

SECOND DAY.

The Convention met at 10½ o'clock, Mr. H. L. STEWART of Middle Haddam, in the chair.

OUR SCHOOLS OF AGRICULTURE.

BY PROF. W. J. BEAL, LANSING, MICHIGAN.

According to the old view of agriculture in our country, a farmer needs no education, or but very little. It was only thought necessary that he have a limited amount of practice on the farm, especially while young. Almost anybody could be a farmer. The clumsy implements used, the imperfect modes of cultivation ; the superstition pertaining to many operations in planting and harvesting ; feeding, rearing, and killing animals ; the crude theories of animal and vegetable physiology ; the composition and needs of the soil ; the action of water, frost, heat, and light, all indicated that farmers, as a general rule, did not believe in acquiring much education.

In some parts of other states we still hear of men who cut timber in the moon, plant in the moon, cultivate in the moon, harvest in the moon, and kill hogs in the moon. They know that wheat will turn to chaff, sorrel to white clover, horsehairs to worms ; that timber grows spontaneously without any sprouts or seeds, and think the good old ways were the best. "They don't see no use nohow in book-larning for farmers."

Of course there are none of the old fossils here at this meeting, for they never go to such places. They know enough already. They have found out that "farming don't pay." We should, however, respect the memory of our ancestors, for most of them did the best they knew. They labored under great disadvantages in a new country, with little money, poor facilities, and that greatest of all obstacles, ignorance, with little or no inclination to improve.

Not every one who tilled the soil was satisfied with what he already knew. A few longed for something better, believed there were better modes of conducting farm operations, and set themselves to finding them out.

Scholarship has long been recognized as necessary for teachers, lawyers, doctors, and the clergy.

It is true that we now find many ignorant men who make

money and a good living on a farm, but they owe much of this ability to educated men who have improved implements of all kinds, modes of cultivation and management of crops, and improved breeding of domestic animals. These men take what they have earned no right to—they look over the fence and receive information without money and without price. No class of men are under deeper obligations than these to men of culture and progress, and yet, they are often the very men who complain most of taxes to support the schools. I need not say that, in the true sense of the word, a man's success on the farm cannot be measured by the amount of money squeezed out of everything.

It probably may be difficult to prove, but I presume we could trace the early progress in agriculture to the efforts of some learned men of other occupations who took up farming for recreation, or as a business. Certain it is, that in modern times, some of our foremost successful farmers have abandoned other business for farming. Although the so-called fancy farmers often fail to make their payments, and are subject to the derision of "practical" farmers, yet they do much to advance agriculture. They make experiments for the benefit of those who will not make them for themselves.

Where agriculture thrives, there we always find a prosperous people. It has always been so, and doubtless it ever will be. Through thought and skill the last 100 years have witnessed great progress in agriculture. These are familiar to you and need not be enumerated at this time.

This awakening of thought in reference to our noble occupation leads to the establishment of schools of agriculture. The first were founded in Europe, and are not yet old, while the first in our own country are still young.

The State of New York established the first, but it was soon abandoned. Michigan followed next. The State Legislature voted in 1850, 30 years ago, to establish an Agricultural School, and five years later, made provision for its location and support. Two years later, in 1857, 23 years ago last May, the college was opened to students. It is the oldest college of its kind in this country. For some years at first, there was a strong effort to unite this college to the State University. An agricultural school was a new thing without any model. Almost every man entertained a different view of what it should undertake to accomplish. There were no trained professors of agriculture, agricultural chem-

istry or horticulture. There were no good text-books in these departments.

The customs of the farmers in Europe were so different from those of the farmers of the United States, that little could be learned in Europe which was just adapted to our practical people. For several of the above reasons, some of the earliest of the professors in agricultural schools failed to hold their positions. Changes of professors in some departments of our agricultural schools have been alarmingly frequent.

I give a list of Agricultural and Mechanical Colleges of the United States. Those which have no farm attached are marked with an asterisk. The list was taken from the Rural New Yorker.

NAME OF INSTITUTION.	Post Office Address of President.	State.
Agricultural and Mech. College of Alabama,	Auburn,	Ala.
Arkansas Industrial University,	Fayetteville,	Ark.
Agr., Mining, and Mech. Arts Col., Univ. of Cal.,	Berkeley,	Cal.
*Sheffield Scientific School, Yale College,	New Haven,	Conn.
Agricultural Department of Delaware College,	Newark,	Del.
Florida State Agricultural College,	Tallahassee,	Fla.
*Georgia State College of Agr. and Mech. Arts,	Athens,	Ga.
North Georgia Agricultural College,	Dahlongega,	Ga.
Illinois Industrial University,	Urbana,	Ill.
Purdue University Agricultural College,	LaFayette,	Ind.
Iowa State Agricultural College,	Ames,	Iowa.
Kansas State Agricultural College,	Manhattan,	Kan.
Agricultural and Mechanical College, Ky. Univ.,	Lexington,	Ky.
Agricultural and Mechanical College of Louisiana,	New Orleans,	La.
Maine State College of Agr. and Mech. Arts,	Orono,	Me.
Maryland Agricultural College,	Agr. Col.,	Md.
*Massachusetts Institute of Technology,	Boston,	Mass.
Massachusetts Agricultural College,	Amherst,	Mass.
Bussey Institute of Harvard University,	Jamaica Plain,	Mass.
Michigan State Agricultural College,	Lansing,	Mich.
College of Agr. and Mech. Arts, Univ. of Minn.,	Minneapolis,	Minn.
Mississippi Agricultural and Mechanical College,	Starkville,	Miss.
College of Agr. and Mech. Arts, Univ. of Miss.,	Oxford,	Miss.
Agr. and Mech. Col., Univ. of Missouri,	Columbia,	Mo.
Mo. School of Mines and Metallurgy, Univ. of Mo.,	Rolla,	Mo.
Agricultural College, University of Nebraska,	Lincoln,	Neb.
College of Agriculture, University of Nevada,	Elko,	Nev.
N.H. Col. of Agr. and Mech. Arts, Dartmouth Col.,	Hanover,	N. H.
Scientific School of Rutgers College,	N. Brunswick,	N. J.
Col. of Agr., Mech. Arts, etc., Cornell Univ.,	Ithaca,	N. Y.
Agr. and Mech. Col., Univ. of North Carolina,	Chapel Hill,	N. C.

	Post Office Address of President.	State.
Ohio Agricultural and Mechanical College,	Columbus,	Ohio.
State Agricultural College, Corvallis, Oregon,	Corvallis,	Oreg.
Pennsylvania State College of Agriculture,	State College,	Pa.
*Agr. and Scientific Department Brown Univ.,	Providence,	R. I.
S. C. Agr. Col. and Mech. Institute, Claflin Univ.,	Orangeburgh,	S. C.
Tenn. Agricultural College, Univ. of E. Tenn.,	Knoxville,	Tenn.
Agricultural and Mechanical College of Texas,	College Station,	Texas.
*Univ. of Vermont and State Agricultural College,	Burlington,	Vt.
Virginia Agricultural and Mechanical College,	Blacksburgh,	Va.
Hampton Normal and Agricultural Institute,	Hampton,	Va.
Agricultural Department, Univ. of W. Va.,	Morgantown,	W. Va.
College of Arts, etc., University of Wisconsin,	Madison,	Wis.

These are located in thirty-seven different States. Each college differs in some respects from every other. Some of them possess and till large fertile farms, performing much of the work with the aid of students; some till only a small farm with students; some possess no farms; some till the farm entirely by hired labor, without the aid of students, and try to make money in the operation. "To run a farm for profit" is one great point made by some of the colleges. There are some colleges connected as branches to a university, others are distinct; some have only an agricultural department; some have military training; some a mechanical department.

There are various plans for students to work. In some colleges students all work at one time of day; in others, at different hours. In some colleges students all work every day throughout the course; in others, during only a part of the course. Some require very little work of students; others as much as three hours daily. In some of the colleges, students are taught telegraphing, engraving, printing, designing; and the girls are taught the art of cooking, sewing, and household economy.

In some places students are paid for all their work; in others, a part or all of the work is for practice and instruction, without remuneration.

We have agricultural colleges with the terms extending through the coolest part of the year, and in the others the term extends through the warmest part of the year, with a long winter vacation, in which students can engage in teaching school.

We have colleges in warm states and in cold states; in states where agriculture is the prevailing industry, and in states where manufacturing is the chief occupation.

I think our country is particularly fortunate in having such a variety of industrial colleges located in the several states. Most of them are proceeding without a model; all are striving to pursue the best way, so far as their means will permit. In time, errors will be eliminated, and the best courses will be learned. In a few years we shall somewhere have a model agricultural college, and probably more than one; while others will dwindle, go down, or continue to pursue a course not very different from other colleges with literary and scientific courses.

In Mississippi, Texas, and perhaps in other states, they have abandoned the practice of uniting an agricultural college with a university. In attempting to successfully unite the two they failed, and have started anew in separate colleges. This was the experience of our friends in Canada. In their noble university, which was well-equipped, they attempted to attach an agricultural college. The officers in charge, after the trial, reported that "The one word, *failure*, gives the history of all such arrangements. Agriculture is overshadowed by other studies; farming is elbowed out by other professions. Agricultural students feel themselves of an inferior grade, the class a dwindling and unsuccessful affair. Stubborn facts refuse to sustain the theory that this department will work well in connection with a general literary course."

For several years they have had an agricultural college, separate from the university. During the past year, report says that they were compelled to turn away two hundred students for want of room. Students all labor, often as much as five hours daily.

What shall constitute success in an agricultural college, is a question quite difficult to decide. Each may be successful in some respects and not in others. We shall differ in opinion as to what an agricultural college ought to attempt. We judge that a college is more or less successful according to the extent and quality of the training given to its students. A successful college is expected to be popular with the class of people who support it; to draw large numbers of students, and to retain a large proportion of these till they complete the course.

Further than this, most people consider what becomes of the students after pursuing a partial or a full course in an agricultural college. No matter what course of study they pursue, their life work will often be modified by the condition of the country in which they live. If agriculture is depressed from any cause, and the outlook for farmers is discouraging, young men will often seek

other business, no matter what has been their training. If agriculture is "booming," many bright young men will seek the farm as a life work. After all, the early training of a young person will have very much to do with his choice of business. In Michigan there are some excellent reasons why all of our young men, after a course in the agricultural college, do not engage in farming. Some students attend the college because they think the opportunities are excellent for obtaining a good education. Some of them have no idea of ever becoming farmers. From the start, they expect to become lawyers or doctors, or engage in some other business. Some attend the college for its excellent advantages in chemistry, or entomology, or botany. Students are induced to attend for various reasons of more or less importance. They flock to college after each other, as sheep over a fence.

After studying for a while, a young person may find that his taste leads him to follow some other pursuit than farming. We have no right to reject a person in Michigan agricultural college for not taking an obligation promising that he will become a farmer. He is allowed to remain and pursue his course if he keeps up with his class and behaves himself.

I have two students in mind who will not likely ever become farmers. One of them went to Philadelphia and attended the Centennial Exposition. He was there a week. On the first day in the morning he went straight to the art gallery and remained there all day. The remaining days found him in the art gallery. His skill with the pencil and his taste are all in one direction. He will be an artist or an architect, and probably a good one, and that is the place for him. Our course in agriculture and horticulture, botany and chemistry, has been a benefit to him.

Another student is an expert at drawing faces in caricature. He cannot keep his mind from these things. He likes drawing and succeeds in it, and all the attractions of the plow and the hoe cannot tempt him to give up the pencil and the brush.

One graduate told me that he was brought up on a farm at home, but he never liked it. After graduating he thought more of farming than he ever did before, but he was going to select law. Others entered with the intention of becoming teachers, lawyers, or engaging in something besides farming, but the course at the college changed their minds in favor of farming. No matter for what reasons students enter Michigan Agricultural

College, most of them, after leaving, intend sooner or later to go on the farm.

Many of our students are poor, and have no means with which to buy farms after completing a course of study.

They will become clerks, book-agents—anything that is honorable—by which they can earn the most money for the time ; but, when money is earned, they intend to buy a piece of land and make a farm of it. Going to an agricultural college will not necessarily make a young man choose farming as a business, nor will steady work on a good farm. If we wish a son to become a farmer, and he has no particular bent in another direction, we should keep the farm in his sight all the time. We must contrive by all honorable means to show him that it is not all drudgery, and that there is no business or profession in which a strong, well-trained mind can be used to better advantage. I cannot see why every farmer should wish his son to become a farmer, but it is generally the rule.

In Michigan, the students have from the start labored three hours a day. They have kept up a familiarity with various operations on the farm, orchard, and garden. In, perhaps, a dozen cases students have boarded away from the college, and have not been required to work. These have all, so far, chosen other occupations than farming. Perhaps they might have done the same had they been required to work three hours a day. Exemption from work—out-door farm work—has always tended to wean students from the farm, so far as my observation has gone.

A four-years' course in college is not too much time for a young man to spend in acquiring a general education, and in learning something about agriculture. A farmer needs a symmetrical education as well as anybody. He should know how to read and speak the English language correctly. He needs to know something of history, political economy, mathematics, book-keeping, botany, zoölogy, chemistry, mechanics, meteorology, physiology, drawing, logic, landscape gardening, civil engineering, a little of architecture, and of course he should know something of veterinary science, agriculture, and horticulture.

Unless the student acquire a general education in school or college, he is not likely to learn these branches ; and is, therefore, liable to become unsymmetrical and narrow.

In a college course for farmers, I place great stress on the thorough training to investigate any topic. They should make

some experiments, and study the laws of correct experimentation. They will thus acquire the habit of obtaining information for themselves.

I have named the branches which seem of most value for students to pursue in an agricultural college. Very much depends on the manner in which these branches are taught. The right men ought to be employed, whose specialties are just what is of most importance for the students to learn. In agriculture and kindred topics, the teacher should possess a practical turn of mind, and good business habits. There are many things which cannot be well taught in the class-room. I have just completed a course of daily lectures on horticulture to a class of juniors. Every attempt possible has been made to impress certain facts and methods clearly on the minds of the class. Most of them have been brought up on farms. After my efforts, I should be ashamed to read you some of the mistakes made in their examination papers. Some of these were made on account of erroneous notes taken during the lectures, some through a misunderstanding of some of my statements. I have found that there is not much use in attempting to teach some things in the class-room and I have given up that way.

A few years ago, after spending the best part of two lectures on the structure of the grape-vine and a few modes of trimming, I questioned my students on the subject. They seemed to understand it all perfectly. The next day, eight or ten of them, each with knife in hand, was asked to prune a grape-vine. They all hesitated and wanted to see me trim one first. I did so, and then directed each of them, all being allowed to suggest mistakes made by the others. Each trimmed three or four vines. Some of them said, "This is worth more than all of your lectures on the subject. Now we understand it."

I might relate a similar experience in reference to some of my early teaching of animal physiology, botany, and zoölogy.

At present, and for the past two or three years, our course in horticulture has been divided into two parts, one consisting of a course of lectures given in the class-room, and the other a course of training in garden or orchard. Students are all taken, about eight in a company, with the proper tools in hand, at the proper season of the year, and have actual practice in budding, grafting, layering, making cuttings, trimming drives, cutting and laying sods, trimming apple-trees, thinning apples, trimming grape-vines, raspberry-bushes, picking, assorting and packing apples, marking

out orchards, taking up and setting out large and small trees and plants, care of hot-beds, management of celery, use of garden implements, crossing flowers, fighting several kinds of insects, and many other operations.

This lesson comes, through one year, as often as twice a month for each junior, and continues for one or more hours, sometimes for three hours. Each is asked to make any suggestions or improved methods, or criticise any point in the work. This is made a part of the course, and is required of each student as much as his lessons in geometry. No pay is given for such work. Sometimes a student works three hours a day for two days or more, as in trimming apple-trees. The trees are all labeled and numbered. Each student takes his trees, and, when done, the members of the division inspect the work, with the professor, for criticism.

This is valuable work and we cannot have too much of it. We are likely to get too little of it, because it takes time and foremen, both of which are deficient. Unless the account goes upon the college record and finds a regular place, it is likely to be neglected or crowded out.

A whole course of such training, and such *only*, would not be enough for an Agricultural College. It would be all art and no science; all practice with no reasons. The students need regular lectures and recitations and practice in writing essays. They must have *laboratory* practice in chemistry, zoölogy, and botany. For example, the old way of teaching and learning botany would not answer. Historical and systematic botany are all well enough, but they should not take the place of drawings and notes, carefully made after prolonged study, with microscopes and other apparatus.

Book learning and the study of drawings to illustrate the text in works on botany, zoölogy, and mechanics can no longer be palmed off as valuable training.

The Old Botany, or the old way of teaching it in many places, was somewhat as follows: The teacher is supposed to be a dried-up old fellow—a regular fossil. He wears odd-looking clothes. He usually teaches his classes from the text-book, and prefers to pursue the study in winter, so pupils can learn the names and peculiarities of plants before the plants themselves appear in spring. There are many hard, unfamiliar names in this study.

With no specimens to illustrate the lessons and a dry teacher,

most of the pupils have acquired a thorough disgust of the study long before warm weather furnishes specimens for illustration. In time spring flowers appear, and the pupils are supplied with them. Each may have a cheap microscope, which he is compelled to hold in one hand. The teacher and class hastily and superficially run over the various parts of the plant. They all turn to an artificial key and wade through this part of the book till the teacher says, "We have found the order to which the plant in hand belongs." They turn to the page for the order and proceed till they come to the name, which may be *Claytonia Virginica*, *Hepatica triloba*, or *Ranunculus fascicularis*. And what next? "We have found the name of the plant." The pupils have merely had an introduction to the stranger in the most formal manner. The teacher can suggest nothing further for the pupil, except that it would be a good plan for each member of the class to collect specimens, press, dry them, place in a portfolio, and give each a label, on which should be written the Latin and common names, the habitat and time of flowering. The pupil has been taught that it is all of botany to learn the names of the parts of a plant, or the parts which are not too small to be easily seen with a cheap hand-glass. Mysteries are still unsolved, and the plant is still a stranger. We ask it no questions: we receive no replies. We have only glanced at the exterior. Such is the mode of study which I say "can no longer be palmed off as valuable training."

THE NEW BOTANY.

A much better way of beginning botany than the above, at least one which I have found better for my classes, may be indicated somewhat as follows: Before the first lesson each pupil is given some specimen to study. If flowers or growing specimens cannot be had, give each a branch of a tree or shrub, which branch may be two feet long. The examination of these is made during the usual time for preparing lessons, and not in the class-room. Without having the specimens in sight, they are to tell what they can about them for the next recitation. They can use books if they prefer, though it is better that they do not. No books can be found that will give much assistance on such a lesson. The time arrives, and the hour is mostly spent in hearing different members report their discoveries, until all have had a chance to add anything not noticed by any other member. The teacher suggests a few other points for study. The pupils are not told

about things which they can see for themselves. An effort is made to keep them working after something which they have not discovered. If two members disagree on a point, on the next day, after further study, they are requested to bring in all the proofs they can to sustain their separate conclusions.

It is often astonishing to notice how much is discovered by so many good eyes. For the next lesson the students review the first lesson, report on a branch of another kind of plant which they have studied, and notice the points of difference and similarity between the two. In like manner new branches are studied and new comparisons made.

For some weeks but little use is made of microscopes or textbooks. In nearly all important cases specimens are examined, and a need felt for a name or a definition, before these are given. After a few lessons answers to the following points are brought out:

Is there any definite proportion of active to dormant buds in any year? Where do branches appear? Is there any agreement in growth as to length of branch and size of the annular ring each year? Is there any similarity of rapid or slow growth of all the limbs on a branch in each year? Is there any certain number of leaves on a year's growth, or any definite proportion between the lengths of internodes? Can the smallest, old, dormant buds be made to grow? Is there any order as to what buds grow and what remain dormant? How much and on what years did each limb grow? There are three ways of telling the age of a branch—by the bud-rings, stem-rings, and color of the bark. The shape, other peculiarities, and variations of buds, and leaf-scars in any species are noted; also the arrangement and position of the buds and bud-scales. Is there any order in the arrangement of the specks on a branch? Do the specks change as the branch grows older, and if so, how? How many leaves each year were required to build up the branch? How large were the leaves and the amount of surface exposed? Did the amount of growth in any year correspond to the number of leaves on the twigs and main axis? Does the ring of wood depend on the growth of the main axis? The arrangement of the scales of cones are studied in this connection. In each case the students are requested to try to classify the topics or place them under proper headings. They are now ready for a book lesson on branches,

buds, and phyllotaxis, and they will read it with interest and profit.

In like manner any other topic can be taken up, provided plenty of specimens can be supplied, as roots, seeds, fruits, stamens, petals, sepals, leaves, etc. After each of these comes the study of the book. Beginners should study plants and refer to books, and not study books and refer to plants.

Some of the above topics are admirably well adapted for theses or compositions. I usually give each student one or more of them each term. For the younger students this year, the following topics will serve as examples: "Compare the leaves and young branches of the Scotch pine with those of the Austrian pine," or "black spruce and Norway spruce," or "sugar maple and red maple," or "butternut and black walnut."

As students advance in systematic botany and morphology, other subjects for theses are assigned, of which the following may serve as examples:

The arrangement and development of parts of the flower, with reference to its self-fertilization, or fertilization by insects, birds, winds, or by other means. Below are samples: Moth-mullein, dog-bane, common sage, thyme, red clover, plantain, milkweed, mallow, thistle, cleistogamous flowers of violet, campanula, iris, lobelia, martynia, Indian corn, wild balsam. One student may study the vines of dodder; one, the climbing of Virginia creeper; one, the twining of the wild morning-glory; one, cucumber tendrils; one, unequal-lobed leaves; one, the time of opening and closing of flowers; several, the development of some irregular flowers; one, the order of dehiscence among anthers of a flower; one, the honey-glands of some flower; glands in other parts of plants than flowers; growing beans in all sorts of soil and with more or less light; the germinating power of weevil-eaten peas; the relative order of development of stamens and pistils of many plants of Indian corn; for what do ants visit plants?

The theses were made up of original investigations and experiments, and were read in class. Students use stage microscopes. Later in the course, each is supplied with a good compound microscope, in a suitable room, where he works daily for a term. Pupils prepare their own slides, make notes and drawings, which are preserved at the college. Most of the time for the term is spent on one plant, a favorite of which is the common pumpkin.

I have been quite particular to show the course pursued, because

some think it is difficult. Aside from collecting specimens, it is an easy way for the teacher. But little time is occupied in lectures. Short talks of fifteen or twenty minutes are often given. Zoology and physiology can be equally well taught in the same manner. Students are shown how to become independent and reliable observers and experimenters. Training is better than teaching. On this point I quote briefly from a recent number of the *New York Tribune*. "Teaching communicates ideas, training forms habits. Teaching imparts knowledge, training develops power. In teaching, the adult explains words. In training, he shows methods. Under teaching, the child hears what is said: under training he sees what is done," and I may add he learns to do it himself. "Training is food which gives strength to run." To train is to show how. Training develops power, which is more valuable than knowledge.

The management of students' labor is somewhat perplexing. For perfect success it needs foremen with unbounded tact and an unlimited amount of patience. For work, students receive pay at a maximum rate of eight cents per hour. During one season, from spring till autumn, one class works on the farm: during the next season the same class works in the horticultural department. To a considerable extent the Seniors are employed as assistant foremen, with small gangs of hands, at various kinds of work. Some of them succeed well; many of them can never learn to manage others to good advantage. About half the Seniors work all the year in the horticultural department. One Senior is set over some portion of the department for the whole year. One looks especially after the vineyard, one the apple-orchard, one the orchard for pears, cherries, and plums, another the trees on the lawn, another the drives and paths, one the hot-beds and a portion of the vegetable garden, one the wild garden and testing seeds, one the plats of sample-beds of grasses, clovers, etc.; another certain experiments, another collecting and pressing plants for class-use and the herbarium.

Whenever any work is done in each of these places, the proper Senior is there to act as foreman in directing the labor of other students. Young men take great interest in the work over which they preside, often working extra hours, if necessary.

They are allowed, as far as practicable, to choose the work they are to look after during this last year of the course. These young men assist in making experiments. They very often make some

on their own account. For example, during one year, one crossed wheat for new varieties; one crossed wild and cultivated crab-apples; two crossed corn; two or three crossed lilacs; one observed the duration of flowers of several kinds; one crossed tomatoes; one observed the peculiarities in the germination of seeds; one studied monstrosities among flowers; another layered apples; one studied the nodding of the heads of wheat; another the depth of the roots of barley and oats; another tested "buggy" peas and those not buggy, for comparison. I could name pages of other small experiments undertaken by students.

Students work as well as they study, and feel much worse for receiving a low rate of wages than they do for receiving low marks for recitations or examinations.

Students talk about agriculture, and write about it in some form or other, in their orations and essays.

After graduating, what becomes of the students? Literary colleges send only from one to three per cent. of their graduates to the farm.

Not all who take a course in medicine become practicing physicians. More than half of those who take a law course do not engage in law. I have never heard any one find fault with these schools, because all of the graduates did not pursue a course in accordance with their especial training.

Michigan Agricultural College has graduated 212 students, employed as follows:

Farmers,	-	-	-	-	-	86
Fruit culturists,	-	-	-	-	-	8
Professors of Agriculture or related sciences,	-	-	-	-	-	13
Instructors or foremen,	-	-	-	-	-	3
Students in agriculture,	-	-	-	-	-	2
Agricultural editors,	-	-	-	-	-	2
Apiarists,	-	-	-	-	-	5
Engineers,	-	-	-	-	-	4
Architect,	-	-	-	-	-	1
Landscape gardener,	-	-	-	-	-	1
Veterinary surgeon,	-	-	-	-	-	1
U. S. Signal Service, Sergeant,	-	-	-	-	-	1
Machinist,	-	-	-	-	-	1
Total Industrial Arts,	-	-	-	-	-	

Business men,	-	-	-	-	-	26
Teachers,	-	-	-	-	-	22
Lawyers and law students,	-	-	-	-	-	18
Physicians and students of medicine,	-	-	-	-	-	9
Ministers and students of theology,	-	-	-	-	-	3
Editor of News Paper,	-	-	-	-	-	1
Deceased,	-	-	-	-	-	5
Total number of graduates,	-	-	-	-	-	212

If we exclude those deceased, and one lady graduate, over three-fifths may be counted as now engaged in pursuits which are in keeping with the objects and training of the Agricultural College.

Some thirteen hundred other students have spent from one to three years at the college. So far as known, a large majority of these are farmers.

Of the graduates, one is professor of botany and horticulture in Cornell University; one professor of zoology and entomology in Michigan Agricultural College; one professor of agricultural chemistry in the University of Wisconsin; one professor of economic botany in the University of Missouri; one professor of botany in the Iowa Agricultural College; one professor of chemistry in Oberlin College; one professor of chemistry in the Agricultural College of Mississippi; one professor of agriculture in Kansas Agricultural College; one professor of mathematics in Michigan Agricultural College; one professor of agriculture in Purdue University; one professor of chemistry and horticulture in Colorado Agricultural College; one professor of agriculture in Texas Agricultural College; one professor of agriculture in Mississippi Agricultural College; three are foremen in Michigan Agricultural College.

One is associate editor of the American Agriculturist; one secretary of the Michigan State Horticultural Society; one has charge of the experimental and test gardens of a very large firm of seedsmen; one is a Trustee of Illinois Industrial University; one a member of Michigan State Board of Agriculture.

My remarks might be much extended in speaking of the high positions and success of other graduates, and of those who took a partial course. Although the list of graduates is not a long one, yet it is one of which the managers of Michigan Agricultural College are justly proud.

"Does the farm pay?" This is a question often asked by the farmers of Michigan. Does it pay what? Does it return more

money into the State Treasury than it draws out? Does it pay as a part of the apparatus with which to educate students? As a general thing, the farm returns more money than it costs to manage it, though sometimes the reverse is true. If the farm were managed purely for making money it would be worth much less for training the students than as now managed. It is proper to ask that no waste be allowed in conducting the farm.

For some time past people have mostly ceased to ask this question of our horticultural department, "Does it pay?" There is much time and labor spent in labelling trees and plants, in keeping the grounds in order, in planting and caring for ornamental trees, in enlarging and caring for the botanic garden and experimental plats. The orchards, vineyards, and gardens are planted with varieties by the score, where but one would be planted for profit, if only a large money return were anticipated. The grounds, orchards, and gardens pay as a great laboratory for our students, and the large number of visitors who come to gain information.

Should experiments be made at Agricultural Colleges? Some may think this a queer question and take it for granted that Agricultural Colleges were established to a great extent for this very purpose. So far as I can learn the teaching force in nearly all such colleges is less than it ought to be. If experiments are made with the present plans, the teachers are compelled to perform double duty. Good experiments cost money, and they cost something else which is equally valuable, viz. : careful plans and skilled labor.

Most people greatly underestimate the difficulties of conducting experiments which shall be valuable after they are performed. For several reasons I should say, By all means conduct experiments at Agricultural Colleges. There should be a separate fund which should be perpetual, and to a great extent separate persons should be employed to make experiments. The public and trustees of colleges are not likely to think it necessary to diminish the time which a professor devotes to teaching, because he devotes considerable time to making experiments.

Good papers and books, agricultural and literary, will always be sought and read by farmers who keep abreast of the times. The less education the members of a family possess, the poorer and cheaper will be the papers and books which they read. The man who thinks the most and the deepest enjoys the most. It is somewhat disheartening to see what trashy papers called "agricultural"

will be pronounced "good" by a certain class of farmers. Some of them are poor hash and make feeble diet.

On the whole our agricultural papers are steadily growing better, and will continue to grow better, and the best will be better patronized, as our farmers become more generally well educated. Our Agricultural Colleges, I am certain, are doing more than any other one thing to improve the quality of our agricultural books and papers. Farmer's Clubs accomplish something in the same direction. They are worth all they cost, and should be encouraged; but they are very few in number, and most of them feebly sustained.

Granges, at least as we have them in Michigan, are better than clubs, because there are many more of them, more people attend them, the meetings are held oftener, they include all the adult members of the family, and closely connect the farmers all over our country.

Well-conducted farmer's institutes accomplish a good work, not so much because the mass of men who attend them learn a great deal during a few short sessions, but because they arouse zeal and enthusiasm, and cause a farmer to think more of his calling.

For the past five or six winters, the Michigan Agricultural College has held six institutes every winter, in various parts of the State. The State Horticultural Society holds three meetings and one fair. Perhaps ten or fifteen other general gatherings of farmers are held each year, for similar purposes. At these meetings will be present from 200 to 1,000 farmers, including members of their families.

At these gatherings we learn from each other. The college men glean items of great value from the experience of men who work their farms; the farmer receives new hints from the college men to be put in practice. Each helps the other.

Books, papers, clubs, granges, fairs, institutes are all valuable, but they are a poor substitute for a systematic training, under good teachers, in several of the sciences.

The habit of close observation is of inestimable value to every farmer; without it he loses many golden opportunities. With close observation generally comes accuracy and correct judgment. A thorough scientific education is also valuable, because it gives the one who acquires it the habit and power of readily acquiring information whenever he may desire. The self-made man, if he acquire this habit, has to travel the same road as the college man, though

he labors under a great disadvantage in not having teachers to guide him in the easiest way.

In our country, there are many thoroughly educated farmers who are an honor to their noble occupation. We need one hundred where we now find but one.

On the farm there is need of more brain-work and less with the hands. At all times brain-work pays the best returns for the time given to it. Labor with the hands is easier than work with the head. If a greater proportion of farmers were well-educated, people would consider farming a higher business. Any occupation takes rank according to the culture of those who are engaged in it. Farmers need to mingle more with each other, and with the best of those who are engaged in other occupations.

Mr. ———. Much valuable information was obtained from Dr. Cressy last evening, after the lecture, of practical benefit to the people who own horses; and so I would like to have Prof. Beal reply to questions in like manner. I would like to have him give us a practical illustration of how he teaches his class to trim fruit-trees and grape-vines, at what time of year, and what method he pursues.

Prof. BEAL. The matter of trimming trees is discussed in our lectures; the reasons are given for trimming them at certain times of year, and the reasons for removing certain limbs, etc. We live in a part of Michigan where the climate is exceedingly severe, the thermometer going down to thirty-three degrees below zero—something you never dream of here, I suppose; and as our seasons are rather short, our trees have to be managed according to our climate. In some places in our State, apple-trees are trimmed in the form of an inverted umbrella, with an open center. In Central Michigan, where I live, that is a bad practice. It lets in the summer sun, and the cold of winter seems to affect trees trimmed in that way worse than those trimmed under a different system. I have seen a good many trees killed by this treatment. Our plan is to leave the center at the top about as thick as the sides, and trim the tree all round. I do not think I ought to occupy the time by giving a lecture on just how we prune trees. The students take their tools in hand, and I remind them again of a few of those rules; to take off no limb from

an apple-tree which is much over an inch in diameter, because the tree is likely to be damaged by removing a large limb, and it is likely to leave a large scar. Even if we paint it over, it weakens the tree. It is better to trim a little every year than to take off a good deal once in five or six years. Then they are advised again, instead of taking off limbs right around the center of the tree, out of the head of the tree, and thinning them all out and leaving the branches at that place naked, to cut off small limbs among the outer branches all over the tree. Sometimes the operator thins by cutting in from the ends and cutting off the small limbs. Theoretically, it would be well to cut off only the smallest limbs, but apples are so cheap with us that it would not pay to pursue this method, and so they generally cut off limbs the size of my finger. It takes a good while, by this process, to make a little display, but it seems better for the trees. The implement we find about as handy as anything is a two-inch chisel ground with a notch in the end like the letter V, with a handle five or six feet long, and the student has a little mallet in the other hand, with which he strikes the handle and thus cuts off the limb. But where the limbs are forked, he is unable to cut them with this implement. This trimming is usually done quite early in the spring, in March, and sometimes in February.

Mr. WADSWORTH. Can you change the bearing year?

Prof. BEAL. We have sometimes changed the bearing year by picking the fruit. This year it appeared that everybody in Michigan, as far as we could hear, was to have an abundance of fruit; and after the apples were fairly set, it occurred to me that our apples would be very plenty, and I put the students in the trees to thin them when they were about the size of my finger-ends. It would take a student perhaps three hours to thin a tree eighteen years old, and as they were paid eight cents an hour, it would cost twenty-four cents. That is not very much. We thinned the apples so that some people thought we would have no crop. There were a few left, and they grew large and fine, and were of excellent quality, and we have strong trees. I am satisfied that they will stand a

much better chance of having something of a crop next year. We pay a great deal of attention to thinning all kinds of fruit. Grapes and plums are more than half picked off, and no one in the West now thinks of raising nice peaches without thinning. I suppose that is the same here.

QUESTION. I would like to inquire if the fruit-buds have formed for another year on those trees that were thinned?

Prof. BEAL. I have not examined them this year to know just how they are, but there are some fruit-buds on them at any rate. Trees may have fruit-buds, and yet not bear fruit. I have studied this matter somewhat, and I find that when trees blossom fully and produce no fruit, there is likely to be some reason for it. There may be a bad storm just at the time the flowers appear; and another reason is, that the trees produce feeble flowers. The anthers are shriveled and produce poor pollen, and many of the pistils, in certain seasons, are small, short, mere rudimentary pistils, which cannot be fertilized to produce fruit, whereas pistils of the usual length may be fertilized and produce fruit. These are some of the reasons that will account for the failure of the crop when apple-trees may blossom fully.

Mr. ———. I would like to ask the speaker a few questions in regard to the honey-locust. Two years ago this spring I purchased four thousand hedge plants through a firm in western New York, and now, to my disappointment, about one-half of the plants in the line are perfectly smooth; as smooth as the osier willow; the other half are thorny. I wrote to the party I purchased of, telling him my complaint. He replied, saying that he never yet saw a lot of honey-locust hedge plants in which some of the plants were not perfectly smooth and without thorns, referring me to an old apple-tree in the pasture where cattle had browsed upon it, and in a few years it would become thorny. I would like to ask you if I can have any hopes of those plants that are now perfectly smooth ever becoming thorny?

Prof. BEAL. I think your hedge will not all be thorny until the plants get old. There is a variety of honey-locust, so called, which produces thorns only to a very limited extent.

Some of your trees as they grow older may throw out thorns, but I doubt if they all will. They do vary in that respect, as the nurseryman told you. It is possible some of his seed came from the smooth variety.

Mr. ———. He referred me to two trees now standing in his grounds, one of which is perfectly thorny and the other smooth, and he termed them male and female.

Prof. BEAL. He is all off the track there.

Mr. ———. I supposed the stamen and pistil were on the same tree of the honey-locust.

Prof. BEAL. Yes, sir. There is no distinction in that way.

Mr. GOLD. Are not the male flowers of the honey-locust on one tree and the female flowers on another, usually?

Prof. BEAL. I think not. I think the same tree has the staminate and the pistillate flowers to some extent. I know we have one tree in our place that bears flowers with pistils and stamens also. No doubt some trees have that peculiarity. Some of our red maples have stamens and pistils and some only have pistils.

Mr. GOLD. One of my first observations in botany was, that there were two trees of that variety in the town where I resided, and only two. My father's tree bore pods; my neighbor's tree, in another part of the village, never bore any pods at all.

QUESTION. Did the tree that did not bear pods have any thorns?

Mr. GOLD.* I think they were both thorny.

Prof. BEAL. I presume so.

QUESTION. Can you give us any reason for the fruit dropping prematurely in our country?

Prof. BEAL. I can only answer the gentleman in a general way, not being familiar with the conditions of fruit-raising here in Connecticut. In our State, fruit drops for a variety of reasons. It may prematurely ripen from some injury caused

*The honey-locust is polygamous; producing staminate or pistillate flowers, or both, on the same tree.

by a hail-storm or by insects. The codling moth causes it to drop. Then there are certain varieties that have stems so formed that the wind takes hold of them and causes them to drop badly. Those sorts that usually drop badly are rejected by planters; they plant other sorts that hold on better.

QUESTION. I would like to inquire if the bearing year can be changed permanently? If you have succeeded for one or two years with a tree, can that change be made permanent?

Prof. BEAL. Not certainly, in all cases. I have tried that in some cases. I have taken all the fruit off of a northern spy in the bearing year, and the next year it bore considerable fruit. But it inclines to go back to the old way. I have no doubt that in a few years it will get back to the old habit, unless the practice of thinning is followed up. I have known a case where a man had two trees of the Talman's sweet, for instance, in his garden. He took all the fruit off of one of the trees one bearing year, and followed that up for a few years, and now they are bearing in alternate years, just as he wanted them to. By thinning heavily in productive years, we can do a good deal toward getting fruit in other years.

Mr. ———. I have seen an orchard that bore in the odd years, and I asked the proprietor how he got fruit at that time. He said he started his trees right. There has been an abundance of fruit all over the State this year. I saw that orchard a year ago, and it was full; this year the crop was very light. The remark he made was, "I start them right." That is, he commenced by picking all the apples off of the trees in the bearing year, and they produced in the off year, and continued to do so.

Prof. BEAL. The experiment is worth trying, and it does succeed to a considerable extent, but is not absolutely certain. It is well worth thinking of, and well worth what it costs to experiment on it.

Mr. ———. This habit continued when the trees matured and became twenty-five or thirty years old. It was almost the rule.

Mr. FISH. I have a very small orchard, and I would like

to ask if it is not possible to so manage it as to obtain a moderate crop of apples every year?

Prof. BEAL. If you produce a moderate crop, so that the tree grows with vigor, it will be capable of producing a moderate crop every year. I know some trees that bear a small crop every year, but if they bear a very heavy crop one year they are likely to miss the next year. That is the case with most of our trees.

Mr. AUGUR. In endeavoring to change the bearing habit of trees, would it not be better to remove the flowers than to wait until the fruit is formed?

Prof. BEAL. It would be, undoubtedly, but it is an expensive process to remove the flowers from a large tree. If you wait until the fruit sets you have much less to remove. That is the only reason for waiting until the apples become as large as my finger-ends.

QUESTION. Is there not a natural law which is arbitrary in this matter? Is this alternation in our fruit trees owing wholly to the exhaustion of vigor? If there is not an arbitrary law which influences this matter of alternation, why is it that the trees all over New England this year, of a given variety, are in full bearing, although of different ages? Although coming into fruitage in different years and at different ages, yet they are all bearing on this same year.

Prof. BEAL. A gentleman here has just told us that he knows an orchard that bore a full crop last year. I do not know the reason why apple-trees should bear so much some years and not others.

Mr. CHEEVER. It seems to me the meeting is getting a little off the question of college education, on to pruning fruit-trees, and the like. I want to ask the speaker whether the Michigan college finds any difficulty in obtaining students? Whether the college is growing in popularity throughout the State, and whether the farmers seem to be willing to help support it?

Prof. BEAL. I am very glad the gentleman has asked the question. I have been connected with the institution ten

years. I do not know much about it previous to that time. This summer I gave a lecture to our students upon this very matter of the growth of agricultural colleges. When I entered upon my duties at the college, we had eighty regular students. The past year we have had two hundred and sixty-five. It has increased more than three-fold in ten years. At the time I went there it was very unpopular. The papers were fighting it throughout the State. Some of the most influential daily papers all over the State were opposed to it. We had to fight for any appropriation by the legislature. I do not know now of a single paper in Michigan (and we have 200 or 300), or a single periodical, that opposes the agricultural college. The most influential dailies are all in favor of it, and all speak a good word for it. This change, I am certain, has been brought about largely by the farmers' institutes that are held in the State, and a good deal is due to the fact that the right men have been at the head of the Granges in the State. The master of our State Grange, and the other officers, are all strongly in favor of the agricultural college. They work for it in every way. If a member of our legislature is not favorable to it, they go for him, so that he does not go to the legislature a second time. They leave him at home, and put another man in his place.

QUESTION. How large an appropriation does the college receive from the State yearly?

Prof. BEAL. I am unable to tell you. It depends upon the new buildings that are to be erected. It varies a good deal in that respect. Last year, for the horticultural department, there was \$2,000 appropriated to aid in building a green-house; \$6,000 was appropriated to build a new library, for books on botany and horticulture alone, and to contain the museum of vegetable products. We had never asked so much before for the horticultural department, but everything was granted that was asked.

Mr. WHITTAKER. Are those appropriations asked for as the wants of the college require, or is there an appropriation every year of a certain amount?

Prof. BEAL. The State is bound to keep the buildings in

repair and build new ones, and it does supply part of the deficiency. The interest on our land grant is now about \$18,000 a year. The land is not all sold, and the interest will be still greater as more land is sold. There is no special amount that is given by each legislature; it varies according to the needs of the college.

MR. WHITTAKER. The Professor says that ten years ago the number of students was eighty, and the past year they have increased to two hundred and sixty-five. Has that growth been gradual; that is, from year to year?

Prof. BEAL. Yes, sir. Certainly it has been, if you take two or three years together. The number varies a little according as times are hard or easy, just as that cause affects other institutions and the general business of the country.

MR. WHITTAKER. What I want to know is whether there has been a systematic effort made to increase the number of students, or whether it has been what we call a natural growth.

Prof. BEAL. There has been no special effort made.

MR. J. S. WOODWARD, of Lockport, N. Y. Let me add a word to what Prof. Beal has said with regard to the popularity of the Michigan Agricultural College. I have a good many friends in Michigan, and my business as well as inclination has taken me there several times during the last three or four years. I am well acquainted with the people all over the State, and I can say that the most popular institution in the State of Michigan is the Michigan Agricultural College.

Adjourned to two o'clock.