or almost no ground, for the quite common belief that the quality of milk varies with the food. There is not time to cite the numerous experiments which confirm this conclusion, but there is no fact in connection with the feeding of cows that is better established than that the cow and not the food chiefly determines the quality of the milk. The quantity of milk is influenced by the kinds and amounts of foods; the quality is almost if not quite independent of either the kind or amount of food. In studying the kinds and amounts of foods that are most suitable for a dairy cow, by far the most important effect is to be noticed upon the yield rather than the composition of the milk.

Differences in breed and individual peculiarities of the animals and in the food and handling, as well as other conditions, known and unknown, bring it about that the best ration for one cow may not be the best for another. The feeder must know his cows and fit the food to their wants. But in so doing he may be greatly helped by feeding standards.

What is a feeding standard? To answer this we must first of all avoid a confusion of terms which has become common. We must distinguish between three different kinds of standards, or rather, since the word "standard" cannot be applied with equal propriety to all, we must distinguish between three different kinds of formulas which may be used to express quantities and proportions of nutrients for feeding. These may be designated as the physiological standard, the formula for profitable feeding, and the formula which expresses the actual practice of feeders.

PHYSIOLOGICAL STANDARDS.

The physiological standards would express the proportions of the different nutrients—protein, fats and carbohydrates, which best fit the demands of the animal for the particular kind of product demanded of it, whether the product is growth, as in the case of young animals; or meat, as in the fattening of cattle, sheep and swine; or milk, with milch cows; or work, as with horses and oxen. In all of these cases a certain amount of nutrients is required for maintenance and a certain additional amount for production. The functions of the several classes of nutrients in meeting the demands for maintenance and production have been more or less definitely shown by feeding experiments. But unfortunately our knowledge is still deficient, and furthermore the differences of individual animals are so wide that with the most perfect knowledge of the laws of nutrition it will hardly be possible to set up accurate physiological standards, and when we get that standard we shall doubtless find that it is after all indefinite, that it varies with the animal as well as with the conditions of feeding; in other words, it will be at best only an average estimate and not an unvarying formula.

FORMULAS FOR PROFITABLE FEEDING.

But the practical feeder feeds for profit, and the ration which will produce the largest amount of growth, or of total flesh or of lean or fat meat, or the largest amount of milk or butter fat, or enable the animal to do the largest amount of work from a given quantity of nutrients, is not always or generally the one which will bring the most profit to the feeder. In other words, the physiological standard may not be the most profitable formula for feeding. The factors of profit are numerous. One of the chief is the physiological action of the nutrients, but the cost of the food and the value of the product have to be taken into account. It may be to the feeder's advantage to use a wide ration when a narrow one would give more yield for less raw material. There is a very wide difference with respect to the width of a ration between the physiological standards as we now understand them and the actual feeding practice of most American farmers, but it would be as unwise for them to conform exactly to the physiological standard as it would be to take the average of the practice of successful feeders for either a physiological standard or a formula for profitable feeding.

In the Experiment Station Record, Prof. Kuehn discusses the standard for a milch cow as follows: "For milch cows it is advisable first of all to determine the quantity of nutrients which represent the minimum requirements per 1,000 pounds live weight of the animals; that is, the quantity which covers the needs of the cows which are dry or nearly dry, and which while producing little or no milk are usually more or less advanced with calf. This minimum amount may be designated as the *basal ration*. It will naturally be more liberal for breeds of high productive capacity and those which keep up their milk yield well in the latter part of the lactation period and only go dry a short time, than for those of inferior milking qualities. For the latter the basal ration need not contain more than 1.5 to 1.7 pounds of digestible actual albunoids per 1,000 pounds of live weight, while with the former up to 1.8 pounds, and with breeds of exceptionally high capacity even more will be needed. The same consideration will enter into account in determining the amounts of fat and non-nitrogenous substances for the basal ration. Amounts ranging from the minimum to a medium amount are to be recommended. In addition to this basal ration each cow should receive as much concentrated food as she will yield profitable returns for. The cow of the highest productive capacity will naturally need a larger quantity of nutrients commensurate with her large production of milk. But the amount of nutrients in the daily ration of one and the same cow should also vary as her milk production varies, being greatest early in the milking period when she is producing the most milk, and gradually decreasing with the advance of the period, until as she becomes dry the concentrated food is discontinued altogether and the basal ration alone is fed. While this means of feeding of course requires attention, it insures the greatest possible profit from the animals, and results in the highest development of the milking qualities of the herd, which being transmitted by heredity, effects a continual improvement of the stock.

"To feed an animal highly during the most productive part of lactation pays well, but to feed the entire herd equally well, without regard to individual production, can prove remunerative only when in addition to yielding milk the cows are fattened. Otherwise such feeding results in great waste of food, is not infrequently the cause of the low profits in dairying, and makes the barnyard manure expensive."

Very little is known about the digestibility of the individual compounds that go to make up a feeding stuff. While we know from experiment the approximate percentage of the protein of wheat which an animal will digest under normal conditions, we know almost nothing of the differences in digestibility of the half dozen different bodies that together constitute wheat protein. While the sugars and starches are pretty nearly if not quite completely digestible, the different kinds differ greatly in time necessary for their digestion. Investigations show that "this variation reaches such a degree that under precisely the same conditions certain of the starches require eighty times as long as others for complete solution." From this it follows that at present we must base the digestibility of different feeding stuffs upon the results of experiments with that material and not upon its chemical composition. The chemist can take a new feeding stuff and from analysis tell quickly and accurately how much protein, fats and carbohydrates it contains, but he cannot tell until after definite digestion experiments with animals how much of these are available for the purposes of nutrition. It is not enough to know the chemical composition of a given food material but it is equally essential to know how much of the nutrients will go into solution through the action of the ferments of the different digestive juices of the stomach and intestines. While a comparison of the composition of closely allied feeding stuffs will be a fair measure of their comparative food values, this is not true of different classes of food materials. For example, wheat bran and clover carry about the same percentage of protein, but nearly eight-tenths of the wheat protein is digestible and less than seven-tenths of the clover protein.

INFLUENCE OF DIFFERENT CONDITIONS UPON THEIR DIGESTIBILITY.

The results of digestion experiments with reference to different conditions of coarse fodders will help to a clearer understanding of the way these crops should be handled.

The Digestibility of Green or Dry Fodder.—Fodders, if cut at the same time and cured without loss of leaves, etc., seem to be equally well digested whether used after curing or fed green. In general, owing to loss of leaves in curing, the green fodders are better digested than are the cured.

The Influence of the Method of Hay-making.—As applied in the above, the method of hay-making has a great influence upon both the composition and the digestibility of hay. Other things being equal, the more rapid the curing the better.

In ordinary field drying and handling of alfalfa there were enough of the leaves and more delicate portions of the plant lost to reduce the protein one-tenth and the fat one-third, and to increase the fiber correspondingly. And there was 4.4 per cent less of the protein, and 17.6 per cent less of the fat digested in the hay as ordinarly cured than in that which was dried without loss of the finer and more delicate portions of the plant. There was no added digestibility of the nitrogen-free extract, and very little of that of the fiber to compensate for this loss.

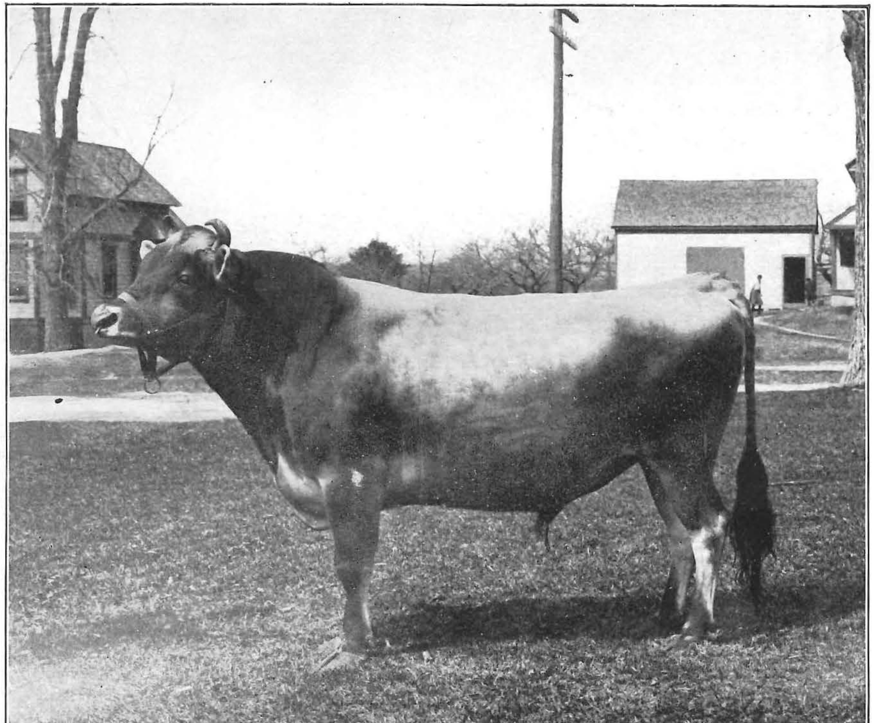
This indicates the great advantage of making hay with the least possible handling, and the advantage of drying only enough to insure the hay keeping, and thus avoid, so far as possible, the loss of the delicate and more digestible portions.

The Inflence of Period of Growth of Fodder Plant.—In general, the percentages of protein, fat, and nitrogen-free extract decrease as the percentages of fiber increase with the age of the plant. Also, as a rule, with added age, the nutritive ingredients of the plant are rendered less digestible.

It does not follow, however, of necessity from these facts that a given plant should be harvested as early as possible. The total yield of digestible nutrients is of more importance than percentage composition and digestible co-efficients. It has been found by careful experiment that the largest yield of digestible nutrients is not obtained by repeated cuttings of a forage plant. The important practical point is to harvest the crops when there is the maximum of digestible nutrients. On the whole probably the best time to cut most of the plants used for forage, whether to be fed green or to be cured and fed as hay, is when they are in full bloom. If cut much before this there will be a loss in yield per acre, and if allowed to stand much later than this the deterioration in quality is greater than the increase in quantity.

Influence of Weather in Different Years.—Crops grown upon the same soil in different years, even when supplied with the same fertilizers, differ greatly in composition from year to year. As would be expected the crops also differ very considerably in digestibility. This is largely due to the weather and conditions outside of the control of the grower, and hence does not need consideration except as it is of importance in estimating the value of a feeding stuff.

Influence of Long Keeping.—Many experiments agree in showing that keeping impairs the value of a fodder, rendering it less digestible. There is a loss in dry matter due to the loss of leaves, etc. The "dust" that is always in hay indicates that a loss is taking place. In addition to this there is probably a loss of dry matter going on even when the hay is so kept that a mechanical loss is impossible. Samples of hay stored in our laboratory have lost from two to five per cent of dry matter. This loss is important, and taken in connection with the impaired digestibility points out the disadvantage of keeping over hay from one year to another.



"Flying Fox Victor," champion two-year-old bull, 1904, by the $7500.00 "Flying Fox." Property of Elm Hill Farm, Cumberland Center.

INFLUENCE OF CONCENTRATED FOODS UPON THE DIGESTIBILITY OF COARSE FODDERS.

Influence of Protein upon Digestibility of a Fodder.—The addition of an easily digestible substance, rich in protein, as gluten meal, leaves the digestibility of the coarse fodder unchanged.

Influence of the Addition of Oil or Fat upon Total Digestibility.—The addition of small quantities of oil, seven to ten ounces per day to 1,000 pounds of live weight, produced no depression, but on the contrary, seemed to increase the digestibility of all nutrients, even including the fat. Larger quantities than the above, however, have a depression upon the total digestibility. If the oil is not separated, that is, not fed by itself, but fed in the form of oil cake or meal (as linseed meal, etc.,) sixteen to eighteen ounces per day per 1,000 pounds live weight may be fed to advantage.

Influence of Addition of Carbohydrates, as Sugar, Starch, etc., upon the Digestibility of Fodders.—A considerable addition of carbohydrates, sugar or starch, produces a depression upon the digestibility of the other food. In general, it follows that the addition of the pure carbohydrates in quantity equal to ten per cent or more of the dry substance of the food, produces depression in the digestibility. Especially is this true in the case of the protein and fiber. Starch produces greater depression than carbohydrates which are soluble in water, as, for example, sugar. The addition of a fodder rich in nitrogen-free extracts produces about the same effect as starch. So long as the nutritive ratio is under one to eight the carbohydrates themselves are not affected. If over one to eight some of the carbohydrates escape digestion.

Influence of Addition of Roots and Potatoes upon the Digestibility of Coarse Fodders.—If the dry substance of the roots is not more than fifteen per cent of the total dry matter and the nutritive ratio is not greater than one to eight, no depression in the digestibility follows. The addition of a food rich in nitrogen at the same time as the roots, makes it possible to add much more than fifteen per cent of roots or tubers without affecting the digestibility of the food. Above fifteen per cent with nutritive ratio greater than one to eight, the digestibility is reduced the same as when carbohydrates are used.

CLASSES OF CATTLE FOODS.

The numerous and ever increasing number of materials used for feeding animals can be readily grouped in two general classes; the coarse fodders, including ordinary fodder plants, green or dry, and roots and tubers, and the concentrated fodders, as the seeds and grains, milling products and the refuses. The forage plants of the greatest value belong for the most part to two great botanical families; the legumes, which include the clover, alfalfa, peas, lupines, vetches and beans; and the grasses, which include all the English grasses and the grains. The roots for the most part belong to the mustard family, and rape, which is coming to be used considerably as a green fodder, also belongs to this family.

Valuable as are the ordinary grasses, on many accounts the legumes are still more valuable for feeding and manure. Among the reasons that legumes are specially valuable are:

They contain large proportions of protein, which serves to form blood, muscle, bone and milk. As for instance, hay from our ordinary grasses carries from four to six per cent of protein, while hay from clover or soy beans will carry eight per cent or more.

Plants of the clover family respond readily to the application of mineral fertilizer. The plants of the clover family have the ability to acquire atmospheric nitrogen and on this account can be grown without the more expensive fertilizers.

The manurial value of the legumes depends upon the large amount of plant food in both the tops and the roots. When the crop is fed four-fifths or more of the nitrogen and a still larger proportion of the mineral fertilizer constituents go into the excrement and if these are preserved make a very rich manure. If the crop is plowed under, this plant food including that acquired from the air and that gathered from the subsoil, is left for the use of succeeding crops. When the crop is removed the roots and stubble with their large amounts of fertilizing material still remain to be plowed in and enrich the land.

GREEN FODDERS FOR SOILING CROPS.

The production of green crops as a supplement to or substitute for pasture is a practice essential to the highest success on many farms. There are few New England farms that can be relied upon to offer grazing in August and September sufficient in quantity and quality to maintain a satisfactory milk flow. Doubtless on many farms soiling can be substituted entirely for grazing to advantage. On the farms with upland rocky pastures in which native grasses of high quality grow, soiling may not be called for, but wherever the conditions call for intensive farming, grazing on permanent pastures cannot be a part of such practice.

Much more feed can be produced on a given area by soiling than by pasturage. Furthermore, grazing is wasteful because of the imperfect use of the growth that is made. Much grass is tramped down and fouled. The matter of fencing which is saved by soiling is also an important item in farm economy. If soiling is to be practiced to help out pasturage during the late summer or early fall, a limited number of crops will meet the demand. Three or four sowings of peas and oats in late May and early June and two plantings of corn a fortnight apart, would usually furnish sufficient green food when it is most likely to be needed for the Maine farmer.

SILAGE.

In the neighborhood of twenty-five years ago this process of preserving green crops was introduced into the United States. At first the silo met with considerable opposition from the more conservative, but now it is unquestioned that it is usually the most economical way of handling certain fall crops, more particularly Indian corn. Many farmers have gone so far as to feed silage the year round; certainly there are some reasons why this is more advisable than growing soiling crops, for soiling has the disadvantage of harvesting in small quantities, which is always more expensive than harvesting on a larger scale. There has been considerable discussion and experimenting as to the relative losses in the ordinary method of curing corn fodder and the losses which take place in the silo. The results of these experiments seem to show that there is about as much loss in one case as in the other. Silage has the enormous advantage over field curing of furnishing succulent food throughout the winter months. Corn, oats and peas sown together, and clover and cow peas, include the plants that can be well made into silage. Abundant experiments have shown that silage made from corn well in the dough stage contains larger amounts of digestible matter than if harvested earlier. It follows from this that the variety of corn to be grown for silage must be one which would in ordinary seasons mature. Experiments at the Maine Experiment Station indicated that it would take 180 pounds of immature Southern corn to equal 100 pounds from the silage made from mature field corn.

CURED FODDERS AND HAYS.

In general it is true that the maximum quantity of dried matter is secured when crops are allowed to fully mature and ripen. But legumes such as clover are an apparent exception to this, because when at maturity the leaves rattle off and are lost during the process of curing. It, however, does not follow that because the crop increases in the yield of dried matter the nutritive value has proportionately increased. The change in texture and in composition of the dried substance sometimes renders it less digestible and this may more or less offset the greater yield. In the ordinary English hay this is the case. The dried matter of matured grass contains a much larger proportion of fiber than the immature. The fiber is not only quite indigestible of itself but it reduces the digestibility of the other food constituents. For example, three American digestion experiments with timothy hay cut in full bloom showed an average digestibility of 62 per cent, while hay from the same fields cut when past bloom had a digestibility of only 55 per cent. The increasing yield with the mature hay showed that there was practically the same amount of digestible dried matter in both the early and the late cut, but the early cut was much more palatable, which gave it added feeding value.

While early cutting should be the rule with the ordinary grasses used for hay, it does not follow with Indian corn.

Mature corn contains less fiber and more soluble carbohydrates than immature corn, and as is well known the dried matter in corn continues to increase until the corn is mature. Hence, for palatability, digestibility and yield it is advisable to allow corn to mature before harvesting; and this is equally true however the corn is to be cured, as fodder or made into silage. The advantage of the clovers and rowen hay as a source of protein is very evident since they have about double the digestible protein found in ordinary grasses when made into silage.

OATS AS HAY.

It is quite a common practice with many farmers to harvest oats before the grain is mature and cure them for coarse fodder. This is a very desirable plan to follow at times when the hay crop is short, or in localities where the land is badly infested with noxious weeds like the Canada thistle or wild mustard, both of which should be cut before they seed.

The oat plant, however, is not an ideal one for making hay. The stalks are hollow, coarse and hard, and unless dried very quickly in a bright sun they become bleached, even when cut green, so that they look little better than straw. To cure the crop in its best condition and retain its bright green color and palatability, it should be dried in a bright sun for a few hours, with liberal use of the hay tedder when there is a heavy growth; then raked together and the curing completed in the windrow or cock, with as little exposure to moisture as possible. If the weather is unfavorable, as is frequently the case during the latter part of July or first of August when oats are mature enough to cut for hay, they are very liable to be seriously injured and rendered unpalatable.

Oats, however, when not sown too thickly, have an advantage over other plants, which make more desirable hay, of being a fairly good catch crop for seeding to grass, as they mature early enough to allow the young grass to get a good start in the fall, and for this reason are desirable on the farm.

Experiments at the Maine Experiment Station show that oats cut in milk stage contain a great deal more digestible protein than at any other stage of their growth, and also that they contain a maximum amount of digestible dry matter at this stage.

A study also was made of different sections of the oat plant, one of which was the first eight inches of the lower part of the stalk; another, the second eight inches, and the third, the remainder of the plant or top. The bottom section had very little food value; the second section had only about half the protein of the top section and is less digestible. In cutting oats, therefore, for hay it is better to leave a high stubble, for the loss incurred by leaving the coarsest part of the stalks on the ground is more than compensated by the improved quality and palatability of the remainder.

OAT AND PEA HAY.

Oats and peas grown together and harvested when the oats are in the early milk stage make a forage crop very much superior to oats alone for either hay, soiling, or silage. As peas are a leguminous plant they increase the protein of the fodder, and also improve the soil by leaving behind, in their roots and stubble, a part of the nitrogen which they take from the air. By growing the mixture then, both the fodder and the soil are improved, whereas if oats are grown alone a rather poor fodder is obtained and the soil reduced in fertility. This combination makes one of the best soiling crops for feed in July and August before corn or Hungarian is mature enough to cut. If the crop is allowed to mature and the two grains are ground together, the result is a most excellent feed for dairy cows and is much used by Canadian farmers. The chief objection to the material for making hay is that it dries rather slowly. The pea vines are like clover in this respect and should be cured in much the same manner, in the windrow or cock. When well cured without too much exposure to moisture and sun it makes a fodder fully equal to our best English hay. In case of bad weather the silo can be resorted to as a means of curing for the crop, but the material should be run through a silage cutter before ensiling, otherwise it is liable to be poorly preserved.

Oats and peas cut green run through the silage cutter and put into the silo have, at the Maine Station, kept perfectly. At time of feeding they were in a palatable condition and were as well relished by cattle as corn silage.

ROOTS AND TUBERS.

Roots and tubers are advantageous foods because they furnish very palatable, succulent food which may be kept in perfect condition during the entire season. Because of their palatability they have an advantage which cannot be wholly measured by the actual nutrients which they carry. The disadvantage of this class of foods, particularly as compared with silage, is that they are expensive to grow. It is, however, possible to get practically the same yield of digestible dry matter per acre from roots and tubers as from corn.

Potatoes have a greater nutritive value than the roots, but because of their market price and the relatively small amount which can be grown per acre, they cannot usually be fed economically. While they contain considerable protein, much of the protein of the roots and tubers is not in the best nitrogen form. In order to store roots through the winter without loss, they should be kept as near the freezing point as possible and be well ventilated.

BY-PRODUCTS—OFFALS.

The waste materials which are used for cattle feeds are constantly changing as processes of manufacture change. They can however, be grouped into a few distinct classes like the milling offals, the refuses from the manufacture of alcoholic drinks, as brewers' grains, distillers' grains, either wet or dried; the corn refuses from the manufacture of starch and glucose and the oil cakes, whole or ground, such as linseed and cottonseed oil cakes.

All of the milling offals from wheat are important both because of their quality and quantity. In the past it was customary to separate the wheat offals into bran, shorts, middlings, etc., but now the refuses from most mills are run in together and sold under the name of mixed feed. The middlings differ from the bran in containing less of the outer coating and more of the finer parts of the kernels. Red dog flour which is usually used as a food but occasionally as food of man, is on the dividing line between middlings and high grade flour. The bran from the roller mills contains more of digestible protein than did that from the old fashioned process. The refuses from the manufacture of spring wheat average to carry more protein than those from winter wheat, but some lots of winter wheat are more nitrogenous than some spring wheat. Hence chemical analysis is necessary to decide upon the quality of milling refuses and the chemical composition, particularly the protein, of this class of feeding materials should be stated when they are offered for sale. Adulterated mixed feeds are too abundant in the market. There is so much profit in selling ground corn cobs and broom corn at the price of wheat bran that the consumer must ever be on the watch against this fraud. The safest thing is to buy only well known, reliable brands of this class of goods.

The brewers' and distillers' grains contain the major portions of protein, the fat and the mineral matters of the grains used in the manufacture of these beverages. The starches and the sugars for the most part are largely used up in the process of manufacture. These grains are valuable sources of protein and when they can be purchased in good condition at reasonable prices are economic cattle feeds. Certain distillers' grains are now being placed on the market which very closely resemble in chemical composition some of the gluten meals.

The gluten meals and gluten feeds are by-products left in the manufacture of starch from glucose and Indian corn. Corn consists largely of starch. The waste product from the manufacture of starch or sugar is relatively much richer in oil and protein than the corn from which it is made. As at present manufactured the corn oil is largely removed from these wastes so that some gluten meals carry a low percentage of fat. These materials vary within wide limits in composition and in nutritive value as even in the market the starch food is made up mostly of hulls and germs. Gluten meal comes from the flinty portion of the kernel and gluten feed is a manufacture of the hulls and the flinty portion. The hulls are separated by themselves, sometimes known as corn bran and the germ portion after the oil has been pressed out, is called germ oil meal. Differing so greatly as these materials do in composition they should never be purchased except under guaranteed composition; the protein and the fat are two important things to be noted. In none of these milling refuses are the names always safe guides, for the gluten meal of one manufacturer may be the gluten feed of another.

Distillers' grains have been in the Maine markets for two or three years. These resemble in composition and nutritive value the gluten feeds. Feeding tests at the Maine Station show them to be good economical nitrogenous feeds.

Cottonseed meal is a by-product from the manufacture of cottonseed oil. After the cotton has been taken from the seed in the cotton gin, the remaining down or "linters" and the hard black seed coats or hulls are removed by machinery. The remnants of the seed are cooked, and the oil expressed by high pressure. The resulting cottonseed cake is ground into the bright yellow cottonseed meal of commerce. Such a meal carries from 40 to 50 per cent or even more protein.

Sometimes the black hulls are ground with the cake and a dark colored meal of very inferior feeding value is the result. Not all dark colored meal is necessarily adulterated with hulls, but strictly first-class *fresh* cottonseed meal is always bright and yellow.

Linseed is made by grinding flax seed from which the oil has been more or less completely extracted. "Old Process" contains more fat and somewhat less protein than the "New Process" linseed meal. The Cleveland Flax Meal is a linseed meal from which the fat has been thoroughly removed by extraction with naphtha. The naphtha is removed by treatment with steam which leaves a coarse flaky product.

BY-PRODUCTS OF THE OAT.

In the manufacture of oat products for human food, the kernel of the oat is separated from the hull. Oat hulls are in themselves low in food value, being worth but little more than the same weight of oat straw. Their value may be materially greater if broken kernels or small oats are ground in with them. Manufacturers of oat products are putting ground oat hulls on the market in many forms and mixtures, such as oat feed, oat chop, corn and oat feed, chop, etc. The bulk of all these materials is ground oat hulls, with admixtures of oat kernels, ground corn, etc. The feeding value of them is variable, and they should never be bought except on a guaranteed composition, and then it should be remembered that the oat hulls are not as digestible as the kernel of oats or other grains. Unscrupulous dealers frequently sell "oat feeds" as ground oats, the unsuspecting buyer thinking he is getting the whole oat meal, which is much more valuable than most oat feeds.

The various oat feeds, corn chops and corn and oat feeds are largely sold—usually under guarantees, to a large extent. Some of these are the straight refuse from the manufacture of oat meal and others, like the H-O Company's goods, are mixtures of such refuse with other by-products of higher protein content. With a few exceptions they are well up to their respective guarantees and no fault can be found with the manufacturers for their desire to sell these goods, as they are making no claims for nutrients which the goods do not contain. Some oat feeds such as Viking Dairy Feed have a feeding value about equal to ground oat straw. The intelligent buyer of feeding stuffs, who has his barns well filled with hay, corn fodder and silage, will have very little use for these feeds low in protein content.

FEEDS LOW IN PROTEIN.

Very few farmers can afford to buy feeds low in protein and high in carbohydrates at any price at which they have been or are likely to be offered. The farmer should grow all the coarse feeds that he needs. Oat and similar feeds are very much like corn stalks or oat straw in composition. Some of these feeds have cottonseed or other nitrogenous feeding stuffs added to them so that they carry more protein than straight oat feeds, but these mixtures are always more expensive sources of protein than are the glutens, cottonseed and linseed meals. One hundred pounds of an ordinary oat feed has from eight to eleven pounds of protein. At seventy-five cents per hundred the protein costs from seven to nine cents a pound. One hundred pounds of a good gluten meal has from thirty-four to forty per cent of protein. At $1.50 per hundred the protein costs about four cents a pound, and it not only costs but half as much per pound as the protein in an oat feed but it is much more digestible. As a source of protein, it would be as good economy to pay $60 a ton for high grade cottonseed meal as to pay $15 a ton for the ordinary oat feed.

MANURIAL VALUE OF FEEDING STUFFS.

The economical user of concentrated feeds must take their manurial value into account in its purchase. Cottonseed meal with its high manurial value is a cheaper food than gluten meal at the same price. Time will not permit me to go into the discussion of this subject.

CONCLUSION.

The wise cattle feeder will grow upon his own land the largest possible amount of the food that he is to feed. He will grow as much of the nitrogenous feeds, the clovers, peas, etc. as possible, but the corn plant will be his main dependence for succulent winter food. Under favorable circumstances he may grow enough to carry his stock advantageously through the winter, but for the most part the home grown foods must be supplemented from the market. To do this most economically the man who has sufficient hay and silage for his animals will usually need to lay special stress on the protein content of the feeding stuffs that he is to buy. While protein is not the sole measure of a food material, for his purpose he can consider it as such, for he goes to the market not to buy starch and sugar but to obtain the nitrogenous materials needed to balance his ration. Hence he will have little use for low grade oat feeds; he will buy bran chiefly because it will furnish needed mineral matter, and he will buy more largely of the gluten, the oil meals, distillers' grains and other materials high in protein. Which of these that he purchases will be largely determined by the market price. Under ordinary conditions he will probably find cottonseed meal to be the cheapest source of digestible protein, particularly when its high manurial value is taken into account.

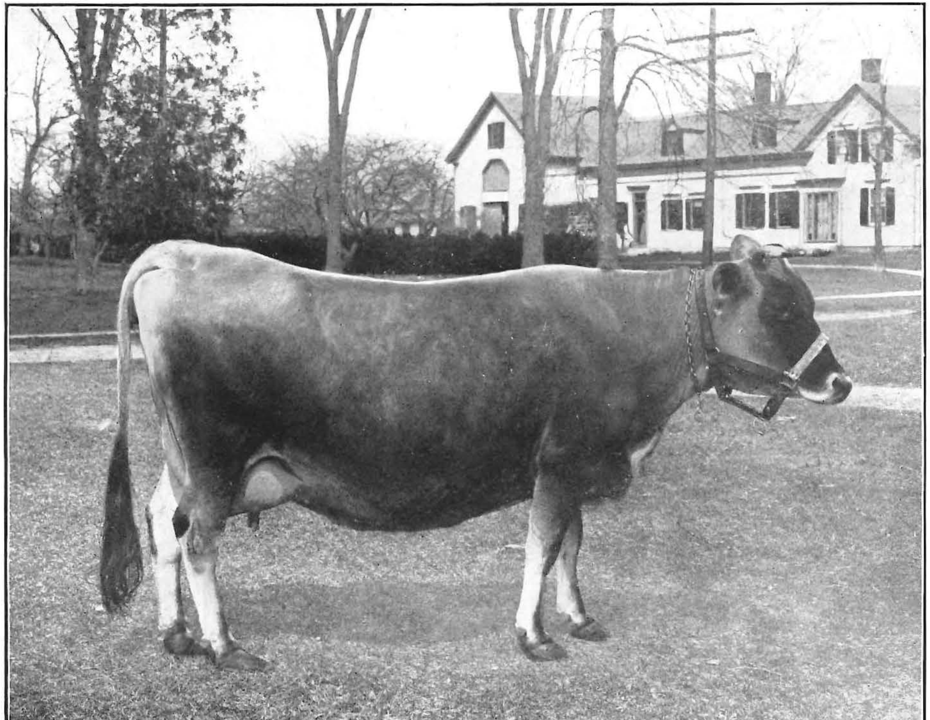
MAINE'S DAIRY INTEREST AND MAINE'S INTEREST IN DAIRYING.

By Hon. J. A. ROBERTS, Norway.

(Stenographic Copy.)

The subject assigned me for discussion this afternoon is Maine's dairy interests and the interest Maine should have in dairying, or the attitude the State should assume toward the interest we have under discussion today. Maine is not what we call a boom State. Its growth in population and wealth and the development of its resources, which are really very great, have been slow; nevertheless growth and development have been constant, and therefore healthful. I remark again that the undeveloped resources of the Pine Tree State are far greater than many of us have been in the habit of according to her. And in passing we might remark that at some future meeting of this association it might be profitable to discuss and call to the attention of this and neighboring states our great undeveloped resources, and show more clearly the possibilities that lie right about us for productive investment and a remunerative employment of labor.

The development of our industry, while it may seem slow as compared to the rapid strides made in some other states, nevertheless has been gaining constantly in the number, quality and productive power of the animals used in the business, in a superior knowledge of the breeding, feeding and care of dairy animals, in the practice of better and cleaner methods, in an enlarged use of lately invented dairy machinery, in the more satisfactory management of our creameries, and the better care of the cream by the producer, leading to a more harmonious feeling between producer and manufacturer, in a better appreciation of the fact that right at our doors lies the best market of the world for all the milk, cream, butter, pork and veal that we can produce, and the appreciation of the fact that the most profit comes to him who is the most careful and painstaking in fitting and preparing these products for the market. And this opportunity which now lies within our reach to put ourselves into a



"Brenda's J. B. Daisy:" Test 18 lbs. 11oz; over 10,000 lbs. milk in one year. Property of Elm Hill Farm, Cumberland Center.

position to produce more goods and better goods is the central idea which should dominate the action of this association, and of every true dairyman who is striving to cause Maine to reach and maintain that position among the dairy states of the Union which she ought to occupy.

Speaking of the present standing of Maine as a dairy State: comparing the year 1894 with the year 1903, the latest figures which we can use, we find that there has been an increase in the number of cows of upwards of 18,000, or a little over 13%, an increase in the number of three-year-olds of 22 1-5%, in the number of two-year-olds of 21 1-5%, and in the number of one-year-olds of 72 1-5%, and an increase in the number of sires of 13%. So we see the progress in the number of animals kept for dairy purposes has been constant and continuous in all these later days, and that the increase is gaining more rapidly year by year. If I could give you the figures that will come out in the next report of the State assessors, it would show that the increase in the number of cows this year over last year is more than that for any year for a number of years. I am not far out of the way when I say that the number of milk producing animals in the State today is about 225,000, and that their product is worth in the vicinity of ten or twelve million dollars. This industry is not centered in any one locality. It is distributed throughout our whole State, in every county and in every town, and that distribution is pretty even if you consider alone the number of animals engaged in the work. We may remark in going along that certain communities and certain sections have been devoting more attention to the dairy business in the last few years, and making it a specialty; and in those communities we find not only that there are more dairy animals, but also that those animals are of superior merit, and that blooded stock, especially males, have been introduced to quite a large extent, thus improving the herds, so that such communities are turning out not only a larger product per cow, but a product that commands the highest price in the market.

The dairy industry of our State is yet small. It is in its infancy, but there is plenty of room for growth. Instead of having less than a quarter of a million of cows we ought to have, upon the farms of the State, at least half a million. And if we had half a million cows, with an increase of 25% product per cow, it would bring to us an additional revenue of fifteen millions of dollars annually. Some may object that we have not the feed, but when we stop to consider the case we recognize the fact at once that there are not in this State, I dare say, one thousand acres of land that have been brought up to their full capacity of production. There are thousands and thousands of acres of land that might be made to bear, not two blades of grass but a dozen blades of grass, or even more, where they are now bearing one; and there are thousands and thousands of acres distributed all over the State that are almost, and some of them wholly, idle that might be brought to bear large quantities of forage. There is no disputing the fact that our State has the capacity of carrying not only half a million of cows, but even a million of cows in process of time. Double the number of cows and increase the product, as I said, by 25%, and you add annually to our farm revenues fifteen millions of dollars. So much more money to be divided up among the farm workers, so much more to go into the channels of business, so much more to go into the savings banks, into new factories, new stores and new dwellings. So much more to be added to the prosperity and added to the pockets of our people; and all the way along increasing the demand for more men and more women as workers, and thus directing thitherward the people of other states and adding to our population, and still further increasing the consuming capacity of our people.

My friends, the State is vitally interested in this industry of ours. It is interested in it in more than one way. The food products coming from the cow are among the choicest and most healthful known to man. Milk, cream, cheese and butter and the meat products coming from feeding the waste products all contain a high nutritive value. To encourage the production of these articles of food in sufficient quantities to feed our own people and leave a good margin for export to other states is certainly a wise policy for our State to pursue. Again, the productive capacity of the soil has a far reaching effect upon the welfare of a people, not only upon their financial welfare, but upon their intellectual and moral welfare. Decadence and degeneracy surely follow upon a depleted soil. The soil feeds the brain that rules the world. There is a strong and direct relationship between the soil and its occupant. An impoverished soil will not produce a race of strong men. On this ground it would seem to be the duty of the State to encourage an industry like the dairy industry that tends to maintain and enhance the fertility of the soil of the State. To strip our State of the large areas of timber and wood, and at the same time make no provision for a new growth, would bring upon our people an overwhelming calamity. Our fields, too, may be stripped of their fertility and their productive power diminished year by year until the point is reached when there is no longer any profit in tilling them. Such a condition would be an overwhelming loss to our people. Agriculture would no longer thrive. Our people would be led away from the country toward the city and toward other states. Population would diminish. Other industries would languish, and the State would go to decay. No, the true policy of the State is to encourage an industry that constantly adds fertility to the soil, increasing its capital, producing food, enhancing its value and desirability, and attracting to it men and women with strong arms and noble purposes.

There are two things especially, in our State, that need protection from spoliation at the hands of the ruthless and the selfish, and those are our forests and our soil. The pioneer generation of the State sold from their land crops of grain, hay and potatoes, year after year, making little return to the land of those elements necessary to the growth of the crops removed; so the time came when the larger part of the available fertility had been used up. The land became impoverished and the youth began to move toward the cities. The present generation has been struggling to restore the land to its former productiveness, and in many sections has succeeded in doing this, and the dairy cow has been a very faithful ally in this noble work. Anyone with limited means, who has been through the struggle of bringing up an impoverished farm, appreciates full well the importance of always maintaining the soil of our State in a fertile condition. And I might remark in passing that he who insidiously advocates the substitution of imported chemicals in place of the dairy cow as an easier and better way of maintaining and increasing the fertility of our soil, better be brought before the bar of actual experience and show cause why an injunction should not be placed on his teachings.

But the State is interested in our business in another way. The man who is successful in the management of a herd of cows is of more than ordinary intelligence. The business affords him a training that develops the mind as well as the muscles. It teaches him prudence, carefulness, diligence, gentleness, love and respect for animals. He becomes a thinker and studies the ways of nature and the methods of the business world. He appreciates the value and need of good and active citizenship. He encourages education, favors measures beneficial and helpful to the community, supports the laws and their enforcement, and pays more than his share of the public burdens as a rule. Of all occupations in the world, and of all lines of farm work, there is none requiring the exercise of greater intelligence, skill, foresight, patience, application and persistence than dairying. Its tendency is to make men of sterling character and strong individuality. Living in the open country, their minds are broadened out to grasp the ideas of the whole world. Our State is mightily interested in its citizenship. It wants citizens of character, and it seems to me that the enlightened legislature of today will seek to stem the tide that sweeps toward the city—that streams from the country to the city—and turn it back to the healthful fields and the law loving and the law abiding country.

Can you think of an industry whose encouragement will bring back so many good returns to the State as the dairy business? And, my friends, if there were time I would carry this further, but I am aware the time is limited. I wish to speak briefly of two things. I will confine myself to two needs the dairy industry has in the State today. And the first, it seems to me, is the need of statistics. At the present time we have nothing in this State except what is gathered from the local assessors in their returns to the State assessors. We can determine pretty accurately the number of dairy animals in the State; but you people who speak on the platform say the man in the dairy business must keep an account of his business in order that he may know what he is doing, and I believe it is just as true that the State should keep an account of its dairy business, and also that it should make an enumeration at least once in two years of not only the number of animals engaged in this business, but of their product and its value, and that becoming known to us would be very helpful in legislation for the industry. Now this might be done with small expense by the local assessors in their annual rounds, taking the valuation.

Again, there should be a deeper and more wide-spread sentiment, especially among the young, in favor of giving themselves a special training for this work. We have established an agricultural college for this very purpose. We have fitted it up with an expensive plant. The nation and the State have put their money into this institution, and it says to the boys and to the men who are engaged in dairying, "Come here and we will give you instruction such as you need." Now I wish there was among our farmers a more positive sentiment in favor of such instruction, and a more positive support of this institution, which will lead them to go there themselves and to send their boys who are to be their successors in the dairy business. If ten men from each county would take a dairy course in the college this winter (there ought to be as many as that) and ten other men the next winter, and so on for ten years, we believe at the close of that period of time the standard of our dairy interests would be elevated fifty per cent and the business largely extended. A man possessed of intelligent ideas, fired with enthusiasm and a desire to excel, who has had the training, when set down upon one of our farms is like a light set for the whole community. This association will never do too much in the encouraging of men upon the dairy farms to make a special study of the principles and best practices at some institution where they can sit at the feet of those who are well qualified to instruct them.

Just one minute more! Our State appropriates money for institute work, but under the best managed conditions there can be but two or three institutes in one county each year. Only a small portion of our people are reached by these institutes in any one year, and it seems to me that if we believe in this idea that is exhibited in this meeting, if we believe in instruction for ourselves and come here for that purpose, we ought to be willing to advocate measures that will bring this instruction home to all the people of the State, for it is those who are not here that need it most.

COMMON SENSE METHODS.

By P. M. HARWOOD, Boston, Mass.

I feel I ought to know you here. It is always a pleasure for me to come to Maine and meet the good people of this State. I always gain both inspiration and information, therefore go home wiser and more hopeful for having come. I was invited here for purposes of conference, and I did not expect or intend to make anything in the nature of a public address, so what I say will have to be purely extemporaneous.

I will just allude to a little incident that occurred last night. I was sitting at the table and was taking some of that butter, that most excellent article which won first prize, when a gentleman near me said that if that butter was in Massachusetts it would be sold as Vermont butter, and bring two cents a pound more than it would under the name of Maine butter. I felt that in that remark there was a little criticism, and I think I have noticed here in Maine before that there is a feeling that such things actually occur up in Massachusetts. Perhaps they do and perhaps they do not. But in any event such remarks appear to me to praise and thus advertise the Vermont article.

Speaking of that makes me think of some notable things I have met in connection with the Vermont "trade mark." It seems to be used all over the United States. Ever since I can remember "Vermont" has been considered the best maple sugar in the eastern market. In the middle west the "Vermont" trade mark means the poorest sugar, usually adulterated. "Ohio" or "Michigan" sugar stands better. The other day when I went down to the exposition at St. Louis I met two excellent ladies from Massachusetts, and they suggested to me the best place to get something to eat. They said: "Mr. Harwood, you are from New England, and if you want to get a good New England dinner and some choice Vermont butter, just go down to the Vermont building." I went there, and what did I find? And by the way, about the buildings there,—I have heard criticism here in Maine about the Maine building, but I want to tell you for your information that from people outside the State of Maine I didn't hear but one building among all the state buildings praised more than the Maine building. We are sometimes inclined to look a little beyond for something good when in reality it is pretty near home. I think the Washington building, perhaps, was the most unique, but next to it, from that standpoint, the Maine building seemed to be receiving the praise of people outside of Maine. It was something out of the ordinary.

But I went to that Vermont house and found one of the cheapest constructed houses, perhaps the cheapest, on the ground in the way of a state building, and it was almost devoid of any contents of interest. There possibly might have been some care taker, although I didn't see him. He had stepped out, I guess, when I was there. But the Vermont idea of getting ahead in the world was manifest. That building had been rented, or at least the ell part of it, to two southern parties for use as a restaurant. There were two restaurants there, I suppose in order to get double rental. And those southerners were furnishing Vermont New England dinners, southern cooked of course, and the delicious "Vermont" butter proved to be an excellent quality of oleomargarine.

I thought that was interesting. I have sometimes found a little oleomargarine in Maine, but I do find here a good deal of butter that is of excellent quality, and I find cream also that is first-class. You send a large quantity of cream to Massachusetts, and we are glad that you do, because you send us cream that keeps well and we need it. You have right here in this city one of the largest cream-producing plants in the world. The product of that creamery goes to Boston; but the idea of making wooden nutmegs doesn't belong wholly to Connecticut, because you send us your pasteurized skim-milk and pasteurized cream, which are put together in that enterprising city and thus made into standard milk.

A neighbor of yours gave me some cream for dinner today,—cream that was three or four days old,—gave me also some to take home, and assured me that it would keep until next Sunday, when I shall use it on my table in central Massachusetts at my Sunday dinner,—cream that was not prepared in any way other than by adopting the most cleanly method.* Ideal cream! I

* Mr. Harwood reports that the last of this cream was consumed on Thursday of the following week and was at that time of consumption still in perfect condition.

spoke last night about the influence of the woman behind the man. Now the gentleman who gave me this cream says his sister is as much, or more, responsible for the cleanly habits in that dairy than he is himself. And I was glad to get that illustration of the truth I believe I uttered last night. Now, if the men and women work hand in hand to produce a more cleanly product, that is what we want. For after all cream produced under conditions of cleanliness, is the only ideal article.

The idea of common sense has been brought out here several times. It is a practical application of knowledge. I will relate two or three instances that have recently come to my attention. A year ago a gentleman from Massachusetts addressed you, you will remember him. He is one of our best farmers, does a great business and is a great man. He told his own story. We also have others, younger men of whom we are also proud. One comes to my mind now, a man almost unheard of outside of his own neighborhood, a former student in the Institute of Technology. He studied engineering, and had to give it up on account of his health. He went to farming, and I want to show you just what common sense, knowledge and a little book-keeping will do for a man. That young man acquired the habit of figuring and thus keeping track of everything. And he tells me that he doesn't breed his cows. He buys the best producing cow he can find and milks her out, and he has figured it so he can tell just what it costs to keep a cow in that way,—just what the average depreciation is. He says that it is five cents a day, and that the cow doesn't lose him anything, because she gives more than enough milk by not being bred to offset the shrinkage. This he knows from positive figuring. I asked him what breed of cows he kept. "Well," said he, "I keep no particular breed, simply heavy milkers as a rule." I said, "Why don't you keep Jerseys?" "Well," he replied, "there are several reasons. One is that the fat in the milk does not mix readily, and another is that they don't give enough milk." "What do you get for your milk?" "Eight cents a quart." "Why don't you get ten cents like some of your competitors?" He said, "I will tell you why. I can't afford to raise my price. There are two reasons for it. Without going very deeply into figures, you will see that eight times eight are sixty-four, and that ten times five are fifty, and that the cow that gives eight thousand pounds of milk a year as compared with one giving five thousand pounds a year will give an income in that proportion. In other words, she gives enough more milk than the Jersey cow, whose milk sells at ten cents a quart, to more than make up, in the ratio of 50 to 64. Then if I raise the price of my milk two cents a quart, it means that I must double my territory. One man can deliver in the present territory, and I would have to go to the expense of another team if the price was increased." It is not every one who would think of all these things, but this man knows. He figures it for himself.

A neighbor of this gentleman, a graduate of the Massachusetts Agricultural College, is engaged in the business of market gardening. At the time I was called to a professorship in the Michigan Agricultural College he was a candidate for the same position, and he was a little sore because I got it away from him; but he says that today he would not give up his business for the best agricultural professorship in the United States. What has he done? In the last ten years he has developed the business until his gross income today is $15,000 a year, and this within a short distance of Boston on fourteen acres of land. He keeps an account of every hour that his men work, and of what they do. He knows what it costs to grow each crop that is raised on his farm just as the most careful contractor knows what it costs to move earth by the yard, and he can figure on what his crop is going to cost just as accurately as any contractor can on a proposed job. There is another advantage in this method, because when the hired man comes in at night he is asked how long he has been at work on a particular task and he has to tell and is obliged also to tell how much he has accomplished. He knows he is being watched and in consequence is toned up and does more and better work. Not only does this book-keeping show what ought to be expected of a man but it also shows what ought to be expected of horses and gives the knowledge of just how many horses it is necessary to keep. By keeping account very carefully, he is doing a profitable business, so much so that the positions of our college professors who are doing such fine work offer no temptations to him, because he is working for himself and is in an independent position.

I did not think I should speak along this line, but the facts came to me after I took the floor. I thank you for your attention, and you will pardon me for taking at this late hour so much of your time.

REPORT OF STATE DAIRY INSTRUCTOR.

In compliance with the rules formulated by the officers of the Maine Dairymen's Association and the commissioner of agriculture, February 17, I respectfully submit my report for the year ending December 31, 1904.

My work for the year began February 15, when I returned from taking the dairy course at the University of Wisconsin. The following is a classified list of the work performed and the amount of time allowed each branch: At the office of the commissioner of Agriculture, 13 days; at my office in Winterport attending to correspondence and making reports, 24 days; attending grange and other farmers' meetings, 27 days; attending farmers' institutes, 19 days; attending fairs, 23 days; attending Dairy Conference and time employed in its interests, 9 days; investigating oleomargarine sales, 14 days; calling on factories and factory operators, 52 days; calling on dairymen and making tests for same, 73 days.

My talks at grange meetings have been along the line of feeding, ventilation, care of product and utensils, and the better selection of cows by the use of scales and the Babcock test. At these meetings I have frequently demonstrated the Babcock test and have tested samples whenever they have been brought in. The work at institutes has been practically the same. The care of the product and the utensils in which it is kept is one of the greatest factors in determining the quality of butter, cheese and cream, and too much cannot be said on this subject, for the time is not far distant when every dairyman will be required to deliver his product in a reasonably perfect condition.

The United States Government is becoming more exacting in its demands for wholesome and clean dairy products, and the great dairy states are going still further in the matter of requiring milk products to be clean and free from disease, and by so doing are improving the quality of their finished products. Those states which succeed in improving the quality the most will succeed in just that same proportion in the value of their products.

I attended the following fairs: Waldo and Penobscot at Monroe, Central Maine at Waterville, Piscataquis County at Foxcroft, Maine State at Lewiston, West Oxford at Fryeburg, Sagadahoc County at Topsham and a grange fair at East North Yarmouth. At five of these fairs I judged the dairy products, at four the dairy stock, and at two I had charge of the butter fat tests. In every class the results were exceedingly gratifying from the standpoint of improvement.

The annual Dairy Conference was held in Auburn December 13, 14 and 15, and was one of the best meetings in the history of the association, both in point of interest shown and number of exhibitors. The average score of butter exhibited was 92.8 which is higher than heretofore, and the highest score, 97½, is also higher than for many years, which is both gratifying and just. Working under direct instructions from the officers of the association I made a personal effort to create an interest in this meeting, and to induce the people to attend and make exhibits.

The use and sale of oleomargarine is causing the dairymen some alarm, and rightly, too, although I fear that in many instances renovated butter is doing more harm than oleomargarine. During the year 75 samples of butter have been taken for suspected violation of the oleomargarine law, in different sections of the State. Out of these samples only three proved to be oleo. So far as we have been able to determine, there is no colored oleo being sold. We find that restaurants are serving oleo to their guests, but in the uncolored state. These, according to the best advice, cannot be prosecuted, so that while considerable quantities are being served in hotels, restaurants and boarding houses, yet we are powerless. I find that many of the best grocers and market men are selling renovated butter, and it seems at present that this is a greater hindrance in our dairy work than oleo, and the State has no law whatever by which to regulate its sale.

It has been reported to me that certain preservatives, generally formaldehyde, have been found in the milk delivered to some of our factories, but at present this matter seems to be well in hand. Certain cities passed ordinances which allowed them to successfully handle the problem, and it has not been found necessary to make prosecutions on the part of the factories. The results of the experiments made by Dr. Wiley in Chicago show formaldehyde to be a menace to public health and it should be dealt with accordingly.

There is considerable dissatisfaction among patrons of factories regarding the test or the method of sampling and testing. While much of this, no doubt, is caused by a lack of knowledge on the part of the patron, and is perhaps a result of allowing the creamery to have the entire responsibility of measuring the value of his product, so many variations occur that in many instances this unrest may be justified. Every one should understand that small variations will occur, even in the same sample, but they should always be small, though one man's sample may vary considerably from one month to another. Creameries should adopt a uniform method of sampling and testing, so that the same sample sent to different creameries will return practically the same result, with only slight variations, and in order to accomplish this the men who do the work both of taking and testing the sample must be exceedingly careful in every step.

The quality of Maine cream and butter is improving. Not only is this apparent from its higher score at our recent Dairy Conference, but from the increased demand for both our butter and cream, so that the danger which many feel that the business will be overdone is so far away that it need give us no uneasiness. Reports from the creameries show an average increase of 10% in the business done over last year.

The dairy butter of the State has always been of two classes,—that made and delivered by dairymen who are making the business a specialty and are expert in handling the product, and that made as a secondary occupation by farmers who have no special market and are keeping but few cows. The former is of excellent quality. There is always a demand for this product, and it brings the highest price. The latter is usually made from cream which has been kept so long that it is not in prime condition, and the business is given inferior skill and attention and cannot be very profitable.

One of the most satisfactory results which I am able to report at this time is the great reduction of defective cream received at our creameries. This is particularly pleasing, because it was the first improvement which this department, in conjunction with the Dairymen's Association, sought to make, and the results are so marked that its history must be interesting. Nearly every creamery has for a long time been receiving defective or sour cream, in amounts varying from 2 to 50 per cent of its product, and while this amount is usually less than 10 per cent, even that quantity is a great source of annoyance and loss, not only to the factory but to the patrons. Either this cream must be kept by itself, handled and churned separately, which is an extra expense, and the butter made is so inferior that it must sell for extremely low prices and at considerable loss, or else this product is allowed to go in with the better grade and soon has caused the whole mass to become inferior and the butter made must be sold at a reduced price. Whichever way it is handled it causes a loss to every patron of the factory, because it reduces the price which the factory receives for its butter, and every reduction in money receipts must make a corresponding reduction in the amounts paid out. The reports received from the creameries for 1904 show a wonderful reduction in this product, 15 reporting that their receipts of defective cream have been reduced 75 per cent, and as many more reporting a reduction of 50 per cent or over. Every report received shows a decrease except one, which shows the same amount as last year. This result has been accomplished by the co-operation of the creamery managers through their association with the department of agriculture and the dairymen's association.

We have within the State a very few persons who are shipping cream direct to customers without pasteurizing, and the prices received are very satisfactory indeed. This business is very profitable, but certain sanitary rules must be adhered to in order to attain success, for if we are to produce a cream or milk that will keep for more than two weeks without any artificial means of preservation it must be free from all bacteria, which can be accomplished only by the utmost care in every branch of the work.

I have tested the milk of over 600 cows during the year, besides many samples of cream and skim-milk. I have found many valuable cows. Much interest is manifested in this branch of the work, many wishing to know just how much butter each cow is producing per day. It is only just to say that Maine dairymen are advancing along all lines, not only in better care of the stock and product but in better selection and more careful breeding, with the idea of producing a better article and securing more profit.

The following are some interesting dairy statistics for Maine: Increase in number of cows reported for 1904, 6,050; total number of milch cows for 1904, 197,297; number of creameries in the State, 67; number of patrons of creameries, 11,055; number of cows furnishing milk or cream to creameries, 71,857; average amount paid each patron per year, $254.75; average number of pounds of butter per cow, 179.4; whole value per cow per year, $49.19; whole value of product of cows used in creameries, $3,534,831.25; whole value of product of all cows at creamery prices, $9,705,039.43.

I will take as a basis for comparison one of the creameries which has kept a record of the defective cream received for the last two years, and which is a factory having an average number of patrons and cows and situated near the center of the State. I find that this factory had an average reduction in defective cream this year, from last year, of 10,500 pounds per month for six months. At an average test of 18 per cent fat this would make 1,890 pounds of butter fat or 2,205 pounds of butter per month, or 13,230 for six months. Taking the same proportion in 45 of the 67 factories, this would amount to 595,350 pounds of buttter which was last year made from defective cream, and this year, by the improvement reported, was made from perfect cream or sold as sweet cream, and it required 2,835,000 pounds of 18 per cent cream to make it. Creamery men advise that butter made from defective cream is not worth as much by five cents per pound as that made from perfect cream. This, for 595,350 pounds would amount to $29,767.50, the money value of the improvement in defective cream from the reports received, as shown by the above figures. Besides this, the quality of Maine butter was improved by the elimination of nearly 300 tons of second quality butter.

In conclusion, I will say that requests have come to me from every branch of dairy work, the manufacturers of dairy butter and cheese and shippers of cream and milk, as well as from the factory patrons and factory managers. I have endeavored to give only such information as I believed was for the betterment of the individual in the particular instance in which my advice was asked, and to be fair and just between buyer and seller, and have used every effort to harmonize their differences and bring them closer together.

I wish to acknowledge the kindness of the creamery managers in giving such information as I have asked from time to time and in co-operating with me in the effort to improve all of Maine's dairy products. And to the dairymen I wish to express my thanks for their cordial reception and evident appreciation of my efforts in their behalf; and to the officers of the Dairymen's Association and the Commissioner of Agriculture for the many kind suggestions which I have received from time to time and which I have endeavored to faithfully carry out.

Respectfully submitted,

S. C. THOMPSON.

EXTRACTS FROM CATTLE COMMISSIONERS' REPORT.

We herewith submit our report closing December 1, 1904, together with an itemized account of all cattle and horses destroyed under provisions of the law of 1887, chapter 177, relating to contagious diseases in this State, and as amended in 1898, chapter 194.

This report will show a large increase in the business done during the year and to show this it would be well to review the work of the board for the last six years briefly. During the years of 1899 and 1900 there were 363 cattle and horses destroyed, costing the State, including expenses, $13,475.55. The appropriation for the two years was $10,000, leaving a deficiency of $3,475.55. During the years of 1901 and 1902, there were 661 cattle and horses destroyed, costing the State, including expenses, $22,435.94. The appropriation for the two years was $15,000, leaving a deficiency of $7,390.83, and these two differences were provided for by the legislature by a special appropriation.

During the years of 1903 and 1904 there were 799 cattle and horses destroyed, costing the State, including expenses, $27,150.53, the appropriation being $21,000, leaving a deficiency of $6,349.91, showing the fact that the commissioners have been decidedly crippled in their finances during the last six years. This state of affairs was no fault of the legislature for the reason that it appropriated the amount recommended by the commissioners and has willingly provided by special act for deficiencies, not disturbing the regular appropriation made for the two years preceding. You will notice the deficiency for year of 1902 was reported to the legislature to be $7,390.83; this amount was provided for by a special appropriation. You will also notice by this report that it was not sufficient to pay the full amount by the sum of $165.67. This overdraft was caused by an error being made in reporting a herd of fourteen cattle to me, destroyed by the commissioners and owned by Mrs. Clara E. Danforth. The report was made out at $275 and should have been $550 gross appraisal, the amount to pay being $275 instead of $137.50, as reported. This error was not discovered until after the money was received.

This accounts for $137.50 of the $165.77 and the remaining $28.17 was a few small bills for burying and disinfecting which was not reported in the deficiency bill, but was justly due the parties who received it. The itemized account was printed in full in the 1902 report and with this explanation we do not think it necessary to reprint it in this report.

The summary of the report shows that there were 231 cattle and 42 horses condemned and destroyed in 1903, and 440 cattle and 86 horses in 1904, total for the two years 799.

The total expense to the State, including all expenses, was $27,150.53. The animals cost upon an average, including expenses, $33.98 each. It cost to condemn and destroy, and disinfect premises and make visits where no cases were found, $11.91 each. The owners receive upon an average $22.07 each. The total expense for the two years was $9,516.91. The three commissioners received for services and expenses $5,118.15, and the veterinarians received for services and expenses $4,398.76. There was $20,000 appropriated for the two years, and $1,000 extra for the expenses incurred in keeping foot and mouth disease out of the State. Out of this amount there was $20,966.29 paid out, leaving on December 1, 1904, $33.71 on hand, and a deficiency created for the amount of $6,349.91. The business is regular and has been done under the same rules and conditions as in 1901 and 1902.

Owners received in 1901 and 1902 $22.60 on an average, 53 cents more than in 1903 and 1904; it cost 61 cents more, upon an average, to do the business in 1903 and 1904 than in 1901 and 1902. This increase was caused by having nearly $1,200 extra expense in dealing with foot and mouth disease and yet we have no cases to report. We should congratulate ourselves when we take into account the trouble and expense all other New England States experienced. With this insidious disease in Massachusetts alone, there were 2,787 animals destroyed, costing the state outside of what the United States Government paid nearly $50,000, and right here let me say that it costs the Massachusetts commissioners $23.09 to condemn and destroy each animal while we do the same in Maine for $11.91 each. It cost the state of Massachusetts in 1903 $92,207.48 to take care of her 196,000 live stock against contagious diseases outside of glanders, while Maine expended only $27,150.53 with a cattle population of nearly 300,000 and scattered over a much larger territory. I only note this as a comparison.

The report shows a rapid increase in the business within the last four years, yet the commissioners cannot say that the increase is caused wholly by there being more disease among our herds. Dairymen and owners of cattle are becoming more educated and more familiar with tuberculosis and realize more fully the importance of having their herds investigated. They have learned that it is far better to lose a few out of a herd than have them remain until the whole herd becomes diseased. There is no profit in a herd of diseased cattle.

Then, again, we have better facilities for finding out the disease. We have more good veterinarians scattered over the State than we had a few years ago, and whenever a farmer has a sick cow or horse he calls the veterinary and if the case is either tuberculosis or glanders the commissioners are notified. Another reason is that farmers have become familiar with the tuberculin test and are not afraid of it as they used to be. They have learned that the use of tuberculin is beyond experiment and are calling on more and more to have their herds tested, and whenever a herd is tested the owner knows just how his herd stands and it puts him in position to keep track of his herd and makes it an easy matter to keep them healthy.

The dairymen of the State have learned that in order to receive popular prices for their dairy products they must place them upon the market above and beyond suspicion as far as purity is concerned. We are expending quite a large amount of money yearly by holding farmers' institutes and dairy conventions in different sections of the State, not only to teach how to manufacture butter, but also to care for and feed our cows. Sanitary conditions are discussed, everything pertaining to the business is harrowed over, and it goes to the consumers as an advertisement of our dairy products, and in order for dairymen to keep in good faith in what they advertise to do, they are calling more upon the cattle commissioners to assist them.

Then, again, the buyers of thoroughbred stock are becoming more particular about putting their good money into high priced stock without knowing whether they are free from disease or not. I can note a number of cases where farmers have bought thoroughbred bulls and raised them, and unconsciously were growing up tuberculous animals, breeding disease not only in their own herd but into their neighbors' herds, and after going to the extra expense and painstaking have suffered the loss of nearly the whole herd.

The manner of doing business has become too expensive and breeders are demanding of the sellers of blooded stock a certificate of health of the animal they wish to purchase and the time has come that whenever a breeder refuses to grant by a tuberculin test the health of the animal he is selling, the buyer goes away without purchasing. There are breeders in the State who are selling their stock under the test. Those that are not are back numbers and practically out of the race.

There is one more reason that in my judgment has had a strong tendency in increasing the work of the cattle commissioners. We should bear in mind that the State has increased in the number of cows within the last fifteen or twenty years, and Maine has become practically a dairy State. We have not only increased our number of cows but we have changed our breeds. We have exchanged our old natives, the Durhams, Devons, and Ayrshires for Jerseys, Holsteins and Guernseys, and to-day they predominate in the State. These first named breeds were noted for their strong constitutions. Strong in limb and lung, they were born and bred in Maine and acclimated to our cold climate, and in 1850, fifty-five years ago, there were 300,000 of these hardy cattle in the State and we knew of no tuberculosis among our herds at that time, and we had no use for cattle commissioners. But about 1880 it commenced to be advocated by practical men that these breeds were not profitable for dairy purposes, and partly out of necessity and partly out of ignorance we commenced to change our breeds and accepted the Jerseys, Holsteins and Guernseys. We not only changed our breeds, but we changed our system of care and feed and sanitary conditions from open barns to closed tie-ups and within the last thirty years we have revolutionized the business. Notwithstanding the fact that the farmers are receiving two and one-half times the yearly revenues that they did before the change we are meeting more obstables to contend with, and in order to keep in good faith with the consumers and live up to what we advertise to do we must do all in our power to keep our herds healthy and in good condition to produce the best dairy products, remembering all the while that the other States in the country are competing against us in this line. They are up against the same proposition and are not sparing pains or money in order to hold their reputation, and in order for us to hold our own and still continue to build up our live stock interest, which is becoming more and more a necessity to the farmers, we must take the same pains. As the pine and spruce disappear from their farms, they are becoming yearly more dependent upon what they produce from the soil. These things seem to establish sufficient reasons why the work of the commissioners has increased within the last few years.

The testing of herds is all done by the owners employing veterinarians themselves, and whenever disease is found the diseased ones are turned over to the commissioners, the State paying for those condemned by the test, the owner paying for the testing of the sound ones. The only record we have showing the percentage of disease in any given number of cattle was reported by Dr. A. C. McDaniels, located in Kezar Falls, in the northern part of York county. His report is as follows: "I have tested during the year of 1904, 556 cattle in the towns of Porter, Parsonsfield, Cornish, Brownfield, Fryeburg and Baldwin. This number consisted of 142 different herds; 15 animals were found diseased, 2.6 per cent." Probably this percentage would correspond with country towns in other sections of the State, yet we are inclined to believe that in the trading centers around the large towns and cities this percentage would be increased somewhat. However, the course taken by the farmers in this part of the State is being adopted by those in other sections and this has a tendency to increase the work of the commissioners.

How the commissioners find the disease: The commissioners have unlimited authority in regard to performing their duties, and any rule made by them with the signature of the Governor becomes a part of the law. The commissioners never hunt after diseased cattle, never order investigation except by verbal or written application. I have one on my desk now which reads thus:

"Dear Sir:—I have a cow in my herd that I have good reason to believe has tuberculosis. Have been told to see you in regard to her, and would like to have you advise me in the matter."

Under the law the commissioners are obliged to answer to such a request, and only by requests similar to this have the commissioners done their work.

More than twice as many horses have been destroyed during the year 1904 as in 1903; 128 in two years is the largest number ever destroyed in any two years. The only reason we can think of for this increase is that other neighboring states are reporting an increase in glanders, and if the disease is increasing in other states there is no reason why it should not increase in Maine, as horses have always been allowed to be shipped into our State from other states without being inspected and no one has ever known whether they were free from glanders or not on arrival.

It would seem as though with Massachusetts destroying nearly 1,000 glandered horses yearly, and New Hampshire and Vermont about the same as Maine, it would be consistent to have a rule that all horses entering the State from other states be examined upon arrival, and if found diseased, returned to the state from which they came or destroyed. This would incur extra expense and without funds sufficient to do the work the commissioners would not dare to make the rule.

Perhaps it would be well to note that as we understand it, all other New England states are doing the work practically the same as we are doing it at the present time. A few years ago the Massachusetts commissioners pushed the business beyond what the people thought to be economical for the state and in the best interest of the stock owners, hence the law was modified and took away the right of the commissioners going into owners' herds and testing without consulting them. The law now is that the tuberculin test can only be used upon cattle shipped into the state, and may be used only by consent of the owners in writing and upon animals which have been condemned as tuberculous upon physical examination. This change brought their work down practically in line with ours. New Hampshire was a bit slow and did not pay much attention to tuberculous animals until within the last two years. They are now more particular in regard to cattle being shipped into their state, and have established a better system in looking after their own herds. The Maine commissioners have kept along in an even tenor, never pushing the business and promptly answering to all applications, endeavoring to establish confidence in the business among the cattle owners. And whenever the farmers have tested their herds and have called upon the commissioners to clean them up, the most gratifying thing about it has been that they have never been called back the second time.

The live stock interest of the State is valued upwards of fourteen million dollars, divided as follows: three hundred thousand cattle valued at about $20.00 each upon an average, total value, six million dollars; horses valued at about six million, and sheep and swine at nearly three million, and still upon the increase. Maine is a seller of cattle and Massachusetts is a buyer, and from twelve to fourteen thousand Maine cattle are sold in Brighton market yearly, bringing a yearly income to the farmers of Maine of upwards of one-half a million dollars. At a fair estimate of two hundred thousand milch cows in the State, bringing to the farmers a gross yearly income of $40.00 each upon an average, the gross yearly income amounts to *eight and one-half million dollars,* besides the income upon young stock and beef stock. This would seem to be a very satisfactory condition of things, notwithstanding the little difficulties we have in keeping our stock healthy, and also shows its importance. We present these figures and suggestions in good faith, believing that it is in the best interest of our live stock interest to keep it healthy and in the interest of those whom we depend upon to purchase and consume our products, as our interests are all mutual, and hoping that the legislature in their wisdom will see fit to provide sufficient funds to meet all expenses, during the two succeeding years, to carry on the work which is prescribed to us by the law governing contagious diseases among cattle and horses.

JOHN M. DEERING, *Secretary.*

OFFICERS OF AGRICULTURAL SOCIETIES.

Name of Society.	President.	P. O. Address.	Secretary.	P. O. Address.	Treasurer.	P. O. Address.
Maine State Agricultural	B. J. Libby	Oakland	J. L. Lowell	Auburn	E. G. Eveleth	Auburn.
Eastern Maine Fair Association	F. O. Beal	Bangor	Ezra L. Sterns	Bangor	S. D. Benson	Bangor.
Maine State Pomological	Z. A. Gilbert	North Greene	D. H. Knowlton	Farmington	Chas. S. Pope	Manchester.
Maine State Poultry and Pet Stock Association	Silas Bartlett	Lewiston	A. L. Merrill	Auburn	Thos. H. Sclater	Auburn.
Androscoggin County	I. B. Clary	Livermore Falls	J. W. Maxwell	Sabattus	W. F. Hutchinson	Livermore Falls.
Aroostook, North	Frank P. Grant	Fort Fairfield	E. T. McGlauflin	Presque Isle	C. H. Richardson	Presque Isle.
Aroostook, Madawaska	Eloi Albert	Up'r Madawaska	Remi A. Daigle	Up'r Madawaska	Alexis K. Cyr	St. David.
Cumberland County	J. L. Robinson	South Windham	C. H. Leighton	Cumberland M'ls	F. D. Scamman	Gorham.
Cumberland, North	Q. M. Chute	Harrison	R. W. Fogg	Harrison	H. Thompson	Harrison.
Cumberland, Farmers' Club	C. A. Merrill	Cumberland C'tr.	A. M. Crocker	Cumberland C'tr.	N. M. Shaw	Cumberland Ct'r.
Cumberland, Bridgton Farmers' and Mechanics' Club	W. S. Hazen	Bridgton	W. E. Crosby	Bridgton	J. S. Ames	Bridgton.
Cumberland, New Gloucester and Danville	E. K. Merrill	R. F. D. 2, Auburn	J. P. Witham	R. F. D. 1, New Gloucester	Geo. W. Haskell	R. F. D. 1, New Gloucester.
Cumberland, Lake View Park Association	Arthur Dyer	Sebago	A. L. Brackett	East Sebago	J. P. Fitch	East Sebago.
Cumberland, Freeport Poultry Association	Willis Snow	Freeport	Geo. P. Coffin	Freeport	L. E. Curtis	Freeport.
Franklin County	J. H. Crowell	Farmington	R. S. Sampson	Farmington	Geo. M. Currier	Farmington.
Franklin, North	D. D. Graffam	Phillips	M. S. Kelley	Phillips	Chas. French	Phillips.
Hancock County	F. P. Merrill	Bluehill	C. S. Snowman	Bluehill	M. P. Hinckley	Bluehill.
Hancock, North	H. T. Silsby	Aurora	J. H. Patten	Amherst	J. H. Patten	Amherst.
Hancock, Eden	D. G. Hall	Eden	Ephraim Alley	Eden	W. L. Alley	Eden.
Kennebec County	John H. Swift	R.F.D.26, Oakland	L. O. Tebbetts	Readfield	C. H. Stevens	Readfield.
Kennebec, South	Geo. A. Moody	Windsorville	A. N. Douglass	R.F.D.9, Gardiner.	Jasper S. Gray	R. 54, Windsorville.
Knox, North	E. E. Thurston	Union	Geo. C. Hawes	South Union	H. L. Grinnell	Union.
Knox, Camden Trotting Park Association	H. M. Bean	Camden	R. L. Bean	Camden	Guy Carleton	Camden.
Lincoln County	A. M. Card	Headtide	B. A. Woodbridge	North Newcastle.	F. M. Rafter	Damariscotta.
Lincoln, Bristol	Joseph Lawler	Bristol	George A. Huston	Damariscotta	C. B. Woodward	Damariscotta.
Oxford County	Wm. J. Wheeler	South Paris	W.O. Frothingh'm	South Paris	W.O. Frothingh'm	South Paris.
Oxford, West	J. A. Farrington	Lovell	B. W. McKeen	Fryeburg	W. R. Tarbox	Fryeburg.

Oxford, North	Sidney F. Abbott	Andover	John F. Talbot	Andover	Joseph H. Abbott	Andover.
Oxford, Androscoggin Valley	Dr. A. L. Stanwood	Rumford Falls	O. M. Richardson	Canton	Dana W. Goding	East Peru.
Oxford, Riverside Park Association	H. S. Hastings	Newry	L. A. Hall	Bethel	E. C. Rowe	Bethel.
Penobscot, West	B. P. Hubbard	Stetson	F. E. Jewett	Exeter	F. E. Jewett	Exeter.
Penobscot, North	S. T. Mallett	South Springfield	B. D. Averill	Prentiss	C. M. Lombard	Springfield.
Penobscot, Orrington	Albert G. Dole	South Brewer	N. A. Nickerson	South Orrington	N. A. Nickerson	South Orrington.
Piscataquis County	W. E. Parsons	Foxcroft	F. W. Leland	Sangerville	C. C. Dunham	Foxcroft.
Sagadahoc County	Wm. S. Rogers	Cathance	Geo. R. Tedford	Topsham	Lyman E. Smith	Brunswick.
Sagadahoc, Richmond Farmers' and Mechanics' Club	U. M. Lancaster	Richmond	Daniel Brown	R.F.D.13 Gardiner	D. W. Alexander	Richmond.
Somerset County	Orlando Walker	Anson	J. F. Withee	Madison	J. F. Withee	Madison.
Somerset, East	J. A. Goodrich	Pittsfield R.F.D.2	E. A. Webber	R.F.D.1, Hartland	Lewis Fish	Hartland.
Somerset, Central	S. W. Gould	Skowhegan	J. P. Clark	Skowhegan	E. D. Packard	Skowhegan.
Somerset, Bingham	George Gordon	Bingham	B. L. Badger	Bingham	Walter Robinson	Bingham.
Waldo County	J. F. Wilson	Belfast	Fred Rackliffe	Belfast	Fred Rackliffe	Belfast.
Waldo, Unity Park Association	Wm. H. Kimball	Burnham	E. T. Reynolds	Unity	E. T. Reynolds	Unity.
Waldo and Penobscot	C. M. Conant	Winterport	C. M. Moore	Winterport	F. L. Palmer	Monroe.
Washington, West	J. E. White	Columbia	E. F. Allen	Columbia Falls	Willis H. Allen	Columbia Falls.
York, Shapleigh and Acton	Zebulon G. Horn	Horn's Mills, N H.	Fred K. Bodwell	Acton	Wm. P. Ferguson	Springvale.
York, Ossipee Valley Union	M. S. Eastman	Cornish	James C. Ayer	Cornish	Wm. H. Pendexter	Cornish.
York, North Berwick	R. H. Hurd	North Berwick	C. M. Boyle	North Berwick	W. F. Neal	North Berwick.

ANALYSIS OF EXHIBITION.

Name of Society.	Number of horses and colts.	Number of thoroughbred bulls and bull calves.	Number of thoroughbred cows, heifers and heifer calves.	Number of grade cows, heifers and heifer calves.	Number of oxen and steers.	Number of animals for beef.	Number of cattle shown in herds.	Total number of neat stock.	Number of sheep.	Number of swine.	Number of poultry (coops).
Maine State Poultry and Pet Stock Association	-	-	-	-	-	-	-	-	-	-	1,000
Androscoggin County	76	24	42	40	56	20	24	206	40	34	90
Aroostook, North	114	18	58	27	4	-	36	107	40	9	67
Aroostook, Madawaska	28	-	-	22	12	3	11	48	27	-	-
Cumberland County	72	25	44	49	188	18	67	391	32	68	24
Cumberland, North	37	7	25	8	60	6	35	141	-	28	14
Cumberland Farmers' Club	31	6	29	28	52	8	28	151	-	-	24
Cumberland, Bridgton Farmers' and Mechanics Asso.	25	12	32	18	34	12	16	124	36	16	26
Cumberland, New Gloucester and Danville	36	7	12	9	20	2	8	48	-	20	14
Cumberland, Lake View Park	-	2	-	4	14	4	-	24	-	1	5
Cumberland, Freeport Poultry Association	-	-	-	-	-	-	-	-	-	-	452
Franklin County	77	12	85	119	160	17	40	408	140	16	38
Franklin, North	50	8	32	44	108	20	36	248	20	22	6
Hancock County	15	6	5	10	40	65	50	176	20	1	10
Hancock, North	17	-	-	20	10	-	-	30	5	2	10
Hancock, Eden	-	-	-	-	-	-	-	33	6	8	6
Kennebec County	42	15	21	40	164	13	39	292	13	30	46
Kennebec, South	43	10	14	16	136	13	15	177	14	-	7
Knox, North	43	6	9	23	92	8	25	163	7	1	18
Knox, Camden Trotting Park Association	-	-	-	-	-	-	-	-	-	-	-
Lincoln County	30	6	8	14	38	5	-	71	6	13	25
Lincoln, Bristol	16	-	-	8	30	-	-	38	4	-	6
Oxford County	63	36	67	102	100	8	36	349	126	15	31
Oxford, Riverside Park Association	21	20	23	21	46	12	40	162	34	16	6
Oxford, West	71	14	49	18	160	12	-	253	17	13	30

Oxford, Androscoggin Valley	12	10	22	11	44	8	14	109	13	1	16
Oxford, North	6	5	18	14	20	4	16	77	28	30	12
Penobscot, West	43	17	28	28	28	2	6	109	2	10	24
Penobscot, North	45	4	16	22	24	15	5	86	14	4	7
Penobscot, Orrington	6	3	12	6	-	-	8	29	17	1	11
Piscataquis County	37	10	32	100	6	-	42	176	4	-	40
Sagadahoc County	53	39	138	127	92	6	90	396	53	41	190
Sagadahoc, Richmond Farmers' and Mechanics' Club	15	1	-	3	10	4	-	18	-	-	12
Somerset County	40	6	12	58	66	20	12	174	126	12	-
Somerset, East	45	7	36	104	12	19	79	147	-	-	26
Somerset, Central	50	7	10	35	56	-	-	108	80	-	23
Somerset, Bingham	27	1	-	6	38	-	-	45	-	10	-
Waldo County	37	9	10	15	40	4	-	78	25	-	26
Waldo, Unity Park Association	18	4	2	15	8	15	20	64	22	39	8
Waldo and Penobscot	72	23	39	45	80	50	92	329	41	2	7
Washington, West	42	12	14	16	14	-	6	62	55	15	36
York, Shapleigh and Acton	6	1	-	14	92	6	-	113	3	2	17
York, Ossipee Valley Union	14	6	12	22	97	4	4	145	22	15	18
York, North Berwick	20	3	-	8	12	-	-	23	-	6	13
Total	1,495	402	956	1,289	2,263	403	900	5,928	1,092	501	2,441

ANALYSIS OF AWARDS.

Name of Society.	Amount of premiums paid trotting bred stallions.	Amount of premiums paid trotting bred brood mares.	Amount of premiums paid draft stock stallions.	Amount of premiums paid draft stock brood mares.	Amount of premiums paid family horses.	Amount of premiums paid gentlemen's drivers.	Amount of premiums paid matched carriage horses.	Amount of premiums paid colts.	Amount of premiums paid horses for draft.
Androscoggin County	$22 00	$9 00	$10 00	$10 00	$9 00	$15 00	$12 00	$54 00	$27 00
Aroostook, North	13 00	5 00	21 00	10 00	34 00	14 00	22 00	47 50	18 00
Aroostook, Madawaska	-	-	-	-	4 00	-	6 00	3 50	4 50
Cumberland County	45 00	31 00	10 00	30 00	10 00	15 00	15 00	20 00	57 00
Cumberland, North	3 00	-	-	6 00	6 00	-	6 00	15 00	70 00
Cumberland Farmers' Club	5 00	3 00	-	-	-	10 00	-	9 00	-
Cumberland, Bridgton Farmers' and Mechanics' Association	18 00	6 00	5 00	5 00	6 00	25 00	7 00	18 00	15 00
Cumberland, New Gloucester and Danville	3 00	5 00	-	5 00	-	5 00	3 00	16 00	28 00
Cumberland, Lake View Park	-	-	-	-	-	-	-	-	-
Cumberland, Freeport Poultry Association	-	-	-	-	-	-	-	-	-
Franklin County	16 50	7 50	4 00	5 00	20 00	20 00	16 00	38 00	40 00
Franklin, North	5 50	4 50	5 75	4 50	5 00	7 00	4 50	7 50	6 00
Hancock County	5 00	-	-	-	-	5 00	2 00	12 00	-
Hancock, North	-	-	-	-	1 00	2 00	2 00	6 25	7 50
Hancock, Eden	-	-	-	-	-	-	-	-	-
Kennebec County	-	31 00	-	18 00	9 00	9 00	3 00	18 00	17 00
Kennebec, South	7 75	4 50	-	-	-	2 50	6 00	30 90	12 50
Knox, North	5 25	3 15	-	3 15	3 15	2 63	3 68	7 26	17 59
Knox, Camden Trotting Park Association	-	-	-	-	-	-	-	-	38 00
Lincoln County	5 00	3 00	-	3 00	3 00	-	-	7 50	8 00
Lincoln, Bristol	-	-	-	-	-	-	-	-	-
Oxford County	48 00	27 00	-	-	-	45 00	25 00	57 00	24 00
Oxford, Riverside Park Association	12 35	31 00	12 35	6 00	-	-	-	4 55	50 00
Oxford, West	12 00	12 00	-	-	-	-	9 00	24 50	35 00

Oxford, Androscoggin Valley	3 00	10 00	-	-	-	5 00	5 00	11 00	51 00
Oxford, North	-	-	3 00	-	-	-	-	7 00	30 00
Penobscot, West	5 50	21 00	3 50	9 00	-	6 00	5 00	7 00	99 00
Penobscot, North	2 50	3 00	2 50	3 00	-	2 50	3 50	18 50	2 50
Penobscot, Orrington	-	-	-	-	-	4 50	-	5 00	-
Piscataquis County	16 00	6 00	13 00	6 00	-	-	-	16 50	36 00
Sagadahoc County	17 00	18 00	6 00	-	-	37 00	-	48 00	26 00
Sagadahoc, Richmond Farmers' and Mechanics' Association	-	75	75	1 25	-	75	-	2 65	-
Somerset County	5 50	4 50	2 00	3 50	4 50	4 50	-	21 00	18 00
Somerset, East	2 00	7 00	3 75	4 50	2 00	-	2 00	9 50	105 75
Somerset, Central	3 00	6 00	3 00	3 00	-	4 50	-	8 50	-
Somerset, Bingham	-	-	-	1 25	1 50	75	-	2 25	20 00
Waldo County	2 00	-	-	-	-	3 00	5 00	4 50	10 00
Waldo and Penobscot	43 00	12 00	6 00	9 00	10 00	12 00	18 00	19 00	63 00
Waldo, Unity Park Association	9 00	6 00	9 00	6 00	6 00	6 00	6 00	6 00	12 00
Washington, West	15 00	7 00	-	9 00	-	75 00	6 00	51 00	28 00
York, Shapleigh and Acton	-	-	-	-	3 50	3 50	-	-	-
York, Ossipee Valley Union	11 00	3 00	-	-	3 00	3 00	3 00	13 00	10 00
York, North Berwick	-	-	-	-	-	-	-	-	-
Total	$360 85	$286 90	$120 60	$161 15	$140 65	$345 13	$195 68	$646 86	$986 34

ANALYSIS OF AWARDS—Continued.

Name of Society.	Amount of premiums paid thoroughbred bulls and bull calves.	Amount of premiums paid thoroughbred cows, heifers and heifer calves.	Amount of premiums paid grade cows, heifers and heifer calves.	Amount of premiums paid herds.	Amount of premiums paid working oxen and steers.	Amount of premiums paid matched oxen and steers.	Amount of premiums paid trained steers.	Amount of premiums paid beef cattle.	Amount of premiums paid town teams.	Amount of premiums paid oxen and steers for draft.
Androscoggin County	$52 00	$80 00	$78 00	$20 00	$29 00	$32 00	$9 00	$19 00	$66 00	$52 00
Aroostook, North	100 00	274 00	22 75	35 00	6 00	-	-	-	-	-
Aroostook, Madawaska	-	-	6 50	4 00	8 00	3 50	2 00	2 00	3 00	6 00
Cumberland County	105 00	104 00	84 00	36 00	31 00	39 00	15 00	22 00	16 00	47 00
Cumberland, North	24 00	9 00	2 50	20 00	6 00	20 50	16 00	6 00	10 00	82 00
Cumberland Farmers' Club	18 00	37 00	21 50	32 00	29 00	13 00	-	9 00	35 00	28 00
Cumberland, Bridgton Farmers' and Mechanics' Association	31 50	75 00	25 00	10 00	12 00	12 00	5 00	6 00	36 00	45 00
Cumberland, New Gloucester and Danville	14 00	23 00	9 50	5 00	2 00	6 50	3 00	2 00	-	6 00
Cumberland, Lake View Park	4 00	-	4 50	-	6 00	-	-	2 00	-	4 00
Cumberland, Freeport Poultry Association	-	-	-	-	-	-	-	-	-	-
Franklin County	67 75	99 75	62 50	57 00	34 50	38 00	3 00	18 50	80 00	50 00
Franklin, North	7 50	21 00	13 80	16 00	5 75	10 25	-	6 25	42 00	6 00
Hancock County	15 00	23 00	50 00	-	18 00	10 00	-	8 00	-	28 00
Hancock, North	-	-	14 35	-	4 75	2 00	-	-	-	-
Hancock, Eden	5 00	-	15 00	5 00	-	-	-	-	-	-
Kennebec County	28 00	30 00	34 00	17 00	30 00	18 00	-	15 00	60 00	40 00
Kennebec, South	22 00	31 25	17 75	11 50	29 25	32 25	11 00	12 25	32 83	15 50
Knox, North	10 24	13 56	17 85	10 50	14 44	11 03	-	3 15	24 15	40 96
Knox, Camden Trotting Park Association	-	-	-	-	-	-	-	-	-	-
Lincoln County	7 50	10 50	12 50	-	9 50	21 00	3 50	6 50	24 00	44 00
Lincoln, Bristol	-	-	7 50	-	-	-	-	-	-	6 50
Oxford County	162 00	173 00	185 00	36 00	118 00	61 00	-	18 00	100 00	121 00
Oxford, Riverside Park Association	131 25	71 00	36 25	94 00	14 25	9 37	3 00	-	24 00	34 00
Oxford, West	40 00	92 00	20 00	-	17 00	25 00	12 00	12 00	74 00	82 00
Oxford, Androscoggin Valley	22 00	39 00	8 50	11 00	26 00	28 00	5 00	9 00	30 00	37 00

Oxford, North	7 75	11 75	15 00	8 00	5 00	12 75	3 75	4 50	4 00	13 00
Penobscot, West	44 00	69 00	48 25	8 00	10 00	30 00	3 00	3 00	-	17 00
Penobscot, North	6 00	10 00	12 00	5 00	-	-	-	-	-	-
Penobscot, Orrington	5 50	11 50	3 25	9 00	-	-	-	-	-	-
Piscataquis County	41 00	38 00	90 75	36 00	7 00	-	-	-	-	-
Sagadahoc County	112 75	227 50	146 00	59 00	64 00	41 25	14 00	12 00	52 00	58 50
Sagadahoc, Richmond Farmers' and Mechanics' Association	30	-	1 25	-	1 45	1 75	50	1 00	-	-
Somerset County	6 00	10 25	31 50	5 00	13 50	16 75	2 50	6 50	19 00	16 00
Somerset, East	24 50	46 50	45 25	49 00	12 50	-	3 50	20 50	-	7 50
Somerset, Central	3 25	9 00	9 75	-	23 50	2 00	-	5 00	-	9 00
Somerset, Bingham	75	-	3 50	-	-	4 25	-	-	-	-
Waldo County	8 00	4 00	5 00	15 00	28 00	5 00	-	5 00	25 00	-
Waldo and Penobscot	70 00	107 00	56 00	118 00	-	39 00	-	74 00	59 00	38 00
Waldo, Unity Park Association	8 25	5 00	26 25	44 00	12 00	6 00	5 00	26 00	-	12 00
Washington, West	71 00	80 00	54 00	10 00	48 00	-	-	-	-	24 00
York, Shapleigh and Acton	1 00	-	10 25	-	6 00	30 75	-	6 00	45 00	11 00
York, Ossipee Valley Union	18 00	23 00	33 00	8 00	51 50	36 50	3 00	8 00	50 00	25 50
York, North Berwick	6 00	-	21 00	10 00	12 00	-	-	-	10 00	-
Total	$1,300 79	1,858 56	1,361 25	804 00	744 89	$618 40	$122 75	$348 15	$920 98	$1,006 46

ANALYSIS OF AWARDS—Concluded.

Name of Society.	Amount of premiums paid sheep.	Amount of premiums paid swine.	Amount of premiums paid poultry.	Amount of premiums paid grain and root crops.	Amount of premiums paid fruit and flowers.	Amount of premiums paid bread and dairy products.	Amount of premiums paid honey, sugar and syrups.	Amount of premiums paid agricultural implements.	Amount of premiums paid household manufactures and needle work.	Amount of premiums paid objects not named above.	Total amount of premiums and gratuities awarded.
Maine State Poultry and Pet Stock Association	-	-	$1,041 15	-	-	-	-	-	-	-	$1,041 15
Androscoggin County	$30 00	$18 00	85 00	$90 00	$75 00	$32 00	$13 00	$15 00	$94 00	$274 00	1,331 00
Aroostook, North	49 00	15 25	55 60	67 50	68 95	8 50	15 75	-	50 10	144 35	1,097 25
Aroostook, Madawaska	6 50	-	-	7 00	-	3 50	-	2 00	10 70	-	82 70
Cumberland County	21 00	12 00	50 00	28 50	25 75	24 00	25 00	-	32 25	13 00	963 50
Cumberland, North	-	18 00	9 50	7 75	4 25	6 00	-	-	20 00	-	367 50
Cumberland Farmers' Club	-	-	11 00	23 45	21 10	10 60	50	-	30 70	32 00	378 85
Cumberland, Bridgton Farmers' & Mechanics' As.	18 00	17 50	14 00	31 75	-	11 50	-	15 00	26 00	37 25	543 50
Cumberland, New Gloucester and Danville	-	11 00	5 75	14 90	18 90	4 15	3 50	-	26 00	45 00	265 20
Cumberland, Lake View Park	-	1 00	2 00	12 50	6 25	3 50	-	-	4 15	-	49 90
Cumberland, Freeport Poultry Association	-	-	401 65	-	-	-	-	-	-	-	401 65
Franklin County	99 50	10 00	27 50	10 25	54 20	14 28	5 00	10 00	5 00	-	913 73
Franklin, North	6 25	4 50	3 00	11 05	12 00	3 25	2 50	3 00	13 50	-	237 85
Hancock County	10 00	2 00	10 00	68 00	28 50	13 00	7 35	-	45 30	-	360 15
Hancock, North	2 00	2 00	4 50	17 80	22 20	2 00	50	-	37 05	7 10	135 00
Hancock, Eden	2 00	5 00	2 00	45 00	37 00	2 00	-	-	4 00	-	122 00
Kennebec County	8 00	14 00	38 00	76 00	102 00	32 50	3 50	-	79 50	6 00	736 50
Kennebec, South	7 00	-	5 90	8 80	20 40	9 55	1 50	-	41 60	-	374 48
Knox, North	4 20	2 10	9 82	15 33	27 83	7 61	19 06	-	43 63	26 36	347 68
Knox, Camden Trotting Park Association	-	-	9 75	3 25	15 75	1 50	10 00	-	8 50	25 00	111 75
Lincoln County	3 50	3 50	10 00	17 00	21 70	6 75	2 00	-	21 75	-	254 70
Lincoln, Bristol	2 50	-	3 75	12 25	6 50	1 00	1 00	-	35 60	9 00	85 60
Oxford County	84 00	25 00	24 60	39 75	67 00	50 75	15 25	7 00	47 45	387 80	1,948 60
Oxford, Riverside Park Association	12 00	11 50	12 50	6 25	8 35	8 55	4 00	-	26 20	150 00	772 72

Oxford, West	15 00	20 00	20 00	20 00	17 50	25 00	5 00	-	23 30	150 00	762 30
Oxford, Androscoggin Valley	5 00	1 00	6 80	12 05	11 20	10 25	1 50	3 00	18 40	58 45	428 15
Oxford, North	14 00	10 00	8 50	10 55	2 00	5 00	2 65	-	15 00	5 00	198 20
Penobscot, West	4 00	6 00	15 00	23 60	22 75	9 60	3 90	-	55 55	29 74	558 39
Penobscot, North	4 75	3 00	7 00	15 00	53 00	7 00	8 00	-	20 00	-	188 75
Penobscot, Orrington	8 50	2 00	4 75	12 50	27 40	1 75	-	-	23 75	8 25	127 65
Piscataquis County	6 00	-	7 25	6 00	20 25	15 50	-	-	15 50	-	376 75
Sagadahoc County	26 50	53 00	135 25	96 25	117 75	70 50	5 75	-	80 00	385 19	1,909 19
Sagadahoc, Richmond Farmers' & Mechanics' As.	-	-	3 60	8 65	9 75	3 65	2 05	-	9 20	6 90	56 20
Somerset County	28 75	1 25	-	5 45	2 75	1 25	-	-	7 65	3 00	240 60
Somerset, East	35 00	-	32 75	15 50	12 25	3 70	1 85	-	18 75	9 30	474 85
Somerset, Central	38 25	-	17 25	9 25	6 00	6 00	-	-	5 75	7 00	179 00
Somerset, Bingham	-	75	-	2 20	60	80	-	-	-	40	39 00
Waldo County	10 00	-	7 00	4 00	11 50	-	-	-	68 00	-	220 00
Waldo and Penobscot	42 00	5 00	11 75	47 45	56 75	23 00	9 50	-	85 50	28 70	1,062 65
Waldo, Unity Park Association	14 25	8 50	1 50	38 00	27 75	10 50	2 25	-	37 00	10 25	360 50
Washington, West	88 00	16 00	37 50	171 50	81 50	30 00	3 25	-	123 10	39 30	1,068 15
York, Shapleigh and Acton	2 25	2 50	12 75	70 00	40 00	13 00	7 00	-	27 75	70 00	362 25
York, Ossipee Valley Union	12 00	8 00	12 00	28 50	40 30	6 25	3 50	-	36 65	3 00	452 70
York, North Berwick	-	3 00	13 00	14 50	6 50	75	-	-	30 00	-	126 75
Total	$719 70	$312 35	$2,190 62	$1,225 03	$1,211 13	$499 99	$185 61	$55 00	$1,413 83	$1,971 34	$22,114 99

FINANCES.

Name of Society.	Amount received from State.	Receipts for membership.	Receipts from loans.	Receipts from entry fees for trotting purses.	Receipts from all other sources.	Total receipts.
Maine State Pomological	$1,000 00	$88 00	$500 00	-	$25 67	$1,613 67
Maine State Poultry and Pet Stock Association	251 53	65 00	-	-	1,473 58	1,790 11
Androscoggin County	500 00	72 00	400 00	$325 00	1,586 00	2,883 00
Aroostook, North	420 51	75 20	-	580 00	4,153 74	5,229 45
Aroostook, Madawaska	30 59	30 00	-	-	23 00	83 59
Cumberland County	277 69	-	-	525 00	4,659 00	5,461 69
Cumberland, North	155 67	10 00	-	-	207 81	373 48
Cumberland Farmers' Club	131 68	19 00	-	173 25	866 55	1,190 48
Cumberland, Bridgton Farmers' and Mechanics' Association	272 38	-	-	232 50	1,377 05	1,881 93
Cumberland, New Gloucester and Danville	81 27	45 00	-	142 00	841 52	1,109 79
Cumberland, Lake View Park	24 28	-	-	19 50	178 73	222 51
Cumberland, Freeport Poultry Association	114 46	13 00	-	192 00	351 05	670 51
Franklin County	432 00	650 00	-	171 00	2,643 53	3,896 53
Franklin, North	91 55	272 00	110 00	130 00	786 23	1,389 78
Hancock County	132 70	-	-	68 50	1,703 34	1,904 54
Hancock, North	44 03	-	-	-	720 70	764 73
Hancock, Eden	34 92	-	-	-	441 08	476 00
Kennebec County	311 14	1 00	-	240 00	1,271 13	1,823 27
Kennebec, South	171 67	20 00	-	100 00	1,321 46	1,613 13
Knox, North	-	-	-	106 08	1,363 86	1,469 94
Knox, Camden Trotting Park Association	-	-	-	-	-	-
Lincoln County	105 97	11 00	-	127 00	1,015 68	1,259 65

Lincoln, Bristol	33 91	1 00	-	-	201 15	236 06
Oxford County	695 98	9 00	-	483 75	3,903 02	5,091 75
Oxford, Riverside Park Association	291 73	-	-	230 00	504 14	1,025 87
Oxford, West	369 90	20 00	-	242 00	5,813 01	6,444 91
Oxford, Androscoggin Valley	152 66	9 00	334 84	581 25	1,481 44	2,559 19
Oxford, North	66 47	-	-	122 50	558 48	747 45
Penobscot, West	308 21	10 00	-	132 50	1,535 75	1,986 46
Penobscot, North	31 10	-	-	-	284 15	315 25
Penobscot, Orrington	42 45	-	-	75 00	656 41	773 86
Piscataquis County	-	106 00	-	31 50	718 62	856 12
Sagadahoc County	662 18	452 00	2,950 00	435 00	5,000 30	9,499 48
Sagadahoc, Richmond Farmers' and Mechanics' Club	27 50	-	-	-	114 50	142 00
Somerset County	70 96	-	-	-	543 49	614 45
Somerset, East	-	-	100 00	400 00	26 75	526 75
Somerset, Central	89 46	40 00	-	175 00	418 85	723 31
Somerset, Bingham	11 37	29 00	-	-	7 50	47 87
Waldo County	69 28	70 00	-	687 50	4,402 43	5,229 21
Waldo and Penobscot	393 63	40 00	-	305 00	3,069 76	3,808 39
Waldo, Unity Park Association	-	-	-	223 75	502 50	726 25
Washington, West	497 73	6 00	147 00	325 00	3,172 02	4,147 75
York, Shapleigh and Acton	137 04	211 00	60 00	-	16 39	424 43
York, Ossipee Valley Union	106 31	-	-	270 00	1,598 78	1,975 09
York, North Berwick	82 96	-	-	121 25	898 42	1,102 63
Total	$8,724 87	$2,374 20	$4,601 84	$7,972 83	$62,438 57	$86,112 31

FINANCES—Concluded.

Name of Society.	Amount expended in improvements.	Amount expended in trotting purses.	Expenses during the fair.	Amount expended for all other purposes.	Total amount paid out including premiums and gratuities.	Value of property belonging to the society.	Amount of liabilities.
Maine State Pomological	-	-	-	-	$1,112 84	-	-
Maine State Poultry and Pet Stock Association	$100 00	-	$382 00	$967 05	2,490 20	$870 00	-
Androscoggin County	200 00	$700 00	570 00	-	2,801 00	1,800 00	$1,200 00
Aroostook, North	700 00	1,400 00	800 00	1,232 10	5,229 35	5,500 00	500 00
Aroostook, Madawaska	-	-	-	-	82 70	-	-
Cumberland County	1,153 43	1,042 50	974 11	957 69	5,091 23	5,000 00	650 00
Cumberland, North	-	-	100 00	-	467 50	2,800 00	-
Cumberland Farmers' Club	65 52	390 00	272 39	196 96	1,303 72	3,000 00	175 00
Cumberland, Bridgton Farmers' and Mechanics' Association	1,550 00	550 00	250 00	60 00	2,953 50	4,000 00	-
Cumberland, New Gloucester and Danville	287 40	405 00	69 85	120 14	1,147 59	2,300 00	155 96
Cumberland, Lake View Park	15 00	108 00	46 50	-	219 40	650 00	-
Cumberland, Freeport Poultry Association	191 00	-	91 63	37 58	721 86	225 00	51 35
Franklin County	401 50	882 50	1,173 07	334 27	3,705 07	10,500 00	-
Franklin, North	50 00	282 50	160 00	637 15	1,367 50	3,847 31	2,598 70
Hancock County	125 00	569 62	618 46	-	1,673 23	5,000 00	-
Hancock, North	-	-	385 81	197 48	718 29	225 00	-
Hancock, Eden	-	-	283 80	59 94	465 74	1,000 00	-
Kennebec County	475 00	600 00	305 00	101 50	2,218 00	3,000 00	1,505 00
Kennebec, South	91 54	520 00	274 55	461 86	1,722 43	2,000 00	-
Knox, North	50 00	420 00	426 64	214 89	1,459 21	2,000 00	500 00
Knox, Camden Trotting Park Association	-	-	-	-	-	-	-
Lincoln County	192 58	500 00	191 91	312 92	1,452 11	2,500 00	275 00
Lincoln, Bristol	-	-	113 00	3 00	201 60	1,200 00	125 00
Oxford County	1,000 00	1,242 50	643 75	100 00	4,934 85	12,000 00	750 00

Oxford, Riverside Park Association	115 00	575 00	219 25	100 00	1,781 97	2,000 00	756 10
Oxford, West	60 00	1,100 00	650 00	3,372 61	5,944 91	10,000 00	3,000 00
Oxford, Androscoggin Valley	200 00	1,275 00	300 00	356 04	2,559 19	3,800 00	3,790 00
Oxford, North	25 00	327 50	75 00	39 45	665 15	2,000 00	-
Penobscot, West	304 54	300 00	498 53	325 00	1,986 46	6,000 00	3,600 00
Penobscot, North	20 00	-	50 00	15 00	273 75	-	-
Penobscot, Orrington	25 00	240 00	192 89	265 38	850 92	1,000 00	50 00
Piscataquis County	50 00	125 00	200 00	-	751 75	-	500 00
Sagadahoc County	1,600 00	1,065 00	1,825 00	3,100 29	9,499 48	7,000 00	2,500 00
Sagadahoc, Richmond Farmers' and Mechanics' Club	13 97	-	8 25	36 50	114 92	100 00	-
Somerset County	-	130 00	113 08	130 00	613 68	1,250 00	30 00
Somerset, East	-	1,000 00	-	-	1,474 85	1,500 00	600 00
Somerset, Central	-	-	450 00	-	629 00	2,500 00	1,300 00
Somerset, Bingham	-	-	6 00	1 25	46 25	-	-
Waldo County	2,499 53	1,450 00	109 43	911 20	5,190 16	6,000 00	1,800 00
Waldo and Penobscot	-	1,013 75	468 31	579 93	3,124 64	2,500 00	-
Waldo, Unity Park Association	-	485 00	156 46	-	1,001 96	275 71	-
Washington, West	50 00	820 00	850 00	1,242 33	4,030 48	2,638 27	978 35
York, Shapleigh and Acton	-	-	11 00	16 85	390 10	2,000 00	-
York, Ossipee Valley Union	184 52	900 00	101 49	276 94	1,915 65	5,000 00	1,389 75
York, North Berwick	-	355 00	355 12	282 91	1,119 78	-	1,000 00
Total	$11,795 53	$20,773 87	$14,772 28	$17,046 21	$87,503 97	$124,981 29	$29,780 21

BULLETINS

PUBLISHED BY THE

Maine Agricultural Experiment Station

IN

1904.

Bulletins 101, 102 and 105 on Inspections, Bulletin 111 on Meteorology and the Treasurer's Report and the newspaper bulletins are not here included.

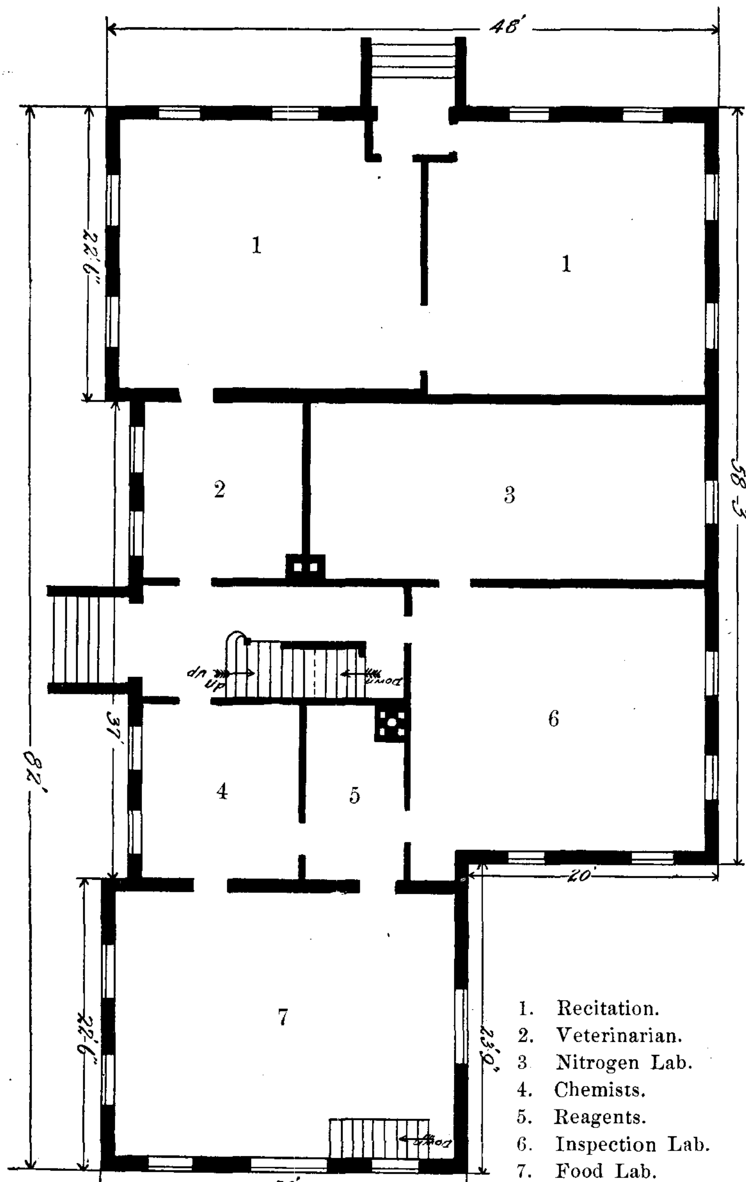
TABLE OF CONTENTS.

HOLMES HALL, 1904.

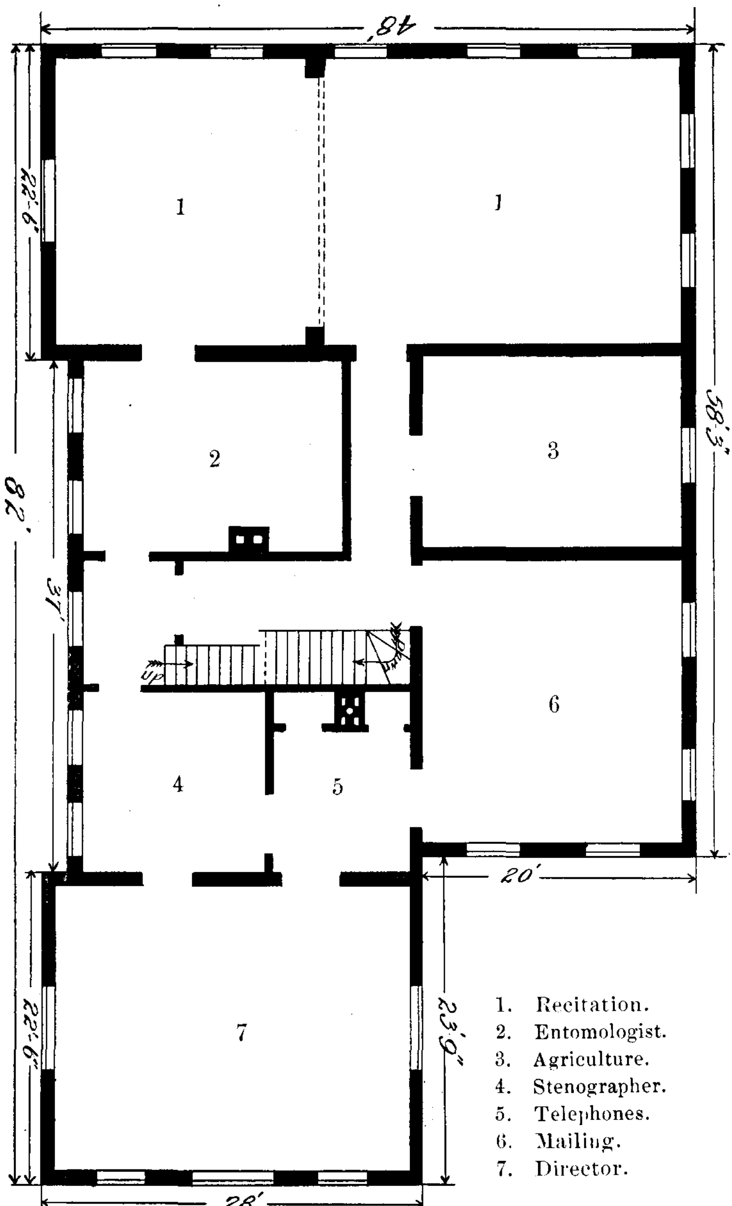
HISTORICAL SKETCH.

The Maine Fertilizer Control and Agricultural Experiment Station was established by the Maine legislature of 1885, which appropriated the sum of $5,000 a year for its maintenance. No provision, however, was made for a building for its accommodation, so the trustees of the State College offered it quarters, although it was established as an independent institution, and the Board of Managers gladly accepted the offer. A laboratory was provided in Fernald Hall and an office in Wingate Hall—the wooden building, since burned, which stood where the present Wingate Hall is located. This State Station was maintained until the passage by Congress of the Hatch Bill in 1887 placed at the disposal of the University the sum of $15,000 annually for the maintenance of an Agricultural Experiment Station, after which it was discontinued.

The increase in the funds available for the support of a station permitted a considerable increase in the staff of investigation, and a consequent increase in its work, which made increased laboratory and office facilities imperative. To meet this demand, it was decided to erect a new building for the exclusive use of the Station, to be located upon the slight elevation to the east of Coburn Hall, one of the very best sites upon the campus. This building was constructed in 1887. It was built of brick with granite trimmings, and was two stories in height, with a one-story ell. In 1899 the building was enlarged by adding a wing to the south side, thus providing much needed space for food laboratories and the director's office. In the latter is placed the greater part of the station library of about 1,700 volumes. The appearance of the building in these two stages of its development is shown in the two illustrations.



HOLMES HALL, FIRST FLOOR PLAN.

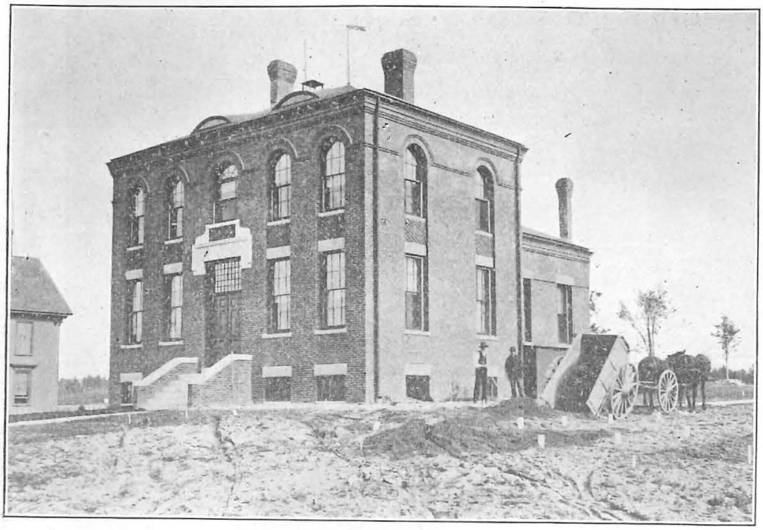


HOLMES HALL, SECOND FLOOR PLAN.

In 1903-04, in accordance with a previous plan, a second wing was added on the north side, thus restoring the symmetry of the building. The structure thus completed is in the form of a rectangle 48 by 82 feet, with a re-entrant angle at the southeast corner. On the first floor (see plan, p. 6) are the laboratory for the analysis of feeds and fertilizers, the nitrogen room, a room for the storage of chemicals, a food laboratory, offices of the chemists and veterinarian, and in the recently completed north wing, recitation rooms for the departments of horticulture and forestry. On the second floor (see plan, p. 7) are the director's office, rooms for the professor of agriculture, the entomologist, the stenographer, a mailing and reading room, a telephone room, and in the north wing a large room used for recitation and laboratory purposes by the department of agriculture. This room may be divided into two rooms or thrown into one by a rolling shutter.

The basement contains the boiler and coal rooms, a kitchen used in connection with nutrition investigations, a calorimeter room, a gas room, and rooms for the grinding and preparation of samples. In the attic are quarters for the janitor, a photographic dark room, and a storage room. The building is heated by steam, lighted by electricity, and furnished with gas. The total cost is somewhat in excess of $18,000. The completed building is shown in the full page illustration.

The recent additions give a dignified building, designed and erected for agricultural investigation and instruction, and it seemed to the trustees of the University to be eminently fitting that it should bear the name of one of our most eminent pioneers in agricultural science, Ezekiel Holmes. This honor is the more deserved, since Dr. Holmes, over 60 years ago, urged the establishment in Aroostook county of a "State Experiment Farm;" and it was largely through his efforts that the Maine legislature in 1865 established the Maine State College as a separate and independent institution. Holmes Hall was formally dedicated on May 25, 1904.



HOLMES HALL, 1888.

HOLMES HALL, 1889.

Warmed House. Curtain Front House.

Fig. 1. POULTRY HOUSES DESCRIBED ON PAGES 23-29.

POULTRY MANAGEMENT AT THE MAINE AGRICULTURAL EXPERIMENT STATION.

G. M. Gowell.

Many years' practical experience in raising and keeping poultry and investigations in poultry breeding at this Station have resulted in the accumulation of a considerable fund of information on poultry management. The object of this paper is to outline this experience for the benefit of poultry keepers, and help them discriminate between some of the wrong theories which have underlain much of the common practice of the past, and the better theories, which underlie other and newer methods that are yielding more satisfactory results. It may be that the methods in vogue with us are no better than those practiced by others, but in the following pages the attempt is made to concisely state the practices which are now being successfully employed at this Station.

The difficulties attending artificial poultry keeping lie in the numbers of small animals that make up the business. With most domestic animals the care-taker treats each one individually, and there is far less draft on the abilities of the herdsman with his large animals than on the manager of even a small poultry plant with its far greater numbers of individuals.

Labor is the costliest factor that enters into the management and equipment of a poultry farm. The cost of food required to produce a pound of beef, pork or chicken does not differ greatly, but while the dressed steer and pig sell for from 5 to 8 cents per pound, the chicken sells for from 15 to 20 cents per pound, and early in the season for much more. The differences in their selling prices represent the differences in the risk and the skill employed in their production. Furthermore, the increasing demand for choice articles of food will tend to maintain these prices, even though the supply be greatly increased. The products of the poultry farms, the fresh self-sealed eggs, each an unbroken package in itself, and the delicately flavored chickens, are among the choicest articles of food to be found in the markets.

While poultry raising is exacting in its demands, there are no conditions imposed that cannot be compassed by persons of ordinary mental and physical capacity. In this as in other callings, the skill which comes from thorough training and the energy needed for persistent work are essential to the fullest success.

The history of the poultry industry of this country is being rapidly made, these years, on the farms, village lots, and at the experiment stations, and written in the minds of the thousands of earnest workers who are engaged in it. From this accumulated knowledge is to come, in the near future, a better general understanding of the subject, which will enable men or women of ordinary abilities to take up the work for themselves, in a small way, and proceed without making many of the mistakes that caused their predecessors to waste money and labor, and lose heart. Poultry and egg production are as legitimate lines of work for persons of small or large means as are dairying, beef growing, sheep husbandry, or general or special crop production. Its advantages lie in its greater returns for its smaller capital investment. Its disadvantages lie in the demand for greater skill, patience and courage than will suffice for any other special, or general, farm industry.

RAISING CHICKENS BY NATURAL PROCESSES.

Circumstances sometimes make it necessary to hatch and raise chickens by aid of the mother hen. While we do not like the method, we have practiced it; having at times as many as a hundred sitting hens along the side of a room—in two tiers—one above the other. An unused tie-up in a barn was taken for the incubating room and a platform was made along the side next to the barn floor. The platform was 3 feet above the floor and was two and a half feet wide and 50 feet long. It was divided up into 50 little stalls or nests, each one foot wide and 2 feet long, and one foot high. This left a 6-inch walk along in front of the nests, for the hens to light on when flying up from the floor. Each nest had a door made of laths at the front, so

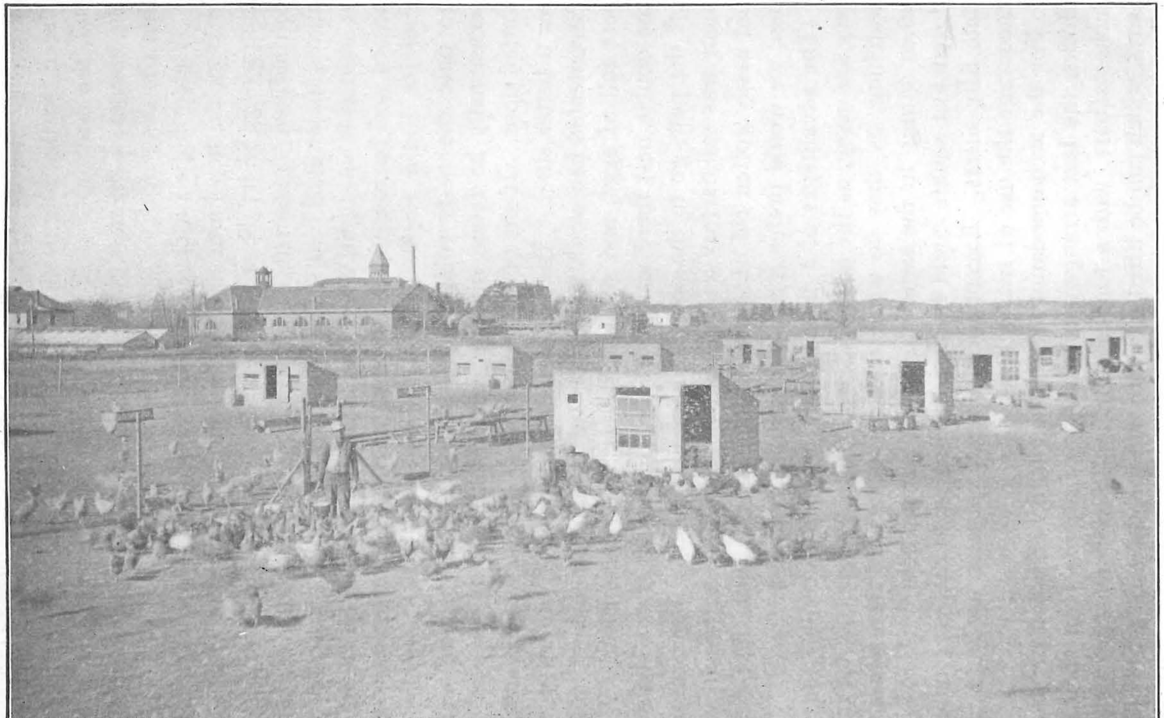


Fig. 2. BROODER HOUSES ON THE RANGE.
See page 17.

as to give ventilation. It was hinged at the bottom and turned outward. Across the center of each nest, a low partition was placed, so that the nesting material would be kept in the back end, the nest proper. For early spring work paper was put in the bottom of the nest, then an inch or two of dry earth, and on that the nest, made of soft hay.

Whenever half a dozen hens became broody they were taken in from the hen house and put on the nests, each nest having a dummy egg in it; the covers were then shut up and nearly every hen seemed contented. In a day or two thirteen eggs were placed under each bird. Every morning the hens were liberated as soon as it was light, when they would come down of their own accord and burrow in the dry dust on the floor, eat, drink, and exercise, and in twelve or fifteen minutes, they would nearly all go onto the nests voluntarily. In the afternoons one would occasionally be found off the eggs, looking out through the slatted door. If she persisted in coming off she was exchanged for a better sitter. The double nest is necessary, otherwise the discontented hen would have no room to stand up, except on her nest full of eggs, and she would very likely ruin them. With the double nest there was no danger of this, as she would step off the nest, go to the door, and try to get out. The arrangement was satisfactory and were it not for the lice, which were not easily gotten rid of, since the chicks grew with the mother hen, we would prefer it to some incubators we have used.

The advantages of a closed room in which to confine the sitters are many, as the hens are easily controlled and do not need watching as they do when selecting nests for themselves, or when sitting in the same room with laying hens. A room a dozen feet square could be arranged so as to easily accommodate fifty sitters. Except for the small operator we would not encourage the use of sitting hens.

For the accommodation of the hen with her brood of young chicks, the best arrangement consists of a close coop about 30 inches square, with a hinged roof, and a movable floor in two parts, which can be lifted out each day for cleaning. This little coop has a wire covered yard attached to it on the south side. The yard is 4 by 5 feet in size and a foot and a half high. Its frame is of 1x3 inch strips and is fastened securely to the coop.

The wire on the sides is of one inch mesh, but on top two inch mesh is sufficient. The coop is easily kept clean and the coop and yard can be set over onto clean grass by one person.

The small run is sufficient for the first few weeks, but soon the chicks need greater range and then the farther end of the run can be lifted up 3 or 4 inches and they can pass in and out at will, while the mother will be secure at home, and they will know where to find her when they get cold or damp, and need brooding. Such a coop accommodates 15 to 20 chicks until they no longer require brooding, after which several flocks are combined in one and put in a portable house on a grassy range.

Whenever the hen is allowed to hatch, or to mother chicks, much care must be experienced or lice will get a foothold and ruin the birds. The free and frequent use of fresh insect powder upon the hen, working it through the feathers to the skin, is one of the best methods for destroying the pests. Grease or oil are effective when applied to the heads and under the wings of young chicks, but care must be taken not to get too much on them, especially during damp weather. The feeding of chicks raised in coops with their mothers does not vary much from those raised in brooders.

RAISING CHICKENS BY ARTIFICIAL PROCESSES.

Incubators have been so much improved that there are several kinds on the market that we feel sure will hatch as many chicks from a given lot of eggs as can be done by selected broody hens. They require little care, maintain an even temperature, and are easily adjusted to meet the increase in temperature arising from developments going on in the eggs. In some machines the moisture supply is automatic and adapted to the requirements. In others it has to be supplied, and skill is necessary in determining the quantity needed. The economy of the incubator is very great. A 360 egg machine will do the work of nearly 30 broody hens, and can be kept at work continually, if desired. We commenced our work in artificial incubation years ago, by trying to maintain the temperature in a home-made wooden box, with double walls, by the use of jugs of warm water. By locating the box in a suitable room and keeping close watch on conditions, good hatches were obtained. It was the best there was at that time, but the use of home-made incubators now, would be like turning back into the days of the wooden plow.

There are several kinds of good incubators, but the one which we have used with greatest satisfaction is the Cyphers, with its capacity of 360 eggs. We have used others that hatch as well, but the Cyphers requires less care. We have not tested many incubators and other makes that we have not used may be as good.

The incubator room must be kept quite constant in temperature. A cellar is a good place in which to run incubators if it is not so cold as to require the lamps to be run very high in order to maintain the necessary degree of warmth inside of the machine. If several incubators are located in the same room, great care should be taken to provide proper ventilation, so that the machines may be furnished with clean fresh air at all times.

Where many machines are used, the hand turning of the eggs absorbs considerable time. We have used several turning devices and conducted experiments to determine the differences between hand and machine turning, and have not yet received better hatches from the hand turned eggs. Machines that have automatic turning shelves will not hold quite as many eggs as when flat shelves are used, but the saving of time is of importance.

A person should get thoroughly acquainted with a machine before putting the eggs in and then make changes and adjustments with great care, lest the results be extreme. We used to think it necessary to have the chickens hatched in March so that they might be ready for laying by November. By better methods of feeding and treatment we can now delay the hatching until April, and the first half of May, and the pullets get to laying maturity as early in the season as formerly.

We use indoor brooders, mostly, and very much prefer them to any outside brooders we have seen in use. The portable brooder houses are built on runners so that they may be readily moved about. The houses are 12 feet long, some of them are 6 and others 7 feet wide. Seven feet is the better width. They are 6 feet high in front and 4 feet high at the back. The frame is of 2x3 inch stuff; the floor is double boarded. The building is boarded, papered and shingled all over. A door, 2 feet wide is in the center of the front and a 6 light, sliding window is on each side of it. A small slide is put in the door, near the top, by which ventilation may be obtained early in the season, before the windows can be kept open. Since shingles on the walls near the bottom are liable to be torn off in moving the houses, double boarding on the walls would be preferable. Two brooders are placed in each of these houses and 50 to 60 chicks are put with each brooder. A low partition separates the flocks while they are young, but later it has to be made higher. The houses are large enough so that a person can go in and do the work comfortably and each one accommodates 100 chicks until the cockerels are large enough to be removed.

In the fall these houses are grouped together, 20 or 30 feet from each other, so as to make the care of the young chicks convenient in early spring while the brooders are in use.

About the 20th of June the grass is cut on some field near to the main poultry, or farm buildings, and the brooder houses are drawn out, with their contents of chickens, and located 50 to 75 feet from each other, in lines, so that they may be reached with little travel. The chickens are shut into small yards, adjoining the houses, for about a week, after which they are allowed to run together. They mostly keep to their own houses, although they wander away quite long distances during the day, returning at feed time, and at night.

The most satisfactory brooder that we have used is the "Peep O'Day." The style that we like best has the cover and part of one side arranged to turn down, making an inclining run the whole width of the brooder, up and down which the little chicks can go without crowding. Some of the later styles of brooders made by this company are not as satisfactory, as they have little passages, through which the chicks are to pass up and down, and they require more or less teaching before they will use them.

Most kinds of brooders as now made, keep the chicks comfortable, at desired temperatures, and have good means of ventilation. The great difficulty lies in the lamps used. The lamp apartments are small and the tendency is for the oil to become warm and form gases, which causes the flame to stream up and make trouble. Most brooder lamps have water pans between the oil tank and the burner which tend to keep the oil cool, but

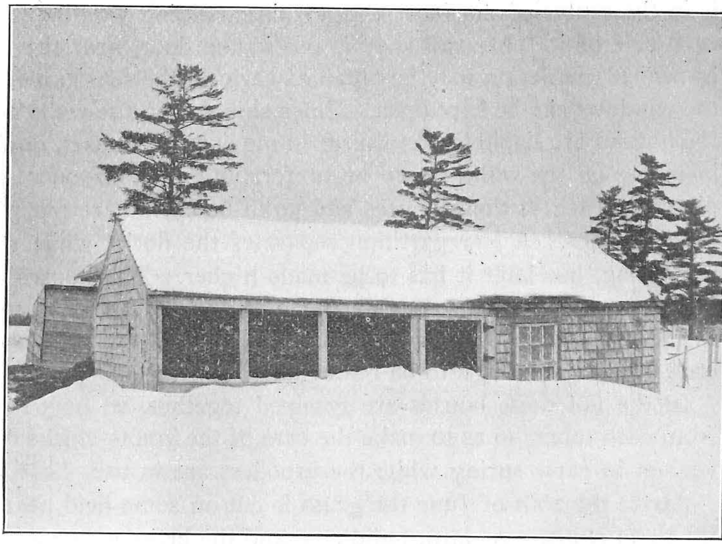


Fig. 3. PIONEER OPEN FRONT HOUSE.
Described on page 24.

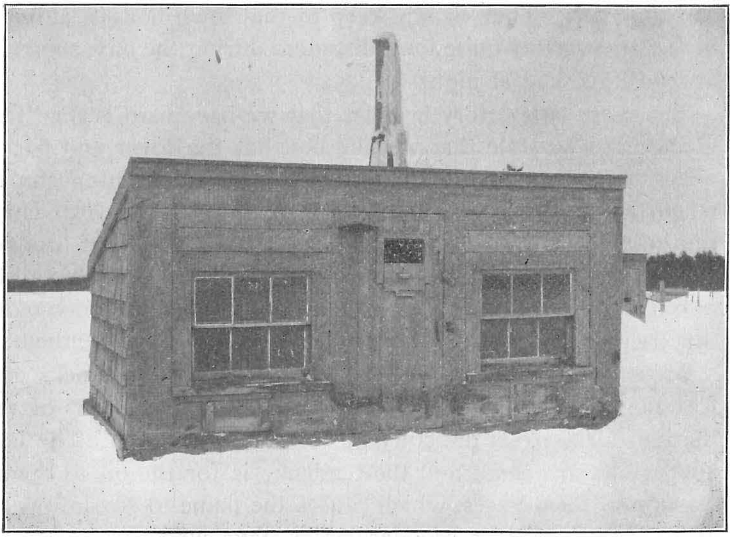


Fig. 4. BROODER HOUSE.
Described on page 16.

even with this precaution we have had two fires, one of which was very serious. The old Peep O'Day lamp was of this kind, but the new ones are entirely different and by far the best of any we have seen. They have no water pans, but are so arranged that currents of cool air pass constantly over the oil tank and keep its contents cool. We have used these lamps, or stoves, for three years—last year more than twenty of them—and regard them as safe, for the oil has never become warm.

TREATMENT OF YOUNG CHICKS.

When the chicks are 30 to 40 hours old they are carried in warm covered baskets to the brooders, and 50 or 60 are put under each hover, where the temperature is between 95 and 100 degrees. The temperature is not allowed to fall below 95 degrees the first week, or 90 during the second week; then it is gradually reduced according to the temperature outside, care being taken not to drive the chicks out by too much heat, or to cause them to crowd together under the hover because they are cold. They should flatten out separately, when young, and a little later lie with their heads just at the edge of the fringe of the hover. Under no condition are they allowed to huddle outside of the brooder. They huddle because they are cold, and they should be put under the hover to get warm, until they learn to do so of their own accord. Neither are they allowed to stay under the hover too much, but are forced out into the cooler air where they gain strength in the day time. They are not allowed to get more than a foot from the hover during the first two days; then a little further away each day, and down onto the house floor about the fourth or fifth day, if the weather is not too cold. They must not get cold enough to huddle or cry, but they *must* come out from under the hover frequently.

The floor of the brooder is cleaned every day and kept well sprinkled with sharp, fine crushed rock, known in the market as "chicken grit." The floor of the house is covered with clover leaves, or hay chaff from the feeding floor in the cattle barns. For raising winter chickens the long piped brooder house is indispensable, and it has many advantages when used at any season of the year. The advantages are especially great when raising chickens, if April or May prove to be cold and wet, for then the small houses are apt to be cold outside of the brooders.

The expenditure is greater for the piped house, for the reason that colony houses should be provided in which the chickens may be sheltered after they leave the brooder-house. In ordinary seasons we experience no difficulty in raising April and May hatched chicks in the small houses. With proper feeding, pullets hatched in these months are early enough to do good work throughout the year.

FEEDING THE CHICKS.

For feed for young chicks we make bread by mixing three parts corn meal, one part wheat bran, and one part wheat middlings or flour, with skim-milk or water, mixing it very dry and salting as usual for bread. It is baked thoroughly, and when well done if it is not dry enough so as to crumble, it is broken up and dried out in the oven and then ground in a mortar or mill. The infertile eggs are hard boiled and ground shell and all, in a sausage mill. About one part of ground egg and four parts of the bread crumbs are rubbed together until the egg is well divided. This bread makes up about one-half of the food of the chicks until they are five or six weeks old. Eggs are always used with it for the first one or two weeks, and then fine sifted beef scrap is mixed with the bread.

It may be that the bread is not necessary and that something else is just as good. We have tried many other foods, including several of the most highly advertised prepared dry chicken foods, but as yet have found nothing that gives us as good health and growth as the bread fed in connection with dry broken grains.

When the chicks are first brought to the brooders, bread crumbs are sprinkled on the floor of the brooder among the grit, and in this way they learn to eat, taking in grit and food at the same time. After the first day the food is given in tin plates, 4 to each brooder. The plates have low edges, and the chicks go onto them and find the food readily. After they have had the food before them for five minutes the plates are removed. As they have not spilled much of it, they have little left to lunch on except what they scratch for. In the course of a few days light wooden troughs are substituted for the plates. The bottom of the trough is a strip of half inch board, 2 feet long and 3 inches wide. Laths are nailed around the edges. The birds are fed four times a day in these troughs until they outgrow them, as follows: Bread and egg or scrap early in the morning; at half past nine o'clock dry grain, either pin head oats, crushed wheat, millet seed or cracked corn. At one o'clock dry grain again, and the last feed of the day is of the bread with egg or scrap.

Between the four feeds in the pans or troughs, millet seed, pin head oats and fine cracked corn, and later whole wheat, are scattered in the chaff on the floor for the chicks to scratch for. This makes them exercise, and care is taken that they do not find the food too easily.

One condition is made imperative in our feeding. The food is never to remain in the troughs more than 5 minutes before the troughs are cleaned or removed. This insures sharp appetites at meal time, and guards against inactivity which comes from over feeding.

Charcoal, granulated bone, oyster shell and sharp grit are always kept by them, as well as clean water. Mangolds are cut into slices, which they soon learn to peck. When the grass begins to grow they are able to get green food from the yards. If the small yards are worn out before they are moved to the range, green cut clover or rape is fed to them.

After the chickens are moved to the range they are fed in the same manner, except that the morning and evening feed is made of corn meal, middlings and wheat bran, to which one-tenth as much beef scrap is added. The other two feeds are of wheat and cracked corn. One year we fed double the amount of scrap all through the growing season and had the April and May pullets well developed and laying through September and October. To our sorrow they nearly all moulted in December, and that month and January were nearly bare of eggs.

FEEDING THE COCKERELS FOR MARKET.

When the chickens are moved to the field the sexes are separated. The pullets are cared for as explained above. The cockerels are confined in yards, in lots of about 100, and fed twice daily on porridge made of 4 parts corn meal, 2 parts middlings or flour, and one part fine beef scrap. The mixed meals are wet with skim-milk or water—milk is preferred—until the mixture will just run, but not drop, from the end of a wooden spoon. They are given what they will eat of this in the morning and again towards evening. It is left before them until all have eaten heartily, not more than an hour at one time, after which the troughs are removed and cleaned. The cockerels are given plenty of shade and kept as quiet as possible.

We have found our chickens that are about one hundred days old at the beginning to gain in four weeks' feeding, from one and three-fourths to two and one-fourth pounds each and sometimes more.* Confined and fed in this way they are meaty and soft and in very much better market condition than though they had been fed generously on dry grains and given more liberty. Poultry raisers cannot afford to sell the chickens as they run, but they can profit greatly by fleshing and fattening them as described. Many careful tests in chicken feeding have shown that as great gains are as cheaply and more easily made, when the chickens, in lots not to exceed 100, are put in a house with a floor space of 75 to 100 feet and a yard of corresponding size, as when they are divided into lots of 4 birds each and confined in latticed coops, just large enough to hold them. Four weeks has been about the limit of profitable feeding, both in the large and small lots. Chickens gain faster while young. In every case birds that were one hundred and fifty to one hundred and seventy-five days old have given us comparatively small gains. The practice of successful poultrymen in selling the cockerels at the earliest marketable age is well founded, for the spring chicken, sold at Thanksgiving time is an expensive product.

A very large proportion of the chickens raised in this State are sent to market alive, without being fattened, usually bringing to the growers from twenty-five to thirty-five cents each. The experiments referred to above indicate that they can be retained and fed a few weeks, in inexpensive sheds, or large coops with small runs, and sent to the markets dressed, and make good returns for the labor and care expended. The quality of the well-covered, soft fleshed chickens, if not too fat, is so much superior to the same birds not specially prepared, that they will be sought for at the higher price. The dairy farmer is particularly well prepared to carry on this work as he has the skim-milk which is of great importance in obtaining yield and quality of flesh.

* See bulletins 64 and 79 of this station.

THE WARMED HOUSE FOR HENS.

This house, which was erected in 1898, is 16 feet wide and 150 feet long. It faces the south and conforms nearly to the land surface, the east end being 3½ feet lower than the west end. The sills are of 4x6 inch hemlock, placed flat, upon a rough stone wall which rests upon the ground surface, and varies from one to two feet in height. The earth is graded up to within six inches of the sills on the outside. The floor timbers are 2x8 inches, placed 2½ feet apart, and rest on the sills. The studs for the back wall are 2x4 stuff, 5 feet 8 inches long, and rest on the sills. The front studs are 10 feet 6 inches long. All the studs are set 3 feet apart. Each 10 feet in length of the front of the building has one 12 light window of 10x12 glass. The top of this window comes within one foot of the plate. Directly underneath these windows and 6 inches above the floor, are other 3 light windows of 10x12 glass. The building is boarded, papered and shingled all over the outside, roof and walls. The floor is of two thicknesses of hemlock boards. The entire inside of the building is papered on the studs and rafters and sheathed with matched boards. The work was carefully done and good dead air spaces were obtained over the whole building.

The building is divided into 15 ten foot sections. The close partitions between the pens are 2 feet high and are made of 2 inch plank. They form strong trusses, to which the studs supporting the central plate are strongly nailed. This saves the floor from sagging from the weight of the roof when it is covered with snow. An elevated plank walk, 4 feet wide, runs along the whole length of the front of the building and rests on the cross partitions just mentioned. The walk is 2½ feet above the floor and allows the hens to occupy the whole floor space. This part of the floor is lighted from the front, by the small windows spoken of above. Above the close partition the pens are separated from each other and the walk by wire netting of 2 inch mesh. Light, wooden frame doors, covered with wire, and hung with double acting spring hinges, are in every cross partition, and also in the partition between the elevated walk and each pen.

The back ends of the cross partitions, 4 feet out from the back wall, are carried up to the roof, so as to protect the hens from currents of air while on the roosts. The roost platform is along the back wall. Four trap nests, described beyond, of our own devising and construction, are placed at the back of the house, at the end of the roost platform.

All the windows are double. Eight of the large outside ones are hinged at the top and kept hasped out one foot at the bottom, except in the roughest weather, and cold winter nights. This furnishes ventilation without drafts, as the position of the outside windows prevents strong currents of air from entering.

Although this house was thoroughly built, we found that the windows had to be closed during rough winter weather, or water would freeze quite hard inside the building. Closing the windows caused dampness and frost on the walls, and the straw litter absorbed the moisture and became, while yet clean, disagreeable to the hens. A hot water heater was placed in a pit at the lower end of the building, and one line of two inch pipe was carried under the roosts to the upper end of the building and returned to the boiler. By use of this heater the building is kept above the freezing point at all times, and there is not much trouble from moisture except when extremely cold weather necessitates the closing of the windows.

The birds in this house have always been in excellent health, and have never shrunk in their egg yields from cold weather except one season, when coal was not procurable and the temperature ran low.

The ease with which the hens are cared for, the availability of the entire floor space, and the welfare and productiveness of the birds kept here, commends this building as one of the best. It was planned and constructed so as to obtain conditions necessary for the welfare of the birds and economize the labor involved in their care at as small cost as was consistent with quality. Not a single part was made for show. While a single walled building would have cost less, it would not have kept the hens warm or given protection from dampness, that prevails in close single-walled houses.

THE PIONEER ROOSTING CLOSET HOUSE.

A dozen years ago several little houses, each 10 feet square, were built for colonies of hens. They were well built and warm, but were apt to be damp and lined with white frost in very cold weather, when the windows had to be kept shut to save the birds from suffering at night. Another feature against them was their size. A person cannot care for hens in so small a pen without keeping them in a condition of unrest, for they fear being cornered in so small a room. Three years ago one of these 10 feet square houses was taken for a nucleus and an addition made, so that the reconstructed house was 10 feet wide and 25 long. The end of the old house was taken out, so that there was one room with a floor space of 250 square feet. The walls were about 5½ feet high in the clear, inside of the building. The whole of the front wall was not filled in, but a space 3 feet wide and 15 feet long was left just under the plate. This space had a frame, covered with white drilling, hinged at the top on the inside, so it could be let down and buttoned during driving storms and winter nights, but hung up out of the way at all other times. The cloth of the outer curtain was oiled with hot linseed oil. The roost platform extended the whole length of the back of the room. It was 3 feet 4 inches wide and 3 feet above the floor. The back wall and up the roof for 4 feet was lined and packed hard with fine hay. The packing also extended part way across the ends of the room.

Two roosts were used, but they did not take the whole length of the platform, a space of 4 feet at one end being reserved for a crate where broody hens could be confined, until the desire for sitting should be overcome. The space, from the front edge of the platform up to the roof, was covered by frame curtains of drilling, similar to the one on the front wall. They were hinged at the top edge and kept turned up out of the way during day time, but from the commencement of cold weather until spring they were closed down every night after the hens went to roost. The hens were shut in to this close roosting closet and kept there nights, and released as early in the morning as they could see to scratch for the grain which was sprinkled in the 8 inch deep straw on the floor.

The roosting closet was closely observed and has never been damp, or its odors offensive when opened in the mornings. There was very little freezing in the closets in the coldest weather. The birds seemed to enjoy coming out of the warm sleeping closet down into the cold straw, which was never damp, but always dry, because the whole house was open to the outside air and sun every day. There were no shut off corners of floor or closet that were damp. We used this building through three winters, with 50 hens in it, and have not had a case of sickness in it yet. Not a case of cold or snuffles has developed from sleeping in the closet with its cloth front, and then going directly down into the cold room and spending the day in the open air.

The birds have laid as well as their mates in the large warmed house have done; averaging last year above 150 eggs each. Their combs have been red and their plumage bright, and they have given every evidence of perfect health and vigor. While they are on the roosts, in bed, they are warm. They come down to their breakfasts and spend the day in the open air. Such treatment gives vigor and snap to the human, and it seems to work equally well with the hen.

The results of the three years' use of this house have been such that we feel very sure that this is one of the right systems of treatment and housing of hens, and it was decided to build several houses on the same plan and join them together under one roof, as one house.

THE CURTAIN FRONT HOUSE FOR HENS.

This building was erected in 1903 and is 14 feet wide and 150 feet long. The back wall is 5½ feet high from floor to top of plate inside, and the front wall is 6⅔ feet high. The roof is of unequal span, the ridge being 4 feet in from the front wall. The height of the ridge above the floor is 9 feet. The sills are 4x6 inches in size and rest on a rough stone wall laid on the surface of the ground. A central sill gives support to the floor which at times is quite heavily loaded with sand. The floor timbers are 2x8 inches in size and are placed 2 feet apart. The floor is two thicknesses of hemlock boards. All of the rest of the frame is of 2x4 inch stuff. The building is boarded, papered and shingled, on roof and walls. The rear wall and 4 feet of the lower part of the rear roof, are ceiled on the inside of the studding and plates, and packed, very hard, with dry sawdust. In order to make the sawdust packing continuous between the wall and roof, the wall ceiling is carried up to within 6 inches of the plate, then follows up inclining pieces of studding to the rafters.

Fig. 5. TWO SECTIONS OF CURTAIN FRONT HOUSE.
Described on page 26.

The short pieces of studding are nailed to the studs and rafters. By this arrangement there are no slack places around the plate to admit cold air. The end walls are packed in the same way. The house is divided by close board partitions into seven 20 foot sections; and one 10 foot section is reserved at the lower end for a feed storage room.

Each of the 20 foot sections has two 12 light, outside windows screwed onto the front, and the space between the windows, which is 8 feet long, and 3 feet wide, down from the plate, is covered during rough winter storms and cold nights, by a light frame, covered with 10 ounce duck, oiled and closely tacked on. This door, or curtain, is hinged at the top and swings in and up to the roof when open.

A door 2½ feet wide is in the front of each section. The roost platform is at the back side of each room and extends the whole 20 feet. The platform is 3 feet 6 inches wide and is 3 feet above the floor. The roosts are of 2x3 inch stuff placed on edge and are 10 inches above the platform. The back one is 11 inches out from the wall and the space between the two is 16 inches, leaving 15 inches between the front roost and the duck curtain, which is sufficient to prevent the curtain being soiled by the birds on the roost. The two curtains in front of the roost are similar to the one in the front of the house except they are not oiled. They are each 10 feet long and 30 inches wide, hinged at the top, and open out into the room and fasten up when not in use. Great care was exercised in constructing the roosting closets, to have them as near air tight as possible, excepting what may be admitted through the cloth curtain.

Single pulleys are hung at the rafters, and with half inch rope fastened to the lower edge of the curtain frames they are easily raised or lowered and kept in place. At one end of the roosts, a space of 3 feet is reserved for a cage for broody hens. This being behind the curtain, the birds have the same night temperature when they are transferred from the roosts to the cage.

Six trap nests are placed at one end of each room, and four at the other. They are put near the front so that the light may be good for reading and recording the number on the leg bands of the birds. Several shelves are put on the walls, 1½ feet above the floor, for shell, grit, bone, etc. The doors which admit from one room to another, throughout the building, are frames covered with 10 ounce duck, so as to make them light. They are hung with double acting spring hinges. The advantages of having all doors push from a person are very great, as they hinder the passage of the attendant, with his baskets and pails, very little. Strips of old rubber belting are nailed around the studs which the doors rub against as they swing to, so as to just catch and hold them from opening too easily by the wind. Tight board partitions were used between the pens instead of wire, so as to prevent drafts. A platform 3 feet wide, extends across both ends and the entire front of the building, outside.

The house is well made of good material and should prove to be durable. It costs about $850. A rougher building with plain instead of trap nests, with the roof and walls covered with some of the prepared materials, instead of shingles, could be built for less money, and would probably furnish as comfortable quarters for the birds for a time as this building will.

This house accommodates 350 hens—50 in each 20 foot section. It was not ready for occupancy until the 6th of December. Since then there has been some very severe weather, considerably below zero at night and about zero during the day, with a good deal of high wind. During this rough weather the bedding on the floor has kept comparatively dry; and the voidings on the platform, as found when the curtains were raised in the mornings, have been but slightly frozen. The yields of eggs during this severe weather and the week immediately following it, were not below those immediately preceding it. It should be borne in mind that had the weather been mild during that time the hens probably would have increased in production rather than remain stationary. They were doubtless affected by the severe weather, but not seriously, as they began to increase in production very soon after the weather became usual for midwinter.

THE YARDS.

The yards to most poultry houses are at the south, or sheltered sides of the buildings, to afford protection during late fall and early spring, when cold winds are common. The north house has yards on both north and south sides with convenient gates. The south yards are used until the cold winds are over in spring, when they will go to the north yards, which are well set in grass sod. With the new curtain front south house the yards are to be on the north side only. The birds will be kept in the building until the weather is suitable for opening the small doors in the rear wall. The necessity for getting them out from the open front house, where they are really subject to most of the out of door conditions during the day time, is not so great as when they are confined in close houses, with walls and glass windows. The use of the rear yards only, may not prove satisfactory. If however, as good yields of eggs and health of birds result, many decided advantages will be obtained by dispensing with front yards. The clear open front of the house allows teams to pass close to the open door of the pens for cleaning out worn material, and delivering new bedding, and also in allowing attendants to enter and leave all pens from the outside walk, and reach the feed room without passing through intervening pens.

TRAP NESTS.

The nest which we use is original with us. It is very simple, inexpensive, easy to attend and certain in its action. It is a box-like structure without front end or cover, 28 inches long, 13 inches wide and 16 inches deep, inside measure. A division board with a circular opening 7½ inches in diameter is placed across the box, 12 inches from the rear end and 15 inches from the front end. The rear section is the nest proper. Instead of a close made door at the entrance, a light frame of 1 by 1½ inch stuff is covered with wire netting of one inch mesh. The door is 10 inches wide by 10 inches high, and does not fill the entire entrance, a space of two inches being left at the bottom, and one inch at the top, with a good margin at each side, to avoid friction. It is hinged at the top and opens up into the box. The hinges are placed on the front of the door rather than at the center or rear, the better to secure complete closing action. The trap consists of one piece of stiff wire about three-sixteenths of an inch in diameter and 22 inches long. This piece of wire is shaped so that a section of it, 11 inches long, rests directly across the circular opening in the division board and is held in place by two clamps, one on either side of the circular opening. The clamps fit loosely and the slots are long enough to allow the wire to work up and down about three inches, without much friction. The next section of the wire is eight inches long and it is bent so that it is at right angles with the eleven inch section. It passes along the side of the box eleven inches above the floor, back toward the entrance door and is fastened strongly to the wall by staples, but yet loosely enough so that the wire can roll easily. The remaining section of the wire, which is three inches long, is bent toward the center of the box, with an upward inclination, so that it supports the door when it is open and rests upon it. The end of the wire is turned over smoothly, forming a notch into which the door may slip when opened.

As the hen passes in under the open door and then through the circular opening to the nest, she raises herself so that her keel may pass over the lower part of the division board, and her back presses against the horizontal wire, as she passes it, and lifts it enough, so that the end supporting the door slides from under it, and the door swings down and passes a wire spring, near the bottom of the box, at the entrance, which locks it and prevents the hen from escaping, and others from entering.

The double box with nest in rear is necessary, as when a hen has laid and desires to leave the nest, she steps out into the front space and remains there, generally trying to escape, until she is released. With one section only she would be very likely to crush her egg by stepping upon it and learn the pernicious habit of egg-eating.

The boxes are placed four in a block, and slide in and out like drawers and can be carried away for cleansing when necessary. Four nests in a pen have accommodated 20 hens, by the attendant going through the pens once an hour, or a little oftener, during that part of the day when the hens are busiest. Earlier and later in the day his visits have not been so frequent. To remove a hen, the nest is pulled part way out and as it has no cover, she is readily lifted up, and the number on her leg band is noted on the record sheet, that is tacked up, close at hand. After having been taken off a few times they do not object to being handled, the most of them remaining quiet, apparently expecting to be picked up.

Before commencing the use of trap nests, it was thought that some hens might be irritated by the trapping operation and object to the noise incident to it, but we have not found an individual that appeared to be annoyed by it, and we have used Leghorns, Brahmas, Wyandottes and Plymouth Rocks. The

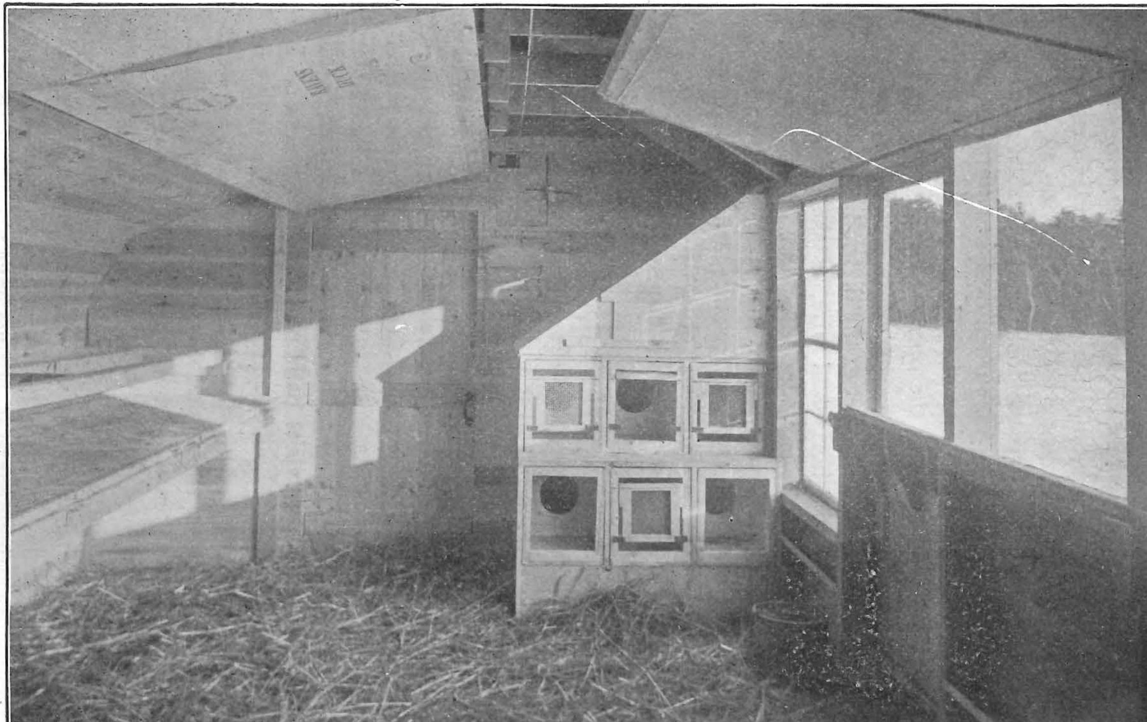


Fig. 6. INTERIOR OF ONE SECTION OF CURTAIN FRONT HOUSE.
Described on page 26.

amount of time required in caring for the trap nests, so far as our work goes, can only be estimated, as the time varies from one day to another, and having only fifty-two nests in operation, the attendant's time was divided with other duties. By noting the total time used per day in caring for the nests, when the hens were laying most heavily, it is believed that one active person devoting his entire time to trap nests, like ours, would take care of 400 to 500 nests used by 2,000 to 2,500 hens. When commencing the year's work he would need assistance in banding the birds, but after that was done he could care for the nests without assistance until midsummer, when the egg yields would probably be diminished and a part of his time could be spared for other duties.

One of the first difficulties encountered was with the leg bands. We procured and used all of the bands that appeared to be durable, and not likely to be lost off. Several kinds were easily put on but would last only a few weeks or months before they would be loosening or breaking, and we finally adopted a make that consists of a fairly broad metallic band encircling the leg, with the ends held together by small brass spring rings. These rings would sometimes get broken or lost out and we put in two instead of one. Even then, when hens were moulting, broody, or for other reasons not frequently handled and the rings examined, the bands would sometimes get off. Bands with duplicate numbers and double rings are now used on both legs and the likelihood of losing the identity of a bird is small.

When not using trap nests, the following is a very satisfactory nest. It is a foot wide, a foot high and three feet long with cover. A partition in the middle has an opening just large enough to admit the passage of a hen. The nest openings are away from the light and when a hen goes to the nest and looks in she blocks the opening and shuts out the light and does not see the eggs plainly. The temptation to meddle and break them is thus removed.

FEEDING THE HENS.

For twenty-one years we have been at work with the same family of Barred Plymouth Rocks and have learned one way to feed and handle them to secure eggs, and to avoid the losses which are so common to mature hens of that breed, from over fatness. Other methods of feeding may be as good or even better. While it is true that only the full fed hen can lay to the limit of her capacity it is equally true that full feeding of the Plymouth Rocks, unless correctly done, results disastrously.

Years ago the "morning mash," which was regarded as necessary to "warm up the cold hen," so she could lay that day, was given up and it was fed at night. The birds are fed throughout the year daily as follows: Each pen of twenty-two receives one pint of wheat in the deep litter early in the morning. At 9.30 A. M. one-half pint of oats is fed to them in the same way. At 1 P. M. one-half pint of cracked corn is given in the litter as before. At 3 P. M. in winter and 4 P. M. in summer they are given all the mash they will eat up clean in half an hour. The mash is made of the following mixture of meals: 200 lbs. wheat bran; 100 lbs. corn meal; 100 lbs. wheat middling; 100 lbs. linseed meal; 100 lbs. gluten meal; 100lbs. beef scrap. The mash contains one-fourth of its bulk of clover leaves and heads, obtained from the feeding floor in the cattle barn. The clover is covered with hot water and allowed to stand for three or four hours. The mash is made quite dry, and rubbed down with the shovel in mixing, so that the pieces of clover are separated and covered with the meal. Cracked bone, oyster shell, clean grit, and water are before them all of the time. Two large mangolds are fed to the birds in each pen daily in winter. They are stuck on to large nails which are partly driven into the wall, a foot and a half above the floor. Very few soft shelled eggs are laid and, so far as known, not an egg has been eaten by the hens during the last five years.

We are testing another method of feeding with several pens of hens this year. It consists of the morning, 9.30 A. M., and 1 P. M. feedings of dry food in the litter as usual, but instead of the mash at 3 P. M. all the dry cracked corn they will eat is given in troughs. Beef scrap is kept before the birds at all times, in elevated troughs where they cannot waste it. They are supplied with grit, oyster shell, bone, and mangolds. Dry clover leaves and chaff are given them on the floor each day. One pen of 30 hens were fed through last year in this way with good results, and 150 hens are being fed on the dry food, through this year, in comparison with a like number of their mates that are having mash at the 3 P. M. feeding, as usual with us.

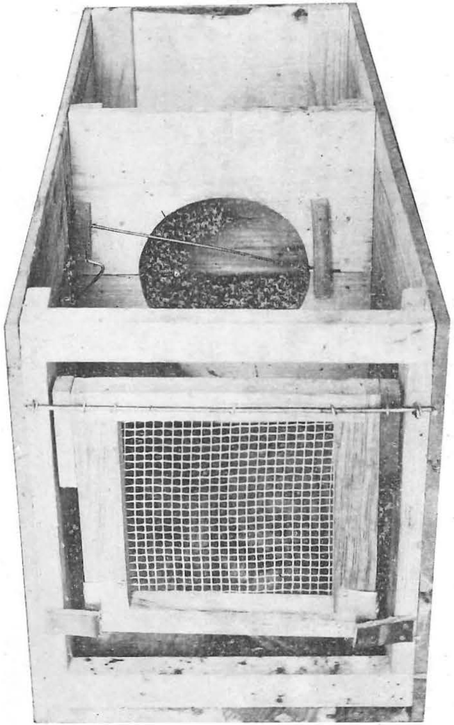


Fig. 7. Front and Top View.

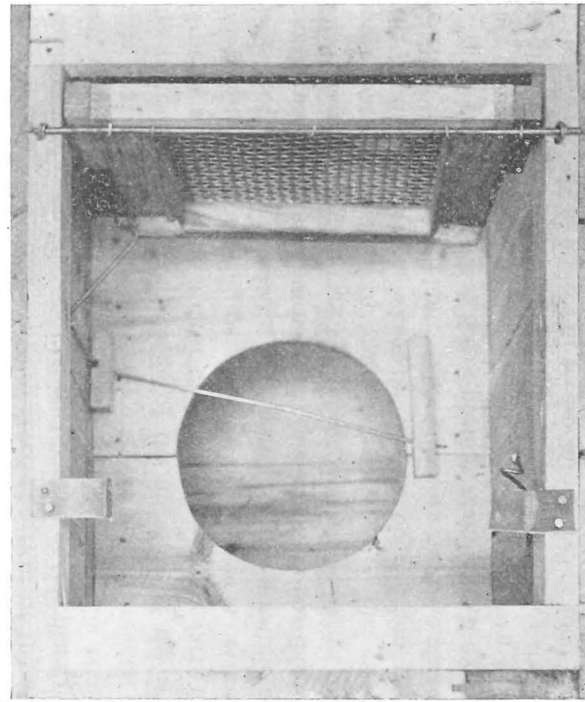


Fig. 8. Front View.

TRAP RECORD NESTS DESCRIBED ON PAGE 30.

ENTIRE WHEAT FLOUR.

CHAS. D. WOODS AND L. H. MERRILL.

Of all the food products which a beneficent nature has placed at man's disposal, wheat easily ranks first. It is true that rice forms the staple food for a larger proportion of the human race, yet it needs no argument to prove the superiority of wheat over this cereal. This superiority is due not only to the intrinsic food value of the wheat kernel, but also to the vast number and variety of products which can be derived from it. The requirements of our modern civilization, and the introduction of the methods and machinery that have made the fulfilment of these requirements possible, have led to a close study of the structure of the wheat kernel. No other seed has received a tithe of the attention bestowed upon this, and the introduction at this place of all that botanists are able to tell us of this wonderfully complex little seed would be of little service to the general reader. At the same time, some knowledge of the anatomy of the wheat kernel is so essential to a clear understanding of the facts to be presented in the following pages that a brief space is devoted to the subject. As this bulletin is designed for non-scientific readers, the use of technical terms is avoided as far as possible.

It does not require a very close inspection of the kernel to discover that it consists of three distinct parts: 1. The essential part of the seed which, when the seed is planted and grows, develops into the new plant. This is known as the embryo, or germ, or chit. 2. A much larger portion, making up the greater part of the grain, which is designed by nature to serve as food for the young plant during germination, or the earlier stages of growth; precisely as a piece of seed potato serves as food for the young potato plant, or as material stored in the egg furnishes nutriment for the developing chick. This part of the wheat kernel is known to botanists as the endosperm, and is the only part which enters into our fine white flours. 3. The coverings of the kernel, the bran, designed to protect the softer inner portions. These three divisions and their relative proportions are conveniently shown below.

1. Germ or embryo, 6 per cent of the wheat kernel.

2. Endosperm or floury part, 82 to 86 per cent of the wheat kernel.

3. Bran or coverings (not including the aleurone layers), 8 to 9 per cent of the wheat kernel.

To these divisions should be added the aleurone layer, making up 3 or 4 per cent of the kernel. Although this layer is botanically a part of the endosperm, it is more convenient, as shown below, to consider it by itself.

Figure 9 shows the divisions named, and also the position of the brush.

Chemical analysis shows that the germ is not only rich in oils and mineral constituents, but contains also a large proportion of nitrogenous matter. Since we have no reason for supposing that these nutrients are any less digestible than those furnished by the endosperm, it may be asked why the germ should not be included in the flour. To this it may be replied that the germ is dark in color and the flour containing it would not make an attractive loaf. Perhaps a better reason for the exclusion of the germ lies in the readiness with which the oils absorb oxygen from the air, thus becoming rancid and imparting a disagreeable flavor to the flour. Since this change comes about slowly, this objection would not extend to flours which are used within a few months after milling.

The endosperm, as has been said, is the only part of the kernel which enters the higher grades of flour. It contains all the starch and all the gluten of the wheat. True gluten is found only in wheat and gives this grain its preeminence over the other cereals. On this account its distribution in the kernel is a matter of importance. The outer part of the endosperm differs radically from the inner parts, consisting of nearly square cells filled with a granular form of protein known as aleurone. However valuable this aleurone may be as a food, it should not be confounded with the gluten, which is found only in the interior of the endosperm. This outer layer of cells is properly known as the aleurone layer, and the name "gluten layer" sometimes given to it is a misnomer. In the processes of the manufacture of fine

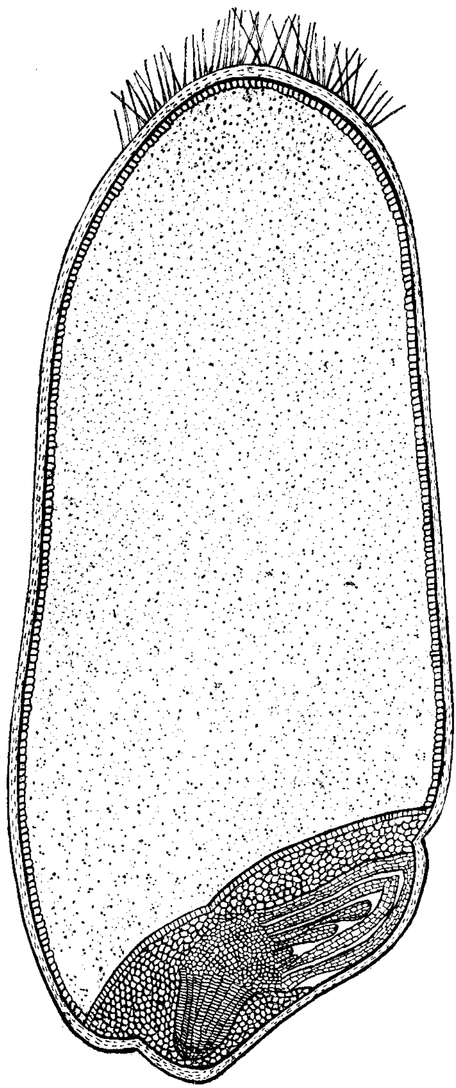


FIGURE 9. Longitudinal section of a grain of wheat. The cut shows the brush of short hairs at the apex, the germ at the base, and the outer coatings or bran, with the cubical cells of the aleurone layer, lying just within. The dotted area, occupying the greater part of the kernel, represents the endosperm or floury portion.

white flour, the aleurone layer is rejected from the flour and is included in the waste products. The middle of the endosperm is softer than the outer parts, being richer in starch and poorer in gluten. If ground by itself, it would make an inferior grade of flour. From the center outward the proportion of gluten gradually increases, the largest amount being found in that part of the kernel which lies just within the aleurone layer.

The term "bran," as ordinarily employed, includes all the portions of the grain removed in the milling processes. It is here, however, used with a restricted meaning, and includes only the wheat coverings lying outside the aleurone layer, and does not include the germ. The different parts of the bran vary greatly in composition and this has led to a close study of the coverings of the wheat berry, the general results of which follow.

The seeds of all our common agricultural plants are borne within a cavity called the ovary. As the seed matures the ovary usually opens and the seed is discharged. In the grass family, to which the cereals belong, we find an exception to this rule. Here the ovary does not open to release the ripened seed, but becomes so closely adherent to the seed that a sharp separation is impossible. Perhaps this may be made clearer if we suppose a common garden bean (seed) growing until it entirely fills the pod (ovary), to which it finally becomes so closely cemented that the bean cannot be shelled.

The wheat kernel, then, consists of a seed still enclosed within the ovary walls. This fact will help to explain the complexity of the wheat coverings, or bran, as the word is here used. The ovary walls constitute what is known to the botanist as the pericarp. In the immature kernel this is found to consist of three distinct layers, the outer of which, the epidermis, bears the small tuft of hairs sometimes called the brush. Within the pericarp are the true seed coatings, consisting also of several layers, the two outer making up the episperm, while the inner is termed the perisperm.

This may be summed up as follows:

Pericarp (walls of the ovary)	Made up of three layers of cells, the outer of which, the epidermis, carries the brush.
True seed coatings	Episperm, of two layers. Perisperm.

While all these divisions may be distinguished in the immature grain, in the ripened and dried kernel the cells composing them collapse and adhere so closely to one another that the minor distinctions become largely obliterated.

Since a close separation of these coatings is impossible, we can not determine with exactness their relative food values. It is generally conceded, however, that both the pericarp and the true seed coatings (episperm and perisperm) consist almost wholly of woody and mineral matter, with but little protein. The nitrogenous matter of the bran of commerce is for the most part contained in the adhering aleurone cells.

The simplest method of milling wheat consists in crushing the berry, thus reducing it more or less completely to a powder. The wheat meal thus prepared will always contain coarse particles of bran. Bread made from this wheat meal will obviously contain all of the nutrients of the original wheat, but the bread will be coarse in texture, dark in color and rather strong in flavor. These objectionable features are much more pronounced in wheat meal made from hard spring wheat than in soft winter wheat meal. Graham flour* or wheat meal is usually made from soft wheats relatively low in protein and high in starch content. Because of this, graham flour, as found in the market, is usually lower in protein than is high grade patent flour. Sifting wheat meal, to remove the coarser particles, was the first step toward the making of white flour. As explained above, the ovary walls and the true seed coats adhere very firmly to the floury part of the wheat berry, and can at best be only imperfectly separated. Up to the middle of the last century even the best milling involved grinding the wheat in a set of stones with cut faces run not quite touching each other, and the fine flour was obtained by sifting by means of bolts, *i. e.,* sieves, of varying fineness. As fine grinding would reduce some of the outer coatings to a fine power, with a resulting dark flour and still darker loaf, only soft wheats, which would readily crush and reduce the soft starchy interior to flour without powdering the germ and outer layers, were employed in making the first grades of flour. This method of manufacture of fine flour from starchy

*So called from Graham, the temperance reformer of the early part of the nineteenth century, who based his cure for alcoholism upon certain radical changes in diet, laying especial stress upon abstinence from meats, and the use of bread made from unbolted wheat meal.

wheats resulted in flours relatively low in ash and protein and rich in starch and allied carbohydrates. Flour with no more than 8 per cent protein and .3 per cent ash were not uncommon. It was this kind of flour that led Liebig to recommend a return to wheat meal and gave Graham the "physiological basis" of his crusade in favor of bread made from unbolted wheat meal. Despite the agitation of this important question, the use of fine flour did not diminish and the results of investigations indicated, on even the part of the poorer classes, an almost invariable preference for white bread. This was particularly the case in the cities, and was at first attributed to perverted taste and classed along with the desire for alcohol, and other abnormal appetites. Investigations by Lawes and Gilbert* showed that this preference was based upon a real difference in nutritive quality, and that while graham bread actually carried more protein and ash than white bread, it passed through the intestines rapidly "before the system has extracted from it as much nutritive matter as it ought to yield." This increased peristaltic action, resulting in lowered digestibility of the bread, was attributed by Lawes and Gilbert to the mechanical action of the bran upon the lining of the intestine. This seemed a reasonable hypothesis and some rather inefficient attempts were made to manufacture a flour in which the bran should be reduced to the fineness of flour. Before much was accomplished in this direction, the method of milling was revolutionized by the introduction of the Hungarian or continuous reduction process. Up to this time the grain had been ground and the milling products separated by a final sifting. The new process passes the wheat through successive sets of rollers or rolls set nearer and nearer together as the milling proceeds. The flour from each set of rolls is removed by sifting and the unreduced portions are passed on to another set. While modern flour mills differ from each other in details, they are all essentially the same in that the bran is separated from the interior of the grain and this interior is reduced to flour by repeated crushing between rollers and numerous separations by means of bolting machines. The bran is also passed through successive rolls and bolting machines, until it is as thoroughly cleaned from the adhering flour as practicable for the kind of flour to be made, or until the cost of reduction so nearly equals the value of the

*Chemistry of Wheat and Flour. Lawes and Gilbert, 1857.

flour obtained as to be pecuniarily unprofitable. The number of intermediate products will depend upon the size of the mill, the number of stands of rolls and number of bolts to which the grain and resultant meals are subjected. The finished products also vary in different mills, but in general consist of

First patent flour Second patent flour First clear grade flour	In most mills these are united into the "straight" or "standard patent" flour used for bread.
Second clear grade	Used for low grade bread.
Red dog flour	Used for bread or for cattle feed.
Shorts or middlings Bran	Frequently sold togethe" as mixed feed for cattle.

The process from start to finish is under the control of the miller and he can make almost any separation desired. For instance, in the demand for breakfast foods it has been found profitable by some millers to separate the middlings and germ in the granular state and sell them under a variety of names, in bulk or fancy packages, at a price considerably in excess of what they would bring in the usual finished form.

The introduction of the roller process of milling has made it possible to utilize the hard spring wheats rich in gluten, and to include in the "straight" or standard patent bread flour much that in the old process of milling was lost in middlings and bran. This has materially improved the bread flours in common use until the standard flours from hard wheat carry more protein than almost any graham flour in the market 25 years ago, and as much or more than many graham flours now on the market. Furthermore, the demand for bread flour of high gluten content has stimulated wheat breeding and the growing of hard wheat, so that even winter wheats are now grown which in gluten content rival the hard spring wheats of the Northwest.

Just before the introduction of the roller process into milling, the attempt was made to find a way to remove the outer or ovary wall layers of the wheat berry, and to grind the remainder into a meal or flour without bolting. It was hoped in this way to make a flour that would carry essentially all the nutrients of the wheat and which would not contain the indigestible woody fiber of the outer coatings, which Lawes and Gilbert had found not only to be indigestible of themselves, but also to so hasten the passage of the bread containing these woody particles as to materially lessen the whole amount of nutrients digested. It was claimed that such a flour would carry the whole of the wheat that has value in nutrition, and thus such flour was at first called whole wheat flour, and later, entire wheat flour.

The Germans seem to have done more experimenting with "decorticated wheat flour" than others, but judged both from the intrinsic difficulty of the separation and from the published analyses of the product, their labors seem to have been only partly successful. If it had not been for the introduction of the roller process, possibly machines to decorticate wheat might have been devised. But this new method at once gave so much better results than any method of decortication then known that it speedily was adopted for all kinds of flour milling, even graham flour being thus made at present.

As now made, 100 pounds of cleaned No. 1 wheat will make either nearly 100 pounds of graham flour, 85 to 88 pounds of entire wheat flour, or 72 to 74 pounds of straight or standard patent bread flour. Larger mills will usually give rather larger yields than small mills, and a starchy wheat 1 to 3 pounds more entire wheat or patent flour than a hard wheat. In the following diagram, cleaned wheat is taken as the standard. Before milling it is customary to clean the wheat from foul seeds and to remove as much as possible of the dirt from the crease in the berry. In this operation a little of the outer layer of the grain is removed. The loss in weight from cleaning varies from almost nothing to occasionally as much as 2 per cent.

DIAGRAM SHOWING APPROXIMATE YIELD OF DIFFERENT KINDS OF FLOUR AND OFFALS FROM 100 POUNDS OF CLEANED No. 1 WHEAT.

100 POUNDS CLEANED NO. 1 WHEAT

will yield

VERY NEARLY 100 POUNDS GRAHAM FLOUR;

or

ABOUT 85 POUNDS ENTIRE WHEAT FLOUR AND	15 lbs. BRAN;

or

ABOUT 72 POUNDS STRAIGHT OR PATENT-FLOUR,	13 lbs. middlings and low grade flour.	15 lbs. BRAN.

THE BRAN.

The diagram shows as refuses from the manufacture of entire wheat flour and straight flour 15 pounds of bran. Are these materials similar, or do they differ so as not to be comparable? Are they *bran* in the botanical sense, as used in the beginning of this paper, or are they bran in the commercial sense, in that they include materials other than the true wheat coverings?

In milling experiments with No. 1 hard northwestern wheat, the wheat and the resultant brans analyzed as follows:

THE COMPOSITION OF HARD WHEAT USED IN MILLING TESTS, AND OF BRAN RECOVERED IN MANUFACTURE OF ENTIRE WHEAT FLOUR AND PATENT FLOUR.

Laboratory number.		Water.	Protein.	Fat.	Carbohydrates: Crude fiber.	Carbohydrates: N-free extract.	Ash.
		Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.
6892	Cleaned wheat (Bran 6894).......	9.41	13.63	2.33	2.39	70.33	1.91
6270	Cleaned wheat (Bran 6281).......	11.19	13.75	2.43	1.96	69.02	1.65
6894	Bran from entire wheat flour made from Wheat No. 6892.....	8.43	15.63	5.06	9.67	55.56	5.65
6281	Bran from straight flour made from Wheat No. 6270............	10.11	15.50	4.94	10.07	53.06	6.31

The bran, so far as chemical analyses show, are as nearly identical as two brans from the same kind of milling and the same wheat would be likely to run. Under the microscope they equally resemble each other. This agreement in composition of bran producel in milling entire wheat flour and straight or patent flour is only what one would expect, since the processes of manufacture are so similar.

The nitrogen content of these brans is greater than that of the wheat from which they are derived, which indicates that they contain much more than the outer woody coverings of the berry and are, therefore, brans in the commercial, and not in the botanical, sense. Moreover, a microscopic examination reveals the presence of large numbers of the characteristic square cells of the aleurone layer.

A company which claims to be "the originators and only makers of this grade (entire wheat) of flour" state that the "husk to which is attached the fibrous beard and which is composed of silex (flint) and woody fiber, is innutritive and indigestible," and in their process is entirely removed from the berry *before* it is reduced to flour. Unfortunately for the accuracy of this statement, the flour of this brand, like that of all other brands of entire wheat flour thus far examined by us, uniformly contains particles of the seed coatings and fibrous "beard" or brush. The advertisement claims that after these husks and hairs are removed, the remainder of the berry is reduced to an even fineness. Unfortunately again for the accuracy of this statement, the bran from their mill, as well as from all others thus far examined, uniformly contains portions from the layers they claim to retain wholly within the flour. Judged from their advertisement, the bran from their flour would be bran in the botanical sense, and would consist largely of woody fiber and silica, and consequently worthless as food for stock. In point of fact, it is good quality bran in the commercial sense. It is valuable for cattle feeding and carries, as all such bran does, more protein than the wheat from which it was made.

HOW DOES ENTIRE WHEAT FLOUR DIFFER FROM STRAIGHT OR PATENT FLOUR?

Starting from the same wheat, the same bran would be obtained in the manufacture of entire wheat flour as in patent flour. The 85 pounds of entire wheat flour would include the 72 pounds of straight, and the only source of the remaining 13 pounds in the entire wheat flour is the 1 to 2 pounds of second clear and red dog flours, and the shorts or middlings which are separated when patent flour is made. It therefore follows that whatever of nutritive value there is in entire wheat flour that is lacking in patent flour must be sought for in the middlings and low grade flours. These materials are usually higher in protein content than the straight flour. The protein of the most importance in wheat flours is in the form of gluten. The gluten of second clear flour is of poor quality and on this account this grade of flour makes a heavy loaf. The red dog flour is obtained from the germ or embryo and adjacent parts of the kernel. While usually high in protein, it is dark in color, and because of the poor quality of its gluten has little expansive power and makes a very inferior loaf. The middlings contain much of the germ, the aleurone layer of the bran, and finely ground particles of the outer coatings. It is usually high in protein content, but with practically no gluten. It is probable that much of the laxative qualities noticed in graham flour and which Lawes and Gilbert attributed to the coarse particles of bran, are in reality due to the character of the protein and mineral compounds of the aleurone layer and the germ. For while entire wheat flour is not so much of a laxative as graham, it possesses this property to such a degree that the claims made by some manufacturers that it is a "complete remedy for constipation" would probably hold true in most cases.

The low grade flours and the middlings carry quite high percentages of ash which are valuable in nutrition. All these nutrients found in the low grade flour and middlings enter into the entire wheat flour, and upon them depend the differences between entire wheat flour and patent flour.

ENTIRE WHEAT FLOUR AND STANDARD PATENT FLOUR FROM THE SAME KIND OF WHEAT COMPARED CHEMICALLY.

In the investigations upon the nutritive value of bread made by the Nutrition Division of the Office of Experiment Stations of the U. S. Department of Agriculture, four sets of analyses of the graham flour, the entire wheat flour, and the standard patent flour, manufactured from the same cleaned No. 1 hard northwestern grown spring wheats, and three sets of analyses of entire wheat flour and standard patent flour, manufactured from softer winter wheats, were made and reported in the bulletins of that office. The average of the results of these analyses are given in the table which follows.

THE COMPOSITION OF ENTIRE WHEAT FLOUR AND STANDARD PATENT FLOUR MADE FROM THE SAME WHEAT COMPARED.

Kind of wheat and flour.	Number of analyses.	Water.	Protein (Nx6.25).	Fat.	Carbo-hydrates.	Ash.	Heats of combustion per gram.
		Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Calories
From No. 1 hard spring wheat							
Cleaned wheat or graham flour	4	10.74	14.77	2.26	70.36	1.87	4029
Entire wheat flour..............	4	11.44	14.09	2.01	71.43	1.03	3967
Standard patent flour	4	11.38	13.89	1.44	72.75	.54	3959
From No. 1 soft winter wheat							
Entire wheat flour..............	3	11.18	12.21	1.45	73.95	1.21	3895
Standard patent flour	3	11.54	11.27	.85	75.83	.52	3869

Since the better brands of entire wheat flour found in the market are made from the hard wheat, the first set of figures are the more interesting and instructive. Flour always contains more water than the wheat from which it was made. This is merely another way of saying that the hard outer coatings which go into the bran are drier than the floury interior portion of the berry. Flour, even entire wheat flour, always contains a lower percentage of protein than the wheat from which it was milled. This means that the milling offals always include much of the aleurone and other portions rich in protein. The more than one-half per cent of deficiency in protein content of entire wheat flour, as compared with graham flour from the same wheat, indicates the falseness of the claim that entire wheat flour carries the "constituents preserved in the flour, precisely in purity and *proportion* as stored in the wheat by nature." The lower protein in the flour means the enrichment of the bran, as was pointed out earlier in this paper. Probably the average standard patent flour would not run as near the entire wheat flour as it happened to in those experiments. From a wheat carrying 14.5 per cent protein, the entire wheat could be expected to carry about 14 per cent, and the standard patent 13.5 per cent protein. The percentage of gluten would, however, be about the same in the two flours.

The entire wheat flour does not carry as much fat as the wheat, but considerably more than the patent. The entire wheat flour carries about half and the patent flour about one-fourth as much ash as the wheat from which they were made. The greater part of wheat ash consists of potassium phosphate, and the ash rejected in the bran and other offals is as rich in this constituent as that saved for food in the flour. Potassium phosphate is soluble in water, and hence is probably readily assimilated. While comparatively little is known of the function of mineral constituents of the food in nutrition, it is known that they are of importance, and where bread is almost the sole article of diet, the removal of the phosphates in the processes of milling diminishes its value in nutrition. In ordinary mixed diet, where several articles of food are eaten, this removal of the ash would not be of very great importance, as the food of a mixed diet would contain, so far as present knowledge of the function of minerals can be taken as a guide, ample soluble ash constituents for the needs of the body.

The entire wheat flour carries 1 per cent and the standard patent more than 2 per cent more carbohydrates than the wheat from which they are milled. Starch is the most important carbohydrate in wheat. There are also present small amounts of dextrin and sugar. There is also always present in the wheat itself about 2.5 per cent woody fiber, which is valueless in nutrition. The entire wheat flour carries about .75 per cent and the standard patent about .3 per cent of woody matter, or crude fiber, as the chemist terms it.

The heats of combustion of wheat and of the flours differ but slightly from one another. From the available data the composition of the three classes of flour milled from a wheat carrying 14.50 per cent protein would be approximately as given in the table below. A hard, high grade wheat is used for illustration. If a soft wheat had been used, practically the same relations would have existed.

THE PROBABLE COMPOSITION OF THE THREE CLASSES OF FLOUR THAT A NO. I HARD NORTHWESTERN WHEAT WOULD YIELD.

	Kind of Flour.		
	Graham.	Entire wheat.	Standard patent.
Water, per cent	10.50	11.25	11.50
Protein, per cent	14.50	14.00	13.50
Fat, per cent	2.25	2.00	1.40
Crude fiber, per cent	2.50	.75	.30
Carbohydrates, per cent	68.50	71.00	72.80
Ash, per cent	1.75	1.00	.50
Heat of combustion, calories per pound	1825	1800	1800

THE COMPARATIVE DIGESTIBILITY OF GRAHAM FLOUR, ENTIRE WHEAT FLOUR AND STANDARD PATENT FLOUR.

In the investigations of the Department of Agriculture already referred to, three sets of digestion experiments were made upon the digestibility of breads made from the same wheat milled as graham flour, entire wheat flour, and standard patent flour. The same subjects were used in the experiments with all three flours from each wheat. Milk was the only food eaten with this bread. As its digestibility is better known than that of any other food material, it is possible to calculate from the diet of bread and milk the coefficients of digestibility of bread alone with tolerable certainty. The results are as follows:

CO-EFFICIENTS OF DIGESTIBILITY OF PROTEIN AND AVAILABLE ENERGY OF BREAD MADE FROM GRAHAM FLOUR, ENTIRE WHEAT FLOUR, AND STANDARD PATENT FLOUR PREPARED FROM THE SAME HARD SPRING WHEAT, FOUND AS THE RESULT OF NATURAL DIGESTION EXPERIMENTS WITH THE SAME SUBJECTS.

Kind of bread.	Number of experiment.	Digestibility of protein.	Availability of energy (heat of combustion).
Graham flour	9	81	83
Entire wheat flour	9	83	87
Standard patent flour	9	89	91

When these coefficients are applied to the figures giving the composition of the three kinds of flour as stated on page 73, the results given in the following table are obtained for the digestible protein and available energy of one kind of each of the flours.

WEIGHT OF DIGESTIBLE PROTEIN AND CALORIES OF AVAILABLE ENERGY THAT ONE POUND OF GRAHAM, ENTIRE WHEAT AND STANDARD FLOURS FROM HARD SPRING WHEAT WOULD SUPPLY.

Kind of flour.	Digestible protein.	Available energy.
	Pounds.	Calories.
Graham flour	.117	1510
Entire wheat	.116	1570
Standard patent	.120	1640

From the standpoint of digestible protein that the different flours will furnish, there is but little choice, but what difference there is is in favor of the standard patent bread flour. The standard patent flour supplies rather more available energy than the entire wheat flour. It would take about 104 pounds of entire wheat flour to furnish the same digestible protein and available energy as 100 pounds of standard flour ground from the same kind of wheat.

FLOUR AS FOUND IN THE MARKET.

Graham flour as found in the market is likely to have been made from a soft winter wheat and will carry much less protein than the graham made from hard spring wheat, which is the kind chiefly discussed in the preceding pages. The soft winter wheat graham will usually carry about 12 per cent protein. The entire wheat flours vary with the kind of wheat from which they are made and usually carry ½ per cent less protein than a graham flour would from the same wheat. The leading brands of entire wheat flour are made from No. 1 wheats and carry usually from 13 to 14 per cent protein. The Franklin Mills Entire Wheat flour is the best known in the Maine markets and the samples examined at this Station carried from 14 to 14.25 per cent protein. Patent flours carry about one per cent less protein than the wheat from which they are made. The standard bread flours of the Northwest carry from 13 to 14 per cent protein. Patents made from hard winter wheats carry 12 to 13 per cent protein, while the protein of soft winter wheat patent flour frequently runs as low as 10 per cent. The Alabama Station* reports two samples of "best grade of white flour offered for sale in Alabama" with 9.22 and 9.24 per cent protein.

There are imitation graham and imitation entire wheat flours on the market which are made by blending some of the poorer kinds of low grade flours, usually from soft winter wheat, with 25 to 30 per cent of wheat offals. The middlings would be used to make imitation entire wheat flour, and to make an imitation graham both the middlings and the bran would be added to the flour. While the dealers claim that these imitations are sold to quite an extent in some sections of the country, it is doubtful if they are in the Maine market. It is, however, more common for bakers to make breads in imitation of graham and entire wheat breads by mixing offals with second clear flour.

Because of the great differences in composition of flours, due not only to methods of milling, but especially to the kind of wheat used in their manufacture, it is impossible to intelligently select and compare different kinds of flour unless the kind of wheat from which they are made is known or brands are selected of known quality.

THE COST OF ENTIRE WHEAT FLOUR TO THE CONSUMER.

As already explained, 100 pounds of hard spring wheat will yield about 72 pounds of standard patent flour, which, in the fall of 1903, retailed in lots of 25 pounds or more for about 2½ cents per pound. One hundred pounds of the same wheat would yield about 85 pounds of entire wheat flour, which retailed in Bangor at the following prices: 5 pound package 25 cents, 12¼ pound package 50 cents, ½ barrel (98 pounds) $3.50, and by the barrel $6.00. According to the size of the package, therefore, entire wheat flour cost the consumer from 3 to 5 cents a pound. The standard patent flour made from 100 pounds of hard spring

* Bulletin 74.

wheat cost the consumer in Maine about $1.80, and the entire wheat flour made from the same amount cost from $2.55 to $4.25. As explained above, the difference between standard patent flour and entire wheat flour from the same wheat is due to the 13 pounds of low grade flour and middlings separated from the former, but included in the latter. The consumer in Maine of entire wheat flour must, therefore, perforce pay from $.75 to $2.45, or at the rate of 6 to 19 cents a pound, for these 13 pounds of low grade flour and middlings. The manufacturers claim that in car load lots they deliver entire wheat flour to dealers in New England at practically the price of standard patent flour, and that this high retail cost is due to the smallness of the demand and consequent lack of competition. Since it costs no more to mill wheat into entire wheat flour than into patent, and since the yield is one-sixth greater in the case of entire wheat flour, the manufacturers should be able to produce it for 25 to 50 cents a barrel less than standard patent. The leading companies claim, however, that a better wheat is used in the manufacture of entire wheat flour than the Minneapolis millers use. Such a claim cannot of course be easily disproved, but so far as the chemical analyses of the flours indicate, it is not well founded. At market prices the digestible nutrients other than ash furnished in entire wheat flour cost the consumer from 40 to 130 per cent more than in standard patent flour. To be sure, he obtains twice as much ash as he would in the patent flours. The function of the ash constituent is little understood, but the present state of knowledge does not warrant the conclusion that the food in ordinary mixed diet is deficient in digestible mineral matter. The use of entire wheat flour for persons in health is not, therefore, as economical as that of white flour. It must be remembered, however, that flour of all kinds is a most economical food, and that entire wheat flour, even at 5 cents a pound, is still a low cost food.

A MILLING EXPERIMENT WITH ENTIRE WHEAT FLOUR.

CHAS. D. WOODS AND L. H. MERRILL.

Arrangements were made with the proprietors of a long-established milling plant, who make a specialty of manufacturing a well-known brand of entire wheat flour, to make a milling test upon the yield and chemical composition of the products obtained in the manufacture of entire wheat flour. The whole plant and the services of their experienced miller were kindly placed at our disposal. Much of the advertising of entire wheat flour tends to throw a mystery around its manufacture, and even when definite claims are not made for peculiar processes, the attempt to convey the impression that it differs essentially from the manufacture of bread flour is usually evident. At this mill, and at all mills where we have been given definite information, the cleaned wheat is crushed between rollers and purified in the same way as in the manufacture of patent flour, with the exception that all the product other than the bran is included in the flour. In the experiment here reported, a stand consisting of 8 breaks was used; 3 for flour, and 5 for reducing the middlings and cleaning the bran. The wheat used was No. 1 hard northwestern spring wheat. The wheat, the flour and the bran were sampled for analyses. Samples of the cleaned wheat were drawn from the storage bin, and samples of the flour and bran were taken every 15 minutes during the run. The details of the experiment follows:

Weight of wheat taken...........	1031 pounds
Weight of yield of entire wheat flour	844 pounds or 81.9 per cent
Weight of yield of bran..........	180 pounds or 17.5 per cent
Loss in milling..................	7 pounds or .6 per cent

As the experiment was made in the midst of a run of a much longer period, the assumption is necessarily involved in the above data that there was the same amount of materials in the mill at the end as at the beginning. It is probably more accurate to neglect loss in milling and base the percentage yield upon the output.

Calculated on total yield of 1,024 pounds, the yields expressed in percentages are:

Entire wheat flour	82.4 per cent
Bran	17.6 per cent

THE CHARACTER OF THE PRODUCTS.

The yield of entire wheat flour in this experiment was a little above 82 pounds from 100 pounds of wheat. The bran appeared to be very well cleaned and it is probable that the yield could not have been greatly increased from this particular wheat by further treatment. According to available data the yield is somewhat smaller than usual. On the other hand, the flour contained less crude fiber than most samples of entire wheat flour examined at this Station, and under the microscope there was less of the outer layers of bran cells than in most flours of this class. The bran cells and per cent of crude fiber were less than was found in other samples of the output of this mill. The wheat was supplied by an automatic registering apparatus which was set as usual. At the end of the run it was found that the output was somewhat less than customary. This may account for the separation noted, or the difference may have been due to the character of the wheat employed. Wheats, even of the same grading, differ quite materially in the proportion of bran and flour. The bran appeared, both under the microscope and from chemical analysis, to be normal bran, such as would usually be had from milling hard northwestern wheat. Apparently the flour differed from straight patent flour only in containing the middlings, red dog, and second clear flours, which are kept out of the high grade patent. As explained elsewhere (see page 69), the difference in composition and nutritive value of straight patent flour and entire wheat flour is to be explained by the constituents of middlings and low grade flours that are rejected from the former and included in the latter.

The composition of the wheat used in this experiment and the entire wheat flour and the bran obtained as products follow:

COMPOSITION OF WHEAT, ENTIRE WHEAT FLOUR AND BRAN IN MILLING EXPERIMENT.

	On fresh basis.			On water free basis.		
	Wheat.	Flour.	Bran.	Wheat.	Flour.	Bran.
Water, per cent	9.41	13.62	8.43	....	....	....
Protein (Nitrogen x 6.25), per cent	13.63	12.63	15.63	15.05	14.62	17.07
Fat, per cent	2.33	1.77	5.06	2.57	2.05	5.53
Crude fiber, per cent	2.39	.68	9.67	2.64	.79	10.56
Nitrogen-free extract, per cent	70.33	70.46	55.56	77.63	81.57	60.67
Ash, per cent	1.91	.84	5.65	2.11	.97	6.17
Heat of combustion, calories per gram	4.034	3.822	4.204	4.453	4.425	4.591

In the following table the yield of entire wheat flour and bran from 100 pounds of wheat are shown and the weights of the nutrients. The close agreement of the figures of the two last columns show that the samples of the different portions must have fairly represented the materials, and that the mechanical and chemical parts of the work are trustworthy.

YIELD OF ENTIRE WHEAT FLOUR AND BRAN FROM 100 POUNDS OF WHEAT, AND WEIGHTS OF NUTRIENTS IN THE PRODUCTS COMPARED WITH THOSE OF THE ORIGINAL WHEAT.

	Flour.	Bran.	Total fresh.	Total water free.	In wheat.
Yield in pounds	82.40	17.60	100.00	....	......
Water, pounds	11.22	1.48	12.70	....	......
Protein (Nitrogen x 6.25), pounds	10.41	2.75	13.16	15.08	15.05
Fat, pounds	1.46	.89	2.35	2.69	2.57
Crude fiber, pounds	.56	1.70	2.26	2.59	2.64
Nitrogen-free extract, pounds	58.06	9.79	67.85	77.72	77.63
Ash, pounds	.69	.99	1.68	1.92	2.11
Calories per gram	3.149	.740	3.889	4.456	4.543

The distribution of the nitrogen and ash of the wheat in the products is as follows:

80 per cent of the nitrogen of the wheat was found in the flour;
20 per cent of the nitrogen of the wheat was found in the bran.
42.5 per cent of the ash of the wheat was found in the flour;
57.5 per cent of the ash of the wheat was found in the bran.

FERTILIZATION PROBLEMS: A STUDY OF RECIPROCAL CROSSES.

M. B. CUMMINGS.

In attempting to account for failure in the making of reciprocal crosses one faces a perplexing problem. The number of cases in which reciprocal crosses cannot be made is small, when compared with that of successful ones. It is not the number of successes or failures, however, which gives the subject prominence. It is not the fact of failure in one case and success in another; but rather the reason for such failure. If we can cross plant A with plant B, why can we not cross plant B with plant A? What is the immediate cause for the refusal of certain plants to cross reciprocally, and how does their refusal manifest itself? To find a satisfactory answer to these questions is the purpose of this investigation.

I. RECORDS OF PREVIOUS WORK.

SOME IMPOSSIBLE RECIPROCAL CROSSES.

No exhaustive list of supposed impossible reciprocal crosses is attempted at this time, since a few cases will serve the purpose of presenting the problem. Kölreuter,[1] during a period of eight years, made repeated trials to secure reciprocal crosses with *Mirabilis jalapa* and *Mirabilis longiflora*. He tried more than two hundred times to fertilize *Mirabilis longiflora* by applying pollen of *Mirabilis jalapa*, but without success. The pollen of the former when applied to the stigma of the latter, however, produced fertile seeds. The same difficulty is met with when an

1. Cited by Webber and Swingle. Hybrids and Their Utilization in Plant-Breeding, Yearbook Dept. Agr., 1897, p. 383.

Note. This paper is part of an investigation which has been in progress for the past 12 years by Professor W. M. Munson, Horticulturist to the Station, upon the effects of pollination. Beginning with 1892, occasional reports of progress have appeared in the bulletins and reports of this Station. The studies here reported upon were conducted under Professor Munson's direction.

attempt is made to reciprocally cross *Matthiola annua* and *Matthiola glabra,* two closely related species.[1]

Thuret[3] is authority for the statement that *Fucus vesiculosus* crossed by *Fucus serratus* is fertile, but that reciprocal crosses with these plants cannot be made. Strasburger[2] found that *Orchis fusca* pollen will stimulate the ovules of *Orchis Morio* into normal activity, while pollen of *Orchis Morio* will not form tubes on the stigma of *Orchis fusca.*

Among more familiar plants, other supposed impossible reciprocals are the red currant and common garden tomato, and summer crookneck and bush scallop squashes. These cases will be discussed in detail later in this paper.

PROCESSES LEADING TO THE FORMATION OF SEED.

In order to pave the way for a study of abnormal conditions, it will be well at this point to review in a general way the normal process of fertilization.[3]

It is now well known that the pollen grain, after being lodged on the sticky surface of the stigma, undergoes a process similar to that of the germination of spores of the lower orders of plants, and not greatly unlike that of the germination of seeds. Soon after the deposit of the pollen, the grains absorb moisture and increase in size; the outer wall, the extine, bursts, and inhibition of watery solutions incites to activity the protoplasm of the grain, and movements of cytoplasm within cause the extension of the inner wall so as to form a tube, the so-called pollen tube. Now the pollen tube, once started in its downward course, makes its way through or between the parenchyma cells of the pistil, manifesting its growth by the formation of new nuclei in the protoplasm, and in the extension of the wall in the form of a tube. This tube penetrates to the region of the ovules and when the micropyle is reached the pollen nuclei pass into the embryo-sac, and a union of the elements is effected which results in the formation of seed. Germination when once started may be completed in a few hours, as in the case of *Cereus grandiflorus;* or it may require several months, as in the case with orchids; or almost a year, as is true with the pines.

1. Cited by A. R. Wallace, Darwinism, p. 155.
2. Cited by H. P. Gould, Potency of Pollen, Cornell University Thesis, 1897, p. 28.
3. Cf. also, Rpt. Maine Agr. Expt. Sta., 1898, 219, et seq.

Just how the pollen tube is nourished, how it is guided to the ovarian region, and what finally brings the elements together, is still very largely a matter of theory and conjecture. However, imperfect as our knowledge is concerning these points, numerous observations on various stages and types of germination, enable one to make a few very general remarks on the above questions.

As regards the nourishment of the tubes, it is known that there are two probable sources of food. The pollen grains contain some elements for nourishment, and the conductive tissue is not entirely without food. From chemical analyses it has been shown that pollen cells contain a certain amount of nutritive material such as starch and maltose, in connection with some invertase and diastase to render them available for the nutrition of the pollen tubes. On the part of the pistil and its conductive tissue there is an abundant supply of elaborated food materials such as starch, sugar, and maltose, which, without doubt, are of much value in nourishing the tubes in their passage to the ovules.

It is very probable that the development and action of enzymes facilitate the descent of the pollen tube, and the discovery of a cytolytic enzyme by Marshall Ward[1] in a species of Botrytis, throws further light on the problem of the penetration of tubes.

An analysis of the factors which facilitate the descent of pollen tubes and finally enable them to reach the ovules shows them to be of at least two sorts. First, mechanical contrivances; and secondly, stimulating influences or attractive substances which cause the union of the elements. The mechanical features include the nature of the conductive tissue which, as we know, is a system of thin walled cells through which the pollen tubes pass, growing as they naturally would in the lines of least resistance. Other features of a mechanical nature are also useful; such as papillæ, which are common in the pistils of Cucurbitaceae; and the position of the funiculus and the ovule itself.

The second set of factors, the stimulating or attractive substances, do not admit of as easy demonstration. As a matter of fact, just what actually brings the male and female nuclei into contact is not known. However, a few probable suppositions may be mentioned here and left for further discussion and investigation.

1. H. Marshall Ward, Annals of Botany, II, 1888.

During the period of receptivity of the pistil and descent of the pollen tube, deep seated changes are going on in the ovary which prepare the ovules for the fertilizing process. This preparation consists in the formation of an organ in the nucellus of the ovule called the embryo-sac, an exceedingly important structure during fecundation. This embryo-sac consists of several parts, which may be referred to as follows: At the micropylar end of the sac is the egg apparatus, which consists of two cells, the synergidae, and another the germ cell or oösphere, which, after fertilization, becomes the embryo. At the opposite end of the sac there are three cells, the antipodals, which are of lesser importance. But the egg-apparatus is the dynamic center; and it is supposed that this structure exerts a stimulating influence as the male nucleus nears its destination, the supposition being that a fluid escapes from the synergidae which attracts the pollen spore and unites the elements.

In studying the approach of sexual organs Pfeffer[1] has demonstrated that the spermatozoids of ferns are enticed into the necks of the archegonia by means of malic acid; and the archegonia of mosses attract the spermatozoids by a solution of cane sugar. Before leaving this point, reference should be made to the statement of Strasburger,[2] who would explain the fusion of the male and female elements as due to chemitactic and chemotropic influences; the explanation being that the nature and strength of solutions in the pistil and in the vicinity of the ovules attract or repel the pollen tubes.

DETERMINING FACTORS, IN CASES OF ABNORMAL FERTILIZATION.

The nature of the problem under consideration necessitates the study of certain factors which may influence in some way the making of the crosses. The factors here considered are:

A. Incomplete development of pollen tubes, due to
  (1.) Impotent pollen or poisonous stigmatic fluid, or
  (2.) Lack of nourishment of pollen tubes.

B. Non-fusion of nuclei.

1. Cited by Wilson. The Cell in Development and Inheritance, p. 197.
2. Strasburger, Text-book of Botany, pp. 263, 281.

A. Incomplete Development of Pollen Tubes.

(1.) Impotent pollen or poisonous stigmatic fluid.

The study of this feature of the problem had its origin mainly with the investigations of Darwin[1] and no systematic study of self-sterility was taken up till after the publication of Origin of Species in 1859. While horticulturists and other investigators were studying the causes of sterility for many years, it was not till quite recently that the histological study of sterility was begun. Even though the general causes of sterility have been pretty well worked out, yet the details of the problem,—the non-development or incomplete development of the pollen tubes,—is, so far as the writer's knowledge is concerned, still unexplained.

It is well at this point to refer to the investigations of the pioneers on this subject. Darwin, for example, found that in the case of legitimate and illegitimate union of the elements in *Linum perenne,* if pollen of either form be placed upon its own stigmas, the pollen grains would germinate and the tubes enter the tissue of the pistil, but to what extent is not known. Darwin observed here that the impotency of the pollen must be due either to the tubes not reaching the ovules, or to their improper action upon reaching them.

Again, in the case of *Linum grandiflora* where other unions, legitimate and illegitimate were made, it was ascertained by examining the pistils that the pollen of illegitimate unions germinated very rarely, and in those where germination did take place the tubes were short and penetrated the tissue of the pistil only a short distance.

In other cases the pollen seems to be absolutely impotent, and in such cases the trouble seems to lie in the inability of the stigmatic secretion to properly excite the pollen in such a way as to form tubes. This has been found to be the case with some of the Orchidaceae where self-pollination results in the death of the flower. Fritz Müller[2] says that pollen masses and the stigma of the same plant in various species of Orchidaceae have actually a deadly effect upon one another, as in the case of *Oncidium oscrohilum.* This was shown by the surface of the stigma in contact with the pollen, and by the pollen itself becoming dark

1. Darwin. Different Forms of Flowers on Plants of the Same Species. Chap. 1, 2, 3.

2. Fritz Müller, Bot. Ztg., 1868, p. 114.

and decaying in from three to five days after pollination. Again with *Oncidium flexuosum,* the plant's own pollen and that of a distinct species were placed side by side, and after five days the latter was perfectly fresh, while the plant's own pollen was brown. These observations are remarkable, for they show that the plant's own pollen not only fails to impregnate the flower, but acts on the stigma, and is acted on in an injurious or poisonous manner. Such action seems to be mutually poisonous.

In 1897 Gould[1] confirmed the work of the older investigators. At the conclusion of his thesis he says: "The power of pollen to produce fecundation exists in every possible degree from perfect potency to absolute impotency. Pollen, like seeds, may be so low in degree of vitality as to be unable to germinate, or be so retarded in its germination that the elements do not come together till the period of receptivity is past. External conditions such as temperature and moisture may influence the vitality of pollen and its potency."

Some recent work by Booth[2] concerning the self-sterility of grapes throws further light on the inactivity of pollen. Results of experiments carried on for several years are summarized in this manner: Poor pollen may be known by a microscopical study of the structure of the grains; the infertile grains are irregular in shape and have sharp angles,—also by the arrangement of pollen, either dry or in fluid media. Fertile pollen comes together in clusters by means of its mucilaginous coatings. Sterile pollen does not have this coating, and comes together only by chance. Culture experiments showed the self-sterile pollen to be lacking in vitality, for in most cases such pollen either failed to germinate or gave a low percentage of germination. Such pollen was impotent on pistils of self-sterile varieties, as well as on its own stigmas. Booth explains the reason for this condition of things, as a probable indication that the flowers of the grape are in an evolutionary stage, and are passing from hermaphrodite to staminate and pistillate forms. Mention of these cases is made here to show how infertility is expressed, for the problem of impossible reciprocates bears hard on the subject of sterility.

(2.) Lack of nourishment of pollen tubes.

1. H. P. Gould, Potency of Pollen, Cornell University Thesis, 1897.
2. N. O. Booth, N. Y. Agr. Exp. Sta. Bul. 224. A Study of Grape Pollen.

It is generally conceded that the descent of the pollen tube is largely dependent on the nature of the stigmatic fluid as a medium for the germination of pollen. During the descent of the tubes certain enzymes are developed; and while the exact nature and importance of these is not worked out, it is thought that they exert a considerable influence on the growth of pollen tubes. If this influence is correct, it follows that unless these nutrients are such as to develop proper conditions for germination, the penetration by pollen tubes cannot be effected. To what extent this will account for failure in making reciprocal crosses is still an open question. It is difficult to understand why trouble should occur in the nourishment of the germ tubes only when certain pollen is used, and not in all cases, and yet a slight disturbance of the sexual organs may be of considerable importance in this connection.

B. Non-fusion of Nuclei.

Whatever reasons there may be for failure in fertilization, it is certain that fecundation cannot be effected unless there is a fusion of male and female nuclei. The fusion of the nuclei takes place only when the pollen tubes develop in such a way as to allow the male nucleus to pass into the oösphere. Pollination and development of pollen tubes may take place and yet fertilization fail to occur. A few instances from other investigations will bear out this statement. Mr. John Scott[1] observed that in the case of *Oncidium sphacelatum* self-pollination did not produce capsules, although the stigmas were penetrated by pollen tubes.

Furthermore, in another species, *Oncidium microhilum,* the pollen was good, for with it he fertilized two distinct species; he found its ovules good, for they could be fertilized with another plant of the same species, but this species could not be fertilized with its own pollen, although the pollen tubes penetrated the stigma.

In 1900 Fletcher[2] noted that self-fertile varieties of plums —miner and wild goose—were infertile on each other. In the case of the wild goose plum the pollen germinates, and the tubes pass down to the ovules, but for some reason the two sexes fail

1. Scott, Journal of Proc. Linn. Soc., Vol. III.
2. S. W. Fletcher, Cornell Univ. Exp. Sta., Bul. 181.

to unite. Gould[1] reported a similar case where crookneck squash was pollinated with bush scallop. There was a vigorous development of pollen tubes, since they passed in the vicinity of the ovules, but there was no fusion of the nuclei.

SUMMARY.

In summarizing those cases in which reciprocal crosses have failed, we may note that in some cases pollen tubes do not develop, in others there is a partial germination, and in others still there is a vigorous development of tubes; but in none of these cases is there fusion of the nuclei.

II. Studies by the Author.

A. RED CURRANT AND YELLOW PLUM TOMATO.

The difficulty which has been experienced in making reciprocal crosses with red currant tomato, *Lycopersicum pimpinellifolium,* and varieties of *Lycopersicum esculentum,* has given rise to the notion that such reciprocals cannot be made. Wishing to know the facts in the case, the writer began investigations with the following points in view. First, to see if reciprocal crosses with these plants can be made. And secondly, if this is impossible, to find out what constitutes the difficulty.

Plants for this work were grown in the University greenhouse. Seeds of yellow plum and red currant tomatoes were planted in flats, and as the seedlings attained proper size they were transplanted, some into large pots and others into large boxes. As soon as the blossoms appeared, a study of the sexual elements was begun. For the first few weeks following the appearance of the flowers, much time was spent in a study of the pollen of these plants. The results of this investigation are given below.

(1.) A comparison of pollen.

In attempting to account for failure in crosses, one is apt to consider pollen as the source of trouble. In view of this fact, a structural and germinative study of pollen was made. Pollen from flowers of the kinds mentioned above was examined in dry and fluid mounts, but no differences in form or structure could be detected. Although the pollen from both species was to all

1. H. P. Gould, Studies in Potency of Pollen, Cornell Univ. Thesis, 1897.

appearances precisely alike, germinative tests were made to note any differences in rapidity and per cent of germination. For this study sugar solutions of 1, 2, 3, 5, and 10 per cent were taken as culture media. It seems remarkable that plants which are so different in gross structure should show absolutely no difference in structure of their pollen, or in per cent and rapidity of germination. In all cultures, however, the protoplasm streamed out in much the same manner, and measurements were made of the length of pollen tubes, but even here no difference could be detected.

A study of pollen of yellow plum was furthered by making close-pollinations, without emasculating, and covering the flowers to prevent access of foreign pollen. In nearly every case the pollen did its work, for the fruit set and came to maturity. Treated in a similar way flowers of red currant gave similar results.

(2.) Trouble with pistils.

In view of the foregoing study and its results, the writer was convinced that the trouble lay, not with the pollen, but probably with the pistils, or in combining yellow plum pollen and red currant pistils. By this time the process of emasculation was begun, and here great difficulty was experienced. It seemed almost impossible to emasculate the red currant without destroying the upper portion of the pistil. This trouble led to a comparative study of the pistils of red currant and yellow plum. This comparison has revealed the major reason for inability to cross the plants.

The pistil of the red currant is considerably smaller than the yellow plum, as can be seen with only a superficial examination; but a more careful study reveals the fact of minor differences which are of considerable importance. The most striking difference, aside from that of size, is to be found at the junction of style and ovary. At this point, in the case of red currant, there is a constriction in the pistil, which is much narrower and is placed in a slight depression in the ovary. A critical examination, however, shows no joint, although there is a slight dissimilarity in size and structure of cells. The style of the red currant is, then, largest half way between the ovary and stigma, that is, it tapers toward the stigma and also toward the ovary.

The pistil of the yellow plum, on the other hand, is continuous with the tissue of the ovary and does not exhibit that narrowed structure which is seen in the red currant; but, in fact, is larger and broader there than elsewhere.

This comparison brings up the mechanical feature in crossing these two species. Here, then, one may note that the red currant flowers can be successfully emasculated only by exercising great care, on account of the ease with which the style separates from the ovary, a slight push to one side being sufficient to detach it. Furthermore the pistil is very slender and exceedingly delicate, and being deprived of the protection which the united stamens afford, it is exposed to changes of temperature and moisture which in most cases are fatal to the pistil.

In successful emasculation of red currant, and with the ordinary method of covering the flowers with paper bags, it was practically impossible to keep the pistils fresh till the period of receptivity. In the majority of cases the pistils withered in the course of twenty-four hours after emasculation, and hardly a single one could be found in perfect condition three days after the removal of stamens. Even when the pistils did survive and were pollinated they did not remain fresh long enough for the pollen to do its work.

In view of these difficulties, it became evident that some means should be provided to prevent the withering and dying out of the pistils. Instead of covering each cluster of flowers with manilla bags, glass bell-jars which covered the whole plant were used, thus eliminating to a marked degree the exposure of the pistils, and securing a fairly uniform condition of moisture and temperature. It should be said here that this scheme was feasible only by using small plants and very large glass bell-jars. By thus protecting the flowers, and in fact the whole plant, less difficulty was experienced in keeping pistils in good condition as long as seemed necessary. Nearly as good results were obtained by using double paper bags, and similarly covering the whole plant. Such good results followed these special methods that the real difficulty in making these reciprocal crosses was considered to be mechanical, and this difficulty can be very largely overcome as previously indicated.

Seeds saved from fruits of these reciprocal crosses, produced fertile plants, and thus we have an answer to our opening questions: Reciprocal crosses of red currant and yellow plum can be made; but special care must be exercised in emasculating the flowers of red currant, and the pistils must be protected from injurious effects of changes of temperature and moisture. The real difficulty in making these reciprocal crosses is a mechanical one, and lies in the delicate structure of the pistil of the red currant.

B. A STUDY OF SQUASHES.

All the previously mentioned impossible reciprocals are those between distinct species; but with the squashes we have more closely related plants, the summer crookneck and golden custard being horticultural varieties of the same species, *Cucurbita Pepo,* a condition which makes the problem all the more remarkable and adds greatly to the interest of the inquiry for facts in the general problem of impossible reciprocals.

(1.) The field work.

The time when this work was done, and the conditions under which the material was obtained, lend latitude to the problem. Some of the plants for this study were grown in the University greenhouse in the winter and spring of 1903, but most of the material was obtained from plants grown in the garden under normal conditions of culture. Plants which were grown out-of-doors were planted June 18 and began to blossom August 10. Staminate flowers were the first to appear, and at this time a study of the pollen of the two varieties was taken up, which will be described in the histological part of this subject.

Pollinating the Plants.—The flowers of the squashes are of exceedingly short duration; the corolla remains open only one day, and generally somewhat less than twenty-four hours. Such short lived flowers necessitated daily attendance in the squash plot in order to do the pollinating when the staminate and pistillate flowers were in prime condition for the operation. Note should be made here of the great care that was taken in securing pure fresh pollen, and applying it to the pistils that were at their height in the period of receptivity. Since the flowers exist only for a short time, pure pollen was easily secured by tying a string over the tip of the corolla the day before the flower opened, thus preventing access and mixture of pollen. Pistillate flowers were protected in the same way—the stigmas were never exposed except for the moment when pollen was applied to them.

Other methods of protecting the flowers were tried, such as covering with paper bags and glass bell-jars, but were found less satisfactory owing to the fact that a close atmosphere for the entire flower seemed to hasten decay of the pistils, thus shortening the age of the flower and giving less time for the action of pollen. No pollen was used that was more than twenty-four hours old; and all pistils were discarded, which, because of age or structure, were unfit for pollination work.

By actual count, 284 pistils of crookneck squash were pollinated with golden custard. Of this number about one-third were picked off at various stages, and preserved for microscopical study. The rest were left on the vines as long as they remained intact. As would be expected in any case of artificial pollination, a large number of the crosses were a complete failure, as was evidenced by the early death of all parts of the flower. In a few cases, however, the ovary made an unusual growth, due, it was thought, to the scarcity of blossoms, and to the vigor of the plants; and as interesting results were in sight, these fruits were left till frost killed the vines.

No apparent difficulty was experienced in crossing golden custard with crookneck; and pistils of each could be fertilized with pollen of its own kind and from the same plants, but pollen of golden custard would not act on pistils of crookneck. Facts of this nature seemed to indicate that the difficulty lay, not with poor pollen in either case, nor with poor pistils, but rather in the way they were combined.

(2.) Histological studies.

This feature of the work was begun by a study of dry pollen, pollen in fluid mounts, and germinating pollen grains. In this work all study was comparative. Pollen of crookneck and golden custard was taken to the laboratory and examined with high and low power objectives, with grains in dry and fluid mounts; but in size, shape and surface markings the pollen of the two varieties was precisely alike. Pollen grains of the squashes do not germinate readily in artificial media, and because of this fact a study of germinating pollen was attended with poor success. A careful examination of the male elements of the squashes adds nothing to the solution of the problem.

Pistils of crookneck pollinated with golden custard, representing all possible stages, were picked; beginning with those of 24 hours' duration and passing up to those which had been pollinated 7 and 8 days. Pistils generally remain fresh 3 to 4 days, and in some cases they did not show decay till the fifth day after pollination. Of self-pollinated and cross-pollinated flowers there seemed to be no difference in duration of flowers. In many cases pistils were left on the plant till the stigma and style had decayed and fallen off; in such cases only a portion of tissue, that immediately surrounding the ovules, could be preserved, but this was actually necessary in order to give pollen tubes—if they did germinate and enter the ovarian region—a chance to act, and furthermore to give the investigator an opportunity to study the final action of such tubes.

Of course a study of the germination of pollen tubes necessitated a large amount of histological work, and in order to get material in condition for this study the following method was followed: Pistils were picked, trimmed so as to avoid all unnecessary tissue, killed, and fixed in a one per cent solution of chromo-acetic acid for 30 hours, washed an equal length of time in tap water, hardened and dehydrated in alcohol of 35, 50, 70, 95 per cent solution, and finally in absolute alcohol. The alcohol was replaced by xylol, and the pistils were then imbedded in paraffin. Sections were cut at thicknesses varying from three and one-third to twenty micro-millimeters; twenty micro-millimeters proved the most satisfactory. The three-color-stain—Flemming's safranin, gentian-violet, and orange G. was used. The tissues were mounted in balsam and finally studied with the microscope.

The object of making and examining these sections of the pistils and ovaries was to ascertain if possible, some reason why fecundation failed to occur, the chief aim being to trace the pollen tubes, if formed, from stigma to ovules. The tracing of pollen tubes is a comparatively easy thing to do, provided the tissue is properly handled and successfully stained. The triple stain previously mentioned proved especially good for this work. In this case the cytoplasm of embryo-sac and pollen tube stains from gray to orange, the nucleus violet, and nucleolus red. Besides being different in color, the pollen tubes are distinguished by the peculiar granular structure of their protoplasm.

The germination of golden custard pollen on pistils of crookneck, is not a rapid process. On an average the tubes have to pass through one and three-eighths inches of tissue, and it generally takes about 8 days for the generative nucleus to reach the embryo-sac. In other words the tubes descend at the rate of four and one-fourth millimeters per day. Germination of pollen begins very soon after the deposit of the grains on the stigma, for at the end of 24 hours many of the tubes have attained a length equal to twice and in some cases three times the diameter of the grain. Before the end of the second day the vegetative nucleus has passed into the tube, and soon after this the generative nucleus has also started on its downward course. During the two following days the tubes continue to descend, and oftentimes they branch to some extent. From this time on nothing important happens till the male protoplast reaches the ovarian region and comes in the vicinity of the micropyle. This occurs about the sixth day, or sometimes between the fifth and seventh days. Before the end of the eighth day the generative nucleus has passed the vegetative, enters the embryo-sac, and finds a resting place near the germ cell. This seems to be the final action of the pollen spore, for tissue nearly ten days old shows the same condition as that which has been pollinated eight days. This seems to give a key to the situation. Pollen grains germinate, pollen tubes descend, the pollen spore enters the embryo-sac; but the nuclei do not fuse. Fertilization does not occur. The reason for failure is, apparently, a refusal of the embryo of crookneck to be impregnated by pollen spores of the other variety.

It now becomes evident that where there is no incompatibility in the structure of the flowers, where no mechanical difficulties exist, and when the pollen tubes descend and enter the ovarian region, the reason that certain reciprocal crosses cannot be made, is non-fusion of male and female nuclei. The elements do not come together, although the protoplast of the pollen grain arrives, that is, in many cases it enters the embryo-sac.

In some cases the nuclei are some distance apart in the embryo-sac while in others the distance which separates them is only twice their diameter. Such cases are quite common. Now, with these facts before us, we are confronted with the question as to which element, male or female, refuses to fuse with the other. In other words, does the pollen spore fail to take, or does the germ cell fail to receive? From the nature of the case we suppose that the germ cell will not receive; for the male nucleus has arrived, and therefore, has seemed to have done its work. That the failure to fuse is not due to a difference in structure of the nuclei, is shown by the microscope. The nuclei, so far as the microscope reveals, are of precisely the same size and shape. So that the dissimilarity or differentation of gametes, if such exist, must be sought in characters which are probably constitutional, perhaps chemical, in nature.

It has been suggested that the reason why the elements do not unite is because there is a lack of affinity in the plants crossed. But an explanation of this sort does not explain, for we hesitate to define lack of affinity. It is well to refer here to the statements that closeness of relationship marks the limit of successful grafting. And the same thing may be said in regard to the limits of crossing. As a rule, only closely related plants can be crossed. Affinity, resemblance, or likeness, allows the union of similar parts. Dissimilarity or unlikeness prohibits union. Now, if we return to reciprocal crosses, we find it difficult to make the application. How is it that the golden custard squash is so like the crookneck that it will receive its pollen and bear seed; but the crookneck be so unlike the golden custard as to refuse to be fertilized by such pollen? If such conditions exist, they must be centered in the sexual elements, the gametes.

In speaking of the delicate adjustment of plants, Wallace[1] has suggested that the reason certain plants refuse to cross recoprocally, is an indication of disturbance of the sexual organs. Very likely there is a germ of truth in this suggestion, and we might add that the sexual organs of impossible reciprocals are in a state of unstable equilibrium. This seems rational from the nature of the case; but what is disturbed? Is it the molecular swing of the basis of life? Is some constitutional character disturbed? Or is there a disturbance in one or both cases? This feature of the problem must remain as a matter of conjecture.

Since there does not appear to be a difference in structure of the gametes, it is at least possible that a disturbance has taken

1. Alfred R. Wallace, Darwinism, page 155.

place which has resulted in some chemical differentation. If this theory is tenable, fusion is prohibited because the chemical stimulus which unites the elements is impaired or destroyed. Some slight change in the chemical composition of the gametes or of the embryo-sac, perhaps both, would disturb the equilibrium and impair the forces which cause fusion. As it now appears, the egg-cell of crookneck is indisposed toward pollen spores of golden custard, that is, there is a manifest expression of selection with crookneck pistils. Not all pollen is congenial, some pollen spores will not be received, and among these non-receptive gametes are to be included those of golden custard. In other words, this is apparently an example of what has been called "sexual elective affinity."

(3.) Some products of the crosses.

When the fruits mentioned above had come to full maturity they were cut open and in some cases many seeds were found which appeared to be well formed. Such results were surprising, but were not to be accepted as demonstrations that these reciprocal crosses can be made, until the fertility of the seeds had been determined and the character of the offspring observed.

The seeds were dried and planted to determine if they were viable; and if so, to ascertain if the offspring were also fertile. The seeds were planted in the greenhouse, and the following is the record of their germination.

No. of the fruit.	No. of seed produced.	No. of seeds planted.	No. of seeds germinated.	Per cent germinated.
1	195	25	5	20
2	160	25	0	0
3	33	25	5	20
4	40	25	5	20
5	37	25	15	60
6	56	25	14	56

The higher percentage of germination in the last two cases may be accounted for by the more careful selection of seed; only the best were planted. The above figures are of value in showing the degree of viability of the seeds.

Bringing forward the figures previously used we have the following statement: Of 284 pollinations more than 200 pistils were left on the vines as long as they remained intact. From these 200 pistils 18 well formed fruits were obtained; of the 18 fruits only 6 produced seeds with embryos, and from these 6 only 5 contained fertile seeds. Germinative tests of these seeds showed on the average that 30 per cent were viable. These facts emphasize the importance of a practical study of the obscure problems concerning plant development as opposed to generalizations from a study of the minute structure of the organs.

From the foregoing results the following statements seem reasonable:

I. Reciprocal crosses with crookneck and golden custard squashes are not absolutely impossible.

II. Golden custard pollen varies in its degree of potency and shows all possible stages, ranging from perfect fertility to perfect sterility. These stages are shown in the decay of crookneck pistils, when pollinated with golden custard; in microscopical sections of such pistils; in the partial and complete development of fruit and seed; and in the sterility and fertility of seed.

GENERAL SUMMARY.

From the foregoing investigations the following conclusions seem justifiable:

Failure in making reciprocal crosses may be explained by some incompatibility in the structure of the flowers. Such barriers may result from delicate structures, and constitute mechanical difficulties.

Failure of pollen to produce fecundation may be explained by the incomplete development of pollen tubes, or, in cases of complete development, by the non-fusion of nuclei.

Failure in the fusion of male and female nuclei is indicative of disturbance of the sexual organs. Such disturbances may be chemical, but are probably constitutional in nature.

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DESCRIPTION OF PLATES.

Figure 10. Male blossom of squash tied to insure purity of pollen. See page 91.

Figure 11. Female blossom of squash (Crookneck) previous to pollination; tied to prevent accidental crossing. See page 91.

Figure 12. Longitudinal section of Crookneck and Golden Custard squashes, at time of pollination.

Figure 13. Crookneck crossed by Golden Custard, at maturity. No. 2 mentioned on page 96.

Figure 14. Crookneck crossed by Golden Custard, at maturity. No. 4 mentioned on page 96.

Figure 15. Crookneck crossed by Golden Custard, 14 days after pollination. No ovules were fertilized and the fruit had begun to decay.

Figure 16. The offspring of Crookneck crossed by Golden Custard. Note the intermediate characters.

Figure 17. Golden Bush crossed by Hubbard. Illustrating the possible stimulating effect of pollen upon the ovary in the absence of fertilization. No fertile seeds were produced.

Figure 18. Stigmas of Red Currant and Yellow Plum tomatoes. See page 89.

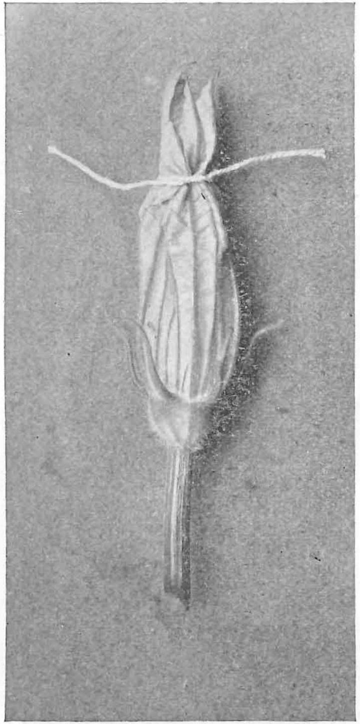


Figure 10.

Figure 11.

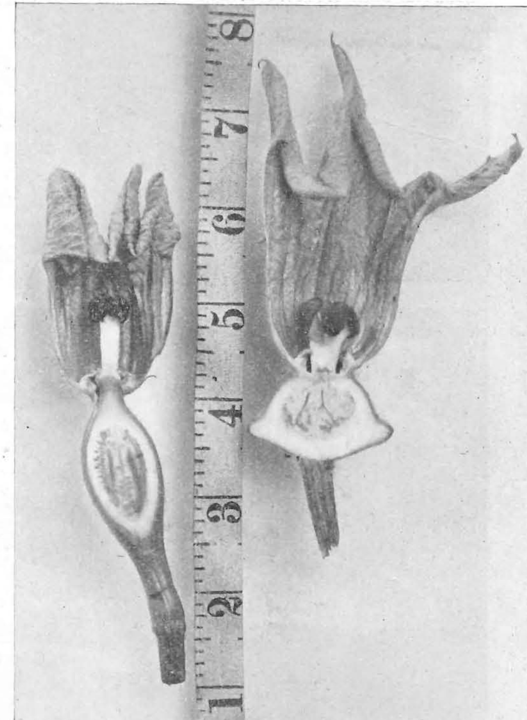
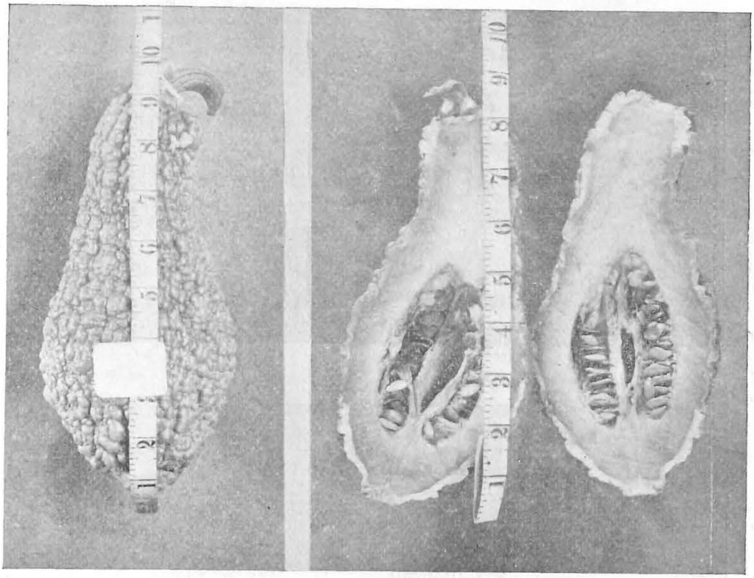


Figure 12.



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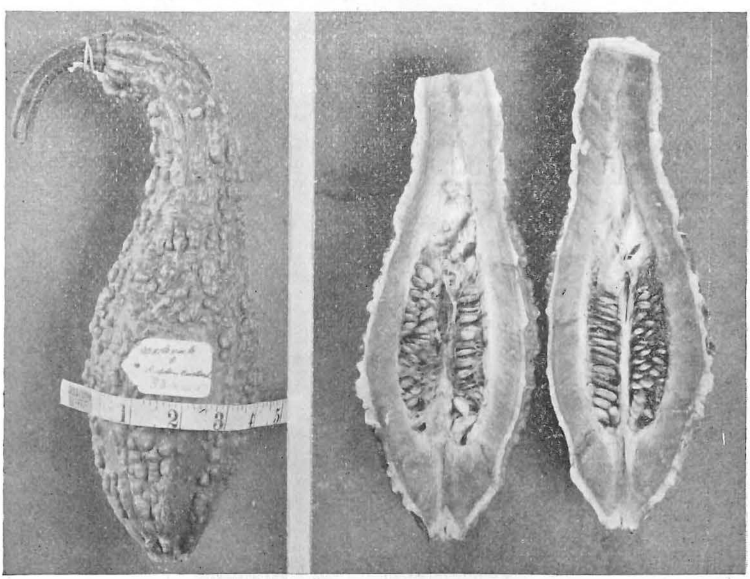

Figure 14.

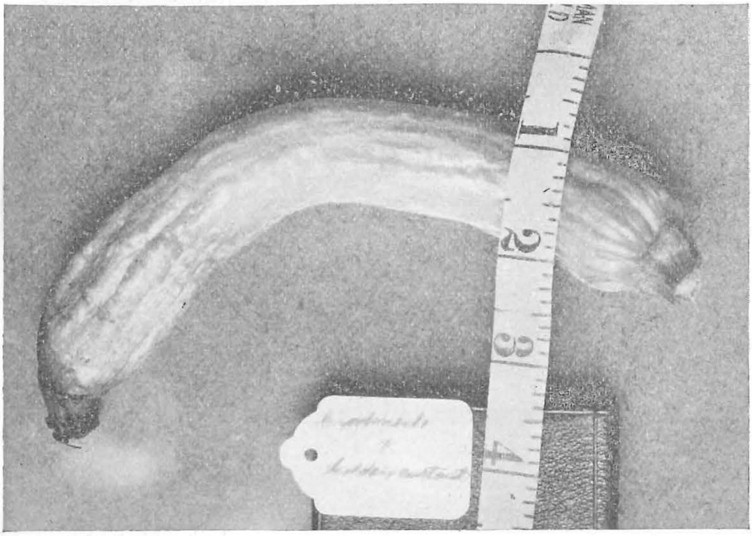

Figure 15.

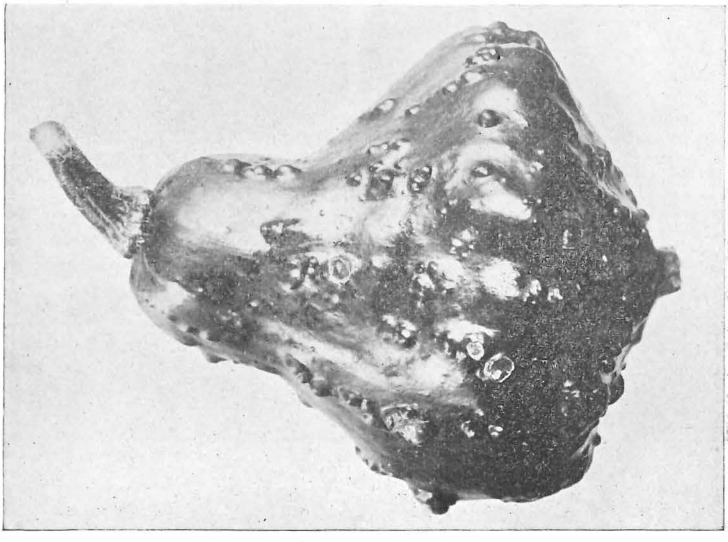

Figure 16.

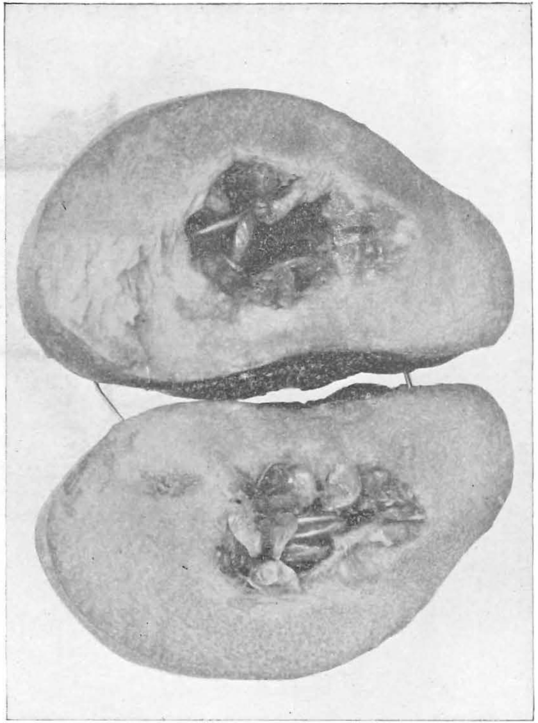

Figure 17.

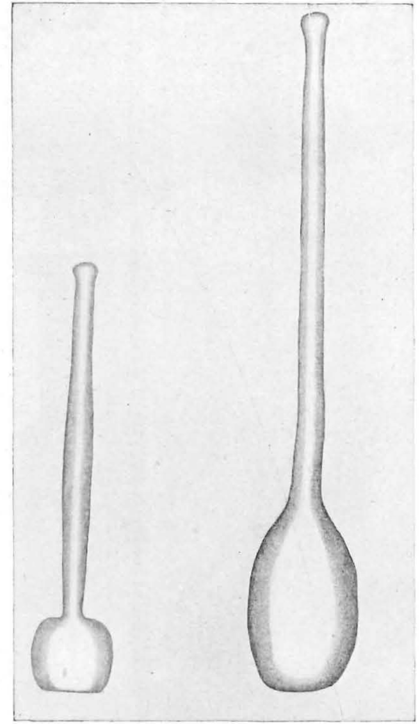

Figure 18.

SOY BEANS IN MAINE.

CHAS. D. WOOD and J. M. BARTLETT.

The soy bean was introduced into the United States several years ago from Japan, where it is grown for human food. In this country it has chiefly been grown as a forage crop, and as it thrives best in a moderately warm climate is better known in the southern and middle than in the northern states. Some of the earlier varieties, however, will mature seed in New England. At the Massachusetts and Storrs (Conn.) Experiment Stations a few varieties have been grown quite successfully for soiling crops, for silage by itself or mixed with corn, and for the seeds. Farmers' Bulletin No. 58 of the United States Department of Agriculture summarizes the present status of the soy bean as a forage crop. Because of numerous inquiries, the Maine station has experimented somewhat with this crop. The result of these experiments are here reported and there is also included such deductions and citations from Farmers' Bulletin 58 and the publications of the Massachusetts and Storrs stations as seem adapted to Maine climate and conditions.

THE PLANT.

"The soy bean is an erect, annual plant, with branching, hairy stem, trifoliate, more or less hairy leaves, rather inconspicuous pale lilac or violet colored flowers, and broad, two to five-seeded pods, covered like the stem, with stiff, reddish hairs. The seeds vary in color from whitish and yellowish to green, brown and black; and in shape from spherical to elliptical and more or less compressed." *

The seeds are self pollinated and on this account are sure to produce seeds wherever the plants reach maturity.

* Farmers' Bulletin 58, U. S. Dept. of Agr.

VARIETIES.

There are numerous quite distinct varieties of the soy bean, only the earliest of which can be grown in Maine. The early white soy bean is the best variety for seed with us. It is not a good variety, however, for soiling or silage on account of its small size, while its tendency to drop its leaves early unfits it for hay. Plants of this variety matured seed at Orono in 1904. The medium early green is one of the best for Maine as it yields heavily and retains its leaves well. This last is an important feature if it is planned to make hay from the crop. The medium early black is the favorite in the central states.

In 1903 and 1904 the Station grew several varieties of soy beans from seed furnished by the United States Department of Agriculture. The early white soy bean matured and the medium early green and black varieties formed pods. The Henderson Early, (a medium early green), purchased from Peter Henderson Company, New York, was as satisfactory as any grown, both in earliness and yield.

CONDITIONS OF GROWTH.

"It is believed in Japan that in northern climates, soils of a rather strong character are best adapted to the soy bean. It is usually sown about the end of May, and when used for hay is cut early in August. In both Europe and America it has been found to thrive best on soils of medium texture that are well supplied with potash, phosphoric acid, and lime. It succeeds very well, however, on comparatively light soils, often giving an abundant crop on soils too poor to grow clover." *

The soy bean requires about the same temperature as corn. Professor Brooks says that the earlier sorts will mature in Massachusetts with as much certainty as will the earlier varieties of corn.

As a general thing, the soy bean is not so easily injured by frost as the common field or garden varieties of beans, and hence it can be planted earlier in the spring and can also be left in the field later in the autumn.

* Farmers' Bulletin 58, U. S. Dept. of Agr.

FERTILIZING AND CULTURE.

Like all leguminous plants, the soy bean, through the aid of root tubercle organisms, acquires atmospheric nitrogen. When the soy bean was first introduced into America it did not form root tubercles. In order to insure the growth of the root tubercles it is necessary to use seed that has been inoculated, or to inoculate the soil with the proper organisms. This last is readily done by applying broadcast a small amount of soil taken from a field where soy beans developing root tubercles have been grown. At this Station no tubercles formed on plants grown in soil that had not been inoculated, but they grew abundantly where soil from infested soy bean was applied at the rate of a few barrels to the acre. According to our experience the beans will grow as well without the root tubercle as with, provided they are liberally fertilized. Their economical growth depends upon the presence of the root tubercles, as in this way they can be grown with little or no nitrogen in the fertilizer. If they are to be grown on soil containing no root tubercle organisms, they require a fairly liberal application of a complete fertilizer. If grown in good soil where root tubercles may be expected to develop, only phosphoric acid and potash need be supplied in the fertilizer. The soil should be prepared as for ordinary beans. It should be made fine, free from clods and lumps, and smooth. A good seed bed is essential to a good growth.

In this climate the soy bean should be planted a little earlier than ordinary beans, but not until the ground has warmed up considerably. The first season we planted in drills 3 feet apart. This was too far apart for the best yield. Nearly double the yield per acre is obtained when the drills are 16 inches apart. In the case of the wide drills it was necessary to cultivate three times with the horse cultivator. With the drills 16 inches apart they were cultivated once with a hand wheel hoe. On fairly clean land good success may be had with broadcasting or still better by the use of the grain drill. If planted in rows, the seed should be sown with a hand seed drill similar to that used for beets or turnips. It will require about 3 pecks of seed per acre of the medium green soy bean when seeded in drills 16 inches apart. If the seed is broadcast, a bushel will be none too much for an acre. It will probably not be wise to attempt to grow soy beans in Maine for the seed, but if this is done, the drills should be at least 20 inches apart and the soil should be kept stirred and clean, as in the case of ordinary field beans. If wanted for silage, the beans can be grown alone or planted with corn. The latter method is quite strongly recommended, the seeds being mixed and put in the planter in the proportion of 10 quarts of corn to 7 of beans. The forage from this mixture can be fed green or cut for the silo.

HARVESTING.

From analyses made at the South Carolina Experiment Station it appears that the dry matter carries relatively about the same percentages of protein and fat when the pods are just forming as they do when the pods are well developed. The stalk carries a large amount of crude fiber, and on this account the leaves are the most important part of the green plant for feeding. The yield will be somewhat greater near maturity but when digestibility and palatability are considered, cutting as soon as the pods form is probably better. From our experiments, plants will be ready to cut with corn for silage if the seed is planted about June 10.

If the crop is to be used for soiling, cutting can begin when the plants are in early bloom and can be kept up in this climate until frost. The soy bean is a coarse growing plant and cures slowly, and on this account it is doubtful if it should ever be grown in Maine to be cured as hay. Cock curing is the most practical method, but will be likely to prove unsatisfactory. For the silo the harvesting can be delayed as long as it is prudent to allow corn to stand in the field. A grain reaper and binder can be used to advantage in harvesting this crop for the silo. If in drills 16 inches apart, 3 or 4 rows can be cut at once. A mowing machine can be used to cut the crop, but it will not handle as well for the silage cutter as when in bundles.

In harvesting a crop for seed, it can be cut before the pods are mature. If the pods become too ripe (in this climate there is little danger of this, however,) before harvesting, they are liable to burst and shell and thus part of the seed be lost. In harvesting for seed the crop can be pulled by hand, or cut by hand or machine. It will be quickest cured if put in piles that are relatively high and narrow. Threshing can be by hand or machine.

YIELD.

The yield of green fodder that can be had in Maine will probably vary from 5 to 10 tons per acre. In the large plots grown by this Station in 1903 the largest yield was only a little over 5 tons to the acre. But the rows were twice too far apart, having been planted in drills 3 feet apart. If they had been planted at the same distance as the small plots in 1904 (16 inches) there is no reason for thinking the yield would not have been nearly or quite doubled, for at no time did the plants come near filling the space between the rows. On good land, with fair cultivation and average season, a yield of 8 tons of green fodder could doubtless be counted upon. Cured into hay this would give a yield of about 2½ tons per acre.

NUTRIENTS IN SOY BEAN AND THEIR DIGESTIBILITY.

In the Farmers' Bulletin previously cited, tables arranged with great care showing the chemical composition of the various parts of the soy bean and their digestibility are given. These tables are quoted in the tables on pages 86 and 87 and to them are added the results of analyses and digestion experiments made at this Station with soy bean and corn.

The composition of the soy bean as compared with other legumes stands high. The fodder closely resembles clover in composition and soy bean silage, in both composition and digestibility, is the equal of clover silage. It is doubtful if any more digestible nutrients can be grown from an acre with soy beans than with clover. But in some localities they are a surer crop and need only a single season for their growth. Soy beans would be more naturally compared in this State with corn, for if grown at all they seem best adapted for silage. The chief difference between corn and soy beans is found in the high protein content of the latter. Like other beans it has the power of taking its nitrogen to form protein from the air, and since it is richer in protein than corn it may be justly considered a desirable addition to the list of forage plants. As the price of feeds rich in protein is advancing it seems very desirable that as many legumes (plants rich in protein) that can gather their own nitrogen from the air be grown as possible.

7

CHEMICAL COMPOSITION OF SOY BEAN AND CORN FORAGE AND SILAGE.

Forage.	Number of analyses.	Fresh or Air-dry Substance.						Water-free Substance.				
		Water.	Ash.	Protein.	Crude fiber.	Nitrogen-free extract.	Ether extract.	Ash.	Protein.	Crude fiber.	Nitrogen-free extract.	Ether extract.
Early bloom to seed[1]	13	76.5	2.3	3.6	6.5	10.1	1.0	10.0	15.3	27.6	43.0	4.1
Whole plant, pod just forming[8]	1	73.2	2.0	3.0	4.9	15.9	0.9	7.7	11.0	18.5	59.4	3.4
Corn fodder[8]	13	78.9	1.3	2.3	4.2	12.7	0.6	6.1	10.8	19.8	60.3	2.9
Soy bean hay (Jap.)	1	16.0	5.9	16.9	35.9	23.1	2.2	7.0	20.1	42.7	27.5	2.6
Soy bean hay (Mass.)[2]	4	12.1	7.3	14.2	21.1	41.2	4.1	....	16.2	24.0	46.8	4.7
Soy bean straw (Mass.)[2]	3	11.4	6.4	4.9	37.6	37.8	1.9	....	5.5	42.4	42.7	2.2
Soy bean straw, hulls and vines after threshing[3]	1	5.7	3.9	4.0	49.5	36.0	0.8	5.3	4.25	52.6	38.2	0.85
Soy bean seed[4]	8	10.8	4.7	34.0	4.8	28.8	16.9	5.3	38.1	5.4	32.2	18.9
Soy bean meal[5]	2	10.4	5.1	36.0	2.6	27.0	18.9	5.7	40.2	2.9	30.2	21.0
Soy bean silage[6]	1	74.2	2.8	4.1	9.7	7.0	2.2	11.0	15.7	37.6	27.0	8.7
Corn and soy bean silage[7]	4	76.0	2.4	2.5	7.2	11.1	0.8	....	10.4	30.0	46.3	3.3
Corn and soy bean silage[8]	1	79.8	1.2	2.1	5.1	11.1	0.7	5.8	10.5	25.2	55.3	3.2
Mature corn silage	1	79.6	1.0	2.1	4.7	11.8	0.8	4.8	10.2	23.1	57.9	4.0
Immature corn silage	4	79.7	1.0	1.5	5.1	11.8	0.8	4.9	7.4	25.7	59.0	3.0
Millet and soy bean silage[7]	9	79.0	2.8	2.8	7.2	7.2	1.0	....	13.3	34.3	34.3	4.8

[1] Ninth An. Rep. Storrs Exp. Sta., pp. 281, 285 (1896).
[2] Eighth An. Rep. Mass. Hatch. Sta., p. 87 (1896).
[3] Second An. Rep. S. C. Exp. Sta., p. 179 (1890).
[4] Bull. 15 U. S. Dept. Agric., Office Exp. Stations, p. 390 (1893).
[5] Eighth An. Rep. Storrs Exp. Sta., pp. 183, 186 (1895).
[6] Bull. Tenn. Exp. Sta., Vol. IX, No. 3, p. 106 (1896).
[7] Ninth An. Rep. Mass. Hatch. Sta., p. 140 (1897).
[8] Maine Station, unpublished results.

SOY BEAN SILAGE.

The soy bean plants dried do not make desirable forage as the cured stalks are rather coarse and hard, and are therefore best fed green or made into silage. Like most leguminous plants, soy beans do not keep as well in the silo alone as when mixed with corn. Consequently, in the trials made at the Maine Station, the beans were cut and put into the silo with corn. The proportion in this case, for convenience, was about fourteen of corn to nine of beans. The silage kept perfectly and when fed out was nearly as green as when it went into the silo. The animals ate it with great relish and the sheep preferred it to clear corn silage. The composition of the fresh beans and the silage are given in the table on the opposite page.

Two experiments were made at this Station, one with sheep and one with steers, to ascertain the digestibility of the silage described in the preceding paragraph. The detailed results will be given in a later bulletin, but the coefficients obtained are given in the table below. It will be noted that the coefficients obtained for protein and fat are a little below those found by the Massachusetts Station, but are above those of soy bean silage.

DIGESTIBILITY OF SOY BEAN AND CORN FORAGE AND SILAGE.

Kind of Forage.	Kind of animal.	Number of trials.	Organic matter.	Ash.	Protein.	Crude fiber.	Nitrogen-free extract.	Ether extract.
Soy bean fodder[1]	Sheep..	8	64.5	18.9	75.1	47.0	73.2	54.0
Corn fodder[5]	Sheep..	12	72.8	44.5	66.4	75.4	72.9	69.5
Soy bean meal and timothy hay[1]	Sheep..	8	69.1	47.1	77.7	61.3	66.2	73.6
Soy bean meal alone[1]	Sheep..	8	78.0	21.3	85.8	......	73.4	84.9
Soy bean (seed)[2]	Sheep..	2	85.0	......	87.0	......	62.0	94.0
Soy bean pods[2]	Sheep..	2	63.0	......	44.0	51.0	73.0	57.0
Soy bean straw[2]	Sheep..	4	55.0	......	50.0	38.0	66.0	60.0
Soy bean hay[2]	Sheep..	6	......	......	70.0	56.0	67.0	30.0
Soy bean silage[3]	Goats ..	2	......	......	76.0	55.0	52.0	72.0
Soy bean silage[3]	Steers[4].	2	......	......	55.0	43.0	61.0	49.0
Corn and soy bean silage........	Sheep..	3	......	......	65.0	65.0	75.0	82.0
Corn and soy bean silage...... .	Sheep..	2	73.2	42.7	62.6	65.1	79.1	67.7
Corn and soy bean silage...	Steers..	2	72.2	31.3	56.4	61.7	80.5	66.7
Corn silage[7]	Sheep..	7	77.0	32.5	65.4	77.4	78.5	82.9
Corn silage[8]	Sheep..	10	73.6	30.3	56.0	70.0	76.1	82.4
Barn yard millet and soy bean silage...........................	Sheep..	4	......	......	57.0	69.0	59.0	72.0

[1] Ninth An. Rep. Storrs Exp. Sta., pp. 248, 250 (1896).
[2] Sixth An. Rep. Storrs Exp. Sta., pp. 160, 161 (1893), taken from European tables by Drs. Dietrich and König.
[3] Ninth An. Rep. Mass. Hatch. Exp. Sta., p. 165 (1897).
[4] Very low; probably quite mature when harvested.
[5] Maine flint corn, ears glazed.
[6] Maine Station unpublished results.
[7] Maine flint corn, ears glazed.
[8] Im mature corn.

YIELD OF DRY MATTER AND PROTEIN.

SOY BEAN VS. CORN FODDER.

The average yield for 7 seasons at the Maine Station of fodder from corn of Sanford or similar variety that will not mature in this climate was a little over 17 tons per acre. For the same period the average yield of green fodder from matured corn was a little over 11 tons per acre. The same season that the Massachusetts Station obtained a yield of 16 tons of Longfellow corn they harvested 10 tons of soy bean fodder from one acre. If we assume an average yield of soy bean fodder at 8 tons and corn fodder at 12 tons per acre, and use in calculation the average of the 13 analyses of each material given in the table, the soy bean would yield 3,560 pounds of dry matter and the corn 5,064 pounds. The soy bean would contain 576 pounds of protein and the corn 552 pounds.

It would therefore appear that a crop of corn will give practically as many pounds of protein as a crop of soy beans, and over 40 per cent more dry matter. Furthermore, the nutrients of the corn are more digestible than those of soy beans. The corn is probably a surer crop, but on the other hand it requires a fertilizer carrying more nitrogen (costing from $10 to $15 per acre) to grow the corn and it is necessary to handle 50 per cent more material to obtain the same weight of protein.

SUMMARY.

Soy beans can be grown in parts of Maine where corn thrives.

Where early corn matures, the early white soy bean will usually mature.

Where Sanford corn ears, the early medium soy bean will form pods.

Soy bean can be grown with less nitrogen than corn.

In order to grow the soy bean most economically, the soil should be inoculated with the organism that forms root tubercles.

The soil should be prepared as for corn or beans and should be free from lumps and clods.

Fertilizers carrying phosphoric acid and potash are essential and on good land no nitrogen is needed if the soil is inoculated for root tubercles.

Sown in drills 16 inches apart, about 3 pecks of seed is needed per acre. If drilled with a grain drill or sown broadcast, more seed, perhaps a bushel per acre, will be needed.

Soy beans can be grown with corn, mixing the seed at the rate of 10 quarts of corn and 7 of soy beans. Thus seeded the drills should be about 3 feet apart.

When sown in drills they should be cultivated the same as common beans. In case of narrow spaces between drills, a hand wheel hoe does the work rapidly and well.

The crop is best adapted for feeding green or for silage.

The crop can be harvested by hand or machine. For silage a grain reaper and binder leaves it convenient for handling and for the silage cutter.

A yield of 8 tons of green crop is an average in average seasons on average soil.

Eight tons of soy bean fodder carries about the same amount of protein as 12 tons corn in milk ready for the silo, but it carries only a little more dry matter than 8 tons of corn.

If grown with corn, it can be cut with the corn, by hand or a corn harvester.

When grown by itself for silage, it is best mixed with corn at time of cutting into the silo. About 3 parts corn to 2 parts beans is a very good proportion.

Less protein (the most expensive part of commercial feeding stuffs) need be fed with soy bean and corn silage than with corn silage alone.

According to Farmers' Bulletin 58, "the soy bean is excellent for green manuring and for short rotations with cereal crops. It should be well limed when plowed under as green manure."

FEEDING EXPERIMENTS WITH COWS.

CHAS. D. WOODS.

SOY BEAN SILAGE AND CORN SILAGE COMPARED.

A rough feeding experiment was made by the Station in the winter of 1903-4 in which the feeding value of the soy bean and corn silagė was compared with clear corn silage. Six cows were employed and the rations fed and milk produced during each period of the experiment are given in the table below.

It will be noticed that the grain ration during the second period when the soy bean silage was fed, was reduced one pound per day for each animal. The grain mixture was very rich in protein and as the soy bean silage was richer than the corn silage, it was thought this reduction could safely be made without affecting the milk flow. The experiment was not so satisfactory as it would have been had not an epidemic of winter scours attacked the herd when the experiment was in progress. This attack was most severe during the period when the soy bean silage was being fed, consequently the yield of milk from some of the cows was much reduced. From this cause the milk flow of Gertrude was greatly reduced during the second period and her records are not included in the totals in the table.

The details of the experiment follow:

NAME OF COWS AND RATIONS FED FOR THREE PERIODS OF THREE WEEKS EACH.

First period when corn silage was fed.

Name of cows.	Rations.
Ruthele Addie 4th Addie 3d	Corn silage 30 lbs. per day per cow. Hay 15 lbs. per day per cow. Grain mixture 8 lbs. per day per cow.
Cummings Ruth Gertrude	Corn silage 30 lbs. per day per cow. Hay 15 lbs. per day per cow. Grain mixture 10 lbs. per day per cow.

Second period when soy bean silage was fed.

Ruthele Addie 4th Addie 3d	Soy bean and corn silage 30 lbs per day per cow. Hay 15 lbs. per day per cow. Grain mixture 7 lbs. per day per cow.
Cummings Ruth Gertrude	Soy bean silage 30 lbs. per day per cow. Hay 15 lbs. per day per cow. Grain mixture 9 lbs. per day per cow.

Third period same as first.

YIELD OF MILK PER WEEK FOR EACH COW FOR EACH PERIOD.

Feeding Periods.	Week.	Ruth —pounds.	Gertrude* —pounds.	Ruthele —pounds.	Addie 4th —pounds.	Addie 3d —pounds.	Cummings —pounds.	Total* —pounds.
First period of three weeks with corn silage.	First	212.2	148.9	158.9	116.8	171.2	140.5	
	Second ..	198.9	140.5	155.6	121.2	170.1	129.0	
	Third ...	192.6	126.5	154.2	116.6	162.0	133.6	
		603.7	415.9	468.7	358.6	503.3	413.1	2347.4
Second period of three weeks with soy bean and corn silage.	First	174.4	115.6	147.5	113.7	155.5	133.8	
	Second ..	173.3	113.1	150.8	120.5	150.5	131.8	
	Third ...	169.2	113.3	146.0	101.1	146.9	132.6	
		516.9	342.0	444.3	335.3	452.9	398.2	2147.6
Third period of three weeks with corn silage.	First	174.4	129.2	148.7	110.7	156.6	133.9	
	Second ..	169.2	147.6	146.5	104.8	156.8	135.4	
	Third ...	159.9	158.8	110.1	88.2	143.3	119.2	
		503.5	435.6	405.3	303.7	456.7	388.5	2057.7
Average of periods when corn silage was fed, milk	....	553.6	425.6	437.0	331.2	480.0	400.8	2202.6
Soy bean and corn silage period, milk	....	516.9	342.0	444.3	335.3	452.9	398.2	2147.6
Milk solids	....	68.7	46.9	60.6	45.8	61.8	50.7	287.6
Butter fat	....	23.8	16.6	20.4	16.3	22.4	18.3	101.2
Third period when corn silage was fed, milk	....	503.5	435.6	405.3	303.7	456.7	388.5	2057.7
Solids	....	70.2	56.5	59.2	38.9	63.9	53.6	285.8
Butter fat	....	25.2	22.5	20.7	12.7	22.4	19.4	100.4

*Gertrude omitted from totals.

SUMMARY OF RESULTS IN THE FEEDING EXPERIMENT WHERE MIXED SOY BEAN AND CORN SILAGE WAS COMPARED WITH CORN SILAGE.

Yields per period of 3 weeks.	Average of corn silage periods.	Third period corn silage.	Soy bean period.
	Pounds.	Pounds.	Pounds.
Milk	2203	2058	2148
Milk solids	....	286	288
Butter fat	....	100	101

While the results are not as satisfactory as could be wished, they seem to indicate that on the whole the cows did practically as well on the mixed corn and soy bean silage with one pound less grain as on corn silage with the larger weight of grain.

UNION GRAINS AND OIL MEAL AND BRAN COMPARED.

Union Grains,—Biles Ready Ration, were introduced into the Maine market the past winter by the state agents, Norton-Chapman Company of Portland. Five samples were examined by the Experiment Station in the winter of 1904. The results were given in Bulletin 102 as follows:

"Union grains are a ready made mixture carrying protein and fat according to the guarantee. They are based upon a feeding experiment with Holstein cattle in which Biles Fourex was fed in combination with wheat bran, gluten feed, ground corn, ground oats, and oil meal. For the farmer who must buy all his feed, Union grains at a fair price would probably prove profitable. As a rule, oats and corn are profitable for cows when the feeds are home grown and are expensive feeds to purchase."

RESULTS OF ANALYSES OF UNION GRAINS.*

Name of Feed and Manufacturer or Shipper.	Protein.		Fat.		Station number.
	Found—per cent.	Guaranteed—per cent.	Found—per cent.	Guaranteed—per cent.	
Union Grains—Biles Ready Ration.............. J. W. Biles Co., Cincinnati..................	24.19	24.00	7.13	7.00	10058
	23.63	24.00	-	7.00	10245
	24.38	24.00	-	7.00	10346
	25.14	24.00	-	7.00	10561
	24.50	24.00	-	7.00	10574

* Bulletin 102, Maine Agr. Expt. Sta. on Feeding Stuff Inspection.

THE FEEDING TEST.

From a car shipped to Old Town one ton was sent to the Station, and was used in a feeding trial with milch cows. This lot carried 24.19 per cent protein and 7.13 per cent fat. When the Union Grains were received the Station herd was being fed corn silage, mixed hay containing considerable clover, and a grain mixture, composed of 200 pounds wheat bran, 100 pounds cotton seed meal, and 100 pounds linseed meal. This grain mixture carried somewhat more protein and a little less fat than the Union Grains in comparison with which it was fed. During all the periods the weights of silage hay and grain fed each animal remained constant. The cows doing the maximum work received 8 pounds per day of grain; the others were fed less.

From the herd there were selected 18 animals, 5 Holsteins, 6 Jerseys, 2 Guernseys, 1 Ayrshire and 4 grades. They were from 3 to 6 months in milk and were all, according to their records, doing a moderate amount of work and were fairly uniform in their milk flow from day to day.

These 18 animals were gradually changed from the oil meal mixture to the Union Grains and after 2 weeks were gradually changed back to the oil meal ration. The average yields of milk on the oil meal ration for 7 days prior to the change to Union Grains and 7 days' yields after the return to the oil meal rations are compared in the table with 7 days in which the Union Grains were fed.

The table on page 126 shows the milk yield of 18 cows for 2 periods of 7 days on oil meal ration, and one period of 7 days on Union Grains. The hay and silage fed was the same in all periods. The same weight of grain mixture was fed in all the periods.

The individual cows were not tested for butter fat, but the herd milk was tested in each period and ran from 4.1 to 4.3 per cent of butter fat during the test, showing that it was uniform in quality. With the exception of the cow Fan all of the cows gave more milk in the second period on Union Grain than in the average of the first and third periods on oil meal.

The test was not as satisfactory as desirable because of disturbing factors in change of milkers. But these changes did not work in favor of the Union Grains, so that there is no reason to doubt the tendency of the results and so far as this one experiment goes the Union Grains showed themselves a better food for milk production than the oil meal ration. The Union Grains cost somewhat more, however, than the mixture of oil meal and bran.

YIELD OF MILK PER WEEK FOR EACH COW FOR EACH PERIOD.

	Kind of Grain Mixture and Yield of Milk.			
	Oil Meal and Bran.			Union Grains.
	First period—seven days.	Third period—seven days.	Average first and third—seven days.	Second period—seven days.
	Pounds.	Pounds.	Pounds.	Pounds.
Guernsey	141.4	106.6	124.0	117.2
Dorothy, Ayrshire	156.5	150.5	153.0	161.5
Hunton 2d, Holstein	90.3	70.5	80.4	92.6
Hunton, Holstein	134.5	122.3	128.4	142.0
Abbie B., Holstein	120.6	109.9	115.3	119.7
Roxy, Holstein	180.5	174.5	177.5	189.5
Fan, Holstein	143.1	141.7	142.4	129.3
Bessie, Grade	115.8	98.0	106.9	119.1
Ethel, Jersey	118.6	114.1	116.3	119.2
Shaw, Grade	113.7	102.4	108.1	112.5
Celia, Grade	150.1	107.8	128.9	148.3
Judy, Jersey	97.8	84.9	91.4	106.4
Posey, Grade	140.3	112.8	126.5	120.6
Adle S., Jersey	97.0	86.3	91.7	97.0
Pansy, Jersey	83.7	59.8	71.7	81.0
Lily, Gurnsey	69.5	55.0	62.8	65.4
Turlip, Jersey	72.9	55.2	64.0	74.0
Maud, Jersey	91.4	68.2	79.8	85.5
Total milk	2,117.7	1,820.5	1,969.1	2,080.9

ALFALFA.

CHAS. D. WOODS.

During the past 25 years many attempts have been made to grow alfalfa in New England. These attempts have, however, met with only partial success, and there is probably, in all New England, not a square rod of alfalfa with a good stand that has been established 5 years. Indeed, it is doubtful if, unless in the most sheltered situation, a single plant could be found that is five years old. The nearest approach to success that has come to the writer's knowledge was that of a farmer at Amesbury, Mass., and it is a significant fact that he has no alfalfa growing at the present time.

While the writer was connected with the Storrs (Conn.) Station a number of attempts to grow alfalfa were made, both on the station land and in co-operation with farmers in different parts of the state. While a few isolated plants near the shore of Long Island Sound persisted for several years, practically all died the first, or, at the latest, the second winter.

Alfalfa has been tried many times in this State, but without much promise of success. Several farmers sowed alfalfa in the spring of 1903, and in a few instances a fair percentage of the stand survived the winter of 1903-4. A small patch in a garden at Houlton, sown in the spring of 1902, probably contains as old plants as any in the State. Two cuttings were made from this in 1902, four in 1903, and three the present season. It grew luxuriantly, and most of the plants survived the first winter, but nearly two-thirds died in the winter of 1903-4. There are also in Fort Fairfield a few plants still standing on the edge of a driveway, where they were sown in 1902.

Because alfalfa has been successfully grown where formerly it was thought impracticable and because of a large number of inquiries, it was deemed best for the Station to give it another trial under the most favorable conditions of soil and treatment possible. About 4 acres are now being grown in co-operation with farmers in Orono, Penobscot county; in Princeton, Washington county; and in Houlton, Maple Grove and Fort Fairfield in Aroostook county. The seed used was specially procured by the United States Department of Agriculture from the cold mountainous regions of Turkestan and had been inoculated with alfalfa bacteria. Root tubercles have developed abundantly on all the plots. Care was taken to select land that seemed to be naturally well adapted to alfalfa as to soil, subsoil and drainage. It was thoroughly prepared and a good stand and growth was for the most part obtained. The sowing was light (15 pounds of seed to the acre) so as to grow seed for further work if the plants should survive the first winter. All the land was well fertilized, part of it was limed and part treated with ashes. Part of the seed was broadcasted and part sown in drills. That in drills was kept free from weeds by hand wheel hoe and hand work. The broadcast portions were cut whenever the weeds seemed to endanger the alfalfa. The drilled has grown much better than the broadcast and at the cutting in August, the drilled gave on all the plots nearly a ton of rather undercured alfalfa hay.

In order to be of much value to Maine agriculture, alfalfa must be able to stand not one, but several winters. The Station does not advise anyone to grow alfalfa at present in Maine, unless in a small experimental way. Next spring the Station hopes to have a limited amount of Montana grown seed, from the United States Department of Agriculture at Washington. This will probably prove as hardy as the Turkestan seed. So far as the amount received will allow, the Station will supply enough seed for an eighth of an acre on condition that the cultural instructions will be followed and the results reported to the Station.

HOME MIXED FERTILIZERS.

CHAS. D. WOODS.

Commercial fertilizers have been commonly employed for more than a generation and in that time there has been comparatively little advance made by the farmer in their use. Where money crops are grown it has become the custom of many successful growers to fertilize liberally, with only slight regard to the needs of the crop and the fertility of the land. For instance, in Aroostook County the growers of potatoes have found that it pays to use large amounts of commercial fertilizers upon this crop, and one finds farmers applying 1000 to 1800 pounds of a high grade fertilizer to the acre without reference to the preceding crop, either in the choice of the kind of fertilizer or the amount to be used.

When commercial fertilizers were first placed upon the market, there was a good deal of excuse for its unwise and wasteful use. While it is not a simple matter, for even the most expert, to always correctly apply the principles of feeding plants to field practice, and while many conditions such as season, tilth, and other circumstances arise both within and beyond the control of the grower, the principles underlying the production and maintenance of soil fertility have been so clearly and frequently stated, that there is comparatively little excuse for slipshod practice in the purchase and use of commercial plant food. The subject of the intelligent use of farm manures and commercial fertilizers is too large to be entered upon at this time and place. Many valuable, readable and readily understood books have been written upon this subject and can be had from any book dealer at prices within the reach of all. Farmers' Bulletin 44, of the United States Department of Agriculture, takes up in a concise manner the composition and use of commercial fertilizers. By applying to your Congressman or to the Secretary of Agriculture, Washington, D. C., a copy may be had free. A little book on "Manures: How to Make and How to Use Them," published by the seedsmen, W. Atlee Burpee and Company, Philadelphia, is a comprehensive book that costs 50 cents; and Professor Voorhees' treatise on Commercial Fertilizers, published by Macmillan and Company, New York, for $1.00, gives a clear and not very technical presentation of the principles underlying the use of the different kinds of plant food for different crops and soils. If one feels that because of ignorance it would be better to buy ready mixed goods than to attempt home mixing, it must be remembered that there is little if any more likelihood of making mistakes in the proportions when mixing than there is of buying ready mixed goods unsuited to the purpose. A farmer complained this year about a fertilizer that he used for potatoes and inquiry revealed the fact that he had used on land in poor condition a fertilizer intended for seeding down, which carried very little nitrogen and with almost none of its constituents in a readily available form. It is difficult to believe that one purchasing and mixing chemicals for the first time would have made such a serious mistake, in the forms and proportions of plant food.

WHY USE HOME MIXED GOODS.

The reasons for and against home mixing are few and easily stated.

In general, if considerable quantities of fertilizers are used, there can be a considerable saving in the purchase.

When separate materials are purchased there is less likelihood of being deceived. This does not apply, however, with very great force when the goods are purchased from the well known and reliable manufacturers.

In home mixing the farmer can readily change the mixture so as to more nearly adapt it to the requirements of different crops. While the manufacturers do this to a considerable extent, it rarely happens that a farmer growing several kinds of crops takes advantage of this fact. He usually employs the same brand regardless of the crop, whether grown on a clover turf or with or without farm manure. This leads to the most important reason of all for home mixing, stated in the next paragraph.

There is a great educational value in home mixing. The use of an unknown mixture gives little information, and the farmer that has for years used ready mixed goods knows but little more as to the needs of his land and crops than when he began. The purchase of unmixed goods will lead to an intelligent use. It is impossible to imagine an intelligent man using unmixed goods on different crops and soils through a series of years without coming to a fairly clear understanding of the chemical needs of the soil and crops, even though he may know nothing of the principles of chemistry. It is furthermore equally difficult to conceive of such a man using unmixed goods year after year without being impelled to study and to read. Just as hundreds of skilled, intelligent feeders have been developed by reading, study, experiment and observation, so equally scientific users and conservers of plant food would be the result of intelligent home mixing.

Two reasons are commonly advanced against home mixing:—

On small purchases there is little or no saving. This is a matter of dollars and cents, and inquiry as to cost of materials, and the same *weights of plant food* ready mixed, will enable any one to answer the question of economy for himself.

It is also claimed that owing to the lack of proper facilities the farmer can not mix as well as the manufacturers. That he can do so with a tight barn floor, and no other implements than a shovel, a screen and a rake has been shown over and over again in every state in the East and South.

A MANUFACTURER'S VIEW OF HOME MIXING.*

"As to mixing at home, they who do it cannot readily obtain their materials at first hand or in an absolutely raw condition. In the first place, the phosphate or bone must be ground and treated with sulphuric acid if available or soluble phosphoric acid is desired. This cannot be done on the farm. The tankages, blood or fish must also be ground for home mixing, also the chemicals, for most of them come in a lumpy condition and need remilling. For this expense of preparation the home mixer must of necessity pay some one, for it is a part of the cost of manufacture. In fact it is the larger part, for when the raw materials are prepared, the phosphates ground and acidulated, and the other materials put into a fine mechanical condition the most important and costly steps in the process of manufacture have been taken. The last step, of putting them together, is the least expensive of them all.

* Extracts from a personal letter.

"There may be a few farmers who can figure out a saving by home mixing, but this is not the case with the great mass of farmers; and even if the home mixers constituted the great mass they would not be able to get their goods direct but would have to take them through distributing agencies in order to secure them in time. In any event, they must pay for the preparation of the materials, freights, bags, and to this cost will also be added a certain percentage for losses and shrinkage, whether they buy the mixed or the unmixed goods; and finally they must pay a profit, for all business is based on a fair return.

"I have never objected to home mixing and to the Experiment Stations urging it, for I know that through it many farmers who have not used chemicals will be led to use them and will eventually become large users of mixed fertilizers. I consider it an excellent educational process and a good introduction to the use of mixed manures. Some of our best customers for complete fertilizers, I may say *the* best customers that we have ever had began as home mixers."

IS HOME MIXING PRACTICABLE?

To make it evident that Maine farmers do and can mix goods that are in all particulars equal to the best factory mixed, the Station made in 1904 co-operative experiments upon home mixing with farmers in Brunswick, Houlton and Fort Fairfield (Maple Grove).

The completeness of the mixing is illustrated by the following: A number of farmers at Brunswick clubbed together and purchased bone tankage, cottonseed meal, nitrate of soda, acid phosphate and sulphate of potash. The tankage was not in as good mechanical condition as was desirable but this was remedied by passing it over a screen with 3 meshes to the inch, and rejecting all that did not go through. The coarser particles were not wasted but were used around fruit trees, etc., where the nitrogen and phosphoric acid would slowly become available and utilized.

After all of the goods had been screened, samples for analysis were taken by the writer. The materials were then weighed out, and spread out in layers, one above the other, on the barn floor, care being taken to put the bulkiest materials at the bottom. They were then mixed by shoveling together four times and bagged. The writer took a sample of the mixed goods, and the calculated composition and that found is given in the following table:

COMPOSITION OF A HOME MIXED "POTATO FERTILIZER," CALCULATED FROM THE MATERIALS USED, COMPARED WITH THE COMPOSITION OF THE MIXED GOODS AS FOUND BY CHEMICAL ANALYSIS.

	Nitrogen, per cent.	Phosphoric acid, per cent.	Potash per cent.
Calculated	4.00	11.30	7.33
Found	3.91	11.02	7.38

This agreement between "calculated" and "found" is closer than could always be expected, for it is indeed inside of the limits of errors in chemical analysis.

To see what would be the result if the sample of the ingredients were taken from unscreened goods in large lots, and shippers' weights assumed as correct, the following results were obtained in mixing by men without previous experience.

COMPOSITION OF A HOME MIXED "POTATO FERTILIZER" MADE FROM MANUFACTURERS' WEIGHTS OF GOODS, CALCULATED FROM THE ANALYSIS OF SAMPLES TAKEN AT RANDOM FROM THE STOCK OF CHEMICALS, COMPARED WITH THE COMPOSITION OF THE MIXED GOODS AS FOUND BY CHEMICAL ANALYSIS.

	Nitrogen, per cent.	Phosphoric acid, per cent.	Potash per cent.
Calculated	4.3	10.2	7.3
Found	4.1	9.9	7.6

While these results do not agree nearly as well as in the case of the more carefully weighed and sampled goods, they run as close as many of the ready mixed goods sold in the State do to their guarantees.

The mechanical condition of these goods was excellent. They were used in the potato planter, and even in the old type Robbin's planter the fertilizer was distributed as freely and evenly as could be asked. The cottonseed meal and tankage were so dry that the use of a filler was unnecessary.

About 40 acres of potatoes were grown with the above home mixed goods, the fields being situated in three towns and two counties. The results will be given in detail in a bulletin now in preparation. The more general results are here briefly stated. In general large crops, ranging in Aroostook County from 275 to 380 bushels per acre, were obtained. On early planted potatoes, and where the season was long enough for the crop grown on the home mixture to mature, the yields were as large as where the standard commercial fertilizers were liberally used. The tops kept greener in color during the last half of the growing season with the home mixture. September 1 there was a severe frost all over Northern Maine. The late potatoes grown upon the home mixture had greener and more succulent vines than those upon the standard fertilizers and in consequence were damaged much more by the frost. In fact the vines of the late planted potatoes on the home mixed goods were practically killed at this time, while the same varieties planted at the same time upon the standard potato fertilizer continued to grow after this frost. As a result the potatoes were larger and better ripened with these than upon the home mixed plots. For quick maturing, the home mixed goods apparently carried too much slowly available nitrogen and too little available phosphoric acid,—a condition that can be readily remedied in a formula.

KINDS OF INGREDIENTS.

There are various materials that are used in the manufacture of fertilizers, but because of Maine's distance from the commercial centers, it will rarely be profitable to purchase any but materials carrying high percentages of plant food. For instance, the cost of bagging, cartage and freight on a ton of muriate of potash, carrying 1000 pounds of actual potash, would be no greater than the freight on a ton of kainit carrying only 250 pounds of potash, and if the kainit could be bought for one-fourth the price of the muriate it would, because of the freight, still be the more expensive source of potash. Furthermore, in mixing and applying, four times as great weight would have to be handled.

The kinds of fertilizing materials that would usually be most profitable and economical sources of plant food for home mixing in Maine are given in the table which follows. It will be understood that this class of goods is always sold under a guaranteed percentage composition, and the percentages here given are only approximate and for guidance in inquiry.

AVERAGE COMPOSITION OF CHIEF COMMERCIAL FERTILIZER MATERIALS.

	NITROGEN.	PHOSPHORIC ACID.		
	Per cent.	Available—per cent.	Total—per cent.	Potash—per cent.
Nitrate of soda	16	....	....	....
Nitrate of potash	14	....	....	44
Sulphate of ammonia	20	....	....	....
Dried blood, high grade	13	....	....	....
Dried blood, low grade	10	....	4	....
Concentrated tankage	12	....	1	....
Bone tankage	5.5	....	12	....
Portland Rendering Co's tankage in 1904	4.9	4.2	16.3	....
Portland Rendering Co's tankage in 1904, screened	5.5	7.3	16.0	....
Dried fish scrap	8	....	7	....
Cotton-seed meal	7	....	1.5	2
Acid phosphate	....	13	14	....
Raw ground bone (bone meal)	4	8	22	....
Steamed bone	2	9	25	....
Muriate of potash	....	....	....	50
Sulphate of potash (high grade)	....	....	....	50
Kainit	....	....	....	12
Hard wood ashes, (unleached)	....	....	1	5
Hard wood ashes (leached)	....	....	1	2

Fertilizing materials should be dry and fine. If moist there is danger of their lumping. Not only the evenness of the mixture, but the availability of forms of plant food is directly dependent upon the fineness of the goods. Ground bone is only very slowly available unless it is finely ground. In ordering chemicals it should always be demanded that they be finely ground and in good mechanical condition, for the mixed goods will not be satisfactory for machine use unless the ingredients are in good shape.

In case no dry and bulky materials, e. g. cottonseed meal, or tankage, are used in the formula, it will be necessary to use some material such as dry loam, or "muck" as an absorbent and filler.

WHERE UNMIXED FERTILIZERS CAN BE PURCHASED.

Unmixed goods can be purchased in Maine from the Sagadahoc Fertilizer Company, Bowdoinham, The John Watson Company, Houlton, and the agents of the American Agricultural Chemical Co. Tankage can be had from the Portland Rendering Co., Portland. Out of the State unmixed goods can be obtained from the fertilizer manufacturers. The following Massachusetts companies do business in this State: The American Agricultural Chemical Co., 92 State St., Boston, Mass.; The Bowker Fertilizer Co., 43 Chatham St., Boston, Mass.; The New England Fertilizer Co., 44 North Market St., Boston, Mass.; The Parmenter & Polsley Fertilizer Co., Peabody, Mass.; The Russia Cement Co., Gloucester, Mass.; and Swifts Lowell Fertilizer Co., 43 North Market St., Boston, Mass.

Edmund Mortimer & Co., 13 William St., New York, N. Y., make a specialty of selling chemicals for home mixing.

PLANT FOOD REMOVED BY CROPS.

It serves as something of a guide in the application of fertilizers to know the requirements of different crops as measured by the amount of plant food that is removed by a single crop. Of course such figures are only approximate and can not be blindly followed. For instance, the legumes, members of the pea and clover family, have the power of acquiring a very considerable part of their nitrogen from the air by the aid of minute organisms which form enlargements known as root tubercles upon the roots of this family of plants.* For this reason this class of plants, although among the richest in nitrogen, and removing large amounts of this fertilizing ingredient, can be grown by the use of mineral fertilizers carrying almost no nitrogen.

The table which follows gives the approximate amounts of nitrogen, phosphoric acid and potash that are removed by quite large yields of the more common farm crops. Not only the

* For a discussion of this see Report of this Station for 1897.

fruit, seeds, tubers, etc., are taken into account in the figures in the table, but the plant food removed in the tops, straw, etc., is considered as well.

THE APPROXIMATE AMOUNT OF NITROGEN, PHOSPHORIC ACID AND POTASH CONTAINED IN THE TOTAL YIELD OF DIFFERENT CROPS, INCLUDING STRAW, VINES, ETC., FROM ONE ACRE IN ONE YEAR.

Kind of crop.	Yield per acre.†	Nitrogen—pounds.	Phosphoric acid—pounds.	Potash—pounds.
Barley	40 bush.	74	23	68
Buckwheat	30 bush.	53	21	60
Oats	60 bush.	60	22	50
Wheat	30 bush.	62	20	26
Corn, ripened	60 bush.	84	32	34
Corn fodder, green	12 tons.			
Potatoes	300 bush.	55	25	85
Turnips	700 bush.	80	52	180
Beets	600 bush.	110	40	190
Clover hay*	3 tons.	123	27	132
Timothy and red top	3 tons.	69	27	58
Mixed hay (some clover)	3 tons.	84	21	93
Beans*	40 bush.	100	40	70

* Legumes that under favorable conditions derive a large part of their nitrogen from the air.

† Larger yields than the average are purposely given, but no larger than should be striven for as an average.

PLANT FOOD IN THE SOIL AND SOD.

The amount of available plant food in the soil has a very important bearing upon what should be applied. There is a widespread belief that a chemical analysis of a soil will serve as a guide to the selection and use of fertilizers. While in a rare and occasional instance a chemical analysis will throw light upon the question of soil fertility, such an analysis is, unfortunately, of very little help in determining the needs of the soil for crop growing. The chemist can tell how much of each ingredient the soil contains, but cannot tell whether it is in available form. Moreover different plants have different feeding capacities, so that the plant food which would be available to one class of plants might not to another. This question can be best answered by putting it directly to the soil in a so-called soil test experiment.†

If a farmer has not experimented with his soil so that he knows to what fertilizing elements it most readily and profitably responds, he must be guided in the purchase of plant food by general principles. And this is as true in the purchase of mixed as unmixed goods. In either case there is considerable uncertainty. The purchase of unmixed goods, however, has the advantage that the farmer knows what he has used, and if he is observant and keeps record of his management, he will know where he made the mistake and how to avoid it the next season.

In addition to the plant food in the soil, the farmer has at his disposal the manure from the farm animals and a very considerable amount in that left in roots and stubble from the preceding crop. A few figures illustrative of this are given in the table which follows.

AMOUNT OF NITROGEN, PHOSPHORIC ACID AND POTASH LEFT IN THE ROOTS (TO THE DEPTH OF 6 INCHES) AND STUBBLE IN ONE ACRE AFTER THE CROP HAS BEEN REMOVED AND A NEW GROWTH HAS STARTED, AND IN FARM MANURE.

Kind of Plants.	Nitrogen, pounds.	Phosphoric acid, pounds.	Potash, pounds.
Timothy and red top, average of 2 experiments ..	62	15	31
Clover, average of 3 experiments	36	10	22
One ton, rich stable manure*	10	10	8

* Manure is extremely variable in composition and weight. A cord of manure will weigh from 3 to 4 tons. Farmers' Bulletin 192, of the U. S. Department of Agriculture, on farm manures, can be had free from your Congressman, or the Secretary of Agriculture, Washington, D. C.

† Circular No. 8 of the Office of Experiment Station of the United States Department of Agriculture explains how such a test can be made. A postal card sent to the Secretary of Agriculture, Washington, or to your Congressman will bring this circular free.

HOW TO MIX CHEMICALS FOR USE.

After the formula has been decided upon, and the chemicals purchased, the mixing is readily attended to in accordance with the following or some similar way.

The apparatus needed consists of: Tight floor; platform scales; shovel with square point; an iron hand rake, and a sand screen with 3 meshes to the inch (frame about 4½ ft. by 1½).

Screen all the materials. Pulverize all lumps and pass through the screen before adding to the pile. Nitrate of soda is apt to be lumpy. If emptied out, slightly moistened and allowed to stand over night, the lumps will fall apart on raking. When practicable the nitrate should be reground at time of purchase.

Spread the proper weight of the most bulky material on the floor to a depth of six inches. Make the top level and spread the proper weight of the next most bulky material on top of the first. Proceed in like manner until all the different constituents have been added to the pile. Shovel over the whole three or four times, taking care to carry the shovel to the bottom of the pile and to mix as thoroughly as possible. After the goods are mixed, they can be stored in bulk or put into bags or barrels until they are needed. It is usually much more economical of time for the farmer to mix the chemicals he may need before the rush of spring work. With well dried materials in good mechanical condition, the mixed goods will keep for months if stored in a dry place. It is better, however, to mix the goods as late as practicable without interfering with other work.

DEVISING FORMULAS.

Although the selection of a formula for home mixing fertilizers, like compounding rations for stock, is a good deal more than mere arithmetic, the data given in the tables on pages 103 and 105 are suggestive and will prove helpful. The correct use of commercial fertilizers involves the supply of plant food that a given soil lacks to produce a good yield of a given crop. Hence to fertilize to the best advantage, the soil to be used must be known.

All soils contain much more plant food than is needed to grow many crops. The larger part of this is not immediately available. It is a part of good farming to make this plant food available and in no way can this be as effectively brought about as by thorough preparation of the soil before planting and, in the case of hoed crops, by thorough cultivation during the growing season. The plant food in soil is, in general, available to growing plants in proportion to the smallness of the particles of soil. Too strong emphasis cannot be put upon the proper plowing, harrowing and other mechanical preparations of the soil and in the case of hoed crops, constant thorough cultivation during the growing season.

While recognizing the danger that may come from a blind following of definite directions for general practice, the following quite specific suggestions are made for a few general crops. *It is to be borne in mind in using these formulas that they are only suggestive and that different conditions of soil make such different treatment essential that a formula which may prove successful on one farm may not be equally so on another.*

In the suggested formulas the composition as given in the table on page 135 is assumed for the chemicals. The analysis of the Portland Rendering Companies screened tankage as found in 1904 and given in the table is used for the composition of tankage.

FORMULAS FOR POTATOES.

In 1904 there were licensed in Maine rather more than 40 brands of fertilizers in which the word potato entered into the name. It is very doubtful if in more than one-third of these brands there was any reason, other than the attraction of the name, to call them potato fertilizers. More than half of them have the composition of general purpose goods with about 3 per cent nitrogen, 8 per cent available phosphoric acid, and 3 per cent potash. Those that would be taken seriously as intended for potatoes carry less phosphoric acid and relatively more nitrogen and considerably more potash. Nearly all of the companies put out a brand with the word potato in its name that carries about 3.5 per cent nitrogen, 6 per cent available phosphoric acid and 8 or 10 per cent potash.

A crop of 300 bushels of potatoes will remove from the soil about 55 pounds of nitrogen, 25 pounds phosphoric acid and 85 pounds of potash. It is quite a common practice in Aroostook

County to use 1000 to 1200 pounds per acre of such a fertilizer as last named, which would furnish about two-thirds the required nitrogen for a 300-bushel crop, three times as much phosphoric acid and rather more than enough potash.

In general the potato plant thrives best in a soil abundantly supplied with all fertilizing elements. In the early stages of growth nitrogen is particularly demanded, and hence a considerable part of the nitrogen should be in water soluble form, so that it may be readily available early in the season. Later, when the tubers are forming, there is special demand for phosphoric acid and potash.

The formula used by a number of farmers in Cumberland and Aroostook Counties in 1904 at the rate of 900 to 1300 pounds per acre, and giving a yield from 100 to 140 barrels (275 to 380 bushels) per acre was as follows:

FORMULA (NO. 1) FOR 300 BUSHELS POTATOES, USED IN 1904. SATISFACTORY WHERE THE SEASON WAS LONG ENOUGH TO MATURE THE CROP. FOR ONE ACRE.

	Weight used —pounds.	Nitrogen —pounds.	Phosphoric Acid. Available —pounds.	Phosphoric Acid. Total —pounds.	Potash —pounds.
Tankage*	500	27.7	36.5†	80.2	....
Cotton seed meal	200	13.7	....	7.2	5.8
Nitrate of soda	100	14.7	....	....	....
Acid phosphate	400	....	68.2	71.0	....
Sulphate of potash	200	....	....	....	96.8
	1,400	56.1	104.7	158.4	102.6
Percentage composition		4.0	7.5	11.3	7.3
Percentage composition as used in Aroostook county*		4.3	7.4	10.2	7.3

*In the Aroostook county lots 420 pounds of a tankage with less phosphoric acid and more potash was used, with a resulting higher percentage of nitrogen and lower percentage of potash.

†This represents the amount of phosphoric acid that is "citrate soluble" as found by chemical analysis, but it is not as speedily available to the growing crop as that of acid phosphate.

The potash was applied in the form of sulphate instead of muriate because it is commonly held that the sulphate produces a better quality of potatoes. Unpublished results of experiments by this Station do not confirm this opinion. Although this formula did as well with early planted potatoes as the commercial fertilizers with which it was compared, it had a tendency to prolong the period of growth, with the result that on late potatoes, particularly in the northern part of Aroostook County, the vines were green and vigorous at the time of the first severe frost, which this year was early, September 1. The other parts of the fields, planted with the standard commercial fertilizers, stood the frost much better than these tenderer vines grown on the above formula. At digging, the yield with late planted potatoes was larger and the individual potatoes were larger and better matured on the standard brands of mixed goods than on the above formula. For late planting with a short season it would probably be advantageous to use a formula with more water soluble nitrogen and more available phosphoric acid, as an excess of this latter seems to hasten the ripening of the crop. Some such a formula as the following might be used:

A COMPLETE FORMULA (NO. 2) FOR 300 BUSHELS POTATOES. THE LARGE EXCESS OF PHOSPHORIC ACID WILL TEND TO EARLY MATURITY. FOR ONE ACRE.

	Weight used—pounds.	Nitrogen—pounds.	Phosphoric Acid.		Potash—pounds.
			Available—pounds.	Total—pounds.	
Nitrate of soda*	200	32	....	....	......
Screened tankage	200	11	15	32	....
High grade dried blood†	100	13	....	....	....
Acid phosphate	500	....	65	70	......
Sulphate of potash	200	....	....	....	100
Total	1,200	56	80	102	100
Percentage composition		4.7	6.7	8.5	8.3

* Seventy-five pounds of sulphate of ammonia could be well used in place of 100 pounds of the nitrate.

† 150 pounds ordinary dried blood or 200 pounds cotton seed meal might be used in place of the high grade dried blood.

If the potatoes are to be grown on sod land and a good stubble of clover or mixed grasses with the aftermath has been plowed under, or if stable manure is used, much of the organic nitrogen needed for the crop will, as shown in the table on page 106 be supplied by either of these materials. Under such conditions a formula containing nitrate and only a small amount of other nitrogen would doubtless give good results. Some such a formula as the following could be used:

FORMULA (NO. 3) FOR 300 BUSHELS POTATOES, TO BE USED ON SOD LAND WHERE A GOOD STUBBLE AND AFTERMATH HAS BEEN PLOWED UNDER, OR IN CONNECTION WITH FARM MANURES. FOR ONE ACRE.

	Weight used—pounds.	Nitrogen—pounds.	Phosphoric Acid. Available—pounds.	Phosphoric Acid. Total—pounds.	Potash—pounds.
Nitrate of soda	100	16	....	....	....
Screened tankage	200	11	15	32	....
Acid phosphate	300	....	39	42	....
Sulphate of potash	200	....	....	....	100
Total	800	27	54	74	100
Percentage composition		3.4	6.8	9.2	12.5

The tankage in the above will be sufficient to keep the fertilizer in good mechanical condition without the use of a filler.

CORN.

Corn is a crop that uses a large amount of nitrogen. It is usually grown upon sod land, or with farm manure, or both. Indeed, it is doubtful if under ordinary conditions it would prove a profitable crop to be grown on somewhat exhausted soil with commercial fertilizers alone. Experiments at the Massachusetts Station indicate that it does best with an excess of potash. Three formulas are suggested for use on sod land and in conjunction with farm manure. In the first of the following formulas the materials will not of themselves make a good dry mixture for machine planting. Two or three hundred pounds of dry loam, muck, or other suitable material will be needed to mix with the chemicals to make a mixture in good mechanical condition. The first formula contains only about one-sixth of the nitrogen needed to grow the crop. With a good sod and especially with a liberal dressing of farm manure, that will be all that is needed. The second and third formulas carry more nitrogen and the dry bulky tankage or cottonseed meal do away with the necessity of a filler.

FORMULAS FOR CORN ON SOD LAND OR IN CONJUNCTION WITH FARM MANURE. FOR ONE ACRE.

	Weight used—pounds.	Nitrogen—pounds.	Phosphoric Acid. Available—pounds.	Phosphoric Acid. Total—pounds.	Potash—pounds.
(No. 4.)					
Nitrate of soda	100	16	....	....	....
Acid phosphate	400	....	52	64	....
Muriate of potash	150	....	....	....	75
Total	650	16	52	64	75
Percentage composition	....	2.5	8.0	9.9	11.5
(No. 5.)					
Nitrate of soda	100	16	....	....	....
Screened tankage	200	11	15	32	....
Acid phosphate	300	....	39	42	....
Muriate of potash	150	....	....	....	75
Total	750	27	54	74	75
Percentage composition	....	3.6	7.2	9.9	10.0
(No. 6.)					
Nitrate of soda	100	16	....	....	....
Cotton seed meal	200	14	....	3	4
Acid phosphate	400	....	52	64	....
Muriate of potash	150	....	....	....	75
Total	850	30	52	67	79
Percentage composition	....	3.5	6.1	7.9	9.3

SEEDING TO GRASS.

In this State spring seeding, with a shade crop of grain, (usually oats) is the common practice. Summer seeding is practiced to some extent, but does not fit into the usual rotation as well as spring seeding. It is doubtful if it is profitable to grow oats or wheat in this State except as a nurse crop for grass. They are exhaustive of plant food, particularly nitrogen, and in proportion to the value of the crop are costly to grow. In spring seeding with grain it is, of course, necessary to take the demands of the grain as well as the grasses into account in selecting a fertilizer. Where seeding follows corn in the rotation, it usually happens that all of the farm manure is used on the corn crop, and all the plant food for the grasses must be otherwise provided. Where potatoes precede seeding, however, usually farm manure can be used in seeding down. The old, and still by far more common way, is to seed with rather slowly available fertilizers, and crop the field until the grass yield is too small to be profitable. A better way is to fertilize the land annually and in case it is desired to keep the field in grass more than one or two years to top dress with soluble commercial fertilizers. Based upon these various methods of treatment and taking into account the amounts of fertilizing materials removed by each crop (see page 105), the following formulas are suggeted. It should be remembered that thorough preparation of the soil is as essential with grass as any crop.

A FORMULA (NO. 7) FOR SPRING SEEDING WITH OATS AS A NURSE CROP IN CONJUNCTION WITH LIBERAL APPLICATIONS OF FARM MANURE.* FOR ONE ACRE.

	Weights used —pounds.	Nitrogen —pounds.	Phosphoric Acid.		Potash —pounds.
			Available —pounds.	Total —pounds.	
Nitrate of soda	100	16	....	....	....
Acid phosphate	400	....	52	56	....
Muriate of potash	250	....	....	....	125
Total	750	16	52	56	125
Percentage composition	....	2.1	6.9	7.5	16.5

*If desired to apply by machinery, it would be necessary to mix with about 200 pounds of some fine, dry material, as muck, or loam.

A FORMULA (NO. 8) FOR SPRING SEEDING WITH OATS WITHOUT FARM MANURE. FOR ONE ACRE.

	Weights used —pounds.	Nitrogen —pounds.	Phosphoric Acid. Available —pounds.	Phosphoric Acid. Total —pounds.	Potash —pounds.
Nitrate of soda	100	16	....	....	....
Screened tankage	500	28	36	80	....
Acid phosphate	200	....	26	28	....
Muriate of potash	250	....	....	....	125
Total	1,050	44	62	108	125
Percentage composition	....	4.2	5.9	10.3	11.9

This will make a dry fertilizer that can be applied with machinery.

A FORMULA (NO. 9) FOR SUMMER OR FALL SEEDING WITH FARM MANURE. FOR ONE ACRE. AT SEEDING.

	Weights used —pounds.	Nitrogen —pounds.	Phosphoric Acid. Available —pounds.	Phosphoric Acid. Total —pounds.	Potash —pounds.
Acid phosphate	100	....	13	14	....
Muriate	100	....	....	....	50
Total	200	....	13	14	50
Percentage composition	....	....	6.5	7	2.5

The following spring apply

Nitrate of soda	100	16	....	....	....
Acid phosphate	200	....	26	28	....
Muriate	250	....	....	....	125
Total	550	16	26	28	125
Percentage composition	....	2.9	4.7	5.1	22.7

A FORMULA (NO. 10) FOR SUMMER OR FALL SEEDING WITHOUT FARM MANURE. FOR ONE ACRE. AT SEEDING.

	Weights used—pounds.	Nitrogen—pounds.	Phosphoric Acid. Available—pounds.	Phosphoric Acid. Total—pounds.	Potash—pounds.
Nitrate of soda	100	16	....	....	....
Screened tankage	400	22	29	64	....
Muriate of potash	100	....	....	....	50
Total	600	38	29	64	50
Percentage composition	....	6.3	4.8	10.7	8.3

The following spring apply the chemicals suggested for use with formula 9.

The Rhode Island Station has experimented with top dressing for grass for a series of years and has found it profitable. Of course it should not be practiced unless there is a good stand of grass plants. It recommends the following:

FORMULA (NO. 11) FOR SPRING TOP DRESSING GRASS LAND, SUGGESTED BY THE RHODE ISLAND EXPERIMENT STATION.*

	Weights used—pounds.	Nitrogen—pounds.	Phosphoric Acid. Available—pounds.	Phosphoric Acid. Total—pounds.	Potash—pounds.
Nitrate of soda	350	54	....	....	....
Acid phosphate	400	....	52	56	....
Muriate of potash	250	....	....	....	125
Total	1,000	54	52	56	125
Percentage composition	....	5.4	5.2	5.6	12.5

* Bulletin 90, Rhode Island Experiment Station.

THE LEGUMES.

The family of the legumes, which include such plants as clover, peas, vetches and beans, carry much higher percentages of nitrogen than most other plants and differ, so far as known, from all other plants in that they can obtain all or practically all their nitrogen from the free nitrogen of the air. This they cannot do directly, but by the assistance of minute organisms which grow upon their roots. (See page 104). In order to thus acquire nitrogen it is necessary that the soil contain the proper organism, usually a different kind for each legume. If the soil is not stocked with the proper organism it can be, either by applying soil from a field known to carry them, or by "cultures." The soil almost everywhere in Maine is stocked with the organisms that work upon clover, peas and beans. Because of their power under these conditions to acquire the larger part of their nitrogen from the air, the legumes can be fertilized very differently, and at less cost than other plants. Formulas, carrying a little nitrogen to give the plants a start, and furnishing the needed minerals for the crop, follow. To make these in sufficiently good mechanical condition for use in machinery, they need to be mixed with about 150 pounds fine dry muck, loam or similar materials.

A SUGGESTED FORMULA (NO. 12) FOR THE CLOVERS, OR ALFALFA WITHOUT OTHER MANURE AND ON LAND CARRYING THE PROPER ROOT TUBERCLE ORGANISMS. FOR ONE ACRE.

	Weights used—pounds.	Nitrogen—pounds.	Phosphoric Acid. Available—pounds.	Phosphoric Acid. Total—pounds.	Potash—pounds.
Nitrate of soda	50	8	....	....	....
Acid phosphate	400	....	52	56	....
Muriate of potash	250	....	....	....	125
Total	700	8	52	56	125
Percentage composition	....	1.1	7.4	8.0	17.9

A SUGGESTED FORMULA (NO. 13) FOR BEANS OR PEAS WITHOUT THE MANURE ON SOIL CARRYING THE PROPER ROOT TUBERCLE ORGANISMS. FOR ONE ACRE.

	Weights used—pounds.	Nitrogen—pounds.	Phosphoric Acid. Available—pounds.	Phosphoric Acid. Total—pounds.	Potash—pounds.
Nitrate of soda	50	8	....	....	....
Acid phosphate	400	....	52	56	....
Muriate of potash	150	....	....	....	75
Total	600	8	52	56	75
Percentage composition	....	1.3	8.7	9.3	12.5

BEETS. MANGOLDS.

A crop of 600 bushels of beets carries more than 100 pounds of nitrogen, nearly 200 pounds potash, and only about 40 pounds phosphoric acid. At the Rothamsted (England) Experiment Station mangolds have been grown continuously on the same land for nearly 30 years with different fertilizers. The results of the experiments are summarized as follows:*

"Mangolds can be grown continuously on the same land without injuring the tilth of the land or the health of the crop.

"A liberal dressing of farmyard manure forms the best basis of the manure for mangolds.

"The crop will further respond to considerable additions of active nitrogenous manures to the dung, particularly of nitrate of soda.

"A free supply of potash salts is essential to the proper development of the mangold, hence a specific potash manuring is desirable, even when dung is used in large quantities, and on a strong soil initially rich in potash. When nitrogenous manures are used in addition to dung, the potash salts should be increased pro rata, in order to maintain the health and feeding value of the crop and to bring it to maturity.

* Farm Journal of Royal Agricultural Society, 1902.

"In conjunction with dung, phosphatic manure is hardly necessary and will give little appreciable return especially when the crop is grown in rotation.

"As soluble alkaline salts are beneficial to the mangold crop, either as direct foods or economizers of potash, a dressing of salt should always be included among the manures for the mangold crop."

Based upon these findings, a liberal dressing for mangolds would be about 5 cords of good stable manure and the chemicals named in the following formula.

A FORMULA (NO. 14) FOR MANGOLDS OR OTHER BEETS, BASED UPON EXPERIMENTS AT THE ROTHAMSTED (ENGLAND) EXPERIMENT STATION. TO BE USED IN CONJUNCTION WITH A LIBERAL DRESSING OF FARM MANURE. FOR ONE ACRE.

	Weights used—pounds.	Nitrogen—pounds.	Phosphoric Acid. Available—pounds.	Phosphoric Acid. Total—pounds.	Potash pounds.
Nitrate of soda	400	64	....	....	....
Muriate of potash	400	....	....	....	200
Common salt*	200	....	....	....	....
Total	1,000	64	....	....	200
Percentage composition	....	6.4	....	....	20

*Beets are successfully grown in Maine without salt.

This can be conveniently applied broadcast, separately. To avoid loss by leaching, only part of the nitrate of soda should be applied at planting and the remainder when the plants are well established. To use in machinery, mix with 200 to 300 pounds fine dry muck or loam.

If stable manure is not used, 40 pounds screened tankage, 400 pounds high grade dried blood (250 pounds of sulphate of ammonia can be used instead of the dried blood), and 200 pounds acid phosphate can be used to replace the manure. This formula has not been put to a practical test and is based in part upon the plant food requirements of the crop and in part upon the experience at Rothamsted.

A FORMULA (NO. 15) FOR MANGOLDS OR OTHER BEETS WITHOUT FARM MANURE. FOR ONE ACRE.

	Weights used—pounds.	Nitrogen—pounds.	Phosphoric Acid.		Potash—pounds.
			Available—pounds.	Total—pounds.	
Nitrate of soda	200	32	....	....	....
Screened tankage	800	44	58	128	....
Sulphate of ammonia (or 300 lbs. high grade dried blood)	200	40	....	....	9
Acid phosphate	200	....	26	28	....
Muriate of potash	400	....	....	....	200
Common salt	200	....	....	....	....
Total	2,000	116	84	156	200
Percentage composition	....	5.8	4.2	7.8	10

FERTILIZERS IN ROTATION.

As an illustration of the use of manure and commercial fertilizers in a rotation, the following, based upon successful farm practice on rather heavy loam of retentive character, is suggestive.

First year. Potatoes on sod land.

Second year. Corn for silage.

Third year. Seeding with oats.

Fourth year. Hay.

Fifth year. Hay or pasturage.

First year. Plant with potatoes on sod land, early plowed the preceding fall and worked to a good seed bed. Apply formula No. 3, page 111, in the drill at planting. A crop of 250 to 300 bushels will have removed all the plant food of the commercial fertilizer and much of that of the sod.

Second year. Corn on stable manure and commercial fertilizer. Plow the land preceding fall. Apply the farm manure in the spring broadcast and work in with disc or other suitable harrow. Apply formula No. 4 on page 112 if 5 cords of farm manure have been used per acre, or No. 5 or No. 6 if less. A crop of 12 to 15 tons of silage corn will have used up the nitrogen of the commercial fertilizers; part of the nitrogen of the manure and considerable phosphoric acid and potash will be left available for the next season's crop.

Third year. Seeding to grass with oats. The land is to be plowed the preceding fall. If it can be spared, topdress with about 3 cords of farm manure and use formula No. 7, page 113. If farm manure is not available, use formula No. 8, page 114. The farm manure, if used, is applied and worked in as for corn the preceding year. For grass, the land must be thoroughly worked, the surface kept true and a good seed bed prepared. Upon the heavy clay loam land at the University the following mixture has proven successful for spring seeding: Oats 5 pecks; timothy 10 pounds; red top 7 pounds; alsike clover 6 pounds. In most seasons the grass will do better if the oats are cut green (in milk) for fodder or hay. Oat hay at best is a poor kind of hay, although if cock cured it makes a hay that will be cleanly eaten. It may be, even at the expense of the grass, best to allow the oats to ripen. Keep teams off the field as far as possible and do not turn stock into it nor cut it, even though the clover does look tempting.

Fourth year. Top dress early in the spring with 200 pounds of acid phosphate and 100 pounds of muriate of potash. As the application of nitrate of soda has a tendency to run out clover, in a five-year rotation it will be better to top dress with minerals only. If it is desired to maintain the field for hay for several years, formula No. 11, page 115 can be advantageously used. Unless there is an unusually early aftermath, do not cut a second crop or feed if the field is to be used for hay the next year.

Fifth year. Top dress as the preceding year and pasture or cut for hay.

If the preceding program is carried out with ordinary seasons, good crops should be obtained and the land should be in better fertility at the end than at the beginning, five years before.

BROWN-TAIL MOTH AND OTHER ORCHARD MOTHS.

EDITH M. PATCH.

It is not the well kept orchard that will serve as a shelter and breeding place for any serious pest. It is the apple tree down the lane, too old and decrepit to yield fruit, but still able to put forth leaves enough for a spring crop of bud moths and tent caterpillars, or a summer brood or two of tussock moths. It is the group of old pear trees, apparently owned by no one, with their branches hung with undersized pears cracked to the centre with scab disease, and later, when their fungus-mottled leaves fall, festooned with nests of the brown-tail moth. It is the wild cherry bushes in the background that show in the winter for the menace they are, when they are seen to be distorted with black knot and hung with old caterpillar webs and tents, besides being decorated by brown egg rings and white egg clusters in provision for next season's caterpillars. It is the deserted or neglected trees that are to be feared, for in them many species of caterpillars dangerous to the orchard trees breed unnoticed, perhaps for years, until they become numerous enough to make conspicuous ravages. Then one orchardist cries, "It isn't much use to try to raise apples with a new sort of caterpillar creeping in every year," and another says, "The fact is, it doesn't seem reasonable to expect a clean orchard with twenty or thirty pests lurking in the outskirts," and turns his attention to neighboring breeding places as well as to his orchard, and markets his crop in spite of the "new pest."

Brown-Tail Moth. *Euproctis Chrysorrhœa.*

History (1734-1904).

European laws have been in force for one hundred and seventy years requiring land owners to destroy the winter nests of the brown-tail moths found on their trees, and this moth was described as a common pest in the earliest works on orchard insects.

About seven years ago the first outbreak of this pest occurred in Somerville and Cambridge, Massachusetts, the centre of the infested region being a florist's establishment where large numbers of shrubs had been imported from France and Holland. It is thought that the brown-tail moth was accidentally introduced upon some of these foreign plants and had become established in the vicinity before it was noticed.

Since 1899 this insect has been introduced,—probably repeatedly,—into Southern New Hampshire, where the infestation is now extended enough to cause alarm.

Five years ago the moths were captured on Cutts Island, Kittery Point* and the same season the caterpillars were reported from South Berwick, where they were supposed to have been imported on rose bushes from Somerville, Mass. The colony at South Berwick was evidently destroyed and the moths on Cutts Island did not at this time continue to breed.

Late in March, 1904, Kittery was found to be badly infested, the winter nests being common in the pear trees in the village, while a few were located in wild cherry fringe on Badger's Island. Many of these winter nests were gathered and burned by the owners of infested trees and those that remained were destroyed by an expert under the direction of the State Commissioner of Agriculture, so that the ravages of the caterpillars were effectually prevented for this season.

Unfortunately, however, last July, during the time when the moths were on the wing, strong southwesterly winds occurred and the insects are reported to have appeared in great numbers

* Maine Agr. Exp. Sta. Bul. No. 61, pp. 36-39.

NOTE. The account of this insect is written with reference to Mass. Crop Report, Vol. 17, No. 3; Mass. State Board of Agriculture, Bulletin of information, The Brown-tail Moth, 1898; New Hampshire College, Agr. Exp. Sta., Bul. 107; Me. Agr. Exp. Sta., Bul. No. 61. It is also a record of observations made this season at Kittery.

in Portsmouth and Kittery, the electric lights about the navy yards being the centre of attraction on the Maine side of the river.

While many of the moths were killed, without doubt enough escaped to distribute eggs all about that vicinity, and though the young caterpillars do practically no harm in the fall, there is every reason to believe that they will be present in alarming numbers another spring, unless the winter nests are removed as they were last season. Such a wholesale immigration of winged forms might never happen again, but while there is a chance of its occurring any summer, and an almost certain danger of small and less conspicuous immigrations, it is well to understand the situation and conditions about Kittery, especially in view of making it less vulnerable to orchard pests.

DESCRIPTION AND HABITS.

The moths. (Figure 27.) The moths, expanding from one and one-fourth to one and three-fourths inches, are white except for the abdomen, which is tinged with brown and tipped with a tuft of brown hairs. This tuft is small and dark in the male, but the large golden-brown tuft in the female is conspicuous enough to be the most striking characteristic of the moth, and has won for this insect its descriptive name of "brown-tail." These moths are on the wing in July, and unlike some closely related pests,* the brown-tail females as well as the males are strong fliers. They are active at night and as bright lights have an attraction for them they sometimes fly a long way toward a lighted district.

The eggs. The female usually selects a leaf near the tip of the branch, on which to deposit from one hundred and fifty to three hundred eggs. Some of the brown hairs from the abdominal tuft adhere to the egg-mass and give it the appearance of a brown felt lump. While the moths have a preference for pear trees, wild cherry, apple, and white oak prove very attractive and other trees are not scorned.

The caterpillars in the fall. By the middle of August most of the eggs are hatched and the young caterpillars spin a slight

*The weak-winged female gypsy moth and the wingless females of certain tussock moths.

web over the leaf near the egg cluster. From this protection they advance side by side, sometimes two hundred tiny caterpillars feeding in an unbroken line, though they huddle together beneath the web when disturbed in any way. When they have eaten all but the skeleton of the first leaf, they draw another into the web and repeat the process at intervals during the late summer. They feed slowly, however, and spend so much time spinning their web that they do comparatively little damage to the trees in fall, and they are still very small when cold weather comes on, those removed from the winter nests being only about one-fourth of an inch in length.

The winter nests. (Figure 19.) In the fall the young caterpillars weave additional layers of silk about their retreat, fastening it securely to the branch by the web, and pass the winter thus in colonies of one hundred and fifty to three hundred. These nests, which look like a cluster of dead leaves hanging from the branches, are readily seen after the other leaves have fallen. This is a very unusual yet most commendable habit in a caterpillar pest, for they can be killed, hundreds at a time simply by destroying the nests in which the colonies hibernate.

The caterpillars in the spring. Early in the spring the young caterpillars emerge from their winter nests and feed upon the opening leaf buds. Until about the middle of June they feed greedily upon the leaves, completely stripping the trees where they are numerous.

When full grown the caterpillars are about one and one-half inches long. They are dark brown with a sprinkling of orange. Long fine reddish-brown hairs cover the body, and a row of conspicuous white hairs runs along each side. Like the caterpillars of the tussock and gypsy moths, they bear bright red eversible tubercles on the top of the sixth and seventh abdominal segments.

Poisonous qualities of the caterpillars. Were the caterpillars to be feared only for their ravages upon orchard and other trees, the situation would be alarming enough, but not less serious is the physical discomfort experienced by people living in infested districts. When the minutely barbed hairs of the caterpillar come in contact with the skin they cause an eruption similar to and in many cases worse than ivy poisoning. These hairs are brittle and where the caterpillars are numerous few people are likely to escape, as the caterpillars drop from the branches and creep about, even entering houses. Direct contact with the insects themselves is not necessary, however, for when the caterpillars shed their skins, the molts are blown about widely scattering the barbed hairs. Thus in infested districts it is no uncommon occurrence for whole families to suffer from the rash caused by the hairs which settle upon clothes hung out to dry. Children gathering cherries are badly "poisoned," and near Everett, Mass., people have been obliged to leave their homes for uninfested places in order to recover from attacks of the "caterpillar itch."

"So severe is this affection that in many cases people have been made seriously ill by it. The best remedy for it is the liberal use of cooling lotions, or, what is more satisfactory, even if less pleasant, the free use of common vaseline."*

The cocoon. The caterpillars are usually full grown in June. They then spin loose cocoons, attached commonly to leaves, though sometimes other shelter is sought. Within these they transform to brown pupæ about three-fourths of an inch long. From the first to the twentieth of July the moths with pure white wings and brown-tipped abdomens emerge from these cocoons to deposit eggs for the next generation of troublesome caterpillars.

Manner of Distribution.

New localities may become infested in various ways. When startled, the caterpillars have a habit of letting themselves down from the branch and hanging by a frail silken thread. They may so swing against the clothing of a person, or drop upon a passing car or wagon and be carried long distances.

Egg laden moths may be attracted to the lights in trains and electric cars and be borne into uninfested localities before they flutter off to deposit their eggs. In New Hampshire the new localities were generally found along the lines of cars coming from badly infested regions.†

* Mass. Crop Report, Vol. 17, No. 3, p. 39.

† N. H. College Agr. Exp. Sta. Bul. 107, p. 59.

"A reliable observer, Mr. A. M. Cobb, Malden, Mass., reports that when the Bangor boat of the Eastern Steamship Line was passing some miles off Marblehead, early in July, 1904, a large swarm of the brown-tail moths came aboard and completely covered parts of the vessel." * Dr. James Fletcher, entomologist, Central Experiment Farms, Ottawa, Can., reports that a single specimen of the brown-tail moth was taken at St. John, N. B., in the summer of 1902. Such occurrences suggest the advisability of watching each fall the ports along this line for winter nests.

About the middle of July, 1904, the morning after a strong southwesterly wind, the telegraph poles and the sides of some of the buildings near the Kittery Navy Yards were reported to be white with the white-winged brown-tail moths. The town was alarmed and great numbers of the moths were washed down with hose and destroyed, but that many escaped and deposited eggs, the neighboring trees (especially the pears and wild cherries) bear abundant evidence.

Thus strong winds, lighted trains and boats, and vehicles of all sorts are seen to be among the factors which hasten the natural spread of this dreaded pest.

REMEDIAL MEASURES, DIRECT AND INDIRECT.

Destruction of certain breeding places.

The vicinity of Kittery, the entering point for the pest in Maine, is overgrown with wild cherry tangles, caterpillar-haunted† and distorted with black-knot fungus. Old and worthless trees, either fruitless or bearing scabby pears and apples, straggle neglected along the lanes and hang half dead branches over every wall. Inasmuch as such trees are a menace to the orchard interests of York county and to the State, it is desirable that they be cut down and burned. Some large and carefully tended orchards (one near Eliot yielded 1,300 barrels in 1902) which are within ten miles of the infested district should be protected against needless risks.

* Mass. Crop Report, Vol. 17, No. 3, p. 38.

† Among the most destructive being the tent caterpillar, two species of tussock moths, the fall web worm and the brown-tail moth.

The argument for such destruction is four-fold. It is in just these trees that the winter nests would longest escape detection, it being especially difficult in a dense growth of wild cherry to ascertain whether every dangling dried leaf is attached to a winter nest. The fruit trees in question being already worse than useless, it would mean apparently a needless yearly tax, either locally or upon the State, to keep them free from brown-tail moths. There will remain enough trees worthy this attention. This remedy, though indirect, would lessen the labor of direct search for and destruction of winter nests over this ground, if not for always, yet for many years to come. Since the infested area is still comparatively small, the cost of the cutting and burning ought not to be great.

Cutting and burning the winter nests.

This is the most important of the direct remedies because it is the easiest, cheapest, and, if thoroughly done, a sufficient protection against the ravages of this pest. The webs and leaves that compose the nest are woven tightly to the tips of the branches and hang there like dead leaves all winter. With so many months for inspection there is no excuse for harboring the hibernating caterpillars on shade or orchard trees. After they are cut from the branches, the nests should be burned, as this is the simplest way of destroying the colony within.

"As showing how cheaply webs may be gathered where a general campaign is made the figures of work done by employees of gypsy moth committee in 1899 are of interest. At that time over nine hundred thousand webs were destroyed at the total outlay of nine thousand seven hundred dollars."* This would mean, accounting for the variation in the number of the caterpillars per nest, the destruction of from 15,000 to 30,000 caterpillars for each dollar's outlay.

A bounty put upon the winter nests.

Last winter in Portsmouth, N. H., the City Improvement Society placed $50 with the superintendent of schools, who paid five cents a dozen for winter nests. Hundreds of nests were brought in by the children and burned in the school furnace. In March groups of Portsmouth newsboys were to be seen scanning the branches overhead and darting off eagerly for

* Mass. Crop Report, Vol. 17, No. 3, p. 39.

"brown-tail nests." In reply to a question one bright-eyed youngster stopped long enough to say, "O we cleaned 'em all out on ——— street and then we came down here." About the same time a Kittery urchin was heard to remark somewhat wistfully, "The Portsmouth kids are makin' their fortune pickin' brown-tails."

Instruction in public schools.

It would be a simple matter to teach in an elementary way a few things about the important insects in the vicinity. A little observation nad a little reading would prepare any teacher to do this. A single lesson would enable a child to distinguish the winter nest of the brown-tail moth from the webs of the fall web worm and tent caterpillar or from the various cocoons which are attached to leaves. All these things are brought into Kittery with the question "Is this the brown-tail nest?" and the fact that many people within the infested district do not know what to look for suggests the need for preparing the children of Maine to watch intelligently suspected areas for the occurrence of this pest. If nothing else were accomplished, it would be worth while to have every child know at least that the insects are not "just bugs that happen to be around," but forces of vital importance both for good and for evil in the agricultural interest of his state and nation. It seems rather a pity to leave a few such things as the relation of the white grub to the May beetle or the bumblebee to red clover, mysteries to be solved in a college course.

Spraying.

The caterpillars are readily killed by arsenical sprays. This remedy is most effective when applied as soon as the leaves develop in the spring. Of course where the winter nests have been destroyed there will be no need of this remedy and it is much easier to kill about two hundred caterpillars enclosed in a nest than to wait until they are scattered over the tree.

State legislation.

Every state needs a statute enabling authorities to treat as common nuisances neglected property which is infested by dangerous fungus diseases or insect pests; and state appropriations should be sufficient to control conditions which are of more than local importance.

"The habit of the caterpillar in wintering over in webs at the tips of the leaves gives a key to the simplest and cheapest remedy, which is merely to cut off and burn webs during the fall, winter or spring. This preventive means is most effective, and gives such excellent results that in Germany, France and Belgium there is a law making it obligatory on property owners to destroy the webs during the winter season. Where citizens neglect to carry out this work it is done for them, and the sum thus expended added to their tax levy." *

THE GYPSY MOTH. *Porthetria dispar.* A FOREWORD.

The gypsy moth has not yet been found in Maine. The entrance of this pest, however, is probably only a matter of time. Unlike the brown-tail moth, the female gypsy moth is weak-winged and is thus unable to deposit eggs far from the cocoon from which she emerges. It is due to this in part that this moth has not yet found its way here, for it has been in eastern Massachusetts for thirty-six years and its ravages for the past sixteen years are well known.

In a district badly infested by the caterpillars of the gypsy moth no garden vegetable except the onion is safe; flowers and grass are eaten, and practically all fruit and forest trees are defoliated, pines and other coniferous trees dying as the result of a single stripping and deciduous trees not being able to withstand a three years' attack.

There is no such simple and comparatively inexpensive means of combating the gypsy moths as with the brown-tail moth, for they do not hang their colonies in plain sight all winter, but pass this season in the less conspicuous egg stage, the egg clusters being hidden in any crevice the infested area offers. These caterpillars are more resistant to poison sprays than those of the brown-tail moth and the problem is in many ways more difficult. It is the wise man who looks ahead and an additional argument for clearing out the growths which are already overrun with orchard caterpillars, (the brown-tail moth among them), is presented by the fact that southwestern Maine is the point where the first infestation of the gypsy moth would naturally occur. Nothing by way of watchfulness, instruction or

* Mass. Crop Report, Vol. 17, No. 3, p. 39.

provisional care that can be done to guard the State against these twin pests should be neglected.

"The gradual spread of the gypsy moth up to the caterpillar plague of 1888-89 is a matter of record. Equally well known is the work of the gypsy moth committee of the Massachusetts Board of Agriculture, which finally succeeded in reducing the numbers of the insect to a minimum and thoroughly controlling the pest. Since the abandonment of the state work in the early part of the year 1900, the moth has had ample opportunity to increase to a point where it is to-day more numerous, and occupying a larger area in this state, than ever before.

"Both the gypsy and brown-tail moths can be controlled by a thorough campaign over the infested municipalities. The work of the former gypsy moth committee has shown that the damage and annoyance from these pests can be practically eliminated by the application of thorough remedial measures over the entire infested districts. It is greatly to be hoped that some effort to systematically control the spread of these pests may be instituted to the end that property owners may be spared the annual visitation of the caterpillar scourge." *

Orchard Caterpillars in Wild Cherry.

In March, 1904, a wild cherry growth, just outside the district infested by the brown-tail moth, presented such strong evidence of being a common caterpillar breeding place that during the summer a few observations were made to ascertain something of the orchard pests there and whether the brown-tail moths would let another season go by without being enticed by this attractive caterpillar commonwealth. Among the insects found there, only those of importance are mentioned; and, as most of these are fully described in Apple Insects of Maine,† the general discussion is not here repeated.

ORCHARD TENT CATERPILLAR AND FOREST TENT CATERPILLAR.

Clisiocampa americana and Clisiocampa disstria.

Both these caterpillars are present. In wild growths they are commonly held in check by birds, parasites and disease. Sometimes their ravages are serious for a season or two, and a watch

* Mass. Crop Report, Vol. 17, No. 3, pp. 32 and 40.

† Me. Agr. Exp. Sta., Bul. No. 56.

has always to be kept for them in the orchard, for the colonies are large and ravenous. Orchardists are everywhere familiar with the dark brown egg-masses found upon the twigs and gather and burn them during the winter. Where these escape detection, the caterpillars can be killed in the spring by arsenical sprays. The orchard tent caterpillars construct a nest in a fork of the branches where the whole brood spends nights and cold or cloudy days. These nests, while small, are easily torn out and the colony within destroyed; or, if neglected then, the caterpillars may be killed by giving the nest a thorough soaking with kerosene emulsion early or late in the day, when the caterpillars are at home. A kerosene swab tied to a long pole is convenient for high nests. A strong alkali, whale-oil soap, or washing powder solution may be used instead of the kerosene.

FALL WEB WORM. *Hyphantria cunea.*

Another nest-building caterpillar is at present even more commonly seen in this vicinity than the tent caterpillar. Their unsightly webs are stretched in every neglected orchard and the cherry tangle is full of them. These nests are made much later in the season than those of the tent caterpillars and are easily distinguished from them, as they are looser structures and very irregular, being woven over all the leaves which the brood feeds upon. Arsenical sprays on the leaves near the nest poison the supply next to be enclosed by the web, and the caterpillars feeding upon them are killed. Sometimes, however, the webs are discovered too late in the season for poisons to be used on bearing trees. Usually the nests are so situated on the branches that while still small they can easily be removed and destroyed. Kerosene or strong alkaline applications can be made as with the tent caterpillars.

There is no need of confusing the nests of tent caterpillars or fall web worms with those of the brown-tail moth, as the greater size and looser texture of these ungainly webs are distinctive marks. Moreover, unlike those of the brown-tail moth, they contain no living caterpillars in the winter.

WHITE-MARKED TUSSOCK MOTH. *Notolophus (Orgyia) leucostigma.*

OLD TUSSOCK MOTH. *Notolophus antiqua.*

WELL-MARKED TUSSOCK MOTH. *Notolophus definita.*

The moths of this Notolophus group are closely related to the gypsy and brown-tail moths. The caterpillars resemble these two pests in having bright red tubercles on the sixth and seventh abdominal segments. The female moths are wingless and usually cling to the cocoons from which they emerge and deposit their egg clusters there. They winter in the egg stage and where they are numerous, the white, rather conspicuous egg clusters (figure 24) are gathered and burned during the winter. The caterpillars may be killed in the spring by arsenical sprays.

Caterpillars of all three species were collected in Maine this summer, the white-marked and the old tussock moths (figure 25) being common in the orchards and cherry growths at Kittery.

The white-marked tussock moth has proven a serious pest in several New England cities. For the last few years Portland has been especially troubled by them. Not long since the park board had the egg-laden cocoons gathered "by bushels" and destroyed. The same proposition faces them this year, for many of the tree trunks along the Western Promenade and vicinity are lined with this season's cocoons, the egg supply on some of the young elms being great enough to forbode defoliated trees in the spring.

HICKORY TIGER-MOTH. *Halisidota caryæ.*

This shaggy black and white caterpillar (figure 23) which grows to nearly an inch and one-half in length does not confine itself to hickory but is commonly seen late in summer feeding freely on many trees, the wild cherry and apple among them.

RED-HUMPED CATERPILLAR. *Œdemasia concinna.*

More of these have been sent to the Station this summer than any other insect. The caterpillars (figure 26) are striking in appearance having fine longitudinal stripes of black, white and yellow; bright red heads, with a humped first abdominal segment to match; and short black spines arranged in rows. The broods are gregarious and if found while the caterpillars are young, the whole colony can frequently be removed with a small branch on which they are clustered, and destroyed. By jarring the branch they can be brought to the ground and killed there. Arsenical sprays will kill them, but as the caterpillars occur from July to October, the presence of ripe fruit often debars the use of poison.

These caterpillars were reported this season from Skowhegan, Farmington, Dexter, Eliot, Kittery, Sebago Lake, Turner, Wiscasset and Orono. Hymenopterous parasites were bred from all the specimens received from Eliot, but none of the caterpillars from the other places were attacked, although they were nearly full grown at the time they were collected.

PROMETHEA MOTH. *Callosamia promethea.*
CECROPIA MOTH. *Samia cecropia.*

These two large and beautiful moths are included, not because they seem likely to do much harm in the State, but because their cocoons, found upon trees in the winter, are frequently mistaken for the winter nests of the brown-tail moth. Figures 20, 21, and 22.

Fifty-three promethea cocoons, gathered from wild cherry and barberry bushes, were brought into Kittery last March for brown-tail moth nests. The collector, a bright little lad, was told that each contained a single brown object which would change to a large moth in the spring, and not a lot of little caterpillars such as the winter nests held. "But," he protested "I *did* open one and there was *not* just one big thing in it, but a whole lot of little ones." A second cocoon opened in his presence revealed, indeed, not a single brown pupa, but nineteen tightly packed cells, each containing the pupa of a hymenopterous parasite. Only nine of the fifty-three cocoons yielded moths. All the rest were parasited,—twenty-two red and black Ichneumon flies emerging from a single cocoon which had been placed alone in a glass. Evidently there is no immediate danger from the promethea moth!

The cocoons of the closely related species, the cecropia moth, are frequently sent in, but the fact that they are usually accompanied by the explanation that "only one was found in the orchard," indicates that they, also, are held in check by natural enemies.

In concluding the list of orchard pests found in cherry growths in the vicinity of Kittery it may be well to state that the observations made were neither frequent nor exhaustive. Other important caterpillars, for example those of the bud moth, * might easily have grown there undetected, for the vicinity was not visited during the time they are at work.

The brown-tail moth was not found in the cherry tangle selected in March, but the succeeding generation was found to be established there in August.

Perhaps in this connection people who have sent orchard insects to the Station may be interested to know that all the living apple-leaf-eating caterpillars, which were received this season, together with what different species were found about Orono, were reared on wild cherry leaves. This was done simply as an illustration of a well known fact, and is significant only where orchards are supplied with pests from neighboring cherry growths.

Some Birds that Feed on Orchard Pests.

When a few particular species of insects become sufficiently numerous to be considered pests and artificial means for controlling them are required, the question is always suggested: How does it happen that the closely related insects just as prolific, just as ravenous, and with similar habits, do not also overrun the orchards? An answer is found in the fact that there are enough natural enemies (as birds, parasites and disease) to hold in check many insects which would otherwise call forth arsenical sprays or other artificial remedies. The fact is not always appreciated, however, that these co-workers, even where they fail to hold some particular insect in check, lessen the labor of man in his battle of spraying machines and other appliances against even the most troublesome species. The woodpecker for instance, pulls out more borers each year than man is able to destroy with knife and wire, yet this bird is not always wel-

* *Tmetocera Ocellana.*

comed to the orchard. It is purposed merely to mention here a few birds that destroy great numbers of insects, the orchard caterpillars discussed in this bulletin among them. The passages which follow are quoted from the popular and valuable Farmers' Bulletin No. 54, "Some common birds in their relation to agriculture."

"While it has long been known that birds play an important part in relation to agriculture, there seems to be a tendency to dwell on the harm they do rather than on the good. * * * The practical value of birds in controlling insect pests should be more generally recognized. It may be an easy matter to exterminate the birds in an orchard or grain field, but it is an extremely difficult one to control the insect pests. * * * If birds are protected and encouraged to nest about the farm and garden, they will do their share in destroying noxious insects. * * * A few hours spent in putting up boxes for bluebirds, martins, and wrens, will prove a good investment. In many states birds are protected by law. It remains for agriculturists to see that the laws are observed.

"About 14 per cent of the quail's food for the year consists of animal matter (insects and their allies). Prominent among these are the Colorado potato beetle, the striped squash beetle, the cotton boll weevil, the chinch bug, grasshoppers, cutworms, and other pests of agriculture. * * * An examination of the stomachs of 46 black-billed cuckoos, taken during the summer months, showed the remains of 906 caterpillars, 44 beetles, 96 grasshoppers, 100 sawflies, 30 stink bugs, and 15 spiders. In all probability more individuals than these were represented, but their remains were too badly broken for recognition. Most of the caterpillars were hairy, and many of them belonged to a genus that lives in colonies and feeds on the leaves of trees, including the apple tree. One stomach was filled with larvæ of a caterpillar belonging to the same genus as the tent caterpillar, while others contained that species. * * * From two-thirds to three-fourths of the food of two common woodpeckers consists of insects, chiefly noxious. Wood-boring beetles, both adults and larvæ, are conspicuous, and with them are associated many caterpillars, mostly species that burrow into trees. * * * It is estimated that the 87 stomachs of night hawks examined contained not less than 20,000 ants; and these were not half of the insect contents. * * * The insects that constitute the great bulk of the food of the big bird are noxious species, largely beetles—May beetles, click beetles (the larvæ of which are known as wire worms), weevils, which prey upon fruit and grain, and a host of others. * * * There is hardly a more useful species about the farm than the phœbe, and it should receive every encouragement. * * * In his insect food the crow makes amends for his sins in the rest of his dietary. * * * June bugs, and others of the same family constitute the principal foods during spring and early summer, and are fed to the young in immense quantities. * * * Grasshoppers are first taken in May, but not in large numbers until August, when, as might be expected, they form the leading article of diet. This shows that the crow is no exception to the general rule that most birds subsist, to a large extent, upon grasshoppers in the month of August. * * * May is the month when the dreaded cutworm begins its deadly career, and then the meadow-lark does some of its best work. * * * Observation both in the field and laboratory shows that caterpillars constitute the largest item of the fare of the oriole."

Among the other insect-eating birds discussed in this same bulletin are the mourning dove, the jays, the bobolink, the black birds, the sparrows, the grosbeaks, the swallows, the cedarbird, the catbird, the brown thrasher, the chickadee (that does much good by eating the eggs of tent caterpillars) and the robin.

"The Baltimore oriole and the English sparrow have been seen feeding upon the caterpillars of the brown-tail moth and the latter bird also attacks the moths." *

"Thirty-eight species of birds have been identified when feeding upon the gypsy moth in one or more of its forms."†

* Mass. State Board of Agriculture. Bulletin of Information. The Brown-tail Moth. 1898.

† Mass. Board of Agriculture. The Gypsy Moth. 1896.

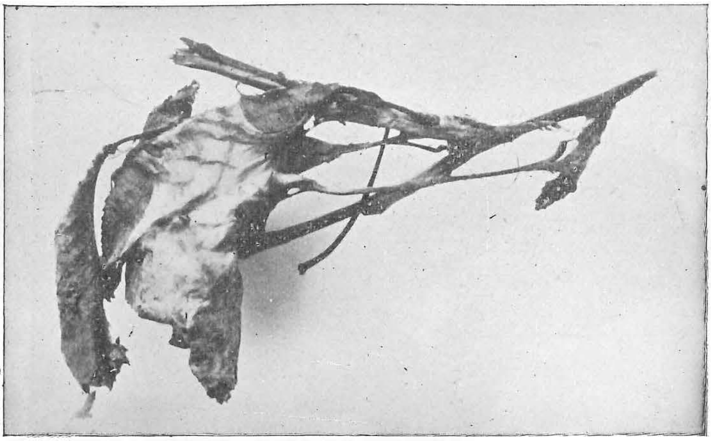

Fig. 19. Winter nest of brown-tail mo th, collected at Kittery, March 30, 1904.

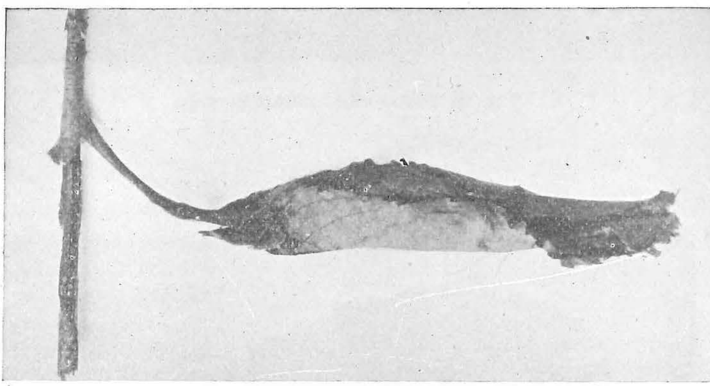

Fig. 20. Cocoon of promethea moth, collected at Kittery, March 30, 1904.

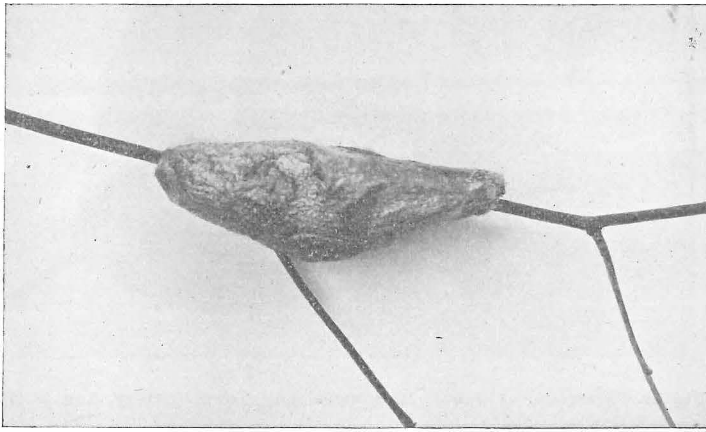

Fig. 21. Cocoon of cecropia moth, collected at Kittery, March 30, 1904.

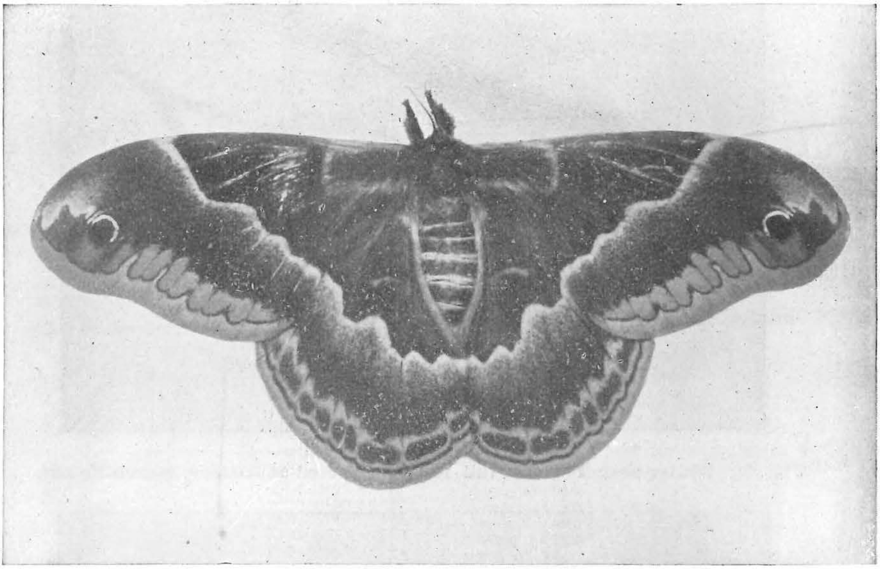

Fig. 22, Promethea moth. Female.

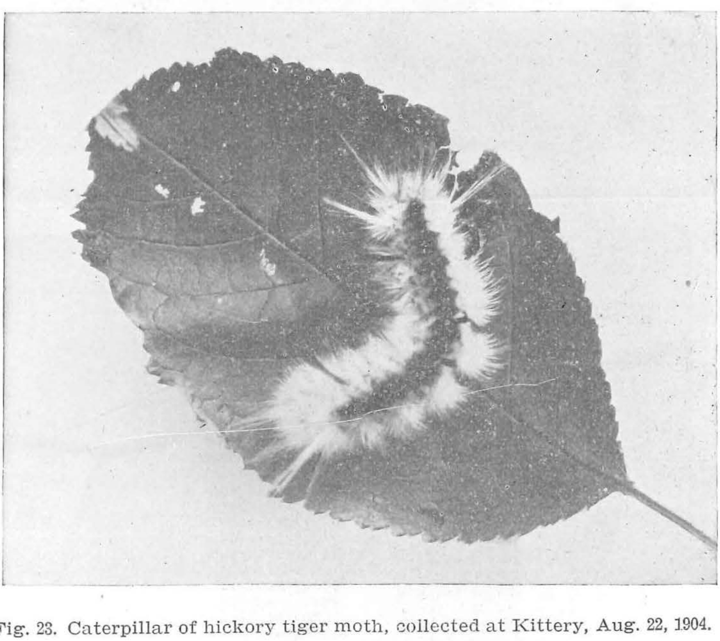

Fig. 23. Caterpillar of hickory tiger moth, collected at Kittery, Aug. 22, 1904.

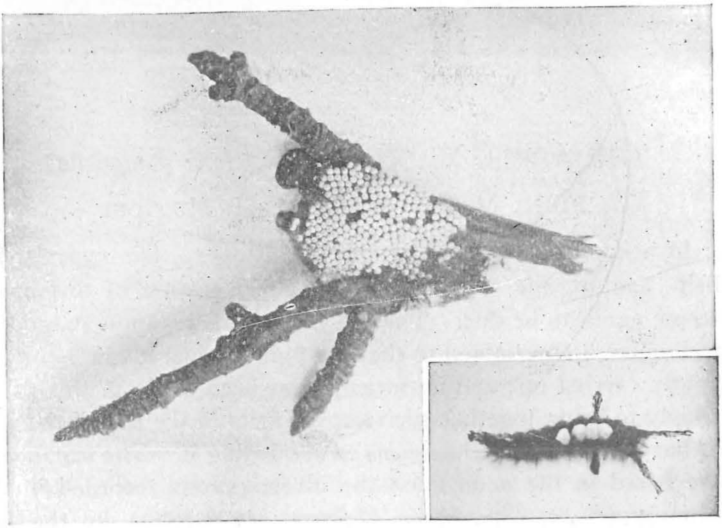

Fig. 24. Cocoon of old tussock moth covered with eggs, collected at Kittery, March 30, 1904.

Fig. 25. One of the caterpillars that hatched from the eggs shown in the accompanying figure.

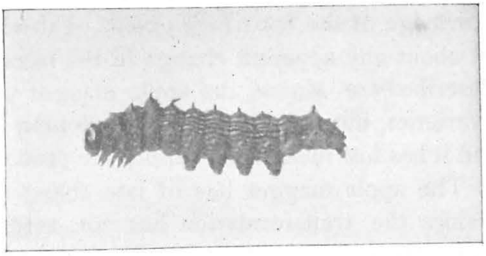

Fig. 26. Red-humped caterpillar.

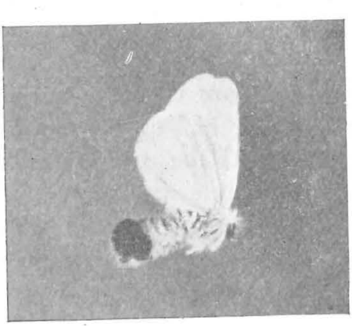

Fig. 27. Brown-tail moth. Female.

THE APPLE MAGGOT *(Rhagoletis pomonella)*.

EDITH M. PATCH AND W. M. MUNSON.

In acknowledgment of, if not in answer to, the appeals for help against the apple maggot, a consideration of this insect seems again to be due. The life history of the apple maggot is well enough ascertained so that the fight against it can be intelligently carried on; and an attempt has been made in this paper simply to bring together such known facts in the life of the pest as have a bearing on the means of combating it. The statements are based in the main upon the investigations recorded in the Monograph on The Apple Maggot (1888-1889) by the late Professor F. L. Harvey.* Independent observations of the advanced larval and early pupal stages have been made, but inasmuch as they serve merely to confirm what has already been done, they are for the most part suppressed.

It has not seemed necessary to restate the detailed work which led to a knowledge of the facts here given. Fifteen years have not brought about any apparent change in the insect. When it was first described for Maine, the apple maggot preferred the softer fall varieties, but was capable of developing in hard winter ones; and it has lost meanwhile neither the preference nor the capability. The apple maggot has of late changed its generic name, but since the transformation has not entered into the nature of the pest, the same things which were true for *Trypeta pomonella* still hold for *Rhagoletis pomonella.*

DESCRIPTION.

Egg.

The light yellow eggs are fusiform and about four times as long as broad, measuring in length from .8 to .9 mm. and in breadth about .2 mm. At the end left nearest the surface of the apple, the egg has a little stalk or pedicel. The ovaries fill most of the abdominal cavity of the female fly. Each side contains twenty-four chains of eggs, each chain having at least seven eggs in different stages of development.

* Report this station for 1889, pp. 190 241.

Larva.

The footless maggot is opaque whitish, with a greenish or more often a yellowish tint. It measures from 7 to 8 mm. in length and is 2 mm. or slightly less in breadth. The body is composed of fourteen segments, the ninth, tenth and eleventh being the thickest. From the ninth segment the body slopes anteriorly to the pointed retractile head segments. The posterior end is much broader than the anterior and is squarely cut off.

The head end is easily distinguished both on account of its pointed shape and the presence of the dark chitinous jaws, which are hook shaped and serve to dig the tunnels and soften the pulp about the larva. The three anterior segments may be retracted, hiding the hooks. See Fig. 31.

The tracheal system is well developed. Anteriorly there are two ventrodorsal tubercles between the third and fourth segments, the cephalic spiracles. Leading from each of these to a caudal spiracle on the fourteenth segment is a lateral tracheal tube. Between the fourth and fifth segments and the eleventh and twelfth segments, the lateral tracheæ are connected by branch tubes.

Pupa.

In this stage the insect is pale yellowish brown in color and oval in shape. It measures about 4.2 to 5.2 mm. in length and is about half as broad. The pupa remains within the larval skin, which becomes thicker and darker. The pupæ are variable in size, the larger ones being quite possibly the females. Fig. 32.

Fly (female).

The adult female is about 5.8 mm. in length with a wing expanse of 12.15 mm. The head is light brown or pale rusty red. The prominent eyes are green with reddish and steel-blue reflections. The antennae are three jointed, the proximal joint being shortest; the second having numerous short thick black bristles on the inner face; and the distal joint long, rounded at the tip. The mouth parts are pale yellow. The throak is black, striped with silvery longitudinal lines, and marked with a dorsal white spot. The wings are broad and clear at the base. Four dark cross bands traverse each wing. The margin of the wing is armed with bristles. The legs are yellowish and black, and the feet are clothed with dark hairs. The abdomen is composed of seven segments, black as to ground color and striped with four white transverse bands. The seventh segment is blunt when the sheath and ovipositor are retracted, but sloping when the sheath is protruded. The ovipositor is brownish, hornlike above, and bears a median groove below which is covered by two flaps, from beneath which the eggs escape. The ovipositor is sharply pointed and somewhat curved at the end. Fig. 30.

Fly (male).

The adult male is smaller than the female, but of the same general color. The abdomen is composed of but five segments and has only three white bands upon it.

LIFE HISTORY.

The flies, a little smaller than the house-fly and readily distinguished by four dark irregular bands across the wings, are found in the apple orchards from about July first until frost. During this time the females are employed laying eggs, by piercing the skin of the apple with a sting-like ovipositor and leaving at each incision one egg buried in the pulp. Each female is capable of laying at least three or four hundred eggs.

From the egg hatch apple maggots which tunnel through the pulp where they feed until full grown. Often their tunnels lie directly beneath the skin of the apple, showing through in the light colored varieties as dark trailing tracks which have won for the apple maggot the popular name of Railroad Worm. (See fig. 28.) But, though the maggot frequently comes near the surface of the apple, it never breaks through the skin and is thus always protected, a circumstance which shows clearly that it is of no use to try to destroy this pest by spraying.

When the eggs are laid, the apples are young and hard and for some time the maggots grow very slowly. At this stage the tunnels are very inconspicuous and the maggots themselves are not likely to be detected except by careful search. As the apple matures, the maggot makes more and more headway and is frequently full grown by the time the apple is ripe. Moreover the presence of the maggots seem to hasten the development of the apples and much of the infested fruit comes to the ground as windfalls. This is the reason so much stress is laid on the destruction of windfalls to get rid of the maggot.

Since the flies are so long on the wing and lay their eggs over such an extended time, the full grown maggots are found at different periods. The first eggs are laid naturally in the early fruit and accordingly as soon as August tenth full grown maggots have been recorded in Early Harvests. On the other hand, some of the later maggots, from eggs laid in harder winter varieties, do not acquire their full size until late in the fall or winter. These are the maggots that are stored with the fruit.

So far as has been observed the maggots are never mature enough to leave the apples before the fruit falls, but the full grown maggots (shown in fig. 31) bore out of the windfalls and bury themselves an inch or less in the ground. Or, if they are in gathered fruit where they cannot find a suitable burying ground, they creep away beneath some protecting object instead. Soon after leaving the apple (sometimes the transformation takes place within the apple but not often) the maggots shrink a little in length and bulge a little in thickness, the skin at the same time growing tougher and slightly darker.

The insect is known in this form (fig.32) as the pupa, and rests in this stage all winter. With the return of summer a second transformation takes place which is complete when a fly (fig. 30) with banded wings breaks out of the tough skin which has covered the pupa all winter and comes from its hiding place to seek an orchard where it may spend its life laying eggs in the pulp of young apples.

PREVENTATIVE MEASURES.

As pointed out here, it is useless to try to poison the growing maggots as they are within and protected by the apple. It is also evident that if the maggots contained in windfalls and picked fruit are destroyed one year there will be no trouble to fear from them the next. Of course it is highly improbable that even by the greatest vigilance, every maggot could be thus destroyed. But when it is considered that each maggot left to its own devices has a chance of becoming a fly capable of laying at least three hundred eggs, and that each maggot undestroyed this year may mean three or four hundred next year, the importance of killing as many as possible is evident. If the apple maggots, as do many insects, all developed about the same time, the problem would be much simpler, but as full grown maggots are found in apples from before the middle of August until into the winter, the watch for them must extend over several months.

If enough hogs or sheep to eat the windfalls are kept under infested trees from the second week in August until the fruit is finally gathered, all the maggots in windfalls will be got rid of. Of course the same results, as far as destroying the maggot is concerned, can be obtained by having windfalls faithfully gathered during this time and fed to stock, or made into cider. In some locaities the entire orchard will be involved and the task will be a hard and wearisome one, but in many places, where only a few trees are infested, the maggots can be destroyed with comparatively little labor.

Many maggots may be found in fruit at canning time. Here the housewife can help the orchardist by burning infested refuse or killing the maggots with boiling water. Where chickens are kept, the parings can be thrown to them, for they will see that no creeping thing escapes.

Stored fruit remains to be considered. If this is kept in closed boxes or barrels the maggots cannot escape, but will stay in the bottom and enter the pupa state there. As each box is emptied of the fruit, the litter at the bottom in which the little brownish pupæ remain should be carefully poured out and burned.

Another question is, what is to be done with infested fruit on the market? Growers and wholesale dealers can do much to prevent increase of the apple maggot by destroying fruit too much infested to be sold or by giving it to some one with stock. Dealers will not appreciate the danger so much as growers themselves and it would doubtless pay orchardists to explain to dealers in their vicinity the danger from infested fruit and to make some arrangements for disposing of it.

With the home-grown maggots put out of the way, we have still to consider the immigrants coming from other states. Badly infested fruit is imported. It would seem to be well worth while for the State of Maine to prevent this by enacting a law, prohibiting importation of infested apples, with an appropriation sufficient to insure at each entrance port the inspection of imported fruit, at least of the early varieties from which most is to be feared.

The fight against the apple maggot, while exceedingly tedious, is not more difficult than that against many other insect pests.

It is useless to wait for simpler or easier methods. Sprays may reach the codling moth before the larva enters the fruit, but the apple maggot is inside the fruit from the very beginning and is safe from poisons. Again, after the maggot buries itself in the ground it is practically safe, as there is great difficulty in fighting under ground insects. But there is a chance to kill it in the fallen fruit and it must be attacked, if at all, at this its one vulnerable point. The way once made plain, the situation is in the hands of the fruit growers, so far as home orchards are concerned, and in the hands of the State as regards imported fruit.

Since this method of destroying the apple maggot was recommended, some ten or twelve years ago, it has been tried in different parts of the State. In this connection it is interesting to note what a few of the fruit growers of Maine have to say from their experience.

One fruit grower in Androscoggin county who keeps hogs or sheep under most of his trees and picks up the rest of the windfalls, met with a loss from the apple maggot this year of about one per cent of his crop. Another in the same county has picked windfalls carefully and states that the trouble from the apple maggot has decreased the past two years, and he experienced no loss from the pest this year. A third man in Androscoggin county says that he does nothing whatever to prevent the ravages of this pest and reports this present year a considerable loss from the apple maggot. He does not pick up his windfalls, nor does he pasture sheep or hogs in his orchard.

From Cumberland county one orchardist reports less injury for the past two years and thinks it is the result, to a great extent if not entirely, of having the windfalls taken care of as soon as they fall from the tree. He pastures with hogs, sheep, geese, and hens. Another orchard owner in the same county does not keep sheep or hogs under his trees and does not pick up his windfalls. He reports the loss of about one-fifth of his crop this year. He states his belief that hogs or sheep enough to take care of the windfalls would prevent the ravages.

One fruit grower in Franklin county who pastures sheep in his orchard and another who keeps hogs under his trees both state that their loss has been very small this year.

A Kennebec county orchardist says the last few years the apple maggot has not been so bad. He pastures sheep in part of the orchard and keeps his apples picked up. A second man from Kennebec county picks up his windfalls and reports that there has been no loss this present year with him.

An orchardist from Sagadahoc county states that he picks up the windfalls and that ravages are decreasing. This year he met with no loss from the pest.

From Lincoln county one fruit grower states that there was no money loss from the apple maggot with him this year. He gathers his windfalls every day. A second man from Lincoln county who keeps hogs under his trees says the maggots did less injury this year than any other year since they first appeared.

Of two Penobscot fruit growers who do not take care of their windfalls, one reports a great loss from the maggot and the other a loss of five per cent of his crop. A third man from the same county picks up his windfalls as soon as they fall. This year he had hardly any loss.

An apple grower in Somerset county says that the apple maggot is not increasing as fast with him as in many places and thinks sheep running under the trees keep the pest down to a great extent.

From Washington county a report comes from an orchardist who has not seen any maggots this year, nor can he find on inquiry any one who has. He gathers his windfalls every day and says it is the common practice in that vicinity to gather windfalls carefully and feed them. Several keep hogs in the orchard.

An apple grower in Aroostook county says he has never seen any maggots in apples grown there.

An orchardist in Piscataquis county says the maggot seemed to increase the last four or five years until this year when he met with practically no loss. He keeps the windfalls from early varieties carefully picked.

With one exception all the fruit growers just quoted feed the refuse from stored apples to stock or to poultry.

Besides the foregoing specific statements it remains to be said that some orchardists who have not made a practice of caring for their windfalls have met with but slight loss from the maggot this year. The question naturally arises, are they feeling the influence of neighboring orchards which are tended?

On the other hand, a few apple growers say they have put the fallen fruit out of the way and yet do not find the trouble decreasing. One of these, however, makes the suggestive remark that the windfalls in neighboring orchards are left on the ground.

It is impossible to ascertain the exact effect, if any, of climatic conditions upon the question. Even if it were possible, the knowledge would probably not prove helpful, for there could be no control of natural climatic conditions on a scale sufficiently large to control this pest.

All things considered, it seems perfectly justifiable to conclude that those orchardists from all parts of the State who have said —"We destroy the windfalls and the trouble is decreasing with us"—have answered their own question as to what shall be done with the apple maggot.

From many counties the reports concerning the varieties damaged came in general terms, indicating that nearly all sweet fall apples and mild sour ones are troubled more than hard winter apples and mild sour ones are troubled more than the hard winter fruit.

Although the lists on pages 149 and 150 are not at all complete, perhaps they will not be altogether devoid of interest. They indicate that while in some orchards even the most susceptible varieties may escape infestation, the maggot is capable of adapting itself to most kinds of apples and that there is no certainty that any variety is safe until the orchardist is sure that hundreds of maggots are not burying themselves in his orchard every fall.

The cuts on the following page shows, in figure 28, apples with characteristic larval trails which give rise to the popular name, "railroad worm." Figure 29 shows, in cross sections of apples, the advanced work of the maggots. Figures 30, 31, 32, represent three stages of the apple maggot—the fly, the larva, and the pupa, all enlarged.

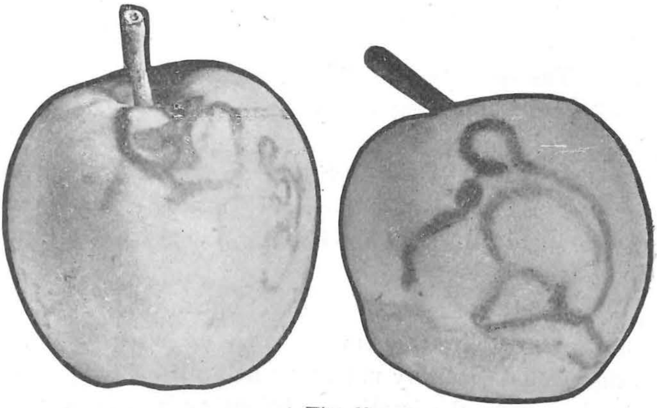

Fig. 28.

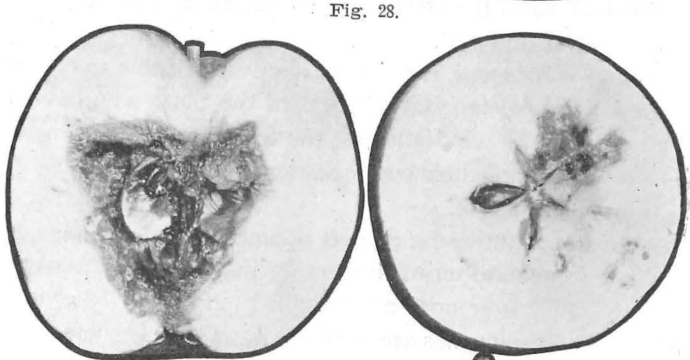

Fig. 29

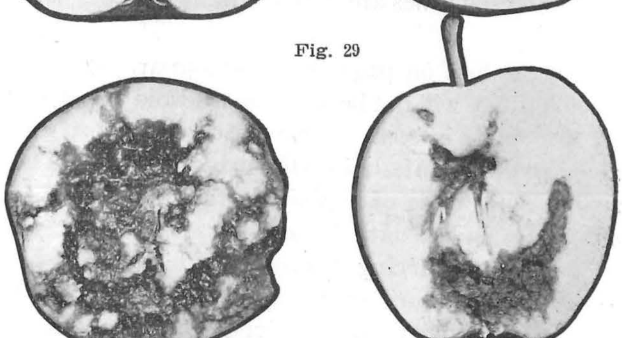

Fig. 31.

Fig. 30.

Fig. 32.

The apple maggot and its work.

APPLES REPORTED TO HAVE BEEN INFESTED BY THE APPLE MAGGOT.

A * against the county indicates that the variety named has been badly infested in that locality.

Variety.	County.
1. August Sweet	Oxford *.
2. Bailey Sweet	Cumberland.
3. Baldwin	Penobscot *, Androscoggin, Franklin.
4. Bellflower	Kennebec, Androscoggin.
5. Deane	Piscataquis, Lincoln *.
6. Duchess (Oldenburg)	Lincoln *.
7. Early Harvest	Franklin *, Cumberland, Androscoggin.
8. Fameuse	Piscataquis, Lincoln, Franklin, Penobscot *, Kennebec, Oxford *, Cumberland, Androscoggin *.
9. Foundling	Lincoln *.
10. Franklin Sweet	Kennebec.
11. Gravenstein	Penobscot, Androscoggin, Lincoln, Kennebec, Oxford, Cumberland.
12. Granite Beauty	Lincoln.
13. Garden Royal	Somerset, Lincoln *, Franklin, Cumberland.
14. Garden Sweet	Kennebec *.
15. Golden Sweet	Cumberland.
16. Haskell Sweet	Sagadahoc.
17. Harvey	Franklin, Oxford, Androscoggin.
18. Hightop Sweet	Sagadahoc.
19. Hubbardston	Sagadahoc.
20. Hurlbut	Lincoln.
21. Jewett's Red (Nodhead)	Lincoln, Sagadahoc *, Oxford, Piscataquis, Penobscot *, Kennebec *, Franklin, Cumberland.
22. King (Tompkins)	Kennebec, Penobscot *.
23. King's Graft	Lincoln *.
24. King Sweet	Somerset *, Lincoln *, Kennebec *, Cumberland.
25. Ladies Sweet	Cumberland.
26. McIntosh	Penobscot *, Lincoln *, Oxford.
27. Milding	Lincoln, Franklin *.
28. Minister	Sagadahoc.
29. Moody	Androscoggin *.
30. Munson Sweet	Lincoln *, Cumberland *.
31. Northern Spy	Kennebec, Sagadahoc *, Lincoln, Somerset, Androscoggin, Oxford *, Franklin.
32. New York Pippin	Kennebec.
33. Orange Sweet	Lincoln *.
34. Peach	Cumberland.
35. Pearmain (Summer)	Kennebec *, Cumberland.
36. Porter	Kennebec, Sagadahoc, Franklin *, Cumberland, Androscoggin *.
37. Pound Sweet	Cumberland.
38. President	Androscoggin.
39. Primate	Kennebec *.
40. Pumpkin Sweet	Cumberland.
41. Red Astrachan	Kennebec, Androscoggin, Cumberland, Sagadahoc, Piscataquis.
42. Ribstone	Penobscot.
43. R. I. Greening	Androscoggin, Oxford.
44. Rolfe	Piscataquis, Somerset, Penobscot *.
45. Sherwood Favorite	Cumberland.
46. Spice Sweet	Kennebec.
47. Spitzenburg	Oxford.
48. Sops of Wine	Cumberland.
49. Superb Sweet	Androscoggin.
50. Sweet Bough	Kennebec *, Oxford *, Cumberland *, Androscoggin.
51. Tallman Sweet	Sagadahoc *, Kennebec *, Somerset, Penobscot, Lincoln *, Androscoggin, Franklin, Oxford *, Cumberland *.
52. Twenty Ounce	Lincoln, Somerset, Kennebec, Cumberland.
53. Wealthy	Penobscot, Lincoln.
54. Winthrop Greening	Kennebec.
55. Williams Favorite	Cumberland.
56. Yellow Transparent	Cumberland.
57. Benoni	Cumberland.

FRUIT REPORTED TO BE FREE FROM THE APPLE MAGGOT, OR ONLY SLIGHTLY ATTACKED, IN SOME ORCHARDS IN THE COUNTIES NAMED.

Variety.	County.
Baldwin	Cumberland, Piscataquis, Sagadahoc, Penobscot, Oxford, Androscoggin, Franklin, Kennebec, Lincoln.
Beauty of Kent	Lincoln.
Ben Davis	Penobscot, Oxford, Lincoln, Kennebec, Somerset, Androscoggin, Franklin.
Benton Red	Penobscot.
Bellflower	Sagadahoc, Cumberland, Androscoggin, Kennebec, Oxford, Somerset, Lincoln.
Black Oxford	Sagadahoc, Penobscot, Androscoggin, Lincoln, Kennebec.
Blue Pearmain	Lincoln.
Danvers Winter Sweet	Lincoln.
English Russet	Lincoln.
Fallawater	Piscataquis.
Gano	Kennebec.
Gravenstein	Lincoln.
Grimes Golden	Lincoln.
Haas	Penobscot, Lincoln.
Harvey	Sagadahoc, Kennebec.
Hubbardston	Androscoggin, Kennebec.
Hunt Russet	Lincoln.
Jewett's Red (Nodhead)	Kennebec, Oxford.
King (Tompkins)	Piscataquis, Sagadahoc, Cumberland, Kennebec, Oxford.
Ladies Sweet	Lincoln.
Maiden Blush	Androscoggin.
Mann	Somerset, Penobscot.
McIntosh Red	Oxford, Androscoggin.
Milding	Piscataquis, Lincoln.
Newtown Pippin	Lincoln.
Northern Spy	Piscataquis, Penobscot, Kennebec.
Porter	Lincoln, Kennebec.
Red Astrachan	Kennebec, Somerset.
Red Canada	Kennebec.
Red Russet	Kennebec.
Rhode Island Greening	Piscataquis, Sagadahoc, Penobscot, Kennebec, Androscoggin, Lincoln, Somerset, Cumberland, Oxford.
Rolfe	Androscoggin.
Roxbury Russet	Kennebec, Somerset.
Russett	Sagadahoc, Penobscot, Androscoggin, Oxford, Lincoln, Kennebec, Franklin.
Spitzenburg	Sagadahoc, Lincoln, Somerset.
Stark	Piscataquis, Penobscot, Franklin, Kennebec, Lincoln, Somerset.
Starkey	Lincoln.
Tallman Sweet	Lincoln.
Wagener	Penobscot, Androscoggin, Lincoln.
Wealthy	Sagadahoc.
Westfield (Seek-no-Further)	Androscoggin.

INSECT NOTES FOR 1904.

EDITH M. PATCH.

The situation for this year is marked especially by an immigration of brown-tail moths, *Euproctis chrysorrhœa,* to the southern part of the State in July; the reappearance of the white-marked tussock moth, *Notolophus leucostigma,* in the shade trees of Portland; the occurrence of the red-humped caterpillar, *Œdemasia concinna,* in all parts of the State; a conspicuous outbreak of the cottony grass-scale *Eriopeltis festucæ,* in many localities; and a general infestation of aphids.

Just the right conditions (whatever they may be) have existed for aphids this summer. From April to November black alders have been white stemmed with *Schizoneura tessellata* as shown in fig. 33. About the middle of July the maples along the Penobscot were clustered thick upon leaves and leaf stems with aphids of the same genus, and the river two miles above Old Town had a milky white cast caused by the bodies and molts. In June whole hillsides were sticky with honey dew, the coniferous trees present being covered with aphids which for the most part belonged to the genus *Lachnus.* The leaves of apple, elm, highbush cranberry, snowball, and currant are among those which were especially attacked. *Chermes pinicorticis* was conspicuous in some localities on white pine. Perhaps the most interesting of the gall producing aphids present is a species of Chermes which is distorting the branches of the Norway and red spruces in eastern Maine. The open cone-like gall of this aphis is shown in fig. 34.

As would be expected, numbers of insects were attendant upon the aphis colonies. Five species of fireflies, *Lampyridæ, were* common upon infested bushes in June; the first of July lace-winged flies, *Chrysopidæ,* were shyly darting about the woods while their progeny of aphis lions were ravaging colonies of plant lice; all through the season striped syrphus flies (fig. 37) could be seen hovering about and their larvæ (fig. 36) could be found everywhere waxing fat in aphis clusters; the lady beetles were not so numerous as might be wished, though eight species were taken at Orono in May and June. Of the insects which were attracted by the honey dew, ants were present in the usual numbers; and in August three species of yellow jackets were very numerous about the leaves and upon the ground under those species of aphids which secreted most honey dew.

The larvæ of a drone fly, *Eristalis tenax,* is never found without arousing curiosity. Fig. 46 will show why it is called the rat-tailed larva. This maggot lives in such places as cesspools, and the "tail" is really an extended breathing tube the tip of which the insect elevates into the air and is so able to breathe, although the rest of its body is buried in fluid matter. The adult insect frequents flowers.

The willow cone gall, shown in fig. 43, is another common object concerning which questions are often asked. This gall is caused by a gnat, *Cecidomyia strobiloides,* about the size of a mosquito, which deposits an egg in the willow buds early in the spring. The subsequent growth of the willow leaves is abnormal and they cluster into a close cone-like object, in the heart of which is a larval cell (fig. 42) containing the yellowish pink maggot. Here the insect passes the winter, and the adult gnat emerges at the time the willows are budding, about the middle of May here in Orono.

Rubber flies, *Asilidæ,* are frequently brought to the station, their queer shape or peculiar manner attracting attention. Two were found this summer preying upon the cabbage butterfly, *Pieris rapæ,* (see fig. 39) and their rapacious appetite leads to the destruction of many insects, the honey bee among them, a fact not enjoyed by bee keepers.

Among the most important natural factors in helping to keep injurious insects within bounds are the ichneumon flies. Although the various species differ in size and color, fig. 38 will serve to illustrate the characteristic form of many of these beneficial insects.

The slow-flying Pelecinus, fig. 35, has been common enough to cause considerable inquiry. No detailed studies have been recorded, but it is reported to be parasitic upon the white grub, fig. 45, the young May beetle, fig. 44.

Other insects important in the economy of nature are the numerous carrion beetles that dispose of decaying flesh which they find in fields and woods. Fig. 41 represents one larg genus, *Silpha,* of these scavengers.

The beautiful maple borer, *Plaginotus speciosus,* fig. 40, was received from Monmouth the middle of July. The insect lays its eggs about this time in the bark of hard maples and the larvæ bore into the wood. Their presence is made known in the spring by the dust that is pushed from their tunnels, and the borers can be destroyed by a knife and a wire, as in the case of the apple tree borers.

During the year a number of insects have been received from correspondents for identification. A list of these with notes is given in the following table. In addition to these, a few other animals have been received and examined. These include: Nematode worms, from salt cod fish. The flesh bordering the alimentary canal was filled with encysted worms, which were more than an inch in length. Millipedes. Numerous in a cucumber house at York Corner, where they spoiled most of the cucumbers. Trap door spider, *Theraphosidæ.* Received from Levant, though evidently a southern species.

INSECTS RECEIVED FOR IDENTIFICATION.

Name.	Date.	Host.	Locality.	Remarks.
Cecropia moth, *Samia cecropia*	March 20	Apple	Madison	Cocoon "only one seen."
Cecropia moth, *Samia cecropia*	March 29	Apple	Kittery	Cocoon, only one seen in orchard.
Cecropia moth, *Samia cecropia*	April 1	Apple	Caribou	Cocoon, four on one tree "not seen before."
Cecropia moth, *Samia cecropia*	May 9	Apple	South Presque Isle	Cocoon, "only one found."
Promethea moth, *Callosamia promethea*	March 30	Wild cherry and barberry	Kittery	Cocoons many, mostly parasited.
Old tussock moth, *Notolophus antiqua*	June 14	Apple	Lewiston	Larvæ.
Old tussock moth, *Notolophus antiqua*	March 29	Apple	Kittery	Egg clusters.
Old tussock moth, *Notolophus antiqua*	Oct. 18	Apple	South Paris	Larva.
White-marked tussock moth, *Notolophus leucostigma*	March 29	Apple	Kittery	Egg clusters.
White-marked tussock moth, *Notolophus leucostigma*	Aug. 18	Elm	Portland	Cocoons. Shade trees badly infested.
White-marked tussock moth, *Notolophus leucostigma*	April 26	Apple	Orono	Egg clusters.
Well-marked tussock moth, *Notolophus definita*	Aug. 4	Dogwood	Orono	Larvæ nearly grown.
Brown-tail moth, *Euproctis chrysorrhœa*	March 30	Pear	Kittery	Winter nests, common.
Brown-tail moth, *Euproctis chrysorrhœa*	Aug. 22	Pear	Kittery	Young colonies, numerous.
Lesser apple leaf folder, *Teras minuta*	June 3	Apple	Skowhegan	Larvæ.
Fall web worm, *Hyphantria cunea*	Aug. 4	Apple	Albion	Larvæ.
Fall web worm, *Hyphantria cunea*	Aug. 29	Apple	Eliot	Larvæ.
Fall web worm, *Hyphantria cunea*	Sept. 2	Apple	Foxcroft	Larval molts.
—— *Ctenucha virginica*	June 9	Grasses		Cocoon found in apple tree.
—— *Ctenucha virginica*	June 20	Grasses	Farmington	Two cocoons, one was parasited.
—— *Lycomorpha pholus*	Aug. 19	Lichens	Sebago Lake	One moth.
Cut worm, *Feltia subgothica*	Aug. 10		East Sangerville	Moths common.
Chain-streak moth, *Cingilia catenaria*	Sept. 22		Orono	Moths common.
Great tiger moth, *Arctia caia*	July 28		Orono	Moth.
Isabella tiger moth, *Pyrrharctia isabella*	July 14		Orono	Moth.
Handmaid moth, *Datana ministra*	Aug. 12	Apple	East Bangor	Larvæ.
Red-humped caterpillar, *Oedemasia concinna*	Aug. 12	Apple	Skowhegan	Larvæ, "many in orchard."
Red-humped caterpillar, *Oedemasia concinna*	Aug. 27	Apple	Dexter	Larvæ.
Red-humped caterpillar, *Oedemasia concinna*	Aug. 29	Apple	Eliot	Larvæ, all parasited.
Red-humped caterpillar, *Oedemasia concinna*	Aug. 4	Apple	Turner	Larvæ.

Red-humped caterpillar, *Oedemasia concinna*	Aug.	12	Apple	Wiscasset	Larvæ.
Red-humped caterpillar, *Oedemasia concinna*	Aug.	18	Apple	Sebago Lake	Larvæ.
Red-humped caterpillar, *Oedemasia concinna*	Aug.	22	Apple	Kittery	Larvæ.
Red-humped caterpillar, *Oedemasia concinna*	Sept.	2	Apple	Farmington	Larvæ.
Red-humped caterpillar, *Oedemasia concinna*	Sept.	8	Apple	Skowhegan	Larvæ.
Red-humped caterpillar, *Oedemasia concinna*	Sept.	9	Apple	South Ampton, L. I.	Larvæ.
Red-humped caterpillar, *Oedemasia concinna*	Oct.	3	Apple	Orono	Larvæ and cocoons.
Glassy cut worm, *Hadena devastatrix*	July	20		Foxcroft	Moth.
Cut worms,——	Aug.	4		Seal Harbor	Larvæ.
Clear-wing moth, *Sesiidae*	July	7	Rose	Hulls Cove	Larvæ.
Achemon sphinx, *Philampelus achemon*	Sept.	5	Apple	Farmington	Larvæ full grown.
Blind-eyed sphinx, *Paonias excœcatus*	Sept.	9	Apple	Houlton	Larvæ full grown.
Mourning-cloak, *Euvanessa antiopa*	July	28	Willow	Portland	Larvæ molts.
——*Grapta faunus*	Aug.	10	Willow	East Sangerville	Butterfly.
Cottony grass scale, *Eriopeltis festucae*	April	6	Grass	Sedgwick	Egg sacs in meadow, numerous.
Cottony grass scale, *Eriopeltis festucae*	July	20	Grass	Gorham	Egg sacs, common.
Cottony grass scale, *Eriopeltis festucae*	July	28	Grass	Dresden	Egg sacs, ground covered.
Cottony grass scale, *Eriopeltis festucae*	July	28	Grass	Eggemoggin	Egg sacs, thick on stalks.
Cottony grass scale, *Eriopeltis festucae*	Aug.	3	Grass	Orono	Egg sacs, not common.
Cottony grass scale, *Eriopeltis festucae*	Aug.	4	Grass	Portland	Egg sacs, badly infested.
Cottony grass scale, *Eriopeltis festucae*	Aug.	6	Grass	Manchester	Egg sacs, infestation bad.
Plant louse, *Aphis Sp.* (?)	Aug.	29	Rose	Sagadahoc	
Green apple aphis, *Aphis mali*	Jan.	25	Apple		Eggs near leaf-scar on twig.
Green apple aphis, *Aphis mali*	June	26	Apple	Dover	
Green apple aphis, *Aphis mali*	Aug.	29	Apple	South Smithfield	On grafts.
Plant louse aphis, *Aphis Sp*	June	20	High bush cranberry	Seal Harbor	Leaves curled. Syrphus fly larvæ present
Honey-dew on leaves	June	21		Abbot	"Nearly everything covered for miles."
Potato aphis, *Aphis Sp.*	Aug.	12	Potato	Houlton	Common
Alder blight, *Schizoneura tessellata*	April	26	Alder	Orono	Larval clusters common
Woolly elm aphis, *Schizoneura americana*	June	11	Elm	Brunswick	In curled leaves which serve as a protection
Woolly louse of the apple, *Schizoneura lanigera*	July	31	Apple	Gorham	In crevice on tree trunk.
——*Lachnus* (*abietis* probably)	June	10	Fir	Augusta	Giant dark aphids. Wingless form eggs near leaf scars on twigs.
Spruce gall aphis, *Chermes*——?	June	23	Spruce	Orono	Galls common on Norway spruce.
Oyster shell scale, *Mytilaspis pomorum*	Aug.	11	Apple	Portland	Twigs badly incrusted.
Leaf hoppers——?	June	25	Apple	West Falmouth	Larvæ.

INSECTS RECEIVED FOR IDENTIFICATION—CONCLUDED.

Name.	Date.		Host.	Locality.	Remarks.
Tarnished plant bug, *Lygus pratensis*	Sept.	13	Asters	Ellsworth	Larvæ and adults.
Black damsel bug, *Coriscus subcoleoptratus*	July	14		Orono	Larvæ, short winged.
Fleas——				South Freeport	Troublesome in poultry houses.
Hair lice, *Trichodectes*——					Troublesome on horses and cattle.
Croton bugs, *Blatta germanica*				Corinth	"A great pest about the house."
Lace-winged fly, *Chrysopa*	July	20	Aphids	Orono	Eggs on alder leaf.
Syrphus fly, *Syrphus*——	July	7	Aphids	Orono	Larvæ common among *Schizoneura tessellata*.
Robber fly, *Asiladæ*	July	23		Old Town	Caught preying upon cabbage butterfly.
Rat-tailed larva, *Eristalis tenax*	Sept.	28			Two pupal molts from stable floor.
Pigeon horn-tail, *Tremex columba*	Aug.	10		Waterville	Female.
Cockoo fly, *Chrysididæ*	June	21		Orono	Female.
—— *Pelecinus polyturator*	Aug.	10		Orono	Female.
Ichneumon fly, *Thalessa lunata*	July	30		Orono	Female.
Strawberry crown girdler, *Otiorhynchus ovatus*	Aug.	8		Maysville Center	About edge of carpet.
Strawberry crown girdler, *Otiorhynchus ovatus*	Aug.	13		Monson	"House full of them."
Strawberry crown girdler, *Otiorhynchus ovatus*	Aug.	17	Grass roots?	Houlton	Numerous in meadow.
Two-spotted lady beetle, *Adalia bipunctata*	Sept.	17	Aphids	Hallowell	Pupæ and adults on birch leaves.
Lady beetle——	June	28	Aphids	Bar Harbor	Larvæ on rose bush.
Herbivorous lady beetle, *Epilachna borealis*	July	6		Auburn	Cluster of larvæ molting on bark of plum tree.
Larder beetle, *Dermestes lardarius*	May	23		Orono	Adults in woodbox.
Larder beetle, *Dermestes lardarius*	June	20		Rangeley	Great numbers in cottage where rats and mice had been poisoned the fall before.
—— *Silvanus surinamensis*	Jan.	7	Corn flour	Orono	700-800 adult beetles in $\frac{2}{3}$ quart flour.
Beautiful maple borer, *Plaginotus speciosus*	July	15		Monmouth	Adult.
Carrion beetle, *Silpha americana*	May	13		Orono	
Rove beetle, *Staphylinidæ*	Aug.	1		Dresden	On mushroom.
—— *Ips fasciatus*	Aug.	17		Portland	Beetles common in meadow.
Three spotted doryphora, *Doryphora clivicollis*	Aug.	22	Milkweed	Kittery	Larvæ and adults.
Asparagus beetle, *Crioceris asparagi*	June	15	Asparagus	Orono	Adults common in garden.

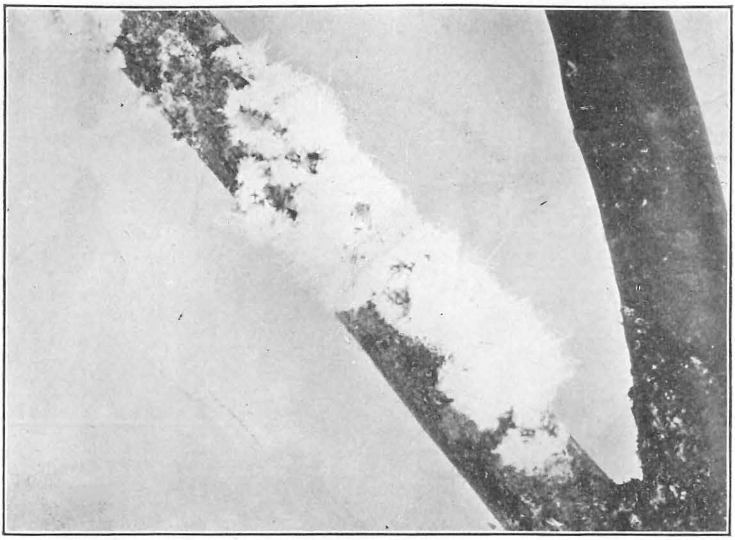

Fig. 33.
Black alder infested with alder blight, *Schizoneura tessellata.*

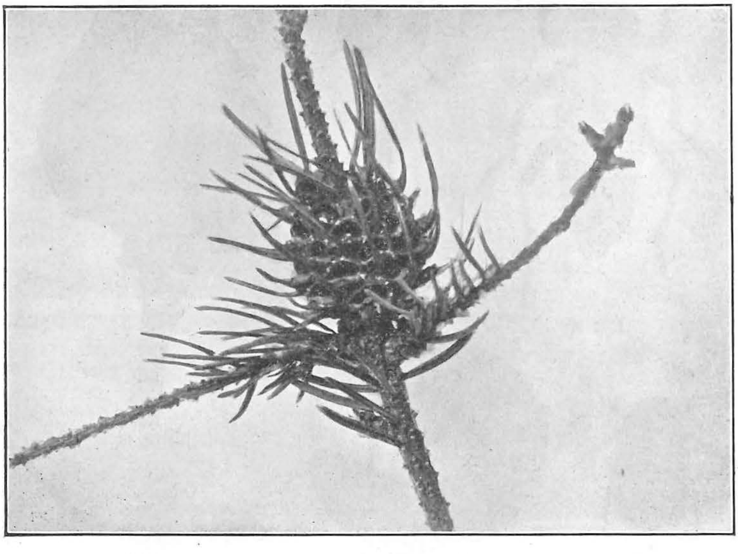

Fig. 34.
Cone-like gall of aphis common on the Norway and red spruces in eastern Maine.

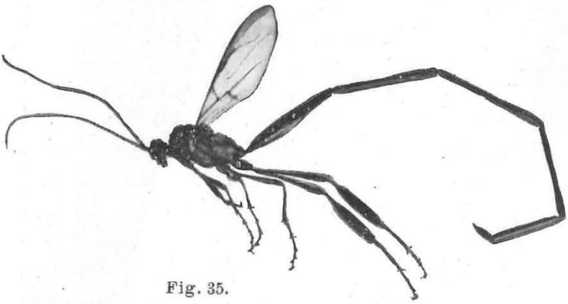

Fig. 35.

Fig. 36.

Fig. 37.

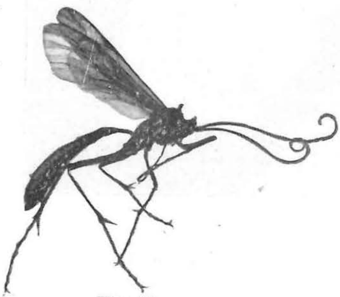

Fig. 38.

Fig. 39.

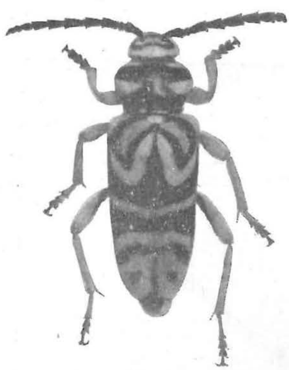

Fig. 40.

Fig. 41.

Fig. 42.

Fig. 43.

Fig. 44.

Fig. 45.

Fig. 46.

Insects referred to on pages 151 to 153.

DIGESTION EXPERIMENTS WITH SHEEP AND STEERS.

J. M. Bartlett.

The experiments here presented were undertaken for the purpose of comparing the digestive capacity of steers with that of sheep. They were begun in the winter of 1901 and completed in 1904, and though the work was carried over a period of nearly four years, not a great many experiments were performed for the reason that only about four months of each year could be devoted to the work, and each experiment required three weeks time.

By far the larger proportion of digestion coefficients obtained in this country are those derived from experiments with sheep, and in calculating rations it has been assumed that these were correct, for all ruminants at least. The small size of sheep and the ease with which they can be handled, probably accounts for their more general use, but our experience with them leads us to believe that, as a rule, they are much less desirable for this purpose than steers. They are nervous, restless and more liable to lose their appetite when confined in stalls, and parallel experiments with two or more animals are subject to wider variations. Out of a dozen different sheep the writer has used, only one really satisfactory animal, equal to the steer, has been found.

DESCRIPTION OF ANIMALS.

The steers used were grade Durhams which were bought in the country and had been rather poorly fed before they came to the Station. They were, therefore, small of their age, weighing about 300 ℔s. at one and one-half years old, when the experiments were begun. Although small, they were hearty and rugged, ate their rations well and did not appear to mind the confinement.

The sheep employed for the first two seasons were young Shropshires that were not very satisfactory. They were small eaters, especially of coarse fodders, and had to be handled very carefully to prevent them from getting out of condition. The third season large well matured lambs were obtained, but they did not take kindly to the confinement, probably because they were so young, and all comparative experiments with them had to be abandoned. The fourth season they were again tried and were more satisfactory.

METHOD.

The method of experiment employed with the sheep was practically the same as has been previously used at this Station, and described in Report for 1891, p. 25, except that the platform on which the sheep stood was raised so that the urine could be collected. For this purpose a rubber funnel was attached with straps passing over the animal's back, and a rubber tube led from it to convey the urine to a vessel beneath the platform. The whole experiment covered a period of twelve or thirteen days, the first seven days being a preliminary feeding period, while during the last five or six days the feces and urine were all collected, weighed and sampled for analysis.

The first two seasons the steers were so small that rubber lined pouches for collecting the feces, similar to those used on sheep, worked very satisfactorily. But during the third summer they made very rapid growth and attained such size that the pouch was no longer practicable and a galvanized iron trough was set in the rear of the platform so that it would secure all the droppings, and a strong wire running across behind the steer prevented him from stepping back into it. The stall and platform were just long enough to accommodate the animal, and all feces fell into the galvanized iron trough. Each ration of hay and grain were carefully weighed, the feces were collected in iron tubs and weighed at the end of the period on the same scales used to weigh the ration. The work was only carried on during cold weather, so no fermentation took place. The urine from the steers was collected with rubber funnels the same as with sheep. Between the experiments the animals were given a week's rest, which was necessary to keep them in good condition.

EXPLANATION OF TABLES.

The tables given on pages 162-163 contain the figures representing the chemical composition, or percentages of nutrients in the foods used in each experiment; also the composition of the feces for each sheep, and the heat of combustion for the foods and feces. The percentages given are on the same moisture bases as the figures given in the tables which follow. The tables on pages 164-165 contain the same data as the above relating to the steers.

The table on page 166 gives the total amount of food consumed by each sheep for each experiment and the feces excreted, also the time covered by the experiments.

The table on page 167 contains the percentage of each nutrient digested or the digestive coefficients for each sheep.

The table on page 168 gives the amount of food consumed by each steer and the feces excreted for each experiment.

The table on page 169 gives the digestion coefficients obtained for each steer.

In the tables on pages 170-171 are given a summary of the coefficients obtained in the experiments described in this bulletin. In the Station reports for 1897 and 1900 will be found summary tables giving all digestion coefficients which have been obtained at this Station previously.

The tables given on page 172 contain the average coefficients obtained for both sheep and steers on the different feed stuffs and mixtures, used in the experiments made to compare their digestive capacities.

The table on page 173 contains the coefficients obtained with the steers alone on mixtures of hay, corn meal and gluten meal.

The description of each experiment follows the tables on pages 173 and following:

COMPOSITION OF FOODS AND FECES IN DIGESTION EXPERIMENTS WITH SHEEP.

	Station number.	Dry matter.	Organic matter.	Ash.	Protein.	Crude fiber.	Nitrogen-free extract.	Ether extract.	Calories per gram.
Experiment 86.		%	%	%	%	%	%	%	Cal.
Clover silage	4259	21.14	19.20	1.94	2.25	8.25	7.97	0.73	1.073
Feces, Sheep I	4260	91.24	81.57	9.67	10.56	33.76	33.95	3.30	4.223
Feces, Sheep II	4261	91.25	81.76	9.49	11.94	33.09	33.51	3.22	4.201
Feces, Sheep III	4262	90.83	81.30	9.53	10.13	31.82	36.46	2.89	4.205
Experiment 87.									
Clover hay	4263	81.46	75.63	5.83	7.90	27.63	38.34	1.76	3.635
Feces, Sheep I	4264	91.45	83.14	8.31	8.56	35.44	36.79	2.35	4.294
Feces, Sheep II	4265	91.86	82.78	9.08	8.56	35.06	36.69	2.47	4.177
Feces, Sheep III	4266	91.79	83.79	8.00	8.75	34.76	37.92	2.36	4.179
Experiment 88.									
Timothy hay	4274	80.06	75.67	4.39	4.93	24.57	44.02	2.15	3.618
Feces, Sheep I	4275	91.90	85.16	6.74	7.63	30.01	43.75	3.77	4.379
Feces, Sheep III	4277	91.64	85.08	6.56	6.94	30.59	44.33	3.22	4.343
Experiment 89.									
Hay	4274	80.06	75.67	4.39	4.93	24.57	44.02	2.15	3.618
Coarse spring wheat bran	4309	92.57	86.01	6.56	16.63	11.17	53.11	5.00	4.118
Feces, Sheep I	4268	92.02	83.20	8.82	8.69	25.83	43.52	5.16	4.374
Feces, Sheep II	4269	90.83	81.75	9.08	8.94	24.49	43.60	4.72	4.227
Feces, Sheep III	4270	91.61	83.39	8.22	8.31	25.73	44.18	5.17	4.356
Experiment 90.									
Hay	4274	80.06	75.67	4.39	4.93	24.57	44.02	2.15	3.614
Winter wheat mixed feed	4310	90.70	84.60	6.10	16.13	13.33	49.94	5.20	4.044
Feces, Sheep II	4272	91.77	83.24	8.53	9.13	26.80	43.71	3.60	4.333
Feces, Sheep III	4273	92.16	83.78	8.50	8.50	26.85	45.44	2.99	4.223
Experiment 91.									
Hay	4278	82.58	78.60	3.98	4.87	25.78	45.59	2.36	3.691
Cottonseed meal	4211	91.99	84.40	7.59	46.75	6.23	21.64	9.78	4.662
Feces, Sheep II	4288	91.02	83.26	7.76	9.31	28.69	41.93	3.33	4.262
Feces, Sheep III	4289	91.02	84.01	7.01	9.06	27.99	43.68	3.28	4.310
Experiment 92.									
Hay	4278	82.58	78.60	3.98	4.87	25.78	45.59	2.36	3.691
Cottonseed meal	4311	91.99	84.40	7.59	46.75	6.23	21.64	9.78	4.662
Feces, Sheep II	4291	90.45	81.91	8.54	10.50	28.53	39.89	2.99	4.200
Feces, Sheep III	4292	90.58	82.11	8.74	10.81	27.67	40.60	3.09	4.236
Experiment 93.									
Hay	4306	83.90	79.66	4.24	5.00	26.98	44.26	3.42	3.810
Coarse corn meal	4307	87.54	86.62	1.02	9.06	2.25	72.25	2.96	3.881
Feces, Sheep II	4293	89.69	83.17	6.52	9.75	27.92	41.91	3.59	4.279
Feces, Sheep III	4295	90.52	84.49	6.03	8.81	30.26	42.44	2.98	4.268
Experiment 94.									
Hay	4306	83.90	79.66	4.24	5.00	26.98	44.26	3.42	3.810
Fine corn meal	4308	87.53	86.51	1.02	8.81	2.09	72.28	3.33	3.903
Feces, Sheep II	4297	89.32	83.17	6.15	8.56	28.29	43.25	3.07	4.236
Experiment 102.									
Corn fodder	4313	51.38	48.06	3.32	4.24	15.61	27.28	0.93	2.260
Waste, Sheep I	4324	46.13	40.43	5.70	3.99	13.22	22.45	0.77	
Waste, Sheep II	4325	43.71	40.93	2.78	3.14	14.25	23.04	0.50	
Feces, Sheep I	4327	88.63	75.90	12.73	11.13	20.75	42.07	1.95	3.964
Feces, Sheep II	4328	89.74	77.83	11.91	10.75	23.77	41.76	1.55	4.004
Experiment 103.									
Leaming corn silage	4315	19.60	18.60	1.00	1.60	5.42	11.09	.49	.916
Feces, Sheep I	4329	89.58	81.70	7.88	9.44	25.09	45.81	1.36	4.076
Feces, Sheep II	4330	89.43	81.81	7.62	8.81	27.57	44.01	1.42	4.053

COMPOSITION OF FOODS AND FECES, SHEEP—CONCLUDED.

	Station number.	Dry matter.	Organic matter.	Ash.	Protein.	Crude fiber.	Nitrogen-free extract.	Ether extract.	Calories per gram.
Experiment 104.		%	%	%	%	%	%	%	Cal.
Timothy hay	4319	84.65	80.08	4.57	5.32	27.62	44.99	2.15	3.791
Feces, Sheep I	4333	90.00	83.23	6.77	7.75	31.41	41.72	2.35	4.262
Feces, Sheep II	4334	89.44	82.08	7.36	7.63	29.79	42.13	2.53	4.231
Experiment 105.									
Hay	4319	84.65	80.08	4.57	5.32	27.62	44.99	2.15	3.791
Linseed meal	4359	89.44	83.71	5.73	40.81	7.86	33.53	1.51	4.097
Feces, Sheep II	4336	89.81	81.22	8.59	11.65	29.44	37.52	2.63	4.193
Experiment 106.									
Hay	4320	82.24	94.71	5.29	6.77	33.10	52.51	2.33	
Corn meal	4360	81.16	98.39	1.61	13.01	2.56	79.97	2.85	
Feces, Sheep I	4337	89.50	80.28	9.22	12.44	27.14	38.39	2.31	
Experiment 118.									
Soy-bean—corn silage	4408	20.20	19.03	1.17	2.13	5.11	9.62	2.17	.722
Feces, Sheep I	4392	91.92	81.88	10.04	10.69	29.72	37.98	3.49	4.168
Feces, Sheep II	4393	91.55	79.79	11.76	14.25	26.65	35.74	3.15	4.107
Experiment 119.									
Hay	4405	81.54	77.08	4.46	6.60	24.50	43.20	2.82	3.712
Feces, Sheep I	4388	91.09	83.19	7.90	8.44	28.60	42.12	2.68	4.201
Feces, Sheep II	4389	90.93	82.40	8.53	10.00	29.70	38.45	2.65	4.177
Experiment 120.									
Hay	4410	82.49	77.96	4.53	7.47	25.76	42.08	2.65	3.790
Linseed meal	4419	91.71	86.49	5.22	31.13	9.43	32.36	8.59	4.523
Corn meal	4418	88.55	87.27	1.28	8.44	1.99	72.95	2.54	3.891
Feces, Sheep I	4390	92.37	22.94	9.43	11.69	27.85	38.36	3.17	4.261
Feces, Sheep II	4391	92.94	83.79	9.15	11.75	27.30	39.45	3.41	4.285
Experiment 121.									
Hay	4411	85.36	81.23	4.13	7.04	25.19	46.20	2.80	4.000
Middlings	4420	90.92	86.93	3.99	18.13	5.22	55.97	4.71	4.165
Feces, Sheep I	4394	91.06	82.20	8.86	9.31	28.43	40.32	2.65	4.139
Feces, Sheep II	4395	91.86	82.56	9.30	9.31	29.15	39.82	2.79	4.222
Experiment 122.									
Hay	4414	86.05	81.68	4.37	6.49	26.63	45.98	2.58	3.945
Low grade cottonseed meal	4425	90.48	85.78	4.70	23.81	21.43	30.53	6.20	4.389
Feces, Sheep I	4396	90.82	82.89	7.93	11.00	31.73	36.40	2.00	4.185
Feces, Sheep II	4397	92.02	84.41	7.61	11.38	31.60	37.54	2.07	
Experiment 123.									
Hay	4416	89.20	84.53	4.67	7.37	27.53	46.41	3.22	4.013
Medium grade cottonseed meal	4424	88.40	81.90	6.50	34.13	13.58	19.83	8.90	3.854
Feces, Sheep I	4400	91.54	81.66	9.88	12.44	29.73	34.96	2.54	4.172
Feces, Sheep II	4401	91.94	81.60	10.34	11.88	31.20	34.59	2.03	4.150
Experiment 124.									
Hay	4415	87.34	83.09	4.25	6.66	27.36	46.31	2.76	4.007
Cottonseed meal (dark colored)	4423	87.28	80.23	7.05	42.50	7.67	14.64	8.62	3.785
Feces, Sheep I	4398	91.21	80.85	10.36	14.00	27.03	35.14	2.44	4.184
Feces, Sheep II	4399	90.79	80.49	10.30	15.00	27.77	33.06	2.26	4.152

COMPOSITION OF FOODS AND FECES IN DIGESTION EXPERIMENTS WITH STEERS.

	Station number.	Dry matter.	Organic matter.	Ash.	Protein.	Crude fiber.	Nitrogen-free extract.	Ether extract.	Calories per pound.
Experiment 95.		%	%	%	%	%	%	%	Cal.
Hay	4274	80.06	75.67	4.39	4.93	24.57	44.02	2.15	1,641
Feces, Steer I	4279	91.11	84.60	6.51	8.38	28.54	44.35	3.33	1,993
Feces, Steer II	4280	92.14	85.56	6.58	7.81	28.04	46.25	3.46	1,993
Experiment 96.									
Hay, 4,274.									
Spring wheat bran	4309	92.57	86.01	6.56	16.63	11.17	53.21	5.00	1,868
Feces, Steer I	4283	90.94	81.25	8.69	9.19	26.78	43.13	3.15	1,930
Feces, Steer II	4284	90.72	81.76	8.96	9.44	27.06	41.63	3.63	1,934
Experiment 97.									
Hay, 4,274.									
Winter wheat mixed feed	4310	90.70	84.60	6.10	16.13	13.33	49.94	5.20	1,834
Feces, Steer I	4281	91.61	83.34	8.27	9.06	26.45	44.86	2.97	1,913
Feces, Steer II	4282	91.06	82.72	8.24	9.25	27.22	42.89	3.46	1,923
Experiment 98.									
Hay	4304	88.26	84.01	4.25	5.42	28.45	46.83	3.31	1,788
Cottonseed meal	4311	91.99	84.40	7.59	46.75	6.23	21.64	9.78	2,115
Feces, Steer I	4285	91.43	83.66	7.77	10.69	28.47	41.57	2.93	1,947
Feces, Steer II	4286	90.49	82.39	8.10	10.38	27.98	40.95	3.08	1,947
Experiment 99.									
Hay	4278	82.58	78.60	3.98	4.87	25.78	45.59	2.36	1,674
Cottonseed meal	4311	91.99	84.40	7.59	46.75	6.23	21.64	9.78	2,115
Feces, Steer I	4298	91.28	83.11	8.17	11.25	27.49	41.29	3.08	1,942
Feces, Steer II	4299	90.53	82.51	8.02	11.31	27.05	40.87	3.28	1,934
Experiment 100.									
Hay	4306	83.90	79.66	4.24	5.00	26.08	44.26	3.42	1,728
Coarse corn meal	4307	87.54	86.52	1.02	9.06	2.25	72.25	2.96	1,760
Feces, Steer I	4300	90.24	83.82	6.42	9.19	29.23	42.16	3.24	1,952
Feces, Steer II	4301	91.54	84.66	6.88	9.44	27.17	44.57	3.48	1,970
Experiment 101.									
Hay, 4,306.									
Fine corn meal	4308	87.53	86.51	1.02	8.81	2.09	72.28	3.33	1,770
Feces, Steer I	4302	89.71	83.48	6.23	9.38	28.85	42.05	3.20	1,940
Feces, Steer II	4303	91.50	85.02	6.48	9.44	28.03	44.62	2.93	1,977
Experiment 107.									
Corn fodder	4313	51.38	48.06	3.32	4.24	15.61	27.28	.93	1,025
Feces, Steer I	4341	89.23	77.80	11.43	11.75	20.01	44.44	1.60	1,847
Feces, Steer II	4342	89.29	78.92	10.37	11.63	20.41	45.15	1.73	1,859
Experiment 108.									
Sanford corn silage	4314	20.19	19.14	1.05	1.41	5.27	12.01	0.45	415
Feces, Steer I	4343	89.27	79.60	9.67	11.13	20.99	45.58	1.90	1,863
Feces, Steer II	4344	89.20	79.11	10.09	11.88	21.06	44.25	1.92	1,851
Experiment 109.									
Leaming corn silage	4315	19.60	18.60	1.00	1.60	5.42	11.09	0.49	415
Feces, Steer I	4345	89.96	82.18	7.78	9.69	23.10	47.91	1.48	1,877
Feces, Steer II	4346	89.33	79.89	9.44	11.13	20.07	47.11	1.58	1,850
Experiment 110.									
Feed flour	4358	82.14	79.18	2.96	21.38	2.25	54.83	0.72	1,702
Feces, Steer I	4347	89.94	79.59	10.35	12.81	21.49	43.12	2.17	1,873
Feces, Steer II	4348	89.54	79.10	10.44	12.38	22.26	42.56	1.90	1,845
Experiment 111.									
Hay, mostly timothy	4319	84.65	80.08	4.57	5.32	27.62	44.99	2.15	1,719
Feces, Steer I	4351	89.95	82.71	7.24	9.06	28.37	42.30	2.98	1,956
Feces, Steer II	4352	89.08	81.89	7.19	8.56	28.24	42.23	2.86	1,944

COMPOSITION OF FODDERS AND FECES, STEERS—CONCLUDED.

	Station number.	Dry matter.	Organic matter.	Ash.	Protein.	Crude fiber.	Nitrogen-free extract.	Ether extract.	Calories per pound, air dry or fresh.
Experiment 112.		%	%	%	%	%	%	%	
Linseed meal	4359	89.44	83.71	5.73	40.81	7.86	33.53	1.51	1,958
Feces, Steer I	4353	89.70	81.31	8.39	10.81	27.37	40.45	2.68	1,906
Experiment 113.									
Hay	4321	87.11	82.49	4.62	5.24	29.63	45.77	1.85	
Linseed meal	4359								
Corn meal	4360	81.16	79.85	1.31	10.56	2.08	64.90	2.30	
Feces, Steer II	4355	90.26	82.17	8.09	11.13	27.92	40.44	2.68	
Experiment 114.									
Hay	4362	84.46	79.53	4.93	5.94	27.25	44.02	2.32	1,709
Feces, Steer I	4363	19.04	17.33	1.71	1.66	6.87	8.11	.69	402
Feces, Steer II	4364	20.36	18.47	1.89	1.85	7.11	8.77	.74	433
Experiment 115.									
Hay	4365	83.00	77.59	5.41	6.28	26.15	42.81	2.35	1,692
Corn meal	4375	88.94	78.63	1.31	9.74	1.58	72.51	3.80	1,775
Feces, Steer I	4366	18.25	16.63	1.62	2.52	5.23	8.09	.79	393
Feces, Steer II	4367	18.39	16.61	1.78	2.51	5.33	7.99	.78	400
Experiment 116.									
Hay	4368	85.28	79.42	5.86	7.17	28.78	41.31	2.16	1,747
Gluten feed	4376	90.61	89.57	1.04	26.38	8.48	50.72	3.99	399
Feces, Steer I	4369	17.81	16.13	1.68	2.56	4.72	8.14	0.71	402
Feces, Steer II	4370	18.41	16.58	1.83	2.68	4.80	8.34	0.76	399
Experiment 117.									
Hay	4368	85.10	79.52	5.58	7.72	26.40	42.83	2.57	1,747
Gluten feed	4376								
Feces, Steer I	4372	16.48	14.85	1.63	2.24	4.94	7.13	0.54	403
Feces, Steer II	4373	18.75	16.62	2.13	2.51	5.53	7.98	0.60	399
Experiment 125.									
Soy bean—corn silage	4406	18.92	17.87	1.05	1.90	5.06	......	......	370
Feces, Steer II	4382	14.55	12.73	1.82	2.13	4.95	5.14	.51	302
Experiment 126.									
Hay	4404	82.74	78.37	4.37	7.45	25.17	42.83	2.92	1,661
Soy-bean—corn silage	4407	20.94	19.61	1.33	1.98	5.42	11.55	0.66	408
Feces, Steer I	4383	17.53	16.70	1.83	2.08	5.92	7.27	.43	348
Feces, Steer II	4384	15.88	14.30	1.58	1.84	5.45	6.63	.38	324
Experiment 127.									
Hay	4404	82.74	78.37	4.37	7.45	25.17	42.83	2.92	1,661
Feces, Steer I	4377	20.35	18.56	1.79	2.14	6.04	9.38	1.01	438
Feces, Steer II	4378	22.33	20.33	2.00	2.47	6.58	10.19	1.09	479
Experiment 128.									
Hay	4409	91.29	86.59	4.70	7.81	27.62	46.62	3.29	1,661
Corn meal	4418	88.55	87.27	1.28	8.44	1.99	72.95	2.54	1,765
Linseed meal	4419	91.71	86.49	5.22	31.13	9.43	32.36	8.59	2,051
Feces, Steer I	4379	20.14	18.18	1.96	2.62	5.94	8.98	0.74	428
Feces, Steer II	4380	21.33	19.35	1.98	2.50	6.51	9.59	0.75	454
Experiment 129.									
Hay	4412	87.50	83.07	4.43	6.34	26.65	47.13	2.95	1,817
Spring wheat middlings	4421	86.52	83.50	3.02	13.31	4.18	60.96	2.92	1,680
Feces, Steer II	4387	21.06	18.45	2.61	2.56	6.40	8.84	0.65	459

DATA RELATIVE TO DIGESTION EXPERIMENTS WITH SHEEP.

Number of experiment.	Animal's number.	Length of experiment in days.	The food consumed by each animal during the experiment.	Total feces—grams.
86	I..	5.....	Clover silage, 15,000 grams	1,970
86	II..	5.....	Clover silage, 10,000 grams	1,463
86	III..	5.....	Clover silage, 12,500 grams	1,875
87	I..	5.....	Clover hay, 5,000 grams	2,133
87	II..	5.....	Clover hay, 4,000 grams	1,731
87	III..	5.....	Clover hay, 4,000 grams	1,775
88	I..	5.....	Timothy hay, 4,859 grams	2,165
88	III..	5.....	Timothy hay, 3,936 grams	1,825
89	I..	5.....	Hay, 3,000 grams, coarse spring bran, 1,500 grams	1,813
89	II..	5.....	Hay, 3,000 grams, coarse spring bran, 1,500 grams	1,828
	III..	5.....	Hay, 3,000 grams, coarse spring bran, 1,500 grams	1,833
90	II..	5.....	Hay, 3,000 grams, winter wheat mixed feed, 1,500 gr.	1,678
90	III..	5.....	Hay, 3,000 grams, winter wheat mixed feed, 1,500 gr.	1,768
91	II..	5.....	Hay, 4,000 grams, cottonseed meal, 500 grams	1,866
91	III..	5.....	Hay, 4,000 grams, cottonseed meal, 500 grams	1,909
92	II..	5.....	Hay, 4,000 grams, cottonseed meal, 1,000 grams	1,971
92	III..	5.....	Hay, 4,000 grams, cottonseed meal, 1,000 grams	1,946
93	I..	5.....	Hay, 3,000 grams, coarse corn meal, 1,000 grams	1,522
93	III..	5.....	Hay, 3,000 grams, coarse corn meal, 1,000 grams	1,697
94	II..	5.....	Hay, 3,000 grams, fine corn meal, 1,000 grams	1,547
102	I..	6.....	Corn fodder, 4,200 grams, 483 grams waste	754
102	II..	6.....	Corn fodder, 4,200 grams, 313 grams waste	843
103	I..	6.....	Leaming corn silage, 15,000 grams	1,243
103	II..	6.....	Leaming corn silage, 15,000 grams	1,354
104	I..	5.....	Timothy hay, 3,500 grams	1,346
104	II..	5.....	Timothy hay, 3,500 grams	1,345
105	III..	5.....	Hay, 3,500 grams, linseed meal, 1,500 grams	1,406
106	I..	5.....	Hay, 2,500 grams, linseed meal, 1,000 grams, corn meal, 1,000 grams	1,137
118	I..	6.....	Soy bean—corn silage, 18,000 grams	1,182
118	II..	6.....	Soy bean—corn silage, 12,000 grams	727
119	I..	6.....	Hay, 6,000 grams	2,717
119	II..	6.....	Hay, 4,800 grams	2,191
120	I..	6.....	Hay, 3,600 gr., linseed meal, 900 gr., corn meal, 900 gr.	1,905
120	II..	6.....	Hay, 3,600 gr., linseed meal, 900 gr., corn meal, 900 gr.	1,881
121	I..	6.....	Hay, 4,800 grams, middlings, 2,400 grams	2,726
121	II..	6.....	Hay, 2,400 grams, middlings, 1,200 grams	1,392
122	I..	6.....	Hay, 6,000 grams, low grade cottonseed meal, 3,000 gr.	4,075
122	II..	6.....	Hay, 3,600 grams, low grade cottonseed meal, 1,800 gr.	2,311
123	I..	6.....	Hay, 6,000 gr., medium grade cottonseed meal, 3,000 gr.	3,833
123	II..	6.....	Hay, 4,800 gr., medium grade cottonseed meal, 2,400 gr.	2,843
124	I..	6.....	Hay, 6,000 grams, cottonseed meal (off color) 3,000 gr.	3,471
124	II..	6.....	Hay, 6,000 grams, cottonseed meal (off color) 2,400 gr.	2,545

COEFFICIENTS OBTAINED IN DIGESTION EXPERIMENTS WITH SHEEP.

Material.	Number of experiment.	Animal's number.	Dry matter.	Organic matter.	Ash.	Protein.	Crude fiber.	Nitrogen-free extract.	Ether extract.	Fuel value.
			%	%	%	%	%	%	%	%
Clover silage.	86	I	43.3	44.2	34.5	38.3	46.3	44.1	40.6	47.7
	86	II	36.8	37.7	28.5	22.4	41.3	38.5	35.5	40.8
	86	III	31.7	36.4	26.3	32.3	42.1	31.2	40.4	39.7
Clover hay.	87	I	52.1	53.1	39.2	53.8	42.4	59.1	43.4	51.0
	87	II	48.8	52.6	32.6	53.1	45.2	58.6	40.7	49.3
	87	III	50.2	51.0	39.3	51.0	44.4	56.3	41.0	48.1
Timothy hay.	88	I	49.1	50.1	31.0	31.5	45.7	58.0	23.3	47.2
	88	II	47.1	48.0	30.3	35.0	43.9	53.5	31.3	44.2
Coarse spring wheat bran.	89	I	69.6	66.6	30.4	76.4	63.1	74.2	37.7	
	89	II	70.1	73.7	24.2	74.1	75.6	73.2	47.6	
	89	III	69.5	72.8	31.5	76.3	66.7	73.0	40.5	64.0
Winter wheat bran (mixed feed).	90	II	78.4	80.9	43.4	77.4	78.5			
	90	III	71.9	74.6	35.5	78.6	66.0	......	......	71.8
Hay and cottonseed meal 8 to 1.	91	II	54.8	56.4	26.5	59.4	49.6	59.4	56.2	52.3
	91	III	53.8	55.0	32.0	59.6	49.7	56.8	55.9	50.6
Hay and cottonseed meal 8 to 2.	92	II	57.7	59.2	28.3	68.7	48.5	61.4	69.2	55.4
	92	III	58.2	59.9	29.8	68.2	50.7	61.2	69.2	50.9
Coarse corn meal.	93	I	93.2	94.0	......	46.5	......	79.1	......	78.3
	93	III	73.7	74.9	......	45.4	......	81.5		
Fine corn meal.	94	II	89.2	90.2	31.3	63.2	56.4	88.6	......	88.0
Cut corn fodder.	102	I	65.5	68.7	14.2	47.2	72.6	69.4	52.6	
	102	II	62.5	65.3	23.0	46.2	67.2	67.0	66.0	
Leaming corn silage.	103	I	61.2	63.5	34.7	51.2	61.6	65.8	77.0	46.4
	103	II	58.8	60.3	31.8	50.5	54.0	64.2	73.9	42.7
Timothy hay, some clover.	104	I	59.1	60.0	43.0	43.9	56.2	64.3	57.9	56.2
	104	II	59.7	65.7	38.5	45.2	58.8	63.6	55.0	56.5
Linseed meal.	105	II	95.5	88.6	69.6	90.1	......	......	81.4	88.4
Linseed meal and corn meal (mixed equal parts).	106	I	89.2	91.2	42 6	87.5	80.4	95.1	85.9	
	106	II	82.4	93.9	......	78.3	......	......	89.0	
Soy bean--corn silage.	118	I	70.1	71.8	45.6	67.0	61.8	74.1	89.4	67.2
	118	II	72.6	74.6	39.1	68.2	68.4	79.4	91.2	71.2
Hay, largely timothy.	119	I	49.4	51.1	19.7	42.1	47.2	55.9	57.0	48.1
	119	II	49.3	51.2	16.2	36.5	45.9	57.7	57.1	48.5
Linseed and corn meal (equal parts).	120	I	83.3	86.4	......	85.4	71.2	90.5	80.5	81.0
	120	II	84.1	86.7	......	85.9	88.4	89.4	76.8	81.7
Spring wheat middlings.	121	I	81.5	83.8	......	91.0	......	87.8	87.0	82.3
	121	II	78.1	81.1	......	90.6	......	87.5	84.5	76.8
Low grade cottonseed meal	122	I	60.1	61.5	......	71.9	30.3	65.7	87.3	58.7
	122	II	62.8	66.6	......	73.3	45.2	69.5	92.8	
Medium grade cottonseed meal.	123	I	66.8	73.3	......	80.9	39.8	72.8	94.6	61.6
	123	II	79.2	82.7	......	86.2	47.2	91.3	......	71.8
Dark cottonseed meal.	124	I	80.6	84.5	......	81.8	......	89.7	94.7	72.1
	124	II	91.0	95.2	......	82.5	......	99.6	99.7	83.4

DATA RELATIVE TO DIGESTION EXPERIMENTS WITH STEERS.

Number of experiment.	Animal's number.	Length of experiment in days.	The food consumed by each animal during each experiment.	Total feces air dry or fresh—pounds.
95	I....	5	Timothy hay, 40 pounds	15.8
95	II....	5	Timothy hay, 40 pounds	15.7
96	I....	5	Hay, 35 pounds, coarse spring wheat bran, 15 pounds.	19.4
96	II....	5	Hay, 35 pounds, coarse spring wheat bran, 15 pounds.	18.7
97	I....	5	Hay, 35 pounds, winter wheat bran, 15 pounds	18.2
97	II....	5	Hay, 35 pounds, winter wheat bran, 15 pounds	18.2
98	I....	5	Hay, 40 pounds, cottonseed meal, 5 pounds	18.5
98	II....	5	Hay, 40 pounds, cottonseed meal, 5 pounds	18.7
99	I....	5	Hay, 40 pounds, cottonseed meal, 10 pounds	18.7
99	II....	5	Hay, 40 pounds, cottonseed meal, 10 pounds	18.8
100	I....	5	Hay, 50 pounds, coarse corn meal, 10 pounds	23.0
100	II....	5	Hay, 40 pounds, coarse corn meal, 10 pounds	21.7
101	I....	5	Hay, 50 pounds, fine corn meal, 10 pounds	22.1
101	II....	5	Hay, 40 pounds, fine corn meal, 10 pounds	18.0
107	I....	5	Corn fodder, 70 pounds	10.8
107	II....	5	Corn fodder, 70 pounds	11.1
108	I....	5	Sanford corn silage, 200 pounds	11.7
108	II....	5	Sanford corn silage, 200 pounds	11.1
109	I....	5	Leaming corn silage, 150 pounds	13.0
109	II....	5	Leaming corn silage, 150 pounds	11.7
110	I....	5	Leaming corn silage, 150 pounds, feed flour, 20 lbs	14.8
110	II....	5	Leaming corn silage, 150 pounds, feed flour, 20 lbs	14.2
111	I....	5	Hay, 50 pounds	19.6
111	II....	5	Hay, 50 pounds	19.8
112	I....	5	Hay, 50 pounds, linseed meal, 10 pounds	21.3
113	II....	5 ..	Hay, 50 lbs., linseed meal, 10 lbs., corn meal, 10 lbs	21.7
114	I....	5	Hay, 80 pounds	148.0
114	II....	5	Hay, 80 pounds	135.3
115	I. ..	5	Hay, 50 pounds, 30 pounds corn meal	115.8
115	II....	5	Hay, 50 pounds, 30 pounds corn meal	116.0
116	I....	5	Hay, 50 pounds, 30 pounds gluten feed	116.5
116	II....	5	Hay, 50 pounds, 30 pounds gluten feed	108.0
117	I....	5	Hay, 50 pounds, 15 pounds gluten feed	113.5
117	II....	5	Hay, 50 pounds, 15 pounds gluten feed	100.5
125	II....	6	Soy bean--corn silage, 325 pounds	127.0
126	I....	6	Hay, 30 pounds, soy bean--corn silage, 240 pounds	144.0
	II....	6	Hay, 60 pounds, soy bean--corn silage, 240 pounds	237.0
127	I....	6	Hay, 108 pounds	180.5
	II....	6	Hay, 108 pounds	190.3
128	I....	6	Hay, 72 lbs., corn meal, 18 lbs., linseed meal, 18 lbs	155.5
	II....	6	Hay, 72 lbs., corn meal, 18 lbs., linseed meal, 18 lbs	160.5
129	II....	6	Hay, 72 pounds, middlings, 36 pounds	157.5

COEFFICIENTS OBTAINED IN DIGESTION EXPERIMENTS WITH STEERS.

Material Fed.	Number of experiment.	Animal's number.	Dry matter.	Organic matter.	Ash.	Protein.	Crude fiber.	Nitrogen-free extract.	Ether extract.	Fuel value.
			%	%	%	%	%	%	%	%
Hay, largely timothy,	95	I	55.1	55.9	41.5	33.0	54.3	60.2	36.3	51.6
	95	II	54.78	55.5	41.5	37.6	55.3	58.6	35.2	51.7
Spring wheat bran (coarse)	96	I	64.2	68.9	20.4	73.5	21.8	73.5	82.7	
	96	II	68.67	72.4	20.4	73.9	29.9	80.1	73.4	63.6
Winter wheat bran (mixed feed).	97	I	70.4	73.0	33.7	76.5	53.5	74.4	92.3	
	97	II	71.1	73.0	34.8	76.9	47.0	78.5	80.8	70.0
Hay and cottonseed meal 8 to 1.	98	I	57.5	59.1	69.9	56.1	54.9	61.1	70.1	54.9
	98	II	57.5	59.2	72.3	56.9	55.2	61.3	68.5	54.4
Hay and cottonseed meal 8 to 2.	99	I	59.5	61.0	35.3	68.1	52.8	62.0	69.7	56.6
	99	II	59.6	61.0	35.7	67.8	53.4	62.2	67.1	56.6
Coarse corn meal.	100	I	78.4	81.2	......	46.2	......	90.1		
	100	II	88.7	91.9	......	53.9	......	90.5	......	80.0
Fine corn meal.	101	I	88.4	90.3	......	47.7	......	94.8		
	101	II	86.7	88.5	......	50.6	......	91.3	......	90.0
Cut corn fodder.	107	I	73.2	75.0	47.0	57.2	80.2	74.9	73.8	71.2
	107	II	72.6	74.1	50.4	56.6	79.3	73.9	70.8	70.4
Sanford corn silage.	108	I	74.0	75.5	47.7	53.9	76.6	77.8	76.3	73.2
	108	II	75.7	77.3	47.1	53.5	77.9	79.7	77.7	74.7
Leaming corn silage.	109	I	60.4	61.9	32.7	47.5	63.3	62.2	60.8	60.2
	109	II	65.8	67.7	30.7	45.9	71.1	65.9	75.7	64.5
Feed flour.	110	I	66.8	70.1	......	78.2	......	77.7	......	73.9
	110	II	67.1	70.3	......	80.0	......	73.3		
Hay, timothy with some clover.	111	I	58.4	59.6	37.9	34.2	59.8	63.2	46.3	55.1
	111	II	58.2	59.8	37.9	36.4	59.4	62.7	47.2	54.9
Linseed meal.	112	I	84.1	87.2	36.8	85.7	69.6	91.4	......	81.3
Linseed meal and corn meal.	113	II	91.5	92.5	52.8	86.2	93.0	96.8	81.3	
Hay, largely timothy.	114	I	58.3	59.7	35.8	48.2	53.4	65.9	45.2	57.5
	114	II	59.2	60.7	35.0	47.4	55.9	66.3	45.7	56.9
Mixture—Hay 10 lbs. and corn meal 6 lbs.	115	I	69.0	70.4	39.5	51.9	66.2	78.3	60.8	66.1
	115	II	68.7	70.4	33.4	51.9	65.3	78.5	61.2	64.0
Mixture—hay 10 lbs. and gluten feed 6 lbs.	116	I	70.3	71.8	38.3	74.1	67.5	73.6	63.7	66.5
	116	II	71.5	73.1	38.9	74.8	69.4	74.9	63.9	68.5
Gluten feed—Hay 10 lbs., gluten feed 3 lbs.	117	I	91.3	92.3	......	85.4	......	89.1		
	117	II	90.4	93.4	......	86.0	......	90.0	......	86.3
Soy bean—corn silage.	125	II	70.5	72.2	31.3	56.4	61.7	80.5	66.7	67.7
Soy bean—corn silage, fed with hay.	126	I	69.0	70.5	43.6	53.5	50.8	79.7	......	71.7
	126	II	61.7	71.6	48.0	61.9	59.6	80.4	88.3	68.5
Hay, largely timothy.	127	I	58.9	60.4	31.6	39.6	59.9	63.4	42.3	55.3
	127	II	52.5	54.3	19.5	41.7	54.0	58.2	34.2	48.6
Corn and linseed meal. (Equal parts.)	128	I	93.43	94.5	54.7	84.8	67.5	95.8	......	81.2
	128	II	84.44	85.6	43.4	85.7	87.4	88.2	......	76.2
Middlings.	129	II	83.4	88.3	......	72.7	......	98.6	......	82.9

SUMMARY OF DIGESTION COEFFICIENTS WITH SHEEP.

Material.	Number of experiment.	Number of animals.	Dry matter.	Organic matter.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Ether extract.	Fuel value.
			%	%	%	%	%	%	%	%
Clover silage	86	3	37.3	39.4	29.8	31.0	43.2	37.9	38.8	42.7
Clover hay	87	3	50.4	52.2	37.0	52.6	43.9	58.0	41.7	49.4
Timothy hay (late cut)	88	2	48.1	49.1	30.7	33.3	44.8	55.8	27.3	46.0
Mixed hay (some clover)	104	2	59.4	60.5	40.8	44.6	57.5	64.0	56.5	58.4
Hay, largely timothy	119	2	49.3	51.2	16.2	36.5	45.9	57.7	57.1	48.5
Corn fodder (few ears glazed)	102	2	64.0	67.0	18.6	46.7	69.9	68.2	59.3	
Corn silage (immature corn)	103	2	60.0	61.9	33.3	50.9	57.8	65.0	75.5	44.6
Soy bean—corn silage	118	2	71.4	73.2	42.7	62.6	65.1	76.8	90.3	69.2
Coarse spring wheat bran	89	3	69.5	72.8	31.5	76.3	66.7	73.0	40.5	64.0
Winter wheat, mixed feed	90	2	72.5	77.6	39.5	78.0	72.3	......	......	71.8
Coarse corn meal	93	2	83.5	84.6	......	46.0	......	80.3	......	78.3
Fine corn meal	94	1	89.2	90.2	......	63.2	......	88.6	......	88.0
Cottonseed meal, high grade	92	2	*94.0	*99.1	26.7	82.1	......	93.1	100	......
Cottonseed meal, dark color	122	2	85.8	89.9	......	82.2	......	94.7	97.2	83.4
Cottonseed meal, medium grade	123	2	61.4	64.1	......	72.6	37.8	67.8	90.1	58.7
Cottonseed meal, low grade	124	2	73.0	78.0	......	83.6	......	43.5	82.1	71.8
Middlings	121	2	79.8	82.5	......	90.6	......	87.5	84.7	76.8
Corn meal and linseed, 1-1	106	2	89.2	91.2	42.6	87.5	80.4	95.1	85.9	......
Corn meal and linseed 1-1	120	2	83.7	86.6	......	85.3	79.3	89.9	78.7	81.3

* Probably too high.

SUMMARY OF DIGESTION COEFFICIENT WITH STEERS.

Materials.	Number of experiment.	Number of animals.	Dry matter.	Organic matter.	Ash.	Protein.	Fiber.	Nitrogen-free extract.	Ether extract.	Fuel value.
			%	%	%	%	%	%	%	%
Timothy hay (late cut).....	95	2	54.9	55.5	41.5	35.3	54.8	59.4	35.7	51.6
Mixed hay, some clover....	111	2	58.3	59.5	37.9	35.3	59.6	63.0	46.8	55.0
Hay, largely timothy.......	127	2	55.7	57.4	25.6	40.7	57.0	60.0	38.3	51.9
Hay, mixed..................	114	2	58.8	60.2	35.4	47.8	54.7	66.1	45.4	56.9
Sanford corn fodder (few ears glazed)	107	2	72.9	74.6	48.7	56.9	79.8	74.4	72.3	70.8
Sanford corn silage (few ears glazed)	108	2	74.9	76.4	47.4	53.7	77.3	78.8	77.0	74.0
Leaming corn silage (immature corn)..............	109	2	63.1	64.4	31.7	46.7	67.2	65.1	68.3	62.4
Soy-bean and corn silage ..	125	1	70.5	72.2	31.3	56.4	61.7	77.54	90.00	67.7
Soy-bean and corn silage fed with hay	126	2	70.3	71.1	45.8	57.7	55.1	80.00	88.00	71.7
Spring wheat bran..........	96	2	66.4	70.7	20.4	73.7	25.9	76.8	78.1	63.5
Winter wheat mixed feed..	97	2	70.76	73.0	34.3	76.7	50.3	76.5	......	70.0
Coarse corn meal...........	100	2	83.6	86.4	......	45.1	......	90.3	......	80.0
Fine corn meal..............	101	2	86.7	88.5	......	50.6	......	91.3	......	90.0
Feed flour	110	2	67.1	70.3	......	79.95	......	73.3	......	73.9
Middlings	129	2	83.4	88.3	......	72.7	......	98.6	......	82.9
Cottonseed meal (in ratio hay 8, meal 1)	98	2	77.8	87.8	84.3	76.1	55.1	93.1		
Cottonseed meal (in ratio hay 8, cottonseed meal 2)	99	2	76.1	80.8	......	81.6	26.3	84.8		
Linseed meal	112	2	84.1	87.2	36.8	85.7	69.6	91.4	......	88.4
Corn and linseed meal, 1-1.	113	2	91.5	92.5	52.8	86.2	93.0	96.8	81.3	
Corn and linseed meal, 1-1.	128	2	88.9	90.1	......	85.3	77.4	88.2	......	77.7
Gluten feed..................	116	2	87.6	90.6	......	86.6	......	85.4	80.2	86.3

AVERAGE OF THE DIGESTION COEFFICIENTS OBTAINED WITH SHEEP AND STEERS.

	Number of the Experiment.		Dry Matter.		Organic Matter.		Ash.		Protein.		Fiber.		Nitrogen-free Extract.		Ether Extract.		Fuel Value.	
	Steer.	Sheep.	Steer.	Sheep.	Steer.	Sheep.	Steer.	Sheep.	Steer.	Sheep.	Steer.	Sheep.	Steer.	Sheep.	Steer.	Sheep.	Steer.	Sheep.
			%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Timothy hay (late cut)	95	88	54.9	48.1	55.5	49.1	41.5	30.7	35.3	33.3	54.8	44.8	59.4	55.8	35.7	27.3	51.6	46.0
Spring wheat bran	96	89	66.4	69.5	70.7	72.8	20.4	31.5	73.7	76.3	25.9	66.7	76.8	73.0	78.1	40.5	63.5	64.0
Winter wheat mixed feed	97	90	70.7	72.5	73.0	77.6	34.3	39.5	76.7	78.0	50.3	72.3	76.5	......	......	......	70.0	71.8
Hay 8 parts, cottonseed meal 1 part.	98	91	57.5	54.3	59.2	55.7	71.1	29.3	56.5	59.5	56.6	49.7	61.2	58.1	69.8	56.1	54.7	51.5
Hay 8 parts, cottonseed meal 2 parts	99	92	59.6	58.7	61.0	59.5	35.5	29.1	68.0	68.5	53.1	50.1	62.1	61.1	68.4	62.2	56.6	53.1
Coarse corn meal	100	93	83.6	83.5	86.4	84.6	......	......	45.1	46.0	......	......	90.3	80.3	......	......	80.0	78.3
Fine corn meal	101	94	86.7	89.2	88.5	90.2	......	......	50.6	63.2	......	......	91.3	88.6	......	......	90.0	88.0
Corn fodder (Sanford corn)	107	102	72.9	64.9	74.6	67.0	48.7	18.6	56.9	46.7	79.8	69.9	74.4	68.2	72.3	59.3	70.8	......
Leaming corn silage	109	103	63.1	60.0	64.4	61.9	31.7	33.3	46.7	50.9	67.2	57.8	64.1	65.0	68.3	75.5	62.4	44.6
Mixed hay (timothy, red top, clover)	111	104	58.3	59.4	59.5	60.5	37.9	40.8	35.3	44.6	59.6	57.5	63.0	64.0	46.8	56.5	55.0	56.4
Linseed meal	112	*	84.1	81.2	87.2	84.5	36.8	69.6	85.7	87.2	69.6	......	91.4	85.5	......	91.9	81.3	88.4
Corn meal and linseed, equal parts	113	106	91.5	89.2	92.5	91.2	52.8	42.6	86.2	87.5	93.0	80.4	96.8	95.1	81.3	85.9	......	......
Soy-bean and corn silage	125	118	70.5	71.4	72.2	73.2	31.3	42.7	56.4	62.6	61.7	65.1	77.5	76.8	90.0	90.3	67.7	69.2
Hay, largely timothy	127	119	55.7	49.3	57.4	51.2	25.6	6.2	40.7	36.5	57.0	45.9	60.0	57.7	38.3	57.1	52.0	48.5
Hay, linseed and corn meals	128	120	66.6	61.6	68.3	63.9	31.6	23.5	68.4	64.5	50.1	45.5	72.1	69.7	73.1	68.2	61.3	61.8
Linseed and corn meal, equal parts.	128	120	88.9	83.7	90.1	86.6	......	......	85.3	85.7	77.4	79.3	88.2	89.9	......	78.7	77.7	81.3
Gluten feed	116	*	87.6	86.3	90.6	87.3	......	......	86.6	85.6	......	......	85.4	89.2	80.2	84.4	......	......

* Bul. No. 77, U. S. Dept. Agr.

COEFFICIENTS OBTAINED WITH STEERS ALONE.

	Number of experiment.	Dry matter.	Organic matter.	Ash.	Protein.	Crude fiber.	Nitrogen-free extract.	Ether extract.
		%	%	%	%	%	%	%
Hay alone, 16 lbs. ration............	114	58.8	60.2	35.4	47.8	54.7	66.1	45.4
Hay 10 lbs., corn meal 6 lbs..........	115	68.9	70.4	36.5	51.9	65.8	78.4	61.0
Hay 10 lbs., gluten feed 6 lbs........	116	70.9	72.5	38.6	74.0	68.0	74.2	63.7
Corn meal...........................	115	84.3	85.4	......	56.4	......	90.4	76.8
Gluten feed (10 hay to 6 gluten).....	116	87.6	90.6	......	86.6	......	85.4	80.2
Gluten feed (10 hay, 3 gluten).......	117	90.0	93.4	......	86.0	......	89.5	......

DESCRIPTION OF EXPERIMENTS.

Experiment No. 86.—Clover silage. In the Station report for 1900, page 141, are given the results of a digestion experiment on clover silage. The results there given, especially on protein, were so much lower than those obtained from clover hay that it was thought desirable to repeat them. The results here given on page 170 are even lower than the others obtained, showing that the digestibility of clover is materially decreased by ensiling. The clover was chopped and well packed in the silo and came out in as good condition as any leguminous plant usually does.

Experiment No. 87.—Clover hay. The material used in this experiment was the same as was made into silage. It will be observed that the dry matter of this hay is 13 per cent and the protein over 21 per cent more digestible than in the silage.

Experiments No. 88-95.—Timothy hay. The hay used in this experiment was late cut and rather poor quality, as shown by the analyses and digestibility. It was prepared by chopping to about 2-inch lengths several hundred pounds, enough to last through the experiments with grain rations for the season, and thoroughly mixing to make it uniform. The hay was not very palatable and only small rations could be fed without some being left in the feed boxes. The coefficients obtained with the sheep are somewhat lower than those from the steers and are, probably, too low for the hay when fed with grain.

Experiments No. 89-96.—Spring wheat bran. This material was the ordinary coarse bran from spring wheat. The results show quite close agreement between the two different kinds of animals. The sheep, however, give coefficients averaging a little higher than the steers.

Experiments No. 90-97.—Winter wheat mixed feed. Winter wheat bran containing some middlings and often called mixed feed. This material gave little higher coefficients than the spring bran. The difference between the results of the different animals was about the same as for spring bran, the sheep giving slightly higher results.

Experiments No. 91-98.—Mixed ration. Hay and cottonseed meal. A ration containing 8 parts hay to 1 of cottonseed meal was fed and the coefficients obtained for the mixture are given. The steers in this gave slightly higher results, except on protein. The cottonseed meal used was of the highest grade, carrying over 46 per cent protein.

Experiments No. 92-99.—Mixed ration. Hay and cottonseed meal. In these experiments the cottonseed meal was doubled and 8 parts hay to 2 parts cottonseed meal were used. The results obtained for the different animals agree very closely. Increasing the grain ration appeared to be favorable to the sheep.

Experiments No. 93-94-100-101 were made to compare the digestibility of coarse corn meal with that of finely ground. Both lots of animals gave higher coefficients for the fine meal than for the coarse, with quite close agreement, except on protein; and the low protein content of the ration probably accounts for that variation.

Experiments No. 102-107.—Corn fodder. The cut corn fodder used in these experiments contained very few ears that were glazed, most of them being immature when harvested. It was well cured and in good condition when fed. The steers ate their rations well, but the sheep did not appear to relish it and left a part of each ration. The coefficients obtained are considerably higher for the steers than the sheep, indicating that palatability may affect digestibility.

Experiment No. 108.—Sanford corn silage. This silage was made from the same material as the corn fodder. The coefficients obtained are slightly higher than those for the fodder cured by drying, except for the protein, which is lower. Only the steers were used in this experiment.

Experiments No. 103-109.—Leaming corn silage. The corn from which this silage was made was not as mature as the Sanford corn. This material was in good condition and well relished by both kinds of animals. The results are a little higher for the steers, except on protein.

Experiment No. 110.—Feed flour. In this experiment feed flour was fed with silage to determine the digestibility of the flour. The results with the sheep were unsatisfactory, so only those of steers are given.

Experiments No. 104-111.—Mixed hay. This hay was a mixture of timothy, red top, and clover. Enough for the purpose was chopped and mixed in the usual manner. The coefficients agree very closely, except in protein which is low in case of the steers.

Experiment No. 112.—Linseed meal. This experiment was made to compare the digestibility of linseed meal. The results obtained for the sheep were unsatisfactory, and those given were taken from Jordan's compilation, Bul. 77, Office Expt. Stations, U. S. Dept. of Agr., which agree well with those obtained for the steers.

Experiments No. 106-113.—Linseed meal and corn meal. This experiment was made with linseed and corn meal, equal parts mixed. The coefficients of both steers and sheep are quite high, but agree very closely. The protein of the mixture is as digestible as that of the linseed alone.

Experiment No. 114.—Hay (mixed). The digestibility of this hay was determined for use in subsequent feeding experiments with grain. The sheep secured proved unsatisfactory, as before stated, and only the steers were used.

Experiment No. 115.—Hay and corn meal. Ten pounds of hay were fed with six pounds of corn meal.

Experiment No. 116. Hay and gluten feed. Ten pounds of hay were fed with six pounds of gluten feed.

Experiment No. 117.—Gluten feed. Ten pounds of hay were fed with three pounds of gluten feed.

Experiments No. 118-125.—Soy bean—corn silage. This material was grown on the farm and was put in the silo in the proportion of nine parts of beans to fourteen of corn. The coefficients for the different kinds of animals agree very closely. The material was well relished.

Experiment No. 126.—Soy bean—corn silage. In this trial only the steers were used and the silage was fed with some hay. It will be noticed that the results are practically the same for the silage as when it was fed alone.

Experiments No. 119-127.—Hay. This hay was largely timothy of fair quality. The steers in this experiment as in Nos. 88-95 gave higher digestion coefficients than the sheep, although this was a different lot of sheep.

Experiments No. 120-128.—Linseed and corn meal. A mixture of hay, linseed and corn meal was fed. The steers as before gave slightly higher results, but the coefficients agree quite well with the ones obtained in Experiment No. 113, particularly the protein.

Experiments No. 121-129.—Middlings. In these experiments, through a mistake, two different lots of middlings were used, therefore the results cannot be compared.

Experiments No. 122-123-124.—Cottonseed meals. These meals are of different grades and the experiments were made with sheep. These meals will be made a subject for discussion in a later bulletin, consequently the coefficients obtained are presented here without comment.

DISCUSSION OF RESULTS.

In studying the table giving the coefficients obtained from the steers and sheep, it will be noticed that there are differences which are somewhat remarkable and should have some explanation. In experiments No. 88-95 with hay alone, the steers gave a coefficient over 6 per cent higher for the dry matter than the sheep, but in the next two experiments when bran was fed with the hay, the sheep gave higher coefficients for bran than the steers. Also in experiments No. 91-98, when one part cottonseed meal to eight parts hay is fed, the steers show only 3 per cent greater digestibility for the dry matter of the ration; and in the following experiment, where two parts cottonseed meal to eight of hay are fed, the steers digest only 1 per cent more of the dry matter from the mixture. Calculating the digestibility of the cottonseed meal for the sheep, using the coefficients obtained in experiment No. 88 for the hay, gives a coefficient for the dry matter of nearly 100 per cent when one part of cottonseed meal is fed, and when two parts are fed about 94 per cent for the dry matter. This seems to indicate one of two things, that the coefficients for the sheep on the hay are too low, or the addition of the grain to the ration materially increased their capacity to digest the hay. It is quite probable that this latter explanation is the correct one, as other experiments show they have no greater capacity to digest cottonseed meal than the steers. The experiment with the hay was carefully made, the results of the two sheep agree closely and there is no reason to distrust the figures. The hay was rather poor quality, very low in protein and not as well relished by the sheep as the steers. In experiment No. 119 the sheep gave coefficients for dry matter only about 1 per cent higher on a somewhat better timothy hay and were still 6 per cent below the steers.

In the experiment with corn fodder (which the sheep did not relish) the steers gave coefficients nearly 10 per cent higher on the dry matter than the sheep; but in the experiment with corn silage, which was well relished by both lots of animals, the coefficients agree more closely.

In the third season, when the experiments were made only with the steers, there are some results obtained on the digestibility of gluten feed and corn meal which are of special interest. (See table on page 173.) In experiment No. 115 a ration of 10 pounds of hay to 6 pounds of corn meal was fed. And in experiment No. 116 10 pounds of hay to 6 pounds of gluten feed was given. In the mixture with corn meal 68.9 per cent of the dry matter was digested and only 51.9 per cent of the protein, but in the ration where the corn meal was replaced by the gluten feed, 70.9 per cent of the dry matter was digested and 74.5 per cent of the protein—a difference of 2 per cent of the dry matter and over 22 per cent for the protein. Calculating the digestibility of the corn meal and gluten alone, the dry matter of the corn meal is 84.3, the gluten 87.6, while the protein of the corn meal is 56.4 per cent and the gluten feed 86.6 per cent—a difference in dry matter of about 3 per cent and protein about 30 per cent. When the protein of these two rations is from the same source, corn, it seems very improbable that such a difference in digestibility exists, and the very low figures obtained for the corn meal are due to metabolic products in the feces, which offset the coefficient much more when a ration very low in protein is fed, than when it is well balanced. It is probable that the protein of the corn meal is really as digestible as that of gluten feed, and this assumption seems to be supported by experiments No. 106-113-120-128 where corn and linseed meals are fed in equal parts, and the coefficients for the protein of the mixed grains are 86.2 and 85.3. This higher coefficient cannot be attributed to the greater digestibility of the linseed, for experiment No. 112 on linseed alone gave a coefficient of only 85.7 for the protein. A more nitrogenous or better balanced ration may in part account for the greater digestibility of the dry matter and protein.

CONCLUSIONS.

Of the animals used in these experiments the steers had a greater capacity for digesting coarse fodders low in protein, like timothy hay and corn fodders, than the sheep.

The more nitrogenous rations were as well and in some cases better digested by the sheep than by the steers, and the addition of nitrogenous grains to the ration appeared to materially increase the sheep's digestive capacity.

The feeding of grain rich in protein with corn meal apparently increased the digestibility of the ration, particularly that of the protein.

It is evident from a study of these results and others before published that as great differences in digestion coefficients will occur between sheep, individually, as is likely to occur between sheep and steers. But if sheep are to be used to determine coefficients for bovines, great care should be taken to select strong animals that are good feeders and will eat coarse fodders readily, otherwise results which are too low are likely to be obtained.

THE INCOME AND OUTGO OF NITROGEN.

J. M. BARTLETT.

In conducting digestion experiments in which the urine can be collected, it is customary to make a comparison between the amount of nitrogen taken into the body and that excreted during the same period. This comparison of the income and outgo constitutes what is known as the nitrogen balance. It is made for the purpose of ascertaining if the loss of nitrogen in the urine and feces is made good by the food. Too much is not claimed for the results thus obtained, since it is known that a part, at least, of the nitrogen taken in is delayed in its passage through the body. This nitrogen lag makes it impossible to tell if the nitrogen excreted during any period exactly corresponds with the income at any preceding period. Nevertheless, if the experiment be continued for a considerable length of time, an equilibrium must at length be established. If the body is not gaining weight, the outgo should now exactly counterbalance the income. On the other hand, an excess of income nitrogen indicates a gain, and a deficiency a loss in body weight. In the experiments described in the preceding pages the feces and urine were collected only after a preliminary feeding period of seven days, when it would seem that the equilibrium must have been established.

The whole amount excreted by the sheep for the five days was weighed, thoroughly mixed, and a sample drawn for analysis. Each day's excretion from the steers was weighed and an aliquot portion taken for a composite sample. The samples were preserved with formaldehyde. The following tables give the data obtained on the urines in these experiments.

NITROGEN IN THE URINE—SHEEP.

Number of experiment.	Animal's number.	Weight of urine.	Per cent of nitrogen in urine.	Weight of nitrogen.	Heat of Combustion.	
					Per gram.	Total.
		Grams.		Grams.	Calories.	Calories.
89	I	3172.0	1.77	56.14	-	-
89	II	2432.0	2.08	50.59	-	-
89	III	2540.0	2.08	52.00	-	-
91	I	1962.0	1.76	34.53	-	-
91	II	1945.0	1.93	37.54	-	-
92	I	3106.0	2.61	81.07	311	966
92	II	3501.0	2.35	82.27	257	900
93	I	2214.0	0.62	15.66	225	497
93	II	2238.0	0.70	15.67	200	448
94	I	1795.0	0.87	15.62	295	529
94	II	1732.0	0.87	15.07	278	481
105	I	2860.0	2.80	80.28	376	1075

NITROGEN IN THE URINE—STEERS.

Number of experiment.	Animal's number.	Weight of urine.	Per cent of nitrogen.	Weight of nitrogen.	Heat of Combustion.	
					Per gram.	Total.
		Grams.		Grams.	Calories.	Calories.
95	I	16960	0.59	100.1	.281	4770
95	II	17370	0.59	102.5	.281	4881
96	I	15780	0.97	153.1	.204	3220
96	II	17830	0.86	153.3	.213	3797
97	I	11110	1.16	128.9	.303	3367
97	II	16920	0.75	126.9	.179	3029
98	I	15330	1.37	214.6	.266	4078
99	I	13970	1.87	261.3	.407	5975
99	II	16650	1.48	246.4	.374	6326
100	I	20320	0.35	711.3	.192	3946
100	II	16100	0.45	725.0	.214	3446
101	I	15330	0.45	690.0	.183	2806
101	II	15060	0.46	692.7	.190	2861
107	I	11020	1.11	122.3	.249	2743
107	II	12020	1.14	137.0	.256	3077
108	I	25850	0.20	517.2	.086	2223
109	I	22910	0.25	573.0	.111	2543
109	II	30250	0.24	727.7	.107	3237
110	I	15740	1.20	188.9	.278	4476
110	II	24670	0.92	227.0	.192	4736
112	I	15420	1.36	209.2	.246	3793
113	I	13020	1.43	181.6	.320	4166
113	II	12880	1.47	189.4	.332	4277
114	I	21550	0.91	196.1	.242	5215
114	II	21320	0.96	204.7	.264	5630
115	I	21090	0.94	198.3	.255	5380
115	II	18870	1.05	198.1	.299	5640
116	I	24400	2.12	517.3	.352	8588
116	II	23590	2.25	530.8	.355	8376
117	I	20180	1.74	351.1	.296	6270
117	II	21950	1.78	391.0	.277	6078

BALANCE OF INCOME AND OUTGO OF NITROGEN FOR EACH EXPERIMENT—STEERS.

Number of experiment.	Animal's number.	Income nitrogen in food.	OUTGO. Nitrogen in feces.	Nitrogen in urine.	Nitrogen Total.	Nitrogen, gain+ loss—	Protein, gain+ loss—
		Grams.	Grams.	Grams.	Grams.	Grams.	Grams.
95	I	141.5	95.9	160.1	196.0	—54.5	—340.7
95	II	141.5	89.2	102.5	191.7	—50.1	—313.5
96	I	309.3	129.1	153.1	282.2	+27.1	+169.2
96	II	309.3	128.1	153.3	281.4	+27.9	+174.6
97	I	299.4	119.7	128.9	248.6	+50.8	+320.2
97	II	299.4	122.2	126.9	249.1	+50.3	+314.2
98	I	327.5	143.5	214.6	358.1	—30.6	—189.3
99	I	480.8	153.0	261.3	414.3	+66.5	+415.7
99	II	480.8	155.3	246.4	401.7	+79.1	+494.4
100	I	247.2	153.2	71.1	224.3	+22.9	+142.9
100	II	210.9	148.4	72.5	220.9	—10.0	—62.5
101	I	245.4	150.6	69.0	219.6	+15.8	+98.8
101	II	209.1	123.0	69.3	192.3	+16.8	+105.2
107	I	215.9	91.6	122.3	214.0	+1.9	+12.2
107	II	215.9	93.4	137.0	230.4	+14.5	+90.7
108	I	205.0	94.4	51.7	146.1	+58.9	+368.3
109	I	174.2	91.2	57.3	148.5	+25.7	+160.8
109	II	174.2	94.6	72.6	167.2	+7.0	+43.9
110	I	484.4	137.7	188.9	326.6	+157.8	+986.6
110	II	484.4	127.2	227.0	354.2	+130.2	+813.8
112	I	489.0	175.3	209.7	385.0	+104.0	+649.2
113	I	565.7	171.1	181.6	352.7	+213.0	+1331.0
113	II	565.7	173.5	189.4	362.9	+202.8	+1268.0
114	I	342.0	178.5	196.1	374.6	—32.6	—203.8
114	II	342.0	181.7	204.7	386.4	—44.4	—277.5
115	I	434.1	211.8	198.2	410.0	+24.1	+150.5
115	II	434.1	211.4	198.1	409.5	+24.6	+153.8
116	I	834.2	216.0	517.6	733.6	+100.6	+628.7
116	II	834.2	210.0	530.8	740.8	+93.4	+586.6
117	I	567.5	184.5	351.1	535.6	+33.9	+227.4
117	II	567.5	183.1	391.0	574.1	—6.6	—41.4

BALANCE OF INCOME AND OUTGO OF NITROGEN FOR EACH EXPERIMENT—SHEEP.

Number of experiment.	Animal's number.	Income nitrogen in food.	Outgo.			Nitrogen, gain+ loss—	Protein, gain+ loss—
			Nitrogen in feces.	Nitrogen in urine.	Nitrogen total.		
		Grams.	Grams.	Grams.	Grams.	Grams.	Grams.
89	I	63.3	25.20	56.14	81.34	−18.04	−112.7
89	II	63.3	26.14	50.59	76.73	−13.43	−83.96
89	III	63.3	24.38	52.00	76.38	−13.08	−81.78
91	I	68.6	32.16	34.53	66.69	+1.91	+11.97
91	II	68.6	27.80	37.54	65.34	+3.26	+20.32
92	I	106.0	30.76	81.07	111.83	−5.83	−36.43
92	II	106.0	33.10	82.27	115.37	−9.87	−58.58
93	I	38.5	23.74	13.66	37.40	+1.10	+6.88
93	II	38.5	23.22	15.67	38.89	−0.39	−2.44
94	I	38.0	19.94	15.62	35.56	+2.44	+15.25
94	II	38.0	21.19	15.07	36.26	+1.74	+10.88
105	I	127.7	26.14	80.28	106.42	+21.28	+13.30

TRUE M. MERRILL, Sabbath Day Lake. See page 134.

APPENDIX.

Annual Report of the State Pomological Society

1904-1905.

CONTENTS.

SECRETARY'S ANNUAL REPORT.

THE 1904 SITUATION.

The Cleveland Leader says the crop of salable apples in the United States this year is acknowledged a little less than fifty millions of barrels, which means something like 30,000,000,000 apples, or an apple every day for every man, woman and child in the United States. The editor remarks that these are tremendous figures, and the most surprising fact about the apple crop is that all of it might be grown in a single county in the state of Ohio, provided that all the trees were well matured and in good bearing condition.

Here in Maine the crop is about the same as last year, though some have placed the crop above a million barrels, and it is probable that more than 500,000 barrels will go forward to market. In some portions of the State dry weather affected the orchards, but the general conditions were favorable, though the Baldwins were generally of less size than usual. Insects and fungi have been less injurious, and winds and storms dealt kindly with orchards until late in the season. The early autumn frosts injured some of the lowland fruit, and the later frosts were still more injurious. There has been a scarcity of help, barrels have sold from 30 to 42 cents, and worse than all the price of fruit has been very low. As a result thousands of barrels of Maine apples were not harvested at all, and thousands of those that were were fed out to stock later in the season.

THE MARKETS.

There were fewer buyers than usual and these started out at a dollar per barrel. Nearby fruits supplied the Boston market, where the price was off for everything save a few varieties. The outlet—in many cases the only outlet—was to send the fruit to

Europe and "suffer" the consequences. The satisfactory returns made on consignments of the best fruit sent in 1903 made it an easy matter for the agents of English commission houses to secure large shipments. Everywhere they told the growers to send them only the best fruit properly packed, but for all this there was much carelessness in putting up the fruit, and when the returns came in they were not satisfactory. The supply was large, and our fruit was in competition with local fruit and that from Canada, packed and exported under the "Fruit Marks Act" of the Dominion. Through the entire season the Canadian fruit was in the lead and sold higher than Maine fruit. The growers in many cases ascribed the low prices to other causes, but in our ignorance of the actual conditions one cannot judge correctly. Of one thing we are confident and that is the necessity of some law, or sentiment if possible, that will ensure to the buyer the quality of the fruit. With prices started at a dollar per barrel, they advanced to $1.25 and $1.50 later, and when the season closed the prices fell back somewhat. At the close of the season the buyers generally claimed that there was little profit for them in the shipments they had made. So far as the growers in the State were affected, there were less buyers than usual and much fruit was not sold.

MEETINGS OF THE EXECUTIVE COMMITTEE.

Three meetings of the Executive Committee were held during the year, the first at Auburn, Jan. 6; the second at Winthrop, Sept. 8, and the third at Skowhegan during the annual meeting. The annual settlement was not made till Jan. 12, 1905, when the treasurer's account for the year was settled.

PUBLIC MEETINGS.

A spring fruit meeting was held in Grange Hall, Union, March 11. The forenoon was devoted to arranging the fruit brought in, and a very good display was made from Knox and Lincoln counties. The meeting was addressed by President Gilbert, Prof. W. M. Munson and Mrs. V. P. DeCoster, and much interest was shown by the discussions and questions that followed. At the evening meeting excellent music was furnished by the Grange choir. The fruit interests in the locality are large, and a fine audience was in attendance.

The orchard meeting was held with Mr. Chas. S. Pope of Manchester, Sept. 9. Here the State Experiment Station has been conducting more or less experiments for several years. The day was not altogether favorable, but there was an attendance of about 150 fruit growers, who looked over the orchard and studied the experiments with intense interest. It was altogether an informal affair, looking over the premises, lunching on the lawn, where hot coffee was served to all, and a dinner to the officers by the Popes, after which President Gilbert called the visitors together, and there were several short talks bearing on the object lessons in the orchard. Of so great importance were the lessons taught at this meeting, that it seemed advisable to give them wider publicity by discussing them at our annual meeting. A vote of thanks was unanimously extended to the Popes for the cordial reception given to all.

By invitation of Mr. J. O. Smith the annual meeting was held in Grange Hall, Skowhegan, Nov. 16, 17 and 18. The fruit exhibition was held in the lower hall and the meetings in the upper hall. The fruit exhibition was one of the best, made up of fruit from nearly every county in the State. There was a small exhibition of plants and flowers, and a beautiful display of chrysanthemums and roses made by Abel F. Stevens of Wellesley, Mass. The meeting was in every way a great success, and the cordial greeting given the visitors will be long remembered by those permitted to attend.

The program of the meeting bore mainly on fruit matters and called out large and enthusiastic audiences. The introduction of the brown-tail moth and the approaching danger from the gypsy moth were ably discussed, and before the meeting was over a committee was chosen to formulate a bill for the protection of the State from these and other injurious insects, and later to ask the legislature to enact the bill into a law. The committee attended to the duty assigned them and without a dissenting voice the bill they prepared was passed by the legislature.

The papers and discussions presented at this meeting were of a high order, and assured everyone that the fruit growers of the State are fast progressing in the best methods of orcharding. These papers and a resume of the discussions may be found in the pages following.

In closing this report the Secretary wishes to congratulate the fruit growers of the State upon the entire and hearty co-operation of the State Agricultural Department, the University of Maine, the Experiment Station and the State Pomological Society. Each organization has its own peculiar work to do, but the spirit of co-operation has been constant and responsive. The successful work of the Pomological Society is to a large degree the result of this helpful and cordial aid.

D. H. KNOWLTON,

Secretary.

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Vice Presidents.

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C. H. GEORGE, Hebron.

Secretary.

D. H. KNOWLTON, Farmington.

Treasurer.

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Auditor.

DR. GEO. M. TWITCHELL, Augusta.

Member of Experiment Station Council.

CHARLES S. POPE, Manchester.

MEMBERS OF THE SOCIETY.

NOTE.—Any errors or changes of residence should be promptly reported to the Secretary. Members will also confer a favor by furnishing the Secretary with their full Christian names where initials only are given.

LIFE MEMBERS.

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Andrews, Charles E..............Auburn
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Atkins, Charles G ....Bucksport
Atwood, Fred ....Winterport
Averill, David C..................Temple
Bailey, W. G ....Freeport
Bennoch, John E..................Orono
Bickford, Lewis I ......Dixmont Center
Bisbee, George E.................Auburn
Blanchard, Mrs. E. M ....Lewiston
Blossom, L. H.............Turner Center
Boardman, Samuel L....... .....Bangor
Briggs, John.......................Turner
Burr, John.......................Freeport
Butler, Alonzo......................Union
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Marston, Charles A ....Skowhegan
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McLaughlin, Henry ....Bangor
McManus, John...............Brunswick
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Moody, Charles H.................Turner
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Munson, W. M......................Orono
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Perley, Charles I................Cross Hill
Pope, Charles S ....Manchester
Prince, Edward M ....West Farmington
Pulsifer, D. W ....Poland
Purington, E. F ....West Farmington
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Ricker, A. S........................Turner
Roak, George M ....Auburn
Sanborn, Miss G. P ....Augusta
Sawyer, Andrew S.......Cape Elizabeth
Seavy, Mrs. G. M ....Auburn
Simmons, H. J. A.............Waldoboro
Skillings, C. W ....North Auburn
Smith, Henry S ....Monmouth
Snow, Mary S ....Bangor
Starrett, L. F......................Warren
Stetson, Henry....................Auburn

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Thomas, D. S .... North Auburn
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Vickery, John .... Auburn
Wade, Patrick .... Portland
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Walker, Elmer V .... Oxford
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Wheeler, Charles E .... Chesterville
Yeaton, Samuel F ..... West Farmington

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Campbell, D. W .... Cherryfield
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Blossom, L. H .... Turner Center
Bradley, Myrtie E .... Vienna
Breed, W. O .... Harrison
Campbell, D. W .... Cherryfield
Day, A. C .... South Turner
Dingley, Mrs. P. G .... Auburn
Fairbanks, A. E .... North Monmouth
Fessenden, Francis .... Portland
German Kali Works .... New York
Goodale, G. C .... Winthrop
Guptill, W. T .... Topsham
Hall, C. G .... Cedar Grove
Harding, Nathaniel .... New Sharon
Hathaway, W. S .... East Auburn
Johnson, H. E .... Auburn
Jones, Mrs. Barnum ...... North Auburn
Jordan, Ira .... Milbridge
Leland, W. E .... East Sangerville
Libbey, R. H .... Newport
Libbey, Mrs. R. H .... Newport
Lord, T. Merrill ...... North Parsonsfield
Mayo, E. R .... Manchester
McAllister, Z .... West Lovell
Merchant, S. L .... Winthrop
Merrill, A. L .... North Auburn
Morrill, Stephen .... Lewiston
Nowell, F. E .... Fairfield
Payson, H. L .... Rockland
Phinney, C. S .... Standish
Roberts, J. A .... Norway
Smith, F. W .... Rockland
Smith, Geo. R .... Augusta
Staples, Mrs. Arthur G .... Auburn
Tarr, Edward .... Mapleton
Toothaker, L. P .... Simpson's Corner
Tucker, Benjamin .... North Norway
White, Edward L .... Bowdoinham
Whitman, H. H .... South Turner
Whittier, Phineas ..... Farmington Falls
Willey, A. B .... Cherryfield
Woodside, E. G .... Lewiston

ANNUAL MEMBERS, 1904.

Allen, S. L .... Fairfield
Arnold, M. F .... Carmel
Beal, S. H .... Skowhegan
Benson, Mrs. G. S .... Skowhegan
Burkett, Andrew .... Union
Butler, L. F .... Madison
Cole, J. E .... Union
Daggett, E. L .... Union
Danforth, F. G .... Skowhegan
DeCoster, V. P .... Buckfield
Frost, J. H .... 188 Pearl St., Portland
Gleason, F. A .... Union
Greenleaf, A. C .... Farmington
Hall, Chas. G .... Cedar Grove
Jepson, Albert E .... Norridgewock
Knowlton, J. B .... Farmington
Leland, Will E .... East Sangerville
Lenfest, Mrs. F. H .... Union
Lincoln, Mrs. E. L .... Wayne
Mayo, E. R .... Manchester
McAllister, Z .... West Lovell
Merchant, S. L .... Winthrop
Nowell, F. E .... Fairfield
Sanborn, C. E .... Skowhegan
Sherman, Mrs. Clara E .... Union
Shurtleff, S. G .... South Livermore
Swan, J. A .... Skowhegan
Tarr, Edward .... Mapleton
Toothaker, L. P .... Etna
Tucker, Benj .... Norway
Warren, Henry P .... Albany, N. Y.
Waterman, L. C .... Buckfield
White, Mrs. Charles .... Skowhegan
White, Edward L .... Bowdoinham
White, P. C .... Skowhegan
Whitman, W. C. & Son ..... South Turner

TREASURER'S REPORT.

CHARLES S. POPE, TREASURER, IN ACCOUNT WITH THE MAINE STATE POMOLOGICAL SOCIETY.

	DR.
January 1, interest on stock, Farmington National Bank	$10 00
February 1, interest on deposit with Augusta Trust Company	10 67
C. A. Arnold for refrigerator	5 00
State stipend	1,000 00
April 20, Henry P. Warren, Albany, N. Y., membership fee	1 00
T. B. Macaulay, 4007 Dorchester St., Montreal, Can., life mem. fee	10 00
July 1, interest on stock, National Bank, Farmington	10 00
August 9, Chas. A. Marston, Skowhegan, membership fee	10 00
October 3, J. H. Frost, 188 Pearl St., Portland, membership fee	1 00
November 9, S. G. Shurtleff, So. Livermore, membership fee	1 00
16, Benj. Tucker, Norway, membership fee	1 00
Edward L. White, Bowdoinham, membership fee	1 00
L. S. Allen, Fairfield, membership fee	1 00
19, L. F. Butler, Madison, membership fee	1 00
M. F. Arnold, Carmel, membership fee	1 00
S. H. Beal, Skowhegan, membership fee	1 00
Mrs. G. S. Benson, Skowhegan, membership fee	1 00
L. H. Blossom, Turner Center, membership fee	10 00
Mrs. Ella H. Crowell, Skowhegan, membership fee	10 00
F. G. Danforth, Skowhegan, membership fee	1 00
A. C. Greenleaf, Farmington, membership fee	1 00
Chas. G. Hall, Cedar Grove, membership fee	1 00
Albert E. Jepson, Norridgewock, membership fee	1 00
J. B. Knowlton, Strong, membership fee	1 00
Will E. Leland, Sangerville, membership fee	1 00
E. R. Mayo, Hallowell, membership fee	1 00
Z. McAllister, Lovell, membership fee	1 00
S. L. Merchant, Winthrop, membership fee	1 00
F. E. Nowell, Fairfield, membership fee	1 00
C. E. Sanborn, Skowhegan, membership fee	1 00
J. A. Swain, Skowhegan, membership fee	1 00
Edward Tarr, Mapleton, membership fee	1 00
L. P. Toothaker, Etna, membership fee	1 00
L. C. Waterman, Buckfield, membership fee	1 00
Mrs. Chas. White, Skowhegan, membership fee	1 00
P. C. White, Skowhegan, membership fee	1 00
W. C. Whitman & Son, South Turner, membership fee	1 00
Loan	500 00
Francis Fessenden, Portland, membership fee	10 00
	$1,613 67

	Cr.
By paid Treasurer, 1903	$73 72
premiums awarded at Auburn meeting	312 00
January 6, R. H. Libbey, expenses as member ex. committee	5 50
Z. A. Gilbert, expenses as President at Auburn	1 00
V. P. DeCoster, expenses as member ex. committee	1 70
C. A. Arnold, expenses as member ex. committee	5 25
D. H. Knowlton, expenses as Secretary, express, postage, etc.	10 67
Charles S. Pope, salary as Treasurer, 1903	25 00
W. M. Munson, photographs to illustrate address	5 00
Smith & Reid, binding Transactions	57 65
Z. A. Gilbert, expenses as President, 1903	5 10
Charles S. Pope, expenses as Treasurer	3 70
George H. Clark, board of Executive Committee	13 30
Box rent in Augusta Trust Company	5 00
March 11, K. F. Wight, board of committee, speakers and express bill	19 75
D. H. Knowlton, expenses at Union	7 51
Z. A. Gilbert, expenses at Union meeting	2 00
R. H. Libbey, expenses at Union meeting	9 20
Charles S. Pope, expenses at Union	5 30
Mrs. V. P. DeCoster, services and expenses at Union	11 00
W. M. Munson, services and expenses at Union meeting	11 55
September 9, Charles S. Pope, premiums awarded at spring meeting	35 00
D. H. Knowlton, postage for 1904	10 00
D. H. Knowlton, postage	10 00
D. H. Knowlton, salary as Secretary for 1904	50 00
Z. A. Gilbert, expenses at Manchester meeting	2 25
V. P. DeCoster, expenses at Manchester meeting	5 35
R. H. Libbey, expenses as ex. committee	8 88
D. H. Knowlton, expenses as Secretary to date	16 32
October 20, W. M. Munson, expenses at Orchard meeting	5 40
November 18, Z. A. Gilbert, expenses as President	4 50
R. H. Libbey, expenses as ex. committee	7 48
V. P. DeCoster, expenses as ex. committee	5 45
C. A. Arnold, expenses as ex. committee	4 50
Mrs. V. P. DeCoster, services as judge and Assistant Sec'y.	5 60
D. H. Knowlton, expenses as Secretary	16 12
Edith M. Patch, expenses at Annual Meeting	2 85
Abel F. Stevens, services as speaker	30 00
W. M. Munson, services as speaker at annual meeting	2 85
H. P. Gould, expenses attending Annual Meeting	39 70
Hotel Heselton, board of speakers and officers at Annual Meeting	50 00
J. O. Smith, printing posters, etc., for annual meeting	14 12
Ansel Holway, services and cash paid for Annual Meeting.	9 50
D. G. Spofford, services as janitor at Annual Meeting	5 00
E. H. Cook, expenses as speaker at Annual Meeting	90
S. G. Shurtleff, judging, etc., at Annual Meeting	5 23
A. C. Day, judging at Annual Meeting	5 40
January 11, Chas. S. Pope, Treas., prems. awarded at Skowhegan meeting	324 00
Smith & Reid, binding Transactions	25 90
Charles S. Pope, salary as Treasurer	25 00
R. H. Libbey, freight paid for Annual Meeting	2 10
L. B. Raynes, reporting at Annual Meeting.	39 10
Charles S. Pope, expenses as Treasurer for 1904	5 10
Knowlton & McLeary Co., printing for the year 1904	56 81
Geo. H. French, photographs of exhibition at Annual Meeting	2 25
D. H. Knowlton, salary for the year 1904	100 00
Cash in hands of Treasurer	90 11
	$1,613 67

AUGUSTA, February 16, 1905.

This is to certify that I have gone over the accounts of Mr. C. S. Pope, Treasurer, and find the balance due the Society outside the permanent funds to be $90.11, with vouchers for all items paid. This examination covers only the items of 1904.

G. M. TWITCHELL, *Auditor*.

PERMANENT FUND.

146 life member's fee as reported for 1903		$1,460 00
Fees received in 1904:		
T. B. Macaulay	$10 00	
Chas. A. Marston	10 00	
Mrs. Ella H. Crowell	10 00	
L. H. Blossom	10 00	
Francis Fessenden	10 00	50 00
		$1,510 00

INVESTED AS FOLLOWS.

Four shares First National Bank, Farmington	$400 00	
Deposit in Augusta Savings Bank	200 00	
Deposit in Augusta Trust Company	360 00	960 00
Due permanent fund for loan	500 00	
Due permanent fund for members fees, as above	50 00	550 00
		$1,510 00

BUSINESS TRANSACTIONS.

MEETINGS OF EXECUTIVE COMMITTEE.

AUBURN, Jan. 6, 1904.

Voted, To withdraw $500 of the permanent fund from the Augusta Trust Company and deposit the same with the Augusta Savings Bank, the same to be done by the treasurer.

Voted, To hold, first, a winter or early spring meeting; second, a field meeting, and third, the annual meeting.

Voted, To offer premiums for exhibition at winter meeting.

Revised, premium lists for winter and annual meetings.

Voted, That the President arrange for the location and program for the spring meeting.

Voted, That the Secretary arrange for location and program for the field meeting.

Voted, To print 1,500 annual announcements.

Voted, To discontinue the rental of box in Augusta Trust Company and authorize Treasurer to withdraw contents of box.

WINTHROP, Sept. 8, 1904.

The Secretary presented invitations for annual meeting from Prof. W. M. Munson in behalf of University of Maine to hold the meeting in Orono; from J. O. Smith in behalf of citizens of Skowhegan to meet there.

Voted, To ask Mr. Gilbert to visit Skowhegan and if the situation there is favorable for the annual meeting, he is hereby instructed to accept the invitation from Skowhegan.

Voted, That the annual meeting be held the week of Nov. 15.

Voted, To employ local judges for the annual exhibition.

Voted, To instruct Mr. Gilbert to arrange for judges.

Voted, That Secretary arrange program and employ speakers.

SKOWHEGAN, Nov. 18, 1904.

Voted, That the Treasurer be authorized to draw from the permanent fund, sufficient money to meet unpaid bills of the Skowhegan meeting.

AUGUSTA, Jan. 12, 1905.

Business of the society closed up for 1904.

On the recommendation referred to this committee: That a committee be appointed to look into the matter of co-operative storage and marketing, suggest plans, make specifications for storage houses, learn what is actually being done in other states and report at the next annual meeting of the society; Recommended, further, that one session of the next annual meeting be devoted solely to the consideration and discussion of this very important subject.

Voted, To lay this upon the table for consideration at the next meeting.

The following recommendation referred to the committee was read, discussed and then laid on the table: That in the judgment of this society the factor of quality in fruit should be given more prominence. That in the exhibitions held in this society, the intrinsic merit of the varieties shown shall be given weight rather than mere number of sorts in the exhibit or the display of color only. Recommended, further, that the influence of the members of this society be used in the same direction, in the various fairs and fruit exhibits held in the State.

The recommendation, that a committee be appointed to confer with the officers of the various agricultural societies of the State with a view to putting fruit and flowers on a satisfactory basis upon the premium list.

Voted, That the members of the committee use their personal influence with their several local societies to secure the object of the recommendation.

Voted, That the Treasurer for 1904, Chas. S. Pope, be authorized to draw from the permanent fund deposited with the Augusta Trust Company, the sum of $200 for the payment of bills for 1904 and 1905.

Voted, That the Treasurer for 1905 be instructed to pay the society's debt to the permanent fund when the stipend from the State shall be received.

PUBLIC MEETINGS.

The spring fruit meeting was held in Grange Hall, Union, March 11, 1904. The forenoon was largely devoted to the arranging of the exhibits, of which there was a very good collection. President Gilbert called the meeting to order and a brief discussion of varieties followed.

The afternoon session was opened by a discussion of fruit packages and other fruit matters. It was followed up by R. H. Libbey and other fruit growers in attendance.

The evening session was devoted to a lecture by Prof. W. M. Munson on "Management of Orchard Lands." There was also an interesting lecture by Mrs. V. P. DeCoster, "The Farm for a Home."

The attendance was good throughout and the listeners were responsive and appreciative.

ORCHARD MEETING.

By invitation of Mr. Chas. S. Pope a valuable orchard meeting was held at his place, Sept. 9, 1904. The day was not entirely pleasant, being overcast and cool, but there was a good attendance, some coming by electrics and others by team.

Eight different experiments are being conducted in the orchard by the Experiment Station, as follows:

Plot No. 1.—The application of potash to prevent "apple scab."

Plot No. 2.—Cultivation, with a light application of superphosphate.

Plot No. 3.—Fertilizer experiments,—nitrate of soda, potash and acid phosphate used separate, and in combination.

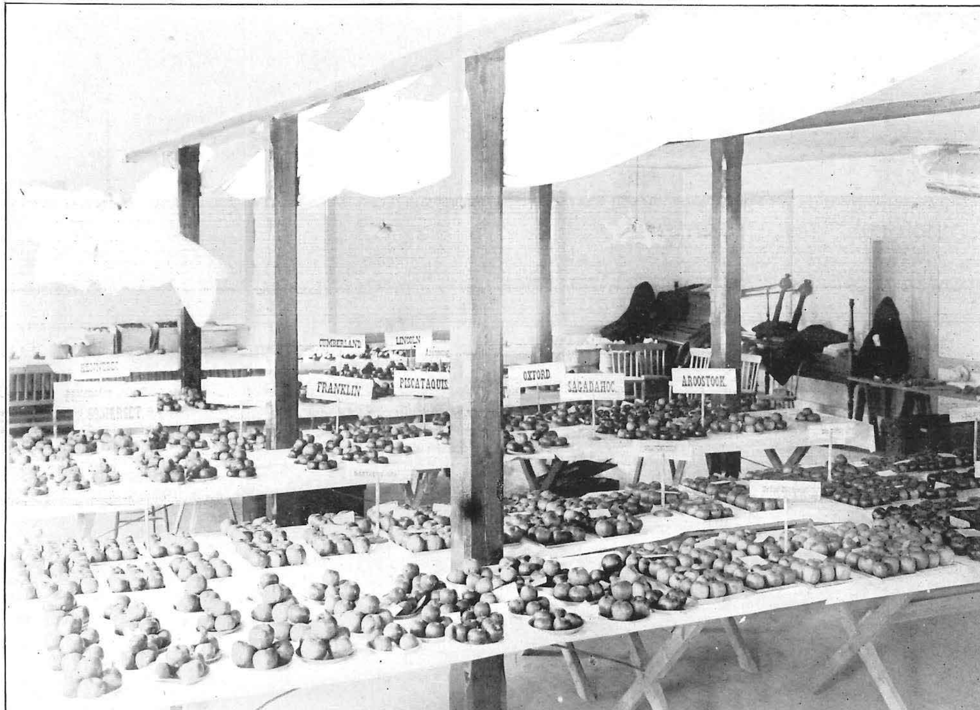
Plot No. 4.—Cultivated and fertilized with phosphate from the Fisher formula, compared with one made with less nitrogen.

Plot No. 5.—Fertilized same as No. 4 on sod land.

Plot No. 6.—Cultivation versus mulch, both with and without fertilizer.

Plot No. 7.—Pastured with hogs.

Plot No. 8.—Engrafting the Ben Davis to test the value of this variety as a stock.



Exhibition Tables at Annual Exhibition in Skowhegan.

There is also shown in the orchard the work of swine, and other features of general interest to fruit growers, as well as results reached by Mr. Pope's methods.

The forenoon was spent in looking over the orchard, which at the time was heavy with fruit. The different experimental plots were placarded, and the visitors were under the guidance of Prof. Munson and Mr. Pope. All were delighted with the opportunity of looking over the experiments and many valuable lessons in cultivation and fertilizing were learned in the most practical way. Many questions were asked and it was fully one o'clock when the visitors collected on the lawn to partake of the basket lunch, to which the Popes contributed hot coffee.

After the lunch there were short talks by President Gilbert, Prof. Munson and others upon various matters connected with the experiments. Before separating a vote of thanks was given with a will to the Popes for the cordial welcome they gave to all and for their kind hospitality.

ANNUAL MEETING.

By invitation of Mr. J. O. Smith in behalf of the citizens of Skowhegan, the annual meeting of the society was held in Grange Hall, Nov. 16, 17 and 18, 1904.

The 16th was devoted to the reception and arranging of the exhibition of fruits and flowers.

The program was as follows:

THURSDAY, OPENING SESSION AT 11 A. M.—Prayer, Rev. George Merriam, Skowhegan; address of welcome, Hon. Chas. A. Marston, Skowhegan; response; President's annual address, Hon. Z. A. Gilbert, North Greene.

THURSDAY AFTERNOON—*Lessons Taught at Our Orchard Meeting.* What a Young Fruit-Grower Learned, Edward L. White, Bowdoinham; Home Fertilizers and Cultivation, V. P. DeCoster, Buckfield; How Trees Dressed with "Fisher Fertilizer" Last Year Behaved This Year, S. H. Dawes, Harrison; Talk About the Experiments and Results, Prof. W. M. Munson, Orono. *Brown-Tail and Gypsy Moths.* The Moths and What They Threaten, Miss Edith M. Patch, University of Maine, Orono; What the State Has Done, Hon. A. W. Gilman, Commissioner of Agriculture; What the State Ought to Do.

THURSDAY EVENING—*Educational Meeting.* Music; Variation in Apples, H. P. Gould, Agricultural Department, Washington, D. C.; music; Some Thoughts on Horticultural Education, Prof. W. M. Munson, University of Maine; music.

FRIDAY, ANNUAL MEETING AT 10 O'CLOCK—Report of Treasurer, Chas. S. Pope, Manchester; report of Secretary, D. H. Knowlton, Farmington; election of officers; report of committee to select a design and wording for "Sweepstakes Prize," Dr. Geo. M. Twitchell, chairman, Mrs. V. P. DeCoster, Mrs. Lucy A. Chandler; other business.

FRIDAY AFTERNOON—*Commercial Orcharding in Maine.* Favorable Conditions, R. H. Libbey, Newport; Commercial Orcharding in Other States, H. P. Gould, Agricultural Department, Washington; Illustrations of Fruit-Growing in Maine, J. Merrill Lord, Limerick, E. H. Cook, Vassalboro, C. A. Arnold, Arnold. *The Fruit Market.* Marketing Apples, E. H. Cook, Vassalboro; discussion of matters relating to fruit and marketing; Marketing, Dr. Geo. M. Twitchell, Augusta.

FRIDAY EVENING—Music; Hardy Roses—Their Culture and Varieties, Abel F. Stevens, Woodside Gardens, Wellesley, Mass.; music.

The following committee was appointed to take into consideration the President's address and such other matters as may be referred to them: Prof. W. M. Munson, R. H. Libbey and E. L. White.

Business Meeting—The following committee was appointed on resolutions: Mrs. V. P. DeCoster, E. L. Lincoln and L. H. Blossom.

The Secretary and Treasurer presented their annual reports and they were accepted.

A committee to distribute, collect and count ballots was appointed, consisting of C. A. Arnold, D. P. True and E. A. Lapham.

Voted and by major ballot made choice of the following officers for the year 1905:

President—Z. A. Gilbert, North Greene.

Vice Presidents—D. P. True, Leeds Center; Edward L. White, Bowdoinham.

Secretary—D. H. Knowlton, Farmington.

Treasurer—E. L. Lincoln, Wayne.

Member of Executive Committee for three years—R. H. Libbey, Newport.

Trustees—Androscoggin county, A. C. Day, South Turner; Aroostook county, John W. Dudley, Mapleton; Cumberland county, John W. True, New Gloucester; Franklin county, E. F. Purington, Farmington; Hancock county, E. W. Wooster, Hancock; Kennebec county, E. A. Lapham, Pittston; Knox county, Alonzo Butler, Union; Lincoln county, H. J. A. Simmons, Waldoboro; Oxford county, J. A. Roberts, Norway; Penobscot county, A. A. Eastman, Dexter; Piscataquis county, W. E. Leland, Sangerville; Sagadahoc county, A. P. Ring, Richmond Corner; Somerset county, Frank E. Nowell, Fairfield; Waldo county, Fred Atwood, Winterport; Washington county, D. W. Campbell, Cherryfield; York county, C. A. Hooper, Eliot.

Auditor—Dr. Geo. M. Twitchell, Augusta.

Member of Experiment Station Council—Charles S. Pope, Manchester.

A rising vote was taken as an expression of the appreciation of the society for the long, faithful and efficient service in the interests of the society of the retiring treasurer, Mr. Charles S. Pope.

Dr. G. M. Twitchell, chairman of the special committee to select a design and wording for "Sweepstakes Prize," reported as follows:

Your committee to whom was intrusted the wording of the design for diploma for Sweepstakes Prize, have attended to their duties and beg leave to report as follows:

For wording of diploma:

SWEEPSTAKES PRIZE.

MAINE STATE POMOLOGICAL SOCIETY.

AWARDED TO

MR. ....

FOR EXCELLENCE OF FRUIT EXHIBIT

AT .... MAINE.

190 .

G. M. TWITCHELL,
LUCY A. CHANDLER,
MRS. V. P. DECOSTER,
Committee.

The conditions governing the award of this diploma to be such as to insure excellence over ordinary exhibits, and the body of diploma to carry different varieties of fruit so arranged as to give value and attractiveness to the prize.

Voted, To amend General Exhibition Rule 11, so that said rule when amended shall read as follows:

"The society's premiums are open for competition to all persons residing in the State; but when premiums and gratuities exceeding $1.00 and less than $10.00 are awarded to a person not a member of this society, a fee of $1.00 will be deducted therefrom; and when premiums and gratuities amounting to $10.00 or more are awarded to any person not a life member of the society, the fee for life membership will be deducted therefrom, and a certificate of membership will be issued accordingly."

The committee on resolutions, by Mrs. DeCoster, reported as follows, and their report was accepted:

RESOLUTIONS OF STATE POMOLOGICAL SOCIETY, 1904.

Resolved, That we extend our thanks to Skowhegan Grange for the use of their beautiful and commodious hall, during the session of the Maine State Pomological Society, and to the citizens of Skowhegan for their hospitality and encouraging attendance.

Resolved, That we extend thanks to Mr. Smiley and his associate musicians, for the excellent music furnished during the sessions.

Resolved, That we express our appreciation to the Somerset Reporter, and other papers, for their able and comprehensive reports of the meetings.

Resolved, That we express our appreciation to the genial proprietor of Hotel Heselton for his efforts to make our stay pleasant and comfortable.

MRS. V. P. DECOSTER,
E. L. LINCOLN,
L. H. BLOSSOM.

The committee to whom was referred the President's address and other matters, reported, Prof. Munson presenting the same, as follows:

Recommended: That a committee be appointed to look into the matter of co-operative storage and marketing, suggest plans, make specifications for storage houses, learn what is actually being done in other states and report at the next annual meeting of the society. Recommended further, that one session of the next annual meeting be devoted solely to the consideration and discussion of this very important subject.

Voted, To refer this recommendation to the Executive Committee.

Recommended: That in the judgment of this society the factor of quality in fruit should be given more prominence. That in the exhibitions held by this society, the intrinsic merit of the varieties shown shall be given weight rather than mere number of sorts in the exhibit or the display of color only. Recommended further, that the influence of the members of this society be used in the same direction, in the various fairs and fruit exhibits held in the State.

Voted, To refer this recommendation to the Executive Committee.

Recommended: That a standing committee on new fruits be established, and that it shall be the duty of this committee to examine into the merits of new varieties of fruit offered for sale in the State, or which seem likely to be of value to Maine growers, and that this committee shall report at each annual meeting.

Voted, That Prof. W. M. Munson be that committee.

Recommended: That a committee be appointed to urge upon the legislature the imperative necessity of enacting stringent laws for the protection of the fruit interests of the State from the brown-tail moth and other noxious insect pests and fungous diseases, and to represent the society in securing the desired legislation.

Voted, That this recommendation be placed in the hands of the President and Secretary of this society to act in connection with the Commissioner of Agriculture.

Recommended: That a committee be appointed to consider the feasibility of legislation regarding the grading, marking and inspection of fruit along the line followed in Canada and in sister states and report at the next meeting.

Voted, That this recommendation be placed in the hands of Dr. G. M. Twitchell.

Recommended, That a committee be appointed to study the requirements of foreign markets with reference to size and style of packages and methods of shipment, and report at the next annual meeting. Recommended further, that this committee shall suggest the most practicable size and style of package for endorsement by this society.

Voted, That this recommendation be referred to a committee consisting of E. L. Lincoln, L. H. Blossom and C. S. Pope.

Recommended: That a committee be appointed to confer with the officers of the various agricultural societies of the State with a view to putting fruit and flowers upon a more satisfactory basis upon the premium list.

Voted, That this recommendation be referred to the Executive Committee.

PAPERS, ADDRESSES AND DISCUSSIONS OFFERED AT VARIOUS MEETINGS OF THE SOCIETY.

ANNUAL INVOCATION.

PRAYER BY REV. GEORGE MERRIAM OF SKOWHEGAN.

All wise God, our Father, we thank thee that thou art the same yesterday, today and forever. We thank thee for thy mercies which have come to us during these past months, and it is with grateful hearts that we bow here before thee near the close of this year. Thou knowest, Father, that we have plowed the fields and scattered the seeds; thou has given us the cold and the heat, the dry and the wet; thou hast given us days of coldness and days of sunshine, and Father, thou hast spoken and the seeds have grown, the trees have borne their fruits and the flowers have blossomed in all their great beauty. And Father, we desire to thank thee for thy manifold kindnesses unto us, the children of men. Thou knowest, Lord, how many of us really are grateful for thy mercies, but thou remainest the same; and this morning, our Father, we turn to thee, praying that thou wilt accept our thanks for the blessings which have come to us. We thank thee, Father, for the fruitage of the trees, for the blossoming of the flowers. We thank thee, Father, for the harvest time of the year. We pray that thou wilt today let thy blessing rest upon this society which now meets. We pray that thou wilt bless the President and all officers connected with this society. We pray that thou wilt grant that this organization may be the means of helping forward the great interests of those who toil on the farms. O Lord, we thank thee for what thou art doing in helping us in our farm work, and we pray, O God, that thou wilt accept our thanks for these many mercies.

Now, our Father, we thank thee for the beauty of this new morning, for this glorious sunshine, for the crisp air which we enjoyed as we came here this morning; and we pray that thou wilt be with those who take part on this occasion, and may, Father, this day and the morrow be sessions full of deepest interest and of profit to all who are connected with this society.

And now, Lord, wilt thou accept our thanks for the mercies of the past, for the mercies of the present, and for thy promises for the future, and into thy hands, O Lord, do we commit our way, praying ever for divine guidance, for Jesus' sake,—Amen.

ANNUAL ADDRESS OF WELCOME.

By Hon. CHARLES A. MARSTON of Skowhegan.

Mr. President, you in your wisdom, and your officers, have seen fit to choose Skowhegan as the point where you would hold this, your annual meeting of the Maine State Pomological Society. Skowhegan, of course, is but a small burg nestled in here between the hills of the Kennebec. We cannot render you the accommodations possibly that some larger place might, but we are willing to do the best we can. Skowhegan never intends to take a back step, as far as her capacities go, in extending the hand of fellowship and sociability to any who may come within her bounds. As I say, we are but a little burg, yet we have a population that we feel proud of. We have a progressive people. We have a progressive town. We have, we believe, an up-to-date little place here, with all our modern improvements,—our electric lights, our fine water system, our elegant sewer system, our nicely paved streets, our macadamized sidewalks, our new bridges,—our men of worth. We are here today as members of a little fraternity of citizens to welcome you within our bounds. And, Mr. President, without any further words in extending to you the glad hand of fellowship, we trust that in the pressure of that hand you will feel the warmth of our hearts, and you may always consider that whenever you come to Skowhegan on any message of this kind, we never intend there shall be anything nailed down. Our hearts, our hands, our houses, are always open, to welcome you.

Mr. President, in the name of the citizens of Skowhegan, I gladly welcome you within our bounds.

RESPONSE.

By Dr. TWITCHELL.

Mr. President, Ladies and Gentlemen: I like to be called upon in this way to make a response. The gentleman to my right asks me why I didn't tell him I was to make the response. I didn't know it myself. A man can't tell what he doesn't know. But I think perhaps just a word in recognition of the fitting welcome which has been so cordially extended to this society by Mr. Marston may not be out of place.

I remember years ago a meeting we held in the other hall in this town, and I wish that we might have before us the photographs of the exhibits then to compare with the photographs of the exhibits here today,—or rather to compare with the fruit which we have in the lower hall, so that we might make some intelligent comparison between the work of that period and the work of the present, because during these years there has been a most rapid and steady advance of our fruit interests through this fruit belt of the State of Maine, and we are producing not only far greater quantity of fruit, but a much better variety of fruit—quality of fruit— than we were producing ten or fifteen or twenty years ago; I think it must be nearly twenty years ago since that meeting was held.

But, ladies and gentlemen of Skowhegan, we accept your cordial words of welcome as further evidence that you will lend your words and counsels, as you go out among your own citizens, asking them to come in and enjoy these sessions with us, and see the fruits of the harvests which have been gathered in this hall—the flowers and the fruits as well—which are for their pleasure and satisfaction as well as for our study and investigation. These meetings are called for a special purpose,—not alone that we may see what has been accomplished, what has been gathered from the harvest fields, but rather that we may come together and investigate the sources, the causes, the conditions, and be helped to better appreciation of the next step which always lies just in front of us. And you who are citizens and are not, perhaps, directly interested save as consumers, are equally interested with us in the carrying forward of this great industry, an industry which today is worth to the State of Maine from one to two million dollars, and which may be in the next few years greatly increased as we come to a better knowledge of the exacting conditions which are confronting us.

And so accept from us our recognition of your kind words of welcome and join with us in the work of the next two days.

ANNUAL ADDRESS.

By Z. A. GILBERT, President of State Pomological Society.

The round of another year brings us to our annual exhibition and convention, and with it comes the duty to your president of formally opening the meeting with such suggestions bearing on the industry we have taken upon ourselves to promote as may be deemed of special importance at this time.

For three years in succession the fruit growers of our State have been favored with bountiful crops from their orchards, the two last of which never having been exceeded in quantity in the history of fruit growing among us. Successive years of bounty are so rare that the fact is worthy of record in our proceedings. In fact such has been the quantity of fruit offered on the market that some have raised the question whether the business has not already reached the limit of demand. A careful survey of market demand, however, through any considerable period of time, will, we are quite certain, dispel all fears in that direction. The present year will complete the measure of fifty years of my own personal financial interest in commercial fruit growing. In that time the changes have been great, but in no direction more marked than in the increase of the quantity of fruit offered on the market. Yet the price of fruit will average for a decade as high now as for any ten years of the half century. There are years of general bounty and consequent low prices and narrow profits. But when such experiences come we should not forget there are also years of generous profits. Fruit production in common with all other lines of business is subject to fluctuations in both yield and price but on the whole compares favorably with other lines of production. So long as people shall love fruit there need be no fear on the part of intelligent growers but its production will continue profitable.

The general public are not aware of the real money value of a good orchard in comparison with other investments. If they were, these hill lands in our State, so well adapted to the growing of apples, could not be bought at the trifling figure they are now offered for. I have sold sixty dollars worth of apples from a single tree in two successive years, forty dollars in one year and twenty the next. An orchard set with trees of my own growing has since changed hands at two hundred and fifty dollars an acre.

One of the greatest orchard centers to be found in the State is in the town of Monmouth. I have watched the development of those orchards with much interest. A tract of "out of the way" land was owned by the late Dr. Marston. The land had hardly a selling value. In order to make it worth something the owner planted it to apple trees, and a fellow townsman of mine had the care of the trees. There were 800 to 1,000 trees in the orchard. Up to the time it reached a good bearing condition the orchard had paid in fruit enough to cancel all expenses laid out on it up to that time. It was then sold for $3,000. The purchaser took apples enough from it the first season to nearly pay for it, and two years later sold it for for $2,300. The first sale was some ten years ago. Since the last sale the orchard has paid for itself several times over. Last year it gave 1,300 barrels, and the present year 1,000 barrels, and no year has the crop been less than 600 barrels. After all this fruiting, the orchard today is estimated to be still worth four to five thousand dollars; and all this on land that before planted to trees had scarcely a selling value. I mentioned this particular tract to show the increased value of low-priced land from planting to apple trees.

There are several large orchards in the same town planted on more accessible lands, just well up to bearing, yet in each case are showing a similar increase in value. An orchard of four hundred trees, all one variety, I have been watching with interest the past season. Every tree was covered with fruit. Up to the present time the fruit it has borne has paid for the land, trees and all expenses up to date. The orchard would now sell for twelve to fifteen hundred dollars. Yet it has but just got up to a bearing condition, and ready to go on with a largely increased production for fifty years. I mention these orchards, not as isolated and exceptional cases, but as samples of what is being realized in thousands of Maine orchards on a large or a small scale. The leading men of our State—business men and capitalists—do not seem to comprehend what is being illustrated in individual cases in every fruit growing town. Were such cases of increase of values as I have mentioned to be found in lines of effort independent of land and the farm, and yet certain, sure and safe, they would be looked upon as fabulous. In the case of orcharding the opportunities are so frequent and so easy to reach that their value is overlooked. It is a curious fact that people cannot appreciate opportunities that are knocking around under foot. They must look to far-away Riverside and Florida to be able to see opportunities for fruit growing.

Another phase of the business of fruit growing, bearing on the question of profit, is almost always overlooked even by those engaged in the business. Just now potatoes are having their innings as a money crop. Yet the potato must be planted and the entire routine of growing the crop must be repeated in full each year. An orchard gives a crop of fruit, while the trees on which it grows remain to repeat their bounty each returning season for half a century. There is no room to question the claim that a Maine apple orchard is way ahead of a California orange grove in net money to its owner. Few of us appreciate the actual low cost of fruit from a well conducted orchard. This association cannot do too much in directing public attention to the profits of orcharding and the favorable opportunities for its development in our State.

There are two lines of work to which our society has given some attention in recent years that call for continued effort in the same direction. I have in mind high quality in fruit as a factor of value, and better storage while the fruit is in the grower's hands.

It is in years of plenty, like the present, that the money value of quality is made specially prominent. The color craze is still on and I do not question but color will continue to have a measure of money value, but it is in connection with high quality that color finds its superiority. There never was a year when fruit the best in quality was more in demand in the market than the present season, and the popular color has given it added value. Note the premium prices at all times during the season paid for the Gravensteins, McIntosh Reds, Snows and Kings. Here is a fact this society may well continue to hold up to the view of fruit growers.

Many growers have this autumn substantially given good keeping winter fruit away, or disposed of it without reasonable compensation for time involved in its handling, for want of storage room. The industry is decidedly weak on this point. Under present conditions of trade any considerable part of our winter fruit cannot be sold at anything like what it should be worth till consumption has made room for it. Growers must get out of the position where they are obliged to dispose of their fruit directly from the orchard. It hurts not only themselves but damages the industry at large. Our society can do no better than to dwell on this feature till conditions are changed for the better.

It will be recalled that at our annual meeting a year ago, the matter of making an exhibition of our Maine fruit at the St. Louis Exposition was before us. The officers of the society had made application to the State commission to have a portion of the forty thousand dollars appropriated by the legislature set apart for such a purpose. The request, together with the society, was entirely ignored in the matter. Later the newspapers of the State reported that some apples were bought for the purpose of exhibition and would be forwarded to St. Louis for that purpose. I have watched out through the season in the public press and no mention of a Maine table of fruit or a Maine apple having been seen has been found. Other states placed liberal sums of money in the hands of their horticultural societies for the purpose and fine displays have been reported. The conclusion must be drawn that our fruit interests, in common with our other industries, got small recognition out of the money appropriated.

There is still too much running after the new and the unknown by amateur fruit growers. At our spring meeting last March I was surprised at the inquiry after the Black Ben Davis, Gano, Senator, Delicious, and other of the new introductions. It would be a needed step for this society to have a standing committee on new fruits whose duty it should be to gain information on the new varieties yearly offered to attention and give it to the public.

In the conduct of our annual convention and other public meetings or in the classification of our exhibitions I have no changes to recommend. At the same time improvement should be our aim, and our officers and members should constantly be on the watch for changes that may lead to still more effective results in the dissemination of knowledge among fruit growers. The cause we have in charge is a grand one. The influence that has gone out from the efforts of this society has been marked.

LESSONS TAUGHT AT OUR ORCHARD MEETING.

WHAT A YOUNG FRUIT GROWER LEARNED.

By Edward L. White, Bowdoinham.

President Gilbert, in an informal talk before the Board of Trade in Auburn a year ago, brought out the fact of making the farms in Maine that hardly yield anything at the present time produce $45 to $50 per acre.

We often read of converting sheep pastures, rocky hills and parts of farms that are not yielding any profits to the owner into productive orchards.

Take up a Maine Agricultural Experiment Station Bulletin and see the picture of an apple tree with thick foliage and covered with fruit, alongside of one with thin foliage and practically no fruit; the difference caused only by cultivation.

When these things are brought before us in this way we often hear the remark that "That makes a good newspaper stoiy," or "That makes a good picture," etc.

When we went into Mr. Pope's orchard last September we found the half had not been told or even pictured. It was plainly written on the foliage of the trees and the abundance of fruit what may be accomplished with the hills of Maine, the unprofitable parts of farms, and with a sheep pasture to cause them to return to us $45 to $50 per acre.

There were two points of interest clearly brought before us while at Mr. Pope's. The opportunities for young men to better our orchards here in Maine, and how we may use these opportunities.

As we stood above Mr. Pope's orchard, looking down over the bank at our right as we entered, seeing a large bowlder almost in our path, it was hard to make ourselves believe that this one-time sheep pasture was an ideal location for apple trees, but such it has proved to be. We could have pointed out many farms in Maine that apparently to us would have furnished better advantages for orchards.

How has this orchard been brought to such a high degree of productiveness? There are several methods being employed at the present time.

The orchard had been divided in many plots or sections for as many different experiments. The following appealed to me as being the most practical for my own use:

The trees in the plot where the hogs worked last season were thrifty and full of fruit, whereas a year ago they appeared the same as the trees in the plot where the hogs are at work this year, the foliage less abundant, lighter in color and not as many apples.

In another plot the trees were mulched with commercial fertilizers in one section and with stable manure in another. The section mulched with stable manure seemed to me to give the better results. By the side of these were trees without any treatment, and this fact was plainly evident.

Another plot was divided into three sections. One section was cultivated with plow and harrow and no fertilizers were used. Another section received the same cultivation, and commercial fertilizers were used. And then the third section had the same cultivation and stable manures were used. And here I gave the stable manure the preference. These results proved that much stress should be laid upon the use of the plow and harrow. There were many other plots of equal interest, but these seemed the most practical to me. The trees were all well pruned.

Another little point I learned was in grafting that we must not get a bud on the scions too near the bark on the trunk, as the branch from this bud will split off quickly.

These are a few of the lessons I learned at the orchard meeting, but the greatest lesson was this: The closer I keep in touch with the men and societies carrying on such experiments the higher I can raise the standard of our own orchard, thereby contributing more to the wealth of my own town and lift the Maine apple still higher beyond the reach of all competitors.

McMahon Apples, Grown and Exhibited by Charles S. Pope, Manchester.

HOME FERTILIZERS AND CULTIVATION.

V. P. DeCoster, Buckfield.

I have not come here with any written preparation. The secretary notified me that he would like to have me spend about ten minutes in giving you a little talk on home fertilizers and cultivation. Consequently I thought that wouldn't demand a great deal in the way of preparation. Accordingly what I say at this time will be upon the spur of the moment. In so doing if I can throw out any thoughts that will do you good, it will be very gratifying to me.

In the first place I will say to you that I am a thorough believer in the cultivation of our fruit trees. What would you think of a farmer planting his corn, his potatoes, his crops that he is raising in the field, and then trusting to the hand of Providence to do the rest. When I see a man that is raising 400 bushels of potatoes to the acre or $100 worth of corn, I make up my mind that man has done some work, he has done some thorough cultivation. Now it is exactly so with our fruit trees. When we hear of a man who is a successful fruit grower we have got to look into the matter and see what he has done, and we find that the man who has best cultivated his trees is receiving the greatest profit. What would you think of a man intending to run a mill with just sufficient water to turn the wheel? As soon as he lets the water on, or the steam, he begins to work to some profit.

Now, I take precisely the same ground with our fruit trees. When a man sets out his trees and just simply lets the hand of Providence do the rest, he is getting no profit from those trees. As soon as he commences to feed them the result is sure. There is no one thing upon the farm that shows a quicker or surer return than a fruit tree.

Then the question comes—What shall we do? Ever since I commenced orcharding—I think I spoke of it in Auburn that I raised my own trees, planted the seed myself and have grown them up to the present time so that they are now averaging from ten to twenty bushels of apples to a tree—they have been fed upon home fertilizers. You may go across from our place a short distance to Mr. Ricker's, one of the apple kings of the State of Maine. He raised last year 2,600 barrels of apples. He has grown those trees upon his own farm with home fertilizers. So it is really a settled fact that we can grow fruit upon home fertilizers and I certainly believe that no fertilizer upon the farm can be used to better advantage than home fertilizer. Now that is not saying anything against commercial fertilizers. I will touch on that a few minutes later.

Now I made it a rule when I set out my trees that I would do the best I could for them. Consequently, I kept the plow going, and I not only raised those trees but I did raise other crops. I raised my corn, my potatoes, my beans, etc., amongst those trees until the trees got to some growth so that they would shade them. Now I simply plow that orchard once in two years—put on a coat of dressing once in two years and plow it every year. It is not necessary that you should put on a very heavy coat of dressing for fruit trees, but keep your plow going, and the harrow, and the result will always follow. You need not be afraid to use the plow. A great many advocate the theory that you can't plow among the trees. Perhaps they can't if they never plowed until the trees got to be large. But commence when your trees are small, and the roots are kept in proper shape, and the limbs, so that there is no trouble.

Then again in speaking of home fertilizers, you might call hogs a home fertilizer. Grand results follow from the pasturing of hogs, and I might also say bad results. I noticed over in Bro. Pope's orchard that the result was wonderful from the pasturing of hogs. And yet, I said to Mr. Pope "What makes those trees die there?" I knew all the time that hogs had dug around the roots too much and got them exposed and gnawed the bark. He said, "I got a little neglectful." That is the way with a great many of us. We do not feel that the pasturing of hogs is an injury to an orchard, for it has a grand result, but you have got to watch that one point and not let them root too much around the trunks of the trees. If they do you are going to lose some trees.

Then again with reference to sheep in connection with the orchard. A few years ago I bought a farm for $300—60 acres in the lot. Soon after I bought it I fenced off about six acres in one corner and put out some fruit trees. I kept them cultivated for several years. It was a mile and a half from home and I didn't haul any dressing, but I mulched it and used fertilizers, and grew crops there for one or two years, and then I turned it out to a sheep pasture in one sense of the word. I allowed the sheep the run of the 60 acres and to come into this exclusively when they wished to. The result has been wonderful. Today that orchard is worth $1,000 to me. The present year I got over a thousand bushels—last year not quite so many—and the buds are started the present year for a large crop. I wouldn't take $1,000 for the orchard today. At night you will see those sheep going off down on the low ground, and in the morning you will see them returning to that orchard, and there they lie all through the day time. What is done to that orchard is done by sheep. I never have seen a trypeta, and not over one out of ten but what are perfect apples. I tell you, brothers and sisters, there are lots of these hills, that if you were to take some corner, some high elevation, and put out an orchard there and fence it, and put sheep in, the result would be wonderful. It would be worth more than your whole farm in a few years.

Then again, a great many people have an idea that the fruit business is going to be over done. Years ago—even when I was a boy—that was not a great many years ago—I know we used to speak about going to market with wagon loads of fruit. At the present time we speak of carloads in the same manner we did then of wagon loads. At the present time fruit is selling for more than it was in those days. There is a greater demand for it. Why, with the transportation we have at the present time there is no danger of overdoing the fruit business. When you can reach any New England city within twenty-four hours and the European markets in ten days you need not be afraid that the Maine fruit is not going to sell and at a good profit. I think there is no stronger inducement for a young man today than to go into orcharding. Why, I expect the time is coming, when this little cake of bacteria that is talked so much about in Washington—when we are going to get them and vaccinate our land and we are going to sit right in the house and see the things grow. Why in the last Lewiston Journal—I think the reporter is here today—they got out an article which I suppose he thinks is worth $1,000 to the people of Maine. Now you can take that little yeast cake and vaccinate an acre of grain and make it grandly productive. I don't know as Bro. Bateman wrote that but it sounded a little like him. I think it is worth looking into. The government don't do things by halves, and the government you know is liberal, and they have offered to donate these little yeast cakes—I am going to call them—for the farmers to experiment with, and I told Mrs. DeCoster that I was going to have one. I am going to sit in the house, and imagine how my trees and things will grow!

HOW TREES DRESSED WITH "FISHER FERTILIZER" LAST YEAR BEHAVED THIS YEAR.

S. H. Dawes, Harrison.

The question of orchard fertility and the best methods to obtain it, is one of the most important that confronts our fruit growers today. There are several ways that are practiced such as pasturing with sheep and hogs, topdressing, mulching, cover crops, cultivation by ploughing and harrowing, with the use of barnyard dressing, phosphates, etc. All have more or less merit, according to the way they are applied and the manner in which the work is done. A successful fruit grower must be a man of good judgment, who loves the business and takes into account the conditions, his surroundings and means, in order to obtain the best results. I have no doubt but that three-fourths of the orchards in our State are standing in grass fields and pastures, many of which it is impossible to cultivate by ploughing, in consequence of the rocky condition of the soil, or where the trees stand too close together.

The pasturing of sheep and hogs is to be recommended. It has one important advantage over all others. The hogs consume all the wormy fruit, which is death to insects, and the trypeta can find no lodgment where they are kept.

Top dressing is also beneficial, where one is so situated that he can procure manure at a reasonable cost. Cultivation is also to be recommended, where the conditions will admit of it, and the trees do not stand too closely together. As for mulching and cover crops, it is easy to say mulch and write about cover crops, but altogether a different thing to procure the material and do the work. It makes good winter quarters for the ground moles and mice, but I never could see that it did the trees much of any good. I believe that all methods and experiments should be backed up by facts and figures, as much as possible. Profit and loss are what interest us fruit growers the most. Unfortunately my orchards all stand in grass land, a part of which is so rocky that it is impossible to plough and cultivate, now that the trees have grown so large and the limbs come so near the ground. In order to fertilize I have resorted to the use of chemicals compounded by a formula of Dr. Fisher, a noted fruit grower, of Fitchburg, Mass. I have only used them three years, but so far they have done all that I claim and more. I gave the results of my first two years' experience in Auburn at our last exhibition and I will not attempt to repeat it here any further than is necessary to explain the results of my experiments this season. Those of you that were present at the orchard meeting at my place last year will recollect that on the east side of my main orchard I have a block of just one hundred Baldwin trees consisting of five rows with twenty trees in each row, and that they were all treated alike with the Fisher formula except the middle row where no fertilizers of any sort were applied, with the result as then stated. I wanted to learn what benefit, if any, the last year's application would have on the trees this season without any further fertilizing. I therefore left one row and made no application whatever and on the next row, which was fertilized last season, I used eight pounds to the tree, which was two pounds less than I applied last year, with the following result: I picked fourteen barrels of fruit more on the row where I made the application both years than I did on the row where I made one last year. When you come to compare this result with the trees I left in the middle row where I made no application whatever last season or this, it was as plain as the nose on your face that the application I made last year was a benefit to the trees this season and they yielded almost double the fruit that the trees did in the middle row where no fertilizers were ever applied. But it did not produce as much fruit by the fourteen barrels as the row did next to it where chemicals were used both seasons. It caused the trees to blossom and set as much fruit as those that received treatment both seasons, but there was a gradual decline as the season advanced in the color of the foliage, the size of the fruit and the thrift of the grass around the trees.

I am told that Dr. Fisher recommends a light application every year, and my experience teaches me that the same theory is advisable. I also experimented further with chemicals and manure on the trees in the middle row where no fertilizers had been applied. On the first six trees I used the Fisher formula with the same result as last year. Late last fall I spread around the next six trees out a little farther than the limbs extended one-third of a cord of good strong stable manure. Early last spring I took a hoe and pounded the lumps up fine and evened it around the trees, hoeing it in lightly so that it would be quickly incorporated with the soil, but strange to say, I could not see that the trees derived any benefit from the treatment this season. But I shall look for better results next year. We cannot go back on manure if we would, for its reputation is too well established for that. I used the formula on a portion of the remaining trees in the row, and those on which no fertilizer was applied of any sort looked sickly and bore but little fruit.

I have read and heard a great deal about the benefit of potash to fruit trees, how it will give color and flavor to the fruit, and as I am naturally fond of new things and like to be humbugged a little as it improves one's judgment, thus putting him on his guard against larger impositions, but I will not stand too much of it. I purchased a bag of sulphate of potash and went through my orchard promiscuously and applied it at the rate of from five to ten pounds to the tree, selecting the varieties that I was particularly interested to have well colored, as you know that color stands high in a scale of points and the market. I do not believe that the best expert on pomology with a compound microscope could detect the least difference where it was used, either in the tree or the color of the fruit. But I hope for better results from it next year, as it is said to be a slow acting fertilizer. The conclusion I arrived at on this point is that the best way to get color is to have the trees far enough apart and prune them so as to let in God's sunlight, for I believe it will give the fruit a better color and flavor than any sort of a fertilizer and it costs less money.

I have read and been told that you cannot grow a crop of grass and fruit on the same ground at a profit, but my experience the last two seasons does not agree with this theory. My large orchard was seeded down to grass ten years ago and it has been cut for hay ever since, and in no year during that time have I harvested so large a crop of fruit and hay as I have the present season. There is another advantage that I will mention in this connection—the aftermath makes a good cover crop, which I will allow is of some use, as it makes a soft bed for the fruit to drop on, which prevents bruising and you get a little more No. 1 fruit. I firmly believe that orchards which are standing in grass as most of our orchards do, that are of good bearing size, that there is no fertilizer in use at the present time that can be used with so little labor and will give such quick returns as the Fisher formula, on both fruit and hay. I should not dare to recommend it for young orchards before they come into good bearing size, as I have had no experience in that direction. I will not recommend any method of treatment any further than my experience goes to prove it. If I had known that I should have been called on to give the results of my experiments this season I would have arranged them so that I could have given them in a more definite form. As it is I shall state the facts as they are in a general way and you can judge of their merits for yourselves.

Last spring I purchased of Lister's Agricultural Chemical Works, No. 364 Commercial street, Portland, Me., about three tons of chemicals and mixed them myself and applied the fertilizer to about all of my apple and one-half of my pear trees, using from eight to ten pounds to the apple and from five to eight to the pear, according to the size. My main orchard is twenty-six years old, and the others are from two to ten years older. In no year have I ever sold over six hundred barrels of apples from them all and only one year as many as that, which was in '96. This season I have sold 948 barrels of apples and about seventy of pears. My pear crop last year was about the same as this season and I used the same amount of chemicals. Now these are the facts and you can judge as well as I how much is due to the season and how much to the chemicals. My nearest neighbors have only about half as many this season as they had last, and the same is true of Neighbor Breed, with his orchard full of pigs. But I shall look for a better yield next season, for some cause or other that I cannot explain his orchard always does its best the odd year.

My experience teaches me that no fertilizer will, as a rule, produce uniform results with different kinds of fruit, neither will it cause trees to bear every season or change the bearing year. Trees, like individuals, have their own peculiarities that no influence can change. I should as soon think of changing the disposition of a company of young people by treating them with ice cream and cake as I would the natural habits of trees by any method of fertilization. There are exceptions I must admit to this rule, for I had some Baldwin and Bellflower trees that never bore any fruit to speak of until I applied the formula and they have yielded bountiful crops ever since. Whether it was natural or not I cannot say, neither do I care as long as I have the fruit. I wish it distinctly understood that I am no agent for any man, corporation or company, and that I have no interest whatever in the manufacture or sale of any kind of a fertilizer either directly or indirectly. All the benefit I get is by using them, which you all can have if you choose, and from what experience I have had I do not hesitate to recommend to everyone who is interested in fruit growing to try some, in a small way at first; study the results and if it does not leave a good margin of profit stop using it. I don't believe in doing business for nothing and when I find that it does not pay me I shall stop.

Mr. DeCoster: Mr. President, allow me just a word. I was at our State Grange meeting a year ago and I took the liberty of buying 500 pounds of this chemical that Mr. Dawes spoke of. I had some trees that were not doing what I thought they should. I make a point of looking over my trees and if I find a tree not growing as I think it ought to I realize I must do something for it. I thought I would use some of this chemical on those trees. Let me say to you that the result was wonderful. I was very much pleased with the result I received from the use of those chemicals through the influence of Mr. Dawes.

Mr. GILBERT: How did you apply it?

Mr. DECOSTER: About ten pounds to the tree. I threw it right around the tree about as far as the limbs extended. Some of those trees this year raised me fifteen to eighteen bushels of apples. Some trees that I skipped I could see the difference in the foliage, and not only could I see the difference in the foliage, but the difference in the grain, in the grass, you could see as far as you could look. I have considerable confidence in those chemicals.

Mr. LIBBEY: You didn't cultivate that in any?

Mr. DECOSTER: No, it was where I couldn't get to it.

QUESTION: Would it or not be any benefit to cultivate that in?

Mr. DECOSTER: It is always a good idea to let well enough alone.

Mr. KNOWLTON: I wish to say two or three words because I want to bring out a point which perhaps Prof. Munson may not dwell upon in connection with this work in the use of this special fertilizer. Before we went to Mr. Pope's orchard, the day before, I had the opportunity of visiting Mr. Atherton's orchard at Hallowell. Some of you have been there and know what it is. He very kindly showed me over his orchard and I was very glad indeed of the opportunity to see it. I have since learned that he has a crop of about 1,600 barrels of apples. Well, it seemed to me as we went over the orchard that the trees needed something, a large part of them, which they hadn't had this year. The foliage was weak and the apples were very small except in those sections of the orchard where he had used some of his stable manures. From what Mr. Atherton told me I don't think he has been stingy in dressing his orchard, because year after year he has been plowing in the old fashioned fertilizer—if I may be permitted to call it so—of wood ashes and more or less bone meal. He called my attention especially to the fact that the trees had shed a large quantity of leaves during the year, and I could see it myself because he pointed them out under the trees. I was very glad indeed to see this orchard because when we got over to Mr. Pope's orchard and saw there the influence not only of this particular fertilizer which Mr. Dawes has been speaking of but of other fertilizers which have been applied under the direction of the Experiment Station, we could see the difference very readily. It was a rare treat to see the condition the orchard was in where most of these experiments were being tried, and especially were the results favorable where the application contained a large amount of nitrogenous matter, which is contrary to the old treatment which we have been giving the orchards. At the same time it is very nice to have this home product brought out, and that is why I asked Brother DeCoster here to talk so that he could tell you, or call special attention to the experiments in the same orchard where hogs had been used, and to some of his own work with the use of sheep. He might have gone a little farther, if he would, and have told you perhaps about poultry,—how the poultry if they have an opportunity to work in the orchard will accomplish almost the same result. I had a very good illustration of that in my own place this year. I had an opportunity of getting a little of the fertilizer Mr. Dawes spoke of and I applied it to several of my trees and the results were very gratifying indeed. The gentleman of whom I got the material applied all but a hundred pounds to his own trees. He said he would not let me have any more, it was so much fun to put it on he was going to do it, but—to use his own expression, you will pardon my using it—he said he didn't think it would amount to a damn anyway but he was going to do it. Well now, this year, while his crop of apples is not so large as last year, yet he never raised so fine fruit as this year, and he told me only the other day that he was going to put the same kind of fertilizer onto his grass ground next year because he wasn't situated so he could either make or buy large quantities of home manure. Well, as to the poultry, I inclosed several new trees this year that had not been inclosed before, and certainly the result there was almost as marked as it was where the Fisher formula had been applied. At any rate it convinced me of just this point, and I think it will any intelligent observer, that the trees along with the other fertilizers which we may give them also need a large amount of the nitrogenous part.

Something was said by Mr. Dawes, I think, about young trees. I have an idea—I don't think it is all theory either, but I have had no opportunity of demonstrating it,—but I have an idea that a young tree, the thing it needs first of all when we set it into the ground is something that will start it to growing, and when you get it once started nature will go a long way to keep up the growth. I have tried this in the transplanting of plants about my garden for quite a good many years. Set out a cabbage plant and put on a little nitrate of soda dissolved in water, and it is surprising how quick it will start growing,—the plant hardly knows it has been transferred at all. And oftentimes you can see that the plant transferred will grow faster, commence almost immediately, than the one beside it where it stood before, showing that a little of this will give the plant just what it needs. I think the same is true in connection with young trees, and I believe that we are going to learn to put something of that kind upon young trees to give them a start.

Dr. TWITCHELL: I am very glad to hear Mr. Knowlton emphasize the value of poultry. There are some perhaps in the audience who remember that years ago I used to do something in Somerset county in poultry growing, and I think there are one or two who were interested then somewhat in carrying it forward. I think it is also well that a word of caution, although it may not appear just in that form, should be offered by those who believe in the home supply as a means of fertilization. It seems easy for us to go into the market and buy, but the money must come from somewhere, while that of course must come from the growing of other crops, what can be produced upon the farm, and with apparently little expense and will give us the results desired. An illustration came to my notice this summer which made such a marked impression on my mind that I cannot resist the temptation of giving it. Six years ago I visited in the eastern part of the State, twelve miles from Eastport, way back among the hills, a farmer who had commenced keeping poultry. I found he had about 2,500 hens, carrying the chickens necessary to continue his flock. They were being kept in the most primitive manner, raising his chickens in barrels out under the plum and apple trees. The hens were running in old buildings, inexpensively built by him at low cost. But he was doing a good business. He was making them pay. A few weeks after I saw him upon the fair grounds and he had entered a horse in one of the races, and in talking with him before some of the officers, I said, "You better put the horse to the plow instead of the sulky, burn up the boots and attend to your hens and fruit trees," and left him. On that same fair ground a few months ago—this fall—he came to me as I stood there with some others and says: "Twitchell, I have got that trotting horse now and I didn't stave up the sulky or burn up the boots, they are up in the barn." "Well," I said, "he is not in the races this year?" He said "No, but the hens are there under those fruit trees, and I want to tell you that since you visited that place six years ago, out of those hens and the fruit trees"—for he doesn't do much farming, couldn't do much there among the rocks—"I have supported my family and have bought $5,000 of stock in the Frontier National Bank of Eastport." That is a pretty good story to tell. He spoke to me in the presence of a number of his neighbors and after he had gone one of them said: "He told you the truth. We don't doubt the story that he told. The results are simply marvelous, the effect of the working of the hens and the fertilization by the hens upon those trees and the quality of the fruit."

TALK ABOUT THE EXPERIMENTS AND RESULTS.

Prof. W. M. MUNSON, Orono.

As representing the Experiment Station I don't know whether I better say very much about this question of orchard fertilization, or not. The experiment stations have apparently been "sat down" upon, somewhat, with reference to the use of fertilizers. I may say this, however, do not think for an instant that any experiment station in this country would say that nitrogen is not necessary for fruit trees or any other plants. Nitrogen is one of the fundamental elements of plant food. Trees must have it just as much as any other plants. So please don't get the idea from what has been said that experiment stations have not been in favor of using any nitrogen on fruit trees, for most emphatically they do favor it.

One other point I cannot refrain from referring to. It was my privilege—I don't know whether it was the particular specimens which Mr. Pope has upon the table down stairs or not,—but it was my privilege, as I was looking over the orchard this fall, to make selection of a great many of those very fine specimens of Talman Sweets, and I may say just confidentially that most of them came from those plots where the Experiment Station had been working, and not where the Fisher formula, or this new formula that we have referred to, was used. Most of them came from those trees which had been fertilized with stable manure and with complete fertilizers, rather than from this new work.

While speaking of this particular branch of the experimental work in Manchester, I may say that the point that we have in mind there is to demonstrate the fact, if fact it be, that an excess of nitrogen, such as is called for by the Fisher formula, may be unnecessary. Now as has been said, this Fisher formula has been called dynamite; so we have right by the side of it, on certain experimental plots, put another formula which we may, if you choose, call lyddite, so we will have a grand cannonading a little later comparing the two formulas. I may simply say by way of explanation, this formula we are comparing with it consists of about 3% of nitrogen, 8% of potash and 6% of phosphoric acid. But I do not care to speak definitely upon this formula until next year, when I hope to report some comparisons for your consideration.

I am to speak this afternoon, and very briefly, I can assure you, upon the experiments which are in progress and which were referred to by previous speakers. As you know, for the last six years the Experiment Station has been conducting some work with reference to the use of fertilizers and the cultivation and management of orchards. We have compared a high grade complete fertilizer with stable manure, and we have compared cultivation with mulching. The results of these experiments up to the spring of 1903 are fully detailed in Bulletin No. 89 of the Experiment Station, and if any of you are interested in the details of this work I would simply suggest that you send for a copy of that bulletin, rather than weary you with those details at the present time. In brief, however, I may say that the results from cultivation have been to render the foliage more luxuriant, to increase the growth to a greater extent, and on the whole to give a larger crop of fruit than has been the case with the orchards which were mulched. I shall show you on the screen tonight by means of the lantern some pictures which have been taken in that orchard, and they will speak more loudly than any words that I can use with reference to the results which have there been attained.

I may say without hesitation that, from the results of our actual commercial work in these orchards, there can be little question as to the advantage of cultivation upon orchards where cultivation is possible. I may also say that upon those fields—and there are very many of them in the State of Maine—where cultivation is not practicable, as upon some of our rocky hills in Franklin county, mulching has been found most efficient.

The use of cover crops, which I may refer to briefly here, is not a part of the work at Manchester. It is a part of the orchard work which we are conducting at the Experiment Station at Orono, and in some of the orchards in other parts of the State. I will not present any figures with reference to the amount of nitrogen, phosphoric acid, etc., that are added to the soil by means of cover crops. I will say, however, that every year at our orchard at the station we practice sowing a cover crop of rye, oats, clover, or vetches, and the same value which Mr. Dawes has referred to as resulting from his grass at the foot of the trees, we find there. We have this heavy velvet carpet for the fruit to fall upon,—and we have the added nitrogen which these clovers and vetches will give to the soil. Vetch which is six weeks old has well developed root tubercles, and as you know, these tubercles are the means by which nitrogen is drawn from the air and added to the fertility of the land.

Another line which is being carried on in this orchard at Manchester is that of top grafting. Now, as you know, there has been a great deal of discussion in this State with reference to the Ben Davis apple; and the statement has been made that if we do not like the Ben Davis, when it comes into bearing, we can top graft it to something else. But the cry comes from here and there and elsewhere that the Ben Davis is not suitable for top working Baldwins or any other rapid growing varieties. The character of the Ben Davis wood is rather willowy, the limbs are slender. And so the question is raised, Is it suitable for top working into Baldwins if we find that it has dropped out of our market here in the East? To answer that question, an orchard of Ben Davis trees fourteen years old was this spring sacrificed for the good of the cause, and a number of different varieties, including Baldwin, Jonathan, Sutton and Spitzenburg, were top grafted upon these Ben Davis stalks. Almost without exception, the cions which were put in have made a very vigorous, satisfactory growth for this year. What they will do in the future, time alone can tell. That is one of the lines of work, then, that the Station is doing in this particular direction.

One of the lines of work which we have considered, was the influence of potash upon the quality of the fruit. We have been using kainite and muriate and sulphate. The original purpose of this was to test the value of potash as a means of warding off the apple scab. We have come to believe at the present time that potash is of no value in that direction. And right here I want to call to your mind something that came to my ears when I was at Manchester. I made that statement, that we had concluded that potash was of no value in this work. "Then," said the party with whom I was talking, "then that experiment is a failure." "Why," I said, "most emphatically, no." Because we find a negative result, we don't consider an experiment a failure. It is just as important to find out what is not true as it is to find out what is true. So don't get the idea because we have some notion, and when we come to study the evidences our notions are not of any value, don't consider that the experiment is not of any value because it may be of the greatest value.

But further, I am comparing in these plots these different forms of potash. These plots have now been under observation for six years, and they will continue six years, or sixteen years longer if necessary, that we may determine if there is any actual advantage of one form of potash over another. Now that we have abandoned the study of potash with reference to the apple scab, these orchards will be treated in a rational manner; but the different kinds of potash will be continued.

Mr. President, with the feast of good things which is yet to come, I had better not occupy any more time on this occasion. Just here, however, I would impress upon the minds of this audience the educational value which is to be derived from a personal inspection of the actual work that is being done in any well managed orchard. Mr. Dawes is doing a capital work in his part of the State, in showing what may be done along certain lines of orchard work. Mr. Pope is doing an equally important work in his, and Mr. DeCoster is developing orcharding in his section. Mr. True over at New Gloucester is emphasizing the importance of careful work in orcharding there; our worthy President likewise in the town of Greene. And so, all over the State, we are establishing little centers from which our neighbors are to learn the importance and the value of fruit growing in the State of Maine.

An 8-year-old Rome Beauty Block. Northwest Arkansas. Photograph from H. P. Gould, Agricultural Department, Washington.

FUNDAMENTAL PRINCIPLES.

H. P. Gould, Agricultural Department, Washington.

It seems to me that there is a fundamental principle underlying this whole discussion, which, if not grasped, will render the value of all that experience much less than it otherwise would be. I want to try to sum up this discussion as it appeals to me, and touch upon what I believe is the fundamental principle underlying the whole thing. The reason why I am prompted to do this rests in the fact that there were several members who told of their experiences, and those experiences were quite contrary to one another in their results. For instance, some one spoke of the excellent results which they had secured by pasturing hogs in their apple orchards, and Mr. Breed, who was with you last year, I think, and who is a neighbor of Mr. Dawes, gave you something of his experience in that method of managing his orchard. If you would consult one of the best growers, and perhaps *the* best grower of apples in the state of New Jersey, he would tell you that he does not want any hogs in his orchard—two experiences that are diametrically opposed, and an orchard is an orchard wherever you find it, and a hog is a hog wherever you find the beast! Now what makes the difference in the result? It is one of fundamental principle, and I am not going to attempt to state the principle until I refer to one or two other conflicting instances. Mr. Dawes in his discussion told you that where he had applied stable manure he did not see any result whatever. Mr. DeCoster's experience is that you have got to hang onto stable manure anyway. Two experiences entirely different, with the same general treatment of the orchards.

Now when you face such a propostion as that, where two orchards are handled in the same way, one giving decidedly favorable results and the other no results at all, or at best, only negative results where are you when it comes to knowing any better what to do with your orchard? It is no accident that such different results were obtained. I believe there is an underlying principle to the whole thing which explains those results. And to go still farther with these illustrations, Mr. Dawes recommended, so far as he had tried it for his orchard, the Fisher formula. Well and good, I have no fault to find with the Fisher formula where it gives results. "The proof of the pudding is the eating of it." That is well enough. But there is one thing in Mr. Dawes' experience with is formula which illustrates the underlying principle that I am trying to get at. That Fisher formula has a certain amount of nitrate of soda, a certain amount of sulphate of ammonia, some sulphate of potash, phosphoric acid and one or two other things, I believe. Mr. Dawes told you that he applied sulphate of potash to some of his trees and got absolutely no results from it, that he could see, during the year in which he applied it, although he said, I believe, that he was looking for more decided results next year—and I think myself perhaps he won't get them. Now the point I want to make in regard to the Fisher formula in this connection, is that in Mr. Dawes' experience it is probable that the sulphate of potash which it contains is doing absolutely no good, and the special point of value in this fact is that whatever Mr. Dawes applies in the way of sulphate of potash in that formula is just money thrown away, because he is getting no returns from it. Now, why? I may not be making correct deductions from these premises, but I think I can make a suggestion at least as to the meaning of it, which is simply this, that his soil does not need sulphate of potash, and if it does not need sulphate of potash, then you may put it on by the carload and you won't get returns for it. So the principal point there, as it appeals to me, in Mr. Dawes' particular orchard, is that if he leaves out the sulphate of potash and thereby saves considerable expense in making up the Fisher formula, he will be just so much ahead of the game.

Now to revert a little to this other experience which I referred to—Mr. Dawes' experience in using stable manure and Mr. DeCoster's experience—there is a fundamental principle in these facts, and the same is true in regard to hogs or no hogs in the orchard. What caused the difference in the results? As it appeals to me, it was undoubtedly due to the difference in the condition of the soil. If the indications point to what I suspect they do, it is simply that in Mr. Dawes' orchard the soil is in a fine physical condition, there is a lot of humus in it, lots of decaying vegetable matter, all the soil needs in order to give maximum results, and therefore the applying of stable manure, which is of marked advantage mostly because of the effect which it has on the mechanical condition of the soil rather than because of the absolute amount of plant food which it adds to the soil, was not needed in Mr. Dawes' case. In Mr. DeCoster's case, I fancy that the soil may not have been in as good physical condition, and that it needed the ameliorating effect of that decaying vegetable matter, and when he applied it, making the soil lighter thereby, more congenial to the plant or trees growing there, holding moisture better and all the other effects which come from adding humus to the soil—then he got just the results which occurred. Mr. Dawes did not get them because his soil did not need the ameliorating effect due to the applying of the stable manure.

The lesson of hogs in the orchard is a similar one. The New Jersey apple grower referred to, had relatively too many hogs in his orchard and they made the soil so rich that the trees made an excessive wood growth and consequently developed no fruit-buds. It was a case of "too much hog;" a smaller number might have been all right.

Now the fundamental fact underlying this whole question of fertilizing the orchard is simply this: To know just what to apply to your orchard to fertilize it in the most intelligent and the most economical way, you have got to know what your soil requires. If you don't, you will do just as Mr. Dawes is probably doing, apply some kind of plant food which is not required by your soil, and hence be throwing away your money by so doing. I want, however, to make this possible exception in regard to the experience of Mr. Dawes. As I have said, on the surface of things that experience indicates that his soil does not need sulphate of potash. Your plants or your trees must have all the plant food they need in what might be called a balanced ratio. That is, as you all well know, all plant growth requires nitrogen, potash and phosphoric acid. If there is an abundance of nitrogen, potash and phosphoric acid, well and good. But if there is a lack of any one, then your trees or other plants will not get the full value of the others. For instance, if there is a lack of phosphoric acid, then your trees are not getting the full effect of the nitrogen and the potash which the soil contains because the trees require the phosphoric acid in order to make their normal, satisfactory growth. So it may be possible that either more nitrogen or phosphoric acid is needed by the trees where Mr. Dawes applied only the sulphate of potash. It is possible that if with the sulphate of potash he had applied either nitrogen or phosphoric acid, he would have gotten the returns that he was looking for. The only way that could be determined would simply be to make the test, to apply phosphoric acid with the potash, or the potash with nitrogen, and note the results. In that way, and in that way only, could one tell just exactly what the trees need.

Now the notion is very commonly expressed by fruit growers and farmers generally, that a chemist can analyze their soil and tell them just what it needs. I have frequently been asked, in my contact with fruit growers and other farmers, if I can have samples analyzed for them, thinking that if the chemist analyzes their soil that is all they need to know. All the chemists in the wide world could not tell you what your soil needed to make it give the results that you are after, and that is no disparagement to the chemist either! The chemists' methods and the methods of the tree are different and do not give the same result. The chemist can analyze your soil. He can tell you how much phosphoric acid there is in it and how much nitrogen and whatever else he may examine it for. That is good as far as it goes, but he cannot tell you how much of the plant food which a soil contains the plant can get out, and that is where the rub comes with the agricultural chemist. The methods that the plant uses and those of the chemist are different and give different results. That is to say, no methods which are known to chemistry will reveal just how much of any plant food is available to the plant itself by means of the methods which the plant uses in getting that food. The only way you can learn this is to do what Prof. Roberts of Cornell University used to say so commonly to his boys and at horticultural meetings—you have got to "question the soil" and find out in that way. This can be done by making applications of pure chemicals in different combinations, applying nitrogen on one plot, phosphoric acid on another, potash on another, then different combinations, nitrogen and potash, nitrogen and phosphoric acid, phosphoric acid and potash without your nitrogen, etc., and then note results, and you will then be getting down to fundamental principles. A good many people think that the Experiment Station ought to do this. The Experiment Station cannot possibly do it for all who might wish it. The Experiment Station can do just what Prof. Munson is doing at Mr. Pope's, it can conduct a series of such experiments as I have suggested, and note the results, as is being done in Mr. Pope's orchard. Those results are good in this orchard—I think Prof. Munson would substantiate me in taking this stand—but they are not necessarily good in Mr. DeCoster's orchard or in any other orchard unless the conditions of the soil are the same as in Mr. Pope's orchard, and require the same elements of plant food that they do in this orchard. Now these experiments are not a failure by any means, even though they apply only to the orchard in which they are made, no matter what the results may be, for they show the fruit growers of Maine how to find out these things for themselves, and this is the important thing after all. The problem can be worked out in your own orchard, for your own conditions, and in no other orchard than your own. You may be shown in other orchards how to do it, and that is where it seems to me the practical feature of those experiments lies so far as their great value to the fruit growing interests of the State is concerned.

E. H. Cook: But I hope the gentleman who has been discussing this subject of fertilization will forgive me if I make one remark on it, and that is that ninety-nine apple trees out of a hundred in the good State of Maine need everything that ever would benefit any tree in the world. They lack everything. They need your nitrogen, and your potash and your phosphoric acid, and everything else. Perhaps Mr. Dawes may have trees that don't need some of these, but that is the exception. All over this State of Maine the trees need everything. They are just crying for everything that ever benefitted a tree, no matter whether it is a saw or the plow, or any kind of fertilizer. Most of the farmers I think in Maine should be thoroughly impressed with Mr. Plaisted's formula for dressing apple trees,—Mr.

Plaisted of Gardiner, one of the most successful orchardists in Maine. People who knew how he succeeded went to him to find out his formula for fertilizing apple trees, and he gave them one—"Anything is a damned sight better than nothing." Most of them get the nothing.

COMMERCIAL ORCHARDING IN THE UNITED STATES.

H. P. GOULD, Agricultural Department, Washington.

There is so much that I would like to say and might say in connection with the orchard conditions and what is being done in orchard sections outside of the State that I don't know just where to begin, and I probably won't know just where to leave off after I get started. The best thing that I can do, perhaps, will be to try to tell you something about two or three of the important orchard sections of the country with which I am somewhat familiar from personal observation.

THE OZARK REGION.

The first section I want to mention is the Ozark region of Missouri and Arkansas. During the past few years there have been remarkable developments along pomological lines in the growing of apples and peaches. Probably there is no section in the country that has been talked about and written about more in the horticultural journals than this one has. You will like to know, perhaps, something about the general conditions there. You would hardly realize that you were in a mountainous territory so far as the general conformation of the land is concerned, except in comparatively few places. It is more in the nature of a high table land, ranging in elevation from one thousand feet up to fifteen or sixteen hundred and in a few places two thousand feet, with comparatively little evidence of actual mountains, although in some portions the surface is broken up into decided mountains extending in elevation quite a little above the general level. And this is what has been spoken of so commonly in some of the horticultural journals and otherwise as "the land of the big red apple."

The soil is quite peculiar in some ways, I think, to that section. It is rather a loose, porous loam, with considerable gravel and rock in it. The subsoil, which is really more important than the surface soil, is also loose and porous and very deep, and as a rule the soil is quite fertile.

They are doing things out there in the orchard line on a tremendously big scale. The size of the orchards would impress you. They reckon things by forties very largely—it is 40, 80, or 160 acres, and so on, and while there are a good many small orchards of ten to twenty acres, there are a great many of 100 or 500, and there are quite a good many orchards of 800 or 1,000 acres, and some under one management as large as two thousand or twenty-five hundred acres,—not all in one block but under the same general management. The two northwestern counties of Arkansas, Benton and Washington, according to the last census, were the leading counties in the country in point of number of apple trees. Benton county, which was the banner one, was given credit for something over 1,600,000, and when you get that number of trees in a single county, you are getting a big lot of them. Washington county had only about 100,000 less at that time. Since the last census enumeration was made in 1900, from which these figures are taken, very extensive plantings have been made in these two counties, and I presume it is a conservative estimate to say that at the present time there are at least 2,000,000 trees in each one.

Another thing which has been very noticeable in these sections where the orcharding has been developed—and perhaps this may be just a suggestion for the people here in Maine—the price of land has advanced three or four-fold, and in some cases even more. Fifteen or eighteen years ago, when this development first begun, any quantity of good orchard land lying in close proximity to the railroad could be bought for six and eight dollars an acre. Now this same land is bringing anywhere from forty to fifty dollars an acre—unimproved, no better than it was fifteen or eighteen years ago; but the possibilities of orchard development have just simply "pushed up" the value of the land.

I don't believe, either, that they can grow any better apples out there than you can here in Maine.

QUESTION: What varieties are they raising in Arkansas?

ANSWER: There are more Ben Davis, I suppose, than there is of any other one variety, and following in the wake of this variety, there are quite a good many others such as Gano, which, as you know, is similar in many respects to Ben Davis, Missouri Pippin, Jonathan, Grimes, and in those two latter varieties they get their most important ones when it comes to quality; York Imperial is grown a good deal; and Winesap to some extent. Then there are a good many other varieties—Rome Beauty, Huntsman, Smith's Cider, Stark, and others of lesser importance. One would predict from this year's experience that there will be very heavy plantings of Jonathan in the next few years. The weather conditions last spring were very unfavorable to the setting of the fruit, and nearly all of the apples were killed in the blossom. Jonathan blossoms just a little later and they escaped in many cases where most of the other varieties were killed; so that this year out there in the Ozarks, where nearly all the other varieties were failures, the Jonathan produced a fine crop in many orchards of very excellent fruit, and so I fancy that this will stimulate the planting of this variety. It may be well if this is the case, because it is one of decided merit when it comes to quality. It is beautiful in appearance, and the cold storage fruit that has been exhibited at the St. Louis exhibition the past season makes it very evident that it is one of the best varieties to handle in cold storage. Its normal season as grown under Ozark conditions, begins usually by the last of September, and they can hold it without much difficulty until the holidays; but in cold storage it holds up wonderfully well when it is put in in good condition. This past June, in fact I think as late as August, I ate Jonathan apples from that section which had been in cold storage since last fall, and they were apparently just as good in quality as they ever were. Now I would not advise going into the planting of Jonathan on a heavy scale here in Maine until you know what the variety is worth here. I might digress just enough here—because this is going to be a mixed up talk any way—to say that I presume the reason why so many Ben Davis have been planted in this State within the last few years has been simply from the good reports that have come to the growers here from that section in the middle West, and perhaps some sections in the South, where it does bear wonderfully well. It is of a beautiful appearance as you know, and it has more quality in some other sections than can be put into it here in Maine. By the way, that is not saying very much. I do not know but what Jonathan might be relatively as poor in Maine as the Ben Davis is. But still there may be some evidences to the contrary—some of you may have it and know that it does do very well. I want to say incidentally, that a plate of apples on the exhibit table down stairs labeled "Jonathan" is not this variety at all.

Another thing which would impress a New England Yankee out in that section, is the relative size of the young trees. At six or eight years of age they are often as large as trees nearly twice that age in many sections. The oldest commercial orchards are only 16 or 18 years of age, so you will understand that the apple industry here is really in its infancy, and none of the orchards have yet come into full bearing; many of them have not yet borne their first crop of fruit.

HOW ORCHARDS ARE FINANCED AND OPERATED.

Just a word in regard to how some of these great enterprises are financed might be of interest. I do not suppose that any two of them are financed in exactly the same way, but, of course, it costs an immense amount of money to get that land and to get an orchard into bearing condition, especially if the land has to be cleared for this purpose, as is often the case. Many of these large enterprises are stock companies, with a comparatively small number of shareholders; many, too, are merely partnerships and some are purely individual efforts. I will take one specific instance that I have in mind. It is one of the largest companies, operating the most extensive orchards in that whole Ozark territory. They have planted in three different places something like 2,500 acres. The company has a general manager. The manager goes to the orchards as often as he thinks it is necessary, perhaps once a week, perhaps once in two weeks, the frequency of his visits depending largely upon the season of the year. At each one of these three places they have a foreman who is the local representative of the company, the man who actually directs the work in the orchards, and who has the management of the crews, and executes the orders of the manager.

When I went out in this section the first time, which was a year ago last June, I expected to find every orchard a garden, every orchard just in the pink of condition and all that, because I had heard so much of this Ozark territory that I did not suppose there could be a neglected orchard in the whole region. But when I got out there, I found that the fruit growers were very much like the fruit growers in every other section I was ever in. Here and there you find an orchard that is kept in just ideal condition, but when you see one orchard that is kept in this condition, you will see anywhere from one to a dozen others that are decidedly neglected. I think perhaps apple trees will stand more neglect out there than they will in some other sections because the soil conditions, the climatic conditions, in fact the whole environment of the trees, seems to be kindly disposed toward them and they make, as you have seen, a very large, vigorous growth, so that the most careful, exacting care is not so necessary as it is in some other sections. They usually cultivate the young orchards for four or five years, growing in the early years of the orchard some interplanted crop, as corn, and then later on when they begin to bear they will seed them down to clover, usually, and plow them up perhaps for a time every other year, but by the time they get to be ten or a dozen years old they are quite inclined to seed them down and let them so remain. I am not sure but what that method is best there. It is simply the application of a principle. If you are after some definite result and can get that result by not cultivating, then there would be no object, of course, in cultivating. The soil retains moisture pretty well; as a rule they have a sufficient amount of moisture and on account of the very rapid growth which the trees make, I presume if the very best tillage, clean cultivation, was given year after year, they might in many cases force the growth of the tree so fast that no fruit buds would form.

THE SURPLUS PRODUCT.

It is interesting perhaps in passing just to notice some of the ways in which they take care of their surplus product, or their second grade fruit, or their culls. All through that section there are a great many evaporators. Many of these are merely cheap wooden buildings with a capacity of 75 or 100 bushels of fruit every 24 hours; others are more elaborate brick structures having a capacity of 500 and even a thousand bushels every 24 hours. Most of the smaller ones are owned by the orchardists themselves and operated in conjunction with their orchards as a means of disposing of their poorer grades of fruit. As a rule, the larger ones are managed independently of any orchards, the owners buying their stock for evaporating from the growers.

While most of the fruit is packed at the orchard where it is grown, some of it, particularly the earlier varieties of apples, is brought to central points, usually some large packing house at a railroad station, where it is handled by local buyers and shipped mostly to southern cities; large quantities of these early apples go to Texas,—Dallas, Houston and some of the other large cities of that state being important points of distribution. Apples generally bring a good price when so handled.

Southwestern Missouri and northwestern Arkansas is also a great strawberry growing region. Some growers have as high as 75 or 100 acres devoted to this purpose. Nearly all of the fruit is handled through local strawberry growers' associations, the growers in the vicinity of any one shipping point constituting the association in that locality. The grade of packing is maintained by inspectors who make rigid examination of all the fruit as it is delivered for shipment. By combining in this way, the fruit is shipped in carload lots, thus saving in transportation charges, and the officers of the associations keep in the closest possible touch with the markets so that the distribution of the fruit is made with view to the demands and conditions of the various points of distribution. The most of the fruit goes to northern cities, such as Des Moines, St. Paul, Minneapolis and other large places. Smaller quantities are also sent to western points, especially to Denver.

VIRGINIA AND GEORGIA.

While I have gone over these points very hastily relative to the Ozark region, and there is a good deal more I would like to say, I must hasten to refer to another fruit section of considerable importance, and one capable of great developments in the future. This is the Piedmont and mountain regions of the southern states from Virginia to Georgia. This region comprises a comparatively narrow strip of land east of the Blue Ridge Mountains and extending their entire length, and also the eastern slope of the Blue Ridge itself with the spurs which project out from the ridge proper. The soil of the Piedmont area is characteristically a red clay or clay loam, with many variations, especially in the amount of clay content, and has an elevation of from 500 to 1,000 feet; the mountain soil is very variable, ranging all the way from a clay to a loose sand, but is usually deep, friable and rich, containing large quantities of humus. The elevation of the land devoted to orcharding is seldom over 1,500 to 1,800 feet, though a few orchards are located at points approaching 2,500 feet elevation above sea level. One orchard in western North Carolina has an altitude of nearly 4,000 feet—the greatest elevation of any orchard east of the Rockies, but this orchard is not within the limits, properly speaking, of the territory in question. The mountain region of these states is where many of the far-famed Yellow Newtown apples are grown—or as it is better known in that section—the Albemarle Pippin. Much of this mountain land is not of much value for general agricultural purposes, but it is admirably adapted to the growing of fruit, especially apples. Peaches are grown, however, to some extent, on the mountains, and, as a rule, do well with a careful selection of varieties.

The Piedmont section of this area is well adapted to apples, and many orchards have been planted, though the most of them are rather small. The Winesap is the most important variety for this section. The red clay or red clay loam produces very fine fruit, other things being equal.

As a rule, the orchards are in a rather neglected condition, the same as they are in most other sections the country over. Much of the soil washes badly unless carefully managed; in some of the mountain orchards, terracing is practiced to prevent washing and the rows of trees are along the contour of mountain slopes, rather than in straight lines.

The conditions are much the same throughout this whole piedmont and mountain area. In some sections, the possibilities are being realized, and considerable planting of orchards is being done; in other portions of the area, no advantage is being taken of the opportunities thus provided by nature. Some of the most interesting apple orchards are in northeast Georgia, but these are on a small scale, while the peach orchards are numerous and extensive.

THE PRODUCTION OF EARLY VARIETIES.

I wish to refer now very briefly to another phase of orcharding which has been developed to quite an extent in some portions of Delaware, Maryland and New Jersey; to some extent also in other places, but it is mostly a very incidental development in these other places. In the states named, it has become quite a well defined feature of fruit growing. I refer to the production of early apples—those ripening from the middle to the last of June up to perhaps the middle of August. It will suffice to say now that the growing of this class of apples is not essentially different from the growing of the later kinds, but the fruit is handled quite differently. The trees are picked over several times as the fruit ripens, and the apples are shipped in baskets or crates the same as peaches are. In fact, the methods of handling the fruit are quite similar to the handling of peaches.

(During the course of these observations, the speaker exhibited a large number of photographs illustrating the conditions in the various sections that were referred to.)

FAVORABLE CONDITIONS IN MAINE.

By R. H. LIBBEY, Newport.

I do not come before you as a public speaker, as an orator,—but simply as a practical farmer, nothing more. It would be useless for me to undertake to make a speech even if I had prepared one. I couldn't do it. So I simply come before you in the interests of this organization. I have been a member of this organization for several years and ever since I joined the society I have done everything in my power for the building up and uplifting of this society. We are farmers together. We are here as agriculturists, as orchardists, and we are here to talk over how best we can improve our orchards, how we can get the most and best results out of them. That is what we are here for.

Now a lecturer from some other place could make a great deal better talk than I can, but I have my ideas. I was forced into the cultivation of fruit from circumstances which it is perhaps unnecessary to relate at this meeting, but it was through force of circumstances. My father was a farmer, and when I came onto the farm following him, which I seemed obliged to do, I followed along hauling the same cart in the same ruts that he had, and the ruts had got deep,—the hub of the wheel rolled on the ground. I stood it for a couple of years and then I said: "The bank account is growing short. What are we going to do? There is no money in farming this way." "There is no trouble in the farming but your expenses are too much." Now that was encouraging to a man who had just come onto a farm to tell him his expenses were too much. I didn't see any way—I didn't know any way to curtail. I had lived amongst folks and the same as they lived. I couldn't curtail. I said to him: "How would it do to have a little more income and not try to curtail?" He didn't see how I could do it. "Well," says I, "I shall haul that cart in the ruts that you have hauled it in no more. I am done. I am going to strike out into a new business." "What are you going to do?" "I am going into fruit culture, something that I think there is a dollar in." And I did. It was then that I commenced and branched out and went into fruit culture. I remember distinctly how my father used to smile when I would make a failure, and I made them—I made lots of them. At that date we didn't have all over the State of Maine the Order of the Patrons of Husbandry, which is one of the best, if not the best organization that there is in existence for a farmer, for an agriculturist. We have meetings weekly, once in two weeks or monthly and go and talk of our business pertaining to the farm and the orchard and the garden. We didn't have those, or if they did, I didn't know anything about it. It was feel my way along. If some paper dickey dude came along and told me that a dwarf pear would bear sooner than the standard, and I bought it, and the next year I discovered it was budded on a quince root and the quince root wouldn't live in this country—I had bought that, paid for it, had that experience—I knew after that. Now we go to the meetings of the Grange and talk these things over; they will tell you these stories because it is in the interests of the organization to talk over such things. I didn't have them. But I went on in that way and I bought my education. I paid for it. I succeeded after a long time; had a hard struggle, but succeeded in getting into varieties of different kinds of fruit until I have made something of a success.

Now cultivation, lots of things, have been talked over here about orcharding. Bro. DeCoster knows more about orcharding than I do. He has experimented. The little fact that he told you, that he bought the plot of land where he set the trees for $300 and it was now worth $1,000, is significant. That may be the case all over the country if men will do it. He never did that by sitting on a nail keg around the stores and smoking a T. D. pipe. He never got it that way. He had to get up and get, and look out for it and know it was cared for—fertilizer was put on the plant and it was taken care of and sprayed and everything done just about right to have it grow. With every other business it is just the same.

I followed along one thing after another, and many times I have had large plats of strawberries and other fruits, of plums, of pears, of blackberries, currants and gooseberries. Now I am running largely to currants and gooseberries, because many of these other fruits like strawberries have to be set every year, and then have to have a man down on his knees pawing around, digging out the weeds, a good deal of the time, while gooseberries, if properly set at the right distance apart, a large part of the work is done by a horse.

Then the beauty of it is when it comes picking time you can have lots of good looking girls around picking the fruit—I enjoy that, nothing better. Pick the fruit, then ship it off and get the money. I had last year 150 bushels of this kind of fruit—nice little income—brought me from 10 to 12½ cents a quart wholesale.

Now I am not going to weary you,—I am not going to talk but a few minutes,—I shall get run down. It is so with the farmer, anything that he starts into, anything that he feels interested in. Now I wouldn't advise any man who would kick a sheep to go into sheep husbandry, neither a man that despises a hen to go into the poultry business. You have got to love the business that you are in. And if there is anything that I enjoy, it is the growing of nice fruit—all over your farm beautiful fruit growing, and you think of the income that is coming back to you when you gather it, and the enjoyment there is in gathering. I once heard a man say that if there was anything he disliked it was peddling fruit. Now if there is anything that I ever enjoyed it was the peddling and selling of fruit. Why, he said, you had to go to the back door and the servants would come to the door. Nothing pleases me better than to go to the back door and have the maid come out in the morning and know that she is a good looking girl. I enjoy that. The man that owns the premises pays. You can stop and have a nice little chat with her, and go to the next one, and it is really a business you can enjoy. I enjoy it very much. And other things are just the same—I mean, other business. I sold a man, a lawyer, a plat of land. He commenced there in Newport two or three years ago and his business was down, and he was an energetic man, he wanted to do something. I advised him to buy a plat of land. Of course we real estate fellows advise everybody to buy that has got money—nobody but what has got money—and he bought this ten acres of land out about a mile from the village. Five acres of it was worthless; it was so full of stones that sheep would want their

Orchard of Cyrus Fenderson, Wilton. Spring of 1905.

noses steel pointed to get them down. About four acres of it was nice land, and he had that plowed, planted, cultivated and sprayed and dug by an Aroostook man that thoroughly understood his business—and there wasn't a weed in it, it was clean—and from that four acres he told me that he had harvested and had in his cellar 1,174 bushels of potatoes, which at fifty cents a bushel paid for all his work, fertilizer and land the first year. Why do we farmers sit around and grumble and say we can't do anything farming? It is because they don't do anything and won't do anything. Any energetic live man can do something. A short time ago a man at my house from Washington state said he had just bought fifty acres of land. He said: "I am going to set every single acre out to trees, and cultivate it and do nothing else but take care of it, and that is for my bank account in my old age." What did Dr. Twitchell do when he thought he was failing up in the office down at Augusta?—went and bought a plat of land with an orchard. "What are you going to do with that?" "For a bank account in my old age. It will give me an income superior to any other investment that I can make."

Now why should we say that anything don't pay? It is because we don't drive our business as we ought to; we don't work it up; we don't do what we might; we are slack; we are not energetic enough. Look at the resolutions passed here. What will they do with them? They will drop them, crowd everything onto a few men without a dollar to do it with. I say we should get together as orchardists all over the State of Maine and see if we cannot bring up the standard of our fruit. And we can if we are a mind to.

PROFITABLE FRUIT GROWING IN MAINE.

By E. H. Cook, Vassalboro.

Mr. Smiley in Vassalboro about sixty years ago set out an orchard, and beginning when it was seventeen years old he received an average of $500 a year from three acres of orcharding every year for thirty years. In thirty years, from three acres of orchard, without cultivation, pastured to sheep, he received $15,000. And he has got the most of it now.

I am well acquainted with a man who is now alive and in active life, and likes a dollar just as well as he ever did, who set Baldwin trees since he was sixty years old and has harvested eight barrels from a single tree—planted after he was sixty years old and he is still in active life.

Albert R. Ward of China bought, ten years ago, 100 Ben Davis apple trees and has cared for them since in a rotation of hoed crops and clover—two hoed crops and one of clover. He has mowed it one-third of the time. After getting this crop of clover he would plow it. He has successfully raised that rotation of crops on the piece of land, got just as much out of those crops as he would if there had been no trees there; gave $20 for his 100 trees ten years ago, and it cost him something to plant them. Those trees have cost him nothing since except they have been in the way a little in tilling the land and raising hoed crops and clover, because he is going to get returns from his hoed crops and clover. Now after the trees had been planted several years he discovered that Ben Davis were not good for anything, and he started in grafting and grafted twenty-five to Baldwins. Why he stopped I don't know, but that is all he grafted to Baldwins, twenty-five. That left him seventy-five Ben Davis trees. By the time those seventy-five Ben Davis trees were ten years old he received more than $400 in clean cash from the apples; and he has not received one dollar from his Baldwin trees.

A man by the name of Lord up in Charleston, Penobscot county, had, quite a few years ago, a fine young orchard—pretty extensive for this land of little orchards,—and they had come to bearing and borne a few years and he heard that Ben Davis were no good and he decided to graft them over. But just before he did he thought he would think over how he had got along so far, and he found that the one-fourth of his apples that were Ben Davis had yielded him more than three-fourths that were not, in that orchard, and he let them be and they are all right yet.

From six-year-old Wealthy trees a barrel to the tree has been harvested, showing that a man who can comb his hair with a towel may still set out apple trees and get the result before he dies. From six-year-old trees the husbandman harvested a barrel to the tree.

I have apple trees on my farm that were set in the spring of '97 that have borne two barrels to the tree. A patch of apple trees that I have in mind over in Vassalboro—of about forty trees—has borne four years in succession, has never rested, and borne very heavily.

Charles Moore of East Vassalboro has a Spy orchard, an orchard of Northern Spy trees of about fifty to sixty trees, that have borne hundreds of barrels in a single year, and borne every year for the last seven years. He is a butcher by trade and has a good deal of fertilizer from his shop, and he puts that on and everything else he gets hold of, and he don't know whether there is any nitrogen in it or what there is; but he knows there are apples at the end of the year. He gets Spies that will weigh those tall trees down clear to the ground, and packed on there as if it were one continuous wall of apples,—year after year in succession, on the same trees and on the same limbs of the trees. And they are mostly Spies, but he has other varieties that do equally well.

On a four-acre patch of orchard two years ago last spring I began to put phosphate, and last year I got a good crop of apples, and a good crop of apples from the same trees this year,—two years in succession. It was dressed with high grade phosphate at the rate of about a ton to the acre, just put right on and thrown away as most folks would have thought. It wasn't tilled. Pastured to sheep. So that I have come to believe that orchards will bear every year if they are fed enough. In fact the orchards in western New York do bear every year, as many men know to their sorrow. Now in western New York there are more apples than you can think. If you were told how many apples there were in Niagara county, New York, today you would not be any wiser for it—you could not comprehend such large numbers. You ride there in an express train for hours and see nothing but orchards. One tree in western New York that I happen to know about bore eighteen barrels one year and twenty-one barrels the next, and it is no uncommon thing for them to get twenty barrels of Baldwins from a tree there. The apples in one orchard sold for $14,000 on the trees. In another orchard, near Rochester—twenty-eight acres—the apples were sold for $21,000. I don't know but what I shall be getting into the situation of the circuit minister who went to North Carolina preaching among his own people, his own denomination. He stopped at an old farmer's and went out with him—this farmer was an elder in the church—went out with him into his barnyard, was walking around and noticed him milking a half a dozen cows into one pail. This minister was from New Hampshire. He says: "Is that all the milk you get from those half dozen cows?" "Why, yes, it is." "Why, one of my cows would fill that pail." Well, the old elder had nothing much to say to him for a little while. Finally, after they had talked a while he told the minister he thought he had better move on. "Why, is there anything wrong about my doctrine?" "No, thy doctrine is all right, but no man can preach acceptably in North Carolina and tell such cow stories as thee does."

There are, beside these instances that I have told, plenty of orchards of the early bearing sorts in the vicinity where I live that pay for themselves by the time they are a dozen or fifteen years old. Now if that was all there was to it, it wouldn't look so large, but you have an investment in an orchard and it pays for itself when it is a dozen years old—your orchard is just as valuable as if it hadn't borne an apple to that time because it is going right on to its bearing age. The growth of your trees is worth a dollar a year if you keep them growing. If you don't grow them any it isn't worth anything, but if you keep the trees growing, the growth of a tree for one year is worth at least a dollar—the tree will be worth ten dollars when it is ten years old. I think that is making money faster for the capital you put in than it would be if you were selling rum or any other occupation that you are a mind to go into—there are drawbacks to all those things. There is no drawback to orcharding.

By L. H. Blossom, Turner.

I wasn't in here at the opening of the meeting. If I had been it might have given me a little clue as to what to say. If I am going to say anything on orcharding I shall have to tell you just what I have done, and that isn't much anyway and wouldn't be very interesting. Some twenty-five years ago I set out three or four acres of orchard. Some of my neighbors thought I was a little crazy, and perhaps I was that I didn't set out more than I did. There was one thing that I kept out and that was the Ben Davis tree, I did away with that. By accident I got two trees. I have taken as good care of them as I could from that time up but I have never received any profit from them. They never bore me over two barrels apiece a year since I set them out and they are nice large trees at the present time. But the Baldwins that I set out at the same time have been profitable trees to me and under the same treatment, on the same soil, in the same orchard. There has been ten dollars in a Baldwin where there has been a dollar in the other. I started out with the idea that perhaps a good many have, that I wanted all the varieties that I could hear of. I got them as far as my purse would allow me to and time and room would permit; but I soon found that wasn't what I needed, and I cut the tops off and put in Baldwins, believing that was the best variety that I could use. And as a market apple, perhaps I wasn't far out of the way.

I believe in cultivation, thorough cultivation. I never looked out for the nitrogen, potash or phosphoric acid particularly, but dressed it heavily with barn manure and kept them growing, and the results have been all right. I think they have found some nitrogen in what I have fed them with. But by accident I got in a few varieties that I bought for Baldwins and they proved something else, and among these varieties was the McIntosh Red, and if I had only made the mistake in setting out all my orchard of McIntosh Red I might have been a millionaire now, but I am far from it. If I were to set out any fruit orchards in the future I should set that variety. What we want is the variety that there is the most money in. That is what we want. Now what would suit me perhaps would not suit you. Neither a chemist nor any other man can tell you what variety of apple will do best in your soil. All the way you can find out is by trying, by experimenting. I have tested that apple enough so as to know that it is the apple I want, and the profit in it is all right. There is no apple on the market today that can sell anywhere with it. I sold my McIntosh this year in Boston for $5 a barrel. The Baldwins are in the cellar begging for almost any price. Kings, such as those, I sold for about half of what my McIntosh brought. The McIntosh is on the boom and very many will go into it and meet with failure. I know they will. When they first come into bearing they don't do very well,—they grow poor, spotted, scabby, cracked. I started to take the tops off of my trees and put in Baldwins the same as I had others, but by some good luck I missed it, I didn't do it, and the result has been just what I wanted. And I find that the case with very many that I have talked with. Quite a number here have said they had grafted them over, and on inquiring of them how long they kept them in the McIntosh they said about three years. Now if they had kept them five years I don't think they would have grafted them over, I think they would still have been bearing McIntoshes.

Now after you raise apples, the question comes up, What shall we do with them and how shall we get rid of them? How shall we pack them? How shall we ship them, and in what manner? I believe we have been making great mistakes in the past in selling our apples to the apple buyers that come along, and we, being anxious to get in all we can, why, we put in too many of the poor apples, and the result has been that our apples have gone abroad and very many of them have been poor apples; whereas if we had thrown away half of those apples we would have got more money than we did.

Now as to packages, especially last year in my section of the state anything that would hold apples was all right. Well, now, I believe it was all wrong. Cheap barrels are not fit to pack apples in to ship abroad. The package has something to do with it. The better the package the better the apple will sell. Now a good many last year used what we call lime casks—they were not exactly that but made after that style, of soft wood. Well, the apples sold for twenty-five to thirty cents less per barrel. Now this year barrels were high, 40, 42, 45 cents my way, and I have been shipping in boxes to the Boston market,—half barrel boxes. Nothing that I have sent yet has sold for less than $1.25 a box and from that to $2.50 a box. Now some one was asked the question here this afternoon if he was willing to have his apples examined, and he said "no," they might examine the other fellow's but he didn't want them to his. Well, now, they can examine mine. That is just what I would like to have them do. Pack nothing but No. 1 apples. It costs just as much for boxes for your poor apples, freight is the same, commission the same,—and the profits nothing. Keep them to home, feed them to your stock, give them to your poor neighbors,—do anything but put them on the market, and ship No. 1 apples, extra No. 1 apples, and I believe there is no business on the farm that would pay like orcharding.

By Secretary KNOWLTON.

I am very glad indeed to have so much brought out upon this subject. Every now and then gatherings in the State are interested in booming some special interest, the game interest, and the dairy interest, and so on. Well, now, it seemed to me that it was entirely proper for us here today at this meeting to try and boom the orchard interests of the State, and I am very glad indeed that the discussion here has taken the shape that it has. It is just what I hoped.

I was very glad indeed to hear what Mr. Gould told us about the orchards and the fruit in the far West and the Southwest. You may ask the reason why. The reason is this, that while we may not generally recognize the fact, yet the fruit grown there is competing with the fruit which we grow here in Maine, and strange to say, when it has come to fancy fruit for the last three or four years I think I am safe in saying that in the New York markets the fruit grown on the Pacific coast and down in Virginia and that region has sold for more money than the fruit grown in New York state. That may be too broad a statement to make, but certainly it is quite largely true. Why, two years ago at one of our meetings we wanted some samples of fruit that was selling in New York packed in boxes. We sent there and got a bushel case of Oregon Spitzenburgs. They cost us there $4.50. At the same time Maine apples which were incomparably superior in quality to these were going begging for customers. I don't know whether Bro. Cook has any of the quotations given him or not, but if he has I think he would tell you that the Newtown Pippins and some of the varieties grown away over in California, and south in Virginia and there where they are raising those apples, are selling at the Liverpool and London markets for more money than our Baldwins. Why is it? The Newtown Pippins may perhaps be better than our apples—perhaps they are—I won't say anything about that, but the Oregon apples and the apples grown over there in the Pacific states I don't believe are so good as ours; and the reason for the price is that they are putting more style in the packing of the fruit, etc. But the point I want to make sure is that we understand that those people out there are competing with us, and that we—if in their immense way of doing things can raise apples and outsell us in the market—there is no reason why we should not rouse up to the idea, or to the fact which has been demonstrated here today, that on a large scale—I don't care how large—the opportunities lie for us to go into commercial orcharding extensively, not in a small way but extensively. At the same time it is perfectly right and proper, and I hope it will continue, for every man who can in a small way to do what he can.

Not a great while ago Mr. Atherton told me that his orchard had averaged him $1,000 a year for five years. I don't know what he will get for his apples this year but he has got 1,600 barrels this year. I will warrant he will get more than his average this year.

VARIATION IN APPLES.

By H. P. Gould, Agricultural Department, Washington.

It gives me a peculiar pleasure to meet here with you at this time, for I have a sense, in so doing, of returning unto "mine own," notwithstanding the fact that this is the first meeting of your society which I have ever attended. I pity the man who could forget the state wherein his boyhood days were spent, and, though some years have now passed since I went forth from her borders to be adopted by other states in turn, I still speak of Maine as *"home."*

I have chosen as my subject for discussion a phase of the "variety problem," which, for the want of a better designation, may be called "Variation in Apples." I do this, however, fully aware of the difficulty which one invites when he attempts to say anything about varieties.

That there is any "problem of varieties" is comparatively a new notion in pomology, but during recent years it has been a subject of frequent discussion, but it seems to me that this discussion has not been to any fundamental purpose in most cases. To know that a variety does thus and so in some particular state, or county, or town, is not enough, and yet this is about as far as most of the discussions and observations have carried the matter. The behavior of a variety has but little significance until we are able to interpret that behavior in terms of the conditions under which the variety in question is grown. Let me say, in passing, that one of the specific lines of research now conducted by the office of pomologist of the United States Department of Agriculture is an effort to work out, in systematic detail, the adaptability of different varieties to different conditions, and conversely, to determine just what the influence is upon varieties, of the various conditions under which we find them growing. This line of research is officially designated as "fruit district investigations," and it is in connection with one phase of these investigations that some of you are giving willing and much appreciated co-operation. While I may not be able to set forth at this time much that is fundamentally new in this connection, I wish to call your attention to some of the significant features of this phase of pomology.

As competition in fruit growing becomes more intense, it is necessary to make finer distinctions in every way—to consider matters from the special, rather than from the general point of view. The fact that a variety is not an entity in itself, fixed and invariable, but is, rather, in a large degree, the result of the conditions under which it is grown, is becoming more fully recognized each year, and of increasingly great moment in commercial orcharding. It is the basis of the oft repeated question, "What varieties shall I plant?"—a question easy to ask, but often exceedingly difficult to answer in a safe and intelligent manner.

In the earlier days of orchard planting but little regard was paid to this fact of variation. If a man recommended "Baldwins" to his friend in Virginia, that was sufficient reason why the Virginian should plant "Baldwin," heedless of the fact that the conditions of the Southland would manifest themselves in the behavior of the apple. As a matter of fact, there are many trees of this variety growing in the South. I will tell you later something of the idiosyncrasies of this variety as they appear under Southern conditions.

It would be interesting to follow the mutation of varieties from the viewpoint of the evolutionist, but it will be more to the purpose of the commercial orchardist to consider the subject in its more practical bearing. To one who is carefully observing varieties which are grown under widely different conditions, the remarkable departure from usual types is a most conspicuous feature and often a most puzzling one as well. Frequently, the variation from usual forms is so great that the identity is nearly obscured and no doubt, oftentimes, completely so.

There are many agencies at work which conspire to produce these variations concerning which we are speaking. They may all be summed up, however, in the one category of "environment." If we should attempt to analyze and classify these agencies, it is safe to assume that the most of them would come under two headings, namely, soil and climate, of which the latter is the more important in the present consideration because more nearly beyond the control of man's power. In the final analysis, these two general headings, soil and climate, would admit of almost endless division and subdivision into the elements of which they are composed, each one of which may be assumed to have its own peculiar influence in the behavior of all forms of life coming within its domain.

In our analysis of these more important agencies of influence, we might include another factor co-ordinate with soil and climate, namely, elevation, which I consider to be one of the most potent factors of all in its relation to the behavior of varieties, but as elevation has so much to do with determining the climate of a place, its influence can well be considered under this caption.

I have intimated that the soil factor is practically less important than some of the others because of its susceptibility to amelioration by the hand of man, though, considered apart by itself, no one could gainsay the fact of its intimate relationship with, and influence over the behavior of the fruits grown therein. Let us consider briefly what some of these influences are. It will bring this matter clearly to mind if it be stated that in order for any soil to give satisfactory results for the growing of any crop, three fundamental factors are essential: A sufficient amount of available plant food; a certain amount of moisture; a proper physical condition of the soil. The practical application of these tenets readily follows, and requires only a passing notice. The small, knotty, and in every way inferior apples that are produced by trees that are growing in impoverished soil are a familiar sight to all, and the corresponding improvement which comes from the requisite application of plant food is as well known, though perhaps not so commonly observed. The effect of too much or too little moisture is seen on every hand. Sometimes this is due to climatic conditions, but I am referring especially to soil moisture, which, to a considerable extent, is independent of climate. In this sense, a condition of too great moisture content is, perhaps, more common than the other extreme, as is evident in the case of land which is poorly drained. The evil influences of soil lacking humus, or of improper physical conditions due to other causes, all manifest themselves in much the same manner in their effect upon the crop, producing small, imperfect specimens, generally of poor quality.

The remedy for such variations from better standards, as induced by these soil conditions, is not difficult to state, in principle, though it is not always an easy matter to fertilize, to dispose of excessive moisture or to ameliorate the physical condition of the soil in the manner necessary to secure the results most to be desired, yet we should learn to recognize the influence of such conditions in their effect upon the variation of the varieties which we are growing when we see the same varieties being grown by others and giving them much better results than we are getting, and if we can correctly diagnose the cause of the undesirable variation, its remedy, oftentimes, is readily forthcoming.

Again, relative productiveness is often a noticeable variation. A variety produces abundantly in one place and is a "shy bearer" in some other, with no apparent reason for it. May I suggest that a lack of fertility often accounts for such results. A single example will emphasize the assertion. In one of the mountain orchards of Virginia which have been under my observation for several years there are a large number of "York Imperial" trees. A few years ago the owner applied South Carolina rock to a few of them at the rate of 400 or 500 pounds per acre. The next year, which was the "off-year" for this variety, the trees which had received the South Carolina rock blossomed very full and produced a heavy crop of excellent fruit, while the other trees not so treated did not even blossom. The effect of this treatment lasted for a number of years; the trees bore more regularly, more abundantly, and the fruit was finer in every way. As the treatment was the same in every other respect, aside from the application of the fertilizer, there can be no doubt but that this variation from alternate bearing to annual crops was due to the added plant food. Indeed, such a variation is a very material one. I must hasten to say, however, that it does not necessarily follow that similar results will always appear from the application of South Carolina rock, but in this particular orchard it seemed to be just what was needed.

The nitrogen supply of the soil is a potent element in producing results which are readily noticed and which are sometimes unexpected and undesired. The excessive growth of trees in soil rich in nitrogen and the poorly colored fruit grown thereon are matters of common observation. The relative time of ripening of fruit grown under such conditions is worthy of incidental notice. I know one apple grower who tells me that he can delay the ripening period of his apples three weeks by the amount of nitrogen which he supplies. The practical bearing of thus being able to influence the behavior of an orchard needs no argument to establish the fact.

These phenomena to which reference has thus far been made are matters of almost every day notice, but perhaps the fact that they are very largely under the control of the orchardist requires that attention be especially directed to it, by way of emphasis.

There are other ways in which the soil may cause great variation in apples of the same variety—ways that are more subtle and less readily defined and less apparent, at least to the casual observer. In the cold storage investigations that have been conducted by the office with which I am connected in the Department of Agriculture, the fact has been developed that the soil may influence, very decidedly, the keeping quality of apples. For instance, the same variety grown on light sandy soil is not likely to keep nearly as well as the same variety grown on a heavier soil. The same thing seems to be true of apples from young trees, even on heavier soil, or from older trees if the crop is very small. These last two tenets throw some light on the first assertion, namely, that any condition of soil or tree which induces a forced and rapid development of the fruit is likely to produce fruit in which the life processes run their course in a relatively short time; hence, the tissues of the fruit break down and decay sets in. In other words, these differences in soil conditions produce physiological variations of the fruit which may not appear until comparatively late stages in its life are reached.

Then there is the question of quality. We all know that a variety grown on some soils may possess a flavor much more pleasing to the consumer than the same variety grown on some other soil. Now you are wishing I would tell you just what to add to your soil to produce fruit of the most delectable flavor. I wish I could do it, but I can't, and probably no one else can do it. We are inclined to attribute such differences to some mineral constituent which one soil possesses and the other does not. But questions of quality and flavor belong to a realm but little understood.

Turning now to the effect of climate as it is expressed in the variation of varieties of apples, (and we may also include likewise all other forms of plant life) we begin to deal with influences that are not so well defined in their effects and are less tangible than the influence of soil. We can handle the soil and see it; in its material form, it seems to be a part of us. But with climate it is otherwise, and its effects are often mysterious to a wonderful degree. But we want to think of these effects for a few moments in terms of plant life, and especially in their ability to produce variation.

What is climate, anyway? We speak of the weather of today, or of last week, or of some previous year, but we do not talk of the climate of last week. The climate of any place has been described by the chief of the weather bureau, U. S. Department of Agriculture, to be "what may be expected to occur as the result of the study of its continuous weather records for a long period of years,—the atmospheric pressure, the temperature, the rainfall and snowfall, the time and frequency of frost, the extremes of heat and cold, the direction and velocity of the wind, the amount of air that flows from the different points of the compass, the amount and intensity of sunshine, the humidity and transparency of the atmosphere, and its electrification." * In other words, the climate of any place is the sum-total of the weather of that place for an indefinitely long period of time. The same authority also broadly divides climates into marine, continental, mountain, and plain, with the many variations produced as these conditions gradually or precipitately shade off the one into the other.

From the above analysis of climate into the various elements which constituted it, it is obvious that the influences which it exerts must be manifold in the extreme, for as we consider the different elements which go to make up the climate of a place, we cannot escape the conviction that each one must be potent, in some way, in forming the characteristics of the fruit grown under those particular climatic conditions. If we view the matter with any sentiment at all, when we consider all the varied climatic influences, together with the many complications of the soil factor, we may be led to exclaim "How does any variety or any form of plant life whatsoever know how to act or what to do with all these varying forces trying to influence it their way?"

* For a more extended discussion of climate by same author, see this subject in Encyclopedia Americana.

Is there any wonder that we sometimes see astonishing variations? As a matter of fact, this view of the case is not all sentiment, for the problem of what any particular variety will do under any set of conditions of soil, climate, etc., is just the problem that we are trying to solve.

It is generally accepted that the most important feature in controlling plant life is the relative distribution of temperature and moisture from month to month during the year. The logic of this reasoning finds abundant support when we compare the climatic conditions of Maine, for instance, with those of Florida as they find expression in terms of plant life. Most of the hardy plant forms which are indigenous to Maine require the rest imposed by the cold of winter, and, if transferred to Florida, where no such rest would be induced on account of the very mild weather during the winter months, the results would be disastrous to the plants in most cases. Needless to say, the transfer of the tender vegetation of Florida northward into the colder regions would be equally destructive. The same thing is true, though for different reasons, if a similar transfer should be made between plants of a humid and an arid or semi-arid climate. In such transfers of vegetation, of course, there might be all gradations from conditions of one extreme to those of the opposite, producing corresponding variations in all plant life.

I stated earlier in this discussion that elevation might properly be considered in connection with climate because of its influence in determining the latter. For instance, an orchard having an elevated location may escape injury by frost when another one, at a lower altitude, might be severely injured thereby. A difference in elevation, too, often makes a noticeable difference in the blossoming of the same variety. This is doubtless associated with the relative temperature at the different elevations. I have no definite data relative to this point concerning apples, but some interesting facts have come to my attention as developed in a West Virginia peach orchard. This orchard is on a steep mountain side, facing southeast; the slope and soil are uniform; the lower side of the orchard has an elevation of 1,700 or 1,800 feet; the upper side is some 300 feet higher. On the lower side, a variety usually blossoms from two to three days before it does on the upper side; there is also a corresponding difference in time of ripening. As nearly as I can get reliable data, an elevation, in this particular orchard, of each 100 feet makes a difference of about one day in the development of the fruit from the blossoming to maturity. I have some temperature records which indicate that there is a perceptible difference in temperature, the upper side being the colder. I ought to state that this orchard is above the usual frost line. When it is cold enough to do so, it freezes, but frosts are almost unknown.

Such differences as the ones last mentioned are often observed between the same variety growing on different slopes, a southern slope being relatively earlier than a northern, but here the differences are doubtless really climatic ones, the rays of the sun being less direct and less intense on the northern slope, hence a lower temperature.

But, as in case of soil influences, so with climate—there are subtle and mysterious ones producing certain variations from all usual types which are generally accorded to climate, but which, at present, admit of no satisfactory explanation, neither is it permitted us to say what particular element of the climate is responsible therefor. We must, for the present, merely accept the fact. For instance, many varieties of apples which are normally round, in cross-section, become distinctly pentangular when grown in some sections of the Pacific slope. In the same spirit of blind acceptance of fact, do I mention it: Some varieties, usually roundish or roundish-oblong in general form, become so distinctly oblate in southern California that their real identity is all but lost. "Smith (*Cider*)" is an example of this. The other extreme is met in northern Michigan where one finds such varieties as "Talman" and "Northern Spy" so much elongated over their usual proportions that it seems incredible, almost, that they are really these varieties. The remarkably "waxy" appearance of the fruit grown in the semi-arid districts of our country where sole dependence for moisture rests in irrigation, and oftentimes the presence of a heavy bloom on apples otherwise entirely free from this, are not so difficult phenomena to explain, for the absence of rain to wash off the bloom and the transparency of the atmosphere seem to be sufficient to account for these things. Other instances of variation which are characteristic of certain sections might be multiplied, but enough has already been said to illustrate the point at issue.

I wish now to refer to a few specific instances of actual studies that have been made regarding the influence of conditions upon the behavior of some well known varieties and, in this way, attempt to outline what I consider to be some of the more fundamental principles involved in this phase of the variety problem.

I promised further reference to the "Baldwin," and, because of its wide distribution, it is one of the best varieties for the present purpose; besides, you are all familiar with it here where it holds first place among commercial winter sorts. Where I know this variety in the Piedmont and mountain regions of the South, it is not a winter variety at all, but ripens during the fall, the exact time corresponding closely with the altitude at which it is grown. Throughout that portion of the Piedmont area of Virginia where it is quite common, the soil is a red clay, or clay loam, and the general elevation about 1,000 feet. Under the conditions of soil and climate which exist here it is usually a September apple, but it often rots and drops before it is fully ripe. More than this, it does not color well and its quality is exceedingly poor and insipid. Go into the mountains, and it is quite a different apple, though not equal to the Northern grown stock in keeping quality, but in general appearance, it may even surpass the average product of the North. Some of the best flavored and the most highly colored "Baldwins" I have ever seen were grown in the mountains of Virginia, at an elevation of from 2,000 to 2,500 feet, in a rich, porous soil, but even here the tendency to drop is quite marked, the normal season of maturity is previous to the holidays and the trees are often very irregular in their bearing capacity. It is found only in the older orchards, which were planted before such a thing as variation in varieties was recognized.

"Baldwins" from Oregon show striking variations in the matter of size; specimens as large as big "Northern Spys" are common, and when they develop the pentangular forms previously mentioned, they are indeed deceptive in appearance.

The "Winesap," which is to some sections what "Baldwin" is to New York and New England, shows other traits peculiar to itself. Probably there is no combination of conditions which produce more beautiful specimens of "Winesap" than the ones I have described in the Piedmont area of Virginia where the

"Baldwin" is so nearly worthless, and yet, taken to the mountains where the "Baldwin" shows marked improvement, it becomes of no account. In the same mountain orchard where I I have seen "Baldwins" of such fine appearance and quality I have also seen "Winesap" that were so small and poorly developed that they could not possibly have any real commercial value—and this is the usual behavior of this variety under such conditions. A peculiar fact concerning the mountain grown specimens of "Winesap" is their great susceptibility to the scab fungus, while at the lower levels this fungus does not attack them seriously, as a rule. The mountain conditions seem to produce some physiological change which renders the apple less resistant than when grown at other points. At the higher, and, I believe, also at more northern points, this variety shows a distinct tendency to stripe instead of developing a solid red color. In southern California this tendency is strikingly noticeable, though this cannot be due to elevation.

The "Yellow Newtown,"(or "Albemarle Pippin," as it is called in some sections,)—a variety which most of you probably know by reputation rather than by actual contact, is strikingly susceptible to the conditions under which it is grown, and the most careful orchardists have learned, when planting it, to make very fine discriminations in selecting soils and locations for it. There are at least three essential points to consider when selecting a site for this variety: Absolutely perfect air drainage; a very deep, porous soil; a great abundance of available plant food in the soil. Of course, these are likewise essential points for all varieties in some degree, but in case of this variety, the extreme degree of the requirement is the striking feature to be regarded. If the aid drainage is in any way obstructed, the "Yellow Newtown" will spot and cloud; if the subsoil is heavy, even to the extent of being merely a stiff tenacious clay in which many varieties thrive, the apples will rot badly, drop prematurely, and those that do remain on the trees will be small, imperfectly developed and of poor quality. As the tree naturally makes a very slow growth, it requires a strong, rich soil, else it always has a stunted, sickly appearance.

The "Ben Davis" is another variety which affords an excellent example of varietal variation, but I am led to believe that the variations in this case are due more to climate than to soil. The wide distribution of this variety furnishes conditions which produce types of almost every conceivable size, form, color and quality as well. It will be sufficient merely to call attention to the contrast between the relatively small and insipid "Ben Davis" of Maine to the large, beautiful fruit of this variety from almost any section in the West or the South, and there is as much difference in the flavor as there is in other ways. But in the sections of the country where this variety is so much more at home than it is in the North, it presents many interesting variations in all of its characteristics. But perhaps I ought to add, by way of apology, that in no section does it ever acquire much that is good in the way of quality, though I have eaten "Ben Davis" when I would have thought it was a pretty fair apple if I could have shut my eyes to the fact that it was this variety that I was eating.

In this way one might go on almost indefinitely, reciting the peculiar and special requirements of different varieties as to soil, climate, elevation, etc., in order for them to develop to their highest degree of perfection or in order to make them fill some particular place in our scheme of fruit growing, but enough has been said to emphasize the fact that an apple tree is a thing of life, sensitive to its environment, to which it responds by making a variety one thing in one place and quite a different thing in some other place.

In the foregoing dissertation, I have attempted to call attention to some of the fundamental agencies which should be carefully considered when the behavior of any variety of fruit is at issue and, in a disconnected way, to show the effect in certain instances of these agencies. But I should feel that I had omitted a very essential factor if I did not refer in this same connection to the orchardist himself as a most important factor in the case, when the behavior of varieties is the thing in question. Verily, man is the greatest disturbing element in all the universe! In my study of the adaptability of varieties I am impressed more and more each year with the fact that the individuality of the fruit grower is one of the most potent factors in shaping results, and I find that in order to interpret correctly the behavior of any variety in any place, it is just as necessary to study the man in charge as it is to study the soil, the climate, or any other factor. Do not mistake my meaning. A few words in explanation will make it plain. One fruit grower prunes, and cultivates and fertilizes his orchard; another one—his neighbor—does not. In the first case the orchard is thrifty, the fruit is large, the crops regular and abundant; in the second orchard all these evidences of perfect adaptation are wanting and the varieties seem to be weak of tree, too small of fruit and irregular in the bearing of even scanty crops. Or one orchard is thoroughly sprayed; the fruit holds to the trees well and is free from imperfections. Another orchard of the same varieties is unsprayed; much of the fruit drops prematurely and of that which remains, some varieties appear to be ruinously subject to scab and, therefore, not adapted to the conditions. But if thorough and intelligent care will overcome such evidences of poor adaptation, shall we say that the lack of it is due to some inherent fault of the variety, or shall we lay the trouble at the feet of the owner and say that he lacks adaptation to fruit growing?

But the fact of great variation in varieties—in some more than in otners and in different directions—is the essential thing to be grasped and that man's power to direct variation rests in his ability to make or change environment; that beyond man's power, there are also agencies at work, having each its own influence upon the forms of life within its sphere. The practical application of these deductions to the solution of the "variety problem" is: Study the varieties you wish to plant under as many different conditions as possible, carefully noting the variations which you see; be sure to connect cause and effect; then study the conditions of soil, climate, etc., in all their varied factors of influence under which you wish to plant them, and be governed thereby.

DISCUSSION OF VARIETIES.

Following the presentation of Mr. H. P. Gould's paper on "Variation in Apples" at our annual meeting, attention was called to several varieties of apples. Concerning these Mr. Gould in answer to questions gave the following:

QUESTION: Is the Newtown Pippin a desirable variety for Maine?

Mr. GOULD: From what I know of the requirements of that variety I should question very seriously the advisability of planting it as far north as this. It seems to me to require a longer season and higher temperature during the growing season than would be possible in this State. There are a few specimens of this variety on the exhibit table down stairs and in some ways they seem to be characteristic of the variety but in comparison with the typical specimens of it from Virginia they show marked variations. The most noticeable exterior variation which I see is in the color. If you noticed them downstairs, you observed that they had a white color. The typical Yellow Newtown has more of a yellowish cast, or greenish in some cases. I think there must also be a good deal of difference in the quality. I have not sampled those downstairs. By the way, I want to say that it is my opinion, and I know that opinion is shared by a good many others, even those who are handling that variety, that it is very much overrated in point of quality. Why the people over in England are willing to pay such large prices for it I do not know, unless it is because of the prominence which the Queen of England gave, or is said to have given to it quite a good many years ago.

(Specimens of the apple on exhibit referred to were submitted to the office of pomologist, Department of Agriculture, Washington, D. C., and pronounced "White Pippin"—not Yellow Newtown as indicated in the exhibit. H. P. G.)

QUESTION: What is the essential difference between that and the Albemarle?

Mr. GOULD: The difference is in the spelling of the name, that is all. Albemarle is a synonym of Yellow Newtown.

QUESTION: What about the York Imperial in the State of Maine?

Mr. GOULD: I do not believe I am prepared to state specifically as to that. I question somewhat its adaptability. As I have seen it growing in the Piedmont territory in Virginia, especially at an elevation of about 1,000 feet, it does not do well. It drops prematurely, not holding to the trees with sufficient firmness. That same variety, however, grown up in the mountains, three or four hundred feet higher, does very much better. It is an apple that is grown very little in the North, and I have not had data enough concerning it to safely draw any conclusion, but it is my impression that it would be of doubtful value. It does very well as far north as southern Pennsylvania and New Jersey.

Mr. POPE: Is it desirable to have the variety for any purpose?

Mr. GOULD: As it usually grows it has rather an undesirable shape; it is a lop-sided apple, quite decidedly oblique, and it does not have high quality. It ranks above the Ben Davis in quality, but I do not believe that it would have any points of advantage over Baldwin even if it could be grown in Maine. The question of varieties opens up a very large problem. I do not believe that in Maine, or in any other of the large commercial apple growing sections the ideal variety is yet known. And if you stop to think of the situation at all, the varieties which are known commercially now and have a commercial rating are the varieties which have been known commercially for years. There has been advancement in methods of orchard management, in methods of tillage, pruning, spraying, and pretty nearly everything else connected with the orchard except in varieties, and there has not been as much attention paid to getting new varieties and developing them—finding out their value—as I believe there should be, and as the merits of the case deserve. If all of the State Horticultural Societies could do what the Minnesota Society has done, it might stimulate interest in this direction, and very material good might result from it,—perhaps not in this generation but in the days to come, because of the general information which would be disseminated thereby. The Minnesota State Horticultural Society has offered a prize of $1,000—and that money is in the bank ready to be awarded to the man who wins it—for the development or presentation of an apple which shall have the quality, size and appearance of Wealthy, the hardiness and prolificness of Duchess and the keeping quality of Malinda, and that premium is open to every one who wants to compete—I think there are no restrictions. I know it is open to this country and I think it is open to any one in the wide world who wants to compete. They want such an apple there, and that society has a thousand dollars, as I say, on deposit for the man who will bring it to their attention. If some such a premium as that could be offered by all the societies perhaps some good might come from it.

Mr. KNOWLTON: Some very handsome apples were brought to me late in the spring. I sent them to the department and they were named Aiken. It was an apple I knew nothing of before—I didn't know there were any growing in the State. They were pronounced very good specimens by the department.

Mr. GOULD: It is an apple that does not have a very wide distribution, and I do not think now of any place where they are growing it in large commercial quantities. Still, there may be. It is one of the newer ones which is worthy of trial.

Mr. POPE: Is there anything being done at the department in the way of crossing apples with the idea of developing new varieties?

Mr. GOULD: Nothing, to my knowledge. That is one of the lines of work I hope at some time I shall be able to take up myself in connection with our fruit district work, but at the present time I think nothing of the sort is being done.

Some beautiful samples of apples grown by John Bunker & Son of Mercer were sent to the Secretary, who forwarded them to the Agricultural Department at Washington for identification. In due time reply came from Mr. Wm. A. Taylor, assistant pomologist, as follows:

"Referring to yours of the 20th instant and to mine of the 21st acknowledging receipt of same, I would say that the two specimen apples referred to by you reached us yesterday. These were characteristic specimens of "Lawver," which has been widely distributed by nurserymen under its synonym "Delaware

Red Winter." The variety is supposed to have originated at Parkville, Missouri. It is a rather shy bearer, and does not appear to us to be well adapted to growth so far north as your State. It is not now being planted in a commercial way in any part of the country so far as is known to us."

OUR MARKETS.

By Dr. G. M. TWITCHELL, Augusta, Me.

In the changes taking place in the industrial world, the organization or association assuming to assist or direct any special lines of work must conform to these new conditions and sustain itself by actively leading in whatever will best serve its members. Especially is this true of an organization aided by the State and created to promote an industry. No matter if the original conception is entirely wiped out, if the first declaration of principles be forgotten, or if the standard of the original leaders be superseded, there is but one course to be pursued and that is to serve the public along the line of least resistance and in accord with the best light and knowledge of an ever changing present. It is not always easy to grasp the full significance of this, yet it is a truism which must be accepted, and accepted in a manner to be made active, or the day of usefulness has passed. He who best serves the fruit interests of 1905 must be prepared to throw over many preconceived ideas and long established practices.

The essential principles remain the same, but methods, practices, markets and details have radically changed. I take it that this society, like others, has become fixed in many of its practices, yet it may seriously be questioned whether these do not stand in need of modification to suit the conditions prevailing today. We discuss the same general line of topics and are hardly ready to permit what we consider heresy to be presented, even though that heresy may become accepted truth within a few years. I rejoice in this spirit of conservatism, for it saves from loss of chart and compass, yet if it were allowed to dominate we should be working the same old craft as was launched forty years ago and in the same manner.

So in any discussion of markets we must deal with them from the standpoint of the progressive, critical purchaser. Perhaps the greatest stumbling block in the pathway of progress is the standard of the producer, for unless this conforms critically to that of the purchaser there is loss. Our conception of quality, variety, perfection, manner of packing and shipping must be directed by the critical buyer in the large centres, or we lose. If we realize this we shall go beyond the point where emphasis is laid upon clean packages, careful picking, critical sorting, etc., and shall ask only what the consumer wants.

First of all it is safe to assert that the markets call for fewer varieties of apples, not more, and if it be true that color dominates yet this must be backed by quality in order for the trade to be held. Varieties must be selected, not with any thought of their value in other sections of the country, but with sole reference to soil and climatic conditions here. The Newtown Pippin is one of the most profitable varieties in central New York, but hardly up to the standard in Maine. While columns have been written in condemnation of the Ben Davis, simply from the superficial outlook of our own small orchards, if we could grow the Ben Davis of Missouri this condemnation would disappear in a large degree.

Instead of multiplying varieties let us multiply the steps leading to better color, size, shape and quality of those now grown and to the increase of these wherever practicable. The State of Maine is not today producing a fraction of the apples which would be harvested yearly, if color and quality were the only objective points sought by growers. Orchards are being left to run to waste simply because the varieties are so many and undesirable that the owners have become discouraged, and yet the agent's picture books are larger and more attractive than ever, and the wonderful stories of this and that new variety, told by persistent solicitors, still secure orders for future delivery. All this time they who have been reaping the harvest of profit have been those who have clung to the Gravensteins, Bellflowers, Russets, Greenings and Baldwins.

Dealing with this subject of markets, the first step to consider is the production of the fruit, and here the rules and practices followed by the most successful orchardists, those who touch the market at the highest point, must be adopted by every grower seeking to make the industry of greatest value to themselves and the State. These have been emphasized over and over again, yet progress along the lines of improvement is slow and tedious.

The great bulk of apples shipped from Maine this season have sold for less than one dollar per barrel, not counting package, while other shippers who have conformed to what are termed new conditions, but which have been emphasized for years by this society, have found prices satisfactory and demand active. The difference between sixty cents and one dollar twenty to one fifty, minus barrels or packages, is too wide a margin to be lost sight of. For years the value of the box, bushel or half-barrel has been urged, but not until the price of barrels became wellnigh prohibitive did the subject attract general attention. The introduction of the box for shipment, no matter what the shape and size, will call for a grading of fruit never before attempted by the average grower, and the fixing of the size and shape of the most desirable and economical package becomes a subject of vital importance to the orchardists of Maine. When barrels cost from thirty-five to forty-five cents each, there is danger of the use of those of inferior grade, to the certain loss of the producer. You cannot force the market, but must cultivate it, and any attempt to put choice fruit before would-be purchasers in unattractive packages will be certain to reduce the price paid to the level of ordinary fruit. If the market is willing to pay for the best, it surely must be offered the buyer in most tempting form and condition, and to establish what this is becomes one of the most important duties of this Pomological Society at the present time.

With all the experience of years pressing upon us, the thorough spraying of the apple trees is still woefully neglected, and because of this the quantity of second grade fruit becomes a menace to the market, and a decided loss to the careful grower and packer. It may not be possible now to reach this by legislation, but the day will surely come when severe penalties should be inflicted upon those who insist upon neglect of the essential principles of protection, and permit their orchards to be breeding places for the myriad forms of insect pests.

Discussing the industry from the standard of the greatest possible value to the State, individual liberty becomes subservient to the best interests of the general public. By no course of logic can a man be sustained in neglecting the protection of his fruit trees upon the ground of individual ownership, when such neglect spreads devastation and loss over the orchards of others. If the State is justified in spending money for the destruction of the brown-tail or gypsy moth, why not for the prevention of the codling moth, tent caterpillar, and other insects which bring hundreds of thousands of dollars loss to our fruit interests yearly. It is this inferior fruit, resulting from neglect of trees and spraying, which loads the market and cuts out so large a per cent of the profits in orcharding. An industry worth two to four millions yearly to the State, surely merits recognition and protection by the State against the fast multiplying pests and diseases. No market, however active it may be, is of any value unless growers and manufacturers are able to supply its demands, and when we discuss this subject it is with the expectation that we may contribute to the supply called for. For this to be possible the preservation of the fruit trees becomes of supreme importance. Today there are enemies threatening the State beyond any we have ever met and they cannot be controlled by individual effort alone simply because some will not, and others care not, to protect their property. The State must appropriate the means and direct the agencies necessary to insure freedom from these pests. The brown-tail moth is already established in several localities and the dreaded gypsy moth will soon be in Maine. The wonder is that it has not reached the State before this time. Whatever is done must be at the earliest possible moment and every fruit grower should be enlisted to ask of the incoming legislature such legislation as will in time free from one of these pests and protect from the other. It is not only folly but vexation of spirit to call attention to, or discuss a condition so grave as this unless there follows immediately a well organized movement for such legislation as will secure the freedom so necessary and so much desired. Every fruit grower should be prompt to acknowledge his obligations to tne Governor and Council, as well as the Commissioner of Agriculture, for the immediate action last spring, taken without legislation but with a full consciousness of the danger, as soon as the presence of the brown-tail moth in the State became known. The emergency was met in the best manner possible, without the least delay, and at small expense to the State, and all was accomplished that could be at that time. We are now on the eve of a legislative session and the further steps necessary must be provided for by the passage of such laws and making of such appropriations as will make possible the thorough and continuous protection of the State until these pests are finally destroyed. Every lover of the shade trees as well as grower of fruit, has need to be aroused to the danger now threatening and the importance of protecting our markets as well as homes and forests, by guarding jealously our trees, and this society can do no less than devote its energies to the spreading of knowledge regarding the danger, and to a discussion of the best measures looking to complete protection.

Although as yet the brown-tail moth is confined to isolated spots they spread rapidly, while, because of the location of their nests in the top, and at the extreme ends of the highest branches of the tall elms, their extermination becomes a difficult problem, with the desired end somewhere in the dim future. Our markets are in danger, our trees are in danger, the fruit industry is in danger and this society the only one specifically interested, hence here is room and call for active efforts not to be delayed. While there may be danger from excess of paternalism in the affairs of the State or nation, it surely cannot be claimed that we have yet reached the danger line in protecting our fruit and fruit trees. This society may well go to the coming legislature prepared to insist upon favorable action along the lines indicated, and surely to initiate measures which, when they become laws, will result in the uniform grading of Maine fruit. Today this is a hap-hazard, hit-or-miss practice, no two packers having the same standard, and worse than all, a large quantity of our choicest fruit going out of the State without being properly branded, or, what is worse, carrying a foreign name, while the seconds go abroad as Maine Baldwins.

Unless there is activity on the part of those specially interested there is grave danger that the name "Maine" will come to be established in the great markets as indicating second quality fruit. Growers have for years been selling their Baldwins and seeing the number ones packed and stamped "Canada Baldwins" and the seconds "Maine Baldwins." This means that unless care is taken the name, which should mean so much, will come to have a commercial standing, which will in no sense indicate the place where the fruit was grown, but simply the grade, and this not the best. Once established it would be well-nigh impossible to correct, but would stand for all time an obstacle in the path of the producer. The dairy workers of the State have for years been obliged to contend with this commercial rating, which attaches "Vermont" to the highest grade of dairy butter, even though made in Maine; while Maine butter, which very likely was made in Vermont, sells at a lower price. This is purely a commercial rating, yet it operates and must operate against the Maine producer. Far more is involved in this fruit problem, for the greatest bulk goes upon the foreign market, where the name becomes a trade mark of inestimable value, to be most sacredly guarded.

If we are thinking only of the possible returns for the crop of the present year the full significance of this will not be realized, but I raise the note of warning and urge upon this society the importance of protecting the future orchardists of Maine by jealously guarding and protecting the name. When the products of our orchards reach five and ten million barrels yearly the word *Maine* stamped upon every barrel of choice number ones will have value everywhere for the individual producer. Permit this name to be accepted commercially as indicating number twos and you place an insurmountable obstacle in the path of every aspiring grower, and cast one side the reputation of the State for producing the best quality of fruit. It is time we shook off the indifference so long manifest, and began a vigorous campaign, not to cease until the superiority of Maine fruit is fixed in the markets of the world.

This exhibition, magnificent as it is, these yearly gatherings of the cream of the orchards, may be pleasant occasions, but shame upon us if our energies are spent in mutual admiration over what these tables hold, and we fail to set in motion measures which will protect the State, promote the industry and preserve our reputation for superior quality.

In order to accomplish any permanent results there must be a well organized movement set on foot by this society to secure legislation by which all fruit shipments shall be carefully and completely graded. Here is where our neighbors across the line have outstripped us and are securing, through the enforcement of laws governing the sorting and packing, an enviable position in the European markets. As these must, for all time, be the distributing centres for the great bulk of the fruit grown on this continent, it is neither wisdom nor economy to allow others to lead in this most important factor in disposing of the product.

We lay emphasis upon varieties, setting, fertilization, cultivation and care of the trees, and these may well be emphasized over and over again, but we have not yet come to insist upon the importance of uniform packages or grading of the fruit. In 1901 Canada passed what is known as the "Fruit Marks Act," some portions of which were amended the following year, the result being a marked improvement in the grade of fruit offered for sale, and better returns to the grower.

Trade rests largely upon confidence and the fact that there is a law requiring the proper grading and marking and that inspectors have authority in each and every case, would be much to attract trade and insure satisfactory prices. It may be claimed that this legislation must be national, and so it should be, but some state will take the initiative, and why not Maine? The only objections to be raised would be either against any attempt to check fraud or "the extra bother," as one party expresses it, of grading into different barrels or boxes. In either case the object aimed at is entirely overlooked, for it must follow that graded fruit will bring dollars to the pocket of the grower, and if this puts a stop to "deaconed" packages it surely is a step to be devoutly prayed for as a help to common honesty. Criticism holds not against the great majority, but those who seek to evade and would deceive for present gain. It is these who lower the reputation of the State and reduce the price otherwise possible for all, and because of indifference to their own best interests the steps here indicated become absolutely necessary.

In an able address before this society at Farmington, two years ago, Prof. Munson urged the measures here advocated, and the fact that no action was taken and no movement organized to initiate necessary legislation is a criticism upon this society. If it is to merit existence in the future it must be because of service to the special industry in whose behalf it was called into existence. The Fruit Marks Act of Canada is essentially as follows:

(1) That the face of all fruit packages must fairly represent the fruit throughout.

(2) Closed boxes and barrels must be marked with the name and address of the packer, the variety of fruit, and its grade.

(3) It is an offense, within the meaning of the act, to dispose of, or have in possession for sale, fraudulently packed or marked fruit even when buyer and seller are ignorant of the fact.

(4) The act provides that No. 1 or XXX fruit "shall consist of well-grown specimens of one variety, sound, of nearly uniform size, of good color for the variety, of normal shape and not less than 90 per cent free from scab, worm holes, bruises and other defects, and properly packed," but does not prevent the packing or selling of any grade that is properly marked. There is no definition of grades marked "No. 2" or "XX" and "No. 3" or "X."

(5) Commission merchants who, after notice, handle fruit put up contrary to law will be prosecuted; but the act makes no provision for the inspection of particular lots at the "request of buyer or seller."

The penalty for a violation of the law, with reference to packing and marking, is not less than 25 cents nor more than $1.00 per package; for removing an inspector's brand, $40.00; for obstructing an inspector, $25 to $500; the fines being equally divided between the informant and the government. Merchants are held responsible for the fruit in their hands, but in every case the original offender is prosecuted if found.

Prof. Munson, in reviewing this act, said: "The beneficial effects of this law are already being felt across the border, and it can but result in giving a tremendous impetus to the fruit industry of the Dominion. Shall Maine lead in a similar movement in our own country? Is it not within the province of this society to go before the State Legislature at its next session and urge the passage of some measure which shall tend to protect the reputation of Maine as a fruit producing State? I am aware that such a measure would meet with opposition, and have little hope that action of the nature indicated can, at present, be secured; but the suggestion is presented for the serious consideration of the fruit growers here assembled. Nearly all of the raw material which the farmer buys,—his fertilizers, his seeds, his feeds—are subject to legislative restrictions; shall he then object if the products he offers for sale are placed under similar restrictions? Do those who object to such a measure dare stand up and give their real reason for such objection?"

The queries which Prof. Munson raised two years ago, I repeat today, and urge a reply from those opposed, or action, immediate action, by those who approve, organize a movement for such legislation as will insure the thorough grading, inspection and marking of all fruit and at once you attract attention to the industry from capitalists, and the orchards will multiply. Looking to this department of agriculture, with sole reference to its possible growth, and value to the State, as well as individual producers, such a step and such legislation becomes imperative, hence it is necessary that this societv set on foot the steps needful to insure favorable action when the full significance of the legal measure is appreciated by the legislators.

In this connection there is one fact that can hardly be urged too strongly, and that is, that there will always be an open market at fair prices for choice fruit.

Another demand of the market which should claim our attention and be encouraged by all authorities, is that of floriculture. No adequate reason can be given why this increasing love of fresh flowers should be supplied so largely by growers out of the State; when through the encouragement this society might offer the trade could be held within the State. If the fruit trees supply a necessary article of food, the greenhouses play an important part in the beauty and attractiveness of the home, and with the rapid increase of wealth throughout this country this inherent love of the beautiful will rapidly increase and the demand for fresh flowers become more and more a factor in our industrial life.

In addition to all that are grown in the greenhouses of this State, no one can estimate the volume of orders which go out of the State to be supplied by growers elsewhere. Here is an inviting field for extensive cultivation and this society may well take the initiative in creating desire for this industry, assisting in formulating plans for the building of substantial greenhouses, and offering more liberal premiums upon a greatly increased variety of blossoming plants.

Another line of work suggests itself as bearing directly upon markets, yet outside the established lines already attempted, and that is to urge upon the officials at our agricultural fairs the vital importance of offering more liberal premiums on fruits, flowers and vegetables.

The great bulk of the revenue at nearly all fairs is devoted to the vaudeville and the races, and only the merest pittance paid to him who grows the substantials or cultivates the beautiful. From fifty cents to one dollar is the maximum premium in the fruit, vegetable and floral department, while the races call for purses reaching into the hundreds. It is folly to waste time in regrets over this condition unless there follows some well digested movement towards reform. This feature of our fairs, important in the highest degree, is steadily dropping out and solely for the reason that its value to the State and importance to the exhibition is not appreciated.

When we attempt any discussion of markets all these factors enter in and call for recognition, and until each receives its full measure of support, and all conditions are made favorable for the furthering of the industry in all departments, the organization which stands as the representative of these varied industries is derelict of duty. If in the past it has not been considered the duty of this body to assist in correcting these conditions, the time has surely come when the scope of its field of operations may well be extended, and assistance given along all lines leading to broader markets.

Every grower of farm products is helped when the essential quality of Maine products is known to the widest possible range of readers and visitors, and as this impression is backed by the quality of the goods put on the market, a permanent and growing trade is assured.

Looking to the future and realizing the sure outcome from the greatest possible development of the fruits, flowers and other farm products, the next step by this body is clearly indicated.

It is to fix by statute requirements such bounds as to inspire a growing confidence in the uniform quality of our products and insure to the careful growers substantial returns for their labors.

We shall approach this result just in proportion as we protect the buyer and seller by requiring the proper grading of all fruit, as the importance of the uniform package becomes generally appreciated, as the necessity for stimulating the growing of flowers is realized and as we help make our annual exhibitions complete through the largest possible display of the fruits of the orchard, greenhouse and garden.

Here is legitimate work for this State Pomological Society in addition to and beyond what has heretofore been attempted, and while neglecting nothing in the range of duties already recognized, let us reach after the larger grasp possible today and serve our State, our orchardists and our society by helping towards the solution of the vexed problems confronting the individual grower of 1905.

THE FRUIT MARKET—MARKETING APPLES.

By E. H. Cook, Vassalboro.

In marketing apples, perhaps the first thing to consider is the package, and of late years the package has assumed considerable importance. The best possible package for exporting apples is an oak barrel, with round hickory hoops, but most any ordinary flour barrel will do pretty well; and as we get away from that we get something less desirable all the time. A cooper was at my place perhaps a month ago and trying to find out just how to make a barrel that would please me. "Well," I said, "the nearer you get to the ordinary flour barrel, the nearer you get to something that they will like in Liverpool." They are conservative people, the English, and we all are somewhat; but they especially. They have been used to the secondhand barrel, or the ordinary flour barrel, for many years, and they won't get away from it without costing you something for it, as some one said. They will discount the rough soft wood barrel from sixpence to a shilling, 12 to 24 cents, and I have seen it on my account of sales where there were discounts, they marked them

United States barrels, Nova Scotia barrels, and discounted in one case 48 cents, for no other reason that I know of except that the barrel didn't suit them. They are very sharp over there. If you put a head into your barrel that is a little thicker than the ordinary barrel head, they will discount for that too. They don't want to buy wood, they are buying apples. If you put a plugged head in, they will notice it. The best package for the export market is the ordinary flour barrel. For domestic markets the new barrel does about as well, and in some markets better because they know they are clean, and they haven't got into ruts so hard and so deep as they are in Europe.

Now in getting this secondhand flour barrel ready for market you want to wash it. You can't wash it with snow or grass or a dry broom. Water is the only thing that will clean it. Dash into your secondhand barrel half a pail of water, take a broom, get that water whirling until it comes to the top of the barrel and your work is done and can be done in a few minutes; but try to clean it dry, and scrub and scrub and scrub fifteen minutes and then it won't be ready, and there will be flour set in motion that will rattle out onto the apples and the apples will be moist and it will look worse than anything you can think of on the apples. The new barrel doesn't need that. All barrels need to have their hoops tightened before you begin to pack. In getting new barrels, the narrower the stave the better. I saw some yesterday, and they were planed and white and pretty looking except that the staves of some of them were nearly a foot wide, and the barrel was not round on that account. As to the barrel question it is going to be easier in a year or two. They are making more and more new barrels so that I wouldn't wonder by next fall if there were more barrels than there were apples, and barrels would be quite cheap. If any of you who raise large quantities of apples don't know how to get barrels—I presume you all do, but for any one who doesn't—he can go off into Palermo or Montville, some of those towns where they have been making lime casks, and there will be mills there that he can get his staves and stuff sawed out cheaply and transported by rail to where he lives. He can get one of those coopers over there who is used to it to set up the barrels at home. Those barrel makers over there don't own anything, they have no machinery, they get their stuff sawed at the mill and take it home and work it all up by hand, costs them about eighteen or twenty cents to make a barrel; and you can buy them there at the shop for twenty to twenty-five cents—delivered thirty miles, as in my case, costs thirty cents. I don't believe that the box will ever come into general use as a package for shipping apples. They have been using the box for quite a number of years. It is not a very new thing. It has been used for shipping apples quite a good while. They usually use the bushel box and when they do that they wrap their apples in tissue paper and put them in layers, and a cardboard between each layer, and a bushel box according to the size of the apple will hold three to five layers. If you have a thousand barrels of apples and want to get them onto the market, and get a telegram from your agent to hustle, it would give anybody fits to hustle a thousand barrels into those boxes, with tissue paper and cardboard, and get them onto the cars. Of course it will do for a few fancy apples, but I don't believe it will ever be done for a commercial way, by the thousand barrels.

Some like the barrel because they can roll it on the floor, platform and dock, and others like the box because they can't roll it; so you see men are not all alike. And I may be entirely mistaken about this box business. The box is no cheaper, no easier to get than the barrel. A box maker wanted me to try boxes. "Yes, I will try boxes, try anything—make me some, a couple of hundred." Well, he wasn't ready. "What is the price of them?" I found I couldn't get enough for my apples any cheaper than I could get the barrels.

There is a very good box made—to digress a little—that is a fine thing on a farm, to hold a bushel. You take two pieces of board 11x12 and nail slats on three sides, leaving one for an opening,—one-half inch slats from one end to the other. Of course I am describing the ordinary crate box. But they can be made for five cents—this half-inch stuff—of course it isn't close together, and a person nailing those slats onto these end pieces of inch stuff can make a box very rapidly. The ends are 11x12 and inside measure is 22¼ inches, which will hold a bushel. When you are packing potatoes it is much easier to take up potatoes in these boxes and put them onto the load and pile them anywhere, and when you get to carrying them down cellar, take one of those boxes and dump it into the chute—it is much easier to handle than a barrel, or even a box. You can scatter them along in the field and let the boy make his pile there and not have to lug to a barrel or to the cart.

Now I shall run against some things I have heard talked of here today in regard to marketing apples, and I hope not to come out as bad as the man who told the African prince that he had seen water so cold that it would be hard and you could walk on it, and the prince ordered him out and had his head cut off. But you want to see both sides of all questions. In marketing apples I should market No. 2's of good, hard, red apples, surely. I should market No. 2 Kings and No. 2 Baldwins and No. 2 Ben Davis. I wouldn't market No. 2 Spies or Russets or Bellflowers or soft table apples. That is the result of my experience. Experience makes me believe in that way. A No. 2 Baldwin will bring almost as much in Liverpool as a No. 1. They don't discriminate there very much as to size, and they will accept worm holes with good grace if they are not woodchuck holes—too many and too large. In shipping to Liverpool, the main thing is to have a red apple that is hard and packed clean, no leaves or litter, long stems, anything of that kind. And get them tight into the barrel, more by shaking than by pressing hard when you get to heading them up. I have had the No. 2's bring more than the No. 1's more than once or twice. I have got very good returns from a car of straight No. 2's this year, as good as I expected, or should have expected had I sent ones. You know Baldwins are very red this year and not wormy, nothing much. I took them down to less than two inches, some of them. They were very pretty, looked like cherries in the barrel, packed clean and tight and nice, and they went over there and they sold for 10-6 in Liverpool, and that gives a very good net. Why I happened to have this carload of No. 2's, I was shipping apples to Aroostook. They have to have a pretty nice apple there. You can't send them anything that will measure less than 2½ inches—it wouldn't pay you to, at any rate—and I sent a carload to Caribou and a carload to Houlton. But I had quite a good many No. 2's, the size apples run now. The first carload I got 10-6, the next one I haven't heard from yet.

Now there is another end—to every string there are two ends. You say "Don't send the No. 2's" and keep back all these apples—give them away or something and only ship half or two-thirds of your apples—all No. 1's—and you will force up the price. If everybody did that I think it would force up the price. What would the poor fellow do who has to live in the garret and hasn't much money to spend? He wants some apples. Why, you ought to ship your No. 2's and let the boarding houses have some apples, some mince pies for the servants and all those things. Can't everybody pay five to seven dollars for a barrel of apples at the other end. Ship them some that they can reach with their pocketbooks. Apples are a good thing—pass them around.

Different varieties of apples do better in different markets. If you had a carload of Bellflowers, they would be as valuable almost as any apples raised shipped to Pittsburg or Cincinnati or most any western market, a carload of nice Bellflowers gotten in without pressing as much as possible, as nearly as possible, and shipped to most any western market would bring good returns most any year; but they are not of any account around here. So it depends somewhat on the market you are going to ship to. Nodheads sell well in Portland and Waterville. They don't know much about them in Boston. Providence they do very well. Providence is a good Greening market, although the Baldwins are coming into favor there more in the last two or three years than before and consequently Greenings are not in quite as good demand as they were. The McIntosh Red will sell anywhere. But just one caution about that McIntosh Red business. If you don't feel within yourself that you can spray your apple trees at least three times a year and every year, don't set any McIntosh Red. The last two or three years we have had a dry June and these spores that spoil the McIntosh Red have been falling around just the same, but when they came down on the apple tree, they found it dry and they died; but if we had had it hot and moist along about the 10th of June those McIntosh Reds wouldn't have been worth shipping anywhere. They are almost sure to be scabby. It wasn't because the trees were young. I don't care if they are a hundred years old, if we have a favorable season for the scab it will spoil your McIntosh Reds if you don't spray them. If you are willing to spray, and know you are going to spray, then you can't beat it, for in its perfection there is nothing better. There is nothing better than the Spy in its perfection, but it is a little difficult on an average to raise them that way.

There is no difficulty in any man shipping his own fruit to Liverpool. Most of you, and perhaps everyone in this audience, knows as much about this as I do, but there may be some one that does not. Any man can ship from one barrel to a thousand to Liverpool just as easy as he can ship apples to Portland. When you get ready to ship your apples and want to try the Liverpool market, get into correspondence with some of the Liverpool commission house agents who are very plenty in Boston—you can easily learn the address of some one of them—and tell him what you want to do and about what time you will be ready to ship, and he will write you right back, if you want to ship such a day, bill them East Boston, care of the Cunard line, or another day, bill them to Charlestown, care of the Dominion line, and all you have got to do when you bring your apples to the station is to go to the station agent and tell him what your Boston agent has told you, bill these apples so and so according to the instructions I have received from the Boston agent. After you have done that then there is nothing more until you receive your account of sales and check. The expense of shipping a barrel of apples to Liverpool from here will be about $1.25. I don't know just what your Boston rate from here would be, but the commission rate is two shillings and five per cent thereof, which would be about fifty cents, and there is about twenty-eight cents for dockage and that kind of dues, and a cent for cablegrams to tell you how much they have brought, and five per cent commission—if the barrel sells for $4 over there that will be twenty cents, and some other minor dues makes it all probably—depends something how far you are from where you ship them, where they take the steamer,—probably about $1.25 besides the packing. You would know about that as well as any one, what that would cost.

Now don't get down on the apple buyer and think he gets more than his share, because he doesn't. How many buyers have you ever known to get rich? They sometimes make quite a lot,

$150 on one carload of apples. In a little while the mail may show them, one single mail, a loss of $500. It is gambling, and it is quite interesting, and exciting and depressing both at times, and if I had never gone into it, I shouldn't, knowing what I do about it,—but a fellow gets to gambling and can't leave off. But the buyer doesn't get more than his share, the middlemen we hear so much about don't get more than their share. For instance, you raise a barrel of apples and pick it and get it into your cellar, and they do the rest except drawing them to the station. But they put more money into the apples than you do. We who grow apples should not think that we ought to receive all that they get at the other end of the route, when they have taken the apples, transported them on cars and boats, kept them in warehouses, keeping an extensive staff of clerks, and all those things. They do more to the apple after they take hold of it—that is, put more expense into it, perhaps two or three times according to where the market is, than the man who raises it. Mr. Smiley was asked how much his apple crop cost him last year for which he received $450 on the trees. "Well, it cost me 63 cents, the whole crop. I hired Preston Lancaster," he said, "a half a day to help me prop the apple trees, and that is all they cost me." Of course he didn't reckon the interest on $15 an acre land that the trees stood on, but it would not have been very great. He hasn't fertilized his orchard, other than to allow his sheep to run there and shut them in there nights, for a generation, and he has gotten good crops right along. It doesn't cost much to raise a barrel of apples. You can raise a barrel of apples for ten cents on the trees before your touch them, so when you sell them for fifty cents—whether you raise them for ten cents or not, I am very sure that selling them for fifty cents on the trees is good business. It will yield you $50 a year per acre, and what other crop will yield that?

Now one thing more about the marketing, the subject that was given me. I will tell you what I do. I was going to say if I were you I would do so and so, but I do this way. Any ordinary year, in the fall, gathering time, I get all the force I can to help me that I can handle, and board or hire boarded in that vicinity, all that I can work to advantage, to go with me into that orchard, and I first gather up all my odd kinds such as Bellflowers and

Black Oxfords and Granite Beauties, and all of those varieties that the buyers don't like to take and later won't go so well,—I hustle those all together and pack them nicely, pack the 2's, pack the small apples any way, and pack the Snow apples before they are fully ripe, and the Kings before they are fully ripe, and all table apples, in ordinary years, that is when Liverpool is in condition to take apples—they are not this year—and ship them as early as I can, try to get them off the last days of September, September 25th, along there, and set them a-going across the water, and the chances are that that carload picked up that way will bring more than any car you will ship later. The first car I shipped that way, which included some windfall Ben Davis picked up in September, and windfall Baldwins, any other variety,—anything that was fit for an apple that a woman would be willing to sit down and make a pie of, as a matter of fact natural fruit, good looking apples, gathered them together that way and made up a carload last fall in the latter part of September, shipped them and got a net back of $2.85,—the best market I had for the year. One of my neighbors was in there when we were packing, hustling all we could when every week would make them less price, and half a week for that matter,—he was in there looking at the apples we were handling over there, and he says, "It is a shame to ship such stuff as that and break the market for good stuff." Later I shipped in January a straight car of fancy Baldwins, and got a good price for them, but not as much as that car I speak of, one of the best cars of Baldwins I ever shipped in January, and it netted back a little less than $2.50. But the odds and ends that I got in early netted back $2.85. Now if you get rid of this soft stuff that I have been speaking of, like the Starkey, the Nodhead, the Snow apple and all those, before the railroad worms wake up in them and while they are hard, you won't have them afterwards hanging around your premises and wondering what you are going to do with them—a little mess here, another there. They are all cleaned up and gone and you have got your money and it is the best way to do. The fall is the time in the average year to market your apples, because in the fall apples are new and consumption is greater, and in the fall they are filling the cold storage houses and the consumption is enormous on that account, and the evaporators and canning shops are running and the demand for them is great. It is four or five or seven times in the fall what it is later in the winter. The foreign markets will take great quantities in the fall when they have no large crops over there—sell 50,000 in a day and not break the markets. Later in the season instead of all this extra demand by the storage plants and the packing houses and all those things, they are putting their stuff on the market, and they are coming into competition instead of being an outlet. You could not sell your apples this year anyway, fall or spring, but in ordinary years the fall is the time to get rid of your apples, and you are not worrying about whether the rats will eat them or they will freeze before spring. Get rid of them and begin planning to raise some more the next year, and what you will do to your orchards. The Russets and Ben Davis ought not to be shipped until after the turn of the year, after the first of January. And you need not worry about your Ben Davis. They will sell easily. They do this year. They will every year. This may be guess work. One man's guess work is just as good as another's. These apples would sell now. One of my neighbors, Mr. George Ayer, shipped some Ben Davis just as soon as he gathered them this year, got back about $1.40, got about the same for his Baldwins—might have varied a few cents, not much difference. Some of the later cables quoted Baldwins and Ben Davis right neck and neck, but later in the season the Ben Davis will do better, although they will do something, ship them in the fall. The time is to wait for the turn of the year for both Russets and Ben Davis, but it is a good time to ship Baldwins as soon as they are gathered. You can't get Baldwins into Liverpool too early after they are colored up; and as to those early apples like the King and Starkey, Nodhead and that class of apples, get them off a little before they are fully colored and let them color a little in the barrel going over. The English say they do, and if they think they do that is all we care about,—they buy them.

Now as to the markets being over with for Ben Davis. Don't you suppose the English know as much about Ben Davis as we do? Why shouldn't they? They have been eating Ben Davis there for twenty-five years, they have been chewing on those Ben Davis for twenty-five years, and we haven't eaten any. How many here have eaten any Ben Davis? There isn't any one.

Then what do we know about Ben Davis? They know because they have eaten them. We don't. They hire apples a good deal there. They go to the grocery man and get a package of apples, a half bushel or whatever they think they will need, and hire them, take them home, put them around on the tables, and what don't get eaten by the company they carry back. And these Ben Davis are first rate to hire.

In marketing the Spy you have to be a little careful not to press them too hard in and bruise them. Shake them and have something solid to shake the barrel on, and don't give it a hard shaking but shake them gently and press them in with your hand and get them up so you can get your head on it just solid and not press it down much. If you do you will press the Spies right into each other. They are tender. They are a fine grained apple. They are splendid and you want to get them at the other end without showing these dints that one apple makes against the other. You can buy cushions for them which consist of paper with some excelsior between. I think they cost about 2½ cents apiece. I have used them some. Don't know whether they did any good or not. In the bottom of the barrel, packing apples, I would put thin paper because it is cheaper than the pulp head, but on the pressed end you want a pulp head, because in driving in this pulp head will prevent the head from starting the skin on the upper apples. And be sure and put just as good apples next to be pressed as anywhere. They will look at that end half the time and they want just as good apples there, and good apples all through. Don't put poor stuff in the middle of the barrel, because it won't pay. I know it won't, too. Don't ask me how I know. You often hear about getting apples ready for market in the paper—"Get very nice apples and face them in." These apples you put in the first tier are sometimes called facers and sometimes called headers or setters, and sometimes it is called deaconing. "Put very nice ones there and nice ones all the way to the top." I won't advise you to pack apples that way. If I were you, and if I were I, and were going to pack apples, I would pack the kind of apples I had, and there is nobody who has that kind of apples. We have apples as they grow. We don't make them grow so and so, gnarly, wormy, or a little bit scabby or spotted, or undersized and all that—we may have neglected our duty about it, but that is the way they grow. And as you find them, pack them. Don't waste half or two-thirds of them. Pack the most of them if you are going to ship on your own account to Liverpool. But if you are shipping to Chicago, it is no use to send No. 2's, or any Western state or Northern city or town. The Americans discriminate more than the English. They don't seem to have so much use for No. 2's. I don't know hardly what they do with them there. Some years they make black currant jam out of the poor apples. One firm last year made 300 tons out of cider apples, poor apples that came from America.

BROWN-TAIL AND GYPSY MOTHS.

The Moths and What They Threaten.

Miss Edith M. Patch, University of Maine, Orono.

THE BROWN-TAIL MOTH.

An extended description of the insect is not necessary here. It will be illustrated by a lantern slide later in the day. There are, also, several mounts on exhibition which will give a better idea of the insect in the various stages than words can. It will suffice to say that the brown-tail moth is a white-winged moth expanding about one and one-half inches, with its abdomen tipped by a conspicuous golden brown tuft.

These moths are on the wing in July and unlike the gypsy moths, the brown-tail females as well as the males are strong flyers. They are active at night and as bright lights have an attraction for them they sometimes fly a long way toward a lighted district. The female usually selects a leaf near the tip of the branch, on which to deposit from one hundred and fifty to three hundred eggs. Some of the brown hairs from the abdominal tuft adhere to the egg-mass and give it the appearance of a brown felt lump. While the moths have a preference for pear trees, wild cherry, apple and white oak prove very attractive and other trees are not scorned. By the middle of August most of the eggs are hatched and the young caterpillars spin a slight web over the leaf near the egg cluster. From this protection they advance side by side, like a little army, though they beat a hasty retreat and huddle together beneath the web when disturbed in any way. When they have eaten all but the skeleton of the first leaf, they draw another into the web and repeat the process at intervals during the late summer. They feed slowly, however, and spend so much time spinning their web that they do comparatively little damage to the trees in fall, and they are still very small when cold weather comes on; those removed from the winter nests being only one-fourth of an inch in length. In the fall the young caterpillars weave additional layers of silk about their retreat, fastening it securely to the branch by the web and pass the winter thus in colonies of one hundred and fifty to three hundred. These nests, which look like a cluster of dead leaves hanging from the branches, are readily seen after the leaves have fallen. This is a very unusual yet most commendable habit in a caterpillar pest, for they can be killed, hundreds at a time, simply by destroying the nests in which the colonies hibernate. Early in the spring the young caterpillars emerge from their winter nests and feed upon the opening leaf buds. Until about the middle of June they feed greedily upon the leaves, completely stripping the trees where they are numerous. When full grown the caterpillars are about one and one-half inches long. They are dark brown with a sprinkling of orange. Long fine reddish brown hairs cover the body, and a row of conspicuous white hairs runs along each side. Like the caterpillars of the tussock and gypsy moths, they bear bright red tubercles on the top of the sixth and seventh abdominal segments.

Were the caterpillars to be feared only for their ravages upon orchard and other trees, the situation would be alarming enough, but not less serious is the physical discomfort experienced by people living in infested districts. When the minutely barbed hairs of the caterpillar come in contact with the skin they cause an eruption similar to and in many cases worse than ivy poisoning. These hairs are brittle and where the caterpillars are numerous few people are likely to escape as the caterpillars drop from the branches and creep about, even entering the houses. Direct contact with the insects themselves is not necessary, however, for when the caterpillars shed their skins, which they do several times during their larval period, the molts are blown about, widely scattering the barbed hairs. Thus in infested districts it is no uncommon occurrence for whole families to suffer from the rash caused by the hairs which settle upon clothes hung out to dry. Children gathering cherries are badly "poisoned," and near Everett, Massachusetts, people have been obliged to leave their homes for uninfested places in order to recover from attacks of the "caterpillar itch."

The caterpillars are usually full grown in June. They then spin loose cocoons attached commonly to leaves, though sometimes other shelter is sought. From the first to the twentieth of July the moths with pure white wings and brown-tipped abdomens emerge from these cocoons to deposit eggs for the next generation of troublesome caterpillars.

MANNER OF DISTRIBUTION.

New localities may become infested in various ways. When startled the caterpillars have a habit of letting themselves down from the branch and hanging by a frail silken thread. They may so swing against the clothing of a person, or drop upon a passing car or wagon and be carried long distances. Egg-laden moths may be attracted to the lights in trains and electric cars and be borne into uninfested localities before they flutter off to deposit their eggs. In New Hampshire the new localities were generally found along the lines of cars coming from badly infested regions.*

"A reliable observer, Mr. A. M. Cobb, Malden, Mass., reports that when the Bangor boat of the Eastern Steamship Line was passing some miles off Marblehead, early in July (1904) a large swarm of the brown-tail moths came aboard and completely covered parts of the vessel." **

About the middle of July, 1904, the morning after a strong southwesterly wind, the telegraph poles and the sides of some of the buildings near the Kittery Navy Yards were reported to be white with the white-winged brown-tail moths. The town was alarmed and great numbers of the moths were washed down with hose and destroyed, but that many escaped and deposited eggs,

* N. H. College Agr. Exp. Sta. Bul. 107, p. 59.

** Mass. Crop Report, Vol. 17, No. 3, p. 38.

the neighboring trees (especially the pears and wild cherries) bear abundant evidence.

Thus strong winds, lighted trains and boats, and vehicles of all sorts are seen to be among the factors which hasten the natural spread of this dreaded pest.

REMEDIAL MEASURES.

Clean Culture.

Among the remedial measures to be considered too much stress cannot be laid upon clean culture. This implies not only the proper care of the valuable trees themselves, but also that they shall be protected from bad company. There may be an apple tree way off in some corner too old to yield fruit, but still bringing forth a crop of bud moths and tent caterpillars; or a group of old pear trees somewhere in the neighborhood with blackened leaves and undersized pears cracking to the centre; or possibly, straggling along the road, is a line of wild cherry bushes distorted with black knot and draped with caterpillar nests and webs. It is these deserted or neglected trees that are to be feared, for in them dangerous caterpillars may breed unnoticed, perhaps for years, until they become numerous enough to make conspicuous ravages. The wise man cuts down and burns the old trees which are infested with dangerous diseases or which are not worth keeping clear of insect pests.

Cutting and Burning the Winter Nests.

This is the most important of the direct remedies because it is the easiest, cheapest, and if thoroughly done, a sufficient protection against the ravages of this pest. The webs and leaves that compose the nest are woven tightly through the tips of the branches and hang there like dead leaves all winter. With so many months for inspection there is no excuse for harboring the hibernating caterpillars on shade or orchard trees. After they are cut from the branches, the nests should be burned, as this is the simplest way of destroying the colony within.

"As showing how cheaply webs may be gathered where a general campaign is made, the figures of work done by employees of the Massachusetts gypsy moth committee in 1899 are of interest. At that time over nine hundred thousand webs were destroyed at the total outlay of nine thousand seven hundred dollars.' (From the Mass. Crop Report). This would mean, accounting for the variation in the number of the caterpillars per nest, the destruction of from 15,000 to 30,000 caterpillars for each dollar's outlay.

A Bounty Put upon Winter Nests.

Much can be done by local interests. One example will serve for an illustration. Last winter in Portsmouth, N. H., the city improvement society placed $50 with the Superintendent of Schools, who paid five cents a dozen for winter nests. Hundreds of nests were brought in by the children and burned in the school furnace. And the children on our side of the river were envious because the Fates had not been generous to them also.

Instruction in Public Schools.

You had at your meeting last year a valuable and interesting discussion upon nature study and related subjects. There is time here only to suggest the need of this phase of education from the economic standpoint. It would be a simple matter to teach in an elementary way a few things about the important insects in the vicinity. A little observation and a little reading would prepare any teacher to do this. A single lesson would enable a child to distinguish the winter nest of the brown-tail moth from the webs of the fall web-worm and tent caterpillar or from the various cocoons which are attached to leaves. All these things are brought into Kittery with the question "Is this the brown-tail nest?" and the fact that many people within the infested district do not know what to look for suggests the need for preparing the children of Maine to watch intelligently suspected areas for the occurrence of this pest. If nothing else were accomplished, it would be worth while to have every child know at least that the insects are not "just bugs that happen to be around," but forces of vital importance both for good and for evil in the agricultural interest of his State and nation. It seems rather a pity to leave a few such things as the relation of the white grub to the May beetle a mystery to be solved in a college course.

Spraying.

The caterpillars are readily killed by arsenical sprays. This remedy is most effective when applied as soon as the leaves develop in the spring. Of course where the winter nests have been destroyed there will be no need of this remedy and it is much easier to kill about two hundred caterpillars enclosed in a nest than to wait until they are scattered over the tree.

State Legislation.

Every state needs a statute enabling authorities to treat as common nuisances neglected property which is infested by dangerous fungous diseases or insect pests; and state appropriations should be sufficient to control conditions which are of more than local importance.

THE GYPSY MOTH: A FOREWORD.

The gypsy moth has not yet been found in Maine. The entrance of this pest, however, is probably only a matter of time. Unlike the brown-tail moth, the female gypsy moth is weak-winged and is thus unable to deposit eggs far from the cocoon from which she emerges. It is due to this in part that this moth has not yet found its way here, for it has been in Eastern Massachusetts for thirty-six years and its ravages for the past sixteen years are well known.

In a district badly infested by the caterpillars of the gypsy moth no garden vegetables except the onion is safe; flowers and grass are eaten, and practically all fruit and forest trees are defoliated, pines and other coniferous trees dying as the result of a single stripping and deciduous trees not being able to withstand a three years' attack.

There is no such simple and comparatively inexpensive means of combating the gypsy moths as with the brown-tail moth, for they do not hang their colonies in plain sight all winter, but pass this season in the less conspicuous egg stage, the egg clusters being hidden in any crevice the infested area offers. These caterpillars are more resistant to poison sprays than those of the brown-tail moth and the problem is in many ways more difficult. It is the wise man who looks ahead and an additional argument for clearing out the growths which are already overrun with orchard caterpillars, (the brown-tail moth among them) is presented by the fact that Southwestern Maine is the point where the first infestation of the gypsy moth would naturally occur. Nothing by way of watchfulness, instruction or provisional care that can be done to guard the State against these twin pests should be neglected.

"Those citizens of Medford who first suffered from the attacks of this pest on their property relate the most alarming experiences. They tell of shrubbery and flowers ruined; of gardens despoiled of corn, small fruits and vegetables; of fruit, shade and forest trees stripped of their foliage finally destroyed; of homes filthy with the pest; of trees, houses, fences and walks covered with the trooping battalions of caterpillars; of the stench arising from the crowding masses; of the crawling of the disgusting creatures into their houses, where they swarmed on house plants, crept into closets, upon the persons of the inmates and even into the beds; of the people's unavailing efforts to check the march of the ravening host with fire, hot water, and coal oil, in spite of which the pest grew worse year by year, until an appeal was made to the town authorities. The town having expended hundreds of dollars and not being able to cope with it, the State, in 1890, was appealed to for aid, and it was not until the forces of the State had worked a year that the course of the moth was even checked." *

"The gradual spread of the gypsy moth up to the caterpillar plague of 1888-89 is a matter of record. Equally well known is the work of the gypsy moth committee of the Massachusetts Board of Agriculture, which finally succeeded in reducing the numbers of the insect to a minimum and thoroughly controlling the pest. Since the abandonment of the State work in the early part of the year 1900, the moth has had ample opportunity to increase to a point where it is today more numerous, and occupying a larger area in Massachusetts than ever before * * * Both the gypsy and brown-tail moths can be controlled by a thorough campaign over the infested municipalities. The work of the former gypsy moth committee has shown that the damage and annoyance from these pests can be practically eliminated by the application of thorough remedial measures over the entire

* Bulletin of the Mass. State Board of Agriculture.

infested districts. It is greatly to be hoped that some effort to systematically control the spread of these pests may be instituted to the end that property owners may be spared the annual visitation of the caterpillar scourge." *

THE BROWN-TAIL MOTH IN MAINE.

By Hon. A. W. GILMAN, Commissioner of Agriculture.

The legislature of 1903 passed an act from which the following is an extract: "If any person in the State suspects the presence of San Jose scale or other injurious insects or diseases preying upon trees, shrubs or vines in his possession or within his knowledge, he shall forthwith notify the commissioner of agriculture to that effect, and said commissioner shall cause the said trees, shrubs or vines to be inspected by a competent entomologist who shall forthwith make a report of the results of his inspection and file the same with the commissioner at Augusta. If dangerous insects or injurious diseases are found by the entomologist the commissioner shall publish the report of the same and see that the best known treatment is applied to such trees, shrubs or vines for the destruction of the insects or diseases with which the same may be infested."

On March 21, 1904, a letter was received from Mr. Clarence M. Weed, state nursery inspector of New Hampshire, stating that one of his deputies had found that the brown-tail moth had passed over the river at Kittery and was present in two small pear orchards in that town. I immediately wrote to the Experiment Station at Orono, asking that a competent entomologist be sent to investigate the matter. Early in April, Miss Edith M. Patch, entomologist for the Maine Agricultural Experiment Station, visited Kittery and vicinity and reported that the small pear orchards and scattered pear trees in the village were badly infested with winter nests of the brown-tail moth. These nests were also to be found, to some extent, on cultivated and wild cherry trees in the vicinity, elms along the street and apple trees. The infested district, as far as she was able to judge, could be enclosed in an area of one-half mile square.

* Mass. Crop Report, Vol. 17, No. 3, pp. 32 and 40.

Upon receipt of this report, I wrote to the president of the Pomological Society, calling his attention to the fact that this pest had invaded the State, and that while the legislature had made it the duty of the commissioner of agriculture to see that the best known treatment was applied to trees, shrubs and vines for the destruction of injurious insects, the act carried no appropriation with it and in order to obtain funds for the purpose it would be necessary to present the matter to the governor and council. I asked him to appear before them at their next meeting or send a letter which might be read at that time. President Gilbert sent a letter strongly urging the importance of using all possible means to exterminate this dangerous insect at this early stage of its invasion, which, together with a statement of the findings of Miss Patch, the nature of the insect and the seriousness of the danger which threatened the State, I presented to the governor and council at their meeting on April 25th. They cheerfully instructed me to visit the field and make investigations, and clothed me with authority to use such means for the destruction of the pest as I thought the emergency demanded.

I at once consulted with Mr. Weed of New Hampshire, who has had a great deal of experience in exterminating the insect in his State, and secured the services of his deputy, Mr. G. A. Thompson of Stratham. Mr. Thompson procured the assistance of men who were accustomed to the work, and in co-operation with the officials of the town of Kittery, a systematic and thorough campaign against the pest was organized. The selectmen and citizens of the town manifested great interest in the matter, doing all in their power to aid us, and practically all of the winter nests were secured and burned, thus exterminating the insects as far as possible, at a slight expense.

In the month of July, at the season when the insect reaches the adult stage, reports were received from the captain of the navy yard at Portsmouth, N. H., and citizens of Kittery and Eliot, that large numbers of the moths were present at the navy yard and were finding their way into the above named towns. I immediately wrote to persons of authority on the matter, asking if anything could be done at this stage in the life history of the insect to destroy it or check its progress into our State. I was informed that nothing could be done at this time except to awaken the people to an interest in the matter and locate as definitely as possible the places where the moths appeared, as a guide to the extermination of the nests the coming winter. In August Miss Patch again visited that section of the State, and we append her report of the situation as she found it at that time.

As the only feasible way of destroying these insects seems to be the gathering and burning of the winter nests, it would appear that with a small appropriation from the legislature, and the cooperation of the citizens of the infested places, the State could be practically freed from the terrible pest during the coming winter.

REPORT OF MISS PATCH.

The examination of Kittery and vicinity which I made August 20-24, 1904, at your request shows the situation as regards the brown-tail moth as follows:

The localities which I knew to be infested last spring were visited first,—chiefly the pear trees scattered or in groups in the village itself. Each of these trees so far as examined had at least one brood of young caterpillars. In was evident that these were a new immigration, for nowhere was there a last season's nest to be seen, all of those which were common last spring having been carefully destroyed.

Several orchards which were nearly half a mile outside the infested district last spring were next visited and I found the young caterpillars common in these, though the broods were not so numerous as in the village itself. Short excursions into the large wild cherry tangle back from the Shepherd Hill road next showed that the moths had scattered egg-clusters here, for I came upon a young brood every few yards, especially upon the outskirts. The apple orchards near here, although free from winter nests last spring, were also infested. On Badger's island one wild cherry bush contained over one thousand caterpillars.

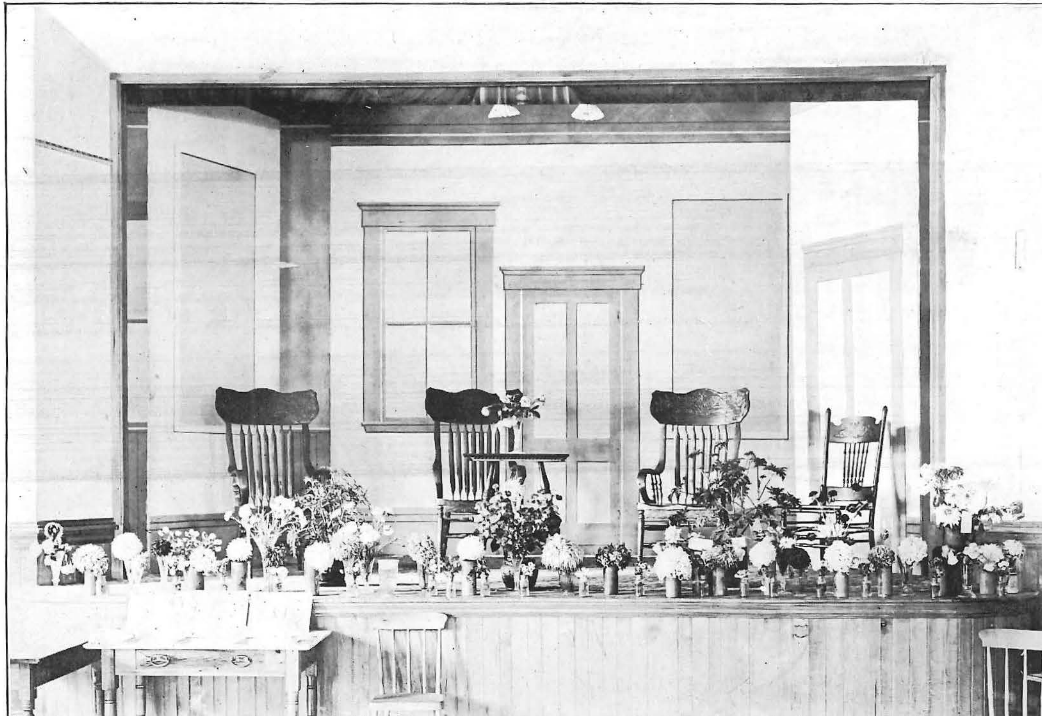
Near the navy yard old worn-out apple trees incapable of bearing apples still put forth leaves enough to tempt tent caterpillars, web worms and brown-tail moths. Along New March street and vicinity, pear trees worthless as far as fruit is concerned, the numerous small pears being cracked to the center, served as bait for many caterpillars, the brown-tail moth among them. Cultivated cherry trees swollen with black knot, as must be excepted while the roads are lined with fungous deformed wild cherries, were also more or less infested. A few broods were observed on elms near infested orchards.

On account of the small size of the caterpillars, which were about one-eighth of an inch long at the time of investigation, I made no attempt to estimate the area of the infested district. This can be done with comparative ease after the leaves have fallen leaving the conspicuous winter nests revealed. As the young caterpillars do very little damage until spring, there is time enough for such investigation.

In the absence of winter nests in the village of Kittery, the general infestation this fall can only be explained by the fresh immigration of moths reported to have occurred in great numbers during strong southwesterly winds this summer; the electric lights about the navy yard being the center of attraction for the winged insects.

This statement of the situation, though not given in detail, will suffice to report the danger which threatens the State so long as this destructive pest and poisonous insect is provided with breeding places in the wild cherry tangles and deserted or neglected fruit trees which are so abundant in the infested region.

EDITH M. PATCH, *Entomologist.*



Chrysanthemum and Rose Exhibit Made by Abel F. Stevens, Wellesley, Mass.

AMONG THE ROSES.

By ABEL F. STEVENS, Wellesley, Mass.

The rose is the perfection of all floral realities. In the charm of individuality, the warmth of perfect coloring and the delight of a matchless perfume, all flowers must yield to the rose.

It has mingled in history's most notable events, has been used in times of joy and sorrow. It has been treated by poets and painters in all ages of the world's history without losing its character or changing its destiny. Poetry and art are lavish of roses, heaping them into beds, weaving them into crowns, twining them into garlands, and forging them into chains of beauty. We delight to place it on the bosom of beauty and we love to bring the rose itself into comparison with the most beautiful works of man and nature. Moore most truly says:

> "Long, long be my heart with such memories filled
> Like the vase in which roses have once been distilled.
> You may break, you may scatter the vase, if you will,
> But the scent of the roses will linger there still."

Though every flower has inspired its ode, the whole world is doubtless ready to acknowledge the rose supreme, for it is the emblem of beauty and true worth, while the rosebud is the emblem of innocence and purity, for from time immemorial and in places of greatest renown the rose has been acknowledged the queen of flowers.

In olden times, as today, the fair bride adorned herself with chaplets and garlands of roses. As we delight to place them on the bosom of beauty, so we claim the sacred privilege of covering the casket of departed friends with fragrant roses, nature's highest type in the floral realm of purity and perfection.

The universal love of roses bespeaks for our people a high order of true culture and pure sentiment in our civilization. No rural home is complete without its broad pillars of climbing ramblers, or capacious beds of blooming roses, and of all the floral gems the rose is indispensable for mantle adornment or table decoration,—the ideal flower for the altar, the parlor, and the study.

CULTURE.

The first and most important requisite in successful culture is good soil, which should be of a strong nature, thoroughly enriched with a liberal supply from the cow stable and bone meal well incorporated into the soil before planting. Have all this plant food deeply spaded into the soil. The best time for setting out the plants is in early spring or late autumn,—April or October, for all the hardy varieties.

All roses must have placed around them some winter protection about their roots—nothing better than to heap up a foot high of soil. Half hardy and tender tea varieties must be laid down and entirely covered with earth, while upright and tall pillar roses may be sufficiently protected by being securely covered with straw or thick evergreen boughs.

All varieties need to be well pruned annually, and the summer and perpetual varieties should be well cut back near the ground as they always flower on the young wood, which will make a much more vigorous growth by such a system of pruning; while all the tender tea varieties, as well as the moss and climbers, need only a shortening of the previous year's growth and thinning out of the weak and feeble branches. The rule in trimming roses is to cut strong growers moderately and weak growers severely.

The rose is propagated by the means known as grafting, budding, layering, and by cuttings and planting of the seed. All of these methods are quite simple and easily done by a knowledge of the art and some practice. For the amateur the simple method of layering of the growing branches in July and August is the best. This is easily done by first forking in some rich compost about the bush, then simply cutting a tongue on the under side of the branch we desire to layer, just opposite a leaf or bud, pegging this down and partially covering the layer a few inches each side of the incision. If the conditions are right for growth new roots will soon form around the joints on the branch we have layered. Give thorough winter protection and the next spring sever the layer from the mother plant and set it where it is to bloom and grow.

ENEMIES AND HOW TO DESTROY THEM.

Like all the most beautiful things in nature, the charming rose has its enemies in insects of various kinds. The most common are the rose chaffer or bug (macrodactylus subspinosus), the green fly (aphis) and the rose slug (sclandria rosea). As we cannot have good flowers without fine foliage, it is of the utmost importance that we attend to the destruction of these insects at the very outset.

The first to appear is the slug, a little green worm that glues the tender leaves together for its harbor till the form of a bud appears, when in a night it will destroy several. Dust your bushes well with hellebore and press firmly every leaf you see tied together by the slug.

The next is the detestable rose bug. Hand picking, brushing them into hot water, covering the bushes with netting and spraying are the only remedies we know.

Then later the aphis or green fly. At once dust the bush thoroughly with tobacco dust, while wet with dew and in midday spray the entire foliage with a liquid.

(1) Kerosene emulsion: Dissolve one-half pound bar soap in one gallon boiling water, add two gallons of kerosene oil; while warm, agitate it until it forms a creamy mass. Dilute with fifteen parts of water for spraying foliage. Or

(2) Steep one pound of tobacco in five gallons of water. Or

(3) Whale oil soap: One pound to eight gallons water. Either of these solutions will be found effectual.

There is one more enemy of our beloved rose,—a parasitical fungus known as mildew, and it is very destructive to the growth of the plants. When grayish white spots appear on the leaves of roses or grape vines, it is certain that mildew is present. The best remedy known to the most practical growers is made by taking three pounds each of flour of sulphur and quicklime, put together and slake the lime and add six gallons of water. Boil all together until it is reduced to two gallons. Allow the liquid to settle until it gets clear, then bottle for use. One gill only of this is to be mixed in five gallons of water and syringe over the entire foliage at evening. Apply this once a week during the growing season and you will not be troubled with a speck of mildew. We will add here that often we use flour of sulphur blown on the leaves with a bellows with good success.

VARIETIES.

Now we will give a selection of varieties that cover the most desirable qualities of the rose, which are (1) beauty of form and (2) color, (3) fine foliage, and (4) fragrance.

As to color, let us say that we have found that in certain families of plants particular colors prevail, and that in *no* instance can we ever expect to see blue, yellow and scarlet colors in varieties of the same species. This is one of nature's most undeviating laws. In the rose we have scarlet and yellow, but no blue. So in the dahlia, hollyhocks, etc. Again, in the verbenas, salvias, etc., we have scarlet and blue, but no yellow. We must never expect nature to step out of her fixed laws and give us a blue rose or a blue dahlia or a yellow verbena. To keep our rose bushes in bloom, cut back the most rampant growing shoots and when the blooms are fully open cut them for the vase. To let them fade on the bush exhausts the plant in the formation of seed. Check the side shoots and give water freely, and mulch the roots well. In a word, the whole secret of growing choice roses is summed up in just three things, viz: Plant deep; manure well; and water freely.

The hardy perpetual roses are the most royal of all roses. Their beauty is of a bold, brave type,—quite distinct from the delicacy of color and odor which characterize the tender tea roses. Once they embraced only the darker, richer tints in their immense full flowers, but now include the purest whites and delicate pinks. In the newest and best varieties we shall name, the season of bloom has been extended more generally over the growing season, although their grandest show of flowers is made in June and July, also in September and October. This class is the grandest of the whole family of roses,—vigorous in growth, superb in bloom, and delicious in fragrance. Of nearly one thousand varieties known to the Rosarians, the following varieties are the very cream of the entire list, covering all the distinct colors, being the best in vigor, hardiness, foliage and in flower.

Red—Alfred Colomb, Ulrich Brunner, Marshall P. Wilder, Gen. Washington.

Pink—Paul Neyron, Magna Charta, Mrs. John Laing, Countess of Roseberry, Madam Gabriel Luizet.

Crimson—Abel Carrier, Gen. Jacqueminot, Prince Camille, American Jubilee, Anna de Diesbach.

Blush—La France, Capt. Christy, Baroness Rothschild, Silver Queen, Rosy Morn.

White—Madam Plantier, Margaret Dickson, Coquette de Alps, White Baroness.

Striped and Variegated—Hallowe'en, Caprice, Striped La France, The Jewel, Roger Lambelin.

Yellow—Glorie Lyonaise, Harrisonii, Persian Yellow.

Moss roses are exquisite in bud. The best red varieties are Laneii, Crimson Globe and Little Gem.

Best white varieties are Reine Blanche and Crested Moss.

Every villa, porch and piazza should have its wealth of climbing roses. The best are Empress, Belle, Blairii, Mary Washington, Queen and Crimson Rambler.

Japan Roses—Madame Geo. Bruant, white; Rugosa Rubra, red; Rugosa Alba, white.

Ever remember this, to have roses in our gardens we must have roses in our hearts.

No rose garden is complete without several good strong bushes of Sweet Briar, with its exquisite scented foliage.

Among the ever blooming varieties are the tender tea roses of charming color and delicious fragrance. The most popular for bedding and constant bloom:

Red varieties—Scarlet Bedder, The Queen, Meteor—excellent, brilliant; Dinsmore—very fragrant.

White—Kaiserine Augusta Victoria—a royal rose with a royal name; The Bride—superb in bud and bloom; Marie Guillot—grand, double, sweet.

Yellow—Pearle of the Garden, Star of Lyon, Sunset.

Pink—The Bridesmaid, Mme. Caroline Testout, Wellesley.

Climbers—Dorothy Perkins, shell pink; Empress of China, dark pink; Mary Washington, white; Carmine Pillar, rich scarlet.

Evergreen roses—These are especially adapted for covering rockeries, banks, terraces, etc. The best varieties are the Nichuraiana, white, Memorial Rose, and Evergreen Gem, large yellow. All of these have a bright shining foliage and showy flowers.

The Polyanthus or Fairy roses, which bloom in rosettes of large panicles at end of each shoot, are fine for pot culture or open ground and bloom from May to November. We have counted one hundred and twenty flowers in one cluster of the Mignonette variety.

The best varieties: Clotilde Soupert—a gem of pearly white with salmon center; Parquette—cluster of pure white; Glorie de Polyanthus—bright pink which are beautifully cupped blossoms in wonderful profusion.

There are the Tree or Standard Roses and if choice hardy varieties are budded into vigorous Rugosa stocks they prove quite hardy and make a charming plant for lawn ornamentation.

NEW ROSES.

Helen Gould—Hybrid tea. The best new rose today, with a great future. Extra vigorous—exceedingly free—every shoot has a flower bud. Constant in bloom. Rosy carmine red, turning a lighter shade. Delightfully fragrant. A rose worthy of the name.

Gruss Au Teplitz—A superb rose of the brightest crimson-red, turning to a fiery scarlet. Flower large, full, sweet, very showy—a constant bloomer. The queen of the garden—the best hardy, ever-blooming rose to date.

Janice Meredith—Cross of Hermosa and La France, uniting the best qualities of each parent, in blooms, fragrance, vigor and color, being a rosy carmine changing to a satiny pink, of exquisite fragrance—a magnificent rose.

Pan-American—A grand new rose. It is in the front rank. A cross of American Beauty on Caroline Testout. A fine grower—long stems—every shoot flowers—always in bloom—opens a soft rosy red, changing to a beautiful pink of delicious fragrance. Valuable for winter blooms or outdoor flowers. Best American rose.

Liberty—A hardy hybrid tea rose, combining vigor of growth, robust constitution and free blooming qualities; delightful in fragrance, magnificent in color, being the deepest degree of ruby crimson covered with rich velvet bloom. It is the highest perfection yet attained in a rose.

Soleil D'Or (Golden Sun)—A new hardy yellow rose of robust growth, charming in foliage and exquisite in flower, the coloring of which is gloriously superb, vying with the rainbow or when the Golden Aurora kissed the Rosy Morn.

The most popular rose today is that beautiful creation of the Rosarian, the American Beauty, a joy and delight to all beauty-loving people, so stately in form, charming in color, and delightful in fragrance.

Our New England homes should be made beautiful by planting about them the choicest roses, the royal queen of all flowers, for the love of a beautiful home is the heritage of our race. Poets of every land and age have sung of the pure joys of having blushing roses and beautiful flowers. It has been the dream of every toiler in our cities to have a quiet home near the restful hillsides and under the spread of shady trees and leafy vines. Where else can nature's charms receive full homage, as in the beautiful country homes, adorned with tasteful gardens of blooming roses and fragrant flowers? Where else can the tuneful harmony of our inward natures resound in unison with the sublimer music of creation, wisdom and goodness?

(Abstract.)

SOME THOUGHTS UPON HORTICULTURAL EDUCATION.

Prof. W. M. Munson, University of Maine.

The standing of any business or profession depends upon the character and quality of the men engaged in it. This being the case, the only way we can hope to maintain the dignity of work pertaining to the cultivation of the soil, and encourage the rising generation to look favorably toward this calling, is by showing that there is quite as good an opportunity for the exercise of the best powers of thought and business ability as in any other calling in life. Mere platitudes regarding the freedom and independence of the farmer, and the joy of being "near to Nature's heart," have very little weight in these days of competition and struggle and mental and social awakening.

The claim is often made that the agricultural colleges of the country educate the boys away from the farm; that the farmer cannot profitably spend four years in preparing for his work and then go back and take up the burden which his father laid down; that as soon as the boys get out of college they will take up some other line of work which will insure them an immediate return somewhat larger than the old farm will yield. At first thought there seems to be an element of justice in this claim. In a vast majority of cases the farm boys who are graduates of the State colleges of the country do follow some other pursuit than that of agriculture. But is it their college education which induces this change of sentiment or of occupation? In nine cases out of ten the boy has been educated away from the farm while still under his father's roof. He has seen that farming in the old way is confining, is laborious, is slow of returns and is altogether unsatisfactory. He enters college with the express purpose of taking an engineering course or a scientific course or a classical course, and thus fitting himself for some other pursuit. From the very first time he enters the public school, his education is all *away* from the farm.

In these days a farmer needs training and broadening and developing quite as much as does a lawyer, a doctor, or an engineer. But this training and broadening may be given by means of studies which shall have a more direct bearing upon daily life than is the case with Greek, Latin, and Calculus. The most successful man is he who has the ability to reach out into a broader social and intellectual sphere; to think and reason and act with assurance. Such a man will succeed whether he be on the farm, in the school-room or in the counting house.

There is a large element of uncertainty in all agricultural operations. What with changing weather conditions, untimely frosts, varying soils, uncertain germination, fungous and parasitic diseases, injurious insects, birds and animals, there would seem to be no end of the list of "unsolved problems" which the farmer must meet. To solve these problems would seem almost a hopeless task for anyone—especially for a "theorist" in the class-room.

What, then, is the use, or the reason for the existence of the agricultural college and experiment station? A thorough study of the laws of nature as applied to agriculture will reduce the uncertainties to a minimum, and will raise the possibilities of production to a maximum. The college brings to bear all of the sciences related to the subject. Botany, chemistry, geology, entomology, bacteriology, and many others, are all made to contribute to the practical solution of the difficulties to which farmer and gardener and fruit grower are heir. There are causes for poor crops which may be overcome; there are diseases of plants and animals which may be prevented and cured; there are physical and chemical and geological conditions which may be met intelligently and successfully; there are processes to be discovered and taught that may promote productiveness when applied to specific crops.

There has, heretofore, in the language of a leading educator, been "too little intellect and too much luck in the practical operation of agriculture and horticulture. There has been too little live investigation and too much following in the rut made by others......The enhanced power to produce comes from the intellect that commands the elements and harnesses the laws of nature. The power to *produce* is in the earth; the power to *increase* that production is in man."

To aid men to get out of the rut followed by others, and to enhance the power to increase production, is the mission of the agricultural colleges and experiment stations of the present day. Just how this may best be accomplished is the problem which confronts thoughtful educators at the present time. In the opinion of those who give the matter careful attention, it is not the cramming of the mind with an array of *facts* which will be most beneficial. It is the appreciation of cause and effect; the growth of mental power; the ability to discriminate. There is a loud call for "practical" instruction from all sides. But the most practical instruction is that which makes an all round man. This is an age of specialists, but the specialist must have something on which to build.

The teaching of the practical only, is narrowing in its tendencies. It makes men of one idea,—incapable of talking intelligently on other subjects. The power of acquiring knowledge is of infinitely more value than a mere medley of isolated facts. It is for this reason that the full college course is superior to a short cut to horticultural knowledge or, indeed, to any other short course of instruction.

The first question which confronts every thoughtful teacher of horticulture is: What shall be the scope of the instruction? Shall the course be restricted to the so-called practical problems attending the propagation of fruits, flowers and vegetables, or shall it be made to include the wider field of landscape gardening, plant breeding, and the application of the laws of vegetable physiology? Shall we study the art of raising plants, or shall we consider the principles on which the art is founded?

Without hesitation it may be said that a course in horticulture which is restricted to the mechanical operation of the propagation and culture of plants is incomplete and unsatisfactory. The student should know something of the origin, habits, and relationships of plants, also of the causes of variation, and the effects likely to be produced by the operations he may perform. In other words, he should know something about plants and the conditions affecting their improvement, as well as something about their cultivation, handling and marketing. For this reason, as well as to train the powers of observation, a thorough knowledge of systematic, structural and physiological botany should be at the foundation of every college course in horticulture. A knowledge of agricultural chemistry, of elementary physics, and of soils, is also essential, for reasons which are apparent, and this work should precede technical instruction in horticulture. With this fundamental basis, the practical details may be very quickly acquired.

Accepting this view, technical horticultural instruction cannot well begin before the third year of the course, except as a general survey of the field, with a discussion of the principles of plant culture may be given. By this time the student will have had sufficient training to understand the distinguishing characters and relationships between the different fruits and vegetables studied, and the knowledge of soils, drainage and agricultural chemistry upon which practical discussions are based.

Without referring to details, it may be said that text-book instruction in horticulture is usually unsatisfactory. So, also, in teaching horticulture by means of lectures, something more than mere talking is required to maintain interest. Actual demonstration is necessary. It is not a question of what results should be obtained; how many bushels of potatoes or onions or apples should be grown on each acre; but what are the methods and why? What are the principles involved? Practical demonstrations may be conducted either at the college or at a commercial orchard, garden or greenhouse, preferably at the commercial establishment.

Laboratory work and collateral reading should be made an important feature of every course in horticulture, as the student retains more lasting impressions from the free, informal discussions attending the demonstrations than from the most carefully prepared lectures. The laboratory work should, however, be as thoroughly systematized as the class-room instruction and, as far as possible, should follow the same line taken up in the lectures.

Much has been said and written concerning the ideals of education. The true philosophy of life is to idealize everything with which we have to do. "Success lies not so much in doing unusual things, as in doing usual things unusually well." If a man's work in life has to do with potatoes or apples, let him *know* potatoes or apples. Let him analyze their structure, follow the germinating seed or sprouting tubers or bursting buds; study the influence of sun and rain and heat and air. Let him know the soil in which his plants grow, whence it came, of what it is composed, how it may be varied. Let him understand the forces set at work when the plow is first employed; the chemical and physiological and biological changes that occur. Let him by the aid of the microscope see the organisms that are helpful to him in his work, and those which he is to subdue. Let him become familiar with the friends and foes among the hordes of insect and bird and animal visitors to his orchard and garden. Let him know of the relation which his chosen plants bear to their fellows. Let him work among and study his plants, learning their individuality and their possibilities. Let him till the ground for the sake of tillage and not simply as a never ending struggle against the curse of weeds. Let him do all this and he ceases to be simply the "man with the hoe," and becomes one of Nature's yeomen. He learns to love his work and will use the force of his trained and sharpened faculties in the improvement of methods until he shall revolutionize potato growing or apple raising.

From what has been said it must not be supposed, however, that the only horticultural instruction that may be given is of college grade, and that a full college course is essential for every young man if he is to succeed in the practical work of fruit growing or gardening. Within the past few years there has been a wonderful development of agricultural instruction in all parts of the country. The movement for the establishment of secondary schools, and of special courses suited to the requirements of rural conditions in many high schools, is rapidly going forward, and it is to be hoped that Maine will push well to the front in the forward movement. The college courses should, however, be kept entirely distinct from the secondary work, and should imply much more thorough training. College graduates and college instructors may be able to give invaluable assistance in developing the secondary work, but that work is of a different, though none the less important, type.

An important mission of horticultural education, and this need by no means be of college grade, is the creation of a new sentiment, a new atmosphere, about rural homes and rural affairs. Children from the farm are often prejudiced against the farm from their earliest period of recollection. They feel instinctively that their lot is less attractive than that of their city cousins. As they go to the towns and villages to attend high school, this feeling of dissatisfaction is increased.

There is no doubt that a neat lawn and a well-kept house, or the contrary, may have quite as much influence in determining the future of the boys and girls from farm homes as the amount of hay per acre or the number of cows in the herd. If farm life is made interesting, farm homes and surroundings made attractive, farm boys and girls will become enthusiastic, activity will be stimulated and profit will follow. This is not mere sentiment, but a statement of fact which should appeal to the business sense of every farmer in Maine.

The mission of horticultural education then, especially in New England, is by means of lectures, institute work, bulletins, and correspondence, as well as in the class-room, to stimulate the desire for better conditions in our rural homes; to point out the possibilities before young men and women in the direction of improved rural conditions and of intensive culture of fruits and vegetables and flowers from a practical point of view; to welcome to a broader field and higher training those who would fit themselves for leaders in either practical or scientific work along horticultural lines; to solve by careful experiment some of the problems which confront the gardener, fruit grower, and homemaker.

SECRETARY'S PORTFOLIO.

Apple blossoms pink and white,
Drifting through the perfumed air
Of a May day clear and bright,
What on earth is half so fair?

Apple blossoms pure and sweet,
Flakes of snow just tipped with rose,
Drifting sweetness at our feet,
With each wind that blows.

Braving winter's dying breath
In response to spring time's call,
Trusting in the One who rules,
And who watches over all.

—*Green's Fruit Grower.*

TRUE M. MERRILL.

On January 13, 1905, after a few days sickness from an unexpected stroke of paralysis, True M. Merrill passed away at his home in New Gloucester.

His great-grandfather, Nathan Merrill, was the first Shaker convert in New Gloucester. He had a large family before he became a Shaker, his father and two of his brothers having previously been converted. "Within a fortnight after the conversion of Nathan Merrill, November 14, 1793, the neighboring families were gathered in," and the Shaker society in New Gloucester was organized a few months later. Some of Nathan's family left the Shakers and made homes in the locality and they and their descendants have a strong love for the Shakers and are among their most devoted friends. One of these was Cephas Merrill, who chose for his home a beautiful spot on a hillside overlooking Sabbathday lake. He and Lovina

Merrill were the parents of True M. Merrill, and here in this pleasant home he was born February 14, 1850, and here he spent his life among those who knew him best and loved him most.

He married Annette Cook and they had two daughters. In 1889 the beloved mother died, and later he married Harriet Rhino, and their home was blessed by three more children. He was an affectionate husband and a kind father, and here they lived useful and happy lives.

More than all this he was a good neighbor and citizen, always loyal to the interests of the community in which he lived. To him and others the town owes much for the excellence of its schools and highways, and for all that goes to make New Gloucester one of the best rural towns in the State. That his townsmen appreciated the man is shown in the fact that they made him one of their selectmen and chose him to represent them in the legislature; later also choosing him a member of the school board.

He was a farmer by occupation, a progressive farmer, too. One who believed in thought and study in connection with the work of the farm. He was interested in every feature of agriculture—stock breeding, crop growing, especially fruit growing. He identified himself with the organizations representing agricultural interests, being a member of the local grange and a life member of the Maine State Pomological Society. Repeatedly he has shown his active interest in the affairs of the latter and attended many of its meetings. Being a fruit-grower himself and a member of this society he sought the best markets for his fruit and in doing so became a solicitor for a foreign market and during the later years of his life did a large business.

Mr. Merrill was also a member of the Masonic fraternity and the Eastern Star, and was buried by Cumberland Lodge, No. 12, F. and A. M., with Masonic honors.

The secretary feels his death as a personal loss, for in many ways he has been a friend and an active assistant in the work of the Pomological Society. He improved, apparently, every opportunity to advance the society's interests, and the assurance that he was "always with us" has often been an incentive to do the best work.

President Charles Wright of the Peninsular Horticultural Society says, "We must expect good crops, and if properly handled, fair prices for them." It is a good way to look at things in Maine and the secretary is inclined to think in orcharding we are quite likely to get better crops than we deserve for the culture, perhaps non-culture, given. He also says, "It is possible to put color into a peach, to put quality into a potato, to make a strawberry firm and cause many other changes by a judicious use of fertilizers. The fertility of our soil is largely kept up by clover, cow peas and other nitrogen-gathering plants."

Several agricultural societies in Maine are offering premiums for Kieffer pears. It seems to the secretary unwise to offer premiums for a fruit we cannot grow well. So far the secretary does not remember seeing a plate of good Kieffers anywhere in Maine. A Kieffer is poor enough anyway, but a poor Kieffer is worse than a poor Ben Davis, and here in Maine they are all inferior. Better offer premiums for varieties that deserve them.

At the present time, the great bulk of the fruit crop of the country is stored in the larger cities, but there is a growing tendency toward the erection of storage houses in the fruit growing districts. Western New York leads in the movement, there being more local cold storages in that section than in any other fruit growing districts in the United States. *S. H. Fulton, Assistant Pomologist, Washington, D. C.*

LEGISLATION.

Reference has already been made of the action of the society with reference to securing needed legislation for the protection of trees, plants, etc. As a result the following acts were secured from the legislature of 1905:

CHAPTER 29.

An Act to provide for the protection of trees and shrubs from the introduction and ravages of dangerous insects and diseases.

Section 1. All nurseries or places where trees, shrubs, vines and plants are grown or offered for sale, shall be inspected at least once a year by a competent entomologist to be employed by the commissioner of agriculture; and if no dangerous insects or diseases are found a certificate to that effect shall be issued by the said commissioner of agriculture; said certificate shall contain also the name of the entomologist and the date when said examination is made.

The entomologist employed for this purpose shall report in writing immediately the results of his examination.

Any proprietor or owner of nurseries or places where trees, shrubs, vines and plants are found to be infected with dangerous insects or diseases shall be notified of the same by the commissioner of agriculture at once; such proprietor, owner or his agents are hereby prohibited selling or offering for sale such trees, shrubs or plants, unless the same have been fumigated or otherwise treated under the direction of the commissioner of agriculture, and such trees, shrubs or plants shall bear a certificate of the same. Any violation of this requirement shall be fined not more than fifty dollars for each and every offense.

Section 2. All nursery stock shipped into this state from any other state, country or province shall bear on each box or package a certificate that the contents of said box or package have been investigated by a duly authorized inspecting officer, and that said contents appear to be free from all dangerous insects or diseases. In case nursery stock is brought into the state without such a certificate the consignee shall return it to the consignor at the expense of the latter; provided, however, that any box or package bearing a certificate of fumigation, which shall be an affidavit made before a justice of the peace, that all stock sold by the consignor has been fumigated in a manner approved by the state nursery inspector of the state from which said nursery stock is shipped, the same may be accepted as though bearing a proper certificate of inspection.

Section 3. Any transportation company that shall bring into this state any nursery stock such as trees, shrubs, vines, cuttings or buds, and any transportation company, owner or owners of nursery stock, or persons selling nursery stock as thus defined, who shall transport such stock or cause it to be transported within the state, the same not having attached to each box or package an unexpired official certificate of inspection or an affidavit of fumigation which shall meet the requirements specified in section one of this act, shall be guilty of a misdemeanor, and on conviction thereof be subject to a fine not exceeding one hundred dollars for each offense.

Section 4. It shall be the duty of the commissioner of agriculture to make full investigation of any locality when the presence of the brown-tail or gypsy moths or other injurious insects or plant diseases may be suspected. Should any person in the state suspect the presence of the brown-tail, the gypsy moth, the San Jose scale or other injurious insects or diseases preying upon trees, shrubs or vines in his possession or within his knowledge, he shall forthwith notify the commissioner of agriculture to that effect; and it shall be the duty of said commissioner of agriculture to cause the said trees, shrubs or vines to be inspected by a competent entomologist, who shall forthwith make a report of the results of his inspection. It shall be the duty of the commissioner of agriculture to disseminate information concerning the brown-tail moth, the gypsy moth and other injurious insects or plant diseases. Wherever such insects or diseases may be found it shall also be the duty of said commissioner to at once proceed to exterminate or control all such insects and plant diseases as may come to his knowledge within the limits of the means at his disposal.

Section 5. For the purpose of inspecting any trees, shrubs or plants supposed to be infested with dangerous insects or diseases, the authorized entomologist shall have the right to enter private or public grounds, and for the purpose of exterminating or controlling any dangerous insects or diseases that may be found infesting trees, shrubs, or plants, the commissioner of agriculture and his employees and municipal officers and their employees shall have the right to enter private and public grounds.

Section 6. For the purpose of carrying into effect the provisions of this act the sums of five thousand dollars for the year nineteen hundred and five and for the year nineteen hundred and six, or such part thereof as may be necessary, are hereby appropriated.

Section 7. In case of violation of this act it shall be the duty of the commissioner of agriculture to enforce the penalties set down in sections one and three of this act.

Section 8. The statute law entitled "An Act for the protection of trees and shrubs from injurious insects and diseases," is hereby repealed.

Section 9. This act shall take effect when approved.

[Approved February 28, 1905.]

CHAPTER 96.

An Act authorizing cities and towns to raise money for the Extermination of Insect Pests.

Cities and towns may raise money to be expended for exterminating or controlling the brown-tail and gypsy moths and other insect pests.

[Approved March 21, 1905.]

ACT OF INCORPORATION.

STATE OF MAINE.

IN THE YEAR OF OUR LORD ONE THOUSAND EIGHT HUNDRED AND SEVENTY-THREE.

An Act to Incorporate the Maine State Pomological Society.

Be it Enacted by the Senate and House of Representatives in Legislature assembled, as follows:

SECTION 1. Z. A. Gilbert, George W. Woodman, A. L. Simpson, George B. Sawyer, J. C. Weston, Charles Pope, Samuel Rolfe, James A. Varney, Albert Noyes, Rufus Prince, J. C. Madigan, S. F. Perley, Hannibal Belcher, J. B. Phillips, Joseph Taylor, Harvey Counce, John Currier, William Swett, Henry McLaughlin, Calvin Chamberlain, Washington Gilbert, George C. Weston, Hiram Chase, J. C. Talbot and S. L. Goodale, their associates and successors, are hereby constituted a corporation for the promotion of fruit culture, by the name of The Maine State Pomological Society.

SEC. 2. Said society shall have all the rights, privileges and powers conferred by the laws of this State upon county and local agricultural societies, and shall be subject to all liabilities imposed by existing laws upon such societies, so far as the same are applicable to the objects of this society; but the bounty to be paid by the State to said society shall not exceed the sum of five hundred dollars * in one year.

SEC. 3. Said society shall have power to elect such officers, and adopt such by-laws and regulations, not inconsistent with the laws of this State, as may be necessary to carry into effect the objects of the society.

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*Increased to One Thousand Dollars by Legislature of 1893.

SEC. 4. The first meeting of said society may be called by A. L. Simpson, J. C. Weston and Geo. B. Sawyer, by a notice signed by them, stating the time and place of said meeting, to be published two weeks successively in the Maine Farmer, the last publication to be seven days at least before the time of said meeting.

SEC. 5. This act shall take effect when approved.

(Approved February 17, 1873.)

BY-LAWS

OF THE

MAINE STATE POMOLOGICAL SOCIETY.

AS AMENDED NOVEMBER, 1902.

ARTICLE I.—Membership.

SECTION 1. Any person may become a member of this Society by signifying his wish to do so and paying to the Treasurer the sum of one dollar.

SEC. 2. Any person may become a life member by paying the Treasurer the sum of ten dollars; and the Treasurer's certificate thereof shall entitle such member, with his wife and minor children, to admission to all the exhibitions of the Society.

SEC. 3. Each member (excepting life members) shall pay to the Treasurer an annual fee of one dollar; and the Treasurer's certificate thereof shall entitle him to admission to all the exhibitions of the Society for that year.

SEC. 4. Any member who shall neglect, for the term of two years, to pay his annual assessment, shall cease to be a member of the Society; and the Treasurer shall erase his name from the list of members. Any member may, at will, withdraw from the Society on giving notice to the Treasurer, and paying the amount due from him to the Society.

SEC. 5. Ten members shall constitute a quorum.

ARTICLE II—Officers.

SECTION I. The officers of the Society shall consist of a President, two Vice Presidents, Secretary, Corresponding Secretary, Treasurer, and an Executive Committee, consisting of three members exclusive of the President and Secretary, who shall be members *ex-officio,* and one Trustee for each county in the State; all of whom shall be elected by ballot at the annual meetings, and hold their respective offices during the calendar year for which they shall be elected, and until their successors are elected. The elective members of the Executive Committee, however, shall be elected at the same time and place, one member each year for the term of three years. In the event of a failure to elect the said officers, or any of them, at such meeting, an election shall be held at the next meeting of the Society duly called and holden.

SEC. 2. All the officers shall perform the customary duties of their respective offices, and such further duties as are herein specified or shall from time to time be imposed upon them.

SEC. 3. The Secretary shall keep a true record of the proceedings of the Society and of the Executive Committee, keep an alphabetical list of the members, and make all reports required or authorized by law.

SEC. 4. The Corresponding Secretary shall conduct the correspondence of the Society. He shall open and maintain correspondence with other Pomological and Horticultural Societies for the purpose of effecting an exchange of publications with the same, for the permanent use of this Society; and shall present at each annual meeting, a report, embracing a review of the proceedings of such Societies, and the substance of all such matters therein as he shall deem to be of special interest to this Society.

SEC. 5. The Treasurer shall keep all moneys of the Society and disburse the same only upon the written orders of the Executive Committee. He shall render his accounts annually to the Executive Committee, and give such bond as said Committee may require. He shall keep a record of the names of the members of the Society, and shall from time to time transmit to the Secretary the names of all new members and of such persons as have ceased to be members.

SEC. 6. The Executive Committee shall have the general management and oversight of the affairs of the Society; transact its business, and appoint all standing and special committees, when not otherwise provided for; examine the accounts of the Treasurer, and make an annual report to the Society, of their doings and of the financial affairs of the Society.

SEC. 7. The Trustees shall represent the Society and act as its agents in their respective counties. They may receive applications for membership, and forward the same, with the fees therefor, to the Treasurer, and shall promote the interest of the Society in their respective counties.

SEC. 8. Whenever the office of President shall become vacant, the Vice Presidents shall succeed to his office, in the order of seniority, for the remainder of the year; and any vacancy occurring in any other office may be filled by appointment by the Executive Committee; the person so appointed holding the office for the remainder of the year.

ARTICLE III.—Meetings.

SECTION 1. The Annual Meeting of the Society shall be held at the place and during the time of the Annual Autumn State Exhibition, and such notice thereof shall be given as the Executive Committee shall direct. If, from any cause, the regular Annual Meeting shall not be held as above provided, a special meeting shall be held at Augusta in the month of January next following.

SEC. 2. Special meetings may be called at any time by the Executive Committee; of which meetings each member shall be notified, by a notice properly directed and deposited in some post office at least ten days prior to the time of such meeting.

ARTICLE IV.—Funds.

The fees for life membership shall constitute a permanent fund, to be safely invested by the Treasurer under the direction of the Executive Committee, and of which only the interest shall be used for the disbursements of the Society.

ARTICLE V.—Amendments.

These By-Laws, except Sec. 2 of Article 1, may be altered or amended at any annual meeting of the Society, by the concurrence of two-thirds of the members present, *provided, however,* that Article 4 shall not be so amended without notice given and entered on record at the preceding Annual Meeting.

INDEX TO AGRICULTURAL REPORT.

INDEX TO EXPERIMENT STATION BULLETINS.

INDEX TO THE POMOLOGICAL REPORT.

ANALYTICAL SUBJECT-INDEX OF AGRICULTURE OF MAINE FOR 1902 AND 1903.

The abbreviation "Sta." signifies the Experiment Station Report, and the abbreviation "Pom." the Pomological Report.

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