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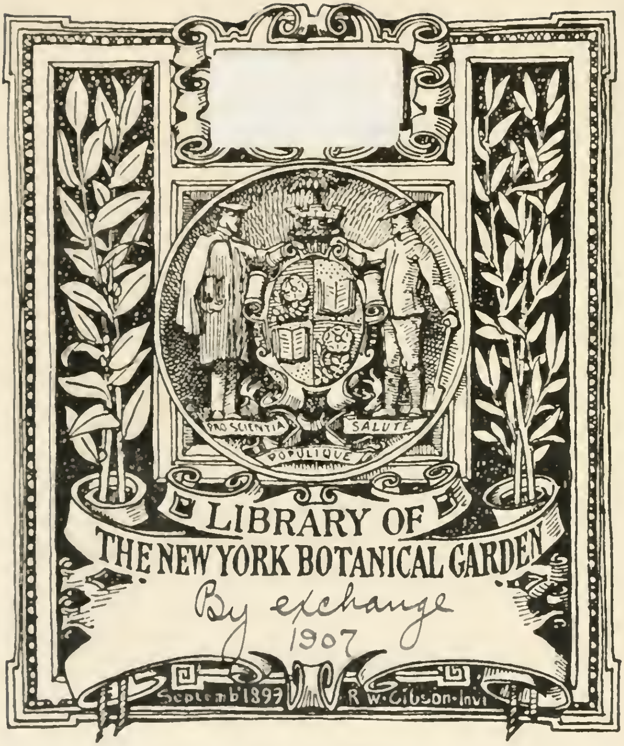
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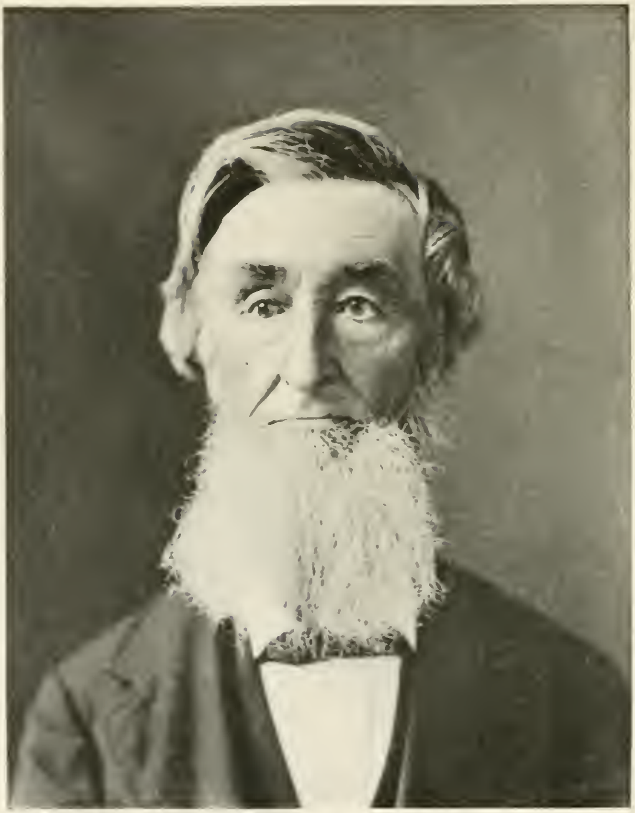


THEODORE SEDGWICK GOLD.

State of Connecticut

PUBLIC DOCUMENT No. 18

THIRTY-NINTH ANNUAL REPORT

OF THE

SECRETARY

OF THE

Connecticut Board of Agriculture

Compliments of
James F. Brown
Secretary

Hartford Press
THE CASE, LOCKWOOD & BRAINARD COMPANY
1906

State of Connecticut

PUBLIC DOCUMENT No. 18

Thirty-Ninth Annual Report

OF THE

SECRETARY

OF THE

Connecticut Board of Agriculture

1905

PRINTED BY ORDER OF THE LEGISLATURE

Hartford Press
The Case, Lockwood & Brainard Company
1906

PUBLICATION
APPROVED BY
THE BOARD OF CONTROL.

To His Excellency

HENRY ROBERTS,

Governor of Connecticut:

In accordance with the provisions of an act creating the State Board of Agriculture, I have the honor to submit herewith the Report for the year ending December 31, 1905.

JAMES F. BROWN, *Secretary.*

NORTH STONINGTON, December 31, 1905.

STATE BOARD OF AGRICULTURE.

1904-1905.

His Excellency HENRY ROBERTS, *ex officio.*

APPOINTED BY THE GOVERNOR AND SENATE.

		Term Expires.
Charles L. Tuttle,	Hartford,	1909
L. H. Healey,	North Woodstock,	1909
Charles E. Chapman,	Westbrook,	1907
Iverson C. Fanton,	Westport,	1907

APPOINTED BY THE GENERAL ASSEMBLY.

Hartford County,	Edmund Halladay, Suffield,	1909
New Haven County,	D. Walter Patten, North Haven,	1909
New London County,	James B. Palmer, Jewett City,	1909
Fairfield County,	Seaman Mead, Greenwich,	1909
Windham County,	N. G. Williams, Brooklyn,	1907
Litchfield County,	Edwin G. Seeley, Roxbury,	1907
Middlesex County,	W. L. Davis, Durham Center,	1907
Tolland County,	Charles A. Thompson, Melrose,	1907

OFFICERS OF THE BOARD.

Governor Henry Roberts, *President ex officio.*

Edwin G. Seeley,	Roxbury,	*Vice-President.*
James F. Brown,	North Stonington,	*Secretary.*
Chas. A. Thompson,	Melrose,	*Treasurer.*
Dr. E. H. Jenkins,	New Haven,	*Chemist.*
Dr. G. P. Clinton,	New Haven,	*Botanist.*
Dr. W. E. Britton,	New Haven,	*Entomologist.*
N. S. Platt,	New Haven,	*Pomologist.*

Auditors.

Seaman Mead   D. Walter Patten   Chas. E. Chapman.

REPORT OF AGRICULTURAL FAIRS IN CONNECTICUT, 1905.

Delegate.	Name.	Place.	Date.	President.	Secretary.
L. H. Healey	New London County	Norwich	Sept. 12–14	E. J. Miner	T. W. Yerrington
C. E. Chapman	Windham County	Brooklyn	Sept. 12–14	F. H. Deming	J. B. Stetson
C. A. Thompson	Beacon Valley	Naugatuck	Sept. 4	Wm. J. Noble	Wm. L. Lloyd
I. C. Fanton	Berlin	Berlin	Sept. 20–22	C. M. Jarvis	W. W. Christian
W. L. Davis	Branford	Branford	Sept. 4–5–6	Edwin Doolittle	J. P. Callahan
C. E. Chapman	Chester	Chester	Oct. 4	Benj. E. Harwood	Edgar W Lewis
L. H. Healey	Colchester Grange	Colchester	Sept. 19	J. R. Dutton	M. R. Abell
E. G. Seeley	Danbury	Danbury	Oct. 2–7	S. H. Rundle	G. M. Rundle
C. L. Tuttle	Farmington Valley	Collinsville	Sept. 6–7	O. F. Perry	E. A. Hough
E. Halladay	Granby	Granby	Sept. 27–28	Geo. O. Beach	Theodore G. Case
S. Mead	Greenfield Country Club	Greenfield Hill	Sept. 12–15	N. H. Sherwood	Mrs. D. B. Adams
W. L. Davis	Guilford	Guilford	Sept. 27	A. Minor Leete	Robert De F. Bristol
C. A. Thompson	Harwinton	Harwinton	Oct. 3	Wm. J. Barber	L. O. Catlin, Torrington
J. F. Brown	Mad River Grange	Waterbury	....	A. J. Pierpont	....
D. W. Patten	New Haven Co. Hort. Soc.	New Haven	Nov. 7–9	R. D. Pryde	Thomas Petit
D. W. Patten	New Milford	New Milford	Sept. 12–15	J. Leroy Buck	J. E. Hungerford
E. G, Seeley	Newtown	Newtown	Sept 26–28	R. C. Mitchell	P. H. McCarthy
I. C. Fanton	Orange	Orange	Sept. 4–5–6	W. S. Woodruff	A. D. Ciark
D. W. Patten	Putnam Park Association	Putnam	Sept. 2–4–5	M. R. Joy	E. M. Arnold
S. Mead	Rockville Fair Association	Rockville	Sept. 26–28	A. Kingsbury	A. L. Martin
C. L. Tuttle	Simsbury	Simsbury	Oct.	E. A. Hoskins	Geo. C. Eno
N. G. Williams	Stafford Springs	Stafford Springs	Oct. 3–4–5	E. C. Dennis	C. F. Beckwith
S. Mead	Suffield	Suffield	Sept.	Waldo S. Knox	A. F. Warner [ardville
C. A. Thompson	Union (Somers, etc.)	Broad Brook	Sept. 20	C. A. Arnold	Henry F. Fletcher, Haz-
E. G. Seeley	Waterbury Driving Co.	Waterbury	Sept.	O. G. Camp	N. W. Heater, Pequab'k
I. C. Fanton	....	Wethersfield	Sept. 26-27-28	J G. Adams	C. C. Harris
J. B. Palmer	Horseshoe Park Agr. Ass'n	Willimantic	Sept. 19–21	Chas. A. Gates	T. R. Sadd
J. B. Palmer	Woodstock	So. Woodstock	Sept. 18–20	Chester E. May	L. H. Healey, N. W.
C. L. Tuttle	Conn. Dairymen's Ass'n	Hartford	Jan. 17-18, '06	H. O. Daniels	J. G. Schwink, Jr., Mer'n
N. G. Williams	Conn. Pomological Society	Rockville	Sept. 26–28	J. C. Eddy	H. C. C. Miles, Milford

FARMERS' INSTITUTE IN 1905.

By vote of the board all its members were included in the committee to superintend the work of Farmers' Institutes, each member to provide for the special needs of his own section of the State.

Pursuant to this plan Institutes were held as far as possible wherever desired throughout the State.

The tobacco growers were especially fortunate in having the services of Mr. A. D. Shamel, of the U. S. Dept. of Agr., an expert in plant breeding and seed selection, who addressed many meetings throughout the tobacco growing area, not only during the winter and early spring, but well along in the growing season.

He was ably assisted in this work by Dr. E. H. Jenkins, director of the Connecticut Agr. Exp. Station, who has given the fertilization of tobacco careful scientific study and is justly regarded an authority on this subject.

This part of our Institute work has been attended with the most satisfactory and beneficial results.

The board has also had the hearty co-operation and support of Mr. J. K. Graham, manager of the poultry department of the Connecticut Agricultural College, who has addressed many institutes for the promotion of this important industry, which is now receiving the attention it justly deserves.

There is no provision of law for a director of Farmers' Institutes in Connecticut as there is in many States, but in few, if any, are more Institutes held in proportion to its farming population. In addition to these held by this board many successful Institutes have been held along their respective lines by the Connecticut Dairymen's Association, the Pomological Society, the Bee Keepers', Sheep Breeders', and Tobacco Growers' association.

AGRICULTURAL CONVENTION AT WILLIMANTIC.

The annual midwinter meeting of the Board of Agriculture was held in Town Hall, Willimantic, Dec. 12, 13, and 14, 1905, in accordance with the following programme. Favorable weather, attractive speakers, and a large attendance made it one of the most enthusiastic and successful meetings of recent years.

The exhibits of fruit and other field and farm crops were less in evidence than in some previous years, but what was much more important the producers themselves were there and entered heartily into the spirit of the meeting.

Tuesday, December 12th.

10.30 A. M. MUSIC BY THE LOOMER OPERA HOUSE ORCHESTRA.

10.30 A. M. INVOCATION.

Rev. Ashley D. Leavitt.

10.45 A. M. ADDRESS OF WELCOME.

His Honor Daniel P. Dunn,
Mayor of Willimantic.

REPONSE BY
His Excellency Henry Roberts,
Governor of Connecticut.

11.30 A. M. ADDRESS — "What the Department of Agriculture is doing for the Farmer."
By Dr. H. J. Weber,
Washington, D. C.

2.00 P. M. ADDRESS — "The Essentials of Success in Future Sheep Breeding."
By Dr. C. D. Smead,
Logan, N. Y.

DISCUSSION.

7.30 P. M. MUSIC.

8.00 P. M. ADDRESS — "The Story of Soils and Plants in their Relation to Liming." Illustrated with stereopticon.
By Prof. H. J. Wheeler,
Director R. I. Agr. Exp. Station.

Wednesday, December 13th.

9.30 A. M. MUSIC.

10.00 A. M. ADDRESS — "Poultry Management."
By Mr. Tillinghast,
Vernon, Conn.

10.30 A. M. ADDRESS — "Dry Feeding: The New Poultry Culture."
By Mr. A. F. Hunter,
Associate Editor American Poultry Advocate.

11.30 A. M. ADDRESS — "The Real Origin and Development of Poultry in Modern Times."
By T. F. McGrew,
Washington, D. C.

2.00 P. M. ADDRESS — "Breeding Animals on the Farm."
By Prof. Thos. Shaw,
St. Anthony's Park, St. Paul, Minn.

DISCUSSION.

7.30 P. M. MUSIC.

8.00 P. M. ADDRESS — "How Shall We Attract Useful Birds About our Farm Houses?" Illustrated with Stereopticon.
By Dr. Edward Howe Forbush,
Wareham, Mass.

Thursday, December 14th.

9.30 A. M. MUSIC.

10.00 A. M. ADDRESS — "The work of the Forest Service for Farmers."
By Herbert A. Smith,
Washington, D. C.

11.00 A. M. ADDRESS — "Alfalfa in Connecticut."
By E. H. Jenkins,
Director Conn. Agr. Exp. Station.

DISCUSSION.

2.00 P. M. ADDRESS — "Feeding Farm Animals."
By Prof. Thomas Shaw,
St. Anthony's Park, St. Paul, Minn.

DISCUSSION.

7.30 P. M. MUSIC.

8.00 P. M. ADDRESS — "Why Present Conditions Necessitate a Knowledge of Dietetic Value of Foods."
By Mrs. Sara Walrath Lyons,
New York City.

To get the largest good out of the meeting the audience must take part by question or discussion.

To give all an opportunity to present any subject affecting the interests of Agriculture, a Question Box will be provided, which it is expected will be freely used for the presentation of practical questions which will be taken up and discussed as opportunity offers.

To make this feature of the meeting profitable, bring in your questions and take part in the discussions.

Ample facilities will be afforded for the exhibition of Fruits and Flowers, Grain and Vegetables, Butter and Cheese; and the bountiful harvest just gathered warrants the hope that there will be a generous exhibit. Mr. N. S. Platt, Pomologist of the Board, will give his personal attention to this feature of the programme.

Articles for exhibition may be sent, properly labeled, by express, at the expense of the Board, to the Secretary at Willimantic, to arrive on Monday, December 11th.

RAILROAD ARRANGEMENTS.

The N. Y., N. H. & H. R. R. Co. has provided certificates which, when countersigned by the secretary, will entitle the holder to return over any of its lines at half rates. These certificates must be shown when purchasing tickets at railroad stations in Willimantic or New London.

HOTEL ACCOMMODATIONS.

The headquarters of the Board will be at the Hooker House.

A committee of the Board will be at the Hall to furnish delegates and others such information as may be required.

Gov. HENRY ROBERTS,
EDWIN G. SEELEY,
N. G. WILLIAMS,
L. H. HEALEY,
JAMES F. BROWN,
Committee.

North Stonington, Nov. 25, 1905.

REPORT

OF THE

PROCEEDINGS OF THE CONNECTICUT STATE BOARD OF AGRICULTURE

AT

WILLIMANTIC, CONN., DECEMBER 12, 13, AND 14, 1905.

MORNING SESSION.

WILLIMANTIC, CONN., December 12, 1905.

Preceding the opening of the Convention an enjoyable concert was given by the orchestra of the Loomer Opera House of Willimantic.

Convention called to order at 10.30 A.M., in the Town Hall, Willimantic, by Secretary James F. Brown.

Secretary BROWN. The hour having arrived for the opening of the Convention we will listen to an invocation by the Reverend Mr. Leavitt of Willimantic.

Rev. Mr. LEAVITT. Let us invoke God's blessing. Lord God, Eternal Spirit, Immortal and Holy Judge, Merciful Maker of all things in being, and by Thy power the ruler of all things in Thy wisdom, we adore Thee for the wonders of Thy earth and of Thy heaven, and for Thy living spirit among us. We give Thee thanks for all Thy manifold blessings that Thou dost continually shower upon us; we bless Thee and thank Thee for the harvests of our fields, the plenteous ore in the earth, and spirit of richness and growing prosperity among us, and for all of those rich stores of inspiration and suggestion in our fellowship one with another.

We beseech Thee that Thou wilt continue to give us insight into the secrets of nature, skill to our hands, and increase in us capacity for wisdom and efficiency that we may be worthy of the prosperity Thou hast blessed us with, and worthy of all high undertakings. And especially would we beeseech Thy blessing upon this assembly. May thoughts of Thee occupy our deliberations, and wilt Thou enable us to trace out Thy wonderful workings in all the laws and forces of nature that we may come more and more into harmony with Thee, and with Thy purposes in the world, and that through Thee we may provide for ourselves and for those dependent upon us a worthy subsistence. And wilt Thou keep us continually in peace and good fellowship. Enrich our hearts and our lives through Jesus Christ our Lord. Amen.

Secretary Brown. I have the pleasure now of introducing to this audience the son of one of the gallant soldiers of my old regiment that went to the front with me forty-three years ago, and who now comes to the front as the chief executive of the City of Willimantic. I take pleasure in introducing his Honor, Mayor Dunn, of Willimantic.

Mayor Dunn. Mr. Secretary and gentlemen of the Connecticut Board of Agriculture, ladies and friends: When I met Colonel Brown on the outside and he told me that he was in the same regiment with my father, a thrill of pride ran through my heart when I thought of the heroes of '61, and heard that the secretary of your organization was in the same regiment with my father: I felt proud of it indeed. But, ladies and gentlemen, I am not here to discuss that subject, but here to welcome you to this grand old city of ours, the city of spindles, a city known all over this State as the "Thread City." I welcome you here today. As the representative of the people of this city, I assure you that I express the sentiment of the people who have a high respect and appreciation for the Connecticut farmer for what you have done. The exhibits at the agricultural fairs held all over the State of Connecticut show today that the farmers are a progressive people, and not only progressive, but, like the mechanic and inventor, they have worked out ideas, studied them up and applied them, until today old line farming has almost passed away and business farming taken its place. Today the prosperity of the farmer is known, not only in the financial world but everywhere. He will soon stand at the head. It is only a question of a few short years when the farmers of this country will be the leaders in our country's wealth. Just look around, all over the State of Connecticut, in the farming districts, and what do you see? Not only in Connecticut, but all over this broad country of ours the farmer today shows prosperity everywhere. Beautiful homes, magnificent barns and stock-houses, well-fed stock on every hillside, beautiful poultry running everywhere, and the thrifty farmer with his many assistants at work in the fields is a sight worth witnessing indeed. But, my friends, I am not here to discuss the subject of farming and agriculture. The eminent men that appear on your programme will, I have no doubt, deal with that subject to the satisfaction and instruction of our people, not only the farmers, but their efforts will be a school of instruction for the citizens of Willimantic. I hope and trust that when this convention adjourns and you leave for your happy homes that you will leave feeling that the people of our city have received useful and instructive knowledge as well as yourselves on the subject of farming.

Now let me say to you again before closing that as the representative of the people of this city I welcome you, and not only welcome you, but in their behalf I extend to you the freedom of this city. It is yours. Do with it as you please. Visit our places of industry, visit our places of business, and when you leave our city, let us hope that the favorable impression that you have formed will be as lasting as the love and respect that the citizens hold for the honest, upright, and thrifty farmer.

Secretary Brown. The programme at this point calls for a response by His Excellency, Governor Roberts. I have to say that I have just received a letter from the Governor in which he regrets that business engagements detain him from our presence. I will read his letter.

Hartford, December 7, 1905.

Col. James F. Brown,
Secretary, North Stonington.

My Dear Sir: Replying to yours of December the fifth, I promised partially, if possible, to be present at Willimantic at the midwinter meeting of the Board, but I find at this writing that it will be impossible for me to be present.

I regret this very much, as I should have been very much interested in the proceedings of your meeting. The agricultural interests are of such value to the State that I feel that any official of the State should do all he could, either by his presence or his efforts to stimulate and foster them. I know they are well taken care of by our efficient Board of Agriculture, but it would be interesting to note the progress these interests are making and to do everything in one's power to assist.

Regretting that I cannot be with you at this meeting, but hoping at some future time to have that pleasure and profit, I beg to remain,

Sincerely yours,

HENRY ROBERTS.

Therefore, owing to the unavoidable absence of our Governor, I have the pleasure to introduce to you our Vice-President, Mr. Seeley, who will preside at this session, and respond, in the Governor's place, to this warm address of welcome, which we have just had from the Mayor of Willimantic.

Vice-President E. G. Seeley. Your Honor, the Mayor of Willimantic, and ladies and gentlemen: I was informed after coming into this room that the Governor was not to be here. That was the first intimation I had of it, and that, consequently, this response devolved upon the Vice-President. Well, I said, give me a chance to get out into the open air, and I walked down the street a little way thinking what I would say and what I would do, and do you know what came into my mind as I passed down the street? I remembered about that grand old patriot, Cincinnatus, who was called from the plow to arms. I remembered, when reading and studying about him in history when a boy, my father said to me, if ever you are placed where you cannot help it, and a responsibility rests upon you, do the best you can. Do not make unnecessary excuses or back out under those circumstances. So, following that instruction which has remained with me all these years, I will endeavor to say a few words in response to the very hearty welcome extended to us by the Mayor. Perhaps it is only proper, to commence with, that I should say that we come here not as a band of robbers; not as a band of impostors, for we do not come here in any such guise. We practice no jugglery and none of the fine arts. We are a kind of insurance company, but it is not exactly the kind of insurance that some companies have been carrying on, because we pay our premiums and we take none ourselves. We have not even a place to lay our heads if we depended upon the State Board of Agriculture, because we get nothing. We have no graft in any shape. We are simply men of the soil and men of toil. We have come among you and we are glad to have this hearty welcome and see so many faces here at the opening of our meetings. We are very glad to come among you and feel something of the warmth and kindly greeting extended by your Mayor.

Let me say to you what perhaps many of you have noticed, that the year book of the agricultural department, as issued by Secretary Wilson lately, shows that the agricultural products of this country today exceed more than six billion dollars. That is the size of the farming industry in the United States. Think of it! What an immense sum that is! Why, you cannot compute it. It is more than all the mines. More than all the financial power. It is really greater than the railroads or any of the other vast interests of the country. Where does it come from? Well, it comes from the soil. How does it come from the soil? Why, the most of it comes through the labor and the brains of the people who live upon the soil. You cannot get away from that. It comes from those who plod right down to the earth. Can there be any doubt then about the agricultural interests of this country? Mark what I say. It must be upon the agricultural interests of this country that is based the perpetuity and maintenance of this nation of ours. It cannot be otherwise. Look among any other class of people on this broad earth, and you cannot find such a condition as that anywhere else. It comes from the agricultural interests of this country, the basis of which is Mother Earth. That is all there is to it.

Now as to our mission. We come only as plain common people among you. We are glad to be welcomed as we have been. We come to receive good at these meetings, and we hope we shall be able to do you good. We certainly shall receive benefit if we get your cordial sympathy and your coöperation in the little work that we intend to do.

Thanking you, Mr. Mayor, for this hearty welcome which you have extended for the people of Willimantic, I again say we are glad to be among you this morning, and to receive this greeting. (Applause.)

Now the next thing on our programme seems to be an address on "What the Department of Agriculture is Doing for the Farmer," by Dr. H. J. Webber, of Washington, D. C. I have the honor of introducing the gentleman to you now.

"WHAT THE DEPARTMENT OF AGRICULTURE IS DOING FOR THE FARMER."

By Dr. H. J. Webber, Washington, D. C.

Mr. Chairman, ladies and gentlemen: I feel some hesitation in attempting to explain the work of the Department of Agriculture. Although I have been connected with this institution for the last fourteen years, and have followed its growth from a comparatively small institution to its development to the enormous position it occupies today, still it is practically impossible for any one man concerned with particular investigations, as I am, to explain many of the details and various workings of that Department. You gentlemen who are engaged in agricultural matters understand that it is necessary for us to specialize in order to make advancement. My specialty has been along the line of plant breeding. Therefore, you will understand that I only comprehend in an indefinite way the other lines of work which are prosecuted. Still, I will attempt to explain some of the general features, and if I fail in this, kindly overlook it and take up some of the books and bulletins of the Department that will explain in detail, and very much better than I can do, any particular points about which you may wish for information.

This department has grown as marvelously as the growth of the farming industry has been marvelous. In July, 1897, the Department of Agriculture employed 2,160 men, while just a few years later, in 1904, the Department employed 4,504 scientific investigators and helpers. Besides these we have over a quarter million of special correspondents and co-operators, who are looking up all lines of work. Many of you gentlemen are probably taking part in that. The growth of this Department, however, is simply a reflection of the growth of the country as a whole, and the growth of the agricultural interests. Our chairman spoke of the enormous figures represented by this industry, taking his figures, I suppose, from those contained in the Secretary's report. Now let me give you those a little more in detail simply to impress this matter upon your mind. Conceive, if you can, the value of the corn industry. Corn, that little thing that we see every day. We grew last year 2,208,000,000 of bushels of corn, at a valuation of $1,216,000,000, an amount probably exceeding any other industry in the United States, unless it be the steel industry. Last year our hay crop was valued at $605,000,000; cotton, $525,000,000. The cotton on which the products of the industries of this city depend aggregated that enormous total. Oats, $283,000,000; potatoes, $138,000,000; barley, $68,000,000; tobacco, which you are all interested in, in Connecticut, $52,000,000; horses, $1,200,000,000; cattle, $1,144,000,000; hogs and sheep, $249,000,000. These items, together with the valuation of other minor farm products, gives us the enormous total of $6,411,000,000, representing the product of our farms in the United States during the last year, — something entirely beyond imagination, a sum stupendous in its magnitude and far greater than the product of any other industry of the country. But what are the other results of this? Naturally with this increase in the valuation of farm products comes an increase in the valuation of the farms themselves. Farms which yesterday, or which a few years ago, could be purchased for from $25.00 to $50.00 an acre are held at $100.00 and $125.00 an acre now. Almost all over this country lands, and old lands, have increased in value, and new lands have been brought into the market and brought under cultivation. The increase in values during the last five years is estimated to be $1,133,000,000, or, as the Secretary has put it, every sunset has registered an increase of $3,400,000 in the farm values of this country, and every month has registered an increase of $102,000,000. I tell you, gentlemen, the wealth of this country is in the hands of the farmers. No matter what others may say, the wealth is in the hands of the farmers, and it is distributed individually here and there exactly as wealth should be distributed. Now it would seem probable to us with all this great increase in values in farm products and in the value of our farms that we have reached the maximum development, but, Mr. President and gentlemen, I want to tell you that this increase has just begun. We cannot lie still and think we have reached the maximum. This increase has been brought about simply by intelligent effort, by the intelligence behind the plow. And that reminds me of a little story I read the other day in reference to an Irishman. The Irishman was in the back coach of a railway train, and a gentleman came along to him, and he says, "Pat, what are you sitting back here in this coach for? Don't you know that the last car is the easiest to jump the track, and that accidents are more apt to happen in the rear coach?" "Well," says Pat, "why don't they take off the rear coach then?" Now that is the way with us. Of course, they couldn't take it off, and we cannot stop our development. Furthermore, we cannot afford to if we can, for, as a matter of fact, we have competitors all over this broad earth of ours. Our wheat growing industry must compete with South America. Our cotton growers must compete with the cotton grown in Egypt, in Porto Rico, in the West Indies, and in other countries all over this broad globe. If we are to keep in the van of this great commercial advancement we must hold our present position. We must have investigators. We must advance all along the line. I think that is what you are doing, and it certainly is a most satisfactory situation.

Now the Department of Agriculture has a part to play in this great development. We use four thousand men investigating the subject, and with such a number as that at work there is bound to be something doing. I think I could give you possibly a more interesting talk if I was to talk on tobacco or on some particular subject with which I am familiar, but I am here to talk about the Department.

Now we have in the first place our organization. The great Department of Agriculture is divided into bureaus which represent certain subjects relating directly or indirectly to agriculture which they are investigating. Take our weather bureau. Who has not heard of the weather bureau of the Department of Agriculture? We are expending $1,500,000 on this bureau annually. Still we hear some say, what has it accomplished. I have heard it said, ladies and gentlemen, that the most important work of the Department was to furnish us with something to talk about. Well, all of us like to talk about the weather at times. That may be true, for the weather is of special interest to us all. But I want to tell you that the bulletins of the weather bureau are in every city, and almost every town of this country. With the daily maps the report goes to every village and hamlet in this broad land of ours, and you know and I know that every mariner before he sails looks at the weather report to see whether there is going to be a storm, and if the weather report says a storm is coming on, or a hurricane, you know very well he enters a safe harbor and waits for the storm to pass. So with the vegetable grower. If he hears the warning of a coming frost you know that he goes out and covers up his plants. You know that the orange grower also if he sees the cold wave flags flying, goes out to his orchard and banks up the trees and prepares his rosin to burn, and all things of that kind, in order to protect his trees against injury. So with other industries. That is the way the thing goes. I think we can safely say that thirty millions of our people know of the weather bureau of the Department of Agriculture and its work, and no matter how we may be inclined to laugh at these reports and joke about them, nevertheless down in our hearts we respect them, and the fellow who has property values dependent upon the weather is pretty sure to use them as a true criterion of what the weather is to be. The man who has property values depending upon the weather follows those reports almost certainly and surely. That shows what their real value is regarded as being in any line of work.

The next great work of the Department is the bureau of animal industry. Next to our plants animals are the greatest source of our wealth. What is the bureau of animal industry doing? That comes a little more closely to us because we are studying animals and plants more particularly, and yet I venture to say that few of us realize what the bureau of animal industry is doing for us, for so much of their work is done in an indirect way. In the first place, it has an enormous inspection bureau. You will remember that a large share of our wealth comes from foreign commerce, and that this foreign commerce is largely governed and controlled by the condition of the animals that we put upon the market, and if it were not for the inspection which the United States Government carries on through this bureau it would be practically impossible for us to ship cattle with the ease with which we ship them today. This bureau is not only charged with carrying on this enormous inspection work, studying how to do it with the most effectiveness, but they are also studying the diseases of animals with which we have to contend. If there is anything that creates consternation in the farmer's mind it is to have his stock taken sick with a disease which he is powerless to combat. Let us consider a few of the diseases which the Department is studying. Take, for instance, blackleg, which affects our cattle industry so severely. Through a careful investigation by the men connected with this bureau, aided, of course, by the experiment stations all over the country, it has been found that we could put out a vaccine somewhat similar to the vaccine used to combat smallpox or diphtheria, by which we could immunize cattle, and greatly reduce the effect of the disease. Now the Department of Agriculture does that very thing. Instead of paying, as you have to pay, for antitoxin, an enormous sum, and which is almost prohibitive, the Department is sending out doses of this vaccine with instructions for administering it. During the last five years the Department has sent out on the average 1,750,000 doses of this vaccine, or whatever we may call it, per annum, for the treatment of blackleg alone. As the result of this enormous distribution of this material, and of other instructions that go with it, a loss which was at one time from ten to twelve per cent. of the entire amount of cattle grown has been reduced to one-twelfth of one per cent. Now I maintain that that is coming right down to the hard basis of fact and large usefulness. In the same way the hog cholera has been combated. A vaccine has been prepared and distributed which is greatly modifying the extent of the disease. Take it in the case of Texas fever about which a great deal has been said, and as the result of the study which has been given to it we are now able to control the spread of the disease. Take the sheep scab, with which the majority of you are familiar. They have been studying methods of treatment and control, and by the preparation of a dip prepared from tobacco, sulphur, and lime, with which you gentlemen are familiar, I think beneficent results have been attained. These are the several things we have got to do if we are going to control the diseases of our animals and the diseases of plants. Now what is the result of these requirements which are so much criticised? In 1899 there were 672,944 treatments. After that, as the result of the effectiveness of the treatment the number swelled rapidly until in 1905 more than seventeen million treatments were made. Now we have returns from nearly six million of these treatments, and the effective cases are figured up as 93.5 per cent., nearly a perfectly effective treatment. We can control many of these diseases if we simply stand together and exercise the best judgment and best knowledge which is obtainable..

Now one of the main lines of the work of this bureau is its inspection work and quarantine work. Many of you are doubtless familiar with the attack of foot and mouth disease which occurred here in 1902. You remember it started in Massachusetts and spread over into Rhode Island, Vermont, and New Hampshire. I do not believe it came into Connecticut. It did not, if I am correctly informed. If the disease had not been stayed it would, of course, have prevented the exportation of our meat. Commerce on that line would have been actually stopped if we had not found some way to control it. Now state boards of agriculture and the state authorities worked together with the Department of Agriculture in quarantining and bringing about an entire control of that disease, and as the result of the quarantine and of that work, over four thousand animals were slaughtered and disinfected. Congress made a special appropriation of $500,000, I believe it was, to aid in the eradication of the disease. The Department paid very nearly $130,000 for animals which were condemned and destroyed. So effective was that work that the year after the introduction of the disease, the year after it became broadcast over those three states, it was nearly stamped out, the quarantine was raised, and our exportation of meat went on the same as ever. Now those are things we hardly think of as being the work of the Department, but when you come to consider some of the efforts of the Department I want you to take all these matters into consideration. We have maintained a quarantine all along the coast and all along the borders of the United States to prevent the importation of infectious diseases. Sometimes we must do it. Some years ago there was a ship inspection law passed, providing for the inspection of ships, and for the treatment of those in an unsanitary condition certain regulations were prescribed. Now how does that affect the farmer? Just in this way. It made the ships more cleanly and safe, and as the result of that all the insurance rates fell over one hundred per cent. So it goes all along the line.

Now let me call attention for a few minutes again to this inspection work which is being carried on. We have here and there in connection with the great packing establishments of the country, men who are examining all these meats for exportation, examining the carcasses to see if they are diseased or in proper condition for food. Last year experts in the service of the Department examined over forty million carcasses. Just think of it! Forty million carcasses were inspected and passed on, a great many of them in the meanwhile being condemned, simply to protect our homes against the utilization of infected meat which would be dangerous to life. Last year over 66,846 cars were inspected, and shippers required to put them in proper shape for the shipment of animals. Last year we inspected 731 ships to see that they were in proper condition for animals, and to see that the animals were held in the proper way. The Department also prescribes regulations regarding the shipment of cattle in order that they may be handled with all possible care and kindness. If they are not certain loss is sure to result. The Department insists, and the enforcement of these regulations makes it necessary for shippers to give a much greater degree of kindness and attention to these matters than was formerly the case.

In the dairy work of this great bureau there are being some exceedingly interesting things brought to light. For instance, in butter, of which we produce enormous quantities, an effort is being made to find a foreign market. We produce more butter than we want to use at home, and the question is, can we ship it abroad? Can we establish a market there? One of the great lines of work of the Department is to look into the possibilities of foreign markets for the purpose of seeing if we can establish trade in other places than those in which it now exists. In the first place, the question to be solved is whether we can ship butter. We have got to have refrigerators. In connection with that, experiments have been in progress at the New York and Wisconsin experiment stations where the Department has been studying the keeping qualities of butter, taking, for instance, a fifty-pound tub and subjecting it to different temperatures to see how it keeps. They have found some interesting facts. If I was to give the maximum, it would be something like five degrees below zero, while it has also been found that if we keep it at the ordinary temperature of, say, about twenty degrees above zero, the butter deteriorates. That is simply another line in which the Department is reaching out and striving to help the farmer by increasing the quality and increasing the market for farm products.

Take cheese. We are conducting experiments in connection with your station at Storrs, and also in connection with the New York and Wisconsin stations relative to the preservation of cheese and the making of cheese. Everything indicates that some very beneficial knowledge will be obtained in these lines. We are carefully investigating that subject. Probably you gentlemen, many of you, are familiar with the results obtained at Storrs up to the present time.

With regard to foreign shipments of butter I neglected to state that on experimental shipments which have been made to Manchester, England, and various other places, they seem to indicate without question that we can establish a paying market in those localities, and every market of that kind that we can open up. is, of course, of the greatest benefit to every farmer. So much then for this great bureau of animal industry.

Now the next most important, and probably the greatest producer of wealth is the plant, and we have in connection with the Department the great bureau of plant industry, which is taking up the subject of plants from all sides and studying it in all its phases. One of the most important lines of work of this bureau is the treatment of plant diseases. Now if a man is at a loss when his stock becomes sick, why I must say that the ordinary man, ordinary individual, be he farmer or other, is more than at a loss when his plants become sick. We are not familiar with plants. We are with animals more or less, and know how to treat many animal complaints, but when our plants become sick then we are absolutely helpless. The pathological practice and treatment of plant diseases practically originated with this Department of Agriculture. I could not begin to tell you all the various diseases which have been studied carefully, and for which treatments have been proposed that are effective. Take, for instance, the peach leaf curl, with which many of you are familiar. This disease at one time caused widespread damage. There seemed to be no way to stop it. We now know, however, that by proper spraying we can control that disease. It is not merely in the discovery of remedies to combat such diseases that beneficial results have been obtained, that is not all. One of the main things comes in carefully studying the life history of the fungus which causes the disease, and finding out when this treatment must be applied to make it effective, and that is what is being done in every case. Take it in the case, for example, of the bitter rot of apples, which is a new disease, and quite widespread over the western part of the country. It is estimated that that disease alone causes damage of over $10,000,000 annually. The experts of the bureau discovered that by proper spraying at the proper time we are able to practically control that trouble. In our experiments this last season we saved over ninety per cent. of the crops where application was made of the spray, while in orchards adjoining those to which the applications were made the property was entirely ruined. Up-to-date farmers must watch these new methods and take prompt advantage of them. Take, for instance, the peach yellows, a disease which has been more or less prevalent in Connecticut and caused large losses. After carefully studying, it was found eradication of the diseased trees seemed to be the only proper remedy, the same remedy that we applied in the case of the foot and mouth disease. That was found to be the best method of treatment, and by that method we are able to control this disease, if farmers and all concerned will work together with us to do the work thoroughly.

We do not limit ourselves simply to the study of spraying methods and things of that kind, but we go into the production of new strains of plants to resist these diseases. Now I am going into a subject with which I am familiar because that is my line of work. It is more or less surprising to some people that a scientist should be able to produce an immune strain of plants. You know perfectly well that certain men are resistant to certain diseases. We know, for example, that one man may be exposed to yellow fever and not take it where another will take it. Another may be exposed to smallpox and resist the disease where perhaps another exposed at the same time will take it. We apply that same principle to the production of immune strains of plants. Wherever we can discover that tendency to resist we can usually by breeding produce an immune strain. This city depends largely on the cotton industry of the South, and we have been able to do something in this line, the benefit of which has been seen here. About ten years ago there appeared in the South a new disease that attacked the little fine roots of the cotton plants and ran up the main stem, soon causing the plant to wilt and die. We found that that fungus would maintain life for eight or ten years, and as the result of the presence of that disease some of the best cotton lands in the South were abandoned; it looked exceedingly serious. Take, for instance, James Island, where the finest cotton was produced, and lands worth from $100 to $125 an acre were plowed up and put into other crops, vegetables and other products, because they could not produce cotton. The disease spread into Alabama, Georgia, Florida, and into other sections of the South, and we thought it was going over the whole country and was liable to destroy the cotton industry. Now one of the men in the employ of the Department discovered that an occasional cotton plant here and there in the field seemed to resist the disease, and would produce a good crop of cotton when its neighbors were wilting and dying. Some experiments were tried. A few of these plants that seemed to be resistant were selected, the seed from those immune plants were planted, and as the result today we have produced some varieties of cotton which will resist that disease completely. When this resistant variety of cotton is planted in the center of a field of the ordinary kind it will stand up like a hedgerow while every plant on each side will go down as the result of the disease.

We had a similar experience in the case of a disease which attacked the cow pea, which is the clover of the South. We selected the seed from the resistant or apparently immune plants, went through the same process, and succeeded in producing an immune pea that would resist the disease.

As the result of these things today, gentlemen, those cotton fields which were abandoned are growing with fine staple cotton, and fields which would not produce a crop of cow peas in the South are growing with fine crops of this clover of the South. The tobacco growers of Florida, who have no cover crop because of the work, are now growing these cow peas resistant to the disease, and the pathologists of the Department, wherever we can, are discovering these troubles and propagating immune strains as rapidly as possible, putting them into the hands of the growers, and in that way have been able to do much.

Now the same sort of work has been carried on, more or less, in relation to tobacco, and several other crops. We hardly know what can be accomplished in this direction as yet, but from the beneficial results which have been produced in the case of cotton and other plants we feel confident that breeders can go ahead and produce crops which are resistant to these diseases.

Now the breeding work of the bureau of plant industry extends to other lines. I want to speak about cotton, as long as that is one of the main products of your manufacturing in New England. All over this great country of ours, from South Carolina to Texas, we grow a little short staple cotton about three-quarters of an inch to an inch in length, and that is the staple which mainly reaches your mills in New England. In a few instances in the Mississippi valley, and in other sections of the South, they grow a staple cotton which is an inch and a half long. In the case of the former it is worth from six to eight cents per pound while in the case of the latter it is worth a much greater price. On some of the islands along the eastern coast of the South they grow the best staple cotton which is known in the country; in fact, the famous Sea Island cotton comes from that section. I like to impress this fact, that while we grow some of the short and poor staple cotton yet nevertheless we also grow the best, for that Sea Island cotton grows from two to two and one-half inches in length, and instead of selling from eight to ten and twelve cents a pound that sells right along for forty and fifty cents a pound for the best grade, and for the poorer grade from twenty-five to thirty cents a pound. Here was a chance to produce a better product by getting a variety, for instance, which would produce a longer staple. Every one familiar with the subject recognizes that if we had a longer staple we would have a better grade of goods because the longer the staple the stronger the thread and the better the wearing quality of the goods. Now the Department has taken up this question of the improvement of cotton. The Department experts said, why can we not produce a better staple cotton? We have here the best, and also, if not the poorest, some of the poor. We have on the one hand a short staple adapted to the climate all over the South, and on the other hand we find some varieties with fibres of the longest kind, and if these two could be combined, not with the idea of producing all of the best, but of substantially improving the poor, it would make an excellent cotton. So the suggestion was made that possibly by hybridizing these varieties and breeding them carefully we could produce a variety of cotton which might not be as good as the best, but which would be substantially better than that which is more commonly grown. The experts of the Department took this up, crossed these two varieties of cotton and began to work towards the idea of producing a better species. That work has been nearly completed. It has reached a conclusion in certain lines this year, and we are sending out to the growers in the South a staple which instead of being less than an inch runs up from an inch to an inch and a half, but much longer than the ordinary grade, and which, of course, is worth more in the market because it will produce a better grade of goods.

Now in the same way we undertook the improvement of the tobacco crop. Many of you gentlemen are interested in that line of work. In the case of tobacco we believe we have already done something for the industry, and that we can do a good deal more. Our experts in studying this matter found, in the first place, that a point of great value to the grower was to separate his seed so as to use only the heavy seed. Well, you say, those of you who are familiar with the subject, how can that be done? The seed is so small that we can hardly see it any way. Well, that was the difficulty, but we found that by separating this seed and using only the heavy seed, we got a better yield, a better plant, and a more uniform plant. Of course, as I say, the difficulty was to separate the seed. One of our experts went to work and perfected a machine for separating the seed, patented the machine in the name of the government, so that any one of you could use it or make it without danger. Now if there is a tobacco grower here I think he has heard of that machine and of the results which came from the separation of the seed. That discovery in itself has been doing a good deal of good for the tobacco growers here in Connecticut, in Kentucky, and in Ohio.

Another thing. One of the greatest losses to the tobacco grower is from the fact that the crop is not uniform. When the shade industry was taken up in Connecticut a few years ago, and the effort made to grow Sumatra tobacco in the shade, it is probable as to that industry, if it can be said to have failed, it failed because of the variability of the product grown more than for any other reason. When we bring seed from any foreign country and plant it here for the first time we usually find that the plants produced are variable. We can correct that by breeding. If you want a certain type of Sumatra we can produce it. If you want a certain type of Sumatra with round leaves, or so that you can cut a certain number of cigar wrappers from them, we can produce it. If you want a round leaf we can get it. Think for a moment what it means to the growers if we can do that, two more leaves to each plant! That, of course, largely increases the crop and, of course, its value to the grower. That is just exactly what I believe careful breeding will do. We have been breeding animals for years. We understand that principle as applied to animals. Many of you are familiar with the gradual increase of the trotting record. You know that a few years ago it was thought that if a horse trotted in 2.16 it would be something marvelous, but we can, most of us, recollect the name of several horses that have trotted in better time. It was thought by some that the maximum had been reached, but breeders will tell you that that time has not only been considerably lowered, but that the record will be reduced slightly as the result of still further careful selection and careful breeding. Draft horses of different types are all the result of this question of breeding. Now, while we have understood this principle as applied to animals more or less, we have been letting our plants go. We have been considering that the plant came under a different category, so to speak, but we are coming to realize that we can breed them just the same as animals. The corn growers of the west are organizing to produce more and better corn. They say they can increase the yield ten bushels per acre, and some growers have done it. Cotton growers know from experience now that they can produce a largely increased yield, and a better crop in all respects as the result of seed selection. In the case of tobacco can we not by that same course of selection produce a larger yield? Every one of you men who have seen a tobacco field know that you have seen certain plants that will have from two to three and four or five more leaves than any other plant surrounding it. That is the plant for you to select your seed from. Up to about two years ago the policy followed in selecting tobacco plants for seed was simply to take a good part of the field near the barn, or near the house, as the case might be, where the plants were nice and thrifty, and leave a couple of dozen plants for seed. Now that does not accomplish the purpose. That is simply taking any plant growing under good manurial conditions and thrifty because it is well manured. As the result of the Department's work, coupled with the work of the experiment station at New Haven — and your experiment station has been coöperating by furnishing funds and furnishing intelligence to run the work with — as the result of this work it has been settled that the way for the Connecticut tobacco grower today, as well as the growers of all other states, is to select a plant here and there throughout the field that is giving the best yield and the best growth, and to take the seed from those plants. By so doing he will be able to get a better yield and a better product. Our experts, however, have gone a little further. They found out that there was danger, owing to the fact that the seed of these selected plants were cross-fertilized, and they found out that if the seed from such plants became cross-fertilized it made plants raised from such seed variable. As the result of that, we have advocated that when such plants had been selected for seed that a bag should be placed over the blossoms to prevent cross-fertilization. This can be done by using a cheap manila paper bag which can be obtained at most any grocery store. By drawing that down over the seed head it prevents the admission of insects so that there will be no cross-fertilization. That policy has been pursued, has been put into operation by the tobacco growers, and I am glad to say with good results. I drove up and down the Connecticut Valley this last summer for a considerable distance, and could see the bags here and there all along the road. Sometimes I came across men who seemed to be a little bit doubtful. They did not know whether that would work out or not, and so they placed the bags upon seed heads that were hidden away from the road, but you could look over behind the hills and see the patches of tobacco occasionally with the bags upon them. I think that practically every man that has adopted this method and pursued it intelligently this year will testify to the good results that have been obtained. Why? Why gentlemen, this is not a theoretical matter. It is a practical fact. These are things that you can see just as plainly as I can see. They are results which can be accomplished by following advanced methods.

Some other very interesting things have been developed in the course of our work with the tobacco plant. For instance, I told the growers of tobacco in Kentucky that it might be possible for us to produce suckerless plants. They laughed, but they all said if you can give us any of the seed we want some of it. Now it would seem impossible to produce a suckerless type of tobacco, but we hope to attain it. You know that one variety of apple branches out in a different way from another. If you are a cotton grower, you know that one brand is entirely different from another. We have one kind of cotton which branches out with great branches over the ground, and we have another type of cotton which is almost limbless. It will grow right up in a column like a cedar tree and produce bolls on each side. These things in nature are not uncommon. It is not such a marvel to produce a plant which is substantially changed from its normal form by the proper treatment, and that is exactly what we believe can be done with respect to the tobacco plant. If any of the growers have seen the experiments which the Department has been carrying on at East Hartford this last season you will bear me out in saying that we have several types there this year which are practically suckerless. I believe, gentlemen, that it is possible for the plant breeder, working with intelligence and care, to produce a tobacco plant which you will not have to sucker, as we express it; which will save all that expense, and which will be just as good. But I am spending too much time on this branch of our work and must hurry on.

I meant to mention another line of our work which has been talked of a good deal, and that is in the production of a new strain of orange. The newspapers have been telling you people up in the North that you could grow oranges up here. I even had letters from people in Canada asking for some samples of this hardy orange-tree adapted to grow in a cold climate. Now, unfortunately, all newspaper stories are not true. I give them credit for trying to tell a thing in the right way, but they occasionally stretch it a little. The fact is, in this connection, that there is a little grain of truth which afforded some foundation for the story which went out. The Department two years ago was able to announce that it had produced a hardy orange that could be grown further north than any existing variety. We were able to distribute last year to about five thousand farmers in Georgia, Alabama, Mississippi, and in the region running through there to Texas and the Indian Territory, a type of orange which we believe will grow in those localities. The orange is not adapted, as of course you all know, to a cold climate. This fruit will not appear on the Boston market tomorrow. It is not even an orange of commerce, but it is an orange which is edible, which produces a marmalade which is first rate, which produces the finest preserves I have ever seen, and which produces equal to the best lemonade which you get from acid fruits. But that is not the whole thing. We have the apple here at home, but in this district to which this orange is adaptable they do not have it. To the people of Georgia, Alabama, and the Carolinas, and all through the northern belt of the southern states where they lack an acid fruit, and where they have to buy apples from the north, if they have them at all, oranges there such as I have described, will come as a great boon.

The Department has spent a great deal of time and money in the importation of valuable productions of other lands. Since Secretary Wilson entered the Department we have had men who have made that their business. There was not originally an office for the importation of plants from other countries for introduction into this country, but now we have men scouring all parts of the earth for the purpose of getting hold of productions of value which can be transplanted here. Many of the most valuable fruits which we have were originally brought from abroad. These have been secured and brought over at various times during the last two centuries. Comparatively recently several valuable things have been obtained. Take Durand wheat, which is a good illustration. You might say that it would be strange that we should find in benighted Russia a wheat which would be valuable to us, but the so-called Durand wheat, which is essentially a Russian wheat, was not imported into this country until lately. The Department sent agents to Russia to study the industry over there, to study into the methods of its cultivation, etc., before it was sent over here. Now the Durand wheat is very hard. It differs quite a little from our wheat here. It yields more heavily as a whole, and contains more gluten, and, all things considered, it has quite a number of points which make it more valuable than our present wheat. It seemed to be doubtful, for certain reasons, whether we would succeed in importing the

Durand wheat, but in 1901, in the northwestern region of this country there were produced nearly fifty thousand bushels of that prime wheat. Last year, in 1905, there was grown over twenty million bushels, and all the farmers who have tried it have found this wheat to be a better yielder and to be thoroughly adapted to their conditions, and it is established now in this country beyond doubt.

We have also imported from Sweden a very fine oat which is a heavy yielder, and fills out well. It has been found that this oat was a substantial addition to our native stocks. We grow today nearly four million bushels annually of those oats.

We also sent a man to Japan to study rice, and have imported some very fine varieties of rice. We imported one of the Japanese varieties which bids fair to supersede the variety usually grown in Texas and Louisiana. It has been found to be well adapted to that region of our country, to be a good yielder, and grows well in the southwest.

One of the interesting lines of work which the Department has taken up, one which I personally enjoy, although I do but little of it, is what we term "farm management work." I know every farmer thinks he knows how to manage his own farm, and we all know that the farmers of the country are succeeding in managing their farms very well, so that they are being made more and more profitable, but, at the same time, we know that John Jones over here in one county is a fine farmer, and we know that Joe Smith over here in another county has a good farm but does not seem to be so good a manager, and we think that if we can get John Jones and Joe Smith together and let them talk over with each other their various methods of management, good will result. That is what the Department is trying to do. We are sending men to successful farmers here and there, studying their methods, and then publishing papers detailing exactly how they have gotten certain results. All that has proven helpful. By reason of these methods we believe that most farmers can improve on the methods they are pursuing today, or, at least, get good suggestions from it. We all know that if a man enters into a business with which he is not perfectly familiar he wants to go to a man who is successful in that industry and learn from him just how he succeeds, how he carries it out, and the more a farmer can learn the more he will enjoy his work, and, of course, the more successful he will be. If we can bring together this knowledge from every successful farmer and make it available to all the farmers of the country, we believe that that will be a very helpful line of work. That is one of the things that the Department is trying to do.

Now aside from these that I have mentioned, the great bureaus of the Department, we have the bureau of forest service, but I notice in looking over your programme that you are to have a talk on that particular subject and I shall not take the time to speak of the details of the work of that department.

Another bureau is engaged in soil surveys, and we also have the bureau of entomology, the bureau of statistics, and several other bureaus which I shall not mention in very great detail.

Probably you are all familiar with the work of the bureau of soil surveys. One of the primary objects of that is to study the soils where crops are grown, and map those soils out so that a man unfamiliar with the soil may be able, by taking the map, to find where certain types of soil adapted to certain plants exist. This work has been going on for several years. Very large areas have been mapped in all the principal crop regions of the United States. Cotton soils, tobacco soils, apple soils, and soils adapted to the growth of many different crops have been more or less studied and exactly mapped. Now this brings that bureau naturally to the study of soil fertility and soil cultivation, and they have given us some new suggestions relative to soil fertility that I believe will be of great value.

It is not necessary to dwell upon the work of the bureau of entomology. All of you have probably heard of the work which this bureau has done in connection with the boll weevil which is affecting the cotton of Texas and adjoining states. When the foot and mouth disease was introduced here Congress made a special appropriation of $500,000 for the purpose of studying and stamping out that disease. When the boll weevil came up from Mexico into Texas and attacked the cotton crop, threatening its destruction, Congress made another emergency appropriation for the study of this pest and its control, if possible. Now, unfortunately, inasmuch as we have to deal with millions upon millions of these little fellows, extermination seems practically impossible, and we have been obliged to turn our attention to the study of some other method besides extermination in order to secure the needed protection for the cotton crop. The Department experts almost over-ran Texas. They have studied every phase of the boll weevil question imaginable, from the use of this machine to the use of that, and from the use of this spray or that spray, and have worked out every idea for its control that could possibly be suggested by the three million people that live down there. Unfortunately, we have found no absolute remedy for this pest. However, as the result of all this study there has grown up a policy which, at least, is giving fairly good results. It was found, as a matter of experiment, that the early variety of cotton, when planted as early in the season as possible, and cultivated thoroughly, would give a crop before these little pests became abundant enough to do damage. Therefore, the result of this study was simply the discovery of this simple method for treatment of the crop. Coupled with this use of early varieties and early cultivation, it was found that by cleaning up the fields, and burning up the old cotton stalks, etc., it would destroy large numbers of the pest. That knowledge has been spread broadcast all over Texas and in the adjoining region afflicted with it. The interest in the matter down there is simply intense. During the last political campaign it was said that it was impossible to get the attention of the people fixed on the election because they were so intent in discussing the boll weevil. You could go into most any town in that district and find groups of men who instead of talking politics were talking about the boll weevil, and the new idea of overcoming the trouble by better cultivation. Now as the result of the efforts of the Department Texas has made a decided advance. There has never been such a quick acquisition of knowledge on the part of the growers of any crop, and I venture to say that the farmers are better informed in regard to advanced methods than in any other industry of like kind. While we have not been able to absolutely control the boll weevil, we have been able to show the farmers that they could produce a crop with the boll weevil all around them.

The other lines of work of the Department probably need not be mentioned this morning, but just a word in regard to the dissemination of knowledge. You are all probably familiar with our year book, in which we bring together special papers on special topics. It is a book of from eight hundred to a thousand pages, and is published in editions of five hundred thousand each, the largest edition of any Government publication. That goes to the farmers all over the country. It also goes to the libraries, as it constitutes a valuable work for reference, and is thus made accessible to every farmer in the land. We also publish a farmers' bulletin, which goes all over the country. It is distributed broadcast. We are attempting in every way possible to coöperate with the experiment stations and with the farmers' institute work. Many of our men are delivering lectures and talking in that way.

I may say that our methods are undergoing something of a revolution. You have perhaps heard of the famous corn trains of the West, of the vegetable trains, apple trains, etc., which have been utilized as a means of spreading knowledge of these crops. I never realized what a success those trains were until I was detailed on one of the corn trains in Iowa last season. The value of that method for distributing knowledge simply depends upon the simplicity of the facts which are being taught. Let me illustrate that. I joined a corn train in Iowa at Sioux City in February of last year. On a Monday morning we pulled out from the station in Sioux City running south. It was snowing very hard. You could hardly see across the street. There were at least two feet of snow on a level. When we pulled into a little station with probably not more than a couple of dozen houses I never was so surprised in my life as I was to see teams lined up for almost half a mile about that little station, and I would be willing to wager that three carloads of people were packed into a small space waiting to be addressed. There were so many of them they could hardly get in. At every station we visited that day, and I think it was fourteen different places, giving talks of half an hour each, we had from four hundred to five hundred people present. And that in spite of the inclemency of the weather. Such a movement under the direction of the State Board of Agriculture, and of the Department, in conjunction with the experiment stations, is certainly of the greatest value in enabling us to bring to the farmers here and there information which they otherwise would never get. It savors of political speaking from the back platform of a train, but I believe that men will attend those trains that never would attend a farmers' institute meeting. The Department is endeavoring to aid in this movement so far as lies in its power.

I can say no more, I believe, this morning on account of lack of time, but I would like to say in conclusion that in connection with this work which the Department is doing if you can glean some idea of its immensity and at the same time get some realization of the importance and dignity of farm life, I shall certainly have succeeded in my mission here. The Department is advancing all means of knowledge on agricultural matters in a way never before undertaken, and if we are to keep our sons and our daughters on the farms, if we are to interest them and keep them there, as I believe we should in this country, we must give them something to do; we must give them something interesting. If we can place in their hands knowledge which will serve to interest them in farm work and hold them upon the farm, we will accomplish an exceedingly useful thing. In this connection I remember a little story of Burbank, and you all know how the name of Burbank as a plant breeder has spread over the country. You have heard of the Burbank potato. Burbank describes the origin of that in this way. He was familiar as a boy with the original Early Rose potato. He knew of the methods that had been pursued because he had talked them over with well-informed people. He was a student in this region, and was going to school. He said that his uncle had a patch of Early Rose potatoes, and he had to pass through that patch every day on his way to school. He was always interested in the matter, and he began to look for seed balls. Now you know the Early Rose is not a prolific producer of seed balls, but one day he came across a plant that had a couple of seed balls developed upon it. Why, he said he watched those seed balls with the greatest interest every day. Every day he said he would walk by them watching intently for one of the balls to fall. One morning when he went by he looked at them and noticed that one had gone. He said that he felt like crying over the loss of that ball. He hunted for it but could not find it. He said that he could not give it up, and every day for a week he said that he went back to the place and searched for that seed ball and finally he said he found it some distance away from the plant, where some animal had passed rapidly through the patch and the ball had been knocked from the plant. Now being familiar with the work in plant breeding he took the seed ball and from that progenitor produced the results obtained in the great Burbank potato. He said that little incident led him to take up his life work of plant breeding, and led to his success entirely. Now what was accomplished by Mr. Burbank may be done by every boy. Any farmers' boy may take up the same kind of work, to improve the crop, may select his seed carefully, and by proceeding in an intelligent way, produce something of value to the community.

Now every item of knowledge that we can add to this industry is a help to all. If we can make it an exact science it simply makes it all the better, more interesting, and more enjoyable. We cannot learn too much. That is what the Department of Agriculture is doing, and what your State experiment stations are attempting to do. How well they are succeeding I will leave you to judge.

I thank you for your attention.

The PRESIDENT. The time for adjournment has very nearly arrived, but there is an opportunity for questions for a few moments, if any of you desire.

Mr. PLATT. Can the Doctor tell us if the Government is doing anything towards controlling the gypsy moth? We hear a good deal about it in our neighboring states, and it may be very near us for all we know.

Dr. WEBBER. In answer to the gentleman I will say that they are working with it, but relative to the results I am entirely uninformed. If you will address a letter to the Bureau of Entomology at Washington they will give you a bulletin and all the information they have on that subject. I am not sufficiently informed to give you the details.

Mr. SEDGWICK. I would like to inquire of the gentleman if the Department is investigating the potato rot? What is the cause of that?

Dr. WEBBER. They are investigating the potato rot very thoroughly and investigating it in a very interesting manner. The Department is trying to produce an immune strain. We started work three years ago, I think it was, in coöperation with the Vermont station, by the importation and testing of foreign varieties of potatoes. I believe that every potato grower has probably observed that certain varieties are less susceptible to that disease than others, and we have knowledge which has come to us of foreign varieties which are immune. We have imported some of them. We sent Professor

Jones of Vermont abroad to study those varieties and to import some of the seed. We imported seed from all the good varieties from Scotland and from other countries, those are all being carefully studied, and we hope, although it is a matter of the future, but we hope we shall be able to place in your hands varieties of potatoes which shall be immune to this disease. Of course, the stations and the Department have also been working along the line of prevention by the use of various washes and sprays. The use of formaldehyde and the corrosive sublimate treatment is probably familiar to the most of you, but we hope we shall have an immune variety, which, of course, will be by far the better thing.

A Member. Mr. President, I am not specially interested in the subject of tobacco, but there are some tobacco growers here, and in speaking of shade-grown tobacco the speaker said that that is practically a failure. I want to ask if that is not because it is grown under shade: if it is not because it is grown without the sun and does not come out well any more than grass does that is grown under shade?

Dr. Webber. The gentleman has asked a mooted question. It is true that a leaf grown under shade is very thin. You are, therefore, fighting with the manufacturer. The manufacturer, on the one side, wants a leaf from which he can cut the greatest number of wrappers, the greatest number per pound. On the other hand, they are liable to get so thin that they break up on the cigar. Now it is believed that the product in Connecticut is rather thin, and, as I understand the matter, in the experiments this year which have been conducted on various lines, they have attempted to correct this in a certain measure. Possibly, it may be done by removing the tent a portion of the season. It is well known that the plant developed in the open sun has a tendency to thicken. The trouble is that there a leaf is produced which is too thick. We have got to reach a mean between those two. We have two ways of doing it. We may be able to accomplish it by removing the tent for a portion of the time. I do not know whether that will be successful or not. It is a matter of experiment. Then again we may be able to do it by breeding, in the same way that one plant produces a lot of suckers and another plant develops none of them. In the same way, one plant will produce thick leaves and another thin. If these leaves are too thin, I believe we can produce a thicker leaf by a process of selection and breeding. The industry at the present time is simply in a stage of development. I may say, however, for the gentleman's information (if he does not already know it) that there are a good many things to recommend Sumatra shade-grown tobacco. Whether the market will take what we will be able to produce here I do not know. I have not been concerned with this experiment except from the standpoint of breeding.

The PRESIDENT. These remarks by our speaker bring this suggestion to my mind in regard to that. What do you wish of tobacco? If I grow grass under shade my horses or my cows know the difference between eating that grass and that which is grown out in the sunshine. I do not know what may be desirable, but probably the taste may have something to do with it. Those who love tobacco can tell about that better than I. It may be that that is the question, whether the man who uses that tobacco will like the taste, or the man who manufactures it can wrap more cigars with it.

The hour for adjournment has arrived. This convention will stand adjourned until two o'clock this afternoon.

AFTERNOON SESSION.

Tuesday, December 12, 1905.

(Music.)

Convention called to order at 2.00 P.M., Vice-President Seeley in the chair.

The PRESIDENT. By your programmes you will see that we are to have an address this afternoon on "The Essentials of Success in Future Sheep Breeding."

Now there has from the earliest times never been any better or more honorable occupation than the rearing and caring for sheep, and we have hundreds of acres here in Connecticut which I have not the slightest doubt are well adapted to the rearing of sheep, and would make it a most profitable industry under proper rules and regulations, and system. Perhaps better than anything else that much of that land can be used for. I am very glad this afternoon that we have a gentleman here who is well posted, as I understand, in rearing and caring for sheep, and it gives me pleasure to introduce to you this afternoon this gentleman, Dr. C. D. Smead, of Logan, New York.

"THE ESSENTIALS OF SUCCESS IN FUTURE SHEEP BREEDING."

By Dr. C. D. Smead, Logan, N. Y.

Mr. President and friends: It affords me a great deal of pleasure to meet with you in your mid-winter meeting at this time, because I expect to learn something of you, a great deal more of you than you will learn of me. Therefore, it affords me pleasure to be with you. I have always in my life endeavored to learn something and have not made a very good success of it, but such as I have learned I shall endeavor to impart unto you.

The President has stated in his opening remarks that in his boyhood days he tended sheep, large numbers of sheep, and became disgusted with sheep and quit the business, as I suppose, resolved at any rate that he would have nothing to do with it. Now I am very sorry indeed that he did that, and I am more than sorry that others have done the same thing. Why? Because, as a matter of fact, the sheep industry of the world today is in a deplorable condition. There is no denying that. You who have given the matter thought and study, looked up the statistics, realize as well as I that there are less sheep in the world today than there have been at any time in fifty years; and the worst of it is they are growing less and less rapidly, and your clothes and mine are wearing out proportionately, and it is certain, Mr. President, that unless a change takes place, which I have faith to believe there will, it will not be long before you and I will not be finding fault with our wool but, as a matter of fact, we will be pretty glad to get it to wear. Our agricultural department at Washington has taken a great deal of pains in conjunction with other countries of the world where sheep are kept in looking this matter up and have now reported that at the beginning of this year there were ninety million less sheep in the world than there were in 1873. There has been a steady decrease then of three millions per year since 1873 in the whole world. A more deplorable thing than that is that there has been a decrease of ten millions of sheep right here in the United States since 1900. Now taking into consideration that fact, and taking into consideration the fact that the sheep of today will be, after the usual lamb crop is disposed of by the first of March or April, above six years of age — and six years is about the age of usefulness — and you can see that we are pretty near on the verge of a sheep famine. It seems, farmers, that it becomes the farmers of the whole United States, not simply the farmers of the State of Connecticut, or the New England States, or New York, Michigan, Ohio, Pennsylvania, or other states where they have been keeping sheep, to see that this is really a serious question, and that the whole United States should be interested. Why? For several reasons. We cannot, in my judgment, and I believe you will agree with me in that, we cannot safely and profitably prosecute farm work in the New England States, or in the states of New York, Pennsylvania, Michigan, and Ohio, at any rate,and I know that it is so in those states because I am familiar with them, — I know that we cannot carry on our farms as we should without we keep some sheep, so I will put it down as an essential thing, as the first essential thing, keep some sheep on the farm. Why? As I came down through Pennsylvania yesterday, and Southern New York, and saw the weeds growing up in the pastures in the dairy sections of Pennsylvania, that the sheep would eradicate and turn into mutton, I could not help but feel that a mistake was being made. Now take into consideration the fact that for the past ten years what we call hothouse lamb has sold on the average at $9.70 per head year after year in the markets of New York, Buffalo, and Chicago, and yet from the lack of a few sheep on the farm many of you have been allowing that money to get right away from you into some other places that could have been added to the income of the farm. I say the first essential then is that a few sheep should be kept on every farm, whether it is a grain farm, a fruit farm, or a dairy farm for the purpose of rooting out the weeds and turning them into mutton. As I travel over my own State of New York I can pick out the farms by the weeds where sheep have been kept all these years. You can tell where they are.

I have been for some years engaged in the farmers' institute work in the State of New York, and at every meeting the vital question that comes up in the dairy section is how to regulate the pastures that cannot be tilled. Weeds of various kinds are growing, coming into them continuously, and the question has been, what are we to do? What is the answer? Why the answer is, keep a few sheep. Now I know that some men within the hearing of my voice say they will starve out the cows, but are you, my friends, so sure of that? If a man has over-stocked his pasture, put a few sheep upon it, put them on with the cattle, and I will guarantee you they will come out ahead. If a man will keep a few sheep with his dairy herd of cattle he will be surprised to find that they will make a more luxurious pasture for them. I know that because I have had that on my own farm. I have tried to study these matters, and I have found by experience that a few sheep running with my cows upon the farm will take the weeds out of my pasture and clean them up so as to allow other grasses grow up that are relished by the cattle. I have improved my own farm in this way, and I could show you a pasture that has been occupied with sheep and cattle side by side running together for the last twenty years. It is as fine a pasture as you could find anywhere, and that has been brought about largely in that way.

Now before we talk about the essentials let me say that we sometimes can learn things by taking a back sight, as surveyors say; or as civil engineers say in running out country lines we will take a back sight to know whether we are going in the right direction or not. Now let us take a little back sight of this industry. What has brought about this condition of sheep culture today in this country? There is not a man who has a flock of sheep today, I believe, but what will bear me out in the assertion that if he has taken care of those sheep he has made some profit for all the time that the flock has been in existence. Now I am not going outside of the United States only as far as to say that in Australia, a great sheep country, owing to the curse of rabbits and the curse of locusts, large flocks of sheep have been decimated. The same has been true in other parts of the world, but for the purposes of this talk we will confine ourselves right down to the United States. What was the condition of the sheep industry, Mr. President, when you were a boy? I will venture to say that there were not in your boyhood days to exceed five thousand sheep in the whole United States that were not merinos or of merino grade. At the outbreak of the Civil War there came a demand for a class of wool that had not existed to any extent in this country before. It was needed for the purpose of making army blankets for the soldiers. There came a demand for some of the coarser wools. The coarser wools went up in price. There was a large increase in the demand even for the gray merino wool. The price went up steadily, and then there began what we will call a revolution of the sheep industry of this country, beginning as it did with the outbreak of the Civil War. At that time there came a tremendous demand for the coarser classes of wool, and with that large demand a great increase in the price of wool, but at the close of the war when that demand ceased, of course, the coarser wools began to go back. There was no demand for them. Something else took place and that something else was this. The high price of wool stimulated the breeding of the merino sheep as never before. I feel proud to say, and proud of the American merino breeders who today produce sheep that stand pre-eminent as the best wool sheep above any other country on earth, but in the race to produce that American merino sheep our breeders did something that brought about a change in the market. It was something that all of us are apt to do when we get a little too enthusiastic. We sometimes overdo. I know I do when I am on the platform. I sometimes go a little too far. I hope I shall not in this. I do not want to trample on any one's toes in what I am about to say. But in the stimulus of breeding these wool sheep shortly after the close of the war, or about 1864 or 1865, and from that on, as the result of the stimulus to this breeding, merino sheep instead of producing about five or six pounds of wool per fleece the breeders actually increased the wool producing power of the sheep very materially. They began to produce heavier fleeces, which brought them into prominence. Here is where a mistake was made by New York and Vermont breeders, and perhaps also by Connecticut breeders. The sheep developed a stronger constitution, they bred more wrinkles in them in order that they might have more surface and so get more wool, and in order to get weight they bred for size. Shearing festivals were held all over New York and I believe in New England. The weight of the fleece came to be the dominant factor in shearing. It was the weight of the fleece that counted, and it kept going up and up; instead of getting an old-fashioned fleece we began to get fleeces which weighed anywhere from ten, fifteen, twenty, to twenty-five pounds each, and occasionally some one would shear a fleece weighing thirty pounds or thereabouts. Then what happened? When the manufacturer took that fleece and scoured it down to about six pounds, he did not feel as though he could stand the racket. There is where the trouble commenced, friends. The manufacturer could not afford to pay for twenty-five pounds and then have it only come out after it was scoured weighing about five or six pounds at the extreme. What did he do? Sometimes a slight thing will change the fashion. At that time there had been brought into the United States with the coarse wools that we have been speaking about some of the medium wools, such as the Southdowns, and a few of the other Downs, the Leicesters, a long-wooled breed, had been brought over. Under the stimulus of the prices which had been obtained for wool they had been brought over. Now this manufacturer, he says to himself, I wonder if I cannot put in a little of that other wool and thereby reduce my cost? Everybody at that time, Mr. President, wore a broadcloth coat. I know they did in New York, and I suppose they did in New England. As a matter of fact, most everyone wore broadcloth previous to 1871-2-3 for a dress suit; yes, and the ladies wore merinos very largely. This manufacturer began to wonder if he could not get out of the hole that he was being driven into by introducing a little Southdown wool, and some of the other medium wools that he could get. Then what happened? Why, he purchased that wool, used it in his product, the trade liked the class of goods that he turned out, liked it because they wore pretty well, and the broadcloth suit was changed for what was called tweeds and cheviots, and things of that class, until today we have got to have a fellow that goes pretty well dressed up if he has a broadcloth suit. Then what took place? As the fashion changed over came the Southdowns, the Shropshire Downs, the Hampshire Downs; and Leicesters and the Cotswolds all came to this country. Down began to go the price of merino wool. Merino wool dropped down and down, and the result of it all was in plain language that these British breeds of sheep, by reason of the change in fashion, almost drove out the American merinos. They were driven away from Vermont, and perhaps Connecticut. I am not as familiar with Connecticut as I am with some other sections. They were driven from eastern New York to western New York, into Ohio, and so on down into Texas, and away on to the ranges. They were replaced by some of these English breeds of sheep. Now I am saying nothing against them. I do not wish to be understood that way at all. It is a fact those sheep came here, and the attempt was made to make them take the place of the merino, and as a consequence more failures were made with them, I believe, than successes. Men undertook to buy them, and did buy them, and took them on to their farms and gave them a class of care and feeding that they used to give to the merino sheep, and the result was the sheep went to the dogs, and the dogs did not do the killing either. Those flocks kept running down and down until men who were attempting to breed them became disgusted with them and what did not die were sold off. Now in consequence of that movement, it is a plain simple fact that large numbers of men today are not keeping sheep. They say we tried those and we failed. Now there is nothing against those breeds of sheep. It was simply a lack of knowledge on the part of those that bought them in failing to give them English care. The sheep came to this country but the Englishmen did not come with them to care for them. There was where the trouble came, along that line. I will say to you today that you cannot, friends, if you have been breeders of merino sheep, and I think you have many of you, you cannot take any English breed of sheep and give it the same care that you did those merinos and make a success of the business. They must have a different line of care. British methods must be followed to a great extent or there will be a failure. A breeder who has met a high degree of success with the British breeds is the one who has made a study of the need of the sheep. He has found that he must care for them according to the methods prevailing in England. He has adopted those methods and has accordingly made a success, while the American farmer that got them and endeavored to breed them, and endeavored to care for them according to the methods he pursued with merinos has made a failure of it. But that is not all, that is not the worst of it. That has been partly overcome. The American farmer has studied English methods until today he is raising and furnishing his flock with succulent food and giving them a little of the care which is needed, and they are succeeding fairly well with them, or did up until about nine or ten years ago. When the English sheep came over without the Englishmen to care for them there came with them something that we knew nothing about here, and I venture to say that previous to about twenty years ago not a man within the hearing of my voice ever saw a sheep louse. I have no reference to sheep ticks now. We had sheep ticks here but they did not thrive very well on the merino sheep. They did not like the mutton, I guess, but they did like the mutton of the British breeds of sheep. I do not know where the ticks came from. They were here. There was however an unseen foe which we had not before that time calculated upon. We could get rid of sheep ticks because we had learned that there were certain classes of poison which were not poisonous to the animal but were poisonous to the sheep tick and the louse or scab mite. Dipping was practiced to get rid of them, became quite well established, until every progressive farmer was able to keep his flock practically clear. After about ten years it was noticed that the sheep were beginning to decline under a disease that was mysterious. Sheep tick, lice, and the scab mite we could get rid of, but as to the other many a farmer was fooled by it and did not know what was the matter. I had a veterinarian make an investigation about fourteen years ago. That was the first I knew about it. I began to hold post mortem examinations, and others were doing the same. As the result of those examinations we found a little infinitesimal worm, the stomach worm, and we found some worms that were in the bronchial tubes. Longer worms. We found along the intestines little nodules. We thought for a time it was tuberculosis. Everything was going to tubercles along the intestines, but under the microscope we found in these little nodules a little worm, so small that we could not see it with the naked eye, and it was soon established that it was this little worm that was doing the damage. Here another thing took place among the farmers of the east. I believe I may be talking to some who had experience with it while I am speaking here today. There seemed to be a kind of panic in the sheep industry about five years ago, created by this disease, and a good many have not gotten over it yet. The sheep began to decline, and the farmers, instead of investigating the trouble as they should, because it was not a difficult matter to locate, became panic-stricken, and many a man went out of the business. I know that in my own section we had a number of farmers who were knocked out of the business by the worm. The farmers got scared when that worm got to work in the sheep folds, and the result of it was that a good many farms that were profitably engaged in the sheep industry are today sheepless. There is many a man that will laugh and shake his head and say, "I cannot keep sheep," but that is because he has been scared at a difficulty which is not hard to overcome. We are living today in what may be called an age of parasitism, or the parasitic age. If you will stop to consider one moment you will see how it is. Take those apples that are on the table, and I will guarantee that the man who raised them fought parasites in order that he might raise them, and if he had not fought parasites there would not have been any of those apples on the table today nor anywhere else. You cannot raise a hill of potatoes without you use a spray of some kind or something to destroy the bugs. We are in just that condition in the animal kingdom. We cannot raise today anything, either in the animal or vegetable kingdoms, anything from a chicken to a lamb, without we get ourselves into a position to fight parasites. If you raise vegetables or fruit, to be successful you must carry on an eternal warfare against bugs and parasites. If you raise animals, from a chicken up to a horse, you must make up your mind that you must prepare yourself to destroy the parasites, or you cannot be successful. We are living in that age. Now that sounds large. It is not. It is true it involves more labor, but it is a hard fight which confronts us, and we cannot raise sheep as we used to raise them. We have got to take care of them and take care of them properly. We must take care of them as the needs of the time demand. That is the hard fact which we cannot dodge. We will say then, that the first essential thing is to have some sheep on the farm, and the next, that they must be properly taken care of. In my connection with the *National Stockman,* and other farming publications, I have frequently had men write to me, asking about their sheep. Now what is to be the first essential thing in reviving the sheep industry in Connecticut, or all over New England for that matter, and in New York and these other states? In the first place, it seems to me, Mr. President, that you people here in Connecticut, or in New England, have a great opportunity in this connection which other sections of the country do not possess. I believe that you have an opportunity here of raising sheep so that they will pay you at least forty per cent. more than anywhere in the West. Land can be bought for from forty to sixty per cent. less in Connecticut and Massachusetts, and in most all of the New England States, than it can in the Far West. I know that from my experience in my own business. I have been out in the West and I can tell you that is the situation. I was there this summer and I was there four years ago. So I am not talking through my hat when I say that. It is a plain fact. Sheep can be raised cheaper here than they can be raised at any point east of the Mississippi River today because, first, the investment is much less for land, which is one of the main things, and then besides that, you have water here in abundance, while in the Far West they have a great deal of trouble on that account.

What will be the next thing? I said in the beginning that the sheep of the country, its lambs, that are now bringing from seven to seven and one-half and eight cents a pound, and as high as nine cents for some grades in the Chicago market,—that is, lambs dropped in May, and when they will bring such prices as that many a man will sell them off. The tendency, therefore, will be to sell off the lamb crop. I will guarantee you that because it is the money that the man is after, and ninety per cent. of the 1905 crop of lambs will, in my judgment, be eaten before the first day of next April. Now the first essential thing for a man to do that is getting six, seven, eight, nine, or ten cents, is to keep his old ewes, and to make up his mind that no matter what the price may be next year he will save his best ewe lambs. Now the next essential is this: you must make up your mind that if you cannot raise the sheep you want on your farm then go into the market and buy lambs. If you find a man that has saved his best ewe lambs and wants to sell them, of course, that is the best thing. The probability is, if that man knows his business, you will not be able to get them. But if you find a fellow that is poor and has perhaps got to sell, buy them so as to have a stock to start with. Now the next thing, of course, is to maintain them. That is one of the main points. They must be properly taken care of, and, as a part of that, diseases and troubles incident to sheep must be taken care of. Of course, for ticks and lice, vermin of that kind, that can be met by dipping. Every successful man will do it regularly. He will make it his business to dip his lambs and dip his sheep in the spring of the year as regularly as he will make it his business to spray his potato vines. Then he is sure that there is no unseen foe that he can discover, except what I am going to speak about in a moment, to interfere with the flock. The best time to kill off lice and ticks is right away after shearing. That should be done along late in the spring. If you shear as we do in New York, it will be usually about May. Some wait until along into June, but quite rarely. Usually from the latter part of April to the first of May is the best time. There is no better time in the world to get rid of lice and sheep ticks than there and then. A sheep has a long fleece and a lamb has a little short fleece, and I believe by far the greater part of such things can be gotten rid of by the right kind of treatment at that time. I have experimented upon it, and I believe almost every one of them can be gotten rid of. There are a number of good sheep dips advertised on the market. The carbolic sheep dips are good because they are non-poisonous. They are non-poisonous to the sheep but they are poisonous to all such insects. Some of the other dips, such as arsenical dips, have got to be handled with care. They will easily kill a sheep. They will kill sheep tick, but they have got to be handled with care. Any one that has had experience knows that it is impossible to dip a sheep without getting his head under some of the time. In the struggle the sheep will go under, and if it swallows any of the arsenical dip or gets it in its mouth it will be apt to make the sheep sick even if it does not kill it. Now why is it there can be dips used which are poisonous to the sheep tick and not to the sheep? The cold tar or carbolic sheep dips that are put upon the market simply have the effect, when the solution is applied, of choking the tick and lice to death. When you examine these insects with a microscope it is found that they have no lungs, but that air enters their bodies through holes in their sides, and if we put these carbolic solutions upon them it simply puckers up those breathing holes and they choke to death. When it comes to the use of the others they simply make a coating over the animal. They do not kill by contact but they make a coating over the animal, and the louse or tick is poisoned by simply taking a bite of it, just as the potato beetle is poisoned with paris green when you spread it on your potato vines. When a bug takes a little bite of the potato leaf he takes the poison with it.

Now here comes the other thing that I want to speak of. Presuming that you have a flock of lambs, or that you will, if you save your best ewes, then what is the next step in properly taking care of the flock? Suppose that you are just starting now, and that you have got a flock of old sheep to start with; that you have an old flock of ewes such as I have described. Now those old sheep may harbor a number of different kinds of worms. The small stomach worm, a little worm which will perhaps average from three-quarters to an inch and a half in length, and no larger in diameter than a common thread, number eight or twelve. That little worm is doing more harm today than any other worm. The nodular worm will come next in order. Now these are undoubtedly today inhabiting the intestines of practically five out of every six sheep in the whole United States. They have spread pretty well over the whole country. These small worms are today inhabiting the intestines of about five out of every six sheep of the age of the old sheep in the United States, and if they are there in large numbers they will cause the death of the old sheep between now and the first day of May unless taken care of. If they are not there in large numbers they will still do damage. They are undoubtedly present to some extent. While the sheep are off the pasture they are passing from the old sheep and are doing little damage. They are doing practically no harm, but next spring when the sheep are turned out to pasture there will be a passage of the eggs of the worm, or the embryo, on to the pasture fields, and then is the time that the lambs will become infected. Now here is something that is really amazing. Young animals, and the same may be said of children, are afflicted the most with worms of all kinds. When those worms get into a lamb they accumulate in larger numbers in the lamb than anywhere else. Now the flock will go well with the lambs until about weaning time, and then from that time they will begin to decline. I have had men write to me, "What is the matter with my lambs? They seem to be weak. They seem to be running down. I feed them well, but they seem to be going back. What is the reason of that?" It is simply because they are worm infected. Now let us reason a little about these worms. So far as has been ascertained thus far, the average life of any one of the worm family is only one year. Now we will suppose that those sheep were turned out to pasture. While they are in the barn they are usually doing no harm by infecting the lambs before birth or after birth, especially if the lambs are born in February or March. Before we turn the flock out to pasture we should try to rid the old sheep of the trouble. We should treat the old sheep to get rid of the worms that will later on infect the lambs. How will you do it? There have been a great many experiments carried on at our experimental farms in New York, and I do not know but it has been the same with you. Today, however, it has simmered down practically to two remedies which can be used. With the gasolene treatment, with one thorough application, fifty per cent. of them can be destroyed. The second should destroy at least seventy-five per cent., and the third dose will destroy practically ninety-five per cent. of those worms. The gasolene treatment stands today, in my judgment, ahead of any other. The next one is a cold tar product, and is called creosote or creolin. If the sheep are dosed with that previous to being turned out to pasture the old sheep will be pretty free of the disease. I know by experience that that is so. I have lost a lot of sheep with worms. I have learned that to be successful some treatment for this difficulty in the spring is absolutely essential. I have learned to give them a dose of gasolene before they are turned out to pasture. A dose of gasolene is a tablespoonful. A dose of the creolin is one teaspoonful. Now if I was to stop right there and simply say, give your sheep this treatment before turning them out to pasture, a tablespoonful of gasolene, you might use it, but I will guarantee you would hoot me off this platform if I ever came here again, because I will guarantee that the first sheep you tried it on you would have trouble on, and you would not go through the flock. There is a right way and a wrong way of using the treatment. There is a right way and a safe way of giving gasolene. Put into that tablespoonful about two tablespoonfuls of raw linseed oil, and then add to that at least four tablespoonfuls of milk. I do not care if you make it a half pint of milk. I do not care how much milk you put in. Some of the experiment stations in the West have said to use gasolene and milk. I would not dare say that on the platform or say it through the press or privately. I would not dare to mix gasolene with milk and give it to sheep because there is too much of a fiery nature in it, and if any mistake was made it would be apt to kill the sheep. Mix the gasolene first with oil. The oil acts also in another way. It is a mild cathartic, and when the gasolene affects the worm a little cathartic crowds him out of his home and the first thing he knows he is on the earth. The oil takes off the fiery effect. Now I said there was a right way and a wrong way to mix gasolene. First, mix it up in that proportion so that the sheep will get a tablespoonful. I do not care how you make it, but put in two tablespoonfuls of raw linseed oil, and at least four tablespoonfuls of milk, or more, if you wish. Put it up in a bottle, and keep the bottle tipped up until the dose goes down the sheep's throat. Of course, some have difficulty in administering the dose. I have been called out of the State of New York to see flocks of sheep that were dying, and I tell you I have learned a lot of things about human nature along this line. One of the things which I have done in such cases has been to fix up a dose and then say to the man whose sheep I was inspecting, "Now, Mr. —— will you please give this sheep this dose," and what have I seen? I have seen a two hundred-pound man grab a seventy-five pound lamb, get him up, and raise his head so high that the lamb could not swallow to save his soul if he had one. He would kick and struggle because when the man had elevated his head above certain degrees of elevation it became impossible for that lamb to swallow or breathe, and the man was simply strangling him to death. And then the man would say, "Confound that gasolene treatment, it has killed my sheep." Now it was not the fault of the treatment.

It was the ignorance of the man. He simply did not know how to administer the dose. I have seen them grab a sheep and throw it down, and then try to ram the bottle down the sheep's throat, ram it down as far as they could and pour that down the sheep. I have heard men say it is almost impossible to give medicine to sheep, but that is not so at all. The right way is this: Take a sheep and simply set it up as though you were going to shear it. Then you do not have to elevate its head, but simply put the hand under its muzzle like that, and the sheep will almost drink the medicine right down out of the bottle. Shake the bottle at times, keep the bottom well up, and pour it down. If you pursue that course, then you can dose them with anything you wish.

Now there is another thing about the gasolene treatment. Gasolene is of a gassy nature, — and perhaps I ought to say that there is practically little or no difference, so far as the effect is concerned, between the creolin or creosote, call it whichever you are a mind to, because the destruction of the stomach worm is accomplished, but I have been convinced by experiments, and without going into details, that the gasolene by itself, being of a gaseous nature, will permeate into the intestines to an extent that the other will not. I have been convinced that no other remedy at present known is apt to reach these lung worms. Now in case a sheep has all three of these worms I have described, we would probably entirely destroy all three by giving creolin. You may have read this. It has been published in the papers, but they sometimes get things wrong. The creosote or creolin treatment, and that is the way it is called in the drug stores, is usually given a teaspoonful at a time in half a pint of water, the mixture being shaken up well, and then it will stay mixed. It is usually given and it will destroy stomach worms.

After a flock of sheep has been treated in this way they can safely be relied upon as free of worms. If you use the gasolene treatment it is better to give it three mornings in succession. Feed them very early at night, and then give them a dose in the morning before they are fed. Follow that up for three mornings, and you will get rid of fully ninety per cent. of the nodular and stomach worms. Then we have safety.

Now comes another thing. We are not always sure. These worms will live, or the eggs will live, we do not know which, over winter, and infect the pasture. Keep in mind the fact that an old sheep is most likely to be always more or less infected with them. To be safe then, under the circumstances, wherever it can be done, it is better not to pasture the same field two years in succession. Many a man, however, is not fixed so that he can do that. He has got to use his pasture every year. If he is going to keep sheep he wants to keep them on it. If such a man will provide simply a covered box of salt, the box being covered so that the rains will not wash away the salt, but so that the sheep can get their noses into it, and with four quarts of salt mix a gill of turpentine, it will have a good effect. I remember when I was a boy that my father on Saturdays when I was not attending school would say to me sometimes, "Bub, I guess we better go to the woods. You are at home, and I guess we better go and get some pine saplings. The sheep need something green." You do not do that. Now we should notice this fact, that a sheep would be his own doctor if he could. We had some of these worms back in those days, but by just such treatment as that our fathers really kept them under subjection. My father and your father thought sheep needed something green to gnaw at, and therefore furnished them with that kind of material. Now we know why they went for them. It practically kept them clean of the worms. You accomplish practically the same purpose with the salt and turpentine. When you mix the turpentine with salt and put it in an infected pasture the result is sure to be good. I have been surprised when carrying on experiments with a flock of sheep that I knew had worms to see how readily they would lick up my box of salt with the turpentine in it, and to see how much more salt they would eat when the turpentine was in it than when it was not. Therefore, if you will provide the flock with that box of salt, it is one of the best things you can do. When that is done we can pasture year in and year out, in my judgment, so far as these worms are concerned. While this treatment will not kill the long worm it will so saturate the system with turpentine that when the little fellows hatch out they will not live long.

Now there is another thing. It is an unseen foe. Every sheep today needs looking over. The sheep of today need attention when they did not need it in your boyhood days or mine. If a man has a flock of sheep, and especially if he has a lot of lambs that look a little unthrifty, dose them. It is not a serious job at all. If you want to be successful in raising sheep you must take care of them and pay the same amount of attention that you do to be successful in other lines. If that is done, our farmers in New England and New York can just as well raise sheep profitably now as they ever did.

The outlook in this country for sheep, as the President has intimated, has never been as good as it exists today. The demand for mutton has never been satisfied. It never will be in your day or mine. The price of wool has reached a solid foundation, and will remain. There is nothing that we can see to cause us worry in other countries. We today stand pre-eminently triumphant with our sheep, and there is no reason why we cannot come to the front in the sheep raising industry if we will. Not in your day or mine will you see wool back where it was without the fashion changes and we go without clothes. We need have no fear of that. The tide of emigration is largely towards this country. Thousands of those people are farmers. It is building up the livestock industry in the east. The western sheep industry has had its day. As an industry it is badly handicapped. Those great free pastures in the west exist no longer, and the lack of water is a serious drawback. The stock-raising opportunities for the farmer of the east never were so good in the world as they are today. With the cheaper land, and with the advantage of water, such as we have in the east, the west cannot compete. I have a friend in Iowa, and from letters that I have received within a few days I learned that the problem of today with western farmers, with land worth from seventy-five to one hundred dollars an acre, is how can they compete with the east in raising stock. That is their great problem today. You talk about western competition! It does not exist. They are actually fearing today eastern competition with your lower price of land, and the tremendous advantage which you have in having plenty of water. We who live in this eastern country do not know how to appreciate water. I want to tell you a little story and then I am going to stop. I alluded to the fact that I was engaged for months in studying the situation and in lecturing to farmers' institutes. I went up into that great country lying on the

Red River of the north, taking in a part of North Dakota and South Dakota, and went away up to the Manitoba line trying to study the situation. While there I met a professor with a Norwegian name. He was with us. I simply could not make those people understand the situation. It was the hardest thing in the world. Finally, I said to that professor, "Professor, I want you to come down into New York State and make us a visit. It is your business to do so, and it is your duty to do so. He was western born and bred, but was a college man, and had never been east of Chicago. I said to him, "Away down east they don't know whether you walk on two feet or four," and I says, "now you come east. If you will come and do a little institute work in New York you certainly should do so." He came. We had a meeting at Cornell University, and then we started out. The first place lay about six miles off, and to reach it we took a livery team and started to drive. When we were about half way the driver drove up to a watering-trough. I noticed the professor. He looked amazed. He turned to me and he says, "Where does that water come from?" "There is a spring back here in the hillside," the driver says, "back here about eight or ten miles." "Why," he says, "does that run all the time?" "Why, yes," said the driver, "it is a never failing spring. There is always plenty of running water there." Well, I noticed he looked a little bit curious. He didn't know whether that was right or not. Finally he said, "Is there any other such spring as that in the State of New York?" "Why," says I, "we can count them by the tens of thousands." Well, he never accused me of lying before, but he came pretty near it then. "Well," I said, "I want to have you believe me, and if you will stay here a month you will be convinced of it yourself." We rode along for a little ways, and says he, "Doctor, I don't know what you people are thinking of. If I had that spring anywhere in North Dakota it would be worth ten thousand dollars."

We do not think of this advantage of water. (*Applause.*)

The PRESIDENT. Now, gentlemen, do not be a bit bashful about asking questions.

QUESTION. What do you do with the dogs in New York State?

Dr. SMEAD. We have some trouble with dogs in New York. They have killed a few sheep. I have learned this, in controlling the dog question, that when there is a determination of a man to do so he can beat a dog every time. Whenever there is a determination by the sheep growers to control the dog question it can be done. That is the case all over the whole country. Dogs, while they are killing a few sheep in the State of New York, are not doing serious damage, and the damage that they are doing today is largely in sections where there are but very few sheep. A dog has got to be educated to get along with sheep. The regular sheep-killing dog, however, is a sneak thief. He does not like noise. If you will put some bells on your sheep they will give a good deal of protection. They will not afford complete protection, but there is something about a bell that will afford at least seventy-five per cent. of protection from dogs. If you will get some small-sized cowbells and put them on they will create quite a racket. I have had quite a little personal experience with that. I always have at least fifty bells on. They are good fair sized cowbells at that. A few years ago at about eleven o'clock at night those bells began to make a racket. It attracted attention. There was a hound that got into the flock. I met him the next day and the hound ceased to exist. That was simply because there was a sentiment of the people against that kind of work. I do not know what your law in Connecticut is, but in the State of New York it is provided by statute today that any man has the right to shoot any dog that is caught either killing, worrying, or annoying sheep, without he is set upon the sheep by the owner or by his consent. Something like five years ago that law was extended so that now if the dog is even found chasing the animals a man has a right to shoot the dog in the State of New York. Dogs, in the State of New York, are recognized as property, and it behooves a man to take care of his property. If a man does not he is liable for damages.

QUESTION. What do you do where sheep have worms in the head?

Dr. Smead. Worms or grubs in the head do not kill one sheep where they are supposed to kill fifty. That may sound like a strange assertion, but the fact is that grubs in the head are not a dangerous foe to sheep except in locations where the gad-fly is extremely numerous. Grub in the head is sometimes due to a lack of grub in the stomach. Where there is no attempt to provide the proper variety of food, or where there is an attempt to winter sheep upon timothy hay, or where the flock is kept in such a way so that they are liable to contract colds and weak lungs, then if the sheep have an excessive number of grubs in the head they will frequently destroy the sheep. I have never yet found a sheep that was actually killed by grubs in the head. I mean from that as the direct cause. I have always found some other contributing cause. In localities where the gad-fly is numerous it is well to use some of the various remedies to keep away the fly.

Question. What is your opinion of ensilage as a food for sheep?

Dr. Smead. My sheep eat ensilage every winter. In this climate sheep need a food of that kind in winter, and I have learned by experience that ensilage will supply that need. It is not well to feed too much of it. Ensilage should be fed in the proportion of about two pounds of ensilage to a hundred pounds of sheep. With a sheep weighing 150 pounds, three pounds of ensilage per day is plenty.

Mr. Platts. Mr. Chairman, we have had lots of instruction how to take care of sheep, how to protect them from disease, etc., but the trouble with us in Connecticut is our inability to protect them from dogs. It is simply dogs and nothing but dogs. I live in a town in the southern part of the State, and when I was a boy sixty or seventy years ago nearly every farmer had sheep. At that time I rarely ever knew of sheep to be killed by dogs. At the present time, so far as my knowledge goes, there are no sheep kept within ten miles of me. Until within a very short time it has been a continuous struggle to raise and keep them. I gave up the business many years ago. When our factory villages grew up, and factories paid pretty good wages to their help, and thereby attracted a class of help which kept more dogs than poultry, and my farm being located about two miles from two of these manufacturing villages I found the question altogether too hard for me. After a series of years our State laws were changed, giving us more and more protection, until at the present day I do not know that a sheep raiser can ask for any better laws, so far as compensation goes, than those in force in Connecticut. That, however, does not solve the difficulty. Dogs will come in the night and destroy half your flock. Twice I have struggled to get up a flock of a hundred breeding ewes, and upon two occasions I have had over one-half my flock killed in one night. The town paid me a reasonable compensation. But that is not the point. I have no fault to find with the compensation paid. The trouble is there is no inducement to try to raise a flock of sheep when that danger threatens us as it constantly does. I gave the business up in disgust some time ago.

Now where is the remedy? I do not know. I have never known a dog to kill sheep that was brought up with them. I have sometimes thought that if there was a tax of five dollars or more laid on each dog, that tax to be remitted to every one who would keep two or more sheep to bring up with the dogs, that it might be a remedy. I do not think it would be a hardship, for any man who can afford to keep a dog can afford to keep sheep. If I have been informed aright, in some European countries there are laws which allow every dog to be shot at sight which is trespassing. I think that might be one remedy. Another remedy may be the use of wire fences of sufficient height to keep the dogs out, but that I should throw aside as unavailable for I do not think that it is practicable. In raising sheep it is necessary to shift them sometimes from one field to another, and it would be necessary to have such a fence around all fields in which such sheep were kept at any time. While it might be effective I do not think that it is a practical remedy.

Mr. Stadtmueller. Mr. President, I should like to make a few remarks on this subject.

In the first place, I think there has been a wrong impression gotten by the present generation, that the decline of sheep husbandry in the State of Connecticut is, first and last, due to the ravages of dogs. That is only a secondary consideration. From the remarks of the gentleman who preceded me it can be seen that owing to certain things it was easier for him to obtain a livelihood in agriculture along other lines, and therefore he gave up the business of raising sheep. That has been the case with many, and that phase of the discussion is something which the speaker did not attempt to speak upon. The decline of the sheep industry is not alone due to dogs. It is not alone due to the change of fashion. It is also due to the relation which the sheep industry has borne to all of the other great commercial industries of the world all along the line. It has been due in part to conditions which have existed. We can now see a change in those conditions. The industry is coming in again. Sheep are on the ascendency. Under the old condition of affairs a farmer kept sheep for wool. Now the condition which confronts the farmer is to keep sheep for eating. The position of things is completely reversed. Wool is now a by-product, and the meat is the primary consideration. Forty years ago the conditions were exactly the reverse as was so clearly stated this afternoon. This is a period of transition. We are going from one thing to the other. Under this changed condition of affairs, I believe if my venerable friend Mr. Platts would start again in sheep husbandry he would find it profitable.

Now in regard to this dog question. Of course, there is this to be said about dogs, and it has been touched upon very lightly in this discussion, that is the lack of public sentiment upon this question. One thing we need to do and that is to rouse public sentiment against the dogs and in favor of the keeping of sheep, and that is one thing that our Connecticut Sheep Breeders' Association is trying to do. That is one thing that every sheep breeder in Connecticut should stand for. We have pretty good dog laws. You look them over, and you will acknowledge, if you are fair and broad-minded, that it would be very hard to suggest any improvement in them. The trouble is that the dog laws which we have today are not enforced. Why are they not enforced? It is just because of the utter indifference of the agriculturists themselves. You cannot expect that those who have no interest in these matters in the State are going to enforce the dog laws. We sheep breeders cannot expect the dairymen to enforce them. The fruit growers are not going to enforce the dog laws. It is right up to us ourselves to see that they are enforced, and the only way to accomplish it is to arouse public sentiment upon this question and to go at it in the right way. I reside in the town of West Hartford. It is one of those towns that is perhaps equally divided between an urban and a suburban population. We have some sheep in that town. I was talking with our town clerk and asking about the dog tax. He said that up to three years ago the dog tax amounted to about eighty or a hundred dollars per annum. Our selectmen discovered that there was a statute upon the book which had been there for a great many years, reading something to this effect: that on or before the first day of June the town clerk of each town shall make a list of all the dogs which have been registered, etc., and it shall thereupon become the duty of the selectmen to find out if there are any dogs that have not been registered. Now how many towns are there in the State of Connecticut where that is applied? The statute is mandatory. It says that the selectmen shall do that. That is what they did in my town, and that is just what we want them to do in every town. We want some good live member of our association in every town that will take it upon his shoulders to see that that statute is followed out and enforced. Mark the results in our town. Since that statute has been followed the dog tax has increased from eighty to a hundred dollars a year to over three hundred dollars per annum. It has increased the fund available for the proper remuneration and payment of damages done by dogs. It helps in another way. Many useless dogs will disappear in a town where that law is enforced.

Now just one word regarding the outlook. I presume many of you are subscribers or readers of the *Country Gentleman,* and if so, you have noticed the movement headed by Mr. Burr in western Massachusetts, for providing farmers with ewes, for loaning out ewes to the farmers. It is reported that that movement is meeting with unusual success. I do not know how many thousand ewes they have placed upon farms in western Massachusetts. They are loaned to the farmers upon the basis that the company will require every farmer receiving a loan of ewes to take care of them, and shall receive for his compensation fifty per cent. of the progeny and one pound of wool for each animal. If men can afford to take sheep on that basis and make a success of it, I do not believe there is a shadow of doubt but what they can go into sheep husbandry tomorrow, owning their own sheep, and make a good profit on the business. At first thought it seems surprising that such a proposition would be a success, and especially when carried out on a large scale where thousands of sheep are involved. Would you want to take a loan of ewes and guarantee to take care of the flock, to keep them and take all of the care of them for a year, and have for your compensation only fifty per cent. of the get and one pound of wool from each ewe? Still that is what that company up in Massachusetts is offering, and apparently making a success of. I will be much surprised if they do not offer it in Connecticut within a year or two.

Secretary BROWN. I invited the Secretary of the State Board of Agriculture of Vermont to be here this afternoon. He wrote me a very interesting letter, regretting exceedingly that he was unable to be present. He said that he was thoroughly interested in sheep culture, and he believed that nothing which he could think of promised so much success to our New England farms as to see them again covered with generous flocks of sheep.

Convention adjourned to 7.30 P.M.

EVENING SESSION.

Tuesday, December 12, 1905.

(Music.)

Convention called to order at 8 P.M., Vice-President Seeley in the chair.

The PRESIDENT. The hour has arrived for opening the meeting. While the men are arranging the stage for the main address of the evening we will have the question box for a few moments. The Secretary will please read what questions he has.

Secretary BROWN. Mr. President, I think we have two or three questions relating to sheep, but as Dr. Smead is not in the hall I will defer them until we can have the benefit of his expert testimony.

Now Mr. President, before taking up the regular programme, I would like to offer the following resolution:

"WHEREAS, there have been introduced into Congress House Resolutions 285 and 286, appropriating $250,000 for suppressing the Gypsy and Brown-tail moths, and $15,000 for procuring parasitic enemies of such moths, now therefore,

"RESOLVED, by this convention that our Senators and Representatives are hereby urged to use all honorable means to secure the passage of said resolutions.

"RESOLVED, further, that the Secretary of the State Board of Agriculture be directed to forward a copy of these resolutions to each of our Senators and Representatives in Congress."

It is no secret, gentlemen, that the gypsy and brown-tail moth which have been so long a scourge in Massachusetts have already crossed the line into New Hampshire and into Rhode Island. A kind Providence has spared Connecticut from the ravages of these insects thus far. We do not know how long that intervention will continue. Any automobile or any railroad car coming out of the infected section is liable to bring them into this State. It has become more than a local question. It has become a question of national importance. The presence of these pests is a serious menace to our agricultural interests. The resolution introduced into Congress proposes that the national government shall take a hand in suppressing these pests, and this resolution is simply to represent the sentiment of this body of farmers assembled in convention. We are requested to urge our Senators and Representatives in Congress to use every effort in favor of the passage of these resolutions.

The PRESIDENT. Any one second the resolution?

A MEMBER. I second the motion, Mr. President.

The PRESIDENT. Are there any remarks?

Secretary BROWN. Mr. Chairman, Professor Wheeler of the Rhode Island Agricultural College is present. He is Secretary of the Federation of Agricultural Clubs in the State of Rhode Island, and has this matter in charge for that State. I would like to ask Professor Wheeler if he would say a word in regard to these resolutions.

PROFESSOR WHEELER.

Mr. President, ladies and gentlemen: I will say that the people in Rhode Island have been very much asleep on this gypsy moth question. I have been one of the worst of the sinners. Last season I went through some of the infected districts. I had heard many things about the ravages of this insect, but I found a great many things far worse than any thing I had heard. These insects constitute one of the most serious pests that we have had to deal with. They even get into the houses and into the pantries. Conditions are so bad, and the pest is so numerous it is absolutely impossible to keep them out of the houses even where the greatest precautions are taken. It is one of the worst pests with which the American people have had to deal in the history of the country.

The female is unable to fly, and therein rests our hope of controlling them. Our federation in Rhode Island took up the matter, and we were of the opinion that the Government should come to our aid at the present time. The trouble has developed to such an extent that, in my opinion, it is beyond the ability of the states to successfully cope with it. We should have the aid of the national government. The insects have already spread into New Hampshire, and we have a local colony in Providence. It is reported that it is at the borders of Maine if not already in the State of Maine. Our federation has sent a circular to all of the New England State Boards of Agriculture, and I think they will be a unit in asking the government to appropriate money at this time to help control this pest. I wrote your Secretary about this, and found him very favorably inclined to bring this matter before you. I only wish to say further that whether you appreciate at present the necessity for your action or not you will in a very short time. I believe that the wisest course for Connecticut to pursue is to urge upon all of your Congressmen the necessity for using every effort to have this pest controlled. If it is not controlled, it is only a question of a very short time before they will spread into Connecticut and bring about here the havoc and ruin they have wrought in Massachusetts and other localities. It is a matter which must not be delayed. Every dollar which is spent now is better than ten later.

Mr. PLATTS. What have they done to exterminate it? What can they do?

Professor WHEELER. The State Board of Agriculture in Massachusetts expended some large sums of money, and they were on the point of exterminating the pest, but it is reported that the expenditure of the money got into politics, and the appropriation some years ago was cut off. As a result, the thing has become such a pest that the people can take no comfort in their homes. They destroy most everything in the way of vegetation. Even the evergreens are being destroyed, and whole orchards are being destroyed. Fruit trees and valuable shrubs. One gentleman that I know of has spent forty thousand dollars this last year in trying to control them upon his place, and is to spend seventy thousand dollars this year.

There are three things to do. First, to destroy the eggs close to the trunks of the trees. That is a work to be done now. If the work is to be undertaken so as to do much good, it ought to be undertaken now. Another thing, is to put a burlap around the trees and allow it to hang down three or four inches so that the caterpillars are unable to get up. Then they can be caught and crushed. The important work needs to be done before the leaves come out in the spring. An appropriation should be made by Congress, and, if possible, on the first day of January, or February, men should be at work. We should not lose a moment's time.

The PRESIDENT. You hear this resolution regarding the gypsy moth. All in favor say "Aye." It is passed. .

The address on the programme for this evening is "The Story of Soils and Plants in Their Relation to Liming," by Professor H. J. Wheeler, Director of the Rhode Island Experiment station. The gentleman has just spoken to you about the gypsy moth. I have the pleasure of introducing him to you now.

THE STORY OF SOILS AND PLANTS IN THEIR RELATION TO LIMING.

By H. J. Wheeler, Ph.D.,

Director of the Rhode Island Agricultural Experiment Station.

Mr. Chairman, Ladies and Gentlemen: It gives me much pleasure to greet a Connecticut audience. This pleasure is that of a former Massachusetts neighbor and as a neighbor and resident of Rhode Island.

Only those who have gone from another State with the plan of making Rhode Island the home of their adoption, can fully realize what it means to become a full fledged Rhode Islander. The two years of probation before one can cast a ballot inculcate a high appreciation of the blessings of true citizenship, and give ample opportunity for intelligent American-born citizens to arrive at a correct conclusion how to vote. Not being burdened at the outset with this duty of citizenship, my first two years in Rhode Island were devoted without interruption to becoming acquainted with her soils, the products of her farms, her people, and the agricultural problems to be solved. As a result of visits to every nook and corner of the State one could not fail to be struck with certain peculiarities which were markedly different from those that are to be observed in many other States and countries. An abundance of common sorrel, blackberry vines, certain varieties of St. John's wort, violets, five-fingers, and wild-grass were visible at every turn. The absence of a good stand of clover in freshly seeded mowing lands, the rapid disappearance of timothy, and the usurpation of its place by redtop and Rhode Island bent were most characteristic features.

Few of the soils are derived from the underlying rocks, but where they are, and whether from slate, pudding-stone, sandstone, conglomerate, or granite, the characteristics of the natural vegetation are much the same as those of the other areas where the soil is composed of granitic glacial débris.

While skirting the western borders of the State it happened occasionally that I inadvertantly found myself in Connecticut, but neither the soil, the vegetation, nor even the people, gave a hint that the limits of the State had been overstepped. Perhaps it was the same recognition of the fact that there may be considerable areas in Connecticut that are similar to most of the land in Rhode Island which led your Board of Agriculture to ask me to tell you something of our various liming experiments.

It is with a peculiar sense of vindication that I have accepted your invitation to present this particular subject, for the reason that many of my colleagues in New England were not ready to believe, ten years ago, that our upland well-drained soils were ever so acid and so greatly in need of lime that profitable yields of certain crops and the greatest returns from many of the commercial manures, were both impossible until after resort to liming. It was claimed that lime had been shown to be unnecessary in Massachusetts and that in all probability the need of lime in Rhode Island was confined merely to the farm of the Experiment Station or immediately surrounding areas. It is perhaps fortunate for the Rhode Island Station that there were so many doubters, since in consequence we had for several years a practically free field of investigation.

It may be of interest to state that in the early Massachusetts experiments to which reference has been made lime was applied in too small quantities per acre and Indian corn was employed in the tests; a crop which is frequently injured by liming.

Believing that it will be of greater interest to hear the actual story of our liming experiences than to listen to a pedagogically arranged lecture on the subject of lime and liming, an endeavor will be made to trace the investigations step by step.

It will be recalled that in the winter of 1889-90 Prof. Atwater, at that time Director of the Office of Experiment Stations in Washington, issued two plans in coöperative experiments. One of these embraced an ordinary soil test and also a test of the relative efficiency of nitrogen in dried blood, sulphate of ammonia, and nitrate of soda. Like amounts of nitrogen were employed in each instance for the "full rations." As a measure of control check plats were introduced. These, like those where the nitrogenous manures were applied, were all manured uniformly with muriate of potash, and dissolved bone-black. All of the nitrogenous manures were applied in "one-third," "two-third," and "full rations." The "one-third ration" of sulphate of ammonia amounted to 120 pounds, the "two-thirds ration" to 240 pounds, and the "full ration" to 360 pounds per acre.

At the request of Ex-Director Flagg ten of these coöperative experiments were established in the spring of 1890, two being located in each county in the State. An additional acre was provided for upon the farm of the Experiment Station at Kingston. In the latter instance a positive ill effect of the sulphate of ammonia was noticed the first season. The extent of this injury is best indicated by the yields of stover. Instead of increased yields with each increase in the amount of the sulphate employed those produced with the "one-third," "two-third," and "full rations" were 3,000, 1,500, and 1,300 pounds per acre, respectively. The following year the corresponding yields were 1,840, 1,140, and 825 pounds per acre. By the use of dried blood and nitrate of soda in increasing amounts the tendencies to give increased crops was the general rule.

At Hope Valley injury from the sulphate of ammonia was visible the second and third years, and indications of approaching injury were soon observed in one or two other localities.

Upon looking up the records of similar injury or those concerning the inefficiency of sulphate of ammonia it was found that most of the European experiments with beets showed it to be far inferior to nitrate of soda as a source of nitrogen. With the cereals this was more rarely or less strikingly true. Two or three instances of the bad effect of sulphate of ammonia had been cited by French and German writers but no one seemed to be at all sure of the cause, nor had there been shown to be a positive remedy.

In speculating concerning the probable reason for the trouble in Rhode Island it was recognized at once that the soil was derived from granitic rock and that in view of the character of the minerals of which it is composed lime might be deficient. It was also already a matter of record that the granitic soils of Scotland need lime. The same was known to be true of certain of the sandy soils of northern Germany. It had also been recorded by several French writers that successful agriculture in certain Departments in France was impossible without resort to liming, especially where the soil was of granitic or of sandstone origin. Especial emphasis had been laid by these writers upon the conditions in the Department of Limousin. There the soil was derived from granitic rock and the agricultural conditions were miserable in an extreme degree until the construction of a railroad rendered it possible to introduce lime at a reasonable cost.

Several of these European writers referred to the soils as positively acid.

In view of the knowledge of these conditions in other countries it seemed probable that the difficulty in Rhode Island was due either to soil acidity and a lack of sufficient carbonate of lime in the soil, or to the absence of the organisms which are capable of changing the ammonia into nitric acid.

The first step actually taken was to test the soil for acidity or a lack of carbonate of lime, by means of several different chemical methods. Of these the blue litmus paper test was found to be the most trustworthy of the simple tests.

HOW TO MAKE THE TEST WITH BLUE LITMUS PAPER FOR ASCERTAINING THE NEED OF LIME IN SOILS.

Concerning the test, the best plan for farmers to pursue is to have the soil tested if possible by the Experiment Station Chemist, for familiarity with the method enables one to arrive at a more correct judgment concerning the probable lime requirement. Still other and more elaborate tests can also be made in the laboratory.

In making the blue litmus paper tests the soil is first moistened until it is of about the consistency of a thick porridge. It is then parted, a strip of blue litmus paper (two inches long by half an inch wide) inserted and the soil pressed around it. After an hour or two the paper can be removed and rinsed by dipping in water a little less deeply than it was inserted in the soil. The end introduced into the soil should not be touched with the fingers. If this latter precaution is taken and it is found upon removal that the paper has entirely lost its blue tint and an intense pinkish red or brick red color has taken its place, it is probable that the soil needs liming.

FURTHER EXPERIMENTS WITH THE KINGSTON SOIL.

The soil where the sulphate of ammonia proved injurious turned a blue litmus paper rapidly red. It was tested to ascertain if proto-sulphate of iron, an occasional toxic constituent of soils, was present, but the tests revealed none. In order to correct the acid condition of the soil and to insure the right conditions for the nitrification of the ammonia, it was decided that it would be best to lime a portion of all three of the plats which received sulphate of ammonia and to sow some garden soil upon one-half of each of the limed sections, the garden soil to be immediately mixed with the other by cultivating. The idea of introducing the garden soil was to make sure of the presence of the nitrifying organisms.

Owing to doubt as to the probable success of the experiment on the part of those in authority, it was not until late in the season of 1891 that permission to undertake it was obtained. It was then too late to introduce either the lime or the garden soil into the soil of the field in a thorough manner without injuring or destroying the crop of Indian corn already upon the land. For this reason only slight indications of benefit from liming were observed the first season.

During the following winter it was shown by Müntz, a French investigator, 'that the nitrifying organisms are praccally present everywhere, even under the glaciers of the Alps and in the interstices of the rock masses of the Faulhorn. For this reason it was not deemed necessary to try further inoculations with garden soil especially since proto-sulphate of iron, which was said to be poisonous to these organisms, had been shown not to be present. In the spring of 1892 a further application of lime was made to the same sections of the three plats which had been limed in 1891. Indian corn was again planted. As soon as the corn was a foot or more in height it was evident that a wonderful change had taken place, for now the growth was better upon the limed areas, with each increase of sulphate of ammonia. Upon the unlimed sections of the plats the results continued to be poorer with each increase.

The view upon the screen shows in the center three rows of corn of the crop of 1893 where the "two-thirds" ration of sulphate of ammonia was used. The much better corn in the background stood upon the limed sections of the plat.

A nearer view of the corn where the lime was used shows the benefit from liming in a more striking manner.

The better growth with the full ration of sulphate of ammonia, after liming, stands in striking contrast to the poorer growth with the same ration before lime was applied.

Here are seen two lots of corn at the left which were grown at Hope Valley, Rhode Island, by the use of a "full ration" of nitrate of soda. The lot at the extreme left grew upon the limed section of the plat and the one at its right grew upon the unlimed section. Little difference in the two is noticeable. Nitrate of soda is, therefore, an immediately efficient nitrogenous manure for soils that lack carbonate of lime and by its continued use the conditions often improve rather than grow worse. In this respect it differs wholly from sulphate of ammonia. The two lots of corn shown at the right, were grown where a "full ration" of sulphate of ammonia had been applied. The large lot at the left was from the limed area of the plat and the small one at the right was from the section where no lime had been used.

At the same time that these and other experiments were in progress in Rhode Island, Wagner and Dorsch in Germany experimented with summer rape grown upon a muck soil by the use of sulphate of ammonia. It was found that when used without carbonate of lime its effect was equal to 28 per cent. of the effect of the same amount of nitrogen in nitrate of soda but that after liming it rose to 90 per cent.

In connection with the publication of this experimental work in Rhode Island, attention was called to the falling off in yields with the ammonium salts as compared with the results with nitrate of soda, at both Rothemstead and Woburn, England. In fact it was shown at the Rhode Island Station in 1893 that the cereals were affected in a very unlike degree by the conditions which cause the ill effect of the sulphate of ammonia. For example, Indian corn and rye withstood the conditions best, then oats, wheat, and finally barley. In this connection it is of interest to note that in 1897 J. A. Voelcker, chemist to the Royal Agricultural Society of England, called attention to the greater falling off of barley than of wheat in experiments with a mixture of ammonium sulphate and ammonium chloride at Woburn. He attributed it at that time to ability on the part of wheat to send its roots deeper and to appropriate lime which the barley roots could not reach. Not until 1901 did Voelcker test his soil with blue litmus paper, when it was found to give an acid reaction. In 1902 he reached the conclusion that the differences in barley and wheat, which were observed earlier, were really attributable to a difference in the power of the two cereals to resist acidity. Later experiments showed, in full agreement with those in Rhode Island, that oats could resist the conditions much better than either wheat or barley.

The two plats now shown were embraced in the Woburn experiment with the ammonium salts. The plat at the right, where little barley is to be seen, had not been limed, while that at the left, where there is a fine crop, received two tons of lime per acre, about three years before this view was taken. It will be seen that the lime has fully corrected the ill effect of the ammonium salts.

Where certain mineral manures were used with the ammonium salts the injury from the latter was longer delayed and was slightly less serious than when it was used alone. Here also the addition of lime corrected the condition.

Recently A. D. Hall, Director of the Rothamstead Station, mentioned the bad influence of the continual use of the two ammonium salts which have just been mentioned, and says that sorrel became abundant upon the plats which received them, excepting where carbonate of lime had been applied.

A more striking illustration could hardly be afforded of the influence of soil conditions upon the relative amounts of sorrel and clover than that afforded by the plats in the nitrogen experiment at the Rhode Island Station. Where mineral manures only were used there was no clover upon the unlimed sections of the plats, but common sorrel was abundant. Where lime was applied there was a full, splendid stand of clover, with but traces of sorrel. The amount of the common sorrel was less upon the unlimed plat where nitrate of soda had been used than upon the corresponding plat receiving dried blood. By the use of sulphate of ammonia, without lime, the amount of sorrel was three and one-half times as great as with dried blood used under the same conditions. In fact it fully occupied the ground to the utter exclusion of clover and it was nearly knee high. A more magnificent growth of sorrel than was observed in that instance is hardly conceivable.

A SPECIAL STUDY OF THE INFLUENCE OF LIMING UPON DIFFERENT VARIETIES OF PLANTS.

In 1893 four adjacent plats of land of exceptionally uniform character were secured for more extended experiments with lime. Observations were already on record concerning the natural herbage of calcareous and other soils, and also many miscellaneous observations as to the effect of lime upon the growth of a few varieties of agricultural plants. It was, for example, well understood that lupines are usually injured by liming and that clover is helped by it. Nevertheless no one had ever taken up the study in a continuous and systematic manner, and so far as concerned the vast majority of agricultural plants little or nothing was known concerning the influence of lime or of soil acidity upon their growth. In order to study this matter experiments, which are still in progress, were begun in 1893 upon four plats of land, separated by three-feet paths. The plats have all been manured alike with magnesium sulphate (Epsom salts), dissolved bone-black (or acid phosphate), and muriate of potash, from the beginning of the experiment to date. Two of the plats received their nitrogen in nitrate of soda and two in sulphate of ammonia. The absolute amount of nitrogen used upon each plat is nevertheless kept identical. One of each of these pairs of plats was limed in 1893 and 1894 and again recently.

The central path shown in this view passes between the two plats which receive sulphate of ammonia. The unlimed plat is at the right. It may be seen in the background that some varieties of plants are making a good growth even upon this plat. The two plats which receive nitrate of soda are indistinctly or partially seen at the left.

In this view are shown the two plats manured with nitrate of soda, the unlimed one being at the right. Here also the marked effect of liming upon certain varieties of plants is noticeable.

With the exception of one or two years a large number of varieties of plants have been grown in rows annually across the four plats.

The plat receiving nitrate of soda and lime is now slightly alkaline to litmus paper. In other words it now turns red litmus paper blue instead of turning a blue litmus paper red, as it did originally. The plat receiving sulphate of ammonia and lime is still slightly acid in its reaction upon blue litmus paper. The plat receiving nitrate of soda but no lime is still more acid, and the one receiving sulphate of ammonia but no lime, reacts far more intensely acid than at the outset. At the time when the varieties of plants were grown which are to be shown upon the screen, even the limed plat, which received nitrate of soda, was still very slightly acid as shown by blue litmus paper, and the others differed from it only in the degree of acidity.

The two apple trees at the left grew where sulphate of ammonia had been applied, and the two at the right upon plats receiving nitrate of soda. The better growth at the right of each pair shows that liming was helpful. The tests unfortunately could not be continued to the time of fruiting, and hence they throw no light upon the yield and the quality of the fruit as affected by liming.

It will be observed that in both instances the Norway spruce trees exhibit injury from liming. The same susceptibility to injury by liming is said to be true of the chestnut, azalia, rhododendron, and of certain other members of the family to which the two latter plants belong.

The white birch has shown marked adaptability to acid unlimed soils, but it seems less likely to be injured by liming than the spruce, cranberry, and certain other trees and herbaceous plants that might be named.

The quince bushes show a marked beneficial influence of the lime. A similar though somewhat less striking benefit from liming was observed with cherries and the American linden.

The two lots of cranberry vines at the left grew upon the plats receiving sulphate of ammonia, and it is of much interest to note that the best growth of vines, shown at the extreme left, occurred upon the unlimed plat, where clover, lettuce, spinach, cantaloupes, onions, and asparagus usually die outright. It will be seen that the vines at the extreme right from the limed plat, receiving nitrate of soda, were inferior to those at their left, where lime was omitted.

The reason for showing but three lots of asparagus is that during the first and second years all of the plants died upon the unlimed plat which received sulphate of ammonia. The lot at the left represents the result where lime was used with the sulphate of ammonia, and the one at the extreme right shows the results with lime and nitrate of soda. In this instance the great advantage of liming is shown even where nitrate of soda was used, as seen by comparing the two lots at the right.

Below are given the relative weights of marketable asparagus obtained in the year 1900.

Plate No.	Pounds of asparagus
23, unlimed, sulphate of ammonia . .	0.00
25, limed, " " " . .	5.87
27, unlimed, nitrate of soda . . .	1.01
29, limed, " " " . . .	9.62

From this it will be seen that liming increased the crop over nine times even when nitrate of soda was employed.

The pumpkins show a positive beneficial influence of lime. It is hoped that these observations may aid the residents of New England to continue to place before their Thanksgiving guests the time-honored "open-faced" pumpkin pie.

Serradella, which is sown with spring grains in Germany, to serve later in the season as a sheep feed, and later as a soil renovator, thrives well upon very acid soil, in which respect it differs widely from most, if not all, of the clovers, the sanfoin, lentil, vetch, pea, and certain other legumes. The two lots at the left, grown by the aid of sulphate of ammonia, were apparently as good as the other two, grown with nitrate of soda. In fact, liming heavily just before the crop is grown, though helpful to clover, is injurious to serradella.

The soy bean and southern cow pea are two other legumes which should follow in the rotation, preferably three or more years after liming, though the soy bean seems to need the long interval less than the cow pea.

The onion does not thrive upon a very acid soil, a fact in full accord with the general idea that wood ashes, which contain over 30 per cent. of lime, make a good manure for this crop. Where sulphate of ammonia was used on the unlimed soil only two or three small onions resulted. In the case of the two lots at the right, from the limed and unlimed plats which received nitrate of soda, the yield without lime was 24 pounds and with lime, 44.3 pounds. These results throw satisfactory light upon the former inability of certain farmers in Massachusetts to grow onions, especially where brands of commercial fertilizers had been used which were acid instead of basic in character.

In the case of the flax the products of the limed plats show little increase from liming. Flax is, therefore, well adapted to acid soil.

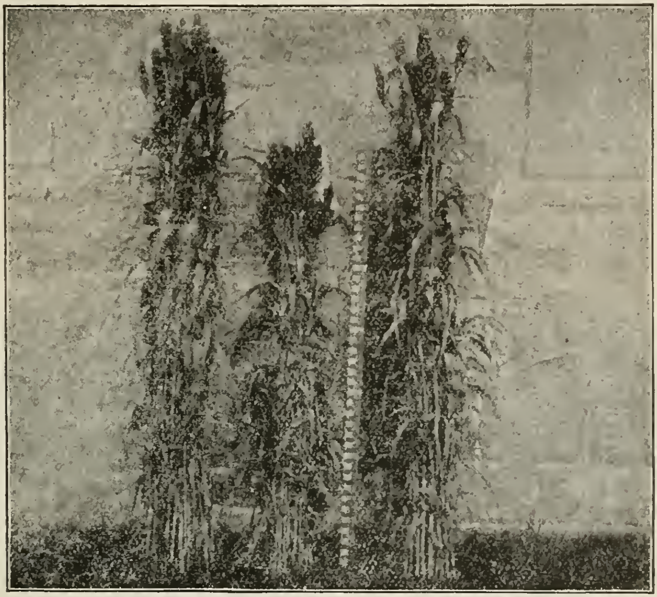
In the case of the chicory little difference in yields resulted; it is evident that chicory will thrive well even upon very acid unlimed soil.

In the case of the broom corn the results with sulphate of ammonia are shown at the left. The second lot from the left and the one at the extreme right were from the limed plats. Broom corn is, therefore, helped by lime.

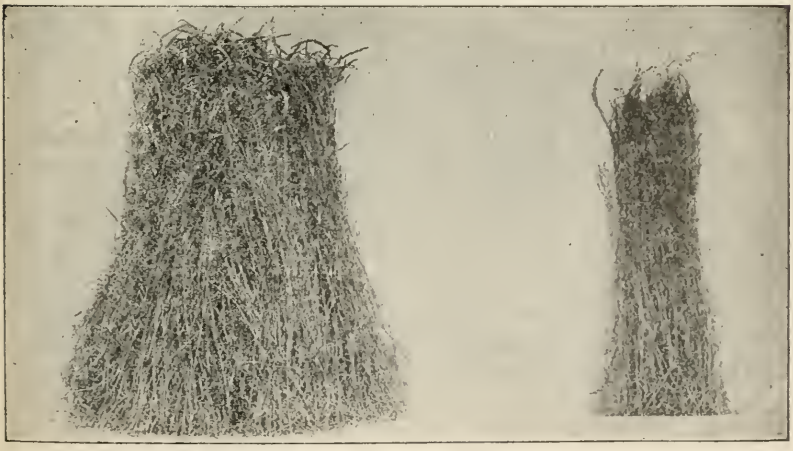
The carnation pink can thrive upon quite acid soil. Liming was nevertheless beneficial in both instances.

Crimson clover can thrive fairly well upon soil which shows considerable acidity, yet upon very acid land liming proved absolutely essential to its success. The two large piles are from the two limed plats. Upon the unlimed plat receiving sulphate of ammonia, it practically failed.

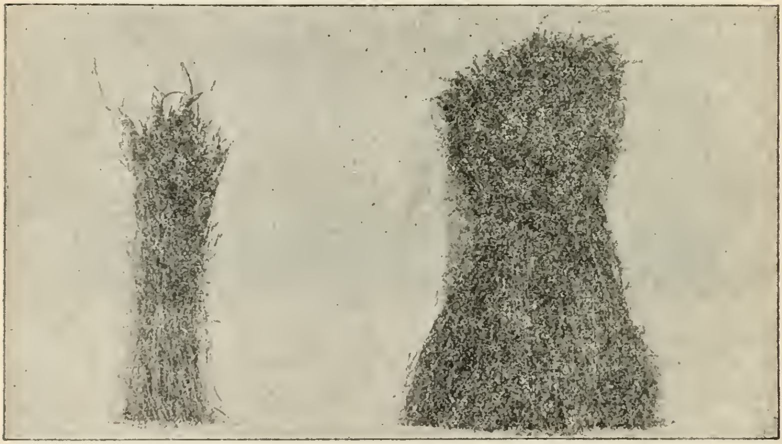
These two bundles of grass are from the limed plat which receives sulphate of ammonia. The grass was assorted, the



large bundle of timothy being shown at the left and the small lot of redtop at the right. This should be compared with the next view.



In this view the results are shown where sulphate of ammonia was used upon the unlimed soil. The small amount of timothy is shown at the left, and the relatively large amount of redtop at the right. The foregoing results taken together with these show the wonderful ability of redtop to thrive upon acid soils, and also the fact that such soils will not support timothy until after liming. What has been said concerning the need of lime for timothy is likewise true of Kentucky blue grass and in a less degree of the awnless brome and other grasses. Rhode Island bent grass, which is closely related to redtop, exhibits the same remarkable ability to thrive upon very acid soil. The very fact of the existence of splendid fields of this

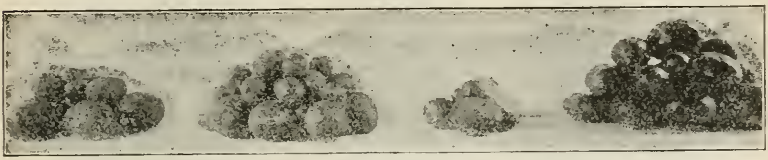


variety of bent grass in the State of Rhode Island is indicative of soil acidity, and the need of lime. It is a case of the "survival of the fittest" upon the acid soil.

In view of the fact that the conditions favorable to timothy are also favorable to Kentucky blue grass care should be taken where timothy and redtop are both desired to secure seed free from the seed of Kentucky blue grass or it will tend to crowd out both the timothy and redtop, producing essentially a "turf-bound" condition.

Alfalfa, like winter vetch, seems to thrive best after using enough lime to render the soil slightly alkaline. In marked contrast to lettuce, spinach, beets, the best results with alfalfa have usually been obtained upon the limed plat manured with sulphate of ammonia instead upon the other limed plat.

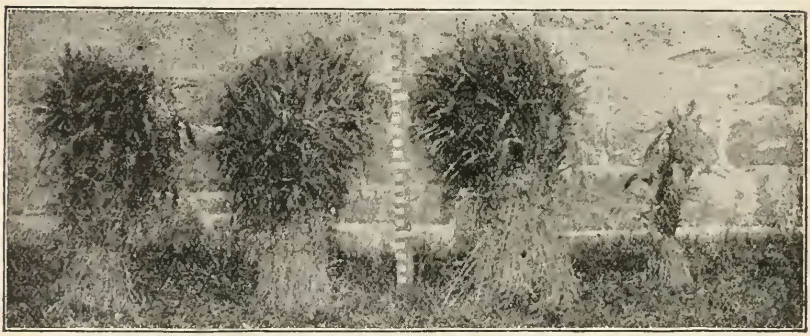
The results with cabbages grown with the aid of nitrate of soda are at the left, and they show its superiority to sulphate of ammonia. Liming proved helpful in both cases as shown by the larger piles.



The watermelon seems to be quite at home upon acid soil. The product with nitrate of soda is at the left, and with sulphate of ammonia at the right. The smaller yields in both cases were upon the limed plats. It is remarkable that the watermelon should be injured by liming, and that it should thrive splendidly upon the unlimed plat receiving sulphate of ammonia, where upland cress, Kaffir corn, sorghum, barley, the cantaloupe, and many other varieties of plants utterly fail.

The cantaloupe is the opposite of the watermelon! The crop from the plats receiving sulphate of ammonia were always inferior to the corresponding ones manured with nitrate of soda. In each case the limed plats produced the larger product. In fact it was seldom, if ever, that fully ripened fruit was obtained upon even the unlimed plat where nitrate of soda was used.

The crops of German millet produced by the aid of nitrate of soda are at the left. It will be seen that the result upon the limed plat, shown at the extreme left, was not as good as where lime was omitted. In the case where sulphate of ammonia



was applied, liming proved helpful. Though unable to endure the degree of acidity which is favorable to the watermelon, German millet seems to thrive best upon moderately acid soil, and liming to the limit of producing alkalinity or even less, is injurious to it.

The following five views show the results with rye, oats, wheat, barley, and sorghum. The products obtained by the use of nitrate of soda are arranged in each instance on the left. The absence of a fourth lot of sorghum at the right was due to its total destruction on the most acid soil. The lot at the extreme left and the second one from the right in each case shows the product from the respective limed plats. It will be seen that the rye and oats endure the acid conditions best and that the sorghum is helped most by liming. Barley needs lime more than wheat and the latter more than oats.

The two lots of tobacco at the left were grown with nitrate of soda, and the two at the right with sulphate of ammonia. The larger lot at the left of each pair was from the respective limed plat. Liming improved the color of the ash in a most remarkable degree.

This view shows that amber cane (sorghum) and Kaffir corn refused to grow upon the unlimed plat, manured with sulphate of ammonia, notwithstanding that the seed germinated well.

This shows the wonderful benefit which resulted to these plants solely from liming. These plants, like the upland cress, onion, cantaloupe, poppy, lettuce, spinach, and beet, are unable to endure a great degree of soil acidity, and the accompanying lack of carbonate of lime.

The limits of such a lecture preclude showing all of the results obtained with about 200 different varieties of plants. Among the beans and also among the annual flowering plants that have been tested, the most remarkable differences have been observed. These results show that the poppy can never become a pernicious weed upon our acid soils, as it has in the wheat fields of the limestone regions of Europe. The castor bean is injured by liming where the golden wax, a string bean, will almost fail for need of liming. The bush lima bean in contrast to certain of the bush green-podded string beans thrives well upon very acid soil.

CONCERNING THE GENERAL NEED OF LIME IN RHODE ISLAND.

Having begun the experiments just enumerated, it became important to learn if the need of lime was more or less common in all of the five counties of the State, and in order to test the matter, coöperative experiments were begun in many different sections. Two plats were manured alike with standard agricultural chemicals. One of these was then limed and beets, barley, grass, and clover were employed in the various tests.

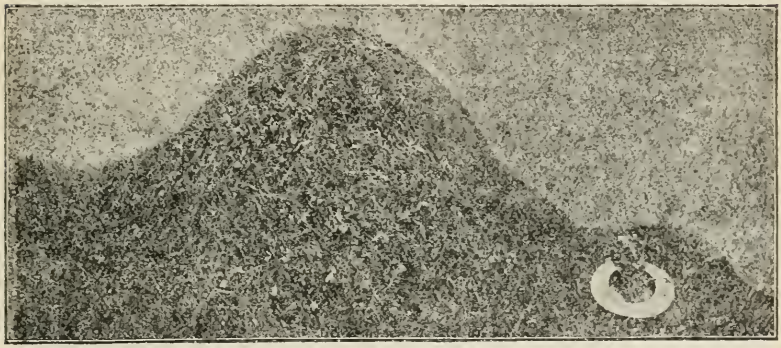
At Foster Center, R. I., in 1896, the yields of red table beets upon the limed and unlimed plats were 143.4 and 36.6 pounds respectively.

In a similar test at Slocums, the yield of table beets upon the unlimed plat was but 1 pound and upon the limed plat it was 101.8 pounds. The barley (cut in the milk) was increased in this case by liming from 3.7 to 39.1 pounds.

In 1897 clover was grown upon the plats at Foster Center. The first crop, upon the unlimed plat, amounted to 140.2 pounds, and upon the limed plat to 195.6 pounds.

In a grass experiment at Hamilton, a section of the unlimed plat gave a product of 151.6 pounds, consisting of about equal parts of timothy and redtop. A corresponding section of the limed plat yielded 205.1 pounds, consisting chiefly of timothy associated with some redtop.

The clover section of the limed plat at Hamilton yielded 204.6 pounds, consisting of about equal parts of clover and red-top, mixed with a few other grasses. The yield of the unlimed section, shown at the right, was but 66.9 pounds; only 5.8 pounds of which consisted of clover.



The second crops of clover from the limed and unlimed sections at Hamilton weighed 74.4 pounds and 0.1 pounds respectively. The smaller amount was cut with a pocket knife, and placed in a straw hat in order to make it visible.

This experiment was conducted upon the hill land at Kingston.

The crops from the two clover sections of the plots were harvested and the clover was separated from the weeds. The two lots at the left represent the clover and weeds from the limed section, the clover being at the extreme left. The two piles at the right are from the unlimed section, the one on the extreme right being the weeds. Where lime was used, the crop was chiefly clover, but upon the unlimed land the weeds weighed nearly as much as the clover.

At Moosup Valley the yield of Mangel Wurzels upon the unlimed land was at the rate of but three tons per acre, but where lime was used it amounted to twenty and three-fourths tons per acre. The view shows the exact relation of the two crops. The lot representing the unlimed area is seen at the right. This was pasture land where chemical manures had possibly never been used.

These and many other similar experiments conducted in different parts of Rhode Island were sufficient to convince the most skeptical that the need of lime was more or less general in every portion of the State.

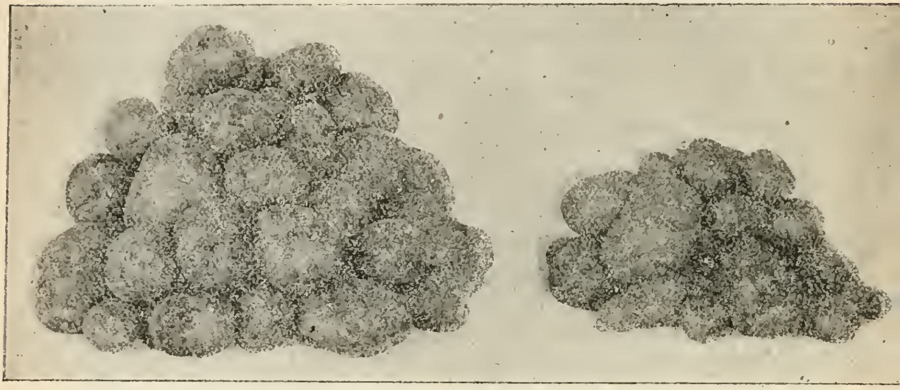
INFLUENCE OF LIMING UPON THE POTATO SCAB.

While digging the potatoes grown in the previously mentioned series of experiments upon the four plats, it was noticed that those grown upon the limed plats were badly scabbed while the others were not. Professor Thaxter at your own Station in New Haven had shown previously that the scab was due to a fungus which grows upon the surface of the tubers. He had also experimented in a limited way concerning the effect of various substances in promoting scab. These latter experiments were brief and necessarily inconclusive, since, for example, it was noticed that plaster and cement exerted "a very decided influence especially upon the virulence of the disease," but that wood ashes "had no apparent connection" with it. No explanation for the action of the mortar and cement was offered and it was even looked upon as possibly incidental.

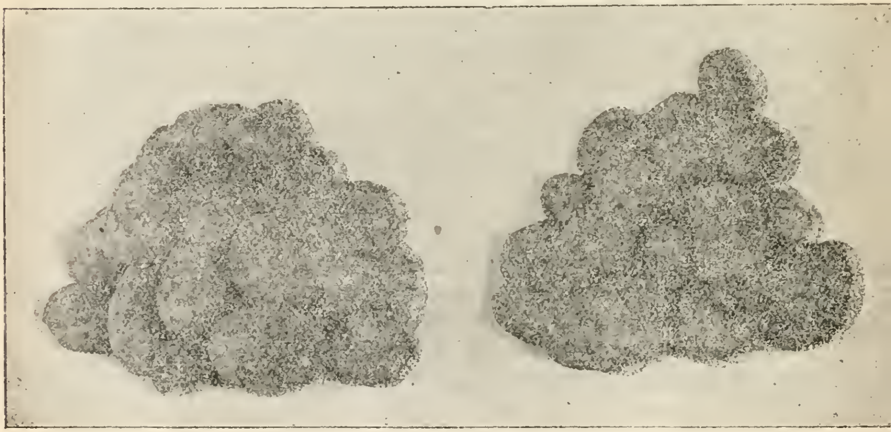
Professor Thaxter found in his pure cultures of the fungus that it grew best in a neutral medium, and this report suggested the idea that if the soil were alkaline the fungus might be aided by it in overcoming the acidity of the tuber while growing upon its surface. If on the contrary the soil were acid it seemed reasonable that it would be more difficult for the fungus to vegetate upon the tuber which the soil surrounded. With these ideas as a starting point the question was studied exhaustively for four years. In brief it was found that stable manure did promote potato scab provided the fungus was present; that the addition of common salt or of acid to the manure lessened the tendency, and that the addition of an alkaline substance, such as sodium carbonate, made the conditions still worse. Slacked lime, wood ashes, carbonate of lime, and substances such as calcium acetate and calcium oxalate which yield calcium carbonate quickly in the soil; or in other words alkaline substances or other compounds which change into such readily, favored without exception the development of scab upon the tubers. On the contrary sulphate of lime (land plaster) and calcium chloride, two compounds that under ordinary circumstances can neither increase the alkaline reaction of the soil nor practically lessen its acidity, both failed to increase the scab. In short the experiments seemed to establish beyond a doubt that even if the scab fungus is present, no considerable amount of scab will develop in a very acid soil if care is taken to avoid alkaline manures. On the contrary if the fungus is already in the soil or if it is introduced into it upon the tubers used for planting, and alkaline manures are used, the crops may after one or two years be practically ruined by the scab.

In the view presented here, the product of potato tubers obtained where air-slacked lime had been used is to be seen at the left; the lot at the right, grown also with the aid of chemical manures but without lime, was entirely free from scab even though badly scabbed tubers were planted in each case.

The left hand lot in the present instance received calcium sulphate, in addition to the same chemical manures which were used in all of the other cases. The lot at the right was grown with the aid of calcium chloride. In the former case but 4.3 per cent. of the tubers were scabbed and in the latter case none of them were affected.



This view shows the results with carbonate of lime at the left, and with calcium oxalate at the right. In the former case 97.5 per cent. of the tubers were badly scabbed and in the latter case all of them were totally unfit for market, on account of scab.



In this final view of potatoes the results with calcium acetate are at the left and those with unleached wood ashes are at the right. In both lots every tuber was scabbed and in the former case 97.5 per cent. of the lot was rendered unfit for market. In the case where the wood ashes were used the yield was good but not a single smooth marketable tuber resulted.

In the light of these results the question which naturally suggests itself is: Why did not Professer Thaxter find that wood ashes favor scab in the same manner as the mortar and cement? The answer seems to be that either the tubers which were planted where wood ashes were used were free from the fungus, as well as the soil itself, or else Professor Thaxter in his zeal used more wood ashes than would be likely to be employed per acre in agricultural practice, thus rendering the soil about the tubers so alkaline that the fungus could not grow. This seems probable for the reason that the mortar and cement would render the soil less alkaline than the same weight of wood ashes, and possibly on this account they produced a condition which was especially favorable to the development of the scab fungus.

Too great alkalinity like too great acidity should lessen the scab judging by Professor Thaxter's experiments upon the pure cultures of the fungus.

The practical suggestions growing out of the Rhode Island experiments are the following:

First. Avoid using scabbed tubers in planting, if possible.

Second. If scabbed tubers or such as are not positively known to be free from the fungus are used, wash them thoroughly with water and then treat them with corrosive sublimate solution or with fresh formalin, as recommended by Bolley and others. (For directions see Farmers' Bulletin No. 77, U. S. Department of Agriculture.)

Third. Avoid as direct manures for the potato crop wood ashes, lime, stable manures, basic slag meal, carbonate of potash and any and all other substances which are alkaline in their reaction.

Fourth. If for other reasons these alkaline substances should be added to the soil, apply them from two to four years before potatoes are to be grown and always treat the "seed" tubers as recommended under (2). In this way the Rhode Island Station has for more than ten years avoided scab and at the same time enjoyed in a considerable degree the beneficial influence of liming in increasing the yield of tubers of merchantable size. By taking these various precautions at the suggestion of the Rhode Island Station, a lady farmer in the State reports this year a smooth crop for the first time in several years.

Fifth. If the soil is already badly contaminated with the scab fungus no treatment of the tubers will insure a smooth crop.

Sixth. If the soil is contaminated, rolling of the "seed" tubers in flowers of sulphur and scattering sulphur upon the seed tubers in the drill, as first suggested by Halstead of New Jersey, will lessen the scab. This is, however, an expensive treatment. At the Rhode Island Station sulphate of ammonia (ammonium chloride would doubtless accomplish the same result), muriate of potash, and acid phosphate applied in the drill have been found effective in lessening the scab in soils already contaminated. These materials also serve a manurial purpose at the same time.

THE INFLUENCE OF LIMING UPON THE "FINGER-AND-TOE" OR "CLUB-FOOT" DISEASE OF TURNIPS AND OTHER PLANTS.

It has been found by investigators in England, and later in the United States, that liming counteracts to some extent the tendency to "finger-and-toe" or "club-foot" disease in the turnip, cabbage, and other closely related plants. J. A. Voelcker of England tested the effect of gas-lime and slacked lime as compared with no treatment. As a result it was found that the least "finger-and-toe" disease resulted where the slacked lime was used.

WHEN TO APPLY LIME.

In order to answer the flood of questions coming to the Rhode Island Station concerning the best time to apply lime, especially for grass lands, three plats were prepared in the late summer. All three were manured in an identical manner. To one plat slacked lime was applied at once and thoroughly harrowed into the soil. The same amount of lime from the same lot was set aside until the following spring, when it was applied to the surface of the second plat as a top-dressing.

The third plat received no lime. All three of the plats were seeded to timothy in the early autumn in an identical manner.

At the right, where the lime was worked into the soil before seeding, the stand of timothy was good. Only a very small stand of timothy was secured where the lime was used as a top-dressing. Where lime was omitted altogether timothy was wholly absent. In all but the first instance the product was chiefly weeds mixed with a small amount of such grasses as could thrive upon acid soil. The material from the top-dressed plat is shown in the middle and that from the unlimed plat at the left.

THE INFLUENCE OF LIMING UPON THE HUMUS.

It was found, after a lapse of several years, that under continuous culture with hoed crops the amount of humus in the soil became somewhat reduced upon the limed plats. At the same time the percentage of nitrogen contained in the humus became greater. It might be inferred, therefore, from the investigations conducted by Hilgard that on this account the efficiency of the nitrogen in the humus may have been increased. Under a system of cropping, which includes the occasional turning under of a grass sod, there need be no fear of injury to the soil from a depletion of the humus by liming, so long as proper attention is paid to the kind of soil and the amount and kind of lime applied. To illustrate, a sandy soil should seldom, if ever, receive more than from half a ton to one ton of lime per acre at a single application, and for such soils the carbonate of lime is usually preferable to either slacked or plain burned lime.

In this connection a word ought to be said about "humus" in a general way. Some of the dictionaries define humus as essentially a brown substance produced by the action of the air upon vegetable and animal matter. Many writers also refer to the entire mass of the organic matter in soils as "humus." Grandeau applied the name Matière noire (black matter) to that part of the organic matter which could be extracted from the soil by means of ammonia water after the preliminary removal of the lime and magnesia. Much is said in the agricultural press about the need of humus in the soil, yet usually without reference to whether the term humus as used applies to the black matter mentioned by Grandeau, or to the total organic matter.

It is a fact that some of the most fertile soils in the United States have neither a large amount of "black matter" nor of total organic matter. The soil of the Experiment Station farm in Rhode Island was found to contain from 3½ to 3¾ per cent. of "black matter" or far more than many of the fertile soils referred to above. In addition a considerable amount of less fully decomposed organic matter was also present. Here one would suppose there must surely be an abundant supply of "humus," but yet as a matter of fact so large an amount of the very fine "black matter" is present that it seems to injure rather than benefit the physical character of the soil. Notwithstanding the large amount of "humus," as the term is ordinarily used, the further introduction of vegetable matter, either undecomposed or in the first stages of decomposition, seems to improve the condition of the soil greatly for certain varieties of plants. Such matter is in condition to lighten the soil and improve its tilth, but if already in the stage of the "black matter" as described by Grandeau, the same result could not be expected.

WHY WAS LIME BENEFICIAL TO THE RHODE ISLAND SOILS?

The question which arose early in the history of the lime investigations in Rhode Island was: How is lime beneficial? If it was helpful solely as plant food then this deficiency could only be revealed by field tests with plants or by complicated laboratory methods. If lime was needed because the soils of Rhode Island were acid, then the simple test with blue litmus paper was likely to reveal the need. This is a test which it is possible for every farmer to make. It is also one by which hundreds of soils can be tested in Station laboratories in a short time at small expense. If lime were needed solely for physical reasons it seemed possible that land plaster or other lime compounds might prove equally or more efficient. At all events the importance of answering why lime was needed must be obvious to all.

If lime helped by virtue of correcting an acid condition of the soil it was to be expected that similar benefit would result from the use of still other substances that could neutralize acids. To test this point lettuce was planted in four pots eighteen inches in diameter. All of the four pots were manured alike. Two of the pots received no further treatment and in the absence of crops from these pots stones were substituted for them when the photograph was taken. The third lot from the right was grown where an additional "half-ration" of sodium carbonate was used, and the better lot at the left where the "full ration" of sodium carbonate was employed. The wonderful benefit derived from its use showed that here was another alkaline substance, containing no lime, which was exceedingly helpful.

If slacked lime proved useful only as a plant food and in floculating and thus improving the physical condition of the soil, then it was to be expected (judging from experiments by others) that sulphate of lime (land plaster) might be equally as effective, provided an equal amount of lime in each combination were employed. It will be remembered that the lime in sulphate of lime is already combined with a strong mineral acid, oil of vitriol, and hence it cannot correct acid conditions without first undergoing a change into carbonate of lime in the soil. This change is so slow that it has little immediate practical significance in ordinary well-drained upland soils.

The largest two piles of beets were produced by the aid of air-slacked lime and the next largest pair with sulphate of lime. The results were still poorer in the case of the other two plats where neither lime compound was used. Mention should be made of the fact that in all of the cases a liberal manuring with potash, phosphoric acid, and nitrogen had been provided. It will be seen that the land plaster failed to accomplish the same result as the slacked lime.

Without going further into the details of the investigations in this direction, which covered in all a period of three to four years, it suffices to say that potassium, sodium, and magnesium compounds which were capable of neutralizing acidity were all more helpful to the soil than other compounds of the same elements which could not aid in the same way. It was, therefore, concluded that the need of the soil was primarily alkaline substances and that, therefore, the blue litmus paper test furnished a probably reliable guide as to its liming requirements. If this is true it is obvious that this or some equally or more efficient test for acidity should be more generally applied to soils.

IN MAKING THE TEST IS IT NECESSARY TO WAIT UNTIL THE LITMUS PAPER DRIES BEFORE DRAWING CONCLUSIONS AS TO THE PROBABLE NEED OF LIME?

When the litmus paper was first put into use for testing soils at the Rhode Island Station a statement was found on record by one of the German authorities that the paper must be dried before definite conclusions can be drawn as to the need of lime. It would be but natural for a farmer to do the drying in the sunlight, the action of which is to bleach the paper to such an extent as to interfere in drawing conclusions as to the probable effect upon it of the soil. The drying also meant some extra delay and trouble. A careful investigation of the question was, therefore, undertaken in the laboratory, which showed that it was not necessary to wait for the paper to dry before drawing conclusions as to the probable necessity for liming. An explanation of these details is unnecessary here and it would be of interest only to chemists.

THE INFLUENCE OF LIMING UPON THE PHOSPHORUS COMPOUNDS OF THE SOIL AND UPON CERTAIN PHOSPHATES USED AS MANURES.

In the course of the liming experiments in Rhode Island it was found that a soil which for years had failed to produce good crops without the application of phosphatic manures, was rendered capable after liming of yielding enough phosphoric acid for several successive crops. Similar results have also been noticed in France where superphosphates had first been used without effect.

Roasted Redondite is a phosphatic manure upon which the liming of the soil has a marked influence. It contains little or no soluble phosphoric acid but frequently shows upon analysis as high as 35 per cent. or more of reverted phosphoric acid. If introduced into ready mixed commercial fertilizers in any considerable amounts the proportion of the "available" phosphoric acid actually present as "soluble phosphoric acid" will be much reduced. Hence in goods where the available phosphoric acid is high and the soluble phosphoric acid is very low it is obvious at once that a considerable amount of bone, tankage, or roasted Redondite has probably been introduced. The tendency to use the Redondite in mixtures is increased by the high percentage of reverted phosphoric acid which it contains which raises the phosphoric acid which is reported as "available." Furthermore it makes the mixed fertilizers drill far more readily.

Notwithstanding the high percentage of "available" phosphoric acid which it carries it has been found at the Rhode Island Station that this roasted Redondite has but little value for most crops if used upon very acid unlimed land. Liming raised its efficiency for most of the crops tested, in a most striking manner. These results ought to show the importance of putting the soil in the proper condition, if the best results are to be expected from ready mixed commercial fertilizers which contain this material. It is equally important not to go to the other extreme and over lime, for by doing so the tendency would be to lessen the efficiency of the phosphoric acid in bone and tankage.

LIMING INCREASES THE EFFICIENCY OF ORGANIC NITROGENOUS MANURES.

The absence of a sufficient amount of carbonate of lime and the existence of a high degree of soil acidity have already been shown to reduce the efficiency of nitrogen in sulphate of ammonia. If plants are grown which are very subject to injury upon acid soils even nitrate of soda cannot exert its normal effect and much of it will be lost by leaching, before the next season. The danger of financial losses in the case of the organic nitrogen is also great if the soil is very acid and in great need of liming. This is also well shown by an experiment conducted at the Rhode Island Station. The same amounts of potash and phosphoric acid were used in all cases. The nitrogenous substances were applied at such rates as to furnish in every instance identical amounts of nitrogen per acre.

Upon the limed soil the sulphate of ammonia lost its toxicity and the efficiency of its nitrogen amounted to 92.2 as compared with that in nitrate of soda placed at 100. Upon the same basis of comparison with nitrate of soda, the efficiency of the nitrogen in dried blood which was 45.5 before liming was 90.3 afterward, and that of roasted leather was increased by liming from 0.9 to 13.8. Expressed in more direct language, the value of the dried blood was practically doubled as a result of liming. Such facts as these and those also brought out in connection with certain phosphatic manures, show that the efficiency of fertilizers is by no means always due to the character of the manures themselves, but that the soil is sometimes an equally important factor. Such being the case, the farmer himself is often to blame if good results are not secured, in consequence of his neglect to put his soil in proper condition for profitable agricultural operations.

It would be absurd to claim that the majority of soils in Rhode Island, or that the majority in certain sections of other states, need liming in as great a degree as the soil at Kingston, yet no doubt many individual soils may stand in equal or indeed in still greater need of lime. Even if the influence of these conditions is not ordinarily as great, the kinds of plants with which difficulty is likely to be most quickly met, have now been pointed out, and this ought to serve as a useful guide in liming operations elsewhere. Before leaving this subject it should be stated that even in Rhode Island upland soils have been found which were more in need of liming than the soil at Kingston, upon which most of these experiments were conducted. Furthermore, in the case of most of the soils tested in the five counties of the State, lime was so badly needed that the yields of many of the important crops, such as clover and timothy, were most seriously depressed.

THE NEED OF LIME WIDESPREAD.

The Rhode Island experiments have shown that the need of lime in that State is by no means confined to the Station farm, but that it is more or less general in every county. Since this work was begun experimental data have come to hand showing that lime is needed in parts of Massachusetts, New Hampshire, Connecticut, New York, Illinois, Maryland, Virginia, Alabama, and other States.

One farmer writing from the State of New York says that thanks to the liming hints from the Rhode Island Station he is securing good crops of clover and grass where both failed or partially failed before. Another communication from a farmer in the same State began with an apology for the long letter which he said was necessary in order to properly express his thanks for the services rendered. He had taken up an "abandoned" farm in a granitic region where abandoned farms and acid soils were common. By the use of lime he had been put in a position so that he was rapidly paying for the farm which the former owner had abandoned, on account of sheer inability to make it pay.

It may not be amiss at this point to show a perfect field of clover where only straggling individual plants were obtainable before the Rhode Island Station called attention to the condition of the soil and the need of liming.

The excellent second crop in cocks in the same field also gives an idea of the good results.

Liming alone without intelligent handling of the soil in other respects is by no means the panacea for the Agriculture of New England. The greatest need of the farmer and his children today is agricultural education. Intellectual, technical training counts, whether the people are white, yellow, or black. The Germans have made it count in their last interval of peace perhaps more than any other nation. We should be prepared to use it in peace and in war if necessary, and to employ it in peace as never before. The sons and daughters from the homes of New England have been powerful factors in the past in leavening the great human lump in this country, and their work is not yet done. Wise leaders are needed today in agriculture as never before and facilities for acquiring some phase of agricultural education of the modern extension and demonstration type should be extended to the vast multitude of New England homes.

In closing this story of liming, practical suggestions and directions for its use have been omitted for lack of time and for fear of wearying a patient audience. These can be had for the asking by sending a request to the Division of Publications, U. S. Department of Agriculture, Washington, D. C., for Farmer's Bulletin No. 77.

Thanking you for your attention and with the highest expectations for the future of the agriculture of Connecticut, I bid you Good-Night!

The PRESIDENT. If there is no further business the meeting will stand adjourned until tomorrow morning at 9.30.

MORNING SESSION.

DECEMBER 13, 1905, 9:30 A. M.

Music.

Convention called to order at 10 A. M., Vice-President Seeley in the chair.

The PRESIDENT. It is a beautiful morning, and I am glad to welcome so many here. It is very encouraging to see such a large audience.

I think the Secretary has some questions in the box.

Secretary BROWN. There are one or two questions, Mr. President, relating to sheep, which we would like to have answered before Dr. Smeed leaves us. The first is: "What should be done with a flock of one hundred sheep that have a few ticks on them now?"

Dr. SMEAD. Mr. President, if I had a flock of sheep that had ticks upon them at this season I would get rid of the ticks. Of course, the question is how to do it. It is very easy indeed. Go about it just as though you were going to prepare to dip the sheep. Catch the sheep and lay it upon its back, put your preparation in a vessel that you can pour from handily. A good thing to use would be an old teapot or coffee-pot that would hold just about as much of the dip as necessary, and from that pour a stream of the preparation along the body and around the skin the whole length of the body. In about one minute or a little less you will discover the ticks are going out from along the backbone and the job is done. Be particular to turn the sheep on its back. The set of the wool is then in such a position that the preparation will take effect. Every particle of the dip runs right to the body and reaches the place where the ticks are. If the sheep is laid in any other way, you will simply have a wet fleece and a dry body. A sheep's wool, you know, is made to shed water.

QUESTION. Why would it not work just as well if you dipped the sheep?

Dr. SMEED. It would.

Secretary BROWN. What is the nature of the mixture you use?

Dr. SMEED. There are a good many mixtures that make a good sheep dip. A strong solution of tobacco will do the work, but I do not consider it the best. Sheep do not like it. A sheep is a good deal life myself. I do not like that, so I do not recommend the tobacco dip. As I stated yesterday, there are several carbolic sheep dips on the market. In fact, there are so many of them on the market that it is hardly worth while to speak about them in detail because undoubtedly many of you have read the advertisements. If you cannot purchase one near by, you can go to a drugstore and get a pint of pure carbolic acid and mix it with a pint of soap, dissolved in any kind of soft soap. Mix it all together in a solution, and use that in the proportion of one part to one hundred of water. The soap is simply used so as to make the carbolic acid a little more solvent. If it is not used it will not mix well with the water. But by mixing it with soap it will mix with the water, and it makes a very good remedy. If you cannot purchase any of these prepared carbolic sheep dips, you can get pure carbolic acid in any quantity you want and mix it up yourself. When the mixture is properly made it makes a very good remedy.

Secretary BROWN. I suppose there are a number of gentlemen in this hall who are interested in poultry. This is not the first time that the State Board of Agriculture has secured speakers upon that subject. A year ago Mr. Delano, of Millville, N. J., presented a paper on "Thoroughbreds versus Mongrels from the Farmer's Standpoint." I have a few pamphlets which contain the address of Mr. Delano, and any member of this audience can obtain a copy by calling upon the committee at the rear of the hall.

The PRESIDENT. The program, for the first thing this morning, calls for an address on "Poultry Management," by Mr. T. C. Tillinghast, of Vernon, Conn. You know last night some one was saying that while there were a great many things that the farmers do not have, yet almost every farmer has some chickens. Every man, woman, and child is, to some extent, interested in poultry. Now we are today a good deal interested in poultry, and I am glad that we are to have a man talk to us who has taken a great deal of interest in it, and I am happy to introduce him to you at this time.

"POULTRY MANAGEMENT."

By Mr. T. C. Tillinghast, Vernon, Conn.

Mr. Chairman, Ladies and Gentlemen:

It is very doubtful if there is any industry in our country in which so many people are engaged or interested as in poultry culture. Most every one keeps a few hens, or at least wants to. They often, if they are not themselves the owners of a plot of ground, find their chickens thriving fully as well on their neighbor's ground or garden. When we consider that the poultry industry is one of the largest in the United States, we certainly believe that it merits the recognition it is receiving here today by the Connecticut Board of Agriculture, and we hope the time is not far distant when its claims will be recognized by our legislature, and that the Connecticut Experiment Station at Storrs will receive an appropriation commensurate with its importance.

I see by the program that I am to speak to you on poultry management. That gives me a very elastic text. I presume anything that I may say on poultry might come under that head. I am very glad to see so many young men present this morning. I think it is evidence, Mr. Chairman, that more than a few are interested in this subject of poultry, and perhaps I could not better use the limited time that I have than by telling you what I think I would do were I a young man and had to start life over again, or, in other words, if I were permitted to return and begin life again. Assuming, however, that I could carry back with me all the information that I may have gained by my experience and observation, I of course would choose the occupation of a farmer, believing that it would give me the largest measure of all the good things that really make life worth living. The trolley, the rural free delivery, and the telephone are destined to become important factors in removing from the farmer's life that isolation to which he has hitherto been subjected, and to make the farm a more desirable place for a home. I can conceive of no branch of agriculture that to me would be as congenial, and at the same time as remunerative as that of fruit and poultry culture. I believe that the two make an ideal combination. One naturally goes with the other. The people never get quite enough good fruit to satisfy an ever increasing appetite. When we scan the market reports and note the price of strictly fresh eggs at forty, fifty, and even sixty cents per dozen, we are compelled to believe that the poultry industry is not overcrowded, and I believe we have no conception of its future possibilities. In this line of work we need not fear competition from any source. I think it is a conceded fact that no better fruit can be grown anywhere than on the hills of old New England, and the market reports tell us that southern and western eggs are always sold at a discount, while, upon the other hand, fresh eggs coming from near-by localities always sell at a premium.

Now, for a young man to engage in fruit and poultry culture, I doubt if any locality could be found anywhere better suited for such work than right here in old Connecticut. We are blessed with a healthy climate. Land is cheap. You can buy a good farm for less than the cost of the buildings originally erected upon it. We have the best of markets right at our door. And last, but not least, our environment here is all right. We have all the advantages of the twentieth century civilization.

I am aware that many believe that poultry cannot be profitably kept in large numbers. They will tell you that a few hens will pay all right, but when you increase the number you diminish the profit. You will hear it frequently said that a farmer kept forty or fifty hens and made them pay, and made them net him perhaps over a dollar each. Well, that, upon the amount invested, was a better return than anything on the old farm. Some farmers have thought that if fifty hens paid well they could increase their poultry and their profit by adding to the number, but have found to their sad disappointment that a hundred hens did not pay as fifty formerly paid. Hence they came to the conclusion that poultry on a large scale was a failure. Now if that was the fact, if poultry could not be profitably kept in large numbers there certainly would not be much encouragement in the development of the poultry industry, and instead of my being here today to talk poultry to you, it would have been better had I remained at home. If we stop for a moment to consider methods, I think we will find that the hundred hens were crowded into the same little house that formerly accommodated the fifty. There was ample room for the smaller number, but it made a crowded house for the hundred. And then again the scraps from the table helped to make a balanced ration for the smaller number, but they did not amount to much with the hundred. There was not enough to go around. Now if, when they increased the number, they had enlarged their accommodations, and had supplemented the table scraps by green cut vegetables and cut clover, so as to give them a balanced ration, they, no doubt, would have more than doubled their income. I believe, and I have my past experience and observation to substantiate such a belief, that there is absolutely no limit to the number of fowls that may profitably be kept, provided, as we increase the number, we keep pace with the increase by providing suitable accommodations and a well balanced ration. That is the key to the whole situation. It is the gist of the whole matter. Here is a neighbor, for instance, that keeps a flock of hens, perhaps forty or fifty. They pay well. Another neighbor keeps an equal number and they pay. Perhaps there are a dozen within a very short distance, each of whom keeps a lot of hens, and they pay well. They are practically on the colony plan. Most of the year they have free range, and they get a pretty good balanced ration from the table scraps and from insects and worms they can glean. Perhaps the women take care of them, and, if they do, a good many of them get lots of pin money out of the poultry. If we knew the facts in some cases, I am sure we would find that the poultry pay for a large part of the groceries. The pin money that the ladies get, however, is not the whole story. They get good health. They get needed exercise in the open air and sunshine which the caring for poultry gives. I think if more of our ladies would engage in poultry culture they would find it helpful in more ways than one.

Now in the transaction of any business the labor question enters largely, and is an important factor in determining profit or loss. It does not matter so much at what prices we sell our farm products. If they cost us more to produce than we receive for them, we are the losers every time, but when we can reduce the cost of production to the minimum, we are in a fair way to pay off the old mortgage. Now I wish to try to show you how by adopting twentieth century methods in poultry culture, you can eliminate nine-tenths of the labor in the care of poultry, and still get better results. I know a great many of you think that an extravagant statement, to say that we can care for poultry for only one-tenth of the labor usually given to the work, but that is just what I believe can be done. Now if I could be a young man again, I would want about one hundred acres of land, a farm of about one hundred acres for my poultry grounds. I would want that farm located near some good market, or, at least close to some good shipping point. I would want the land suitable for the production of fruit. Such land generally is all right for poultry. I would like to have that farm well watered. I would like to have a living stream of water passing through the whole farm, or numerous springs upon it, so that water would be easy of access from any part of the farm. Now what would I do with such a farm? Why, I would make that farm a fruit and poultry farm. I would set out about seventy-five acres of that farm in apple trees, with peach and plum trees between. I would set the apple trees forty to fifty feet apart. I believe in letting everything have the sunshine and the air. I would reserve twenty-five acres of the one hundred for the culture of small fruits, such as raspberries, blackberries, grapes, strawberries, and also for the growth of such vegetables as I might need for my poultry. I would also raise some clover. I would have on those twenty-five acres my brooding houses for growing my chickens. Now that would make an ideal place for chickens to develop in. The shade of the raspberry and blackberry bushes would be a protection against hawks and crows. On the whole, I think it would be a safer place than on my neighbor's lawn or in his garden. Then on the seventy-five acres set with the larger fruit I would reserve twenty-five for my breeding stock and for thoroughbred stock. I should expect to have some pretty good birds, and if good birds were worth one hundred dollars each, why I should expect to capture some of those prizes. I would have my breeding stock also on the colony plan, which I will describe later. Then on the fifty acres remaining of that part of the farm set with the larger fruit, the apples, peaches, and plums, I would use to keep my stock upon devoted to the production of market eggs. That would make a poultry range for that stock of fifty acres. Now I would have the best egg machine I could get for the production of those eggs. From my experience and observation, I should say today that the White Leghorn on such a range gives the best results. We get a fairly large white egg, and an egg that in the New York market brings top prices. I would scatter over those fifty acres my colony houses, built perhaps ten by twenty, and designed to accommodate fifty fowls. In other words, I would put on about four houses to the acre. That is, if I wanted to keep the largest number possible on that number of acres. Of course, you can have the intensive colony system or you can have the extensive. You can let a hundred hens run over five acres if you wish, but I think it is all right on the colony system to put two hundred hens on an acre. If the land was good, they would get all the green food they would require. Therefore, I would stock those fifty acres with poultry at the rate of two hundred per acre. Now I would have my colony houses scattered, and assuming that I have them filled with White Leghorns, I am all ready for business. Now many of you think, undoubtedly, it would be quite a task to care for so many. It would under the old system, but under the new it would be nothing but play. I would not feed my hens over once a week. I would feed them in self-feeding hoppers. I would have my man fill up those hoppers once a week. I would have him fill them with wheat screenings, if I could get them. They are, on the whole, as economical a poultry food as I think we can get. I would have one hopper filled with wheat screenings, and another with beef scraps. That would give them all they need. Then in the winter I would supplement the wheat screenings by giving them cracked corn at night, giving them all they want. There is no danger of a hen that is fit to lay, and that is worth keeping, eating too much of a well-balanced ration. More hens are starved than over-fed with the right kind of food. Snow and corn would not make an ideal poultry food. It would not make a balanced ration, but those with other materials to balance the ration would do no harm. Now, as I said before, I should want my plant to be well watered. If there is a stream of water running through the place, or there are springs here and there which are accessible to the poultry, it will be a good thing. Hens will go quite a distance to get water, where they do not find it readily and the exercise does not harm them in the least. I would also in the winter feed roots of some kind. Turnips are very easily grown, and after being run through a machine the hens devour them very greedily. Anything in the line of roots you may have, can usually be utilized. I would also have cut clover to give them. I would keep beef scrap all the year. Occasionally, in the orchard I would sow some oats, throwing them into the spaces between the trees, and harrow them in, and then let the hens dig them out. Hens do not consider it work for them to scratch. It is the natural propensity of the hen to dig. As many of you know, they do pretty good work of that kind in the flower garden or in the vegetable garden. Even a little bit of a chick, almost as soon as it is hatched, and before it has learned to toddle around much, commences to dig. You place a hen where she can exercise her natural propensity to dig and it will do her good, and it will be doing good in the orchard. In this orchard of fifty acres you will have ten thousand helpers to assist you in keeping the insects down. I do not think we appreciate the capacity of ten thousand hens in helping to cultivate an orchard. I will guarantee if you will take some screenings once a week, and throw them near the base of your trees, the borers never would trouble that orchard.

Now what would be the proper course to pursue as to water? Some of you may say the course I have pursued is all right in the summer and fall when the ground is bare, because then they could go to the stream or springs for drink, but that when the snow is deep and when it is cold, you say, how would you manage them? I would let them eat snow. I would not water them. But some of you may say, if hens are allowed to look on snow or step on snow it would stop their laying. Well a good many things are said that experience does not bear out. One gentleman said to me last winter at an institute where I was speaking, how do you know that hens will lay where you give them snow? He said that his hens had snow all winter and that he had not gotten an egg. I asked him if his hens got any grain. And I tried to impress on him the fact that snow and a little grain was not a balanced ration, and that it was necessary, if he would have his hens lay, to give them a well-balanced ration. Give them enough to eat snow will not hurt them. I have experimented with that and I think that is correct. He claimed that the snow would not make good eggs, that the eggs would be all yolk, but I do not think there is anything to that. I have found that the poultry get along very well by eating snow. We want to get rid of as much of the drudgery of poultry keeping as possible. I am satisfied that snow properly given with a balanced ration does not hurt them. I doubt very much if I would let a man water my hens in the winter if he would do it for nothing.

Now most of us before engaging in any new enterprise very naturally want to know if there is any money in it, or whether it can be made to pay. I presume there may be some men and women here who would like information on that question. I presume there may be also some fruit men here, and I think they would tell you that a hundred acres of fruit would net anywhere from one hundred to two hundred dollars per acre. One hundred dollars per acre would be a very conservative estimate. Now you can do a little figuring yourselves. One hundred acres at one hundred dollars per acre from fruit would give a pretty good income, or enough to buy a pretty good farm in old Connecticut. But what of the poultry? There are ten thousand White Leghorns on that fifty acres. If a hen will not net one dollar per head there is some fault in her keeper and not in the hen. One dollar per head is a moderate estimate. A farmer told me the other day that he had fifty hens, and that their product at the ordinary market rate netted him about two dollars per head. Well, ten thousand hens, at one dollar each, does not make a bad income. If you make it two dollars each you can see where it goes. I do not dare to give these figures. Figures will not lie. I will let the boys in the audience do the figuring.

Then again for my breeding stock. I should expect to supply all my neighbors far and near with eggs for incubation, and I would get fancy prices for those; that is, I would get above the market price, and I should expect to have some fine specimens for the shows. I would not show myself, I would let the other fellow do that, but I would have them pay for the fancy birds I raised. That would help me in the end and be much less expensive. The other poultrymen would soon find out where those fine specimens were raised. I should expect as large an income from the twenty-five acres of thoroughbred poultry as from the fifty acres of market poultry.

Now all these figures seem large, but I honestly believe that they are within the range of possibility. I believe if a young man that has the know-how in him, and has the energy and push to make it possible, he can approximate the figures that I have given. I would not advise every one to engage in fruit and poultry culture, for if I did, and my advice was followed, I should expect in a few years to find a good many abandoned poultry plants scattered over the country. Our talents are not all the same. It is a great thing for a young man to find his niche in life; to find the place he can best fill. We find many misfits all about us. The different professions are crowded with those who are complete failures. They might possibly have met with success had they remained on the old farm. And then again there are those who have spent their whole lives on the old farm and have not amounted to anything. They have barely made a living. It is possible had they followed the avocation of their choice, they might have achieved success. I believe largely in hobbies. I believe that every one should have some high ideal. We find that most of those whose names are written in the halls of fame are men and women of one idea; they have had one supreme purpose in life, and have bent their whole energies and strength for its accomplishment. Life is too short for the average man to become expert in a dozen different lines of work. It is better to be moderately successful in one thing than to fail in a dozen. For those, however, whose tastes incline them to fruit and poultry culture, we believe there is nothing in the line of agricultural pursuits that begins to offer the inducements, both in pleasure and profit, that the raising of poultry and poultry products, according to modern methods, offers.

I think my time is nearly up.

DISCUSSION.

The PRESIDENT. I think an audience like this is quite inspiring. I think it is a demonstration that more people are interested in poultry, perhaps, than in any other branch of the farming industry in our state.

Mr. TILLINGHAST. I forgot to say that I have here some of the plans and models of the hoppers and brooders and things of that kind we use. The feeding hopper is rather a crude model, but it shows the points. Those can be passed around. As to this brooder, there is no patent on it. It can be used by anyone. We find it does good work. The principal advantage of this is that this space here is covered by a piece of galvanized iron. There is about an inch of space between the iron and the floor, and the air goes into all of the four corners. The heat rises from the heater into the pan, permeates over the back of the chicks, and then is forced out. With some of the brooders the same air is breathed over and over again. As you can see, with this, there is no opportunity for the fumes of the lamp to get into the breathing space where the chicks are. There is a circulation all the time of pure air. I have found a brooder of that kind more successful than anything I have ever bought and which costs five times as much.

I will be glad to answer any questions.

Professor BEACH. Will you kindly tell the audience what per cent. of eggs are produced in the winter months from that body of hens?

Mr. TILLINGHAST. That is a very good question. I have no data so that I can give you precise figures. I have always been a little delicate about giving figures. I will tell you why. If I should tell you that I made my hens pay three dollars net, lots of you would say that I lied. I do not want to pass for a liar. If I should come here and tell you that my hens did not pay their keep, why, you would say that Tillinghast was a fool, and I do not want to pass for a fool. No man wants to advertise his failures. On the whole, I will say this. I am in the poultry business to stay. We are perfectly satisfied with what we are getting. We get all we deserve and all we work for in the poultry business. If there is any failure in any way, it is not the fault of the hen. It is the fault of the keeper.

Professor BEACH. Then are we to understand that you do not know the per cent. of eggs obtained?

Mr. TILLINGHAST. No, I do not.

Professor BEACH. Is it a fact that it is as large as during the summer months?

Mr. TILLINGHAST. In what I have said I have been trying to tell what I would do. I am not here telling what I am doing. I am telling what I would do. I will tell you this, however, that I would not be afraid to wager that I could take hens, taking my own pullets, and commencing the first of November, I could get a half yield from that time to the first of April. I would be willing to put up a wager that I could do it. I know I can get results by working for them. But I am not saying that we are getting that. I am telling these boys what I would do if I was a boy again, knowing what I do now about the poultry business.

QUESTION. Did you ever know of any person who succeeded for five years in getting one hundred dollars per acre from a fruit farm, or an average of a dollar each for ten thousand hens?

Mr. TILLINGHAST. I never knew a party that kept ten thousand hens. I have known a good many who have engaged in poultry culture on the old style. That is, with long houses or in little pens. Those methods have all been written up in books and papers. I am not trying to follow those methods. They knew nothing about the methods I have described. We often read or hear of some rich New Yorker who has gone out into the country and proceeded to establish a big poultry plant, putting in a considerable investment, and organizing it upon a large scale, but in a few years the plant has been abandoned. Now, as I said, lots of farms keep a flock of hens and they make them pay. There is no question but what they make them pay, and the idea seems to have been spread among them, that while you can keep a few hens and make them pay, you cannot increase the number, but I have proven to my own satisfaction that there is no reason why if fifty hens will pay, with proper care, many times fifty will not pay just as well in proportion. If one colony pays fifty dollars, is there any reason why you cannot spread these colonies over additional space, and by taking the right kind of care, make the additional number pay equally well in proportion? If we can make a hundred hens pay a hundred dollars net, there is no reason in the world why we cannot make one thousand hens pay one thousand dollars. Yes, or five thousand hens pay five thousand dollars, provided we give them as good care and a balanced ration.

Mr. Graham. Mr. Tillinghast, about how long have you been keeping chickens?

Mr. Tillinghast. About twenty-five years.

Mr. Graham. About how long have you been keeping them on this colony plan?

Mr. Tillinghast. Oh, roughly, perhaps eight or ten years.

Mr. Graham. I understand you have houses for your pullets where you start them, and after you take the cockerels away, you let them grow up gradually and run in with the other hens in the house, is that so?

Mr. Tillinghast. After we have disposed of the cockerels, we put the pullets where they eat with the hens from the hopper, and they get their water in the same way, so that they are no more care at all until they begin to lay. I have some which we have not given any care since they were a third grown.

Mr. Graham. I wanted to bring out that fact that the pullets and hens were running together.

Mr. Tillinghast. They are running together. The pullets are marked so we can tell them.

Mr. Graham. How long have you been doing that? How many years have you been marking the pullets?

Mr. Tillinghast. That is a comparatively new thing with me. We have only been doing that for two or three years.

Mr. Graham. Do you suppose that you have got any hens on your plant over three years old?

Mr. Tillinghast. Yes, I have got them there, old grandmothers, six or eight years old.

Mr. Graham. Have you any method of telling how old your hens are, or how many of those hens are over two years?

Mr. Tillinghast. I have for the last two or three years. Some of the older ones I cannot tell whether they have passed that age or not.

Mr. Graham. Do you make a practice of culling them out? Do you take the old hens out each year, and put new blood in, or do you leave a hen there until she dies?

Mr. Tillinghast. Why, that depends.

Mr. Graham. I understand that your plan is to increase the number each year, and I wanted to know how you kept your stock up?

Mr. Tillinghast. If I do not get as many pullets as I want, I keep the old hens. A Leghorn hen will lay as long as she lives, and she will pay as long as she eats. She will not pay as much as when she is younger, but if I want to increase my stock, I take that method.

Mr. Graham. You think that no matter how old a hen is she will pay for what she eats?

Mr. Tillinghast. A White Leghorn hen will pay for what she eats and more. There is one thing about older hens. You get better eggs and you get stronger chicks. In my experience I have found a good deal of difficulty in getting pullets' eggs to hatch.

Mr. Graham. You have found from experience that the eggs from older hens are better?

Mr. Tillinghast. That has been my experience. I was going to say that I would not set an incubator with pullets' eggs if you would give them to me. I will say this: I would hardly accept eggs that were laid by hens that were kept in little runs and had hot mash and all that. I would hardly accept them as a gift, for I used to keep hens that way and I could not understand why the eggs would not hatch. Sometimes if they did hatch, the chicks would die off like poisoned flies. Die right off in a week or two. I would raise a very small percentage of those hatched. Since I have given my hens free range, I have had no trouble in that way. If I put fifty chicks in a brooder I expect to take out about that number.

Mr. Graham. You are raising a larger percentage of chickens then within the last two or three years, since you have adopted these methods, than you did before, that is, you are raising a larger percentage of chickens that you hatch now than you did four years ago?

Mr. Tillinghast. If they die there is always a cause for it. They do not die unless there is some cause. If we find there is a considerable mortality among any lot of them, we try to trace it, and to trace it back to its original cause. If we look carefully we can generally find the cause and remedy it. There is no trouble. To be successful in raising chickens, you want first to give your breeding stock every care. There is where the foundation of your success is laid.

Question. What do you do with your surplus stock, and stock that you want to work off?

Mr. Tillinghast. Sometimes we sell it to some one for breeding. It would be all right. Sometimes I would sell them in a pen of ten or fifteen for breeding purposes to some one who wanted thoroughbred stock, and they would get good results. They would be all right for that purpose. If I had anything that was not fit for breeding and wanted to get rid of them, I would sell them to whoever would make the best offer.

Mr. McGrew. Mr. Chairman, I have been listening with a good deal of interest to what Mr. Tillinghast has had to say. He has got the only plant of the kind in the world, so far as I know, and he has been very successful with it. He has made money. I want to bring out a little more clearly the business side of his plant than has been brought out by the questions which have been asked. I have never been at a place where a man seems to grow a larger percentage of chickens from what he hatches than Mr. Tillinghast's. I never have seen a man that handled Leghorns, and got as many eggs and as good results under a special system of management as Mr. Tillinghast, and the point we want to find out, and one which he apparently will not let us find out at present, is what percentage of eggs he can get from those hens, especially during the winter months, under the system that he is using in keeping them. If he will just answer that, it would be a great benefit. I do not know of anybody here who can get it out of him unless he is willing to tell us.

Most of the poultry keepers tell us that if we want to raise four or five thousand hens, and want to get the best results from them, we must not water them early in the morning; that we must wait until the sun is up, and to give them a little lukewarm water. Now this gentleman keeps one, two, or three thousand hens. I think when I was there he had about two thousand, and he tells us that they must depend upon what they get. He is getting eggs from them. Now it would be of great value if he could come before us at some time and tell us what the percentage is, or could tell the world what percentage of eggs he gets from one of his colonies of fifty hens. That is what the people want to know. If Mr. Tillinghast, with his information and ability, could see his way clear to give us that information as to egg yield per month for twelve months from just one of his colonies, he will benefit every single man that is giving his life to the study of poultry. I wish to impress upon him the duty of keeping for the information of the poultrymen of the world, a record during the twelve months from the time he goes home tonight of at least one pen, so that a year from now he can tell us what that pen did per month during the year. That is what we want him to tell us, because he is on the road to a great success or a great failure under this twentieth century style of breeding hens.

Mr. Tillinghast. I will say to my brother in reply to that, that I hope some time to give the public some figures, but our plant now is in an embryonic stage. We have not been able to keep a record which the public might deem satisfactory. We are sometimes handicapped with help. Sometimes a man that is used to doing all sorts of work about the place gets sick and we have to do it ourselves. All those things enter into the cost. I have had a record which has been kept to the satisfaction of Tillinghast, but not for the public perhaps. Some time I mean to have figures that can be given out. When I get my plant covered with poultry, I shall expect that the figures will mount up into the thousands. I am afraid if I give figures to the public that they would question my veracity.

Mr. Graham. Mr. Chairman, I would say that at the Experiment Station at Storrs, we are taking up that very question. We have now several pens of stock that are getting snow. Those birds have been getting cold water before breakfast since about the first of November. We have several other pens which are getting warm water twice a day, and have been since the first of November. Sixteen pens, I believe. The others are getting cold water. When they jump off the perch in the morning they get a nice cold drink. Before very long we will be able to give you some data.

Mr. Tillinghast. How do those birds do that eat snow?

Mr. Graham. We have only had snow a couple of days, Mr. Tillinghast.

Mr. Stockman. The gentleman says on the platform here that he is not telling what he does but what he would do on his ideal one hundred acres. I would like to inquire if he is using this method to any extent on his poultry plant at the present time. I have kept poultry more or less for some time, and twenty-five per cent. of my hens are laying now, but I am not feeding them snow for drink.

Mr. Tillinghast. I would advise the gentleman to try one pen with the same method, to give one pen snow and the others water. Perhaps the first day the snow might not have the desired effect. I think a hen wants to get used to the condition, perhaps, or to the use of snow. I will guarantee, however, that you will get eggs from snow. A gentleman came to my place about two years ago. He had about a hundred hens. He was not getting the eggs he should. I showed him some pens that had not had anything but snow all winter, and I was getting about two-thirds from those pens. I said to him, " If you will follow my prescription, you will get eggs in two weeks' time." " Why," he said, " I will do anything." I asked him how he fed his hens. He said he carried down some warm water about eight or nine o'clock in the morning, and then he gave them some potato peelings and such, and then scattered a little corn in the winter. " Why," I says, " your hens are half starved." " Why," he says, " they tell me there is danger in getting them too fat." I told him to get a bag of wheat screenings, and a bag of scraps, and to give them all the corn at night they would eat; to never mind about the hot water, but to open the little door so that they could help themselves to snow. I asked him to try that plan and then report. The next time I saw him he said he was getting eggs from the hens and had not watered them at all.

Secretary Brown. I do not think the speaker has answered the question of the gentleman from Morris. The gentleman from Morris asked Mr. Tillinghast if he pursued the methods that he would pursue if he was a boy again.

Mr. Tillinghast. Why, that would be self-evident. Any method that I would pursue with the information I have gained by experience and observation I would certainly pursue if I were to start over again. I am practicing whatever I am preaching. Most certainly, I am using the method that I am speaking of.

Question. I would like to ask the gentleman this question. He says he has four brooding houses on an acre. How does he keep those hens properly divided up? Do you have a wire fence between the houses?

Mr. Tillinghast. We have no fence except the fence around the whole place to protect the stock from dogs. Dogs sometimes get in, and we have lost at times a good many hens. We have no division fences except between the breeding and laying stock. The stock on our fifty acres is our laying stock. We do not keep any cockerels there, but we are keeping that stock entirely for the purpose of raising market eggs. We have those houses scattered about, and there is no difficulty in getting the hens to divide themselves up properly among the houses. If you have ever noticed, where there has been a brood of chickens, and you try to get those chickens into the hennery and notice how tenacious they are to get back to the house. It is the same way when they grow up. It is an old saying that a hen will come home to roost every time.

Question. I understood the gentleman to say that he only fed his chickens once a week, and then later on he said something about feeding them every night. I would like to understand how he does, if he only feeds them once a week.

Mr. Tillinghast. We feed just once a week. That is, the hoppers are filled once a week. Of course, in the summer, we do away with the cracked corn. We feed cracked corn more to give color to the yolks. In the winter if you feed a hen on wheat screenings altogether, the yolk is not so desirable. If you want to make a bright golden yolk, the corn is better. We supplement the other food in the winter with cracked corn because I want the hen to eat all she can, and corn does no harm, even if she does eat all she can of wheat screenings. If this is given at night, the hens have a long time to grind it up through the night.

Now on a place of fifty acres of fruit, instead of buying fertilizers, commercial fertilizers, fine bone, and such things, I would not bring the fertility of the west here to the east, but I would buy my corn by the carload and let the hens grind it. Also feed the cracked bone and let the hens grind it. They will grind it finer than any mill can do, and give it back to you in a more available form for plant food. So in this way we have a double profit. We have no fertilizer bills.

QUESTION. I would like to ask Mr. Tillinghast if he has ever used the stuffing process.

MR. TILLINGHAST. I never have.

QUESTION. Do you consider it any advantage to feed warm food once a day to your poultry?

MR. TILLINGHAST. Why no. Not any great advantage, and yet if I had certain material that I wanted to get rid of, if I could not feed it well in a hopper, perhaps in the winter if I had help that was not doing anything, I could feed it that way. I would not want to feed it to breeding stock. I prefer to feed the flock as much as possible from the hopper. About twenty years ago, when I commenced, I was away from home a good deal through the day, and did not reach home at night until four or five o'clock. At that time I found my poultry was all on the roost. It was too late to feed them. I used to get up at five o'clock in the morning and give them a hot food. I thought I had to do it. And then at noon I gave them some kind of grain to scratch for, and at night I used to give them corn. That practice was not very satisfactory. I conceived the idea of making a kind of hopper. I had a little boy about five or six years old, who was old enough to do what I told him as near as he could. I put the grain in the hopper, and had the little boy, about three o'clock, go out and open the door to the hopper. His mother would send him down to open that door. The hens could get it at that time and go on the roost with full crops.

One advantage of this system of dry feeding from a hopper, is that you can get along with less intelligent labor. Most any man is intelligent enough to fill a hopper, but it requires more or less of an expert to feed soft food. I have had men, and they would overfeed or underfeed. If too much was placed before the fowls, then it was left to sour and spoil, and, as a consequence, I used to have fowls in the hospital a good deal of the time. I have no use for that system now. The hens are kept now under natural conditions. We are bound, of course, to lose some under the best conditions.

Question. I would like to ask the gentleman if he can give us some more details of his houses and what they cost.

Mr. Tillinghast. I think there are some papers here doing that. I take quite a number of poultry papers. The "Feather" is a good paper, and there is a picture here of the colony houses, and instead of explaining the details, I thought you would get a better idea if you took that and examined it. You can then see the way it is built up.

The President. I think, gentlemen, that we shall have to leave this discussion temporarily. We have another gentleman who is going right on with the same subject. Mr. Hunter is going to speak to us. We should be glad to have him come forward and tell us about "Dry Feeding; the new Poultry Culture."

DRY-FEEDING; THE NEW POULTRY CULTURE.

By Mr. A. F. Hunter.

For many years past there has been a growing dissatisfaction with both the methods employed and the results attained in our poultry work. The methods employed have involved an excess of labor and the results attained have been, in far too many cases, disappointing — the disappointments taking the form of poor health of flocks of both mature birds and the young chicks, resulting in a lowered egg-yield, increased mortality, diminishing profits, and in very many cases an abandoning of the poultry business. That there may be many contributing causes to the unsatisfactory results has been conceded by poultry writers, among them unsanitary conditions in the houses and ground of yards poisoned by the droppings, vermin infestation, stock debilitated by inbreeding and breeding from late hatched and consequently immature pullets and cockerels, bungling methods of feeding, shutting the birds up in tight houses, etc., etc., etc.,— any or all of these may have helped to the unsatisfactory results above noted.

In the last few years observing poultrymen have been experimenting along two different paths, in the hope of finding aids to better results; one of these paths being to more and more open up the houses to fresh air and sunlight, the other being a better and more common-sense method of feeding; the first of these we have not time to study in detail, merely pausing to observe that it is a decided gain in method, and substantially improves the conditions of health in the flocks — the second, that of feeding, gives us all the range we have time for today.

That quite a good deal of the trouble we have been having with our flocks was due to defects in methods of feeding has come to be the opinion of many observers, and of late the feeling has been gaining ground that the feeding of a cooked mash is a serious mistake. One reason for this is found in the fact that the fowls gobble the food down very quickly, far too quickly for the digestive organs to properly perform their allotted task, and the results have appeared in the form of indigestion, looseness of the bowels, and other symptoms of the birds being out of condition. Not infrequently the birds have become over fat, the organs become engorged, a blood vessel bursts, and a fowl is found dead under the roost in the morning. The explanation of this is that feeding a cooked mash is "forcing" the birds beyond their ability to digest and assimilate; it is analogous to "forcing" for rapid growth of tender, delicate flesh for market, and the process is all right for chickens that are to be early killed for the table; for that definite purpose the quicker the growth the greater the profit. But for birds that are to endure the strain of persistent egg-production, and are to be the parents of strong, vigorous, bound-to-live offspring, the "forcing" process invites disaster, because it induces and continues a condition of tenderness, which is exactly opposite from the hardiness so desirable for the best results.

The conviction that feeding a cooked (or wet) mash is a mistake is well illustrated in the statement of a poultryman, writing in one of the poultry papers, who says: "When I want to force the birds to heavy egg-production, I feed a cooked mash, but when I want to get good strong-bodied eggs, eggs that will hatch out a large proportion of strong, vigorous chicks, I feed the breeding pens a dry mash and all dry grain — and I get eggs that will hatch!" There is a clear statement of the conviction that mash feeding is a mistake if we want the limit of strength and vigor, and who does not? It is clear that not only the best of health and strength is desired by all who want the best profit from their flocks, and it is being demonstrated by experiment that the best and most continuous egg-yield is gotten by a radical departure from the cooked-mashed method of feeding, and adopting the method suggested by our friend quoted above, of feeding the mash dry and supplementing it with the usual feeds of dry grains and seeds.

A farmer in Illinois tells his experience in feeding, and how he came to adopt the dry-feeding method. He says: "After reading much upon the subject I concluded the greater part was nonsense, and I now fully believe that inside the next ten years feeding poultry in every stage will be much simplified. I have had some experience in growing hogs, and did considerable experimenting with feeding. I found that by using ground, mixed grain, fed dry, I could grow a prettier, more shapely, and firmer fleshed hog, than by feeding a slop.

"Nothing under the sun fed in its natural state will blow up a pig to such an extent as a rich slop, and no pig so fed will have the fine symmetrical appearance of one that is fed more in accordance with nature. I fully believe the slop-feeding is destructive of the digestive organs of the pigs, and also fully believe the mash business for chickens and hens gives the same unfortunate result. Any mash will begin to sour soon after being eaten and subjected to the heat of the body, and this too early souring of the food in the crop, before it is properly passed on to the gizzard and intestines, is the foundation of sour-crop and bowel trouble. I will guarantee you that if cracked or whole grain is given regularly (and not in spurts now and then), examination of the crop at any time will not reveal that sour smell so frequently noticed in mash-fed hens.

"When dry-fed, a chick or fowl will not gulp down a great amount of the food at one time, and I fully believe that with dry feed, moistened with saliva, it will not sour nearly so quickly as if it is moistened with hot water or milk. If my method of feeding will grow good, healthy Plymouth Rock pullets to weigh seven and one-half to eight and one-half pounds in seven to eight months, I believe that pullet is in better shape to lay, and, if continued on dry food, will at two years of age lay as many or more eggs than will a mash-fed chick and hen; and not only this, but the eggs will be larger and more fertile, and when you come to sell the carcass it will have both a better appearance and better weight. I know the eggs I am getting now are better in size, color, and shell than any I ever bought; I mean thirty-five to fifty per cent. better in quality, and this I attribute to my having adopted the dry-feeding method. I am certain that dry food properly fed means health, with no sour-crop and no bowel trouble.

"When I began dry feeding I had never seen an article upon the subject. I knew I could do better with hogs on dry food, but had never studied why. I knew I had too much to do, was too busy with the farm work, to grow chickens with mashes. I planned my year's campaign before a chick was hatched, that is, the best of grain and sweet milk before the chicks all the time, beef scraps also and charcoal accessible all the time, with clover-hay chaff for litter, and good range. I have experimented with dry feed for chicks for two years, the past year for all ages of poultry, with the best of success."

That tells us how a busy farmer out in Illinois worked out a better method of feeding his flocks, better because it cut down the work fully a half, and gave him better results, both in growth of young chicks and in egg-production. He had learned that he grew a better looking hog, and one that the meat of was firmer and better, by feeding it on dry grains, and he argued that if all dry grains were better for a hog the same method of feeding would give better results with chicks and hens. This farmer "put brains" into his work, and an eminently satisfactory saving of labor combined with a bettering of results, was his reward.

Here is another writer's argument: "Well-bred chicks are naturally hardy. Chicks born of strong hardy parents come into the world about as well fitted for the battle of life as anything we know of. Given half an opportunity, fed within the bounds of reason and common sense, and properly brooded, it seems almost impossible to kill them. They have an ample coat of down which protects them from almost all kinds of weather for short periods. Given a well regulated brooder they will cheerily run out into an almost zero temperature, and apparently be as happy and contented as though it was warm summer weather, and they certainly grow much better than when placed in what some call better conditions. They eat a mouthful or two, kick up the scratching litter in search of a tidbit of seed or grain, and then scamper back under the cover for a minute's warming, and they certainly grow much better than when placed in what some may think more favorable conditions. Fed improperly, or kept at too warm a temperature, or when they are so unfortunate as to have had weak parents on one or both sides, the reverse conditions seem to be the result — they are about as delicate, puny, and unsatisfactory atoms of mortality as the world produces.

By closely studying nature's methods with chicks, we find that the mother hen, leaving the nest when the chicks are from one to two days old, does not have a chance to lead the way to a dough dish and fill them up with an indigestible mess of dough. On the contrary, she starts out on a hunt, if she is undisturbed, she makes a good display by nightfall, and has succeeded in filling the crops of her numerous family. If we could dissect those crops we would not find a scientifically prepared mixture of one to four, or one to five, or "sixteen to one," or any other startling array of chemical combinations; instead we would find a bug or two, a worm, some seeds that we may have carefully planted in the garden a day or two ago, together with a variety of weed seeds, and plenty of grit. This composite mass has been gathered together in ten or twelve hours' time, with a liberal sprinkling of exercise thrown in, and if the weather conditions are favorable and the mother hen does not drag the youngsters around through the wet grass too much in the morning, she usually comes out at the end of the season with as many full sized chickens as she started from the nest with.

Instead of this common-sense method of feeding chicks, the usual way, when the old hen brings off her brood, is to shut her up in a coop and dump down on a board in front of the coop all the wet dough she and the chicks ought to eat in a day's time. Some of this is eaten, but most of it is trampled into a door mat for the youngsters, and in an hour's time looks much like the dirt surrounding the coop. Exposed to the hot sun, it does not take long to start the process of fermentation, and we soon have the germs of bowel trouble growing at the rate of forty miles an hour! The books say that chicks should be fed five times a day, and the nervous owner argues that if five times is good, six times is better, and soon comes around with another mess of wet dough which he deposits on the top of the first "charge," and there is now a sandwich of dough and dirt. In a few days' time the chicks begin to drop off one by one, the common manifestations of bowel trouble, such as pasting up behind and watery diarrhœa, are in evidence, and the owner begins to "darn the chicken business" or else he blames the man from whom he purchased the eggs for having inbred stock, and we have another of the many cases of "the chicken business don't pay nohow!"

"Perhaps our friend's more painstaking neighbor improves upon this method and bakes the mash into a sort of bread, which is a decided improvement, because it removes the greater part of the water, but at the same time it considerably increases the labor. His chicks certainly do better, and make a very good growth for a few weeks, and he begins to boast that the solutions of the poultryman's troubles lies in cooking the food, so he invests in an amateur bakery and bakes everything. His chicks apparently continue to thrive, but as the weather gets hotter he notices some bowel trouble among the half-grown birds; these die and he shouts that cholera has struck him, and writes to the editor of a poultry paper, who tells him it probably is cholera, as the symptoms he describes look like that. After changing the method of feeding once or twice, and losing half of his flock, he gets around to feeding hard grain and pulls the remainder of them through, although they are not now as large, nor nearly as healthy as chicks raised under the natural method and without the assistance of a bake shop!"

This graphically describes a common experience in feeding chicks, but does not explain the cause of the difficulty, which may be defined as, in part at least, a too rapid eating or "gulping" of the food. One poultry writer describes it as follows: "Your mash-fed chicken gets up in the morning, waits around an hour or two until the feeder gets ready to bring along a bucket of hot or cold mash, which is thrown down on a board or trough and a wild scramble begins. Each one gulps down what he can reach; the weaker get a little and the stronger get the bulk of the food. If the mash is hot it raises the temperature of the bird above what is normal, and perspiration is started, which is far from what should be, as this opening of the pores of the skin paves the way for a chill and the foundation of colds and roup is laid. The food goes through the crop with very little change except fermentation, and the extra work of preparing the food for digestion is thrown upon the gizzard and intestines, whereas the saliva of the mouth and kneading of the crop should have done quite a little towards softening and partly digesting it.

"The cooking of food, some say, makes it more digestible, which we have no doubt is true, but the question arises as to what particular part of the food it makes more digestible. Of course, the starch is more easily digested, but the protein is not, and we think that here is where the mischief arises from cooked food. The simple scalding of a mash makes no chemical change in it; you may just as well mix it with cold water as hot, the chemist tells us. The writers say mix the mash as dry as you can mix it; if it is better to mix it as dry as possible, why is it not better to leave the water out of it entirely? Surely, it is very much easier to mix it dry than wet. 'But,' it is objected, 'the fowls won't eat it!' This is true. They will not eat the dry mash for a day or two, when they have been brought up on the wet-mash ration, but brought up on the dry mash they eat it freely and whenever the appetite prompts, and it never stands before them sour — the last spoonful in the hopper is as sweet as the first.

"Furthermore, each bird gets its full share. There is no wild scramble for the heaps of wet mash in the trough. A bird goes to the food hopper and eats two or three mouthfuls of the dry mash, taking time to turn over and properly moisten it with saliva, and then turns away to search for other bits, as a seed or two, or a grain of wheat, or oats, or barley, or kernel of corn; there being no frantic scramble for the feed-hopper there is ample time for each bird to help herself to all she wants, and they all get their full share.

"The pith of the argument for dry-feeding lies in that eating slowly, a bit at a time, first a mouthful of dry mash, then a bit of grain, or a seed or two, and then a snip at a clover leaf or head, then to the drinking fountain for a sip of water. It does not take us long to discover that this is exactly the way the fowl or chick eats when running wild and finding its food bit by bit — it is 'nature's way' for a bird to feed, and if we but do our part in supplying the essential food elements so the birds can take what they want and as they want it, the conditions seem to be right for them to eat in the natural way, and they will eat no more than they want and eat it in the way their systems can best appropriate it."

Dr. Nottage, of Goshen, Mass., who is a sturdy advocate of the dry-feeding method, says: "To better understand the advantages of dry-feeding, let us look at the method I employ in using the grains. The fact that I have gotten rid of mixing and cooking mashes, and am now feeding most of the grain and for the greater part of the time from feedhoppers, shows how much easier it is to care for a good sized flock of fowls. The advantages are apparent to all who feed their flocks four or five times a day, and are constantly fussing with them. I have come to be spoken of by the farmers around here as 'the man who feeds his hens twice a week,' from the fact that during the growing period, from the incubator to the pullet that is about beginning to lay, I feed all the grain and beef scraps from feed hoppers, which I fill twice a week. Keep in mind that all young stock is on free range, and the laying birds in yards so ample they seldom wander to the ends of them; also that this laying stock is let out to wander at will on alternate days.

"I would not advise changing suddenly any method of feeding, as it will seriously affect the egg output for a time; but after a few days the hens will be laying as before. The best way is to begin with the chicks right from the incubator. Looking at the subject of feeding from the beginner's standpoint, I am certain that fewer mistakes will be made and a larger number of chicks raised to a healthy maturity by feeding dry grains and beef scraps from feed hoppers kept constantly filled, provided the chicks can run upon grass range. There will be seen no rushing and trampling crowds of chicks, but a contented and lively set of youngsters that are plump, healthy and happy, although on free range, where some people think they are likely to run all the flesh off their bones! They will also find time to dig holes in the dirt, lie under the shade of the trees and enjoy life. He will be surprised at the rapid growth of his stock, if it has any 'grow' in it. More of this when we speak of results. Do not get the idea that an experienced poultryman cannot produce like good results with his mashes, for he certainly can. However, let a beginner start with mashes and they will often become 'messes,' and more chicks will drop out of the race than if he adopts the plan that I pursue with mine.

"Have plenty of grit where the chicks can pick it up for their first meal. Get your miller to mix together one part of good sound wheat to two parts good sound corn and crack them a little finer than common cracked corn. Put a small heap of this in the front of the brooder, and beside it a small heap of dried beef scraps, from which the coarser pieces have been sifted out; this sifting out of the coarse pieces to continue till the chicks are big enough to eat the scraps as they come to hand. If you have skimmed milk, keep the youngsters on that for a drink until they become a little tired of it, which may be in two or three weeks; you can let them have their choice between milk and water. If there is not a green sod for them to pull and work at when they get into their second week, chop up some onions, or lettuce, or cabbage, and let them have some once a day. Get them out on the ground as soon as there is a blade of green grass to be seen pushing up through the sod.

"You can carry the birds along on the ration of half wheat and half cracked corn, with the beef scraps added, until the pullets are about half grown, say ten to twelve weeks old, then the grain ration is gradually changed by the introduction of the best grade of oats till in a couple of weeks it will be a fourth oats, a fourth wheat, and half cracked corn, and on this ration they are left to grow to full maturity. The addition of oats to the hoppers is to strengthen the body-building side of the ration, oats being the best body-builder of all the grains.

In this simple way it is possible to grow good, strong, healthy layers, and not have one bit of fuss about 'balanced rations' and forty different kinds of food. When the pullets show signs of getting ready to lay, which they will do by October first, if they are hatched in April, it is high time to get them into the quarters they will occupy during the winter, and it is now time to change the manner of feeding somewhat."

The food for the laying hens is in a food-hopper which is divided into three compartments, each holding about half a bushel; in one compartment is a mixture of one-half barley and a half cracked corn, in the middle compartment is the beef scraps and in the other whole oats. This food is there in the hoppers all the time, the hoppers being re-filled twice a week, and never being empty, and they eat of either or all of them just as they choose. It is evident that if the hoppers were sufficiently large to hold a full week's supply of grain, they would only need to be filled once a week, and then the Doctor would have it told of him that he only fed his hens once a week!

The question of green-food supply, here in our rigorous climate, where snow covers the ground for many weeks and some winters as much as four months, is an important one, and the question is frequently raised as to feeding something warm, "to warm up the birds when they come off the roosts." If one has the feeling that he must feed something warm, by all means make it a feed of steamed clover, cut in half-inch lengths, and the green-food supply will be covered at the same time. The freshening of the cut clover by either steam or hot water makes it more palatable, makes it considerably like new-mown hay before it is cured, and the fowls relish it greatly. They also relish the cut clover dry, and some progressive poultrymen keep a wire-netting pocket of cut clover hanging against the wall of each pen, the clover being cut in half-inch lengths and a half-bushel at a time put in the pocket. The fowls eat a good deal of it. The usual green foods, such as beets, turnips, carrots, cabbages — any of the vegetables commonly used for this purpose, can be fed just the same when the grains are fed in hoppers as when the old-time mash breakfast was fed, followed by the noon and night feeds of grain in the litter.

Another prominent poultryman's method of dry-feeding he describes as to give the chicks a mixture of assorted grains and grit about the size of a pin head for their first food. With a dish of beef scraps standing constantly before them, and the fine ground food thrown in litter, with plenty of green food (cabbage or green grass), they have an inducement to scratch from sunrise to sunset, and they take the food slowly and naturally. With the beef scraps always within reach, they at no time crave more animal food, their systems rapidly adapt themselves to a season of plenty, and nature constructs a body planned for a continuation of this same diet, namely, good, thick, strong leg and frame, and a chicken that looks ready to eat at any stage of the game! Long-bodied, short-legged, hardy, " born-to-live " looking fellows, free from all the ills and pains of chickendom, and fit to wrestle for a living through thick and thin, through good weather and bad, so long as the food holds out.

" When they reach the age of six to eight weeks, we gradually wean them from the small grains and substitute cracked corn and wheat, place them in colony coops on grass range, and soon discontinue the wheat, feeding cracked corn and beef scraps in hoppers, feeding once a week or oftener as the size of the hopper and number of chicks demand. These food-hoppers should be made quite high in front, three inches at least, as the birds are always trying for the larger pieces of beef scraps, and with a low front to the tray of the hopper they waste quite a little by throwing it out with their bills. The hoppers should be covered with waterproof paper to prevent the food becoming wet, if they are placed outside the roosting coops; an excellent plan is to have a small ' shelter ' to put the food-hopper under; this will protect it from the rain and give the birds shelter also — a double advantage. This system continues until the sexes are separated, and then we place the males in yards sufficiently large so the birds never eat them bare of grass. Putting the cull cockerels which we intend to market in pens by themselves, we compound a mixture of equal weights — corn, wheat, oats and barley, ground as fine as flour — if we can induce the miller to reduce it to that fineness — feed it dry and continue the beef scraps as before. This method of feeding market cockerels has given us fatter chickens than we have ever been able to produce by any other method.

"A mixed lot of cockerels is about as uncomfortable a set of individuals as is ever gotten together, and this method of feeding is the only one by which each bird can be fed singly and all get a full share. Here each one goes to the hopper and eats as long as he has plenty of saliva to moisten the food, then moves away, allowing a weaker brother to come up and take his turn. They must necessarily eat slowly, because they can swallow only a small amount of this dry mixture at one time, and thus all have an equal opportunity at the food.

"Here the digestion of the food begins in the mouth. If the crop of one of these birds is cut open, in place of the sour, partly fermented mess that is found in the crop of a mash-fed chicken, we find the grain as sweet as ever, but smelling as though partly cooked; there is no fermentation of any kind, and we think the crop now does the work nature intended for it to do.

"With the system of dry-feeding and the chickens on range, the hopper of food awaits them immediately they are off the roost in the morning; they eat a little and then start upon the day's hunt over the fields for the bugs, worms, grasshoppers, and grass, which go to make life one sweet dream for them. At any time during the day that their appetites dictate, they can call around at the coop, get a supply of such grain and meat food as they desire, and eat it unmolested, and in a gentlemanly and ladylike manner. Much more uniform gains result; the younger and weaker chicks thrive as well as the larger and stronger, summer chicks grow practically as well as the spring hatched — and bowel trouble is a thing unheard of from the shell to maturity; the essential things are that the proper heat be maintained in the brooders for the baby chicks, plenty of room in the coops for them to be comfortable as they get older, and that the grain and beef scraps used are of the best quality.

"When the pullets go to the laying houses they are fed cracked corn, wheat, oats, and barley; fifty per cent. of this, however, is cracked corn. A hopper of beef scraps is kept constantly before them, and we now add a hopper of dry bran. The whole grain is thrown in litter two or three times a day, as convenience dictates. The birds are made to scratch for all of their grain, and there are cabbages for them to eat constantly before them. If cabbages are not plenty we use cut clover, scalded to soften it, fed in deep troughs. We have used with excellent success a dry mash, consisting of twenty-five per cent. corn meal, twenty-five per cent. beef scraps and fifty per cent. bran, *fed dry* in boxes during the morning, giving what they will eat up by noon, when we give a light feed of whole grain, with a full feed at night. Hard grain is thrown in litter, as previously noted, and while this ration is a little cheaper than the other, because the dealers put the poorer grades of corn into their meal, the results are not always so satisfactory as we could wish, and for that reason. A good egg-yield will result from this ration if the ground grain and beef scraps are of good quality. We have no difficulty in getting birds to one or two pounds above standard weight by this method, and we want to say that we believe that ninety per cent. of the chickens raised in this country do not have sufficient quantity of the right quality of food; what is called over-feeding we believe would be more correctly expressed as improper feeding!

"There are very few breeds that would get too fat to lay if properly exercised, and we have yet to find one of our birds in this condition.

"As to fertility, and the strength of the germs, we believe no system of feeding can equal this method. The eggs uniformly test well, and the germs live through and hatch good, strong, bound-to-live chicks that are ready to take up the dry-feeding method as their ancestors did. No weaklings result, provided the other conditions surrounding the birds are right — one of the most important of which is an abundance of fresh air, and our fowls will stand an almost unlimited amount of this if the houses are free from draughts and they are not subjected to the daily sweating over a hot mash. Each generation of these youngsters seems hardier than their ancestors, are more cheaply raised, for any uplifting of the general health of the flock must be reflected in the decreased mortality of the youngsters.

"The labor saved is no small item, for the difference between feeding the chicks three times a day with grain, plus the cooked Johnny-cake, or heating the water and stirring up the mash for a large flock of hens — and having the food always accessible to the chicks in summer, and the dry mash with throwing the dry grain in litter in winter, amounts to a saving of a third to a full half of a man's time and physical energy — all of which we have demonstrated to our complete satisfaction is labor wasted. This labor directed to other details, and the poultry work is full of them! — will grow the chicks and care for the flocks much better, or will allow double the numbers to be kept with the same number of steps taken daily. Experiment has demonstrated that quite as many, if not more, eggs will result, than from the mash-feeding system, and any old stock that is kept over will be found to lay nearly as well the second year as the first, the birds lay better through the molt, there is less mortality among the adult birds, and the profits will be found to be on the right side of the ledger when the accounts are made up."

An excellent test of the dry-feeding method was made at the Maine Experiment Station this last year, the report, given in Bulletin No. 117, of that station, confirming many of the claims made by the advocates of the dry-feeding method of rearing chicks and feeding adult fowls. After describing the former method of feeding the chicks, which includes two feeds of mash a day, the bulletin says:

"Until last season we had continued feeding two feeds of cracked corn and wheat and two of mash daily as long as the birds remained in the field. Last June we had 1,400 chickens well started, and we changed the plan of feeding by keeping cracked corn, wheat, and beef scrap in separate slatted troughs where they could help themselves whenever they desired to do so. Not more than one-fourth of the grain was wheat for the pullets, while in the cockerel division, nothing oyster shell were always supplied. There were no regular but cracked corn and beef scrap were fed. Grit, bone, and hours for feeding, but care was taken that the troughs were never empty.

"The results were satisfactory. The labor of feeding was far less than that required by any other method we have followed. The birds did not hang around the troughs and over-eat, but helped themselves — a little at a time — and ranged off, hunting or playing and coming back again when so inclined to the food supply at the troughs. There was no rushing or crowding about the attendant as is usual at feeding time where large numbers are kept together. While the birds liked the beef scrap, they did not over-eat of it.

"During the range season — from June to the close of October — the birds ate just about one pound of the scrap to ten pounds of the cracked corn and wheat. They had opportunity to balance their rations to suit themselves by having the two classes of food to select from always at hand. It would seem that we had not been far wrong in our previous feeding, as the birds used just about the same relative amounts of scrap to other food, when they had liberty to do so, that we had formerly mixed in for them.

"We are not able to say whether this method is more or less expensive of material, than when we fed the four feeds each day at regular hours. As near as we could calculate, there were no appreciable differences.

"The birds did well under this treatment. The cockerels were well developed and we never raised a better lot of pullets. The first egg was laid when the oldest pullets were four months and ten days old. For the last six years the pullets have been from four months and ten days to four months and twenty days old when the first eggs were found. This year we shall make another change by adding dry mash to the menu — having a trough of that material besides the ones containing beef scrap and cracked corn. The difficulty of keeping the food clean and dry during continued exposure is nearly overcome by using troughs with slatted sides and broad, detachable roofs. We make them from six to ten feet long, with the sides five inches high. The lath slats are two inches apart and the troughs are sixteen inches high from floor to roof. The roofs project about two inches at the sides and effectually keep out the rain except when high winds prevail.

The roof is very easily removed by lifting one end and sliding it endwise on the opposite gable end on which it rests. The trough can then be filled and the roof drawn back into place without lifting it. This arrangement is the best of anything we have found for saving food from waste and keeping it in good condition. When dry mash is used in it, there is considerable waste by the finer parts being blown away. When used for that purpose it is necessary to put it in a sheltered place out of the high winds."

The dry-feeding was continued with the pullets thus raised, with decidedly satisfactory results. The report says:

"On the first of last November we began feeding 550 April and May hatched pullets wholly on dry food. They were in the curtain-front houses with warm elevated roosting closets and in flocks of 50, 100, and 150. At five o'clock in the morning the flocks of fifty birds were given two quarts of cracked corn; at half-past ten they had one quart of wheat and one quart of oats. This dry material was all spread on the litter on the floor but was not raked in. Along one side of the pens were feed troughs with slatted fronts, in which was kept a supply of the dry material of which the moist mash, before described, was composed. These troughs were never allowed to remain empty when the supply was exhausted. The dry mash was constantly within the reach of all birds and they helped themselves at will. Oyster shell, dry cracked bone, grit, and charcoal were accessible at all times. A moderate supply of raw mangolds and plenty of clean warm water was furnished them. When they were first put upon this ration they were not acquainted with the dry mixture in the troughs and ate of it sparingly, but in three or four days they were using as much of it as at any later time until they got to laying heavily. When the feeds of cracked corn, wheat, and oats were given, the birds were always ready and anxious for them and would scratch in the litter for the very last kernel before going to the troughs where an abundance of food was in store.

"It was very evident that they liked the broken and whole grains better than the mixture of the fine materials; yet they by no means disliked it, for they helped themselves to it — a mouthful or two at a time — whenever they seemed to need it, and never went to bed with empty crops so far as we could discover. They apparently did not like it well enough to gorge themselves with it, and sit down, loaf, get over-fat and lay soft-shelled eggs, as is so commonly the case with Plymouth Rocks when they are given warm morning mashes in troughs.

"Some of the advantages of this method of feeding are that the mash is put in the troughs at any convenient time, only guarding against an exhaustion of the supply, and the entire avoidance of the mobbing that always occurs at trough feeding when that is made a meal of the day, whether it be at morning or evening. There are no tailings to be gathered up or wasted as is common when a full meal of mash is given at night. The labor is very much less, enabling a person to care for more birds than when the regular evening meal is given.

"We cannot give the results of a full year's feeding in this way, as we have practiced it only from the first of last November to the close of June. The number of hens lost during the winter has been less than ever before, even when they were kept in the same style of houses. We can ascribe this to no other cause than that the birds did not overload with food at any time. We have never had so many eggs laid during the winter months by a like number of hens, but that may be due to better breeding, or to the open-front houses which the birds occupied.

"During the months they were not laying heavily, the consumption of mash was but about four pounds and the demands for shell, bone, and grit were less. It will be noticed that the proportion of wheat fed was less than in any former ration we have fed and that the cracked corn was increased, thus cheapening the ration.

"The average yield of the 550 hens during March was 20.4 eggs per bird. The whole number of eggs laid by them during the six months from November 1st to April 30 was 42,126, an average of 76 per bird. It must be borne in mind that these birds were not selected but were the whole number of chickens reared last year."

The most radical of all methods of dry-feeding is that followed by Mr. Tillinghast, of Vernon, Conn., and he, literally, feeds his birds but once a week and waters them not at all! As to the watering, the birds go to near-by springs or a tiny brook to drink, and when the springs and brook are frozen and there is snow on the ground they eat snow for their drink.

The remarkable thing about Mr. Tillinghast's feeding method is the very few grains he feeds; the ration is almost wholly wheat screenings and beef scraps, and they are kept in hoppers, one of each in each house, and are accessible to the birds all the time. The hoppers for the wheat screenings are made from good sized boxes, shoe boxes chiefly, and will hold a bushel or more each, a supply amply sufficient for a week for the fifty or sixty birds in a house; the hoppers for the beef scraps are about eight inches square by a foot and a half high, and will hold something more than a peck each. These two hoppers of food are refilled once a week, and an ample supply is always at hand.

The very small addition made to this ration is a remarkable feature of it. In the winter time about a quart of cracked corn is thrown on the scratching litter on the floor of each house, about the middle of the afternoon, when the wagon is driven around to collect the eggs; during the summer the beef scrap is likely to become caked in his hoppers, so they will not feed down, and for that reason Mr. Tillinghast stops filling the scrap-hoppers about the first of May, and puts about a pint of beef scraps in a feed trough in each house, at time of driving around to collect the eggs. The birds have free range over the fields and orchards in which the houses are located, and in summer can get abundance of green food; in winter a supply of vegetable food, of such roots as mangolds, turnips, sugar beets, or refuse squashes, is fed out to them, and a wire-netting pocket of cut clover, dry, is hung against the wall for them to pick from — it is surprising what a quantity of this dry cut clover the birds will eat, and it seems to fill a manifest want in the balancing of the ration.

The first question that arises is as to the profits when poultry is kept on this go-as-you-please plan, and unfortunately Mr. Tillinghast does not give us figures of egg-yield to prove the profits. It will be evident that the work of feeding and caring for the flocks is reduced to the minimum; and as Mr. Tillinghast is increasing his plant and stock each year he is evidently satisfied with results. He has housing capacity for about three thousand head and last winter had about that number of birds on his place; it is his intention to increase to eight to ten thousand head and he claims that he can himself care for five thousand head of layers housed and cared for upon his plan.

We visited him in midwinter and saw some houses of pullets in which the egg collection of the day was about fifty per would feel was quite satisfactory. As illness had prevented his cent. of the number of birds in each house, a result that anyone getting out so great a number of chickens as he had intended, he was carrying over a very large proportion of old stock, and those old birds, while laying some eggs, were, as always, laying scantily. At that visit we personally went around to more than three-fourths of the houses, and saw but one bird of all the great number we inspected that gave any indication of indisposition; that bird was sneezing, which indicated a slight cold. We visited him again this summer, when the hens were molting, and of all the birds we looked over, probably over three thousand in all, saw but two that seemed out of condition, and the egg yield at that time was quite as good as could be expected in molting time; some of the pullets had even then begun to lay.

It is evident that if a ration which is nine-tenths wheat screenings supplemented in winter with a good light feed of cracked corn, will give such a good showing in general healthfulness of the flocks and egg yield in midwinter, then we who have expended a great deal of time in compounding a mixed ration and feeding three times a day have thrown away our labor and pains! The tables of analysis given in Bulletin No. 22, of the United States Department of Agriculture, show wheat screenings to have a feeding value very closely approximating to that of good, sound wheat and that wheat is the best food of all the grains is very well known.

That wheat screenings is a very economical food, there is good proof in an experiment made at the Connecticut Experiment Station last summer. Mr. Graham wished to test the Tillinghast method of housing and feeding chickens, and had built two colony houses exactly like his. In one of these houses he put 44 Rhode Island Red chickens, that were hatched April 24th, from a hundred eggs bought of a farmer living near. On June 5th two of the chickens had disappeared, probably having been caught by some animal or hawk, and the 42 chickens left, then about six weeks old, weighed 22 pounds and 12 ounces. Twenty-four of them were pullets and eighteen were cockerels; on the 29th of July the cockerels were killed and dressed for market; they averaged to weigh three and one-half pounds apiece undrawn, and sold, at the wholesale market price, for 82 cents apiece. The cost of the food for both themselves and the twenty-four pullets to that time was $4.28 — the one hundred eggs cost five dollars, making $9.28 as the cash outlay for the forty-two chickens at about fifteen weeks old, and there had been a cash return of $14.76 for the cockerels sold, and the twenty-four pullets were left. On the 8th of September one of those pullets began to lay, when about four and one-half months old, and in the month of September forty-eight eggs were laid by that lot of pullets. Their food for the first two weeks was commercial chick-foods, bought of dealers in poultry supplies, and after that was wheat screenings supplemented with what insects, worms, bugs, etc., they could pick up on range. Not an atom of meat food of any kind had been given them, no milk or other animal food, and here we find the remarkable showing of Rhode Island Red pullets reaching laying maturity at four and one-half months old on wheat screenings alone, supplemented by the animal food picked up on the range. We feel justified in calling this a *remarkable* showing!

And the grand total of results, as evidenced by the testimonials coming from many different sources, all point to an equally remarkable showing in favor of the dry-feeding method of feeding both chicks and fowls. The general health of the flocks is better than where the cooked mash was fed, the eggs are larger, stronger-bodied, more fertile and hatch out strong, vigorous chicks — chicks that are of the bound-to-live kind, and that are the delight of their owner. Here is one reported test of the fertility of winter eggs from dry-fed hens:

A Mr. Boulton, living in Connecticut, was advised by a neighbor to send to Dr. Nottage for some eggs from which to hatch early chicks, and sent him an order for a hundred eggs, in February. The following is his verbatim report upon them.

"We put yours in one tray (100 eggs) and marked them, and in the other tray put a hundred eggs from a man of a great deal of reputation, who feeds mash. I wanted to test the difference, thinking it might show in the fertility. Of your hundred, sixteen were infertile, and of his, sixty-four! I paid the same price for both, and I think the result shows well for your method of dry-feeding."

Experienced incubator operators well know that the measure of fertility is (approximately) the measure of weak germs left in the machines at the first test, and expect that about the same proportion of the eggs will fail to hatch, that there are infertile. As 64 per cent. of the eggs from the mash-fed hens were infertile, it is fair to suppose that 64 per cent. of the thirty-six eggs remaining would be weak germs and fail to hatch. That would give 23 (plus) of weak germs, and a "fair expectation" of thirteen chicks to hatch. Of the dry-fed hens' eggs, there were but 16 per cent. infertile, which would indicate but thirteen (plus) weak germs, and a "fair expectation" of eighty or eighty-one chicks to hatch. Certainly, quite a difference there!

Last summer we were visiting a large poultry farm in southern New Hampshire, and the manager called attention particularly to the bright, lively appearance of the youngsters, of which there were about 2,100 running about, some of them about half grown then. He told us that he had lost but thirty-four in all, out of that great number, and upon our expressing surprise, for there are usually a greater proportion than that which are born weak and cannot possibly survive the hardships of infancy, he told us it was a fact, and that a careful census of several of the older families had proved the correctness of the records of mortality among them.

At the Jordan Farm, Hingham, Mass., they raised several thousand chickens each year, with practically no loss from that scourge of chickenhood, "bowel trouble," and all the food for the first weeks is Cyphers' Chick Food. The result of this simple feeding method is a most gratifying growth of the youngsters, who seem to have no set-backs, and to grow "naturally," to grow from the start, without having any time lost or backward slips to make up.

The most remarkable growth of young fowls of which we have ever heard, was a pair of Barred Rock cockerels castrated, and grown to be "soft-roasters." They were killed the day they were six months old, and weighed (the pair) twenty-three pounds, live weight, and the larger one weighed ten and a half pounds, dressed. They were grown on a ready-mixed chick food for the first weeks, with cracked corn added after the first four or five weeks to increase the ration, and beef scraps. The last two months the ration was cracked corn and beef scraps, and the total result was a growth never equaled by any other method of feeding.

A New Jersey friend writes me:

"My young stock this year are simply wonders! Some of the pullets are already showing good sized combs and wattles, and from appearances, look as though they would lay by the middle of September. Some of the capons, hatched March 23d, will weigh five and one-half to six pounds now; certainly a fine testimonial to the dry-feeding method. All I have to do is to keep the hoppers filled, and they do the rest. I find I am this year raising three times as many birds as last year, with only about one-half the labor."

Let us, however, turn again to the Maine Station bulletin, and quote the statement given there. This is a State experiment station bulletin, and the statement has the weight of being an official report. It says:

"The number of hens lost during the winter has been less than ever before, even when they were kept in the same style of houses. We can ascribe this to no other cause than that the birds did not overload with food at any time. We have never had so many eggs laid during the winter months by a like number of hens, but that may be due to better breeding, or to the open-front houses which the birds occupied.

"The average yield of the 550 hens during March was 20.4 eggs per bird. The whole number of eggs laid by them during the six months from November 1st to April 30th inclusive, was 42,126, an average of 76 eggs per bird. It must be borne in mind that these birds were not selected, but were the whole number of pullets reared last year."

Doesn't that have a triumphant ring to it? Isn't that a most convincing proof of the great gain of dry-feeding? That "we have never had so many eggs laid during the winter months by a like number of birds," and "the number of hens lost during the winter has been less than ever before," covers the whole range of profitable work in egg production; when we get more eggs during the winter months and fewer birds die, we may feel reasonably certain we are upon the right road, that we are making the best of success with our poultry work. Outside of the question of saving in labor and there is a decidedly great gain there, stated to be as much as a third to a half — the better growth of the youngsters, and the better health and greater egg yield of the laying stock, is ample ground for adopting the dry-feeding method of keeping poultry.

DISCUSSION.

The President. This is an exceedingly interesting paper on the same line as the one we have already had. Are there any further questions?

Mr. Blakeman. Mr. Chairman, I have noticed that this gentleman in speaking of food which should be given to poultry says nothing about the addition of shells. Most poultrymen think that the addition of broken shells is indispensable. I want to inquire whether that is used generally, or whether he recommends it.

Mr. Hunter. It is used universally. It goes without saying. That is the reason it is not spoken of. Every intelligent poultryman keeps a supply of ground shells. Most of them pulverize the shells into fine bits.

Mr. Wakeman. May I ask one question? I do not keep a large number of poultry, but what I have, have been kept in a very convenient place on my farm near the barn. They have been there a number of years. I find I cannot keep them there any longer on account of the condition of the land. I am told that by plowing the ground once or twice it will be all right to use again. How many times will it be necessary to plow it, and how long must it be kept plowed up before it will be safe for me to use it again for the same purpose?

Mr. Hunter. I should want to do it two or three times. If I were in your place I would move the chicks to new ground. Your chicks will do better on new ground. A thing that is worth doing at all, is worth doing well.

Mr. Tillinghast. Mr. Chairman, I see we have quite a number of ladies present. I wish Mr. Hunter would tell them if he knows of any ladies who are successful in raising chickens. He goes all over the country and he knows.

Mr. Hunter. Last week I visited a farmer's wife in Maine, who keeps about five hundred head of Barred Plymouth Rocks. She is most successful. She helps her husband milk the cows, and she makes butter and all that sort of thing, but she finds time amid all her work to take care of about five hundred Barred Plymouth Rocks. She gave me some figures which I am going to publish in my paper one of these days. She makes an average of two dollars apiece on from four hundred and fifty to five hundred head. It is a better average by a good deal than from her cows.

Mr. President. Our program having been somewhat overcrowded this morning, Mr. McGrew's address is to come the first thing this afternoon instead of this morning. Mr. McGrew is from Washington, D. C., and is to continue right along on this same subject.

The meeting will now stand adjourned until 2 P. M.

AFTERNOON SESSION.

December 13, 1905.

Music.

Convention called to order at 2 P. M., Vice-President Seeley in the chair.

The PRESIDENT. The address given on the program for 11:30 this morning we are to have now. We had chicken this morning, some of us had chicken for dinner and we are going to have more chicken this afternoon, and we are going to have it by a man who understands it, Mr. McGrew, of Washington, D. C.

THE REAL ORIGIN AND DEVELOPMENT OF POULTRY IN MODERN TIMES.

BY MR. T. F. MCGREW, WASHINGTON, D. C.

Mr. President, and Ladies and Gentlemen:

We were told this morning that the hen comes home to roost. I love to come back to Connecticut. I was born in Ohio, and, as you know, the people of Connecticut had much to do with the early settlement of the State of Ohio. When but a lad, I was fond of poultry, and had a few chickens in a shoe box in the corner of the lot.

In 1879, with a friend, I visited the Board of Trade in the city of Indianapolis, and while there made the statement that we expected to see the poultry products of the State of Indiana ultimately far exceed the pork product of the State. The President of the Board of Trade replied that he loved to see people stand by their oars, but he said he would as much expect to see the clouds fall as to see that statement come true. Be it said, however, to the honor of the State of Indiana, that the last census shows a greater number of dollars and cents in poultry and its products in that State than in pork.

The question was asked just as we were adjourning this morning, if we knew of any woman who had been successful in the cultivation of poultry. This same census states the fact that five millions and six hundred thousand farms reported the growing of poultry. We all are familiar with the fact that the largest amount of poultry grown upon the farms, is grown by the women, and if the lords of creation ever reach that point where they will permit every dollar which comes from poultry grown by women to go to them rather than appropriating it themselves, the next census would show seven or eight hundred millions of dollars credited to poultry grown by women. Women are most successful in the business. The Board of Trade and Commerce, of New York, credited five hundred and twenty millions of dollars last year to poultry and its products, and more than one-half of all this has been produced by the hand and physical labor of women and children throughout the country. Poultry is a product that any child over ten years of age can produce, and a product which our old grandfathers and grandmothers can indulge in to their profit.

Two conditions of poultry are observed. We discussed this morning the utility side of poultry. In dealing with the utility side of poultry, as generally spoken of, people say that it is the expectation that a hen will lay more than enough eggs to pay for its feed and keep. But that is not the whole story. Where would our Short-horn cattle, our Herefords, our Devons, and our Plymouth Rocks be if it had not been for the fanciers who follow the show-room? Fanciers whose effort has been constant all the while to increase the quality of the stock, and who have increased the quantity of the product from about twenty-five or thirty eggs to a hen thirty years ago to a point, according to the last census, of over seventy. The only difference between the utility hen that lays eggs and the show-room hen is the same difference that exists between our daughters and our wives at home doing their work and when they are dressed up to go to church. Then they are on dress parade. Poultry in the show-room must be in the finest condition in order to win prizes. Let me cite to you what I know of one Wyandotte hen, in her seventh year, a hen which has won dozens of prizes in the show room. She is a celebrated hen. I think it was on the 16th day of last November that the hen commenced to lay again this fall, and up to the time I heard last, she had laid seventeen eggs in three weeks. Utility is the condition of the fowl for that purpose. Exhibition in the hall is another matter which simply means excellence, elegant condition and the pink of perfection so as to place them in the exhibition hall.

I have been asked to recite the history of the origin of poultry. Before going into that dry subject I wish to state this fact — perhaps I will cite a few more before I start upon that — when people, not familiar with figures, delve into them, they are very apt to go a little astray. When I asked the question this morning of the per cent. of egg yield of Mr. Tillinghast's hens, I did so in good faith. You will hear people thoughtlessly say we get ninety-four per cent. fertility from our eggs. We hear people say we get eighty and ninety per cent. egg yield from our hens. What does that mean? That does not mean that eighty of our hens lay in one day. Thirty-three and one-third per cent. egg yield in round numbers every year is one hundred and twenty eggs. Taking it by the month, and it is ten eggs per month. Sixty-six and two-thirds per cent. is two hundred and forty-five eggs per year from a hen, and with all due respect to all the records of the world, I think that all the hens that ever laid two hundred and forty-five eggs in one year could be placed in one small wagon and hauled by a pony ten miles away to market. Let us deal in facts. There is nothing in facts to be afraid of, but do not let us be misled by them. We are very apt to gain a wrong impression. People do not mean to lead you astray, but the man who says "I had ninety-four per cent. fertility" is apt to unconsciously create an erroneous idea. Now that means to him that after he had made his last test ten days before the eggs hatched, that the eggs he left in the incubator produced ninety-four per cent. of living chicks. If he only had ten eggs left in the incubator, he does not count the other ninety which have been taken out. So that when you figure it down, the extreme probability is that he does not produce to exceed twenty-five living chicks from every hundred eggs that he places in the incubator. And when I say living chicks, I mean chicks past one week old. Every single chicken that goes into the market in the United States has cost from some source or other four eggs to produce it. I have been challenged in this statement, but I have sent letters out until I am tired, and I have received hundreds of answers from people who have kept account both of eggs hatched in an incubator and under hens, and they could not prove that they had exceeded twenty-five living chickens to every hundred eggs. That being the fact, how would it be possible for a man to have ninety-four or ninety-eight per cent. fertility. In the same way if the hens of a poultryman produced thirty-three and one-third per cent. of eggs, it would raise the average of seventy to a point where it would add almost one hundred and eighty-seven millions of dollars in one jump to the egg product of this country. Those are things that we must look at. If a man has got a hen that will lay one hundred and twenty eggs per year, and those eggs are sold in a good fair market, he can make from a dollar to a dollar and a quarter a year on that hen. That is a fact without any stretch of the imagination to lead up to it. If you have a flock of hens that are producing an average of ten each per month of egg yield, you ought to make from a dollar to a dollar and a quarter per year from every one of those hens. You ought to make that much over the cost of feeding the flock and the care of the poultry.

In the origin of poultry we have simply what might be called the theory of the naturalist. The naturalists of early days were not men of letters or men of great information. They gathered information from what they saw and recorded it as best they knew. Some of these naturalists have accepted the theory that all of the numerous families and varieties of pigeons have descended from one variety known as the Blue Rock pigeon, so plentiful throughout many of the continental countries. We are told that our chickens have descended from one Gallus Bankiva, or the Jungle Fowl of India. Following that original statement comes the discovery of the naturalist who found another jungle fowl which he named Sonnerati. We are taught by these early naturalists that these two were the original ancestors, from which have descended our poultry. Naturalists again tell us that the most immense animal in the world was that species of elephant called the Mammoth. Later they discovered the great Lizard, and within a few months the naturalists of the Museum of Natural History in New York have discovered one very much larger than any of the others, so that they had to call it Rex, in order to get a name superior to those which they have already described.

We might accept the theory that the Jungle Fowl of India was the ancestor of all our games and game bantams, but I would ask the scientist and the naturalist, and I would appeal to you if you can believe that the mammoth fowls of China, the Shanghai, the Brahma, and Cochin could have descended from those little miniature birds known as the Jungle Fowl. I think that other sources must be looked for beyond all this to tell us the truth of whence they came. Perhaps I have been led a little astray from the pathway of the naturalist, from the fact that a friend of mine visited China some twenty years ago, in company with a good Catholic father, who was in a position to have great insight into the buildings and homes of the Chinese people of a class much like our Jesuits here. They call them their retreats. In these retreats are a lot of people and their descendants who have lived there for ages on the borders of the Chinese Empire. These people have records which this old father of the church found out, went so far back beyond anything that he knew of, or that was recorded in the Bible, or by the church, that he said he was afraid that if it became published to the world it might upset the Christian religion. In these records, the part that I was interested in, and my friend as well, was recorded the fact that four thousand years at least before the beginning of the Christian era, these people had these retreats; and kept some of the large sizes of Chinese poultry. The record shows that they had been cultivated, and that the hatching of such fowls had been in practice. The eggs from such poultry had been sold, and the young chicks hatched and sold four thousand years before the Christian era. In our own Bible we have it recorded that when that Good Man upon earth was deserted by his nearest friends the cock crew thrice. If there had not been some such variety of fowls at that time they would not have been domesticated so as to have been near enough to the pathway of the Master to have crowed so early in the morning. Some thirty-five years after the crucifixion, three separate varieties are mentioned in Roman history. In Pompeii they dug up a flagon, on one side of which was engraved a beautiful game cock, and on the other was a pea fowl, showing that these two were known in their beauty and elegance. Now with all this information that has come to us, cannot we realize and be ready to accept the idea of a more extended creation originally than the one little Jungle Fowl?

Another matter that has interested me very much, and which carries us back, is the intimation made by the members of the American Legation in China during the troubles there, that the records show that the Chinese people had discovered America centuries before Christopher Columbus was heard of. Why not, if these people came here to settle in the far north, is there not enough similarity of appearance between the Eskimo and the Chinese to lead us to such a conviction? The ancient history of China goes back beyond anything that has ever been recorded by the ancient Hebrew or anyone else. Those records are undoubtedly authentic. Taking the method and their manner of keeping the records, it is said to convince every one who has come in contact with them of their truthfulness. This being the fact, and it being found in the recorded history of this brotherhood that they kept poultry of this mammoth size, it leads me to believe that long before there was anything known of the Jungle Fowl in India, there was some other fowl from which those large Chinese fowls descended. Now in proof of this, let me make this statement: All poultrymen know of the Malay Game, a mammoth game fowl. It is a question, according to the ancient records of India, whether the Malay or Kulm fowl was the first. It may be somewhat unimportant whether the Malay was first or the Kulm fowl was first. That cannot be decided. They do know, however, that the Kulm fowl and the Chinese Shanghai were very similar. From what origin came the great Shanghais and Brahmas and Langshans? Some of the original of all these, like the Kulm fowl, had no feathering whatever upon the shanks, while others showed the development of the shank and toe feathering to a slight extent when they came to us from China. The plastic condition of the conformation and changes has been cited from the fact that Bantams can be created almost at will. Nature has willed it almost to an absolute certainty that the largest per cent. of influence as to size and character rests with the female. The making of Bantams is accomplished through the selection of the very smallest of females, and pairing them with the smallest males possible to obtain; through the breeding of two generations in the one twelvemonth, and curtailing the size through the hatching at the beginning of winter and rearing during the cold months without much care and protection. As an example of this, the writer, within the space of six years, reduced through nine generations Dark Brahmas to Dark Brahma Bantams that were shown within the standard weight. These were all built up or created through the selection of the smallest females and then reduced in size under the influence of rearing the young during the winter months. This entire family was disposed of, and within four years from the time of their passing into other hands, we scarcely think there can be one descendant found from that family that could go into the showroom at maturity and weigh in under standard weight. The dwarfing through unnatural methods does not prove anything for or against the early or original creation of the ancestors.

Many years ago the breeders of Leghorns said their fowls were too small, and they introduced the Minorca blood. Soon they began to learn to use only hens in their second year, and the largest they could get, and thus they began to increase gradually the size of the fowls. As you increase the size of the bird you increase the size of the egg.

Following along in recent or modern history of poultry, the first great event in this country was the production of the Light Brahma. Following this came the Leghorns, a breed which came into the possession of a gentleman of White Plains, N. Y., from a vessel lying at anchor in New York harbor; when they came he recorded the fact that these White Leghorns had white shanks and beaks. That fact led many of us to believe that the original Leghorn was a White Minorca. All of the European poultry, the Polands, the Hamburgs, and the Leghorns, are the producers of white shelled eggs. Every bit of poultry that we have that is in any way tainted with Asiatic blood, produces eggs having a brown shell. If you will remember that distinction, you will find that in European poultry, Polish, Hamburgs, Leghorns, and Minorcas, all of these produce eggs with a white shell. On the other hand, the Asiatic family, including the Langshans, Malays, Cochins, and the Brahmas, all belong to the class of fowls that produce brown shelled eggs. When you intermingle either of these you never get aught but a tinted colored shell. There is no blood so strong in the whole poultry fraternity as the blood of the Asiatic fowl. Our Plymouth Rocks, Wyandottes, and the

Orpington varieties of England, are all influenced by the superior power of the Asiatic blood. Every one of these produces a brown shelled egg. You cannot bring together two separate breeds or varieties of poultry and intermingle the blood without changing three things, the form, size and shape of the egg. Whenever you produce a cross from pairing together any two breeds you have interfered with the regular line of product, and therefrom come the countless numbers of ill-formed and misshapen eggs. Mr. Tillinghast told you that he preferred the White Leghorns because the White Leghorn egg went into the New York market at the highest price. It is a white shelled egg. Why does the white shelled egg go into the New York market at the highest price? Because they are all white and all of regular size. Nothing but European fowls will produce such eggs. You cannot violate the laws of nature to any great extent in crossing without showing the effect upon the egg. By the time you have influenced size and form, you will find you can get neither the clear brown nor the clear white egg. It is the clear, bright, white-looking egg that the New York market wants. If there is anything in the world that caters to the taste of the New Yorker, it is appearance. There is no place in the world where so much stress is laid upon appearance as in New York and they want these beautiful white shelled eggs. But you can leave New York in the morning, after having had white shelled eggs for breakfast, and go from there to Boston, and there everything is brown. You could not hire them to introduce anything else but the brown shell. If people would be as particular in taking care of their poultry as they are to get the doctor for the horse, when he is sick, they would succeed better in the business.

Mixed hens lay mixed eggs, and when you go into the market with them, you get from sixteen to nineteen cents a dozen, while Brother Tillinghast may go into the market and find plenty to take his at forty-two cents. What is the meaning of that? He keeps his Leghorns pure. He can get forty-two cents a dozen for the best white shelled breakfast eggs, and these other mixed eggs sell at from sixteen to nineteen cents in any commission house down-town. Suppose you have five hundred mixed hens. My advice is to go home and sell those five hundred mixed hens in the market for what you can get for them. As far as possible handle only pure bred fowls of some variety. If anybody tries to induce you to cross your stock, chase him off the place. If you have a variety of hens that lay nice, clean, fine-shaped, brown shelled eggs, you can sell them even in the New York market for forty cents. Do not put mixed eggs into the market if you wish to get the best price. These are facts. These are things that people should stop to consider. If you could put into the market from the State of Connecticut every single egg that will be produced this winter, and get forty-two cents instead of sixteen to nineteen cents for off-colored and ill-shapen eggs, you would have about two hundred and fifty thousand dollars coming into this State for eggs, simply because you did not allow somebody to come along and try to persuade you that their idea of cross breeding is better than pure bred poultry. When you see a man that is getting nineteen cents a dozen, just think of Brother Tillinghast, and think how nice he is fixed down there at his home with his forty-two cent eggs. It is just as easy for you all to have forty-two cent eggs, for there never will be a time as long as this country increases in population as it does when there will not be a market for such eggs, and there will never be, I am afraid, more than enough to supply the people of the city of New York alone.

Now I do not wish to tire you, but I must mention one or two facts more. I want to help you to do better because nothing makes people feel happier than a nice little cash balance in the bank. Then they can look every man in the face, and say, "I do not owe you a cent." I have visited the markets of New York, Boston, Washington, Philadelphia, Baltimore, Kansas City, Chicago, Dallas, Texas, and St. Louis, and I do not think there is a city of over one hundred thousand inhabitants where I have not gone among the poultrymen and inquired as to the price of eggs and dressed poultry and I find this very same condition in most all of them. Dressed poultry is selling from seven, nine, twelve, fourteen, sixteen to twenty cents a pound, and if you want something nice out of the icebox, you must pay about thirty cents. Now what are the facts about that situation? The man that sold that thirty cent poultry made money; was doing well. The fellow that sold the seven and nine cent poultry probably has a mortgage on his place and never will be able to lift it.

I received a letter from a lady in New York, who said to me:

"I have two little children to support, and I want to sell my eggs in the New York market." I went down to a gentleman whom I knew, told him about the matter, and he said, "Why certainly, I will take all she has to sell." She shipped them in, and he immediately telegraphed her not to send any more. I telegraphed her to come to New York. She came, and I took her to the store. That man paid her five dollars to stand in his store for two days and try to sell her own eggs. It taught her a lesson. She went back home, and for five years she has never been paid less than thirty cents a dozen for her eggs in that store every single week in the year, summer and winter. She learned the lesson that every one must learn in the future who expects to successfully run a farm, and that is, if you sell at the bottom price you are going to be bankrupt; if you sell at the top price, you are going to make money.

There is another thing that I want to talk to you about, and that is the agricultural interests of the United States. Five million and nearly six hundred thousand farms are reported as growing poultry, in the last census of the United States. That proves conclusively that we have five million six hundred thousand farmers not only interested in agriculture but interested in poultry. It is safe to say that each one of those farms represents or supports five people, making a little over thirty millions of the population of the United States that we know are farmers or dependent upon the farms. If those thirty million of people go with a load of potatoes or a load of corn, or a load of watermelons, or with a basket of eggs to market to sell they have got to deliver to the people to whom they offer those goods, the identical article that they are selling. Perchance, some of the good ladies here have gone to market with their farm produce, and they desire to return home and make some lovely mince pies, such as my grandmother used to make and serve when I was a child. I want to ask them if they believe that the people to whom they present their products for trade will be as particular in returning a good quality of cinnamon, cloves, allspice, ginger, or whatever they wish to use at home, as they are to get good products from you? How do you know when you trade your wagon-load of potatoes, in part, for a few pounds of pepper, that you do not carry up to your home finely ground hulls of buckwheat flavored with capsicum? It is due to the farming interest of the world that every man, woman, and child shall rise in his might, over the length and breadth of this great country and say we demand at the hands of our government a law that will return to us pure food products in exchange for the products that we grow upon the farms by the sweat of our brows and bring them in exchange for barter.

I have but a few minutes more to stay, but if any one has a question to ask, I would be glad to have you ask it. Before you do so, however, I want to say one more word. The backbone of the American government is the agricultural people, from Maine to California, and from Alaska to the Gulf. You are the people that own the country. You are the people that can govern. You are the only people that can say to the legislature of the national government, we demand our rights; we demand that the people that have gone ahead and practiced this outrage upon our stomachs, our homes, our families, by selling impure articles of food, shall be compelled to brand upon the product that they sell us, the honest contents of the package. How many of us, when we buy canned goods, ground coffee, a package of tea, or cinnamon, cloves, allspice, or any of these things know what we get and what we pay for? Now if you people will look facts in the face and act together as the saying is, you can be the power that will rule the world, so far as America is concerned, and you can have whatever is your right, if you will only unite and say we are the people, and we wish the true return that is our due.

Now if there is any question that anyone would like to ask before I go, I would be glad to answer it. Before I go I want to thank you for your kind attention.

Secretary Brown. At this point I would like to offer the following resolution:

" Whereas, the agricultural experiment stations are found to be of the greatest aid to the farming interests of this State, and

Whereas, the Hon. H. C. Adams, Congressman from Wisconsin, has introduced a bill, H. R. 345, providing for increased federal appropriations for these experiment stations, RESOLVED, that the Connecticut State Board of Agriculture in annual convention assembled, endorses this step in agricultural progress with most hearty approval, and

RESOLVED, further, that the Secretary be instructed to transmit copies of this endorsement to the several Senators and Representatives from this State, together with a respectful and urgent request that they lend this bill their earnest and favorable support."

MR. STIMSON. May I say just a word in that connection? The finest champion in Congress today, of modern progressive agriculture, is the Hon. H. C. Adams, of Wisconsin. He is aggressive, he is full of modern agricultural ideas. For several years, in the face of big odds, he has struggled in the committee to secure the passage of a bill providing for an increased appropriation for the different States for the benefit of the experiment stations located within them. Several times he has been very close to getting the bill through. This year if we all work together with this best friend of ours who has appeared in recent years, we believe that the bill will pass. The bill is unqualifiedly endorsed by the National Association of Agricultural Colleges and Experiment Stations, and by the presidents of the colleges. The bill has no string to it whatever. A string in previous years has been put on. For instance, a string of this sort has been put on, providing that some one may say how the funds shall be used in the different States. The bill as it stands today is without a string of any kind. We in Connecticut will be at liberty to say what this money shall be used for. The experiment stations in Connecticut are investigating some of the present problems of agriculture and problems that are going to demand attention, and the stations are becoming very much pressed for funds to do this work.

Mr. Tillinghast said this morning that he had no records of his egg yield over a month or two that he wanted to make public. We have an experiment in progress at the College by which we are testing Mr. Tillinghast's method and keeping careful account of it. Now it is cheaper to make a mistake in one place than it is to make a mistake in four or five hundred or a thousand places. It is cheaper to demonstrate to your satisfaction the best method of success in one place than to make people attempt to attain such success in many. We, at the experiment station, want to help you poultrymen. We want to do four times as much as we are now able to do. We want to do four times as much for the dairymen of this State, and for the fruit growers, as we now do. The appropriation that the federal government will provide, if this bill passes, will not increase our capacity four fold, but it will increase it two fold. This resolution puts upon the Secretary of the Board of Agriculture a duty. If you pass it he will transmit the will of the Board of Agriculture to our several Senators and Representatives. I hope, however, he will not stop there. I said in the beginning that farming needs friends. How? Last winter when we wanted a dormitory at the Agricultural College, you went up to Hartford on that day when the matter was under discussion before the legislature, and you filled the hall of the House of Representatives. You said we need a good house for our boys to live in so that they can get an agricultural education, and you got the building. Now buy two postal cards, or one postal and a two-cent envelope, and by spending ten minutes' time you can show your interest as a friend in this movement for the advancement of agriculture in Connecticut and in the country, and at large. Let every man here, I do not care how many women — the more the better — write to every man of our Representatives and Senators from Connecticut. Write to your Representatives and Senators this: "Please send me a copy of the Adams bill." Do not forget it. Or you can go a little further, "Please send me a copy of the Adams bill asking for an increased appropriation for experiment stations." When you get it read it through. The friends of agriculture only ask that these measures shall be passed on their merits. Read the bill. If you think it stands for what you want it to stand for, then please write a letter to each one of the Senators and Representatives from Connecticut in Congress, and say, "I am familiar with that bill. As I know the needs of agriculture in Connecticut, and as a favor to me, as a Connecticut citizen, and to the people of my township, whose sentiments I know in regard to it, will you please lend your efforts to the passage of this measure?" Let us work together. The bane of farming in the past has been incredulity and divided endeavor. In union there is strength. (Applause.)

The PRESIDENT. Any further remarks? Are you ready for the question? All in favor of passing these resolutions signify by saying "Aye." Contrary minds, "No." It is unanimously passed.

We must now go on with the program. Professor Thomas Shaw, of St. Anthony's Park, St. Paul, Minn., will now give us a paper on "Breeding Animals on the Farm." I have the honor of introducing Professor Shaw to you now.

BREEDING ANIMALS ON THE FARM.

By Prof. Thomas Shaw, St. Anthony's Park, St. Paul, Minn.

Mr. Chairman, and Ladies and Gentlemen:

Before leaving home to visit New England, one of my friends was good enough a short time before I left to call my attention to an article in one of the St. Paul papers. It referred to the subject of abandoned farms in New England. He wanted to know why I was going down to New England, the country of abandoned farms, to talk to the people on agriculture. The next morning I happened to get hold of a copy of the census report on agriculture in the United States. He aroused my curiosity a little bit, and I wanted to know a little more about that country of abandoned farms, so I looked up the question in regard to the production of corn, and I found that the average production of corn per acre in the six New England States for the ten years ending in 1899 was thirty-five bushels per acre. I then turned to the report regarding the production of corn in seven States of the corn belt of the

West, and I found that the average yield per acre in those seven States for the same time was twenty-nine and a fraction bushels per acre. Then I sat down and wrote an editorial for the *Orange Judd Farmer,* and wound it up by saying that I would recommend to the people of the corn States to send on a delegation of thorough farmers to New England to find out how to grow corn. So I came to New England to talk on agriculture, or to attempt to talk on agriculture. I know, fellow-farmers, it is a bold undertaking. I know it better than some of you know it, if you have never tried it. To go to a country in which you never have set foot before, and to look into the faces of an intelligent audience, and to talk to them on the agriculture of their country — I tell you, farmers, it takes a little nerve. But I may tell you that I am delighted to be able to say that while I never took much stock in that question of abandoned farms, I take less than ever I did before I came to New England. Now I want you to understand that this abandoned farm business is something serious. It is hurting you people. It is hurting your reputation, and it is hurting you unjustly, as I am glad to find, and I want to have you understand that the people of the West are not responsible for those views which they hold in regard to your country. It is due to the pamphlet and magazine articles that are printed somewhere in the West, but not in the East, sensational in character, and they find their way into our periodicals, and these are the sources of information from which the people of the West form their opinion in regard to what is going on in New England. But fellow-farmers, really some of our Western men think New England and New England agriculture is going to the dogs; that there is no hope for New England farming. But, Mr. Chairman, I have not heard, sir, a single note in a minor key in regard to agriculture since coming to this State; there is hope in the sound of your rivers that run down from the mountains towards the sea; there is hope in New England everywhere; there is more hope in the intelligence of the men that till your lands. One can see it in the faces of New England farmers, such as those I am looking upon today. But fellow-farmers, I did not come to New England to talk to you simply about the hope of New England farming. I came to talk to you about a very different subject. I came to talk to you about what the students call "hardtack," if I may use the phrase. I do not think it is very far wrong. I came down here from Minnesota, more than a thousand miles, to talk to you, farmers, about the subject of animal breeding. I want to tell you right here, lest you should be disappointed, that I did not come to tell you anything that you do not know. You may say that is strange. You may say, "You come a thousand miles to tell us what we know already?" Right. Let me ask you — did you go to church last Sunday? What did you go for? Did you go with the idea that the man who stood up and faced you and talked to you about the higher things of life was to tell you something new? No, you did not go for that purpose at all. You just went for the purpose of keeping in remembrance and refreshing your memory upon what you did know. I came to New England, not in the hope of telling you anything new, but with the hope of putting your memory in such a condition about some of these things that you will go out and try to do some of the things I believe you should. I shall look upon my mission as a failure if these things which I shall now attempt to give you on the subject of animal breeding are not of value. I would like to know, fellow-farmers, how many times you have listened to this kind of discussion from the institute platform. I do not know whether you discuss the question of animal breeding much in New England or not, but I do know that they do not talk about it very much from the platform in the West. I sometimes think it is because of the complexity of the question. In some respects the art of breeding is like a great hole in which an intellectual giant may sink a thousand fathoms and more at the very first plunge. In other respects it is a broad shallow, in which a child intellectually may wade without any difficulty. In some respects the operation of its laws is so regular and plastic that the skilled breeder may almost mold and fashion at will. In other respects they are so erratic and subtle as to confound the most skillful, the results are so different from what he expected. The great differences thus resulting in some instances from even skillful breeding are doubtless the outcome of laws that are apparently antagonistic, but not really so. They are only apparently so because they are not yet sufficiently understood. It may be that they never will be, but, happily for the breeder, the results from the proper application of principles, that are now well understood, are so regular and uniform, that the man who diligently applies them will, with unfailing certainty, so improve the average of the animals in his stud, herd or flock, that they will be brought to a higher level.

The known laws that govern breeding are three in number. They are known respectively as the law that like produces like, the law of variation and the law of atavism. The first and second of these laws are apparently antagonistic. The third, like a pendulum in operation, swings between the two.

The law that like produces like, means that the progeny shall be like the parents, not an exact facsimile, for two parents are never found exactly alike, but in all essential features there will be a close resemblance. This resemblance will, with more or less of uniformity, extend to the physical form, to function, to habit, to disposition, and indeed to every feature of the organization. This law is the great Magna Charta of the breeder. The results from the operation of this law are by no means uniform. They will be nearly so, however, in proportion as the parents have been purely bred, in proportion as they have been bred in line without having reached the danger point of weakened stamina, and in proportion as the parents are strong and vigorous.

The law of variation, or the law that like does not always produce like, is apparently antagonistic to the law of likeness. It means that the progeny shall not always be like the parents. Though apparently antagonistic to the first law, it may be simply a part of the same, the differences being the result of modifying factors in transmission as yet not well understood, and until understood, beyond the control of man. In breeding pure blood animals, these differences are not usually very well marked, though they are constantly present. Sometimes they are very great, as when, for instance, the progeny of horned parents are hornless, but such variations are of infrequent occurrence. Some have claimed that in transmission, variations are more constant and greater than resemblances, in other words, the second law of breeding operates more strongly than the first law. In breeding pure bred animals, this is not true. If it were so, the breeder would be on an uncertain sea; without sail or rudder. The only improvement that he could make would be through selection.

The presence of the law of variation is by no means inherently adverse to improvement in breeding. The result depends first, on the character of the variation, and second, on the disposition made of the animals which thus vary. Variations are sometimes downward, in other instances they are upward. When downward, the animals should be eliminated. When upward, they should be retained for breeding. Were it not for variations in the direction of improvement, advance in breeding would be impossible. Viewed from this standpoint, the law of variation is a blessing rather than the thorn which it sometimes proves to be.

The law of atavism is the law which, in transmission, determines that the progeny shall be like some remote ancestor. It is probably a branch of the first law of breeding acting in an erratic way. Like the law of variation, it is a disturbing factor in breeding. But it is more disturbing than the former, in that it introduces variations that are undesirable. It resurrects from out the dead past what the breeders have been trying to eliminate. The frequent occurrence of a white calf in the breeding of Shorthorns which the breeders have been trying to avoid for generations, illustrates the disturbing character of this law. It may be that its existence is intended to compel the breeder to give careful attention to purity in blood lines, since its power wanes in proportion to the increase in the duration of the period covered by pure breeding.

Having thus briefly outlined these laws, the effort will be made to enlarge on some feature of their practical application to the operations of the breeder, and also of every farmer who breeds even one animal on his farm. The points that will be more particularly dwelt upon are those which relate to the evidence of prepotency in sires, to the improvement of live-stock through upgrading, and to the futility of promiscuous breeding in so far as it relates to the improvement of live stock.

Prepotency means the power possessed by a parent to transmit individual and breed properties to the progeny. The measure of its strength, however, is more evidenced in the former than the latter. Thus it is that prepotent sires produce uniformity in the stud, herd, or flock. The uniformity thus produced is proportionate to the prepotency of the sire and the excellence of the uniformity is at least measurably proportionate to the excellence of the individuality in the sire. The importance, therefore, of possessing good and prepotent sires cannot easily be overestimated. The truth that the sire is half the herd is only a half truth. He is as much more than half the herd as his prepotency exceeds that of each female parent in the same.

But how may it be known that a sire is prepotent before his prepotency has been actually proved, as evidenced in the offspring. The answer to this question is of all absorbing interest to the breeder, for sires are usually chosen before they have begotten progeny. This raises the question as to the probable guarantee of prepotency. These include purity of breeding; line breeding in degree and individual vigor.

Other things being equal, a sire is prepotent in proportion to the duration of the time that he has been bred pure. This result follows from the continuous increase in the dominant blood elements with increase in duration in breeding without the introduction of alien blood. Whether there is a time limit to this increase is as yet an unsettled question. In other words, it is not yet certain that an animal from an ancestry bred pure for a thousand years will be appreciably more prepotent than an animal bred from an ancestry kept equally pure for five hundred years. These dominant blood elements having become thus fixed and stable, are transmitted with at least reasonable certainty to the progeny.

Other things being equal, a sire is usually prepotent in proportion as he is line bred or otherwise. Line bred means bred within the limits of one family for at least several generations. The closer the relationship at the outset of the line breeding and the longer the duration of such breeding, the more prepotent the sire is likely to be. For instance, suppose a Shorthorn sire is chosen from the Missie family of Cruikshank Shorthorns. If the said sire is chosen amid progeny bred for generations from Missie sires and dams, no other Shorthorn blood meanwhile having been introduced, the line is likely to be more prepotent than if drawn from progeny whose ancestry included members of various families of Chuikshank Shorthorns.

Other things being equal, prepotency is strong in proportion as the sire is possessed of inherent vigor. This is in keeping with that other observed fact, that usually prepotency is stronger in an animal when at that age in which bodily vigor is greatest, rather than at an earlier or a later period in its life. The evidences of bodily vigor are form and action. The latter is usually spoken of as carriage, and, as an evidence of prepotency, it is probably some more important than bodily form. The evidences of bodily vigor are such as relate to strength and vigor for the breed. The most prominent of these, probably, is not chest size so much as chest capacity. Vigor in action may be nicely illustrated by observing the carriage of a Southdown male. The vigorous male steps quickly. He carries his head proudly. His full eye observes everything. The slightest sound causes him to prick up his ears. Such a male purely bred, is almost certain to be prepotent.

But what is meant by other things being equal? Simply this, that with each of the indications mentioned, the other indications shall be present in at least fair degree, and that the parents and progeny shall both be sustained with suitable food, fed in liberal but not in excessive supply. For instance, long purity of breeding will count far more if linked with line breeding and bodily vigor, and so of each of the other indications, and all these will be more potent when the feeding and management are favorable to high development.

In addition to the indications mentioned, the performance of the immediate ancestors for several generations should be carefully noted. By performances is meant what the animals have done in speed attainment, milk, meat or wool production, according to the end for which they are kept. Nor should the fact be lost sight of, that high performance in the ancestry is valuable as it is near, and less valuable as it is remote. High performance in the immediate parent of a sire is of great value, but high performance in an ancestor of ten generations in the upward line of ascent is of but little account. This will be readily apparent when it is remembered that the blood properties of an ancestor of ten generations, previously, are only present in an infinitesimal degree.

The claim, therefore, that an animal traces to some famous ancestor of many generations back, is of but little account. It can only deceive those who do not know. Excellence in performance in the near ancestry is not only valuable, but it is valuable in proportion as it is uniform in the near ancestry and far reaching in its comprehensiveness. By uniformity is meant evenness of performance in all the near generations, and by comprehensiveness, the extent to which various desired qualities are present.

By upgrading is meant the improvement of common stocks through the use of successive sires chosen from one and the same pure breed. For instance, when common females, it may be of mixed breeding, are mated with a pure bred Holstein sire, and when the female progeny continue to be thus mated in succeeding generations, the produce are termed grade Holsteins, and when this line of breeding is continued for several generations they are termed high-grade Holsteins. When good and prepotent sires are chosen, it is, in a sense, wonderful how quickly common stocks will be improved, providing the food given is suitable, and the care of the animals is proper.

When the process begins, mixed blood elements in the females is no detriment. It does not stand in the way of quick improvement. In fact, the reverse may be true, since every additional blood element lessens prepotency in the female. In other words, the less purely bred she is, the less the power that she will have to transmit her own properties. Consequently, when mated with a purely bred prepotent sire, the preponderance of resemblance in the progeny is to the sire. The preponderance in all essential properties will come from him also, and in both instances because of his superior prepotency.

Analyze further this upgrading process. Suppose the foundation female is a ewe secured from the range and that she is possessed of the blood elements of a dozen different breeds. She is mated with a prepotent Southdown male. Let the difference in blood elements or properties between the two at the outset be represented by one hundred. The first thought would be that fifty per cent. of the properties or elements in the progeny would be inherited from the dam and the same from the sire. That is not true. More than fifty per cent. of those properties come from the sire, as many more as the prepotency of the sire, in virtue of his purity of breeding, exceeds that of the dam. Less than fifty per cent. of those properties come from the dam, as many less as her prepotency or power to transmit her properties is less than that of the sire, as a result of her mixed breeding. The preponderance in properties in the progeny inherited from the sire will exceed those inherited from the dam, as much as the power of the sire to transmit his own properties because of his strong prepotency, exceeds that of the dam to transmit hers, because of her weak prepotency. This explains why in the first instance of such mating, the progeny bear so strong a resemblance to the sire.

The difference in blood elements at the first, as previously stated, may be represented by one hundred. Now, since the progeny inherits far more largely in such breeding from the sire, the difference in those blood elements will have been reduced more than fifty per cent. So far as the sire is concerned, the progeny will be possessed of far more than fifty per cent. of inherited properties from him. The exact per cent. represented by such inheritance cannot be exactly stated, but it would be approximately correct to say that seventy-five per cent. of properties in the progeny were inherited from the sire, which would leave twenty-five per cent. of the same to be inherited from the dam. Thus a great stride has been made in the very first mating. The difference in blood elements now between the Southdown sire and progeny will be represented by twenty-five instead of one hundred, as at the first.

Mate with a Southdown male again and the progeny of the second generation will be possessed of approximately ninety per cent. of Southdown properties; of the third generation of approximately ninety-seven per cent., and of the fourth generation, of approximately ninety-nine per cent. The progeny of the fifth generation will, in individuality and useful properties, be practically equal to pure bred Southdowns. This wonderful transformation may be accomplished in five generations of such breeding. In other words, the entire common stocks of farm animals in the United States could be transformed within the time named into pure breds, that is, into animals as good as pure breds, for practical uses. At the present time, however, the supply of pure bred sires would be far too little to accomplish such an end within the time.

Suppose that instead of pure Southdowns, grade Southdown sires had been used. If the prepotency of those sires in each instance exceeded that of the dams with which they were mated, then there would be improvement. The improvement would be proportionate to the excess of that prepotency. But even on the supposition that the prepotency of each Southdown male was superior, variable elements would probably appear in the progeny as the outcome of these elements in the sires, and these would in some instances, at least, make improvements slower, while such sires were used, the level of improvement reached would never equal that made in the former instance, and improvement would be made very much more slowly. The advantage, therefore, and profit, from using only pure bred sires is clearly apparent when these can be secured without excessive cost.

Suppose again, that the Southdown sires had been inferior individually, though purely bred, what would have happened? Why, because of their prepotency the result of the purity of their breeding, they would sustain their own individual superiority in the progeny. This might not have followed in some instances because of the influence of atavic transmission, resulting in bequeathing properties to the progeny possessed by superior ancestors. As a rule, however, the transmission would more or less resemble the inferiority possessed by the sire. The breeders of grades are usually content with a very common or inferior pure bred, because of the cheaper cost, but to invest in such is clearly a mistake. The place for all these inferior sires is the block in the case of meat-making animals, and in the dray or van in the case of horses. The breeder who chooses sires thus, makes a grievous mistake. An inferior sire is *dear* at any price. He is dear as a gift. The extent to which such sires have been used by the breeders of grades has greatly retarded live stock improvement.

The view so widely held that while the progeny of the first mating are a great improvement on the females from which they are bred, the progeny of the second mating and also of succeeding generations, is likely to be inferior, is a fallacy. In upgrading, such a result would be clearly impossible. The improvement will be continuous until the level of the breed is reached from which the sires are chosen. It is in cross-breeding that such results sometimes follow, that is, when sire and dam are mated each strong in the blood elements of a different pure breed. In such instances, usually but not always, the progeny is at least the equal of the sire or dam in useful properties, but not in prepotency. The improvement is probably the result of the renovating influence that would seem to inhere more or less in introduced alien blood. In succeeding generations, however, there may be a tendency to revert to one or the other of the two breeds thus mated, thus leading to uncertainty in the results and sometimes to retrogression.

What may be termed promiscuous breeding is the style of breeding most commonly practiced. The average farmer chooses a sire from a certain breed, it may be on the ground of convenience or because the breed for the time being is popular. Soon another breed becomes popular, and a sire is chosen from that breed. It may be that in a lifetime sires have been used from half a dozen breeds.

Now see what this means. Suppose, for instance, a pure Jersey sire is mated with a grade female of breeding that is much mixed, far more than fifty per cent. of properties in the progeny will be inherited from the Jersey. Suppose that now a pure Holstein sire is used in mating with the females thus begotten, the progeny will possess more than fifty per cent. of Holstein properties, but the Jersey properties will be proportionately eliminated. Suppose again that pure Shorthorn sires are chosen to mate with the grade Holstein females, then more than fifty per cent. of the properties will be Shorthorn, the Holstein properties will be proportionately reduced and the Jersey properties will be still further eliminated. Those who breed thus are like the man who, as often as he walks up the hill, walks down again, or like him who sails continuously in a circle. At the end of a lifetime of such breeding, the breeder will find himself just where he was when he started.

Upgrading is the true system of improving live stock. Cross-breeding, that is, the mating of two distinct breeds, should have but little place in the operations of the farmer. It may be advantageous in some instances, as when the dams and their progeny are to go to the block. It may be profitable, for instance, to cross aged Merino ewes with males of some better mutton breed, and to prepare both for the market by fattening them on rich pastures, but ordinarily such crossing should stop with the first cross. To carry it further would, probably, for a time at least, introduce elements of reversion.

But, it may be asked, are there no instances in which alien blood may be introduced with animals that have been upgraded? There are such instances, as when the animal thus graded have partially lost some useful property or properties. It is possible to restore those properties or at least to improve them greatly in some instances by the introduction of an outcross, that is, by making one cross from sires of another breed.

This may be illustrated in the condition of many of the high-grade herds of Poland Chinas in the corn belt at the present time. Many of these have too little bone, too little stamina and weakened breeding properties. One cross from sires of either the large Yorkshire or Tamworth breeds would lead to wonderful improvement along those lines. The breeders could then fall back again upon Poland China blood if they desired to do so. Such teaching may sound like rank heresy to some, but that it rests on a sound basis, will be found by all who put it to the test.

The way to improving the average stocks of the country is therefore so plain that any can understand. It is so entirely feasible that all may practice it and it is so inexpensive comparatively that every one may adopt it. But the thought should ever be present, that in all upgrading the food must be adapted to the needs of the animals, otherwise the improvement sought will be hindered in proportion as such adaptation is lacking.

Now I do not know whether I have been talking to you, farmers, in regard to anything you wanted to hear or not, or about what will help you. I think I better find out, so I think I better stop right here. I hope I am not through yet, but I want the audience to do the rest. I forgot to say to you right at the beginning, to think about this question, and if there are any of the points in regard to this that are not clear to you, be prepared to ask questions. Let your questions come in like a shower. I do hope that you farmers will have a lot of questions to ask in regard to this important matter. I do not think there is a more important matter relating to your work, or to those who are engaged in the breeding of live stock, than this very thing we are talking about this afternoon. Now let us have your questions.

Mr. Manchester. I would like to ask the gentleman this: We are breeding cattle and have been using pure bred Jersey sires for the last twenty years. According to the theory you are going on, our stock ought to be greatly improved. It has been improved, but not over three out of five are any improvement over the dam. Why is that so?

Prof. Shaw. You say not over three out of five?

Mr. Manchester. Not more than three out of five show any improvement on the dam.

Prof. Shaw. You remember that we have been talking about the law of variation. Now I suppose that explains it. I hope that you are not going to tell me that your herd now is not a pure bred herd, if you have been choosing pure bred sires for twenty years. I hope you are not going to claim that your herd is not as good as though they were pure bred, I hope you will not say that.

Mr. Manchester. I could pick out a great deal better pure bred herd.

Prof. Shaw. Of course, you know that breeding alone will not do it. There must be careful selection.

Mr. Manchester. If that theory of yours is correct, why are not all of them an improvement on the dam?

Prof. Shaw. Because of the operation of the law of variation. A man may be breeding from pure bred sires, and that man may be breeding in the very best possible manner, and yet probably one out of every three will not be as good. The principal thing for a man to do in breeding that kind of stock is to turn it off and save the best. There must be a constant selection along with the improvement in breeding.

Question. What is the cause of the law?

Prof. Shaw. I could tell you better if I understood how those animals were cared for.

Question. Is there any danger in using a thoroughbred sire after keeping him one or two years that he may not be prepotent? He may look all right but, unfortunately, may not be prepotent for reasons that cannot be seen.

Prof. Shaw. That is a good thought. It is true, you may get a sire that is not prepotent, and who may be purely bred. There is another mistake that farmers make sometimes. They sometimes get a pure bred sire that is prepotent, but he is an inferior individual. He has prepotency of the wrong kind. A sire of that kind is dangerous. You remember when I was talking, I presupposed that every sire chosen was good. A farmer should not use an inferior sire.

QUESTION. I would like to ask one question. How many sires were used in getting that result of ninety-nine good points of the same blood as the improved breed? That is, how many different sires were used in order to get that result?

Prof. SHAW. Five.

QUESTION. How could anybody tell? How could you get back to the blood of the original sire anywhere in that line?

Prof. SHAW. That depends on the man who is doing the work. I do not recommend it for a man who is not well versed in that work. He is very apt to make a mistake, but it can be done.

QUESTION. In other words, if we have a good sire this year, and next year a heifer should be bred to another sire, and the following heifer bred to still another sire, and so on down the line, do you get back to the original blood at all?

Prof. SHAW. That is the safest line of breeding, in my judgment. The other line may be adopted. A skillful man may adopt it. I might have attained this result by using simply three sires.

The PRESIDENT. Do you think that this rule is invariable? As I understand it, you say there is an invariable rule, but it does not seem to work always.

Prof. SHAW. The law of variation is always unquestionably operating.

Mr. STADMUELLER. I would like to ask a question as to how much the progress of breeding has been helped by not paying any attention to negative results? That is, suppose we select a sire, a prepotent sire, who has sired possibly a dozen cows of superior merit — doesn't that go to demonstrate some ability of the strain?

Prof. SHAW. I do not know that I understand the question. How do you explain that? Is that it?

Mr. STADTMUELLER. In other words, do we not exaggerate our knowledge in general regarding breeding? Do we know very much about it as long as we get negative results? For instance, take a certain sire, and say that ninety per cent. of his progeny is excellent, I am afraid that the records would show that only a very small per cent. of the greatest sires that ever lived have amounted to anything.

Prof. SHAW. I think I understand you. You are quite correct now. You mean where the prepotency is maintained in a remarkable degree? That is certainly true. It is rare. It is easy to find it in a fair degree, but not in a remarkable degree. In one case out of twenty-seven sires, I think only five were remarkably prepotent, the rest were only ordinarily prepotent.

Secretary BROWN. I would like to ask Professor Shaw whether the result produced there is the result of theory or practice. Is that the practical result which is attained?

Prof. SHAW. Why, gentlemen, I have already told you this: We began at the Minnesota station with a range ewe, very common grade of sheep. The blood all mixed up. We have no other animals bred quite as the range sheep are. We began some experiments at the Minnesota station. We used pure bred Southdown sires, the best that we could get. The Southdown is a mutton sheep. In three generations we beat the world at Chicago. Mark you, it was not in five generations but in three, and with that kind of breeding. That shows whether the theory holds good in practice.

Mr. PHELPS. I think now we are getting to the meat of the whole question. The Professor made the statement that in five generations he will produce a herd, by breeding graded stock, which would be just as good as a thoroughbred herd. I think possibly Prof. Shaw can do it, but I do not believe that five per cent. of the farmers of the State of Connecticut can or will do it. Now we have an instance here of a young farmer, whom I have known for a number of years, who has been working to upbuild his herd. He has been breeding from Jersey thoroughbred sires, and yet he says that only two out of five of the offspring have shown improvement over their dams. Now either the theory is wrong, or else the theory and the practice do not agree.

Prof. SHAW. Now just wait a moment. On what lines were those sires chosen? That is an important question.

Mr. PHELPS. I think that now we are getting to the heart of the matter. I think in five generations the average man will not produce a herd of graded stock that will be anywhere near equal to a herd of thoroughbreds, that the same man might probably produce, and I think it is owing to this reason. If he pays good money for a few thoroughbred females, he will be very ready to go out and pay a good, big sum of money for a sire to mate with such females. The average farmer has a herd of graded cattle which he knows to be worth from forty to fifty dollars, and he is not apt to use that care, and that forethought, and the amount of cash necessary, to get the kind of sire he ought to have. On the other hand, if he does not hesitate to pay for and use the right kind of a sire to mate with his grades, the result is much different. That, sometimes, is the reason why a man using thoroughbreds on both sides "gets there" faster than the man working with thoroughbreds on one side only.

Prof. SHAW. I did not say that he won't get there faster. I only say that what I have indicated is what the other man could do.

Mr. PHELPS. But I do not believe that five per cent. of the farmers of Connecticut will do it.

Prof. SHAW. I have shown you that it can be done in three generations.

Mr. STADTMUELLER. I am sorry that the gentleman who has been referred to has been obliged to leave the hall, because I believe he is a very good exponent of the very doctrine that Prof. Shaw has been promulgating this afternoon. He has been working upon the same identical theory. He has bred his animals by using pure bred sires, and the proof that the theory works out in actual practice, is that he admits, on the whole, that his herd is better. Now, from my personal knowledge of the case, and from what I have heard him state at institutes, and from personal statements he has made to me, I am safe in saying that his herd has a larger product in butter fat, and in the production of fine butter than the average herd of thoroughbred Jerseys. He has accomplished every result that Prof. Shaw insists may be accomplished, but the average farmer of the State of Connecticut cannot afford to come to the thoroughbred cow, because it requires more capital, and in the general market, the product of the thoroughbred cow will not bring one cent more. That brings about a condition that we must remember. We are not going to help the average farmer by preaching to him the necessity of starting out with thoroughbred dams. He cannot do it. I am very glad of the explanation which has been given here this afternoon by the gentleman.

We ought not to forget the fact that we are bound to have some disappointments in breedings thoroughbreds. I have been breeding thoroughbreds for over twenty years, and out of every five, even with thoroughbreds, there are quite a proportion that are not successful.

Mr. Phelps. I believe that both gentlemen are right. I believe, however, that we cannot afford to preach the doctrine that thoroughbred stock should not be kept by the average farmer, or, at least, by many more than now do keep it. I think, if a man is endeavoring to build up a good grade herd, the very best thing he can do is to mix in with that herd a small number of thoroughbred females, and then to breed the majority of his herd along grade lines, using, however, the same bull on the thoroughbred females that he does on the grade animals. Gradually, he will thus work from graded stock to thoroughbred stock, and then he will have a desirable product, and, not only a desirable, but a salable class of offspring.

Prof. Shaw. Mr. Chairman, I am exceedingly thankful for the side-lights that have been let in on this question by the last two speakers. I would like to say in this connection that I do not want to discourage the breeding or sale of pure bred females. I would rather that all animals in America were pure bred or registered stock than to have them as they are, but what I wanted particularly to represent to this meeting was this: That while perhaps nineteen farmers out of twenty have not the money to buy pure bred females, they do have the money, as a rule, to buy one male, and that if a farmer has a large herd, he can effect a tremendous improvement in that herd in that way. Now the suggestion made is perfectly correct, but I say let him introduce the pure bred blood as he can. If he cannot do any better than that, then introduce it as he can by introducing pure bred females. I would recommend that, however, only under this condition, that if he finds he has made a success of his graded stock. If he has not made a success of his grading he has no business to touch the thoroughbred stock, for he will make less of a success with the pure bred if he has has not been making a success with the graded cattle.

A Member. I would not object to it, provided the females had good strong stamina. I am a great stickler for stamina. I believe, gentlemen, that the difficulty with many of the pure bred sires today, is that we do not get stamina. If our animals are possessed of strong stamina of the right kind, we can use them to breed from.

Mr. Phelps. Do you object to vicious sires, provided they are properly handled, for use in breeding stock?

Prof. Shaw. Well, I would like to know what causes the viciousness. There is a viciousness that is inherited. I do not like that. There is also a viciousness that is caused by a man who does not know how to handle that animal. If it arises from any such source as that, I would not object to breeding from such an animal as long as the animal did not endanger somebody's life. It goes to show that such a sire has the right kind of vigor, such as I have been talking about. I do not like inherited viciousness, and would not recommend breeding from such a bull.

Mr. PHELPS. Are not some of the very best sires vicious sires?

Prof. SHAW. Yes sir, they are.

Mr. SEDGWICK. In breeding thoroughbreds, why do we get such a lack of uniformity in milk production among heifers of a given strain of blood? I have two three-year-old heifers, who are from two cows who are sisters by the same bull. The mothers are both what you might call smaller than the average as milkers. Both of these heifers came in about the same time and looked very much alike. One of them dried out at the end of three or four months. She did not hold out well in her milk at all. The other one continued for a year, and shows a tendency to a large yield or flow of milk still.

Now one thing further. I have bred Holstein cattle for the last twenty-five years, and I have noticed that same thing in thoroughbreds all the way along the line. It is an exception when you get an extra good heifer from among them. Why is that?

Prof. SHAW. There is no man in the United States that can answer that question. We simply have to recognize the fact. It is the outcome of the working of the law of variation, but why it is an outcome of the law of variation we cannot be quite sure. It may arise from the food, to some extent, or it may arise from exposure. From elements of that kind.

Mr. SEDGWICK. I have had precisely the same result from breeding what you might call scrubs; from these old red cattle of Connecticut. It seems to be impossible to get a uniform type that will increase the milk product in all instances.

Prof. SHAW. You cannot get any class of animals that will be uniform in producing good performances. There will always be variations. That never has been done since the world began. Whether it ever will be, I do not know.

QUESTION. I would like to ask the speaker if the progeny get their milk-producing power from the sire? Is that generally an acknowledged fact?

Prof. SHAW. I do not know whether you all heard that question. The gentleman asks the question whether the milking qualities are inherited from the sire or are they partly inherited from the sire and partly from the dam? I can answer that only in this way: that prepotence is always inherited from the animal that is the more prepotent. Whichever one is the more prepotent, the inheritance will be from that end. It is usually from the sire, because the sire is most always the more prepotent, but I would say right here that I am a believer in the fact that a male as such transmits such properties to the female. The female also transmits certain properties.

A MEMBER. A man must use his eyes in breeding cattle. I have had considerable experience in breeding. I bred for several years from graded bulls, and afterwards used a thoroughbred bull, which was not registered, and which was supposed to be selected with great care. It came from some of the most fashionable stock in the State of Wisconsin, but that bull proved worthless to breed from. He was a thoroughbred bull, but simply because he was not registered, did not have the standing of thoroughbred registered stock. Every farmer that wants to spend his money for a thoroughbred sire has got to choose wisely, or he is going to lose.

Prof. SHAW. That is a very good point.

A MEMBER. Can that be stated again? We did not hear that question back here.

Prof. SHAW. The substance of the statement of the gentleman is that a graded sire had been used, and afterwards unregistered sires chosen with very great care, and the results from the former were better than the results from the latter. I can readily understand how that would be possible, because you know if an animal is bred after the method I have been talking about for, say, about ten generations, even then you cannot get that animal recorded according to the rules in force now in any herd book. That sire, bred in that way, and particularly chosen, might be better than any registered sire. I will admit that.

Mr. Phelps. There is one very important lesson brought out right there, and that is, that a pedigree is nothing more or less than a record of the ancestry of an animal, and may be worth two cents, and it may be worth two hundred dollars. There may be an instance where an animal has no pedigree, simply because there was no printed record kept of the ancestry of the animal, yet it would not hurt the animal for breeding purposes. On the other hand, there are many animals with big, long pedigrees, which are of little value either for their direct product or their offspring.

A Member. I have listened with a good deal of pleasure to the statement which the Professor has made concerning his success at the international stock show, with his Southdown sheep, and I would like to ask this question. I am not a stock breeder, but I am curious if you are going to breed animals, for instance, mutton sheep, to send to the international stock show, would you, if you were going to do that again, select dams from range sheep and breed them with a fine Southdown, or would you breed the Southdown pure?

Prof. Shaw. I would rather prefer the former course.

A Member. With the native range sheep?

Prof. Shaw. Yes, and I will tell you why. There is no harm in introducing a little alien blood. That is very apt to strengthen the strain. Now I am ready to quarrel with all the live stock associations in the United States on this point, but no matter about that now. If an animal is bred for twenty generations in that way you cannot get that animal recorded in any herd book. I think it is a damage to the breeding interests, but perhaps that caution may be necessary. Be that as it may, a little alien blood gives stamina and generally increases the size, and does not prevent grading the stock up to a thoroughbred standard, provided it is chosen in the right way.

A Member. Could you, with your experience and your ability in choosing Southdown ewes, if you picked them out and bred them with your Southdown bucks, couldn't you get as good results as to go out on the range and use the same number of range animals?

Prof. Shaw. Well, I think there would not be much difference, but it would depend upon the range of choice that I had. I think it could be done. Of course, it could be done more quickly. If you took the other course, you would have to breed through three or four generations.

A Member. But you are going to spend six or eight years in getting your high-grade stock that way where it might have been attained by the first course, are you not?

Prof. Shaw. I do not say I would rather do that. I say it can be done that way.

A Member. How long will it take you to get that ninety-nine and two-thirds per cent. animal, how many years after you start?

Prof. Shaw. Five. There it is on the blackboard.

Q. Do you get those five generations in five years?

Prof. Shaw. I beg your pardon, but it would take at least ten years.

Q. Then why couldn't you start with a few good, well-bred animals and get more money in ten years by breeding than you are able to get by that plan? Is it not possible? I am asking practical questions, and not trying to bring up any side-light discussions.

Prof. Shaw. There may be some farmers present who have some two-thirds Jersey cows, we will say, today. There may be others present who have scrubs. Now the man who has the two-thirds Jersey, if he wants to improve his stock, he has got that much further on than the other man, and he will get to the perfection point so much the quicker because he is two-thirds of the way now. You see the point.

Q. What is the expense of such a sire as you speak of, and where would I go to work to find such a sire?

Prof. SHAW. It is impossible to answer that question definitely. The price might run all the way from fifty dollars to five hundred dollars. Of course, it would be absolutely absurd for an ordinary farmer to buy a five hundred dollar sire for a common herd, but I think he might afford, probably, to pay a hundred dollars, and, generally speaking, good sires of that kind can be gotten for near that price. For thoroughbred sires, of course, a man has to pay more.

Mr. TILLINGHAST. Mr. Chairman, I would like to ask the Professor if what he has said about animals would apply to poultry. Would the same law govern in poultry breeding?

Prof. SHAW. I am almost sorry that the gentleman put that question. Inasmuch as he puts it, I will answer it, but it conflicts with what I heard on this platform a little while ago. I should answer unhesitatingly yes, but I heard the statement from this platform, if I understood the speaker aright, and I am sorry he is not here to correct me, if I am mistaken — I heard him say that cross breeding, which is just the kind of grading I am talking about, would give seventeen cent eggs instead of forty cent eggs. I cannot understand that, gentlemen. I think I would rather trust to cross breeding to improve my stock, whether animals or poultry.

The PRESIDENT. This convention will stand adjourned until seven-thirty this evening.

EVENING SESSION.

December 13, 1905.

Music.

Convention called to order at 8 P. M., Vice-President Seeley in the chair.

The PRESIDENT. We are to have a stereopticon address this evening, the subject of which is "How shall we attract useful birds about our farm homes." Dr. Edward Howe Forbush, of Wareham, Mass., is the gentleman who will give the address, and he is now on the platform. I take great pleasure in introducing him to you.

HOW SHALL WE ATTRACT USEFUL BIRDS ABOUT OUR FARM HOMES.

BY EDWARD HOWE FORBUSH, WAREHAM, MASS.

Horace Greeley once said that the farmer who allows a man to shoot his birds would be just as consistent were he to allow him to shoot his cattle, for one is of as much value as the other. While this may be an extreme statement, it is probable that were all the birds destroyed the consequences would be quite as serious to the farmer as would be the destruction of all his cattle. Few people realize the value of the services that birds render to man in checking the multiplication of insect life.

When we fully appreciate the number, the fecundity, and the consuming powers of insects they assume an economic importance greater than can be accorded to the ravening beast of prey. Let us consider briefly the potency for evil that lies hidden in the tiny but innumerable eggs of injurious insects which require only the summer sun to give them destructive life.

The number of insect species is greater by far than that of all other living creatures combined. (More than three hundred thousand already have been described.) There are many thousands of undescribed species in museums. Dr. Lintner, the late distinguished State Entomologist of New York, considered it not improbable that a million species of insects would be found in existence. The number of individual insects is beyond human computation. Dr. Lintner says that he saw at a glance, in a small extent of roadway near Albany, more individuals of a single species of snow-flea, as computed by him, than there are human beings on the face of the earth. A small cherry tree, ten feet in height, was found by Dr. Fitch to be infested with an aphis or plant-louse. He estimated, first counting the number of these insects on a leaf, the number of leaves on a branch, and the number of branches on the tree, that there were twelve million plant-lice on that tree; and it was only one tree of a row similarly infested. To give the reader an approximate idea of the number of insects on the tree, it was stated that were a man to count them singly and as rapidly as he could speak, it would require eleven months' labor at ten hours a day to complete the enumeration.

Insects are enormously reproductive, and were the progeny of one pair allowed to reproduce without check they would cover, in time, the entire habitable earth. The rapidity of propagation as shown in some insects is, perhaps, without a parallel in the animal world. In order to give some idea of the powers of multiplication of the Colorado potato beetle, the *Canadian Entomologist* states that all its transformations are effected in fifty days, so that the progeny of a single pair, if allowed to increase without molestation, would amount, in one season, to over sixty millions. Speaking of the power of multiplication shown by plant-lice, or aphids, Dr. Lintner says that Professor Riley, in his studies of the hop vine aphis (*Phorodon humuli*) has observed thirteen generations of the species in the year. Now if we assume the average number of young produced by one female to be one hundred, and that every individual attains maturity and produces its full complement of young (which, however, never occurs in nature), the number of the twelfth brood alone, not counting those of all the preceding broods of the same year, would be 10,000,000,000,000,000,000,000 (ten sextillions) of individuals. Where, as in this instance, figures fail to convey any adequate conception of numbers, let us take space and the velocity of light as measures. Were this brood marshaled in line with ten individuals to a linear inch, touching one another, the procession would extend to the sun (a space which light traverses in eight minutes) and beyond it to the nearest fixed star (traversed by light only in six years), and still onward in space beyond the most distant star that the strongest telescope may bring to our view, to a point so inconceivably remote that light could only reach us from it in twenty-five hundred years. The smallest approach to such unchecked multiplication on the part of this insect might paralyze the hop-growing industry. While the aphids may represent the extreme of fecundity, there are thousands of insect species, the unchecked increase of any one

MR. DIKE, WHO FEEDS THE WILD BIRDS ABOUT HIS HOME. IS HERE SHOWN WITH A CHICKADEE EATING SEEDS FROM HIS CAP.

of which would soon overrun a continent. Kirkland has computed that the unrestricted increase of the gypsy moth would be so great that the progeny of one pair would be numerous enough in eight years to devour all the foliage in the United States.

Many insects are remarkably destructive because of the enormous amount of food which they must consume to grow rapidly to maturity. Many caterpillars eat daily twice their weight of leaves, which is as if an ox were to devour every twenty-four hours three-quarters of a ton of grass. Their voracity and rapid growth may be shown by the statement of a few facts: A certain flesh-feeding larva will consume, in twenty-four hours, two hundred times its original weight; a parallel to which, in the human race, would be an infant consuming, in the first day of its existence, fifteen hundred pounds of food. There are vegetable feeders, caterpillars, that during their progress to maturity within thirty days, increase in size ten thousand times. To equal this remarkable growth, a man at his maturity would have to weigh forty tons. Mr. Leopold Trouvelot, who introduced the gypsy moth into this country, says: "The food taken by a single American silkworm (*Telea Polyphemus*) in fifty-six days equals in weight eighty-six thousand times the primitive weight of the worm." In view of such statements, need we wonder that the insect world is so destructive and so potent a power for harm!

When we consider the dangers arising from the immense numbers, fecundity, and voracity of insects, the fact that insects new to cultivated crops are constantly appearing becomes a source of grave apprehension. Every year economic entomologists, who are constantly increasing our knowledge regarding insect pests, discover new insects attacking important crops or trees. Dr. Lintner made a list of insects injuring apple trees in the United States, which was published in the appendix to his first report as entomologist of New York state. It contained one hundred and seventy-six species, while large though lesser numbers have been found on the plum, pear, peach, and cherry. Dr. Packard described four hundred and forty-two species which prey upon our oaks, and believed it not impossible that ultimately the number of species found on the oaks of the United States would be from six to eight hundred or even one thousand. The list of insects which feed on grasses, cereals, field and garden crops is very large and constantly growing, for it is continually receiving accessions both from native and foreign sources.

The destructiveness of some of these insects is so enormous as to amount to a heavy annual tax on the people of the United States. Hence, since the first settlement of the country, the amount of this annual tax has been increasing. In September, 1868, Professor D. B. Walsh, editor of the *American Entomologist,* estimated that the country then suffered from the depredations of noxious insects to the amount of three hundred million dollars annually. By the census of 1875, the agricultural products of this country were valued at two billion five hundred million dollars. Of this amount, says Dr. Packard, we, in all probability, annually lose over two hundred million dollars from the attacks of injurious insects. In the report of the Department of Agriculture for 1884, the losses occasioned by insects injurious to agriculture in the United States, it is said, are variously estimated at from three hundred million dollars to four hundred million dollars annually. In 1890, Professor C. V. Riley, in response to a letter of inquiry, stated that no very recent estimate of the injury done to crops by insects had been made, but that he had estimated some time previously that the injury to agriculture by insects in the United States exceeded three hundred million dollars annually. Mr. James Fletcher, in his annual address as president of the Society of Economic Entomologists, in Washington, in 1891, stated that the agricultural products of the United States were then estimated at about three billion eight hundred million dollars. It was believed that a sum equal to about one-tenth this amount, or three hundred and eighty million dollars, was lost through the ravages of injurious insects. The latest calculation of the loss occasioned by insect injury in the United States which has come to my notice is that of Dr. C. L. Marlatt, who, by careful estimates, approximates the percentage of loss to cereal products, hay, cotton, tobacco, truck crops, sugars, fruits, forests, miscellaneous crops, animal products, and products in storage. Dr. Marlatt attributes a loss of eighty million dollars to the corn crop alone, and approximates the loss to the wheat crop at one hundred millions each year. The injury done to the hay crop is estimated at five hundred and thirty thousand dollars, while the codling moth alone is believed to injure fruit crops to the amount of twenty million dollars. His statement, based on the value of farm products as given in the Reports of the Bureau of Statistics of the United States Department of Agriculture for 1904, gives the loss from insect depredations for that year as seven hundred and ninety-five million one hundred thousand dollars, and this is believed to be a conservative estimate of the tax now imposed by injurious insects on the people of the United States, without reckoning the millions of dollars that are expended annually in labor and insecticides in prosecuting the fight against insects.*

In considering the losses caused by insect pests, and the possibility of preventing them, it is well for us first to observe how nature, if left to herself, provides a system of checks, which in the forest or wilderness operate to maintain the balance of life so nicely that, ordinarily, neither low-growing plants, shrubbery, nor trees, suffer greatly from the attacks of insects.

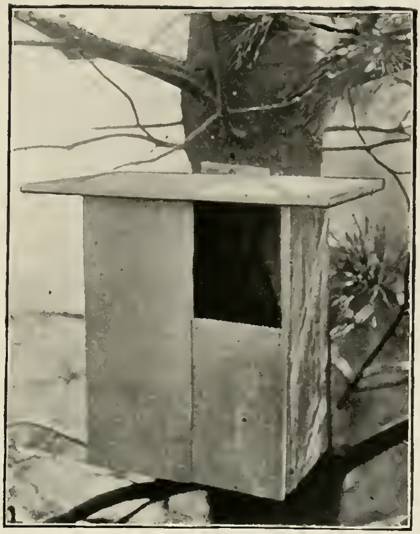
First, birds, bats, other insectivorous mammals, batrachians, reptiles, and predaceous insects, feed upon injurious insects, and thus hold their increase in check. These are the primary controlling agencies. When these fail, parasitic insects, increasing, attack the insect hosts, and when these also prove ineffective — when vegetation is destroyed and the food supply exhausted — disease and starvation kill off the swarming insects and give vegetation a chance to renew itself. These latter agencies, which are so effective under natural conditions, are of less immediate service to the farmer, however, in checking injurious insects than are the birds, for, although parasites, disease or starvation, ultimately check many great outbreaks of injurious insects, these most effective checks do not avail until such insects are most numerous, usually in the second year of their abundance, when it is too late to save the crops. The birds, on the contrary, form a mobile standing army, that can be concentrated at once upon any insect outbreak, reducing it before it has done much harm. This quelling of insect invasions by birds is a common occurrence, but is seldom noticed for the reason that birds often suppress the insect uprising before it has become apparent to common observation, or has done any considerable injury. The instances where birds fail to check insect outbreaks at once attract attention, for then

* "The annual loss occasioned by destructive insects in the United States," by C. L. Marlatt, Year book, U. S. Department of Agriculture, 1904, p. 464.

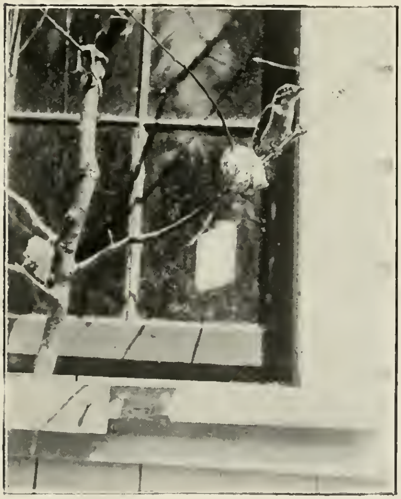
these uprisings soon become apparent because of the injury they do. Birds would ordinarily hold in check all insects which they eat with avidity were it not (1) that the birds have been much reduced in numbers; (2) that man in planting and cultivating crops makes conditions favorable for the propagation of insects and unfavorable to the increase of birds. Many species of birds, especially game birds, are gradually disappearing; a few are extinct. The farmer, by devoting large areas to a special crop, and growing the same crops year after year, offers the insects that infest those crops a splendid opportunity to multiply, while the cultivation of the field drives out the birds that formerly nested there.

Birds are remarkably active and energetic creatures, having a high temperature, rapid circulation and respiration, and requiring a tremendous amount of food to sustain their activity and repair the waste of the tissues.

Some of the smaller birds require only half an hour to an hour and a half to digest a full meal, and the stomach is filled many times each day. The rapidly growing young need far more food in proportion to their size than do the old birds. An adult crow will eat from five to eight ounces of food daily. A young crow, nearly fledged, requires about ten ounces. Professor Treadwell found that a young robin needed, daily, a quantity of beef equal to one-half its own weight, or forty-eight per cent. more than its own weight in worms, to secure its healthy growth and development. Where insects are numerous, birds eat them with almost incredible rapidity. My assistant, Mr. F. H. Mosher, saw a pair of tanagers eat thirty-five newly hatched caterpillars in a minute. They continued eating these minute insects at this rate for eighteen minutes; so that, if Mr. Mosher's count is correct, they must have eaten in this short time six hundred and thirty of the little creatures. This would not make them a full meal, as the entire number would hardly be equal in bulk to one full-grown caterpillar. By carefully watching two yellowthroats, and counting the plant-lice they ate, he estimated that they destroyed seven thousand within an hour,— a thing almost incredible, but still possible, when we consider the exceedingly small size of the insects at the time, their swarming numbers, the activity of the chickadee, and its remarkably rapid digestion. Dr. Judd speaks of a letter received from Mr. Robert H. Coleman, in which he



A HOME FOR A SCREECH OWL.



DOWNY WOODPECKER ATTRACTED TO
THE WINDOW BY SUET.

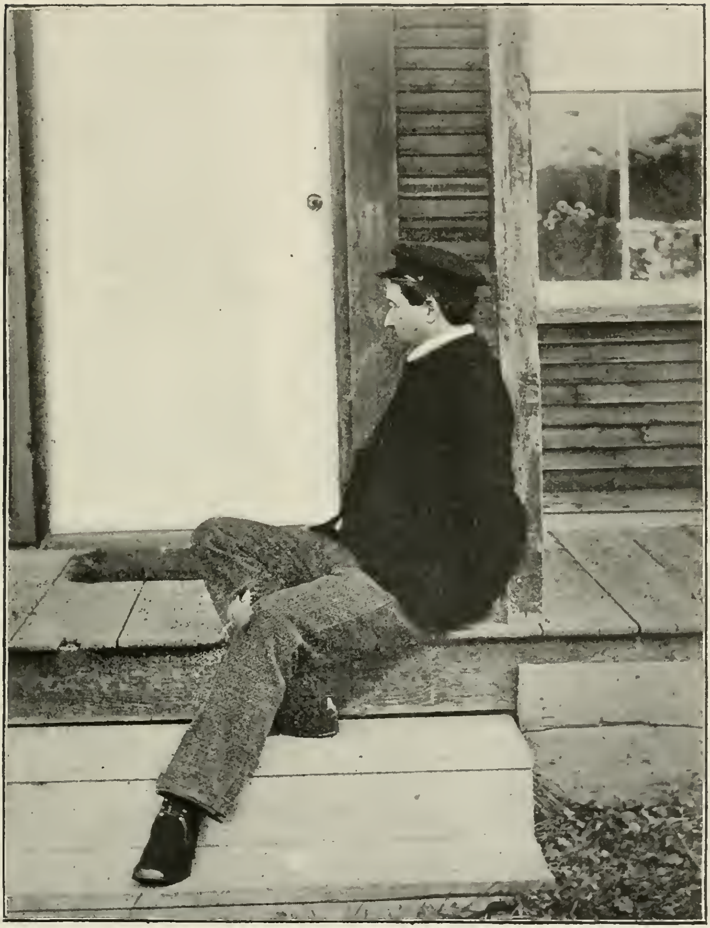
VIREO FEEDING HER YOUNG.
(Photograph by C. A. Reed.)

says of a palm warbler that he watched, that it must have killed nine thousand five hundred insects in about four hours. These may be extreme cases, but even if we halve the numbers given, they will still show the bird's possibilities for good.

The remarkable appetites of the young birds keep their parents very busy. The old birds usually carry to the young from one to twelve insects at each visit to the nest, although some visits are made for other purposes. A pair of vireos visited the nest one hundred and twenty-five times in ten hours. A pair of chippies made nearly two hundred visits to their young in a day. Two martins have been seen to visit their young three hundred and twelve times in fourteen hours. A pair of rose-breasted grosbeaks made four hundred and thirty-six calls at the nest in eleven hours. House wrens have been seen to enter their nest from thirty to seventy-one times an hour.

If we turn for a moment to the records of the amount of food found in birds' stomachs by dissection, we can see at once why they are such effective checks on the increase of insects. A large part of the alimentary canal is often packed with food. The stomach of a bird is not seldom found to contain, as Professor Beal remarks, enough food to form a pile "two or three times as large as the original stomach with food all in it." Where birds have no crop or special enlargement of the gullet, to contain an extra supply of food, the whole gullet is used for this purpose, and when favorite food is abundant the bird will fill itself to the throat. The amount of food found in the stomachs of birds, as given by the investigators connected with the United States Biological Survey, seems large, but anyone can verify the statements made by examining the stomachs for himself, for they are all preserved and kept for reference. Professor Beal found in the stomach of a yellow-billed cuckoo two hundred and seventeen fall web worms, and in another two hundred and fifty American tent caterpillars. Two flickers were found to have eaten respectively three thousand and five thousand ants. Sixty grasshoppers were found in one nighthawk's stomach, and Professor Harvey has found five hundred mosquitoes in another. Seven thousand five hundred seeds of wood sorrel had been eaten by a mourning dove, six thousand four hundred by another, and nine thousand two hundred, chiefly of weeds, were found in a third. Dr. Judd says that the stomachs of three bank swallows contained, altogether, two hundred ants, and a nighthawk has been known to take a thousand at a single meal. One thousand seven hundred seeds of weeds had been taken at one feeding by a bob-white; three thousand leguminous seeds were found in another, and no less than five thousand seeds of pigeon grass were taken from a third. Dr. Warren has taken twenty-eight cut-worms from the stomach of a red-winged blackbird. Stomachs of snow-flakes examined at the Biological Survey have contained from five hundred to fifteen hundred weed seeds. Professor Forbes took from the stomachs of seven cedar birds, or cherry birds, nearly one hundred canker worms each. In a letter recently received from Professor Beal he says that one hundred entire beetles were found in the stomach of a cliff swallow; that from the stomach of a yellow-billed cuckoo there were taken the remains of eighty-two caterpillars, each of which was originally from one to one and one-half inches long; another had taken eighty-six, and from forty to sixty were found in several others. From the stomach of a Franklin gull there were taken seventy entire grasshoppers, and the jaws of ninety-five more, showing that it had eaten one hundred and sixty-five grasshoppers. Another contained ninety grasshoppers and one hundred and two additional jaws. Another contained sixty-eight crickets. These grasshoppers and crickets were each more than an inch in length. When we consider that the digestion of birds is continuous, and that when food is plentiful the stomach is filled many times each day, the effect that must be produced on the insects with which birds satisfy their appetites will be more clearly understood. There are many records of the benefits resulting from the insectivorous habits of birds, and many others which tell of the increase of injurious insects which has followed the destruction of birds, but time will not allow me to quote them here, for the chief question to be considered tonight is, "How shall we attract and protect the useful birds about our homes?"

He who is about to purchase a farm or country place may, by keeping in mind the attractions which birds require, secure a place naturally well adapted to their wants. Such a place should be so situated as to provide shelter from cold northerly winds and storms. It must be well watered, and partly wooded with groves or patches of evergreen trees and windbrakes of



A CHICKADEE COMES TO MR. A. C. DIKE'S DOORSTEP AND ALIGHTS UPON HIS KNEE.

trees, shrubs, and vines. It should be near a small swamp, a meadow, or large stream, which should also be sheltered by woods or hills upon its north side. It should have a great diversity of wild vegetation, including a variety of fruit-bearing trees, shrubs and vines. If the place be situated in a broad river valley, it is likely to be visited by many migrating birds.

Were I selecting a place with special reference to its fitness to maintain bird life, I should prefer to have a large portion of the land wooded. If there are too many trees, they can be cut in much less time than it takes to grow them, and those trees, shrubs and vines, especially attractive to desirable birds, can be left. There should be an orchard with some trees going to decay, thus furnishing homes for woodpeckers and cavities for such birds as nest in them. There should also be an old field, much pasture and mowing land, with cleared land enough besides for garden and cornfield. As this is a brief description of many New England farms, one need not go far to find such a place.

The cultivated cherries are well known to be among the most attractive of bird foods, and those who have enough cherries for themselves and the birds are fortunate. Those not well provided with cherries may protect their fruit by planting the Russian mulberry or shadberry, for these fruits ripen as early as the earliest cherries and appear to be preferred by the birds. The greatest difficulty encountered in cultivating the shadberry, is that the birds get all the fruit. Since I first learned, by my own experience in Medford, that birds prefer mulberries to cherries, I have found that many farmers and fruit growers have had a similar experience.

We may protect our fruit in this manner, but how shall we get the best results from the presence of the birds? At present birds are not often numerous enough to do more than reduce somewhat the numbers of injurious insects. Birds have abundant choice of insect food and are not compelled to make a close search for their prey. Now if we can attract more birds to our orchards than would ordinarily come there, and keep them there, especially in winter, by supplying them with a little inexpensive food to tide them over the storms, they will search the trees so thoroughly that few insects will escape. If we wish to secure the greatest good possible from birds at points threatened with insect attack, we must maintain there a larger bird population than the land will support under ordinary conditions. How to do this with the least trouble and expense becomes our next study. It is well to begin with the winter birds, as they are of the utmost importance to the farmer because of their destruction of weed seeds and hibernating forms of insects. Insects lie dormant in some form for six months or longer, each year, and so they cannot escape the attacks of birds. The winter birds are obliged by necessity to search them out. One bird can destroy, during a winter, at least one hundred times as many insects in embryo as it can in the same time in summer when the insects have grown larger. In winter, the farmer is likely to have more time to attend to birds than in summer, and at that time they most need his help. No doubt thousands of birds are starved in hard winters that might be saved with very little trouble on the farmer's part.

It is very desirable to keep with us, so long as possible, the many species of sparrows which pass through the country on their way south in the fall, and to persuade some of them to remain through the winter. Careless husbandry tends to bring these birds about; they gather to feed upon weed seeds in neglected gardens and fields. But if we wish to have them continue this good work all through the winter and spring, they must be provided with food and shelter to which they can resort during snow storms and afterward while the snow lies deep, or when all vegetation is covered with a coating of ice from driving sleet or freezing rain. Unless they are thus provided for, they must either go farther south or succumb to the inclemency of winter.

The sparrows prefer the shelter afforded by thickets, and tangles of deciduous bushes and vines, such as are sometimes found on the south side of a hill near the edge of a swamp. A few brush piles will give them additional shelter. A little chaff from the barn floor scattered in the dooryard, whenever a flurry of snow covers the ground, will bring them about the house. Where there are scratching sheds for poultry, with the south side of each shed open except for its screen of poultry netting, the birds will find shelter and food on cold stormy mornings. These sheds are strewn with straw or other litter, which is likely to contain weed seeds, and fine particles of grain overlooked by the fowls. In time the birds become bold

CHICKADEES (SEEN THROUGH THE WINDOW) FEEDING ON SUET.

A WINTER SHELTER FOR BIRDS.

enough to enter the sheds even when the fowls are there, and they will always resort to them in the early morning before the hens are out. Birds readily pass through ordinary poultry netting, and when once in the sheds they are safe from the attacks of cats and hawks. Those who wish to provide any food more attractive than the above, have their choice of the various seeds sold at the bird stores.

Farmers should always grow sunflowers for the fowls. These will attract goldfinches; sunflower heads or the detached seeds make a good winter bird food. If the farmer wishes other bird food, he can give one or more of the children a small patch of land near the house on which to raise Japanese millet. This is merely a cultivated and improved variety of barnyard grass (a common weed) and sparrows seem to be fond of it. If sown broadcast on rich, moist soil, it will grow from five to seven feet in height, and the large seed heads will supply an immense quantity of seed. It takes but three or four square rods of land to produce all the seed one will need for birds in winter. A bushel or two ought to suffice for the birds during an ordinary winter.

Winter is the time to feed jays and crows. If they do not molest the smaller birds, they can do no harm in winter, and they may do much good. In Massachusetts the jays are already learning to eat the larvæ of that notorious pest, the brown-tail moth, which hibernates in winter in "nests" upon the limbs and twigs.

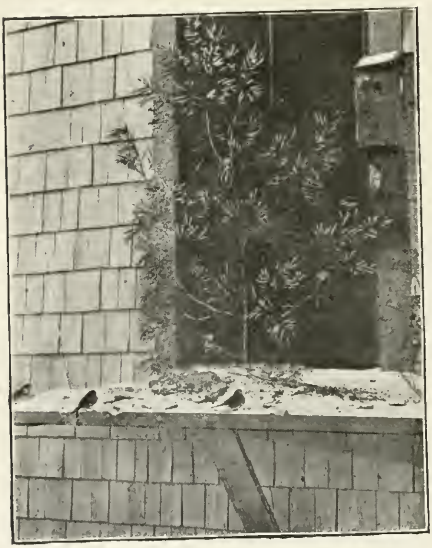
Hang up a bit of worthless meat in a tree. It should be high enough from the ground to be out of reach of dogs and far enough from the house so that the cautious crow will trust his precious skin within the distance. The skinned carcass of a fox or cat will do very well; but it will not last long after the crows find it. It should be so placed that they can find no convenient roost within reach of it, for it will then last the longer and keep more crows from starvation. When the snow is deep they will resort to it, and when the ground is more or less bare, they will still remain and hunt field mice and hibernating insects in the fields or the shrubbery along walls and fences.

Woodpeckers, nuthatches, and chickadees are all attracted by animal food. Juncos and tree sparrows will eat it during deep snows when their usual food is buried. Unsalted bones with meat, fat, or marrow attached, beef or mutton tallow, fat or suet, all may be used for this purpose. Uncleaned bones from the market hung upon the orchard trees will furnish food for these birds. Fat or suet will give them the needed animal heat on which they must rely during the coldest weather. If a bird can get food enough, it can withstand very cold weather, but if it starves, it soon freezes. Bones and suet should be put out early in the fall, that they may attract and hold birds that are migrating. These food materials should be renewed occasionally until late in spring, for when we have once taught the birds to rely upon them, we must keep up the supply, if we wish to retain the birds; if they are not provided with a never-failing food supply, storms may drive them away or starve them. When birds have found the food provided for them and have become accustomed to look for it daily, we may, if we will, attract them about or even into our dwellings.

Chickadees and nuthatches are remarkably unsuspicious, and may be taught to eat from the hand of any one who cares to spend the time necessary to accomplish that end.

Several other species may be enticed to our doors and windows, where their habits and manners may be watched and studied in comfort during the most inclement winter weather. To accomplish this, and at the same time to see the birds upon the limbs and in their natural attitudes, small shrubs or branches may be fastened upright to each window sill that may be selected as most convenient for the purpose. The branchlets and twigs may extend over the entire window and they may be further supported by being tacked here and there to the window frame. Small pieces of meat, fat or suet, may then be tied on the branches. These morsels should be well wound with twine, to prevent any bird from tearing one down or carrying it off bodily, and should be tied up about a foot apart that the birds may all have an opportunity to come at the same time, if they wish to do so. If only one piece of meat is provided, the birds are likely to fight over it, or to drive one another away; but if the above directions are followed, they will soon learn that there is enough for all, and several birds may be seen feeding at once at the same window. While these birds are being thus attracted to the windows, the sparrows also may be drawn about the house by chaff or bird seed thrown upon the ground or snow.

THE BIRDS' CHRISTMAS TREE.
(CHICKADEE FEEDING.)

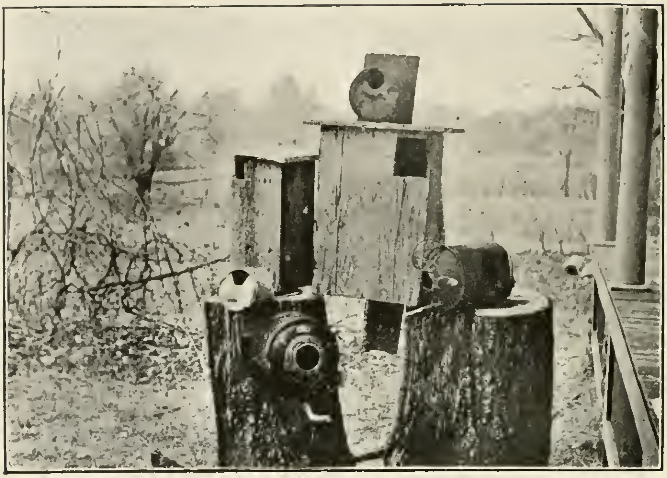


JUNCOS ON THE WINDOW SHELF.

Next a shelf or table may be made of half-inch box boards. The side of a large shoe box will do. This may be covered with old bagging and a cleat or rail put about the edge to prevent the food put on it from blowing away. A little evergreen tree may be set up on the shelf which is then fastened under a window sill, as seen in the plate, and the birds' Christmas tree is ready. Various food materials are fastened to the tree. Chaff and seed are scattered on the shelf, and when the first snowstorm comes, if not before, sparrows, chickadees, woodpeckers, and perhaps even jays will visit the shelf at intervals all day. This feeding shelf can be attended to, the snow brushed off, and the food replenished from within by merely opening the window. If the birds are shy at first, a lace sash curtain may be put up, and any one may then sit at the window and watch them as well as though they were hung up in a cage in the house. The birds may quarrel some at first, but they will soon learn to feed together in amity, and so with very little trouble and care we can establish a winter aviary out of doors. This shelf should be high enough to be out of the reach of cats and dogs, so that the birds may feel safe in coming there. In time they will become so tame that they will come into the house when the window is left open and will take food from the table. We have to keep the doors and windows closed at my home, else the birds will come into the house. The chickadees always come into the woodshed when the door is left open, and there they search the woodpile for borers. One bird came several times to take from the hand a borer that was held out to him. We have had about the house at different times, flocks of from thirty to fifty juncos and tree sparrows, many jays and chickadees, and one or two pairs of nuthatches of both the common species; while flickers, kinglets, creepers, cross-bills, robins, quail, and pheasants come in greater or less numbers. In 1903-04 two fox sparrows stayed all winter, and this year a towhee or chewink is still with us. Myrtle warblers and meadow larks are commonly seen, and one season a pine warbler came in January. Their presence gives a healthy stimulus to observation and serves to break the monotony of winter isolation upon the farm, while as one result of it our trees are seen all summer in full foliage and never suffer seriously from the attacks of insects. The sparrows also help by eating most of the weed seed in the garden.

Our first attempt at availing ourselves of the services of winter birds was made in 1896. The birds were attracted to an old orchard by the methods just described, and in the fall, winter, and spring they destroyed thousands of the eggs of the cankerworm and tent caterpillar moths, probably also the larvæ and pupæ of the codling moth, as well as scale insects, and other enemies of the trees. When spring came, efforts were made to attract the summer birds to the orchard with such success that they destroyed most of the insects that were left by the winter birds, and our orchard retained its foliage and bore a good crop of fruit in a year, when nearly every other orchard in the town (Medford, Mass.) was leafless and fruitless because of the prevalence of insect pests.

The food of the birds in our orchard was carefully studied, and the numbers of insects consumed by them estimated. For example, four chickadees were found to have eaten at one meal one thousand and twenty-eight eggs of the fall cankerworm moth. Four birds killed later in the season were found to have eaten one hundred and five egg-bearing females of the spring cankerworm moth. As the female moths had, on the average, one hundred and eighty-five eggs each in their ovaries, these four birds had destroyed at one meal over nineteen thousand of these eggs. My assistant, Mr. C. E. Bailey, estimated that each chickadee would consume each spring 138,750 of these eggs. It is easy to see why our trees were not leafless that summer. In spring and summer, birds are attracted about our homes mainly by the insects and fruit to be found there, and if the farm is well provided with these, there ought to be no dearth of birds. Still it is a good plan to keep our feeding shelf supplied with food all the year round, and in warm weather, a pan of fresh water will be used daily unless there are other places near by, at which the birds can drink or bathe. At nesting time a little nesting material hung on tree or fence will sometimes decide birds to nest near by. Swallows and phœbes may be induced to nest, if they have free entrance into the farm buildings, and projections are available on beam or rafter, which will give needed support to their nests. But the most successful plan to assure the presence of certain birds, is to put up bird houses and nesting boxes. These boxes may be inexpensive. Large cigar boxes will do for wrens, but should



INEXPENSIVE NESTING BOXES.

YOUNG CHICKADEE JUST FROM THE BOX.
(Photograph by C. A. Reed.)

be used only where sheltered from the weather, for sun and rain will soon warp and crack them, thus rendering them leaky and unfit for use. Other small boxes may be utilized. Very acceptable bird boxes may be made of hollow limbs.

For practical utility a nesting box should not only provide the birds with an acceptable nesting site, but it should also furnish them perfect protection from the elements, and should be so made that the interior can be quickly examined and the contents removed, if necessary. The entrance must not face prevailing storms. The box must be so strong that woodpeckers cannot easily enlarge the entrance sufficently to allow enemies of the occupants to get in. It must be placed beyond the reach of cats or other night prowlers. All these essentials may be secured without expense by using worn-out or discarded utensils or receptacles. In a few minutes an empty tomato can may be made into a bird box by slitting the tin of the opened end twice and turning down the piece between the slits, thereby making a hole not over an inch wide and high. It can be put up very quickly by placing the bottom of the can against a tree trunk and nailing it there with two wire nails driven diagonally through the edge, or by fastening it to a board or pole, which can be attached to a tree or building. The cover may be kept in place by pinching the mouth of the can a little. This is a practical box for wrens, and it may be used by bluebirds, if the entrance is made larger. When holes are cut through tin, the sharp edges around the opening should be turned over with a pair of pliers, that the birds may not injure themselves while passing in or out. Rusty or painted tin is the best, for birds seem suspicious of bright surfaces. There should be a few nail holes in the lower side, to allow any water that drives in to escape. Milk cans, oil cans, tin tea kettles, large tin funnels, flower pots, sections of stovepipe, drain pipe, and various other objects may be utilized, but those are best which, like pails, milk cans, or tea kettles, have removable covers. The cover should also be made to fit rather tightly, that it may not be too easily removed.

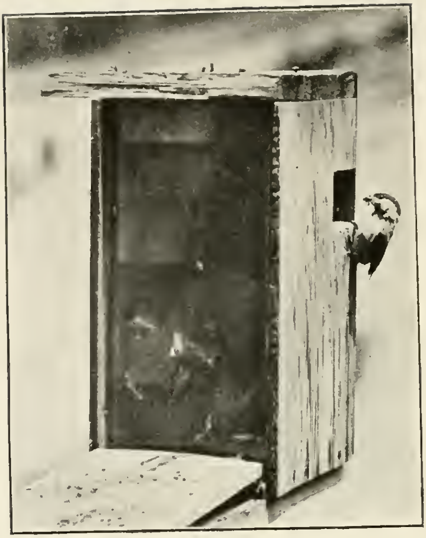
My experience indicates that chickadees prefer a wooden doorway to their tin castle.

Ornamental bird houses add to the attractiveness of a country home, and may be displayed where old tin cans and cheap bird boxes would be out of place. In building such bird houses, the best plan is to imitate the design of some dwelling. A pretty cottage or country villa in miniature may be constructed.

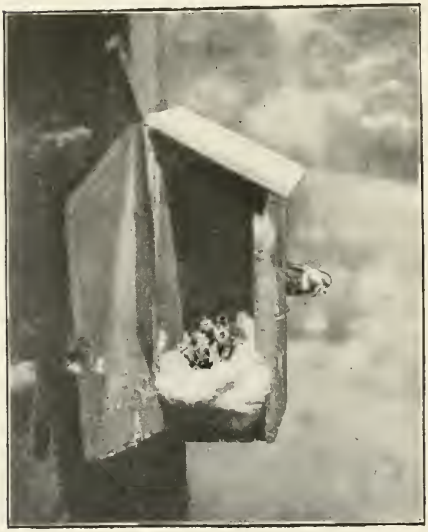
A house for a large martin colony ordinarily involves the expenditure of a considerable sum; but a very good house that will accommodate a colony of ordinary size, may be made from a flour barrel. The roof is of zinc, or of wood covered with painted canvas. The house should be placed on a pole, at least fifteen feet high. It should have several large rooms, six or eight inches square, with entrances two or three inches in diameter, that it may offer plenty of room for several pairs of birds, and that each tenement may be readily inspected and cleaned when necessary. A house of this size will accommodate so large a community of martins, that when once intrenched within, they will be able to hold their own against bluebirds, or sparrows. The rooms should be so tight that there can be no draft, and the whole house should be painted in light colors, that the young birds may not suffer too much from the rays of the hot sun. It is well to have the floor of each tenement a few inches below the entrance, that the young birds may not be readily pushed or crowded out of the nest and so become a prey for cats. Such a catastrophe may be still further guarded against by having a piazza extending around the house below each tier of doorways, and constructing a railing three inches high around it. Each of these platforms should have a slight downward slope, to carry off the rain and prevent it from driving into the doorways below. In fitting up rooms, a square box should first be made to go up the center of the barrel. All the rooms will be backed by this, and the pole will go into it.

Generally a bird will use a box much larger than it needs, but it will not occupy one which it deems too small. For chickadees, the hole should be at least nine inches from the bottom of the box; they sometimes use a one and one-eighth inch hole, but prefer one an inch and a quarter in diameter. The entrance should not be larger, for then the bluebirds or swallows may use it. Bluebirds require a one and one-half inch entrance, while a two-inch hole will do for martins.

During the past few years I have been experimenting with nesting boxes, in the hope of attracting about the house some birds that do not ordinarily breed there. As there were a few



THE "OBSERVATION BOX" ON THE WINDOW SILL.



A CHICKADEE FAMILY IN A WINDOW BOX.

chickadees in the woods not far away, I first attracted them to the house in winter by putting out food, then I put up a few boxes near the house in the hope that the chickadees might use them. As spring approached all the hollow trees and decayed stumps that might be chosen as nesting places by these birds within a radius of many rods of the house were cut down. Soon a pair of chickadees began to build a nest in what we called an observation box, which had been attached to the sill of an upper window. This was made after a pattern which I began using thirty years ago, and is illustrated here. The large door is kept closed until the birds have nested and the young have hatched, after which it may be opened at will, and all the family affairs of the birds may be observed through a pane of glass which is inserted in the rabbet into which the door closes. This box is quite safe for the young birds, as the hot sun cannot shine into it, and they cannot be seen, except from the window on the stool of which the box is fastened. Seven young were reared from this nest the first season, and other broods have been graduated from it since. Another box on a near-by apple tree has become the nursery of several more broods. Still another box was fastened to the frame of a kitchen window within a few feet of a door opening outward. A quantity of cotton was placed in this box, in the belief that it would form a warm nest for the birds on cold winter nights, and we thought that one or more of them occupied it at times. Early in the spring a pair of chickadees began carrying cotton out of this box. Day after day they worked industriously, but did not appear to make any use of the cotton. Finally it became evident that they were merely digging out of the cotton a hole for a nest, as most of the cotton taken out was carried to a neighboring pear tree and either thrown to the breeze or left hanging on the twigs. So the little birds continued to work day after day until they had hollowed out a neat white nest in the midst of the cotton. Then they lined it with a few threads, hairs and feathers, and the female deposited ten eggs, from nine of which young birds were afterward hatched and reared. As the box had a door that could be opened, the little mother could be watched from the kitchen a very few feet away. She seemed as interested in our housekeeping as we were in hers. When the young were hatched, however, she had no time to indulge her curiosity, for it required trips averaging about two minutes apart during most of the day to supply them with food and so stop their gaping mouths. In the meantime another brood was being reared by another pair of birds in a box in the apple tree, some two rods away.

In 1904 an attempt was made to provide a dwelling place for the screech owls that occasionally were heard in the grove near by. These birds are believed to feed mainly on insects, mice, and other so-called vermin. A box, similar to the one in the illustration, was put up in a large pine tree about four rods south of the house. It was not occupied that season, but the next winter an owl visited it occasionally, and, as spring approached, a small gray owl might be seen some evenings at sunset, sitting in the doorway and solemnly looking over its hunting ground. The jays, robins, and chickadees soon learned the secret of the box and told it so that all the world might hear. A little later sticks, straws, and other rubbish might be seen protruding from the opening. Late in April I ascended the tree and found the little owl sitting upon her eggs. Soon the white, downy young appeared, and then the lining of the nest was embellished with the wing and tail feathers of several blue jays, one robin, and one red-winged blackbird. Otherwise, however, the owls did not appear to trouble the smaller birds, but rather protected them by killing the blue jays which formerly ate their eggs. I believe that rather more small birds than usual reared young in the neighborhood, although fewer chickadees were seen the following winter. The owls reject the indigestible portions of their food, which are thrown out through the mouth, and may be found upon the ground about their nests or roosts, in the shape of pellets, composed mainly of bones wrapped up in fur or feathers. In order to determine the character of their food, I gathered all the pellets that could be found, and in only one instance were there any remnants of a bird (a robin, of which we have a surplus). On the other hand, there were found the bones of deer mice, wood mice, field mice, and mole shrews, the remains of from one to three of these little animals being found in each pellet. While this experiment has not yet progressed far enough to prove that the owls are desirable tenants, it seems probable that they much more than pay their rent. Five young were raised to maturity last year and sent out into the world to earn their living, as their parents did before them.

SCREECH OWL BROODING YOUNG. (FRONT OF BOX REMOVED.)

YOUNG OWLS IN NESTING BOX.

The work of attracting birds about the house and domesticating them there is of inestimable value to children as a source of amusement, as training for the observational faculties, and as an object lesson in kindness. This may be illustrated by the story of a bird box that was put up by the little son and daughter of Professor C. F. Hodge, of Worcester. Alone and unaided, they set up a pole, fastened a box upon it, and later, when the young birds, which were reared in it, were deserted by their parents during a severe storm, the young people fed and reared the little ones. These birds became so tame that when called, they would come to be fed long after they could fly and had left the residence of their human friends. When we teach our children thus to love, protect, and feed the birds, it may be possible to so increase the bird population that those insects pests on which they feed, will give us little trouble.

DISCUSSION.

Secretary BROWN. You intimated in your lecture, Professor Forbush, that you had seen signs of the brown-tail moth in Connecticut. We are very anxious in Connecticut in regard to that insect. In fact, we live under the shadow of a great fear that the gypsy moth and the brown-tail moth will invade our territory. Will you please tell the convention more definitely where and what the indications were of the presence of the brown-tail moth.

Prof. FORBUSH. I do not want to say positively, Mr. Chairman, that the brown-tail moth is in Connecticut. What I saw on the train was what seemed to me to be indications of its presence, but a man traveling at the rate of thirty miles an hour cannot be sure. What I saw was simply a few leaves wound up into a small web about so large, sometimes larger and sometimes smaller, and that is the usual way in which the young caterpillars pass through the winter, and then the minute the foliage starts up in the spring, they start out and commence their work. I think I saw signs of it within two or three towns of yours here, but, of course, it may have been something else.

Secretary Brown. There is one other question. "Have the birds lessened the quantity of gypsy and brown-tail moths in Massachusetts?"

Prof. Forbush. Unfortunately, we have in this country a plentiful supply of English sparrows, and they have a tendency to drive other birds away. Just at the time when the English sparrow began to drive our other birds out, these moths appeared. We had comparatively few birds in that section, so that the moths have increased. They have become so many in fact, that nothing has stopped them. You are going to have them right here. You will have the brown-tail moth within five years, and the gypsy moth within ten years, and you might as well understand it and get ready for them. There is no question about it. You want to do everything you can to stop these insects because they are going to be the worst pest you have had to deal with in years. The gypsy moth preys on all kinds of vegetation. It will kill your pines, and get into your houses, and is a nuisance of the worst order. I know a man who five years ago thought the gypsy moth was not going to amount to much, and he did not want anything done on his property. I went out to see him the other day. He said, "I have lost two-thirds of my apple trees, and have suffered much damage on other trees and shrubs." That is the way it goes. One gentleman I know of has spent over fifty thousand dollars on his place in trying to stop these insects. He is still working. We have got some parasitic natural enemies of these creatures. Of course, they can be cultivated, but until they can be to a sufficient extent, we have got to fight. You will have them here just as sure as there is a God in Heaven, and you have got to do everything that you can to fight them.

Convention adjourned until 10 A. M., Thursday, December 14th.

MORNING SESSION.

December 14, 1905.

Music.

Convention called to order at 10 A. M., Vice-President Seeley in the Chair.

The PRESIDENT. We have a few questions that I will ask the Secretary to read.

Secretary BROWN. You remember that poultry was the prominent subject discussed yesterday. In the box I find this question, "Do rats trouble when self-feeders are used? And if so, what can be done to get rid of them?" Is there any poultryman here who can answer that question?

The PRESIDENT. Is there any other man that knows what to do with rats when they get to eating up grain and doing mischief, and all that sort of thing?

Secretary BROWN. Mr. President, I know what I do. I get some arsenic and mix it with grated cheese and a little flour. I put it where nothing else can get it, in one of the buildings outside, and then I put some water near so as to accommodate the rats. They like the cheese and they do not feel the arsenic until it is too late. They naturally go to the water, and the water gives them a comfortable exit.

Secretary BROWN. There is one other question that interests truckmen: "Has anyone had experience in using a tobacco setter for settling cabbages and other plants?"

Mr. MITCHELL. In the next place to where I am now living is a large cabbage shipping station, and they are using the setter entirely for setting cabbage plants. I have asked what kind of service they gave, and am told that the plants live even better when set by the machine than you can make them live when set by hand.

Secretary BROWN. Here is a question for stockmen, or those who own large barns: "Is it wise to have all of your barn buildings under one roof?" Those that have encountered fires lately may have a word to say on that. Perhaps Mr. Patten can give us some information.

Mr. D. W. Patten. I do not think, Mr. Secretary, if my barns had been so situated I would have had any buildings to-day, but being scattered somewhat, I was able to save the larger part of them.

Prof. Shaw. Mr. Chairman, I would like to say a word on that question. Is it possible to be as economical in labor by having barns separate as it is when they are under one roof? Suppose that buildings in one case are separated, and suppose in another case that they are under one roof. Is it possible to have as much economy in the labor of feeding when the buildings are separate as when they are under one roof?

The President. I think not.

Secretary Brown. I suppose the whole question turns on whether the danger arising from having them under one roof is more than counterbalanced by the extra labor where the buildings are separate.

I would like to ask Mr. Averill if he does not think it is well to have more than one barn where you have diseased cattle quarantined with tuberculosis or anything else of a contagious nature?

Mr. Averill. I would say it is highly important to have a place where animals can be quarantined and isolated away from other animals in the herd. It is not necessary that that should be done in an outside building, because after having an animal sent to quarantine the stable or place occupied by the animal in quarantine can be thoroughly fumigated, cleansed, and disinfected.

The President. You say that they may be in the same barn?

Mr. Averill. I think if people would exercise due caution about traveling between infected and uninfected animals, so as not to carry the infection when passing from the stable where the animal was in quarantine to the others, it would be safe enough to keep quarantined animals in the same barn. I would say, however, that if you have a separate building there is an added risk of fire and loss by lightning. If you have buildings scattered about the farm you are more liable to have buildings destroyed by fire and lightning.

Prof. Shaw. May I ask the gentleman if the risk would not be less by keeping the infected animals in separate buildings than in the same building with the other animals?

Mr. Averill. There would be less risk in keeping them in neighboring buildings. I am free to admit that if an animal was kept in a separate building and was cared for by a separate attendant there would be far less risk of further infection and secondary cases. We have had and are having at the present time scarlet fever in my own town. The school is closed. It broke out in three families. In each of these families there were not less than seven children. Now if those patients were quarantined in the same building with those children, in two out of three cases I am sure there would be no secondary cases. It looks to me, Mr. President, that we do not need, in treating cases of contagious disease among cattle, to go to that extent, of course, the foot and mouth disease excepted. If scarlet fever patients can be isolated in a house where there are six or seven other children I think that the same precaution observed in the treatment of animals would undoubtedly have a similar effect.

Prof. Shaw. I would like to ask the gentleman's opinion about this: Take a tuberculous cow, for instance, kept in the same building with cows that are not tuberculous, and in the same part of the building, only in a box stall, but not a tall box stall, or where the partition does not go up to the ceiling. I am asking about this for this reason. I was asked to visit the station at Geneva in the summer. I went there for information about tuberculosis. They had been conducting some experiments, and they took me to a stable where they had a tuberculous animal put into a stall by itself. The stall did not extend to the ceiling. There were other animals in that room. I thought, Mr. Chairman, that that was a queer thing for an experiment station to do. I would not want them on my own barn, but I would like to know the opinion of this gentleman on that subject.

Mr. Averill. Why, as I said before, Mr. President, if an animal can be quarantined so as to be entirely separate from the rest of the herd there is, of course, less danger. A box stall, such as Prof. Shaw suggests, should afford protection to the other animals in the herd, but it is not absolutely perfect. We know that because a farmer that has a tuberculous animal in his herd keeps it among his other animals until, perhaps, it dies. It does not necessarily follow that there will be any secondary cases. On the other hand, there may be some that will have the disease. If the owner has a good spacious box stall to put that animal into, the danger to the other animals will be very much less, but the danger would not be entirely removed. Everything that can be done by the caretaker or owner to remove danger, is, of course, an advantage, but the only way to be absolutely free from the danger of infection or inoculation is to keep the infected animals entirely apart.

Secretary Brown. As pertinent to the subject to be discussed this morning, I want to ask permission to read a few lines from the *Hartford Courant:* "Wisconsin, by not applying practical forestry work, will soon suffer, in the practical exhaustion of her pine lands, the penalty of wastefulness. The figures of statisticians of the Department of Commerce and Labor show that the pine shipments for the first eight months of this year were almost as great as the corresponding period of 1904 and greater than 1903, but notwithstanding this seeming abundance it is a question of drawing upon the few remaining large tracts which are owned by the lumber companies and which are being cut off very rapidly. The development of scientific forestry seems to have come too late to save the Wisconsin pineries, but they afford an excellent object lesson for other states." This morning's paper seems to be very timely in view of the subject which we are to discuss at the opening of this morning's session.

The PRESIDENT. You will notice on your programs that we are to have an address on "The Work of the Forest Service for Farmers." That is one of the things that is coming to be very important to farmers, and I am glad to introduce to you Mr. Herbert A. Smith, a native of Connecticut, but now of the U. S. Department of Agriculture, Washington, D. C., who will speak to you upon this subject.

"THE WORK OF THE FOREST SERVICE FOR FARMERS."

By DR. HERBERT A. SMITH, Washington, D. C.

Mr. President, and Ladies and Gentlemen:

I am indeed glad to come back here and talk to the people of Connecticut about our forests, and especially so from the fact that this very region is connected with my earliest memories. From the time I was four years old until I was nine I lived within twenty-five miles of here, and always these woods and hills have held a place very close to my heart.

The Forest Service is, as perhaps you know, a new name lately given to an old organization, formerly known as the Bureau of Forestry, a part of the Department of Agriculture at Washington. Up to a little less than a year ago the Bureau of Forestry held a somewhat singular position. It was the recognized authority in this country in all matters connected with conservative forest use. It was the only part of the Government which had in its employ trained foresters, and it was the one place to which other Departments of the Government controlling forests had to apply when they wished any information and guidance in the management of their forest land. At the same time there had developed in this country, as a recognized part of our National policy, the policy of setting aside and maintaining forest reservations. A year ago the National reservations, set aside under both Democratic and Republican presidents, embraced a total area of over sixty million acres of land. Yet notwithstanding that the Bureau of Forestry had all the technical knowledge necessary to handle these lands in the proper way, it did not have under its control one single acre of forest land in the whole United States.

Now Congress has changed all that. The Bureau of Forestry has become the Forest Service, because evidently its most important task is going to be the management of that part of the national domain in which forests are to be maintained and used for the benefit of the people. During this last year the forest area in reservations has increased to a far greater extent than in any previous year, for President Roosevelt is a great supporter of the reserve policy, because as a clear-sighted and far-sighted man of affairs he recognizes the vital importance of this question to the people of the country as a whole. One hundred million acres of land are now under the administration of the Forest Service. That is a greater extent of territory than all New England, New York, and Pennsylvania. It is to be maintained in perpetuity for the use of the people, for the preservation of the timber supply which is absolutely necessary for them and for the protection of water supplies, especially necessary in the West. This work of administering the reserves will ultimately be the main work of the Forest Service, and hence its change of name.

At the same time, the present work of the Service is broadly along the line of all the work of the Department of Agriculture — the work of making the land of this country contribute all that it can to the welfare of the nation. Idle land or waste land is not helping us; it is not mere expanse of territory, but land which is being well used, which makes us powerful and prosperous. Our forest lands, on the whole, are not being well used. A forest may be cultivated just as much as a plowed field. A wild forest, even a wild forest in a state of nature, is not equal to a cultivated forest in point of its ability to contribute to the welfare of mankind. We have treated our forests generally as purely natural resources, and have taken their timber without any effort to keep up the supply. Take the pine forests of the Lake States. We have used them up. They have contributed tremendously to the upbuilding of the country. In every little village of New England and in every farming community of the Middle West, the benefit of cheap lumber from those forests has been felt. It has gone to build farmers' houses and barns, it has gone to build factories and workingmen's homes. But in the future we shall not have these forests as sources of timber supply, and we shall all be the worse off on that account. If instead of cutting those pine forests off, with tremendous waste in some instances, they could have been cut under such conditions that a new crop would have come up to take the place of the old, what a benefit it would have been to the nation! On land which is now desolate and for the greater part worthless, we should then have a supply coming on against the day of our need which is certainly approaching.

I wonder if you appreciate at all how much agriculture as practiced at present owes to science, or to what an extent the common; everyday practice of today is indebted to the scientific researches of the past. I sometimes think that if we could look back upon the practice of our ancestors when they first came to this country, it would seem to us hardly less barbarous than the method of culture employed by the Indians in raising their small crop of Indian corn. In England, at the time when the colonists came to this country and practically through the eighteenth century, farming land was for the most part held in common. This land was divided into three classes. First was the meadow along the stream, or grass land, in which each man had his portion assigned up to the time when the grass was cut, after which it became common again for all the cattle to graze upon. Next above this was the plow land, of which one-third was sown to wheat, one-third to peas, barley, and a very limited range of other crops, and the third was fallow. The third to be left fallow was changed every year, so that any given piece of land was cultivated only two years out of three, and then allowed to rest for a year in lieu of fertilizing. Individual allotments changed every season. No man could improve his land under such circumstances, because he did not hold it permanently, but only in turn. All implements were home-made. The cattle and sheep were pastured on the "waste," or higher land, which was never tilled, and which furnished wood material as well as pasture. Weeds were abundant, manuring unknown, improvements discouraged; in every way the system of agriculture was primitive and wretched. Agricultural progress was necessary before a larger population could be supported, and great parts of England were waste at that time which are now highly productive, thanks to the improvements which the study of scientific farming introduced. This kind of study, which virtually adds to our territory because it adds to the supporting power of our land, is what the Department of Agriculture exists for.

Now our way of treating the forests has not advanced so much over the method of those early days. We leave it largely to take care of itself. We oftentimes turn our cattle out to pasture in it. We do not attempt to use the land to its full power. Farmers' holdings are small individually, but in the aggregate they are of tremendous importance to this country. Something like two hundred million acres of land — upwards of one-third of all the forest in the United States — is held in farmers' woodlots. It is a work most emphatically of national importance to see that this land is well used, that it yields its fullest contribution to the individual and to the nation, that instead of being only half as productive as it might be it shall have as many trees growing upon it as it will properly bear, and of the best possible kinds, and that these shall be utilized in the best way. The needs of this country for timber in the future are going to be far more pressing than you probably realize. Lumber prices have risen steadily during the past century, and rapidly in the latter half of it. Good timber in the woodlot, if it is not deteriorating, is exactly like money in the savings bank. Interest is accruing on it irrespective of the growth, and the woodlot is in fact a most excellent auxiliary savings bank for a farmer. He has the equivalent of money in it. He can get more in it. He will not have to withdraw money from other purposes in order to do this. He can get more money in his woodlot, and at the same time use it for the production of ties and cordwood which he can sell, as well as for the production of fuel for his own use. That is to say, he can use it under such methods that the woodlot timber will be getting better all the time. The ordinary way is just the opposite. The forest is allowed to deteriorate through the use of careless methods by the farmer. When he goes into his forest he takes his axe and cuts the best trees, or those which are the easiest to work up.

It does not occur to him that he is leaving inferior trees, which he will not want, to take the place of those which he removes. In other words, the weed trees, as the foresters call them, are left — the useless trees, or trees that crowd out and displace good trees. The result is very much as though the farmer went into his garden and kept pulling his vegetables and allowing the weeds to grow up and fill the ground. The work which the Forest Service is trying to do for the farmer is to teach him to cultivate his woodlot, to learn about his trees, and about the different requirements of different species, and to make the land yield its fullest possible supply.

The question of timber supply is a matter of vital importance to the entire country. The railroads, for instance, the means of transportation, are absolutely dependent upon the forests for their ties. Every railroad tie laid in the track — and engineers have found no substitute which they are willing to accept in place of the wooden tie — every tie laid in the track all over the country requires two trees growing in the forest in order to keep it there.

The present price of railroad ties of the best quality bears no proportion at all to the nearness of the exhaustion of the supply, and the railroads know this very well. Some of the most important railroads in the country are going into the business of raising ties for themselves because they fear the time may come when they cannot buy the ties that they need. But tie production is going to be one of the most profitable employments of the woodlots. White oak ties are the ties which the railroads prefer, and I suppose that the supply of white oak ties is going to be substantially at an end before very many years have passed. The white oak is too good a tree; we can not afford to use it for ties. A white oak tree which can be bought in this country in the region of its best growth for a dollar and a half, in Germany would bring perhaps a hundred or a hundred and fifty dollars; sometimes even two hundred dollars are paid for a single tree. An acre of white oak is sold sometimes in Germany for over two thousand dollars, and it it is not at all unlikely that our prices will, before very many of us are old men, be but little below the prices of timber in Germany.

The capacity of the country to consume timber is almost beyond any credible form of statement. You may think that the substitution of other materials will diminish the need of lumber. Quite the contrary. Our cities are built of stone, brick, iron, and concrete, but more wood goes into our cities for construction purposes today than in the days when they were built entirely of wood. Our steamships are built of iron; but more wood goes into ship building now than formerly. And so on through one industry after another. The cooperage industry, which consumes large quantities of oak, recognizes that its existence is imperiled by the scarcity which it has itself created. The amount of lumber that is consumed for barrels of all sorts — oil barrels, sugar barrels, molasses barrels, beer kegs, whiskey barrels, flour barrels, apple barrels, and then for lime, cement, truck, and almost every other kind of article, is enormous in its total amount. The coopers will have to turn to the woodlot as one of their main sources of supply. So also in the case of mining, which consumes even more timber than the railroads, the demand upon our forests is very great. The miner must have timber to prop up as he goes along. His demands require provision for the future. And so with every great industry; all are consumers of timber, and will suffer when timber grows scarce and dear.

To meet this need the farmers must do their share. What is the method? What is the wisest course for the farmer to take who wishes to make the most out of his woodlot? Well, he must begin by remembering that he wants his land fully stocked. If he has an old pasture that is coming up slowly to forest growth, on which the red cedar and the white birch, or gray birch, as it is more properly called, is coming in, he ought to help nature along. Here is probably an opportunity for him to do some planting with very profitable results, and although he may not himself live to cut planted timber, it is not necessary in order that this savings bank should be helpful to him that he should wait until the timber is full grown. It is certain that well-timbered land is going to be salable land, and especially that which has a good stock of young timber on it. It is going to be salable at a much better price than land which has received no care.

Then the farmer must look out that as he cuts his trees he selects them in such a way as to benefit the forest and to provide for another generation. The branchy, wide-spreading tree, the crooked tree, or a tree of a kind which is not likely to prove salable, is the best kind for him to cut down when he is getting out his supply of firewood, because he thus makes room for better trees. As he cuts he wants to look about and see which are going to take advantage of the cut. Perhaps he will see that he had better cut some young sapling or some half-grown tree which is ready to push into the opening he will make, but which he will not want. He must pick the trees that he wants left, and provide for them. There is a very striking picture in the back of the room, of a chestnut tree which had grown seven inches in diameter in thirty-four years. The rings showing the growth which the tree made are very close together for these years; the tree had been too crowded to have a fair chance. Then the trees about it were cut sufficiently to give it an opportunity, and in the next eight years it doubled its diameter. In other words, it made four times as much wood on the same length of trunk in eight years as all that it had made in the preceding thirty-four years — since the ratio of volume increase is the square of the ratio of diameter increase — besides the increase due to its greater height. You can see in the picture the wide rings which are the indication of this rapid growth. So that thinning is an important means of making your timber add to itself at the fastest rate.

When the farmer goes in to cut he is very likely to lay about him with the axe pretty freely. The little stuff in his path is regarded as brush, and is cut out of his way without much thought that it has any value. Very likely just the trees that should have grown up are thus sacrificed, and the next cutting may be set back a dozen or fifteen years. You all know that the growth of sprouts, which start from the stump after cutting, is much more rapid that the growth of seedlings. This is because the sprouts do not have to establish a root system of their own, but are virtually branches of an old tree which has been pruned back to the very ground. Consequently, in this region of second-growth hardwoods, almost all of which sprout from the stump, by far the largest volume of wood can be secured under a system of sprout, "coppice," management. But it must always be borne in mind that the vigor of sprout growth declines as the root systems age, for the sprout is itself, as has already been said, only a branch. Consequently new seedlings are needed in a sprout forest to replace the enfeebled stock.

So when the farmer begins to cut in his woodlot he needs to remember that a small sapling which has grown from seed and is well located with respect to an opening is valuable out of all proportion to its size. And he wants to remember also that it is highly wasteful to cut a tree, even when it has reached a fairly good size, if it is still growing vigorously, unless, of course, it is a tree which is not wanted. A 12-inch tree puts on twice as much wood to each foot of trunk in growing another inch as does a 6-inch tree. To cut a tree which is six or eight inches in diameter is like drawing your money from the savings bank just before interest day. You lose the benefit of the earning power that the tree has been gathering.

There is such a thing, however, as having too many trees, though as a rule the danger is that your land will be understocked rather than overstocked. That chestnut tree to which I referred a moment ago, which was thirty-four years old before it really began to grow, should have made, I suppose, a tree from which three ties could have been cut in something like that age. A white oak will require from forty to fifty years, I believe, in this region, under favorable conditions, to make a three-tie tree. I do not wish to go into this too far, because it is a matter for your State forester to inform you on rather than for me to discuss, but I presume that the fact of the greater rapidity of growth of the chestnut will make that generally the best tree to grow for tie purposes in this State. That is the sort of thing that the farmer must ask himself, or must ask the forester. He must inform himself as to what tree is going to be the most profitable in the long run, and also what the requirements of the different kinds of trees are. One tree will grow in a situation where another will not. It is necessary to know about each kind, and how to give it the conditions which will make it grow the best. The farmer must study his forest.

Now I have said something about what the forester calls thinnings, and what he calls improvement cuttings. The purpose of thinnings is to improve the growth of trees already on the ground, and thinnings are, therefore, naturally made in rather young timber, and yield only small stuff. Improvement cuttings, on the other hand, aim primarily at making place for new growth by the removal of trees which are overmature, crooked, broken-topped, or otherwise defective, or which are of the less desirable kinds. The man who wants to increase the productiveness and value of his woodlot must not expect to get something for nothing. It will pay him to cultivate his land, woodland as well as plowland; he will get more from it; but he cannot cultivate without putting in labor. When he begins to make thinnings or improvement cuttings he must not expect to secure his cordwood as easily as if he picked out his best and biggest timber and cut it clean, or cut all that was good and left the bad. You cannot eat your cake and have it too; or rather, you cannot eat your woodland goose and keep on pocketing future golden eggs. The difference is between gathering your capital, on the one hand, and letting it roll up interest on the other. If you can make the cultivation pay for itself in the incidental product of wood, you are not doing badly. If you can make your improvement cuttings more than pay, it is very much like finding money. You will then, in fact, have kept all of your cake, and had a taste of it too.

Yet the forester, as a practical man, ought to be able to tell you how on occasion you can harvest your timber at a reasonably low cost and at the same time provide for a speedy renewal of the forest. It is hard to give general prescriptions in such matters; ordinarily the Forest Service tries to answer requests for information from individual owners by sending an agent to make an examination and give advice on the ground. But I believe that in this region as good a method to recommend as any I can give you is what the forester calls the group method. Select a spot, or several spots if one will not supply what you want to cut, where your forest crop is ripest—possibly overripe; and clear, with due care of course for young growth, a hole in your forest, taking care that the diameter of this hole is not more than twice the height of the surrounding trees. Another year, or better several years later, after you have opened as many holes as you think advisable, but not until after seedlings have had a chance to establish themselves wherever they are needed, you can begin to widen the holes by cutting in concentric rings about them, and this can be continued until the whole area has been cut over. By this method you can get an entirely new seedling forest, if you are cutting trees which do not sprout, or if you have an old or deficient sprout forest you will fill up the blanks and get supplementary seedlings under way.

Bear in mind, however, that if in any one year you cut more wood than grows on your whole woodlot in that year, you have diminished your principal, and if you cut over your whole area before the area which you cut first has had time to grow to maturity, a period will have to follow during which your woodlot will stop paying dividends.

The farmer is in a better position to care for his forest and make money from it than other owners, because he can do this work in the woods at a time when there is not much else to be done on the farm — that is, in the winter. If he takes an interest and is observing, if he goes into the woods with his axe and notices what is happening, and thinks what he wants and takes his measures accordingly, he will soon learn a good deal about his forest as well as make a decided difference in its value.

The work which the Forest Service is doing for the farmer is perhaps better appreciated in other parts of the country at present than it is generally in the East. In the West the farmers' need in a large part of the country is for water, and the farmers there now recognize that the first and most important means of securing water is through forest conservation, not because forests make rain but because forests enable the farmer to get the benefit of what rain does fall, through the storing power of the forest. I was very much struck last winter to hear a Congressman from western Kansas say in Washington, at a very important meeting of forest users, held under the auspices of the American Forestry Association, that in his Congressional district alone — that is to say, in a region having a population of about two hundred thousand people — there was more arable land than in the entire kingdom of Japan, if they only had water for it. Japan supports a population of forty millions. Japan is a first-class power, about on a par with England in population, and a little ahead of France. We have room within our confines for empire after empire, but the development of these western lands depends very largely on irrigation. Irrigation and forestry are so closely connected that one can not exist and do its full work without the other. The most important work of the forester in the West is to conserve the water supply so as to hold the rain as it falls and let it run down little by little from springs that flow all the year, instead of rushing from the hillsides and mountain slopes and sweeping down in destructive floods. And so this work which the Forest Service is doing for the farmer is appreciated in the West as of tremendous importance to its people. That work is important for New England too, for every farmer in the West means a larger demand for the manufactures of the East. New England is essentially a manufacturing district. It must have a market for its manufactures, and is, therefore, directly interested in this matter of irrigation in the West.

Again, the West is largely a grazing section. A map was prepared recently in the Forest Service showing the extent of the Western range. This range, you know, is for the most part public land. That map, which showed in green the portions utilized for grazing, looked as though pretty nearly all the West from east of the Rocky Mountains to the Pacific was green, as though it was all grazing land. Now a very large part of this vast livestock industry depends on the forest reserves for summer pasture. In its efforts to make the reserves yield as much forage for the grazing industry as is possible without injury to the forests themselves, the Forest Service is working for the agricultural interests of the country, applying here again the principle that every kind of land should be put to its most profitable use.

Before I leave this subject I want to say a word about the use of our forests for pasture here at home. If you are pasturing your woodlots you are almost certainly decreasing to a very considerable extent their productive capacity. Cattle will graze upon the young seedlings and the young shoots as they come up. They will break them down, and they will trample the ground and make it hard so that the seeds when they fall will not take root easily in it. Oftentimes you may notice, as you drive through the country, woodlot pastures in which there are only old trees. It is, therefore, perfectly evident when you think of it that when once those trees are cut or dead the forest will be like a stream which has been turned aside near its fountain head. It passes by and nothing is left. So I say to the farmer, decide what your land is most valuable for. Trees and grass do not get on well together. They are mutually antagonistic. Grass is not good for the forest, and trees are not good for grass. To a very moderate extent you may perhaps pasture in your woodlot, but you must be constantly on your guard that grazing does not go far enough to affect the condition of the forest. It is just as well if you can keep the woodlot absolutely separate from the pasture.

And then, of course, you must keep out fire. Fire is the worst foe of all to the woodlot. A young farmer was telling me not long ago how near his house there was a very dense grove of young saplings. "You could not see into them at all," he said. "If a cow got in there I could not find her. But last spring, when the leaves were dry, I touched a match to them, and the fire went up like a flash." Now perhaps it was best for him to make that land into pasture, though I doubt it very much. I do not believe, however, that he had ever given the question whether the land would be better under forest or for pasture a moment's consideration. He simply looked upon that young growth as brush. If he had left a five dollar bill lying around and a little child had touched a match to it, and it had "gone up like a flash," I think he would have found some speedy way of making a very distinct and positive impression upon that child of the fact that he had done a mischievous and wasteful thing. Yet, from my point of view, he had probably done just exactly that kind of a thing himself. Fire must be kept out if we are going to have our woodlots amount to anything at all.

The farmer who will bear these things in mind, who will seek for information, who will make his forest produce all that it is capable of, will not only do a good thing for himself and his family but will also be doing something toward the public good. In making his own land most useful he will be helping to make and keep this country great, rich, and prosperous among the nations of the earth.

The President. I do not trouble myself much about alfalfa, but I would like to know more about it, and we have a gentleman here who I think has been sitting up nights with the problem, Dr. Jenkins, of the Conn. Agrl. Experiment Station, New Haven, and whatever he tells us is sure to be well worth hearing, so I am going to introduce Dr. Jenkins to say something about alfalfa.

ALFALFA IN CONNECTICUT.

By Dr. E. H. Jenkins.

Alfalfa is no new thing in Connecticut. It has been tested now and then and here and there in the State for twenty-five years or more with no success, so far as I can learn, until very lately.

The facts that it is a success in the West, that if it could be grown here it would be a great boon to all our dairymen, and that comparatively recent study and observation have shown reasons why earlier tests have not succeeded and how we may hope to succeed where we failed before, have caused a great revival of interest in it.

The Station has made a number of careful trials with it in various places, and the aim of this paper is to notice some things which must be done in order to get a good stand of alfalfa and incidentally to show that in this State, at least, it is a difficult and painstaking matter to start the crop. It is no such easy thing as if often represented.

THE MERITS OF ALFALFA.

About its yield and its fodder value little need be said, for they are constantly emphasized as chief reasons for its extensive use. From fields of more than an acre, where the alfalfa had been three years on the land, an average of 13.8 tons green weight per acre were harvested at the New York Station, containing over 1,100 pounds of protein.

In New Jersey the yields on carefully measured fields have ranged from 18 to 24¾ tons of green matter, or 4.4 to 7.2 tons of alfalfa hay per acre.

The Colorado Station reports an alfalfa crop which yielded about twice as much dry matter as a corn crop on an equal area and similar soil, and four times as much protein. The corn crop was called a fair one, yielding 14 tons of green fodder; but this is in a country where, I imagine, alfalfa will grow much better than with us and corn will not yield as well.

The Canadian farmers report from 12 to 24 tons of green fodder, or 3 to 6 tons of hay.

The figures which I have here, but need not read in detail, show that a moderate crop of alfalfa, 18 tons, green, contains 1.7 times as much protein as 28 tons of green corn fodder, and four times as much as three tons of hay of good quality.

Alfalfa hay is a richer feed than clover hay, containing as much digestible protein, pound for pound, as wheat bran. One of our Connecticut correspondents says "My horses would leave their grain to eat it and the hens would do the same. I shall keep at it till I make it go."

If alfalfa can be grown and cured here, its value to our farmers and dairymen will unquestionably be very great.

AVERAGE COMPOSITION OF ALFALFA, CORN FODDER, CLOVER HAY, AND MEADOW HAY.

	Alfalfa, green	Corn Fodder, green	Red-Top, green	Alfalfa Hay	Clover Hay.	Fodder Corn, field cured	Hay, mixed Grasses
Percentage Composition.							
Water,	71.8	79.3	64.8	8.4	15.3	42.2	16.0
Ash,	2.7	1.2	2.3	7.4	6.2	2.7	4.6
Protein,	4.8	1.8	3.3	14.3	12.3	4.5	6.4
Fiber,	7.4	5.0	9.4	25.0	24.8	4.3	29.9
Nitrogen—free extract,	12.3	12.2	19.0	42.7	38.1	44.7	41.0
Fat,	1.0	0.5	1.2	2.2	3.3	1.6	2.1
	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Percent. digestible.							
Protein,	3.6	1.3	2.3	7.6	6.5	2.6	3.6
Nitrogen—free extract,	11.4	11.8	20.5	37.8	34.9	33.3	42.7
Fat,	0.4	0.4	0.7	1.3	1.6	1.1	1.0

Besides yield and richness, alfalfa has other great merits. At its best it is permanent on the land. There are very few meadows in the State which do not need to be taken up every five years, at least, and re-seeded. Alfalfa is claimed to keep up its productiveness almost indefinitely, only needing perhaps occasional top-dressings of phosphates and potash salts.

It is an excellent soiling crop; the first cutting being ready somewhere between the middle of May and early June, and two or three other cuttings follow until the 15th of September or later. I believe that if we introduce it here this will be its chief use and its best use at first and while it is in the experimental stage.

We all know that to cure clover hay properly, so that it is not so dry as to lose its leaves and its value in handling, nor so wet as to heat too much and spoil in the barn, is no easy matter in our New England weather.

The same is true of alfalfa, all the more because of the greater burden of the mowing. It is not quick to dry, but if too dry loses its leaves like clover and with them a large part of its value. Rain on the nearly cured crop spoils it. It must be cut too, when ready; for the stalk gets woody very quickly as it comes into bloom. We have much to learn about making clover or alfalfa hay. Most of us, I think, err on the side of too much drying. If we can get in clover or alfalfa without dropping any leaves, pack it down well in the mow, close the barn and have it heat a good deal, without fire-fanging, we shall be sure of good feed.

At the West, in a dry climate, where the praises of alfalfa are chiefly — and with most reason — sung, this matter of making hay is, by comparison, simple, for there is no danger from rain and it cures much more safely in the cock than here.

For these reasons, I say, a successful alfalfa culture depends firstly on our ability to get and to keep a good permanent stand, and secondly on learning how to house it for winter use.

ALFALFA IS A CROP TO HARVEST, NOT TO PASTURE.

Under the best conditions, when well established, cattle may be pastured on it lightly. If they feed too long on it they will bloat, as on clover, and if they eat it too closely, as sheep are likely to do, they may damage the stand permanently. It is very hard to patch an alfalfa field by re-seeding the thin places. The new-sown plants never get vigorous and fill the gaps.

ALFALFA IS A NITROGEN-GATHERING CROP.

So much has been said too on this point, both of alfalfa and of all the cultivated legumes, that any more words may seem quite unnecessary. But let us have our heads clear as to the facts. The crop contains each year very much more protein — of which the distinguishing element is nitrogen — than any of our cereals or hay crops. Yet it does not seem to exhaust or diminish the store of nitrogen in the tilled soil as they do, but rather increases its store, and yet keeps up its yield year after year, while cereals, if raised continuously, steadily decrease their product till they come to a certain minimum production which they can keep up for a long time perhaps.

A part of this difference between legumes and other kinds of crops may be explained by their deeper rooting; a part also perhaps by their stronger feeding capacity — their ability to assimilate forms of nitrogen from the soil which cereals cannot assimilate — to eat, let us say, what cereals cannot eat; and partly (and to my mind only partly) this nitrogen-gathering quality is to be explained by the action of those bacteria which live on the roots and in connection with the well-known "nodules" of the roots. It has been fully proved that alfalfa plants having these nodules with living bacteria, are able, in ways not fully understood, to get hold of the free nitrogen of the air in the soil and combine it in vegetable forms. This, other plants than legumes, with few exceptions, and as far as we now know, cannot do. This gives to alfalfa and other legumes their greatest agricultural value. They enrich the crop and, through the roots, stubble and crop residues, the soil itself with nitrogen, that most expensive element of plant food. This fact of the enrichment of the soil by legumes was well known a good while ago, and the practice of growing pulse alternately with a grain crop is immemorial in India. Such parts of the explanation as we now have it is quite modern.

I believe that Professor Atwater and Dr. C. D. Woods at Middletown were the first to give an absolute proof of the assimilation of free nitrogen by legumes under conditions which were beyond criticism, and European investigators chiefly have taught us what we know of the extent and the method of this assimilation.

It is not the only way in which soils gather free nitrogen. It is certain that other microbes, low forms of vegetable life, which are not connected with legumes, also gather it. A soil containing humus and not acid, under favorable conditions, will of itself gather a certain amount of nitrogen. What conditions favor this and how much nitrogen may be gathered by this means remains to be learned, and to my mind this is one of the most important questions regarding the maintenance of soil fertility which is waiting for solution.

But certainly the supply of free nitrogen which legumes furnish seems at present to be far greater and more rapid than that from other sources.

The raising of legumes is and has long been known to be a way of restoring exhausted soils, by increasing the amount of humus, nitrogen, and perhaps also available mineral matters in them.

It needs to be remembered, however, that there is a limit to this nitrogen-gathering action of any legume. If a soil already contains a good supply of available nitrogen, a crop of legumes will not add to that supply from the air, but will live on the combined nitrogen already present in the soil. You cannot go on forever catching nitrogen in your "nitrogen trap," as some call it. The plant and the microbe have to be starved into activity.

REGARDING THE HARDINESS OF ALFALFA IN CONNECTICUT.

We have grown it for five years at the Station with no sign of winter-killing. Scattered plants of it still persist in our turf ten years after the patch of alfalfa was plowed up and cultivated. Here and there through the State I have found it thriving in headlands and fence corners from seeding of unknown date. But whether it will bear exceptionally cold winters without being ruined or badly damaged as a farm crop is more questionable.

I have seen a half-acre on very sandy land but in a moist place, which had yielded fairly well for seven years with almost no care. Another field of several acres on heavier soil yielded very satisfactory for a longer time, but was so damaged by the last two exceptionally cold winters that it was turned under to be re-seeded to alfalfa after a year's cultivation to subdue the grass which had come in. Of course, even rye is sometimes badly winter-killed, but to make alfalfa profitable we must hold it on the land for a term of years. Its value is largely in its permanence. The land requires special preparation for it, the crop needs considerable care, compared with other forage crops, during the first year of its growth, and the reward comes in the permanence of the alfalfa, which must yield two to four cuttings yearly of very valuable hay or green fodder for a term of years with no more care than a permanent meadow, if it is to pay. It has been grown long and successfully in the province of Quebec, in Canada, and it is now grown in the British possessions north of us from the Atlantic to the Pacific, and is stated to be the staple forage for winter feeding in the drier parts of British Columbia. Yet, on the other hand, Fletcher, of the Ontario Experimental Farms, says that the attempts to establish it as a regular forage crop of Canada have not been very successful.

In New York, reports from 86 growers of alfalfa showed that in a very severe winter 67 per cent. of the crops were more or less damaged and 33 per cent. were not. The damage was most common on heavy lands.

A small patch of Turkestan alfalfa on the Station grounds, drilled in in the spring of 1904, in a rather exposed situation, and which grew feebly that year, though kept clean of weeds, was given a light mulch of stable manure in the late fall and came through the very severe winter of 1904-1905 with absolutely no damage and did extremely well this last summer.

I believe that alfalfa will stand ordinary winters in most parts of this State with the little mulch that the fall growth gives it, that it will stand very severe winters if covered with snow, but may not if the ground is bare, and that a light mulch of long manure in the early winter is a desirable thing as a sort of insurance against winter-killing. It also greatly favors the increase of the bacteria of the soil on which the success of the crop depends, and in this way, as well as a direct fertilizer, pays for itself.

We have had trouble and, I believe, if it is generally grown there will be general trouble during the winter from the attacks of field mice, especially where it is under deep snow or other heavy mulch. The mice are fond of the large roots and eat out their crowns, thus killing many of the best plants.

It remains to say something about the fitting of an alfalfa field and its care.

A very erroneous impression has been widely spread lately regarding the possibilities of alfalfa culture. Magazine articles regarding the artificial inoculation of land and the advertisements of firms who offer inoculating material have given the impression that very recent discoveries had made it possible for the farmer, simply by inoculating his field with a laboratory preparation, to ensure success with almost any legume crop, enrich his land, and at the same time get large crops of very rich fodder. In short, to sit still and get rich; to get a good deal for nothing. This may work for a time in life insurance, but not in farming.

The truth is that he *may* succeed with alfalfa if he is skillful and fortunate. But in this State, at least, as our experience shows, he can only succeed with alfalfa by taking the greatest care in selecting his land, in fitting it for the crop, and in caring for it after planting. If he succeeds fully he will be very richly repaid for his work. If he does not make a great success he will make a pretty thorough failure.

In the first place, the very poorest land will not grow alfalfa. It has got to have a fairly deep soil without a hard-pan underneath. It cannot live in standing water for any length of time, nor will it endure drought.

A well-drained but not a very dry field is essential. If not naturally a lime soil, a heavy dressing of lime in some shape is required in the beginning, and a top-dressing of lime or ashes from time to time. 1,500 to 2,000 pounds of lime kiln ashes or of stone lime is not too much. Alfalfa is a lime-loving plant. Potash salts and bone may also be used when fitting the land.

Equally important is it to get the land as clear as can be of weeds. Alfalfa is sure to fail on weedy land. Once established and growing thriftily after the first year it will choke out weeds, but in the first summer weeds will easily choke alfalfa. If land is not clean in the spring, it will pay better to summer fallow and sow alfalfa in August than to invite failure on such land by spring seeding. August is a better time to seed than spring because the summer weeds slacken their growth from then on, while alfalfa thrives until hard frost.

A proper seeding is not less than 20 pounds, and I believe 30 pounds is better when not less than 90 per cent. of the seeds germinate. It is essential to get at the start a perfect seeding. You cannot mend or patch it later.

And lastly, as regards preparation of land — what about inoculation? To succeed with alfalfa the soil *must* contain the microbe, which by its housekeeping with the plant makes possible the fixing of free nitrogen. That is absolutely certain. It may be in the soil to start with, it may be introduced at seeding time by inoculation of the soil or of the seed, but in one way or another the particular nitrogen-gathering microbe which associates with this particular plant must be there, or the crop is doomed to failure.

Some soils naturally contain this organism apparently. At least, alfalfa sown without any intentional inoculation does well from the start and develops nodules on the roots. In our Station garden this was the case.

Other soils, and, I think, most soils, do not have this organism in them and need to have it brought to them. In places where repeated trials with alfalfa have failed, the inoculation of the soil has been at once followed with a good stand.

As to the best way of getting this microbe into the soil, I believe the surest way is to scatter on it soil taken within a few inches of the surface of a well-established alfalfa field where the plants show abundant root nodules. One hundred pounds of soil is enough, sown over an acre and harrowed in with the seed, or any time within three months before seeding.

Equally successful in Illinois has been the use of soil taken from waste land where the sweet clover, melilot, grows abundantly. This plant is not uncommon on waste lands here in Connecticut; it is a nitrogen-gatherer, and the observations and tests of Dr. Hopkins have proved its value in inoculating alfalfa fields.

The cultures made as a commercial venture, which have been so widely advertised to " double the yield " with the statement that " you can be absolutely sure of a heavy crop of alfalfa the first year after seeding," cannot be recommended. Experiments indicate that they are worthless.

I have tried to give very briefly an idea of the merits of alfalfa as a crop, the work which is necessary to success with it, and not to hide the difficulties of its introduction.

We need to raise more leguminous crops than we do now, not more for the sake of our cattle than for the sake of our land. We need them as cover crops for the winter, to prevent washing and leaching. We need them as green manure in the spring, and we need them to lessen our grain bills. Cow-peas and soy-beans are used to some extent. Red clover is neglected. To my mind there is more chance of *general* success with red clover than with alfalfa.

I wish every farmer in Connecticut might have seen the fields at the Agricultural College at Storrs as I saw them before snow flew. They were certainly an object lesson in good farming. There was no bare ground in sight in the late fall. Every field was tucked up for the winter with a coverlet either of rye or, for the most part, as it looked to me, of red clover. There was no chance for loss of nitrogen from the soil by leaching; there was rather the certainty of a gain. None of the land was lying idle.

But this is not a talk on clover. Alfalfa at present has the center of the stage. An acre of alfalfa, at its best, will certainly yield more concentrated cattle feed than any crop which we can grow. It is worth a trial by all dairy farmers, even those who have failed with it years ago, for we have new knowledge regarding the causes of failure and the road to success.

But this is the real point of this talk. Don't let us take the time to simply fool with it. Laying down an alfalfa field is like making a road. It requires skill and work. It is to last for years. Do it right then, or leave it alone. Choose the land very carefully; get it as clean of weeds as it is possible, either by a summer fallow or by a hoed crop which is kept specially clean; put on a heavy dose of lime; get seed of which 90 per cent. will sprout, preferably from unirrigated western seed farms; inoculate with soil from another alfalfa field or from a patch of sweet clover; if weeds are abundant, clip the field five or six inches from the ground as often as needed to keep them down; and if the stand of alfalfa is thin and the weeds rampant, be prepared to turn the piece under and seed again between the first and fifteenth of August.

Every one of these points is quite essential to a fair trial of alfalfa. To omit any one is to endanger the whole experiment. They will not ensure success. On many soils alfalfa will not grow successfully. The thing should be tried as an experiment and as one where you can afford to lose. If you succeed, it is easier to increase your acreage than it was to make the start.

Success will pay handsomely, but it will come, like every other success, only with labor and skill and watchfulness. Success is not distributed in any two-dollar packages with nitro-cultures.

DISCUSSION.

Mr. Phelps. Dr. Jenkins made the statement in his interesting paper that some soils naturally contained the alfalfa microbe, and I think he said that he found that to be the case with the Station grounds at New Haven. I would like to ask if he has found that condition common about the State.

Dr. Jenkins. No. As a rule, I think inoculation is necessary. The soil must have the microbe in it in order to be successful with the crop. It is necessary to inoculate the soil if the organism is not present. I have already spoken of the manner of getting the microbes into the soil.

I might add to what I have already said that you should not be discouraged if the first year you get no crop from your alfalfa that is worth saving, that is, from the first year's seeding. Do not be discouraged if you do not get any alfalfa that you can make hay with. If your plants look heavy and thrifty in the fall, and the field shows signs of your getting a good stand, give a good mulch of stable manure late in the fall and that will probably bring the field through in good condition. The next year, in all probability, the results will be better. Every one of these points is quite essential to the production of a good crop.

Now I recognize that this is a discouraging, lukewarm, and half-hearted sort of a paper, but the intention of the paper has been to give the facts as they appear to us. I think it is better to tell the truth about it as we see it now. There has been so much inordinate praise of alfalfa that it is likely to damage the success of the crop in the State through a misunderstanding of the difficulties in the way of successfully raising it. You remember how it was with ensilage. When ensilage was brought out the shout went up at once that you could increase the amount of digestive food for your cattle by putting the green fodder into your silo and manufacturing a food. After a while it was discovered that the matter was not sufficiently understood. Ensilage did not turn out as was expected, and the consequence was that it got a black eye in this State. Now we are beginning to see things in their true light, and are getting the benefit of that knowledge.

Take the matter of Sumatra tobacco. We went into that quite extensively in some parts of the State in 1900, and after the first crop dealers in New York were apparently so pleased with it that they said it was worth $1.75 a pound, that they would give that for it. We sold a lot of it for $1.75 which, of course, was very encouraging. We cautioned the farmers, however, at that time to go slow until it was fully understood, to try it as an experiment, and not to put in more money than they wanted to throw away, but the promoters came down on the State, companies to raise Sumatra tobacco were formed, subscription agencies were opened in Hartford in special offices, and the farmers in the tobacco raising sections besought to take stock and go into the raising of Sumatra. After a short time it became plain, as many of you know, that the matter was not sufficiently understood, and the result is that the whole business is now as flat as a pancake.

Now it has been somewhat the same with alfalfa. There has been a lot of talk about alfalfa that has been in the nature, as they say on the street, of hot air. It has been boomed by some as something with which we could certainly succeed. We cannot certainly succeed. It depends very much on circumstances, and upon how the crop is handled. It has been tried in the State for twenty-five years. We have been trying it for a considerable time, trying to learn the facts about it applicable in this State. We have been testing growing it with farmers for a couple of years, and we do not feel at all sure about it yet. There are many encouraging things about it, but it is not a thing that we can afford to go into on any considerable scale as yet. It must be tested further. There are two or three alfalfa fields in the State that seem to be very promising, and which look as though they would be worth a great deal to those who have them, but it is not a thing to bank upon as an assured success yet. (Applause.)

Mr. Phelps. Professor Jenkins has given us a considerable amount of meat in his paper, and we want to see if we cannot digest some of it.

I have interested myself in the work of growing leguminous plants, including alfalfa, and as I have had considerable experience on the subject, I thought possibly it might be of some interest to the people here, and I want to ask your indulgence for a few minutes.

In the first place, there is need for investigation along this line, from two standpoints; one from the standpoint of soil improvement, and the other from the standpoint of cheaper feeds. I want to speak of the first. For the last six or seven years, it has been my privilege, and a part of my duty, to prepare for use about a carload of chemicals every year, and I have found that the prices of phosphates and potash materials have remained about uniform for the past eight years. There has been very little change in the price from year to year. How is it with regard to nitrogen? When I started in making home mixtures, I could buy nitrate of soda for from thirty-seven to thirty-eight dollars per ton. How is it today? The price has gone up. Last winter, when getting the prices for chemicals, I became quite concerned on the nitrate of soda question, and I began to look around to see if I could find anything for a substitute. I found I could buy nitrate of potash, and get it more cheaply than I could the same amount of nitrogen and of potash in the form of nitrate of soda and muriate of potash. I talked it over with my proprietor, and he said you had better put in five tons of it at seventy-five dollars a ton. This year I thought I would be a little forehanded, and for several reasons it seemed best that we should put in our chemicals in the fall, and I began to get prices. I found nitrate of soda quoted at fifty to fifty-two dollars per ton in New York. I sent to the house where we got our nitrate of potash last year, and it was ninety dollars per ton. That knocked out the nitrate of potash question. I investigated carefully to see where we could buy our chemicals in the bulk best, and found, as the result, that we could save about a dollar a ton, on the average, over New York prices by buying in Baltimore; but at the best, the nitrate of soda cost us over fifty dollars per ton delivered. Now this great advance in the price of nitrogenous fertilizers brings up a very serious question. What are we going to do with the nitrogen question? What are we going to do for this food element for our plants?

We find the same condition of affairs when we study the question from the standpoint of feeds for our animals. Ten years ago we could buy plenty of cotton seed meal for from twenty to twenty-two dollars per ton. Now we are lucky if we can buy a carload for twenty-eight or twenty-nine dollars per ton, and all nitrogenous feeds have pushed upwards in the same way. We are face to face with a very serious problem, in fact, with a double problem. How can we buy nitrogen for feeding our plants and how can we obtain protein for feeding our animals? It seems to me that along the line of growing legumes on our farms, and the conservation of soil nitrogen by using certain crops as a means of drawing nitrogen from the air lies our best hope of success. I believe, for that very reason, that, in a careful, conservative way, every dairyman should experiment with alfalfa, and make it a success, if possible. I have been experimenting with it more or less for the past six or seven years, but more particularly in the last two years. When I went onto the farm where I am now located I found a very nice field of alfalfa. My predecessor was interested in the question, and he had foreseen the need of alfalfa. How good the crops were before I took charge of the farm I do not know, but I do know this, that we cut three very good crops in the year 1903, and used it for soiling purposes. You will remember what a severe winter we had in 1903 and 1904. During the summer of 1904 we cut three light crops. The clover and other grasses came in, and crowded out the alfalfa, but we used it for soiling purposes, getting, on the whole, a fairly good yield. In the spring of 1905 we started a new field, using about thirty pounds of seed to the acre. I got some pure culture from Washington and attempted to follow their directions for starting it. I should like to relate this because I can see from my experience some difficulties ahead for the average farmer in handling the pure cultures. The directions were to place the culture in a certain amount of rainwater, or distilled water, adding the nutrient salts, and then to set it in a warm place for a period of twenty-four hours. I did not know what would be considered a warm place. It was, however, the month of May, and the weather was getting warm, so I thought I would set it on the piazza of the house and see what would happen. I left it there for twenty-four hours, but at the end of that period the milky color which the directions said would show did not manifest itself. I said to myself there must be something that is not quite right, I will leave it by the stove. I did so, and the next day the milky condition was very apparent. Now suppose that condition was placed before the average farmer. What would he have done about following directions? I left it in a warm place for twenty-four hours. I knew, however, it was not in condition to use, and I waited for another twenty-four hours. I then soaked the seed in the culture solution, dried it by spreading it on some sheets, and then went ahead and sowed the seed in the usual manner.

I found, in the early part of July, that the nodules were beginning to appear on the roots. I looked over the field, and here and there were plants which had a different appearance from others, and I found, when I dug down carefully, that the nodules were present on the roots. I soon found that I could tell by the appearance of the foliage the plants that would have the nodules, and I could pick out those that would not. Not more than a quarter of the plants showed the presence of nodules, even though I had been reasonably careful in following the prescribed method of seed inoculation. We had a very fine growth which we cut off when about a foot high, about the 15th of July. For the next two weeks the weather was dry, and the weeds came on very rapidly. They choked the alfalfa back and it seemed likely to go into the winter in rather poor condition, so I plowed it up.

In the fall of 1904 we plowed up the old alfalfa field where we got such a good crop in 1903, and a fair crop in 1904. This year, I said, I will see if we cannot get ahead of those weeds. So I re-plowed the field last spring, manured it, and re-plowed it again. During the summer we cultivated and harrowed thoroughly once in about two weeks. The seed was sown about the middle of August, and when the cold weather came on the alfalfa was a thick mat about four to five inches in height. It was looking in good condition as the winter season came on. I think we shall get something in the way of a crop the coming year as the field is now quite free of weeds.

I believe in following out, in a very careful way, the directions that Dr. Jenkins has given, and especially that we must have these inoculating bacteria from some source. If they are not in the soil they must be placed there. I believe if we will follow Dr. Jenkins' advice, and work with the very best methods we can get, there is a fair degree of certainty that we can prove that alfalfa may be raised successfully in Connecticut. We must, however, clear our fields well of weeds during the early summer season, and seed after mid-summer. I should have preferred to have seeded two weeks earlier than I did, or about August 1st, but the working conditions on the farm are sometimes such that one cannot do things just when he wants to do them. I believe fully that alfalfa, and a good many of the other legumes, are crops that we must grow more generally if we are going to produce cheap nitrogen for the feeding of our plants, and if we are going to produce a cheaper form of protein for the feeding of our animals. We certainly should do more than we have been doing in the past toward producing and saving nitrogen on the farm.

Mr. J. B. Noble. I would like to ask Dr. Jenkins if we can get a crop of alfalfa in Connecticut whether it is a desirable dairy feed? We know that they do grow large crops of it, and it is fattening for animals, but is it a good dairy feed for the production of milk and butter?

Dr. Jenkins. I have not had any experience. I never got so far that I had a lot of it to feed to cows. I know this, however, that Mr. Stadtmueller, on a big farm at West Hartford, has used it. I believe he is selling milk from thoroughbred Jersey and Guernsey herds, and I know he would not have used it if, in his observation, there was anything about it that was not just right for a good dairy herd. Unquestionably, it is very rich in nitrogenous food, and I should think it would be important as a dairy feed. I never heard the point made anywhere that it was not good for milk and butter products. Of course, Mr. Stadtmueller is raising milk and not butter, and for his milk producing I think he certainly finds it an admirable thing.

Mr. Strawhecker. Mr. President, this is an intensely interesting subject to farmers in Connecticut whether we ultimately succeed in raising it here or not. I can hardly agree with the Doctor in the statement made during the last part of his address that his paper was a lukewarm paper. I consider it a very valuable exposition of the alfalfa subject.

It has been my pleasure to have been in a position to observe during the last four or five years considerable in regard to alfalfa growing in central and western New York, and down through southern Ohio. Of course, central New York appeals to us with rather more interest than points further west. They have had splendid success with growing it in New York. I remember riding from Dunkirk into Buffalo along in June, and noticed at one point that the railroad embankment was thoroughly covered with it. In fact, it seemed to be quite a good solid stand.

I knew of a party that started to grow it upon upland ground, and after growing some on lower land he found he could get three good cuttings. The good cuttings were from thirty to thirty-four days apart. There is another point that I would like to ask the Doctor's opinion on, and that is in regard to getting a good stand the first year when it has attained a height of six inches. It is said if you try to mow it before it gets up to a certain height that it will slip right over the machine. Have you ever had any experience with that?

Alfalfa has a tendency to grow too much top unless it is cut. It needs to be cut at the right time or the stalks become woody. When it is cut at the right time you cannot get any better hay.

As for feeding purposes it is most excellent, and it is highly relished by most all kinds of stock, pigs as well as cattle. They have grown it to some extent in the Housatonic Valley, where I am still interested. Just what kind of land will do the best for it I am not quite sure, but I apprehend it needs a good quality of land. I think it would be almost useless to attempt to start it on some of the old cold river plains over there. I would not want to do that. I think we must prepare perhaps the best land to be inoculated with the proper bacteria, and then the prospect for getting a crop is pretty good.

I am intensely interested in this subject, and would like to hear from any others who have tried it, and especially with reference to the kind of ground it seems to do the best on.

Mr. Phelps. The gentleman has touched on a very important point, and that is the necessity of taking some good soil. I think that is where a great many of the failures with alfalfa have come about. Farmers have thought that alfalfa, being a legume, would gather its nitrogen from the air and would thrive even if put in rather poor soil. I think that is a great mistake. Alfalfa, especially the first year, gets very little nitrogen from the air, and the soil really wants to be a rich soil. After it gets well established we have got a different condition to deal with, but you want a rich soil the first year.

Mr. Strawhecker. I have heard it stated that the bacteria needed for red clover is the same as that for alfalfa. I am not sure whether they are or not. I would like to ask Dr. Jenkins if he has any information about that.

Dr. Jenkins. I do not think that bacteriologists can tell whether they belong to the same species or not, but certainly they are two different strains, if they are not distinct species. They are distinct strains so that a culture that would inoculate an alfalfa field would not with the same efficiency inoculate red clover. I am quite sure they are distinct strains, if not species. Recent observations and tests at one of our agricultural stations, which were repeated by bacteriologists in several other stations, showed that cultures which have been put out by some of the commercial companies with which to inoculate alfalfa fields, showed that they were so full of fungi and other things instead of being a pure culture that if they ever had any of the organisms which would inoculate an alfalfa field to begin with they were run out and destroyed by this fungi and were absolutely worthless for the purposes for which they were sold.

Question. If we sow alfalfa with red clover will it help you out in any way? I do not know whether anyone here is familiar with the work of Mr. Goble at Bristol. He has been trying for a number of years to get some alfalfa on his farm, and has tried both by sowing it in the spring and also in the fall. This year, about the last of June or the first of July he mixed it up with red clover. Will the clover help the alfalfa?

Dr. Jenkins. That I cannot say. It is frequently sown with the clover crop. I never have tried it in that way. As far as my results and knowledge of others have gone they have not seemed to favor the use of any cover crop with it. They have had better results without. In some cases, particularly in the west, I have read of their using clover, but I think it would only help it as a shelter or protection and not in any way help the inoculation of the roots.

Mr. Matthews. Will the alfalfa do any better on land that has the clover bacteria in it? I have the bacteria on my clover. I am using clover as a cover crop, and I was thinking of trying alfalfa, and wondering whether I would be more likely to succeed on the clover land.

Dr. Jenkins. I do not think that clover nodules in themselves will materially assist the success of alfalfa, yet the land on which a crop of red clover is grown will be more apt to raise a successful crop of alfalfa. I should think so. I should say if the soil had sufficient lime, or the right kind of plant food for leguminous plants in it, alfalfa would succeed. In other words, I should expect more success on that kind of land, but not, so far as we know, by any transfer of bacteria from one root to another.

The President. I would like to ask Professor Shaw to say something about this matter.

Prof. Shaw. Mr Chairman and Gentlemen:

As the time is so far gone I will not say very much on this question, although I have thought a little about it and have had some experience in growing alfalfa. The thought came to me when Dr. Jenkins was referring to the fact that sweet clover would grow in dry places in different parts of the State, whether alfalfa would not grow in the same localities. I wonder if anybody has tried it. I will qualify that by saying that it is quite possible for sweet clover to grow in the west in certain localities, and alfalfa grown on that same land and under the same conditions will not grow well. I apprehend it is because the sweet clover has more power to gather nitrogen from the soil than the alfalfa; that it would be necessary, in order to be quite sure of success, to enrich the land thoroughly by applying some fertilizer, and especially, I should say, of farm manure.

Now if the bacteria are not the same, and scientists seem to be agreed on that, for growing sweet clover as for growing alfalfa, it seems to me that all that would be necessary would be simply to enrich the soil. I hope that some one of the farmers in this State will find that out. Dr. Jenkins is undoubtedly in a good position to do it, and it seems to me to be a piece of information that will be of some service to the farmers of this State. I believe that alfalfa is going to be grown right up in the

Saskatchewan River valley in the Canadian Northwest. In fact, it includes alfalfa at the present time. You will pardon me for this personal reference, but when I wrote that chapter on clover and said that the 49th parallel was about the limit of clover as well as alfalfa I found later on I was wrong. I spent sixteen days in riding over the Canadian Northwest, and when I came back home I had to revise that chapter. I said that the northerly limit of growing clover or alfalfa is north of the Saskatchewan River in the Canadian Northwest,— about four hundred miles north of parallel 49. I simply refer to this, farmers, so that you may be encouraged to believe that you will succeed in growing alfalfa. I think you will find the same to be the case in the State of Connecticut. We are growing it in Minnesota very successfully, where the winters usually are much more severe than they are here. We are not growing it all over Minnesota, and we never will because some of our land is not suited to it, and before I sit down I would like to refer to an experience in growing alfalfa that I had myself. It was on a patch of eleven acres, which was, of course, a little large for an experiment. The patch came up fine. It was sown in May, and we cut it off two or three times during quite a wet summer. Some of the cuttings of plants and weeds we allowed to lie as a mulch on the ground, and the plants grew admirably until about the first of September, and then began to wane. When winter fairly set in I said to one of the men to take some of the best rotted manure that he could get in the yard and draw it over the poorest part of the field, and he did so, going over it several times back and forth, and the result was this; that the next summer there was a magnificent stand of alfalfa where the fertilizer was scattered over the poorest part of the field, and on the other part of the field the plants were more or less sickly, so that they were plowed up.

Now I am not prepared to say that farmyard manure has the power of giving to alfalfa the ability to draw nitrogen from the air, that is, to draw it from the air without being inoculated, but I cannot help but think, gentlemen, that there is a pretty close relation between that ability and the amount of fertilizer that is put on the patch.

The President. The meeting will stand adjourned until two o'clock this afternoon.

AFTERNOON SESSION.

December 14, 1905.

Music.

Convention called to order at 2 P. M., Vice-President Seeley in the Chair.

The President. If the speaker of the afternoon was not in the house, I should like to have the Secretary read some communications just received from two different sources. I think, however, that if the speaker will shut his ears we will read them even though he is here, and I will ask Secretary Brown to read the communications.

Secretary Brown. I think, gentlemen, it is due to you and due to the speaker of the afternoon that a better acquaintance should be established between you, and in order that there may be a better understanding between you and him I will read a letter received this morning from Mr. Herbert Myrick, whom you all know.

"Springfield, Mass., Dec. 13, 1905.

"My dear Mr. Brown:

"Our good friend, Prof. Thomas Shaw, received a warm welcome at Lisbon, N. H.; also here yesterday before the Massachusetts State Grange. I never knew a speaker to be so warmly received by a New England audience. I hope he will be equally beneficial to you. He is absolutely the best informed, from both a practical and scientific standpoint, of any man in his line in this country."

Enclosed with Mr. Myrick's letter was a paper containing what the Master of the Massachusetts State Grange said when introducing Prof. Shaw.

"It gives me pleasure to introduce to this great audience of Massachusetts farmers and their wives the leading expert in America upon the subject of live stock breeding, feeding and management. This gentleman's name is already a household word in New England although this is his first visit here. He has this week addressed the New Hampshire State Board of Agriculture at Lisbon, and tomorrow speaks before the Connecticut State Board of Agriculture. Brought up in Ontario, Director of the Minnesota Experiment Station, and now live stock editor of the *New England Homestead,* he is also identified with the *Homestead's* contest to add millions to the profits of grain growers."

The PRESIDENT. Ladies and Gentlemen, it gives me great pleasure to introduce Professor Shaw, who will speak to us this afternoon upon the subject of "Feeding Farm Animals."

FEEDING FARM ANIMALS.

By PROF. THOMAS SHAW,

St. Anthony's Park, St. Paul, Minn.

Mr. Chairman, and Ladies and Gentlemen:

The introduction which your Chairman and the Secretary of the State Board have been pleased to give me I must say somewhat takes away my breath. If an introduction of that kind had come after my talk rather than before it I would probably feel a little more self-possessed than I do at present. I do want to say this, however, before taking up the subject that I shall more particularly talk upon; I do want to say that I do hope to be better known in New England in the future than I have been in the past, and I do hope to be able to enroll on the list of my friends a large number of the intelligent farmers of this part of the great American Republic.

I do not know that I have referred to that grain-growers' contest, and had it not been for the reference made in that document read by the Secretary, should probably have passed it over, but I will say simply in passing that it is true that I do have to look after that contest. I believe it is to be the greatest contest that was ever established among the farmers of any country. In regard to the causes of the contest in growing grain, and increasing the product of the farm, of course, the future can only speak, but I do want to say to you, farmers, that it is not simply an advertising dodge. It is something that is, in my judgment, very greatly for the benefit of farmers everywhere. It is something that is intended to help not only the farmers of New England, but the farmers all over the United States.

I have been announced to talk to you on the question of feeding live stock, — a great, wide question, like the question that I attempted to speak upon yesterday. I can see, brethren, as you cannot, perhaps, some difficulties with the discussion of this question before an audience of Connecticut farmers. I put the question to several, — are any live stock fattened in Connecticut? And generally the answer came in the negative. I did hear about one or two that attempted to fatten live stock in a somewhat extensive way, but I have yet to meet the first man who is fattening live stock upon his farm in the sense in which live stock is fattened upon the farms of the western country. I know, of course, that my subject does not confine me to the question of fattening live stock, because it is a question which involves not only the fattening of live stock but the feeding of dairy animals and the feeding of all kinds of farm stock. I put this question to the same men. I said, "Do the farmers in Connecticut grow their own meat for their tables?" but, farmers, they told me "No." I asked, "Do the farmers grow their own pork for their own tables?" and, farmers, they told me "No." I wonder why Connecticut farmers do not grow their own beef, and do not grow their own pork, for I do not need to tell you, farmers, that every dollar kept upon the farm in that way is a dollar saved. I am not here on this platform to tell you that you cannot bring in cattle from the west and fatten them and sell them in the market here and make them pay you. I am not here to tell you that. I am here, however, to tell you that I do not see why you should do that; that it is my profound judgment that you can grow your own beef, that you can grow your own pork, and you can do it just as well, and, in fact, you can grow better beef and better pork than you can buy. You can do it cheaper than you can do it by getting it from elsewhere to begin with and putting the stock through the fattening process here.

The successful feeding of farm animals is never the result of accident. It is the outcome of giving food and care more or less in conformity with the leading principles that govern such work. The measure of the success will be the measure of the fidelity with which these principles have been observed. True, the individual who thus succeeds may not be able to formulate those principles, but he unconsciously follows them all the same, or success would not crown his efforts. In the absence of formulated principles the individual must learn from the experience of some one else; in their presence he has a safe guide, in the absence of experience, although experience is necessary to enable him to apply them in the most successful manner.

The following are chief among the leading principles that govern the successful rearing and feeding of farm animals: —

1. They must possess quality before they can be fed and reared with marked success.

2. More food is required to make a given gain as the birth period is receded from.

3. When periods of stagnation occur before maturity, the food of maintenance, fed during such periods, brings little or no return.

4. When development is seriously arrested at any period before its completion, the feeding quality of the animal is affected adversely.

5. When development is unduly forced by stimulating foods while the animal is young, its feeding qualities are injured.

6. In the fattening process, when animals are so ripened that they cease to make good gains, further feeding can only be done at a loss.

7. In selecting a ration for feeding, a due regard must be had to the chemical constituents of the food or foods which compose it.

8. In nearly all instances a mixed diet is superior to one composed of any one food.

9. In fattening animals the profit or loss resulting is largely influenced by the cost of the animals up to the time when the fattening begins.

10. Pregnant animals should be maintained in a good condition of flesh.

11. When animals are exposed to temperatures below what is normal, additional food proportioned to the degree of the exposure will be necessary to restore animal heat.

12. Discomfort from any source arrests development and consequently produces loss in proportion to the degree and continuity of the same.

Quality when applied to farm animals is comprehensive or otherwise as the term is defined. More commonly it has reference to handling the skin and flesh, especially of cattle. When thus applied it has reference mainly to the sensation conveyed to the mind through the sense of touch. Its presence is usually sought by touching certain portions of the body with the finger tips to ascertain the depth of the covering, and by grasping the skin over the ribs within the hand to ascertain its looseness and flexibility. A good depth of elastic flesh relatively over the portions that are more difficult to cover, as the loin and shoulder blade, and loose, pliant skin are indicative of good digestive qualities as they are the outcome of these.

As used here, however, quality is used in a wider sense, that is to say, in the sense of capacity for well doing as indicated by the breeding and form in addition to the handling. The breeding of animals has, of course, an important influence on their feeding qualities. As a rule, well chosen, pure bred animals of the beef breeds will make greater gains and more rapid gains from a given amount of food than will common stock of mixed and inferior breeding, or than animals of the various dairy breeds. This statement has been denied, and some of the experiments conducted by the experiment stations would seem to favor such denial. Other experiments tend to sustain the opposite view. Of the correctness of the stand taken, however, I have not the shadow of a doubt. Good digestive and assimilative qualities are as much a matter of transmission as qualities or properties that relate to form.

The possession of correct form is, of course, immensely important. The precise nature of such form will be largely dependent on the precise object for which the animals are reared. In meat-making animals it usually means much relative width and depth, and fore and hind quarters well balanced as to weight. In milk giving animals it means much capacity of barrel and various other accompaniments which cannot be mentioned here.

The difference in capacity of animals similar in age, breeding, and form, to digest and assimilate food, is very great. It varies in some instances between fifty and one hundred per cent. One steer being fattened will sometimes gain but little more than one pound a day, whereas another steer will gain two pounds per day on practically the same food. But the difference in returns in meat-making animals as the result of form is no less great. One animal possessed of correct form will sell for five cents per pound alive, when another fed for as long a period will only sell for three cents, the difference being based entirely, or almost entirely, on form.

As a rule, the amount of food required to make a pound of gain in meat-making animals increases as the birth period is receded from.

It is easily possible to make an animal of beef inheritance gain two pounds daily during the first year, not including birth weight, even though reared essentially on skim-milk and adjuncts during the milk period. The same animal is not likely to increase in weight the second year more rapidly than one and one-half pounds per day, or the third year more rapidly than one and one-quarter pounds per day, notwithstanding that more food was consumed the second year than the first, and the third year than the second. The explanation is found in greater activity of the digestive organs near the birth period and to the increase in the cost of the food of maintenance as the birth period is receded from. Young swine furnish an exception to the rule regarding increase in weight, but not in regard to increase in the food required to make weight. Young swine while nursing cannot be made to gain so rapidly as at a later period.

The economy of pushing our meat-making animals rapidly from birth until ready for the block will be readily apparent. The importance of so doing increases with relative increase in the cost of food. It may be different where, at certain seasons of the year, cheap and coarse foods are abundant on the farm, and it is desirable to utilize them to the utmost, or where pastures are partly or wholly free, as on the range. It may be that a steer grown on the range will bring the greatest profit sold at four years. It may also be that a steer grown on farms in the Mississippi basin, where, oftentimes, much fodder is wasted, will bring greatest profits at three years, but in the eastern and New England States, greater profits will certainly come from selling steers finished at an age not exceeding two years, where food is relatively dear.

The truth must be self-evident, that if at any time before development is complete, growth ceases in whole or in part, the cost of the food of maintenance is proportionately increased. If cessation in growth is complete, there is no return for the food of maintenance during its continuance, unless it be under conditions where animals are thus carried on until they can be maintained on cheaper foods. For instance, it may pay a ranchman to carry an animal through the winter without gain in order to bring it to that season when it will graze on pastures that cost but little or are entirely free. But it will not pay the eastern farmer thus to carry a young animal through the winter, since pastures on eastern farms are valuable as well as coarse foods.

The farmer who puts a young animal in winter quarters at the advent of winter, and who turns the same out to graze, say, five months hence, without any advance in weight, has virtualy lost the food fed during those five months. The only return he has is a poor grade of fertilizer, the value of which will be largely offset by the labor expended in caring for the animal and the cost of providing suitable shelter. In growing meat-making animals, therefore, on eastern farms, the wisdom of keeping the animals growing all the while and with prudent haste, and of selling them at a relatively early age will be abundantly apparent.

Should development be arrested in whole or in part at any time before it is completed, the capacity for future development is weakened in proportion to the degree to which development was hindered.

When the hindrance to development is slight and covers but a short period, the injury resulting may be so slight as to be imperceptible. Notwithstanding, time is lost in completing development and there is also a proportionate loss in the food of maintenance. If the arrested development has been prolonged and severe, in addition to a proportionate delay in completed development and a proportionate loss in the food of maintenance, there will also be a proportionate loss in the capacity for future development. Feed the animal ever so well subsequently, and it will never wholly regain what has been lost. In other words, the same profit can never again be made from growing the animal that would otherwise have been possible. If the arrested development has been exceedingly severe, then the loss of capacity to develop may be so great as to preclude the possibility of making any profit from rearing the animal under any conditions howsoever favorable. It should also be remembered that the loss of capacity for future development is greatest when arrested development occurs near the birth period, and gradually grows less as it is receded from. The importance, therefore, of keeping animals pushing on with prudential haste from the day of birth until development is complete, or until they are ready for the block, cannot be easily over-estimated.

Arrested development may arise, of course, from various sources. It may come from insufficient or unsuitable food, or food both insufficient and unsuitable, also from food excessive in supply and nutrition, or from undue exposure, or from several of these, and it may be other causes combined. It would be too much to claim that the source of arrested development did not influence the loss of capacity referred to, but it would not be claiming too much to say, that whatsoever the source, the loss in capacity to develop will be serious whenever prolonged periods of stagnation occur in the early growth of the animal. The unsatisfactory development subsequently of the ill-cared-for whey-fed calves furnishes an illustration.

When food is exactly adapted to the needs of a young and growing animal, it would not be easily possible to injure the animal by over-feeding, but it would, of course, be easily possible to waste food through careless feeding. Exact adaptation has reference to foods in due balance both with regard to chemical constituents and proper adjustment between the concentrated food fed and the roughage. With some foods adaptation is so perfect that animals feeding upon them will not injure themselves and will at the same time make satisfactory development in the line sought. This is true of rich pastures grazed in summer, and of clover and alfalfa hay fed in winter. Other foods fed at will may be seriously harmful, in fact, positively dangerous, while at the same time they are helpful when fed with due regulation. For instance, one feed of rye meal consumed at will may destroy a young animal, while a suitable amount fed from day to day with other food adjuncts would be decidedly helpful.

Injury from excessive feeding of meal to young animals most commonly occurs when they are less than one year old. During the milk period, young calves will seldom, if indeed ever, injure themselves by feeding ever so freely on a meal ration composed of ground oats and wheat bran fed in equal parts by weight, nor are they likely to injure themselves subsequently on such food with suitable fodder adjuncts. The reference here is to animals grown for meat. But a time comes when so much of the meal would be consumed that it is unprofitable to feed it longer at will. But suppose instead of the meals mentioned, corn was used, or rye, or a mixture of these, a time would come when development would be checked, if not positively arrested. The too concentrated character of the food in conjunction with the excessive amount fed has overtaxed the digestive and assimilative organs to the extent of weakening them it may be permanently.

When the animals are being grown for milk production the properties concerned in future milk production may be weakened by such feeding before the point has been reached when the digestive organs become impaired. The injury may come from the influence which the food has exercised on assimilation. It has strengthened the digestive habit of utilizing the food in making fat and the influence in this direction is felt even after the female has begun to produce milk. It is possible, however, if not indeed probable, that this thought has been carried too far in the rearing of dairy heifers.

When animals are so forced during the finishing period by feeding so much strong meal that they get off their feed, that is, lose appetite in whole or in part, the danger point has been reached. The digestion has been more or less impaired. Cessation in feeding the meal or the grain that has caused the trouble is the remedy. In many instances, however, subsequent gains will be less than they would have been had the digestion not been thus impaired.

It is also true that dairy cows under high pressure feeding may have the milk giving function weakened in the absence of any symptom of indigestion, results from sheer overwork. The machinery of digestion has been driven at a speed so high and so continuous that the wear has been excessive, although there has been no breaking down in any part thereof. The limit of the period of high usefulness in a dairy cow may thus be easily and materially shortened.

Animals that are being fed for the block are ripe when, under normal conditions of feeding they cease to make material gains. If kept longer, the larger portion of the food fed is given at a loss. The loss may soon become serious, for, under such conditions, they may continue to consume large quantities of food. Such ripeness is indicated by a firmness of the flesh under gentle pressure or by marked falling off in the gains under suitable conditions of feeding. In an experiment conducted under my personal supervision, pork during the fattening period was made up to a certain point at a cost of approximately four cents per pound, whereas during subsequent weeks the cost was approximately ten dollars per hundred pounds, the food being fed the same in kind. The importance of disposing of animals promptly when finished is thus apparent.

The mistake, however, is far more frequently made of selling animals unfinished. Probably ninety per cent. of all the cattle sold reach the block under rather than over-finished. This more than anything else probably is accountable for the too common belief that there is no money in fattening cattle. Sometimes cattle are sold half finished because the price of food has become unduly high. At other times, because suitable food supplies cannot be obtained, but more frequently, perhaps, because many do not properly understand what good finish in cattle means.

When foods are being fed a due regard must be had to their chemical constituents, which means that a proper relation must obtain between the amount of protein and carbo-hydrates fed under normal conditions of feeding to insure the most satisfactory results. This relation will vary with the animals fed and the objects sought from feeding them. These varieties cannot be discussed, they are so many. There must also be a certain relation between the amount of concentrates and roughage to bring highest profits. But since this relation is a shifting quantity and is to some extent affected by food values, it also will not be discussed further.

I call attention to the important fact here, that the real value of a food factor may be more or less in practical feeding than chemistry would assign to it on the basis of food constituents. Two factors at least must be considered in judging of the value of a food in addition to the chemical constituents which it contains. The first is palatability, and the second is the influence exerted on the digestion. Thus, rye straw, because of its low palatability, has a lower food value than chemistry would assign to it. Animals will not eat it freely unless impelled to do so by hunger. On the other hand, field roots have a higher food value because they favorably influence the digestion.

The further fact is also significant, that in some instances, foods may be fed at a greater profit when fed out of balance rather than in balance. This is possible when one food is so much cheaper than another opposite in character, that it may, as it were, be fed in excess. I have fattened lambs at a greater profit on a ration not in balance than on one in balance, because of the relative cheapness of corn, a leading factor in the former. In alfalfa areas, it also sometimes pays better to feed protein in some excess than incur the cost of securing other foods to balance the ration.

In feeding animals for a prolonged period, a mixed diet is superior to a ration composed of only one or two food factors. This may, to some extent, be owing to some chemical action which the foods exercise one upon the other in the process of digestion. It is probable, however, that it is due more to the influence exercised by the combined foods on the appetite and to the more even balance that is thus likely to be secured in the mixed diet. Animals, like individuals in the human family, tire of one kind of food when fed continuously upon it. To this there may be some few exceptions. They tire more quickly of some food factors than others. Swine, for instance, will consume corn for a longer period with a relish than barley or rye, and horses will consume oats with avidity for a longer period than any other kind of grain.

These influences are more noticeable when the feeding is forced, as when animals are ripening for the block. The appetite under such feeding slackens, hence any judicious change of diet that will lead them to consume more food will usually be found helpful.

Among the many influences which affect the profits that result from feeding, but three will be discussed here, viz: —

the influence of food values, of cost before the fattening period, and of the price received for the animals when sold.

The influence of food values is so evident that it is scarcely necessary to discuss it. Other things being equal, the difference in returns from feeding corn at twenty cents per bushel and the same at forty cents will be at once apparent.

Some seasons the price of food varies much. One kind of grain may be dear and another kind cheap. All kinds of grain may be relatively dear while fodders may be cheap. Under such conditions, the aim, of course, should be to feed the cheaper foods as far as may be judicious in the one instance, and to utilize fodders as far as may be practicable in the other. Sometimes, however, it may be advantageous to feed more or less of the dear food, because of the advantage which results from feeding foods in balance.

Where the conditions are normal it follows that, as a rule, foods may be more cheaply grown by the farmer than purchased, but it may, notwithstanding, be necessary to purchase more or less of one or more food factors not readily procurable from home sources in sufficient quantities. The grower may thus find it profitable to purchase wheat middlings freely, notwithstanding that he may be a large grower of corn. It is also generally true that fodders are relatively cheaper than grains, hence the larger the amount of these that may be judiciously fed, the larger will be the profits. In this fact is found the justification for the free use of corn ensilage in feeding live stock and in chaffing and mixing dry fodders with meal, in order to increase the consumption of the former.

As a rule, a pound of increase made during the finishing period costs more than the food used in making it. To this there are some exceptions, as when meat brings a good price while the foods used in making it are cheap. If, therefore, profit is to be made on home raised animals fattened on the farm, it must come from the two following sources, viz: the growing of the animals on cheap foods up to the time when the fattening begins, and the increase in value on every pound of live weight possessed by the animal at that time resulting from the fattening process. The profit of the feeder who buys the animals which he feeds can only come, of course, from the last named source.

Suppose, for instance, that a feeder purchases a steer at four cents a pound live weight, feeds him for six months and sells him for five cents a pound. Suppose the weight when purchased was 1,200 pounds, and when sold 1,500 pounds, the gain being three hundred pounds. Now suppose the three hundred pounds cost fifteen dollars to make it, then no profit has been made on the increase in weight. The profit comes from the advance of one cent per pound in the value of each of the 1,200 pounds of weight possessed by the animal when the feeding began, that is to say, it would be twelve dollars, leaving the value of the manure to offset the labor and interest on the investment.

The close relation, therefore, between buying and selling prices in animals that have been fattened is very apparent. The difference between the buying and selling price, as a rule, should not be less than one cent per pound, if any considerable profit is to come to the feeder. Before substantial profits can be assured this difference should be from one and one-quarter to one and one-half cents per pound.

At first thought it may be imagined that, since profit in feeding comes from the increase in value in the weight possessed by the animal at the time of purchase, the more the animal weighs at that time, the greater will be the profit resulting from fattening. In many instances that does not follow, since young animals considerably below maturity make greatest increase for the food fed to them.

The fallacy so extensively believed that pregnant animals should be kept in moderately low flesh has done much harm. It is, of course, quite possible to keep a pregnant dam in a condition of flesh too high for the well-being of the progeny, but the instances in which this occurs are few indeed compared with those in which the opposite is true.

The pregnant animal while in this condition must maintain herself and also nourish the foetus which she carries. The double duty thus present calls for liberal feeding. Where this is not forthcoming, the foetus is sustained in part at least at the expense of a lowered condition of flesh in the animal. This, of course, reduces the ability of the dam to properly nourish the offspring after birth.

After the young animal has been born, the drain upon the dam for its sustenance is usually heavy. To meet this need, the tax upon the system of the dam usually lowers her flesh though liberally fed. It follows, therefore, that a dam in good condition when her offspring is born can nourish it better than one in low condition. The former has stored up flesh previously which is now drawn upon to feed the offspring.

Animals that are being fattened must be protected from excessive cold or the cost of food in proportion to the gains made will be materially increased. It is probable, nevertheless, that more loss results from keeping animals too warm and closely confined while being fattened than from exposing them unduly to cold. Recent experiments have shown that animals fattened in sheds with liberty to move about in the same, and also in yards adjacent, have brought higher profit than those tied in the stall. The former consumed more food, but they also made greater gains.

The degree of the exposure or of the protection that should be given varies with the class of the animal. Sheep, for instance, will bear more cold than cattle, and cattle than swine, but it is imperative that all animals that are being fattened shall be protected from storms. Food is expensive heating material.

The feeder who attains to marked success in this line of work must study carefully the needs of the animals which he feeds. If the conditions prove too warm through change of weather, more ventilation should be promptly given. If they prove too cold, additional attention should be promptly given. If an animal gets off food, immediate attention must be given to its needs. The more completely comfortable that animals can be kept, the better they will flourish, and it will be the constant endeavor of the faithful stockman to make them comfortable. While engaged in such work, he can never come down from the watch-tower of vigilance, and his reward will be proportioned to the fidelity and intelligence which he has shown in his work.

Now I think I should not talk longer on this question, but I will be glad, if any of you have questions, to answer them if I can.

DISCUSSION.

Mr. Dimock. I would like to ask if you recommend feeds that the cattle do not relish?

Prof. SHAW. The question is as to how much stress should be laid on palatability, provided the animals take it. I would be satisfied if the animals would take it. I would not care particularly how much of a relish they had for it if they would only take it.

QUESTION. Can we gain anything by feeding roots, such as carrots and turnips, under the same circumstances as silage?

Prof. SHAW. I would say in answer to that, that the ensilage is cheaper. If you look at it simply from the standpoint of making milk it is better because corn can be grown more cheaply than roots, but corn will not do everything that roots will do. As I said before, if a man has a silo, and he feeds ensilage to his cows, he has got to feed a large quantity of corn if he is going to get the results. Now then if along with the ensilage he can feed half a bushel of roots a day he need not give as much silage. If he has the roots it is economical from that point of view. Merely feeding two or three pounds a day I do not imagine will be enough.

A MEMBER. About five or six years ago I visited some relatives in one of the best dairy districts of the country. They were making first-class butter, and their butter brought the very best prices. They were using nothing but rutabaga turnips and hay. As soon as their milking was done they fed the cows a large quantity of rutabaga turnips, and they got a great deal of butter from their herd, and were able to get the highest prices in the market. What do you think of that practice?

Prof. SHAW. Well, I can imagine that rutabagas might be fed to such an extent that the customers might complain, but I am satisfied that if fed as you say, that is, fed after milking, that quite a considerable quantity can be fed a day without tainting the milk.

A MEMBER. I would like to ask the speaker if he would advise us to do away with our dairy cows and grow beef?

Prof. SHAW. I did not say that. Unhesitatingly, I should say, raise some beef, raise enough to kill for the family meat. I maintain that any dairyman can do that.

I understand that many of you are sending your milk away to the cities, and therefore you have not much left, but I do not suppose there is any dairyman but what has enough left for one animal. Of course, it depends on how much you get for your milk, and it depends also on the way you are shipping your milk away, whether you are making butter, whether you are separating your milk at home, etc. I would say that if you are separating your milk at home, you had better raise every one of your dairy steers, the Jerseys and Guernseys probably up to the age of eight to twelve months, and the Holsteins probably to the age of eighteen months. It would probably not be wise to keep them longer than the time mentioned. Of course, you will have to raise them principally on skim milk. They would not get whole milk more than one or two weeks at the best. If you are separating your milk, it seems to me, it can be utilized in this way so as to bring in a nice little sum of money if the stock is properly grown. Of course, after a certain time the farmer can feed bran, oats, and especially those roots that I have been talking about. They are all good.

Mr. J. Hoyt. I understand that the western people when they bring the steers in in the fall dehorn them so that they can be shipped closer together. Do you think it is a good practice?

Prof. Shaw. Of course they must be dehorned. It is a necessity, because they would hurt each other, and probably, in some instances, it would amount to a loss of a steer or so. They are apt to get hooked. It is not a matter of choice which a man who is fattening cattle has. He must do it. I am strongly in favor, especially in the west, of fattening cattle in an open shed rather than in a stable. In that respect I have completely changed my mind, and especially so since I have had experience with keeping steers in the west.

Mr. H. O. Averill. Mr. Chairman, I was somewhat surprised to hear the speaker recommend that cows be kept out of doors more, and that they be kept in cold barns. Now if I were to keep animals for the purpose of seeing to how good an old age I could keep them, that principle might be the correct one from my point of view, but if I am going to keep dairy cows for the purpose of trying to get the most profit out of those cows every year, it would be my theory that we should keep them in comfortable, warm barns. It would be my theory still further that they should be kept in the barns especially in unpleasant or inclement weather. Perhaps it would be well to let them out to get the fresh air for a short period of time, but I believe that cows which are kept in warm barns, if they are let out in wintry or inclement weather that the contrast from going from the warm barn out into the cold air is not beneficial, and especially so if they are allowed to remain, even if it is not a stormy day, for any great length of time. The change will certainly be a shock to the vital energies of those animals, to their systems, such as will make them susceptible to tuberculosis, if tuberculosis exists in that herd. I think it will be a shock to their systems such as would injure their production of milk. I should like to ask the speaker if he would advise a dairyman, who was striving to secure the greatest profit each year from his herd, to leave his cows out in cold weather in the winter time?

Prof. Shaw. I would say in answer to that question, unhesitatingly, no. I am in entire agreement with every word that you have said. I probably did not make myself as clear as I should have done in speaking on that question. The point I wanted to emphasize was this: that, in my judgment, a great many dairymen have injured their cows by keeping them in stables too warm, in the first place, and too illy ventilated in the second place. I do not know whether you Connecticut dairymen have made that mistake. I do know that many Minnesota dairymen have made it, and with but one result, that the

State Veterinary Inspector has been called in and the animals have been treated for tuberculosis, and whole herds, in some instances, have been slaughtered. It is that that I am seeking to guard against. I do not know whether you have any tuberculosis in Connecticut. I hope you have not, but if you have I think you may take it for granted that it has arisen from one of two sources. The first source is too close breeding of the animals, in and in breeding, and the second source, and the far more fruitful source, is keeping the cows in stables too warm, and more particularly where they are illy ventilated. I think you will find that tuberculosis has arisen from that cause a great deal oftener than from exposure, or from giving them that shock to the system to which you have referred. Of course, it is bound to occur if you turn them out in the cold, but I think the danger is the greatest from the source I have indicated.

Secretary Brown. How many times daily would you feed a herd of dairy cows, twice or three times? There is a difference in practice on that point.

Prof. Shaw. I would feed but twice a day. If the animals are given enough twice a day at regular times they eat that food up and then they stand in perfect rest and manufacture that food into condition to be assimilated, that is, by chewing it over in the cud. I think the best results will be gotten in that way.

A Member. Do you advocate giving warm water to dairy cattle or cold water?

Prof. Shaw. I question whether it will pay to give hot water to a herd of dairy cattle, especially if they can get access to good pure water as it comes from a well, an ordinary well or from a good spring. If they have to choose between drinking from a vat in the yard where the ice has been broken away, and the water is icy cold, then I would say give the warm water unquestionably, but I do not think the cattle need it heated if they can get it from any such source as I have indicated.

Mr. J. Hoyt. My experience has been that the cattle like cold water better than they do hot.

The President. There is a great variety of opinion on this subject, the same as with other points in the life of the dairy cow. I have found it so. Now there are points that have not been brought out this afternoon, and I would like to have them brought out.

Mr. Mitchell. During the course of the speaker's address this afternoon he spoke of the effect of temperature. It may be of interest to the farmers present if I relate the circumstances of a case in this matter of temperature. There was a large herd of Holsteins kept in New York state, and in order to settle this question of the best temperature they tried some experiments. They began at about forty degrees and increased the temperature to about sixty, taking pains to see to it that the cattle breathed pure air all the time. It was found that they increased the amount of milk. They attempted to keep the temperature at about fifty, as they found that at that point they secured gratifying results.

I also want to report that at the Vermont Station they carried out some experiments to ascertain whether there was any difference between the productive capacity of cows kept in the barn and those let out in severe weather, and put back. The result was in favor of letting the cows out for a little time in the morning.

Prof. Shaw. I am obliged, Mr. Chairman, for the information just volunteered. I would like to ask, however, if the gentleman knows over how long a period those experiments extended. If the cows were kept at that temperature that you referred to I think it would take a number of years to determine the full results. No doubt the present results favor what you say, but what would be your opinion?

Mr. Mitchell. This was four or five years. I was in the barn about four years ago. I presume the temperature was not above fifty-two or fifty-three. I know the owner of that herd has been very successful in that way. He is not only particular to keep the temperature at about a certain point, but he is also particular to have good ventilation and good air.

Prof. SHAW. I can imagine that a stable for dairy cows ought to be kept a little warmer than a stable for animals that are being fattened, and especially when they are being fed corn, owing to the peculiar nature of that food. It is very heating. If animals are being fattened it would be too warm.

QUESTION. How much would you feed to fatten an animal per hundred pounds live weight?

Prof. SHAW. If I got that question correctly, it is this: how much should be fed to an animal that is being fattened per hundred pounds live weight? I think I can tell some things of a little interest in regard to that. If you were to ask that question of a man living in the heart of Illinois, or in southern Minnesota, he would tell you that the steer should have about thirty pounds per day of corn. I tried some experiments on that once. The steers that were fed in that experiment averaged about nine hundred pounds when the experiment commenced. They were fed about six months, and they averaged about twelve hundred pounds when the experiment closed. I fed three of those steers at the beginning with six pounds of meal a day. They had about twenty pounds of ensilage right along together with the six pounds of meal. The balance of their ration consisted of mixed hay. A pound of each was added per month during the six months. We began another lot at eight pounds per day and added a pound every month. Another lot began at ten pounds a day, and a pound was added to that ration every month. When the experiment was completed the steers that I began to feed six pounds a day had made practically as much gain as the steers that I began to feed ten pounds a day. There was not much difference in the amount of hay consumed by the three lots. Now the philosophy of the thing is evidently this: if you give a steer all he will take he will take more than he can utilize. I tell you, farmers, the whole science of feeding in the west has got to be revolutionized inside of the next few years. The feeders cannot stand it. They cannot make beef at present prices by feeding the amount of corn per day that they are giving. Some are feeding half a bushel.

Mr. HOYT. You think they are wasting a good deal of corn?

Prof. SHAW. I know they are. I have told them so.

A MEMBER. I would like to inquire as to the best way of feeding a grain ration; whether it should be fed dry or moist.

Prof. SHAW. I do not think that it makes any practical difference, provided you can get the animals to consume enough rough food. As you can see, some kinds of food are not as palatable as you would like, but you want to get the animal to take that rough food, and naturally sprinkle meal over it, and the animal will consume more of such rough food or cheap food. I tell you, farmers, it is worthy of the most profound study to get our animals to take all the rough food that we can get them to take, and take as little grain or meal as they will do well on. That is where the profit lies. Now if I was feeding grain along with ensilage, I would put the ensilage in the manger and spread a little meal over it, letting the cattle do the mixing. If I was feeding coarse hay or straw, of which animals will consume a certain amount, I think I would mix the meal with the hay and straw.

I would like to ask, Mr. Chairman, if the dairymen of Connecticut who are making butter, grow many swine? How is it, farmers?

Secretary BROWN. I can answer for my section, and I believe in the sections where we have creameries, the skim milk is taken and fed either to calves or pigs and quite a good deal of pork is made.

Prof. SHAW. I am glad to hear that. That, of course, is as it ought to be. I put the question with this in my mind.

As doubtless many of you farmers know, the roots I have been talking about make splendid food for brood sows, especially when fed with a few ears of corn or a little barley or something of that kind. It is an exceedingly cheap food.

Secretary BROWN. There is one point in regard to feeding animals on a Connecticut farm that I think should be emphasized, and that is this: depend upon your farm for just as large a per cent. of the food of your animals as possible. Do not go to the west or to the grain dealer for a single dollar's worth of feed for your cattle that you can raise on your farm. The present year my ensilage corn was not quite as thick as I intended to have it, and the consequence was I grew a great deal heavier crop of ears than I expected to. I had a couple of acres of corn that I could not get into my silo. That corn was heavily eared. We cut it, partially cured it, and set it up in big shocks. Last Saturday (December 9th) I commenced to feed that corn. We ran it through the cutter, ears and all, and into the shed, and I am feeding that to my milch cows, without any other grain. They do not get a particle of other grain except what is in that corn. I am not going to pay out a dollar to Minnesota or Illinois for grain to put into my cattle while this lasts.

QUESTION. How thick would you advise us to plant corn for a silo? Thick enough to grow a few ears?

Prof. SHAW. I would prefer in planting corn for the silo to have quite a considerable amount of grain. I do not think it is at all hurtful to get the greatest possible maximum of grain because I do not think in that case there would be enough for the stock to waste. A fodder crop, however, may be almost entirely without ears, but in the other case a crop which would produce the greatest maximum amount of grain.

The PRESIDENT. At what stage would you cut it?

Prof. SHAW. I would cut it at the green stage. I do not think that that can be improved upon. If the corn was planted very late so that I was not likely to get it into the silo before frost, I think it should be allowed to wilt, probably for a day, before putting it in the silo, and that would prevent excessive acidity which would otherwise characterize that kind of ensilage.

Secretary Brown. Mr. President, I beg pardon for interrupting again, but I desire to give a word of experience. One fact, you know, is worth a hundred theories. I had the misfortune a few years ago to procure some very poor seed corn for my silo. Of the first planting I do not believe there was more than one grain in a thousand came up, and the second planting gave me such poor returns that I found I had not silage corn enough to more than half fill my silo. At that time I had a large crop of field corn, our common flint corn, and in order to have the ensilage corn and field corn go into the same silo together, I allowed the field corn to thoroughly ripen, and the ensilage corn was then pretty green. I picked the best ears from three or four acres of the field corn, and it was white unto the harvest when I picked them. I filled my silo half full, I should say, with that dry corn fodder from which the best ears had been plucked. On top of that I put the ensilage corn, of which there was enough to fill the silo, and when we opened it in the winter, and got down to that dry corn fodder, I found the best ensilage there was in the pit. The very best there was in the pit was that dry corn fodder which was at the bottom of the silo.

Question. Did you wet it when you put it in?

Secretary Brown. Not at all. It appeared perfectly dry to look at it from the field. It was a pretty good growth of flint corn but the stalks were green. The leaves and the husks were quite dry.

Question. I would like to ask Mr. Shaw what the difference is between those two kinds of stalks that we find in corn.

Prof. Shaw. Mr. Chairman, I could not give the chemical constituents of the difference in the two, but I lean strongly to this opinion, that as the stalk corn grows up it gets dry in one case and in the other case, where it produces an ear, it simply gets ripe. If you have as many stalks as can be grown without ears in the one case, and you grow just what stalks you can to make a reasonable crop in the other case, I am inclined to think that you will have as much nutriment in the one case as in the other, only you will have more bother.

I was particularly pleased with the remarks made by your Secretary, Mr. Brown, when he stated that it should be the aim of every farmer to raise all the food that he can possibly raise on his own farm, and not send to Minnesota or to the west to buy grain. I do not think that that can be too strongly emphasized.

The President. I wonder if any man here has tried to any great extent the sowing of oats, and then cutting them just as they were turning for fodders, straw and all.

A Member. I have tried that for two years and I like it very much.

The President. Do you find any better way of using your oats?

A Member. No sir; I think it is one of the best fodders we have.

Secretary Brown. We have not had an oat thrashed in twenty-five years. Every spear of oats that grows on my farm is cut in the milk and cured and fed to the cattle in that condition.

A Member. I think they are worth a great deal more without thrashing. I have tried it both ways, and I would rather have my oats in that shape than hay.

Prof. Shaw. I would like to ask if any of you farmers have grown cow peas along with your oats and fed them in the straw?

A Member. It seems to me to be a little too cold in this climate to do that. I think it requires a little warmer climate. I have tried it once or twice, but not very successfully.

Prof. Shaw. I cannot understand how that can be. I am told that they can do it in Massachusetts and in northern New York. They also do it in New Hampshire.

The President. I do not think that they can do it here.

A Member. I think there has been quite a change in the last few years in the method of feeding oats. The practice of thrashing seems to have completely died out so that it is a rare thing to even see a thrashing machine. I think the modern practice has been very successful. People would not have been doing this for twenty or twenty-five years unless the majority of the farmers thought it was the more practical method. We have a good market here for our hay. We can get for a good part of the time from eighteen to twenty dollars a ton, and if we can feed these oats it is just as well to do it and sell your hay at twenty dollars or thereabouts.

Prof. Shaw. I would like to ask if the farmers of Connecticut grow sorghum to any extent for feeding cows? Has anybody present done that?

A Member. I have tried that. I also know that some other people have tried it here, and I have heard some people speak of it very highly. I tried it in an experimental way for two years, but I think there is something about the New England climatic conditions which militate against its successful cultivation here. It does not seem to do well.

Prof. Shaw. In the west we can get more bulk with it than in corn.

A Member. My experience with it extended over two years, and that was some time ago. Perhaps the cultivation of it in a New England climate is better understood now, but I have not tried it lately.

Prof. Shaw. Did you grow it thickly?

A Member. Yes. I put it into drills and also sowed it broadcast. I tried it both ways.

Prof. Shaw. It is a particularly valuable crop in the west because of its palatability.

The President. It is almost time for us to close this discussion, but before we do so I want to say a word.

Now there is just one thing about this whole matter that we have been discussing and that is, comfort. Make your cattle, your stock, comfortable and they will thrive. When you talk about this matter of your cows being turned out into the cold I think we should be guided largely by what makes them comfortable or uncomfortable.

Now you take a cow that has been used to a warm stable, and has been fed in such a manner as to open her pores, and let that cow out on a cold day to stand around and there will be trouble. Such a course of treatment would not be at all proper for that cow. The cow is not comfortable and cannot do well while remaining in that condition. That is all there is to it. It is just so when you get to the point of palatability. Some things may contain but a small percentage of goodness, according to the figures that the professors give us, but there may be something about that kind of food that cattle like, and when that is the case there is more than just a small percentage of goodness in that food. The animal likes it. There is evidently something in the nature of the animal which prompts it to eat that food. It makes the animal comfortable. That is the point.

Now I think that the Secretary has something to say and then we will adjourn.

Secretary Brown. I hope no member of this convention will go away from the hall without looking carefully at the specimens of the gypsy moth and the brown-tail moth which are on the table in the rear, which have been preserved by the Connecticut Experiment Station for our instruction. I want you to look at those specimens carefully so as to be able to identify them, and when you discover them in the State of Connecticut, as Dr. Forbush says we surely will within the next five years, — as soon as you discover specimens of either the gypsy moth or the brown-tail moth in this State, I want you to report it to the State Entomologist, Professor Britton of New Haven, without delay.

Convention adjourned to 8 P. M.

EVENING SESSION.

December 14, 1905.

Music.

Convention called to order at 8 P. M., Vice-President Seeley in the Chair.

The PRESIDENT. The Connecticut Board of Agriculture has been in the habit of saving the best part of its program until the last. Now you know the ladies must have their say sometimes, and the topic for this evening is something peculiarly within woman's sphere, and that is, the necessity of our having some knowledge of what we are eating and drinking, and how it shall be prepared for us. That is a very important subject, and I am very glad to introduce to you this evening Mrs. Sara Walrath Lyons of New York City.

WHY PRESENT CONDITIONS NECESSITATE A KNOWLEDGE OF THE DIETETIC VALUE OF FOODS.

BY MRS. SARA WALRATH LYONS, NEW YORK CITY.

Mr. President, Ladies and Gentlemen:

Your honored Vice-President's introduction of me this evening leads me to appreciate the fact how more and more thought is becoming revolutionized on the subject of woman's rights. That woman's sphere of usefulness, as instanced in the past, is not now confined wholly to the home and fireside, but that now when she feels that she has some important truth to present — some important message to give to the world — it is quite the proper thing for her to mount the platform and give it.

As the varying conditions of life bring change in thought regarding woman's sphere of usefulness so of necessity must they effect a change in the ways of living. This is the reason why I have taken for my subject this evening "Why Present Conditions Necessitate a Knowledge of the Dietetic Value of Foods."

There are many important reasons why a knowledge of food's dietetic value is necessary, but the two preëminent reasons consist in the fact, first, that large amounts of adulterated and preserved foods are placed on the market utterly unfit for human consumption, and secondly, that one's diet cannot be of a nature conducive to health without a knowledge of food's chemical composition and use in the body.

But not only is it necessary to have a knowledge of food values in the selection of foods but this knowledge of food values must extend to their preparation. The best and purest of foods, prepared in an indifferent way with little or no thought regarding their digestibility, naturally will not yield their full nutritive value. Neither is this condition possible where food is imperfectly masticated. We go through life so carelessly indifferent, making use of all things supplied us by the hand of bounteous nature in such a matter-of-fact way, that we do not pause to consider the origin or source of such, but take it for granted that if we eat when hungry human nature will care for itself. This would, no doubt, be the case if not constantly sinned against beyond the point of endurance.

The attitude usually assumed in the selection, preparation, and consumption of food is one of indifference except, perhaps, as it may appeal to the eye or palate. Mind governs man in thought on other subjects, why should it not govern him in the selection of his food? This question, so full of vital importance, I leave with you to consider.

Hurry, worry, and bustling activity characterize the life of most Americans. There seems to be no time for the observance of those things governing health, and it is only when man is brought to an abrupt standstill by illness of some kind that the question in all its phases is considered.

One of the worst habits that the American people have contracted is that of bolting their food instead of eating it in a rational manner with due regard for its mastication. Three times a day this cramming process takes place and with a sense of duty well done man rises from the table without a thought of wrong doing or that a physical sin has been committed.

But not only have we formed the habit of bolting our food, but we have also formed the habit of taking tea and coffee with our meals. The use of tea and coffee with food doubtless originated from the fact that they are stimulating, but now this thought is greatly overlooked and their greatest virtue seems to consist in the fact that they are useful in washing food down the digestive tract. This does away, in a measure, with the necessity for mastication. When the necessity for a thorough mastication of food is ignored the first step in the process of digestion is also ignored, which I shall endeavor to show you later, and although kindly nature may endeavor to endure this abuse for a while she nevertheless resents it and with good reason.

The best beverage that I know of is cold water. It should be drunk freely between meals, but not so as to interfere with food's digestion. The free use of water is to life a necessity. That of tea and coffee is not and the less one drinks of these stimulating beverages the better it is for them. Americans need no stimulant, as they are far too nervous a race of people to use them. What they do require is more hours for rest and sleep, which does away with the necessity. Hot milk, but not that which has been boiled, if sipped slowly, will stimulate and refresh tired nature when solid food would prove objectionable. It is always advisable, in using milk, to think of it as a food and the jaws should work in a manner similar to the masticating of a solid substance. This is necessary in order that the digestive secretions may flow to act upon the solids which milk contains.

When milk is hurriedly drank, or taken into the stomach in an ice cold condition, there is danger of severe digestive disturbance. The secretions of the stomach being acid and milk being of an alkaline nature it is at once converted into a curd, while the more hurriedly it is drank the larger the curds. If it is taken when in an ice-cold condition, it checks the flow of the digestive secretions and continues to do so until heated to the body's temperature.

Cocoa is also a liquid food and should be masticated just the same as milk. As cocoa powder contains a large percentage of starch, part of it a natural constituent and part a form of adulteration, it should be mixed with water and well cooked before the hot milk is added and then served without further cooking. Milk and cocoa, and of course water, should be the only beverages allowed children. Mothers should give more thought to this habit of allowing their children the use of tea and coffee with food; as they also should of allowing them other forms of stimulating beverages, for "As the twig is bent the tree is inclined," and false habits of life, inculcated in early youth, are almost impossible to eradicate in later years. Not only does the use of tea and coffee produce with the child nervous disorders and so a weakened, frail physique, but in time a desire comes for stronger beverages. This desire is also fed unthinkingly by brandy sauces, by brandy in fruit cakes and puddings, in mince pies and in brandied peaches, etc., while the free use of spices and other stimulating condiments is also to be deplored. "Habits are the crutches of old age," and we lean upon them more and more with every year. In early youth is the time to form right habits, and if mothers will but recognize the important part that diet plays in the destiny of their child, I am sure that many of the evils so sadly deplored will cease to exist for lack of fuel to exist upon. Many times I have been asked, "Do you think it possible for one with fixed habits in life to change them, to form new ones?" We are never too old to learn new and better ways of living, and where there is a strong determination to do so false habits can be gradually overcome, until, with time, an entire change has been made in one's method of living.

In the committing of physical sins the individual committing the sin is not the only one to suffer. Everyone near and dear to the individual must suffer, and with ill health in the home there can be no cheeriness in its atmosphere. A strong, healthy stomach is one of life's greatest blessings, but we do not consider it as such until too late. Parents desire only good for their children, still they many times encourage them in those things which they know to be wrong, and as a result there are but few children but what are ailing with some form of stomach trouble. We see the results in their frail physiques. Is it not time to inquire into such conditions, to study cause and effect?

How often we hear the remark that a child is "a natural born imitator," and so he is. He observes his parents at the table, as they hastily consume their food, and thinks he is privileged to slight himself in the same way, which he straightway proceeds to do with an alacrity often surprising.

In all that I have heretofore said I have tried to impress upon your minds the fact that the digestion of food begins with its perfect mastication. Our teeth were given us by the Divine Creator for the purpose of grinding our food, and by so doing to prepare it for the stomach's digestion. It seems, with many, so difficult a thing to remember that it's the action of the jaws that causes the salivary glands to work and that it is their digestive secretions upon which so much depends. After food is swallowed it is beyond man's control. The muscular walls of the stomach do their best to convert into nourishment that which is given them to digest, and if they fail in their task we alone are to blame.

The digestive secretions of the stomach being acid these secretions can only act upon the proteid foods or such foods as the lean of meat and fish. Eggs, milk, cheese, and the gluten of wheat, peas, and beans are also acted upon by this acid secretion, as is the proteid of nuts. Starchy foods are not digested in the stomach, nor changed by its acid secretions at all, as their digestion begins in the mouth by the action of alkaline secretions. The secretions of the mouth and of the lower stomach, or duodenum, being alkaline they produce the form of ferment necessary to digest starch and which converts it into a form of sugar assimilable as nourishment.

From all this you cannot fail to perceive the great necessity of a perfect mastication of food if you would avoid digestive disturbances. Hot muffins, biscuits, griddle cakes, and all other doughy substances, even though well masticated, produce irritating effects in the stomach. They form, by its action, a doughy ball impossible for the digestive secretions to penetrate. The next step in the digestion of food is when it passes on and out into the duodenum, where the starch of the food is acted upon by the secretions of the bile and pancreas and by these secretions converted into sugar.

When the stomach is overtaxed by an improper selection of food, or by over-eating, its digestive forces naturally weaken and it is but a step to dyspepsia. The taxing of it with hot, doughy substances is a thing to be avoided and not cultivated if health is a consideration. You can readily perceive from these facts that a person can starve while seeming to be well nourished. The proteids are what we depend upon to build up the human structure. Inability, through any cause, to obtain these elements from food breaks down the muscular walls of the body and the tissues starve in their effort to support life.

A mason would never think of using poor mortar in cementing the walls of a building together. Should not we be just as particular with the human house, or body, and select and consume only that form of nourishment which is necessary for its growth and strength? Nature protests when sinned against but we do not always heed. Indigestion is but the warning voice of dyspepsia; dyspepsia but the forerunner of disease;. still we not only continue to improperly masticate our food, but to improperly prepare it.

Over eleven thousand million pounds of meat is consumed in this country every year, due, to a great degree, to a lack of knowledge in preparing vegetables in a palatable manner. The preparation of delectable pastry, I am sorry to say, seems to be a stronger point for consideration. In the cooking of even the plain and homely potato there is an art. This vegetable is a much abused article of diet, for without a knowledge that the best and most nourishing part of the potato lies next to the skin, it is thickly pared, and usually cooked in a way not intended to elicit words of appreciation.

In preparing potatoes for the table they should be scrubbed well with a vegetable brush and after cutting out all bad portions they should be cooked with the jackets on. If they are to be boiled drop them in hot water, after seeing that the potatoes are about equal in size, and keep them constantly and steadily boiling until done. This condition is only attained when the starch cells of the potato burst and it is only then that the potato will pierce done and is fit for food. When this condition has been reached they should immediately be drained and placed in a hot tureen and covered with a towel of loose texture in order that the steam may escape and the potato remain dry and mealy. In baking a potato there should be maintained a low degree of heat, for then its skin will peel off in a thin coat and the most nutritive part of the potato be preserved. In ascertaining whether the potato has baked sufficiently long press it between the hands, and if it yields readily to the touch and bursts its jacket in the pressing, this condition has been reached. It should then be taken from the oven placed in a hot tureen and kept, until served in a manner similar to the boiled potato. The bursting of the jacket of the baked potato is as necessary as with that of the boiled, as this enables the water it contains to pass out and off as vapor. If this steam condenses, or is unable to escape, the potato naturally becomes heavy and soggy and in such a condition unfit for food. We thus see that science applied even to the cooking of a potato is well worthy of consideration. When we go still further and analyze the potato, finding that the albuminoids and the most nourishing parts lie next to the jacket and that these nourishing parts have been ruthlessly cast away, or fed to the live stock, then will we begin to appreciate the fact and to understand that the preparation of food to yield nourishment is not a small thing to consider. The consideration of such should be the delight of every housewife. The kitchen is the laboratory of the home. As such it should be considered, for it holds much within its environs. The health of the family, to a great extent, depends upon the one who prepares the meals, and with a full appreciation of these duties no wife or mother should ignore them.

But not only will we consider the food value of the potato but that of other vegetables. Take, for instance, cabbage. Usually in cooking, or even in using the vegetable raw, the coarse outer leaves are used in connection with the tender inner portions. All this is wrong, for the tough outer leaves of any plant or vegetable are always difficult, if not impossible, to digest, and are productive of digestive disturbance whenever the attempt is made. Feed these coarse outer leaves to your live stock, to your domestic animals, for their nerve energy will not be depleted in digesting them. Conditions of life are such that you have no nerve force to spare in the effort.

Not only is it necessary to observe the preliminary preparation of cabbage, but its cooking. It should be boiled in plenty of water in an uncovered kettle, and as soon as the vegetable pierces tender, drained of the poisonous acids which the water contains and then placed in a hot dish. Vegetables should never be served underdone, neither should they be served overdone. One condition is about as bad as the other, for neither condition tends for health. The coarse outer leaves of salad plants are as objectionable as those of cabbage and these should not be used as food either. Neither should the coarse outer stalks of celery. A little forethought in this respect will go a long way toward promoting right bodily conditions.

It is the observance of these little things that tend so much to keep us in good physical condition. Who has not felt the effects of improperly cooked food, or the miserable after effects of such food? Not only does the eating of improperly cooked food irritate the whole digestive tract, but it also acts as an irritant to the mind, and in spite of our best endeavors it is impossible to concentrate thought, or to make any great mental effort. We are ready to admit that something is wrong, but we are seldom ready to admit that this something is our food. When we do see and admit the fact that as we are physically, we are mentally, then only will we earnestly consider the conditions for health, and so considering, strive to observe them. That "health is wealth," is a true saying, while indifference to food's dietetic value cannot help but be the foe to true progression. Ignorance is the mother of vices and the sooner we admit that the educational system of our country is entirely wrong in ignoring the physical conditions of the growing youth of this country the better it will be for all future generations. It is only when such conditions are observed and amended that we can hope for real improvement in the human race.

America is known as the great meat-eating nation. Statistics prove that we annually consume over eleven thousand million pounds of meat. Why this immense consumption? In my opinion it is due to careless indifference in the preparation of vegetables as food. No one can be expected to eat with relish a soggy, watery and insipid tasting vegetable. It is not palatable and, if eaten at all, needs much seasoning to pave its way to favor.

Badly cooked vegetables, as I have endeavored to show you, are badly digested, and instead of yielding nourishment introduce into the system poisonous vegetable acids harmful in the extreme. To do away with this immense consumption of meat, which, in many instances, acts as a poison in the human system, more attention must be given to the cooking of vegetables. While it is an art to properly cook meat it is an even greater art to cook vegetables. This fact is plainly demonstrated in the serving of food at either hotels or restaurants, for meat is almost invariably served cooked in a palatable manner, while vegetables require the use of sauces and spicy condiments to make them edible. The usual thing with the frequenter of restaurants in ordering a meal is to order a steak, accompanied with fried potatoes and coffee. Fried potatoes are admittedly indigestible; the coffee is stimulating, and so, to a degree, is the meat.

To one confined to indoor pursuits, and it is usually this class of people that select such a diet, such a meal is little better than poison. It is impossible for fried potatoes to be perfectly digested under the best of conditions, while the waste substances which fill the blood vessels of animal flesh cannot help but be of a poisonous nature no matter which way we look at the question. There is really but a small per cent. of meat consumed in this country that is fit for human food. This important fact was made known to me not long since by a prominent veterinary surgeon whose years of experience lend strength to his words. Tuberculosis prevails amongst animals to an alarming extent, and even when seeming to be in the best of health they are suffering from this awful disease. When animals are affected with tuberculosis the whole muscular structure is naturally diseased and through the laxity of laws governing the sale of such meat and inability to trace the origin of such, it is not only placed in the stores for sale, but consumed by the many who have no idea of the wrong perpetrated upon them.

Vegetarians wisely substitute nuts for meat. Their argument is that it is not humane to destroy the life of animals. While this is a strong point to consider and to find favor in our minds, we should not ignore the physiological side of the question, for when it is admitted by physicians, who have given much study to the subject, that meat eating conduces to various forms of disease, in fact, creates disease, it is time for man to seriously consider whether it would not be wiser to abstain from meat eating altogether. For my part, if you will pardon this personal allusion, I seldom eat of animal flesh at all. I find that I can keep in the best of health and strength without it. The albuminoids found in meat and which act as a repairer of the tissues of the human body can be found, without eating diseased waste substances, in eggs, nuts, and the gluten of wheat; also in peas, beans, and lentils. These, as I have mentioned, are known as the proteid foods, with the further addition of milk, cheese, fish, and meat. We require only one-fourth part of the proteid elements in arranging a diet, and that man or woman that consumes more food than the body requires to build up and repair its waste, sows the seeds of disease apparent in the years to come.

The eating of meat not only introduces poisonous waste in the human body, but the digested fibre of the meat clogs the blood vessels and by so doing interferes with the circulation of the blood, and the functions of the various organs of the body.

If all this array of facts is not convincing proof that a vegetable diet is preferable, I wish you one and all would experiment with yourselves and judge, by means of such experiments, whether health is not yours for the seeking. I am sure that you will find a trial of a few months convincing proof that better health attends a vegetable diet. Wise mothers will not educate their children to the use of meat, but will give them instead nourishing soups of peas and beans and good whole wheat bread. The cracked or whole oat is one of the best of foods for children, as is also corn meal, which can be used in a variety of ways. Time should not be considered as wasted in arranging a diet; for health, the greatest of earthly blessings, attends well directed efforts in this direction, and a little thought given each day as to what to eat will yield a harvest of blessings.

Often I have had said to me, "but how shall I find time to arrange a diet adapted to the individual needs of my family? I haven't time for such, my time is so taken up." Yes, we are a busy people. I never dispute this fact, but are our energies all wisely directed? Have we not drifted into the habit of doing many senseless things which it would be better if left undone? How about the time spent in concocting various dishes for the table which take so much time and thought in their preparation? There is scarcely a day of my life but what I am assured by some wife and mother that her family cannot do without pies, cakes, and pastries, to say nothing of salads, mixed pickles, chow chow, etc., that are thought necessary and substantial foods. I invariably ask, are you not to blame for all this? Have you not made the cross that is laid with so heavy a weight across your shoulders? If mothers educate their children with a fondness for such food can they expect anything else but that these unnatural, perverted tastes will follow their children through life? But mothers, somehow, do not seem to see the errors of this training or why their children are not physically fitted for great mental strains or efforts, and they only will or can see, when they understand the chemical composition of foods and the full meaning of dietetic values. It is an old adage that tells us "that man is as the food he eats," but the literal meaning of the saying is but little understood. Let us see if we can trace its origin.

Foods, learned chemists tell us, are composed of elements found in the soil of the earth, which the little rootlets of growing vegetation take unto themselves to thrive and grow on. The kindly hand of nature supplies within its depth everything necessary for the development and growth of plant life, and these elements, compounded in the laboratory of Mother Earth, are given to us as food in the forms of starches, or, as chemically termed, carbohydrates; as proteids, or nitrogenous compounds; fats and mineral substances.

In these various food groups we find different elements, the office of some of these elements being to build and repair the tissues of the body. The foods that contain these elements are known as the flesh builders, or the proteids. Another group, the carbohydrates, yield heat and energy, and still another supplies the material from which the bones, teeth, hair, and nails are built. Chemists determine these facts by analyzing foods and studying their effect in the human body. They have also found that the human body is composed of like and similar elements as found in food. These elements are of many and varied kinds as supplied by nature, but I will only name a few of the most important ones. Some of these, you will observe, are gases, some are solids, while others are of a mineral nature. Of the gases we have oxygen, nitrogen, and hydrogen. Familiar as we are with the thought that nitrogen and oxygen constitute the air we breathe, we have still to learn that these gases form a part of our foods and likewise form a part of the human body. The gas, or element nitrogen, is found in all nitrogenous foods, these foods being usually classed as the proteids. It is this element in food upon which we depend for strength and muscular development. The gases, hydrogen and oxygen, combined form water.

In the carbohydrates or starches, and also in the fats, we find the solid carbon, which burns in the human body with great heat. Should we toast a slice of bread until it became charred and blackened we would have as a result charcoal, or the solid carbon. Burn this charred piece of bread or reduce it to ashes and we have the mineral substance found in the solid, carbon.

Besides the elements oxygen, nitrogen, hydrogen, and carbon there are many other important elements found in food, such as phosphorus, sulphur, chloride, sodium, fluorine, silicon, manganese, magnesium, copper, and iron. All of these have an important part to play in the internal economy of man, and if these elements are not supplied in the proper ratio to the body's requirements some part of the human structure must suffer.

It is here that we are led to see man's perversion of the work of nature. He separates and divides the component parts of foods, introducing in the market such a variety of substances that the brain grows bewildered with the effort of selecting, and by so doing gives us as food an artificial substance, devoid of the necessary elements for sustaining life. To illustrate: in the past, with the primitive methods of milling, there was but one way of grinding wheat, and that was by crushing it between two flat stones. The whole wheat grain or kernel was crushed in this way just as nature had grown it for use, and contained within its bran coats all the elements necessary to sustain life. At the present time we have countless methods of milling, and countless grades and kinds of flour. The work of nature is perverted and unless one has a knowledge of the dietetic value of foods they know not how to help themselves.

In the germ of the wheat are found the soluble phosphates which nourish the brain and nerves; in the bran coats, which includes the gluten of the wheat, are found the elements which build the bones and teeth and those which build up the fleshy structures of the body. When these bran coats are removed, as in the milling of flour today, what is the result? We have left only that part of the grain known as the carbohydrates or starches and which are only useful in the human body as fuel. That is, they yield heat and energy, but do not act as a repairer of the body. The only thing possible to do under such circumstances is to substitute the elements taken from the wheat and in this way secure a balanced food substance. It is this separating of the natural food products that is detrimental to health and the substituting by manufacturers in the separating, of inferior substitutes. Not only are inferior substances substituted but adulterated ones, so that one hardly knows what they are purchasing as food.

For instance, skimmed milk cheese is filled with lard as a substitute for the butter fat taken away and which is made into sweet cream butter. The cheese is then sold for full milk cheese. Various kinds of baking powder and pulverized sugar have a large percentage of crushed stone and rock, while it is impossible to purchase pure syrups any more. Most of the syrups sold consist almost wholly of glucose, and it is this substance that is sold in glass jars as strained honey. Glucose is a thick syrup produced from the starch of corn by the action of sulphuric acid and an artificial production that it is well for man to let alone. It also forms a part of most jellies and jams, while the so-called preserved fruits sold in buckets have a large percentage of it, but usually not the faintest suspicion of fruit. Neither, as a rule, do soda water beverages nor ice cream preparations. Hay seed is used as a substitute for berry seeds to further deceive, and the law permits such frauds and we, as individuals, ignore them!

Ground spices are found to be largely adulterated with cocoa nut shells, olive stones, wheat brans, ground rice, etc., and I could go on enumerating at length, for there is scarcely a food substance in the stores for sale but what is adulterated and if not adulterated, preserved, for it is only the first or best grades of vegetables, fruits, and meat that are not preserved. Fruit in season and perfectly ripened requires no preservative, but the over-ripe and partly decomposed fruit does, as does that which is under-ripe. Fruit necessarily preserved by the use of chemical preservatives is not fit for use. No one cares to eat decomposed or unripe fruit in its natural state, and surely no one cares to eat such fruit that has been slovenly canned with the addition of a preservative to destroy the life giving elements in the blood.

It was only last year that Dr. H. W. Wiley, Chief Chemist of the United States Department of Agriculture, demonstrated to the world that food preserved by the use of borax or boric acid was injurious to the human body. He experimented with several young men and for several months the experiments were continued until it became a demonstrated fact that the use of borax or boric acid, used as a preservative, was detrimental to health. Even half a gram a day was found to be injurious, if continued for any length of time.

I fancy I hear you all asking, what then can we eat? Is there any known article of food not adulterated? As conditions now exist there seems to me but one open way to pursue and that is to adopt, as far as possible, the simple, primitive methods of preparing foods as in the past. Use of the freshly grown vegetables and fruits instead of the canned products. To save time in the preparation of fruits and vegetables for cook- the housewives having formed the habit of using canned foods freely and think nothing of using them the year round. The original use of such was to help tide over from season to season when fresh vegetables and fruits could not be procured, but this fact has been overlooked.

Not only should we eliminate canned fruits and vegetables from our diet, but meat, as largely as possible, for reasons already stated and because it is usually preserved with boracic acid. This acid preserves meats' color and by other artificial devices it is made to seem plump and fresh. Spices should be used as little as possible but when used one should purchase the unground berry. By adopting this plan of action you avoid their adulteration. Whatever you purchase as food get the best procurable. The best is none too good, and if we expect to derive sustenance and strength from our foods we must select those that will make such a condition possible. We should not expect results if we are indifferent to them. What nature requires for health is pure, wholesome, unadulterated foods. Simplicity of diet and preparation of foods should be the watchword in every home.

But there are other things for us to correct and that is the methods employed by food manufacturers to deceive. For the past twenty years efforts have been made to induce Congress to pass a pure food bill. Such a bill has been regularly introduced each year, but of no avail. Last year it succeeded in passing the House of Representatives, but the Senate laid it aside as usual. It would seem that our wise and learned Senators are not wasting time and thought on the health of the nation, and but little does it seem to concern them how many lives are sacrificed each year through their indifference to this bill. At least this would seem to be the case, for I have Dr. Wiley's word for the truth of this statement, "that last year's pure food bill was laid aside by the Senate while they took up for consideration a bill relating to the misdemeanors of two sailors." The laying aside of a bill is but a subterfuge resorted to to get rid of a bill, and so year in and year out some ruse is resorted to with the pure food bill until patience with the American people is ceasing to be a virtue. Manufacturers of food products for the first time are beginning to show alarm and well they may. Let us all earnestly work for the passage of this bill, for with its passage lies the health of the people. The health of its people should be the first and predominant thought with a far-sighted government, for health is the pulse of a nation's growth and the backbone of a nation's greatness.

Not only does pure blood produce conditions for health, but it also breeds healthy thoughts as it is only possible for pure blood to do. As thinking people let us seriously consider these problems and resolve that impositions which reflect on health shall not be countenanced or supported. It is only by co-operation that we shall succeed in overthrowing this greedy monopoly of our rights, so let us co-operate in every way possible with Senator Heyburn, and by so doing win for truth, for right and justice! Over two billion dollars, it is said, go into the pockets of unscrupulous manufacturers every year. Not only do they rob us by compelling us to pay our hard earned dollars for an adulterated food substance, but they also enrich themselves at the expense of the health of the people. Such conditions should not be tolerated, and I, for one, intend to give my best efforts to awakening thought and creating sentiment against them. Our representatives in Congress are there to do the will of the people. Let us signify to these Senators, that represent our States, that it is our desire that they work for the passage of this "pure food bill." When they become convinced that we are in earnest in seeking its passage, only then will they become active and the bill become a law.

From all that I have said to you this evening I am sure that you must see that the physical, mental, and moral of man work hand in hand. That they form a trinity which in this world cannot be separated one from another. The body is the temple that holds life's treasures, and as such it should be carefully nurtured, for it is only the physically strong body that is capable of supporting great mental efforts. This fact, as I have stated, seems to be ignored in the training of children and as a result, and at an early age, many succumb to sickness and disease. The physical forces have not been capable of sustaining the strain of prolonged mental efforts and so a bright useful light goes out. It is thus seen that abnormal conditions of body produce abnormal conditions of mind. This is a law of nature. The physical, mental, and moral of man degenerate with one accord. Let us strive for the normal condition, remembering that God created us whole, and by thus striving create harmony of life's forces — Health and Happiness.

Secretary Brown. Mr. Chairman, before we close, I want to say just a word. This subject of the pure food law is one of vital importance, and it may be said that the laws of this State have wrought something of a revolution in the modes of adulteration, which is no longer of a dangerous character, especially when compared with that which was carried on here a few years ago. Formerly, foods were adulterated here without regard to their effect upon the human system, but at present, according to a paper which was read by Dr. Jenkins in New Haven last week, the methods of adulteration have been changed so that poisonous materials are no longer used, but the percentage of adulterations is no less than formerly.

Mr. President, as you know, we have now been for three days practically the guests of the Town of Windham, and of the City of Willimantic, and it is with great pleasure that I desire to offer a resolution, extending to the Town of Windham, and to the City of Willimantic, and to all who have aided in making our convention here a notable success, the sincere thanks of this Board of Agriculture.

The President. You hear this resolution as presented by the Secretary. It is duly seconded. All those in favor of passing this resolution of thanks will signify by saying "Aye." It is unnecessary to call for contrary minds. It is unanimously passed.

I think there is no further business, and this convention will now stand adjourned.

In Memoriam.

Theodore Sedgwick Gold, former Secretary of the Board of Agriculture, was the son of Dr. S. W. Gold of Cornwall, Conn.

Born in Madison, N. Y., March 2, 1818, died March 20, 1906, at his home on Cream Hill, where he had lived for sixty-four years.

When he was very young the family returned to Connecticut and lived in Goshen until after his graduation from Yale in 1838.

After teaching for three years he moved to the ancestral farm in Cornwall and with his father established an agricultural school, which they continued for twenty-four years.

It was through his untiring efforts and belief in the results to be obtained that the Connecticut Board of Agriculture was established in 1866 and he was made its first secretary, which office he held continuously for thirty-four years. Mr. Gold also, with the aid of others, secured the establishment of the Connecticut Experiment Station, the first in this country, and it has proved its merit by holding first rank with any in the world.

He was officially connected with the Connecticut Agricultural Society from its beginning in 1853, for twenty years Trustee of Storrs School and Agricultural College, Member of the Board of Control of the Connecticut Experiment Station from its establishment, Fellow of the A. A. A. S., Member of the Am. Pom. Soc.; Am. Forestry Asso.; National Geographic Soc.; Am. Hist. Soc.; Conn. Hist. Soc.; Conn. For. Asso.; S. A. R., and Founders and Patriots.

For nearly half a century he lectured on agricultural subjects, having delivered a course of lectures at the Sheffield Scientific School in 1860. At one time editor and for more than sixty years a contributor to the agricultural press.

Mr. Gold was always a student from his infancy to his last days, an extensive reader on subjects relating to science and the arts. He had a wide acquaintance with men of learning and prominence throughout the country.

As a farmer always progressive in his methods and an early importer of blooded stock.

As a man, life-long friendships attest to his worth and steadfastness.

As a teacher he won the love and confidence of his pupils.

In his family he was universally loved and revered. In the Church at North Cornwall, where he worshiped for sixty-four years and held the office of Deacon for over thirty years, he always stood for what was highest and best.

Mr. Gold lived to the ripe age of eighty-eight with powers of mind unimpaired and with interest unabated in all things connected with his farm, the State, and all mankind.

The substance of the following paper was presented at the annual mid-winter meeting of the Board of Agriculture, held in Hartford December 14-16, 1904, but the Secretary was not at liberty to publish the stenographer's report without revision by the author, which serious illness prevented until too late for insertion in report for that year.

The importance and permanent value of the paper amply justify its insertion here and the thanks of the Board are due Prof. Gregory for revising the stenographer's notes for publication.

THE GEOLOGY OF CONNECTICUT IN RELATION TO ITS WATER SUPPLY.

By Herbert E. Gregory.
Professor of Geology in Yale University.

Whatever may be said of man's intellectual and spiritual endowments he is, nevertheless, an animal, and as an animal is controlled by his geographic environment, and he must adjust himself to temperature, rainfall, and other conditions of climate, and is dependent upon the plant and animal life about him, which in turn are dependent upon the soil, water, and food supply. Man is not the swiftest animal, nor the keenest scented, nor the keenest sighted. He is not the strongest animal nor the longest lived. He has won out in the struggle for existence and has established his supremacy at the head of the animal kingdom simply because he is better adjusted to his environment. Man has been remarkably successful in modifying and overcoming his natural environment, but evidently within limits. He cannot prevent the lightning, nor make a flood plain where lofty mountains now stand, nor can he change a desert into a region of heavy rainfall.

No factor has exerted such control over man's advancement, civilization, and migration as the supply and character of water. The normal human adult consumes daily about 4½ pounds of simple liquids, and when it is considered that this is the chief part of his food supply, and at the same time, the part which is most liable to contain harmful organisms, the importance of water supply is readily seen. Furthermore, the plants on which man depends for food supply require enormous amounts of water to bring them to maturity. It requires 310 tons of water to produce a ton of corn, and in order to produce a ton of dry oats the oat plants must drink 522 tons of water. On the average it requires 325 tons of water to produce one ton of dry matter in the common field crops.

The value of a given water supply for domestic purposes varies with the locality and with the increase of population, and accordingly during the process of settlement of the United States different sources of water have been used and abandoned in turn. The first European emigrants were satisfied with any of the numerous streams of fresh water which enter the Atlantic from the well watered slopes of New England and the coastal plain. But the streams were muddied during floods and in times of high water the water courses were burdened with accumulations of organic matter from swamps and marshes. To remedy this defect cisterns were built to store the rain water, as is now common in Bermuda and certain tropical regions. As the pioneers made their way westward their movements were controlled by the water supply. Springs determined the location of camps, and many a log cabin built by some practical frontiersman near an abundant spring of pure water was the nucleus about which has grown the permanent village. The origin of the water in the spring and its possibility of exhaustion did not attract the attention of the settler, and the result was that many of the springs became contaminated or dried up. Certain springs known to the Connecticut pioneers seem to have disappeared entirely from the landscape. With the change from hunting and lumbering to agriculture a new problem in the water supply was presented. Much of the best tillable land was found to lie above the water courses where there were no springs; and furthermore the cultivation of the uplands resulted in polluting and decreasing the flow of the springs lying at a lower level. To remedy this defect springs were deepened and holes were dug where seepage indicated the presence of water near the surface. These were the first wells. As the demand for an easily accessible supply of water increased wells were dug without regard to surface indications and this artificial supply soon replaced the natural supply from streams and springs. The farm or the village home without its well was a rarity, and the water supply was satisfactory both as to quality and quantity. However, as generation succeeded generation and the population increased, the soil beneath barns, houses, and fields became charged with certain poisonous products which found their way into the wells. The surface wells of most thickly settled regions are now subject to contamination, but the danger is not readily recognized, for certain kinds of filth increase the clearness and sparkle of the water and add an agreeable taste. The old oaken bucket is no longer a symbol of purity. Windmills, steam pumps, and iron pipes are much less poetic, but far more conducive to health. At the present time the nature of the water supply is being carefully studied and the tendency everywhere is to sink wells of small diameter and of great depth and wherever a sufficient number of inhabitants makes it profitable to store up the water in reservoirs and to keep it constantly under the surveillance of trained scientists.

SOURCES OF WATER SUPPLY.

The water supply of the earth is included in rivers, lakes, and ground water. In the first instance, the world's entire supply is the rainfall, which is controlled in its amount and periodicity by the temperature and prevailing winds, so that there are distributed over the earth regions of no rainfall, arid regions, humid regions, and regions of excessive rainfall. The rainfall measured during one year in Indio-California was less than 1/10 of an inch, and in Northeast India, at Assam, 905 inches fell in a year.

Rivers. Rivers form the first natural water supply. They develop on land surfaces wherever there is a rainfall and the rocks are not so porous as to take up all the water. The size of the stream, its system of tributaries, and the shape of its valley depend upon several factors, and the development of a complete river system is a long and complicated process. When water falls on a new land surface it is a stranger — no rain-drops have been there before it and no rills are marked out to rivers and thence to the ocean. It flows down any offered slope in simple channels — about equally spaced. It pays no attention to the character of the rock floor beneath — hard rock and soft are equally acceptable. As the streams enlarge, however, they soon learn to select the softer and less resistant rock for their channels, and as time goes on they become more and more adjusted to the rock structure beneath. The Farmington River, from Farmington to Tariffville, is in soft strata; so is the Housatonic for some distance south of Canaan. At Tariffville and New Milford these same streams cut through hard rock.

Not only the river system but the shape of a river valley itself depends upon the character of the rock forming its bed. The form of the valley also depends upon the length of time a stream has occupied its present channel, *i. e.*, the age of the valley. In accordance with rock character and age, rivers have cañons and gorges or wide, open valleys. Rivers differ from each other and parts of the same river valley show marked difference in shape. The Scantic is very unlike the Naugatuck. The Quinnipiac Valley at Milldale is almost a plain, but at South Meriden there is barely room along its banks for a wagon road. The valley at Milldale is some millions of years old; that at South Meriden but a few thousand. The Connecticut has occupied its present channel for a few million years and has cut a rock-walled valley below Middletown. During the same time it has widened its valley at Hartford until it stretches from Bloomfield to Rockville. Below Middletown the Connecticut found hard rock, while above that point it encountered soft material. Rivers are found in Connecticut in all stages of development.

Lakes. Hills, valleys, rivers, and lakes are not permanent topographic forms, but are features of an ever-changing landscape, and it is only by poetic license that we may speak of eternal vales and hills " rock ribbed and ancient as the sun." Lakes have a shorter life history than most scenic forms. They are full-grown when the valleys are still young, and they die long before the hills have reached maturity, and before the rivers have developed their greatest power. It is only when lands are in their infancy that lakes abound, before the enemies which destroy them have attained full strength. Lakes are hindrances to the rain, frost, wind, and river in their work of land sculpture. So, while they may be ornaments of topographic youth, they must be sacrificed to the demands of active life struggle.

Lakes are not distributed haphazard over the world, but in accordance with definite geological principles. In the United States the lakes are most numerous on the plains from New

England to North Dakota. The drainage system in this region is all new. Waterfalls and lakes, which are always youthful characters, abound. The rivers have not been allowed to complete their cycle of development. The even course of their lives was broken into and they were once more brought back to youth. It is as if they had met with an accident — the accident of glaciation — which renewed the youth of the entire land surface. During the Glacial Age, when the world's winter closed in and the great ice sheet crept down from the north, it took entire possession of the land. Living forms were compelled to migrate or perish. Rivers, hills, and valleys had no choice but to submit helplessly and to see their life work completely undone. Because of its great weight, its slow but irresistible motion, the glacier transformed the landscape beyond recognition. In one place a gorge was cut in solid rock; in another a river system with its thousands of tributaries was completely buried under débris. Elsewhere a rugged, picturesque landscape was transformed into a featureless plain. These changes wrought by the glacier in the landscape must endure for ages. Of the rivers which sprang up after the ice had melted some were able to find their former channels, many were not. Some valleys were only partly filled, some completely obliterated. There was thus presented to the rainfall a new surface, and the newly formed streams wandered about over strange lands, and in the absence of well-established drainage many depressions were left without an outlet. The conditions were right for the birth of many lakes; the hollows and pockets filled with water, and the water bodies must remain until mature topography is re-established.

During the Glacial age the United States was covered by ice north of a line running across Long Island, New Jersey, Pennsylvania, and Ohio, and thence west and northwest. Because of the complete change in water channels due to glaciation, the scenery north of the ice limit differs markedly from that south of the line. The southern rivers have regularly developed tributaries and flow in valleys corresponding in character to their age. Northern rivers, especially the smaller ones, have gorges and waterfalls. The southern States have few lakes, the northern have abundant lakes, ponds, and marshes. The Century Atlas maps show no lakes in Delaware, Maryland, West Virginia, Kentucky, Tennessee, Alabama, and Kansas. Connecticut has 216 large enough to be represented on a map of the same scale. Within a radius of 25 miles from Boston there are 180. Minnesota has 476 on the Century map, and Maine, New York, Canada, Michigan, Wisconsin number their lakes by the thousands. In fact the connection between the origin of lakes and the former presence of the ice is so close that the southern extension of the ice lobes could be roughly determined by mapping the lakes.

Ground Water. The water which falls as rain upon the earth is divided into three parts — that which is evaporated, that which finds its way directly into the streams and forms rivers and lakes, and that which enters the ground, to remain there for a longer or shorter period of time. The fluctuation in level of lakes and streams shows clearly the relation of the water bodies to rainfall. The amount of water in the ground is likewise intimately connected with the rainfall. In dry weather the water in wells sinks and in droughts may entirely disappear. Springs are strong flowing, or intermittent, or cease altogether in accordance with the variation in climate. The amount of ground water depends chiefly, therefore, upon the amount of rainfall, which averages between 2 inches and 600 inches a year. Connecticut receives between 40 and 50 inches per year.

The amount of water which enters the ground is dependent somewhat upon the character of the topography and the texture of the soil. If the rain falls gently more goes into the ground; sometimes all of it enters. If the surface of a country is flat it will evidently take in more rain than if hilly, and if the soil is loose and open it will receive more rain than if dense.

Taking the earth as a whole 22 per cent. of all the rain that falls enters the rivers, and the remaining 78 per cent. is divided between that which is evaporated and that which enters the ground. Certain rivers of New South Wales take only 2½ per cent. of the precipitation; some New England streams carry over 50 per cent. The amount evaporated is relatively small and the total amount of ground water is great and varies with the porosity of the rocks and the soil. When marbles of uniform size are placed together it is found that the pore space equals 32 per cent. to 40 per cent. of the solid parts. Theoretically, when the spheres are as compact as possible there is a minimum porosity of 25.95 per cent. and when loosely packed may reach a maximum of 47.64 per cent. So long as the spheres are of uniform size the porosity of a pile of large marbles is the same as that of small ones. In nature the grains are not like marbles, all of one size, and are not tightly compacted, so that the porosity of sands and gravels falls below the theoretical maximum and above the theoretical minimum. Chalk will absorb two gallons of water for every cubic foot. Sandstone consists of cemented grains and is so constructed that it may hold 20 to 30 per cent. of its weight of water. There is enough water in the sandstone underlying parts of Minnesota and Wisconsin to make a lake covering those States to a depth of 50 to 100 feet. Sand may contain 30 to 40 per cent. of its volume of water, and some of the loamy soils near the surface of the ground have a capacity for even a larger amount. Not only do sands and sandstones contain water, but every known rock contains a larger or smaller amount. The densest granite known in this country, that from Montello, Wis., which was used for the sarcophagus of Grant's tomb in New York, has a porosity of .237, or about one-fourth of one per cent.

Ground water is most abundant a few feet below the surface and decreases in amount from that point downward. At great depth no pores can exist; under the pressure of the overlying rock all spaces, cavities, and pores would be closed. The depth to which any open space in rocks may occur is about six miles below the earth's surface.

So great is the amount of ground water that if it were taken from the surface rocks down to that depth there would be sufficient water to cover the entire earth with an ocean 3,000 to 3,500 feet, equal to one-third as much water as in the present oceans. This great amount of water remains in the ground from year to year, and varies in its amount and nearness to the surface with all the factors which determine climate.

The level below which rock and subsoil are always full of water is the *water table*. This water table is not a horizontal plane but adjusts itself to the topography. In lakes and swamps it is at the surface. It is at less depth in valleys than on hillsides, but it bends upward and downward with hills and valleys, and in a humid region is never at great depth below the surface. Wells sunk below this water table will produce water. In dry seasons the water table recedes from the surface, and if wells are to be successful they must be sunk deeper. The fluctuation of the water table with the supply of water is well shown in irrigated regions. Here the supply is artificial, in other cases it is natural, but the result is the same, and wells sunk in such a region will be dry part of the year unless they reach a depth below the dry water table.

The water contained in the ground does not remain stationary, but wherever the land is above the level of the sea it has a drift or underground flow, usually in a definite direction. This motion of ground water is rarely in the shape of a definite stream; only in limestone regions where underground drainage has been established do such phenomena occur. In extreme cases, as in parts of Kentucky, all the water flows underground and the surface channels are dry over many square miles. In the case of Kentucky this absence of surface water appears to be no drawback, for other beverages supply the lack, but it is a decided defect in the scenery. Ground water generally forms no streams, but moves gradually and finds its way between the grains comprising the rock. The rate of movement is very slow indeed. In fine sand with a slope of ten feet to a mile ground water will move 52 feet per year. In fine gravel it sometimes attains a speed of a mile a year. By suitable study it is possible to determine the rate and direction of motion of the ground water for any given place. The movement of ground water has an important relation to health. Noxious water may flow for some distance before being purified by natural filtration, especially if it has occupied the same course for many years, and care should be taken in the location of wells. In 1872 a typhoid epidemic broke out at Lausanne, Switzerland, and it was found that the polluted water had traveled through a mile of sands and gravels.

Ground water is returned to the surface naturally by springs, or artificially by wells of various sorts. Springs are usually due to one of three causes: they may be outlets for subterranean streams, like Silver Spring, Florida, or Cascade Spring, South Dakota; they may be located along some crack in the earth's crust and thus be outlets for very deep water supply, like the mineral springs of Virginia, and many Connecticut springs; and finally they may occur at the contact between strata of open texture and water-tight layers. Probably 90 per cent. of all springs belong to this last class. The water saturates the upper beds down to some impervious layer and then follows this layer out to the surface. Springs located along deep cracks show little or no variation with the seasons. Springs nearer the surface may become intermittent or cease altogether.

With this outline of the source and occurrence of potable water in mind we may now examine some special features of Connecticut geology to see what factors control the supply in rivers, lakes, soils, and bed rock.

Rivers of Connecticut. The river system of Connecticut has a long and varied history. Back in the Cretaceous age of geological time, after the sandstones and lavas of the Connecticut Valley had been formed, the entire State of Connecticut seems to have been worn down to a condition approaching a plain at sea level. Such rivers as existed on the plain wandered back and forth in valleys with gentle grade, and finally found their way into the sea to the east and to the south across Long Island. The plain thus formed seems to have risen from the sea gradually and with a slight tilt to the southeast. On this plain the old rivers were revived and new rivers began their life history. The streams took a general southeast direction in accordance with the slope of the overlying land. Many of the Connecticut rivers have maintained this original direction. The Shetucket, the Hop, the lower Connecticut, the upper Farmington, and the Housatonic River from New Milford to Derby, flow in channels which they inherited from the Cretaceous age. Many of the rivers of the State, however, occupy courses which are not in accord with the structure of the Cretaceous plain. The slope of the State is northwest to southeast from Bear Mountain, 2,350 feet in height, to sea level at Stonington, but many rivers run to the south and to the north in directions contrary to the general slope of the land. The factors which determine the directions of these streams are the structure of the rock on which they flow and the modifications which have been brought about by the presence of an ice sheet. The common brownstone from Portland and Longmeadow and elsewhere in the central part of Connecticut was laid down in horizontal beds and upon them, at three different times, were poured out lava flows 100 to 400 feet thick. These beds have been broken and uplifted so that they dip to the southeast, and subsequent erosion has developed prominent hills. The Hanging Hills, Farmington Mountain, Cedar Mountain, Saltonstall, Totoket, etc., have thus originated. The rock floor over the entire State has been fractured, cracks and ridges produced running chiefly in a northeast-southwest direction, but also at various angles to that main line of breaking. Streams would follow readily along these lines of fracture and it is believed that many of the larger and smaller water courses of the State are controlled in their direction by the uneven topography produced by faulting. In certain places, as west of Talcott Mountain, the rock floor was of such softness that the streams cut out a valley much more rapidly than in other places, and regardless of the original slope of the land, the stream made its way along the line of least resistance. Thus the Farmington, which now enters the Connecticut at Windsor, appears to have formerly flowed through New Britain and later entered the Sound at New Haven. By the process of glacial damming and the filling of channels many of the smaller Connecticut streams have been greatly modified in their direction, and flow in channels which evidently are abnormal. The streams at Winsted are good illustrations of such changes.

Taken as a whole, the rivers of Connecticut have intrenched themselves in rocks which absorb but a small portion of the water that falls as rain, and accordingly the rivers carry to the sea a large part of the annual precipitation. A series of measurements made on the Connecticut from 1871 to 1885 shows a remarkable uniformity in the rainfall and in the per cent. of water which enters the river. The amount of annual run-off varied between 45 and 71 per cent., and the rainfall between 43 and 50 per cent., excluding the abnormally low rainfall of 1871. An examination of the monthly rainfall charts shows also a remarkable uniformity throughout the year, but there is considerable variation in the per cent. of run-off. The smallest amount of water is in the river in September. The per cent. of run-off in Connecticut rivers is very large and is in striking contrast to rivers of arid and semi-arid districts where a very small portion of the water which fall as rain is represented in the river. Because of the regularity in rainfall and the water-tight drainage basins certain brooks and streams in Connecticut that are not large enough to be noticed in atlases carry more water to the sea during certain seasons of the year than great rivers like the Rio Grande and the Colorado River of Texas. A chart showing the discharge of the Housatonic River at Gaylordsville shows considerable variation, but there is enough water in the stream at all times to form a good river. The Rio Grande, on the other hand, varies between great abundance of water and stages when the valley of this large stream is dry.

There is no lack of water in Connecticut rivers, and as a supply for household purposes the river waters of the State are by nature entirely satisfactory. Increase in population and the development of manufactures have made the river waters of little value, but their loss of value is due to artificial conditions and does not depend upon geological structure of the State.

Lakes of Connecticut. One of the most marked features of the Connecticut landscape in the presence of lakes, ponds, and swamps. They owe their existence almost entirely to the fact that Connecticut has been overridden by a continental ice sheet. The land has been entirely remodeled, certain valleys have been filled, others scooped out. Materials of different characters have been widely and unevenly spread throughout the State, and the region, which perhaps before the Glacial age was thoroughly well drained, has now many places where the water remains for a considerable time before it is finally carried into the sea.

The great number of these lakes is manifest by the fact that on the topographic atlas of Connecticut there are mapped 1,026 lakes and 420 swamps. Lakes owe their permanency to the fact that evaporation is not so great as the supply of water, and wherever a lake occurs it is an indication that the water table or level of ground water stands permanently up to that height. In regions of slight rainfall the mineral particles in the water are concentrated, the lake becomes salt, and may entirely disappear by continued evaporation, leaving nothing but a plain of muds and sands carrying a high per cent of salts of different kinds. The lakes of Connecticut, however, are not in danger of extinction in this way. Their outlets may be cut down and the water thus drained, and they may be filled with sediment brought in by muddy tributaries, but most of them are doomed to extinction by the action of plant life. Lakes, ponds, swamps, marshes, and bogs are members of one family just as are acorns, oak sprouts, oak trees, and oak stumps. They pass through a life history to ultimate extinction. Probably more than half of the water bodies which dotted the landscape in glacial time have disappeared, and many a Connecticut farmer is tilling choice bits of land which formerly were covered with lake water.

The lakes of Connecticut are a favorite source of water supply for cities, and nothing can be better. They are natural reservoirs and do not require the expense of constructing dams. The process of preparation for water supply is chiefly clearing out of undesirable vegetation and protection from pollution by outside agencies.

Ground Water in Connecticut. So far as they concern the ground water the geological formations of Connecticut consist of two very distinct parts, namely: the bed rock and the surface covering of loosened material. The bed rock of the State consists of sandstones, with their associated lava beds, in the center of the State, and the wide stretch of metamorphic and crystalline rocks which occupies the remainder of the State.

The crystallines consist of limestones, gniesses, and schists, with some granite and similar rocks locally developed. All of these rocks are of very great antiquity and show forms of structure which can be developed only at very great depths below the surface of the earth. They have been squeezed, and twisted, and injected with hot rock and hot water solutions, and have been so much altered that it is now next to impossible to determine the nature of these rocks before metamorphism took place. Their structure and present attitude indicate clearly that they are the bases of ancient mountain ranges, probably rivaling the Southern Appalachian in their height and ruggedness. All of these rocks have a common characteristic in that they are crystalline, that is, composed of crystals rather than broken grains or fragments. These crystals are placed tightly against each other and oftentimes interlocked so that there are no open spaces between them. The texture of the rock is so dense that there is no opportunity for water to circulate around the individual crystals. Such rocks are clearly not favorable as water-bearing beds. They contain some, but always a small amount of water, rarely over 1 per cent. A well sunk in such rock is apt to be a failure, or, at the most, furnish a scant supply. Rocks of this character are, however, oftentimes filled with joints and cracks which are not due to the original texture of the rock, but to the movements of the earth's crust which have taken place since the rock was formed. Under such circumstances crystalline rocks — granites, gneisses, and schists — contain a large amount of water, but it is not evenly distributed, and it is a chance that a particular well will be sunk in such a way as to take in the water occupying the crevices. Reports have come to me from places in this State where wells have been completely abandoned or used only during rainy seasons because they have been sunk in unjointed crystalline rocks. It is such rock that forms the beds of the upper tributaries of the Connecticut, and which enables that river to receive such a large share of the water which falls as rain.

The bed rock of the Connecticut Valley district, reaching from New Haven to Thompsonville, and extending from Mixville, Bristol, and North Granby on the west to Middletown, Glastonbury, and Hazardville on the east, is a sandstone of various grades of fineness, from clay-shales to conglomerates containing pebbles two or three feet in diameter. These rocks are made of grains more or less closely cemented together with iron, clay, and lime. There is considerable space about these grains, which may be occupied by water and, as a rule, each grain is surrounded by a film of water. Such rocks, therefore, are very favorable for water-bearing beds and may contain as much as 30 per cent. of their volume. Wells sunk in the sandstone in Connecticut yield abundantly, are rarely abandoned, and rarely do they need to be dug to great depths. In the list of wells in Connecticut, published in Bulletin No. 102, U. S. Geological Survey, it will be seen that a great number of the strongest flowing and most satisfactory wells and springs of the State are located in the sandstone belt.

The surface covering of rock in Connecticut is almost entirely of glacial origin. The soil formed during thousands of years of exposure to the atmosphere and water has been removed and carried to the south. If a hilltop in Connecticut is compared with one south of the glacial line a great difference will be noted. The southern peak shows rock fragments in all stages of decay, which have weathered from the mass underneath. They are part of the bed rock and have been decomposed in place by the action of the atmosphere. The top of a Connecticut peak is seen to be rounded off and cut down to solid rock. No bowlders formed by decomposition occur on it. Formerly this peak resembled the one from Virginia. Another noticeable feature of the soil covering in Connecticut is the fact that loose materials lie directly upon solid polished rock beneath. There is no gradual change from loose soil to firm rock, but an abrupt transition. Furthermore, the soil is often composed of rock entirely different from that on which it rests. It has plainly been carried to its present position. South of the limit of glaciation there is a gradual transition from soil to unchanged rock.

This material deposited by the glacier is of two main classes, — the till or bowlder clay and the stratified drift.

Till is the material left by the glacier and came in part from that which was underneath the ice, and in part from the fragments at the side and on top of the ice. It is a jumbled mass, unstratified, and composed of materials of all sorts and of all sizes. It contains clay and small pebbles and large bowlders. The bowlders may be like the bed rock underneath and may have no relation to it. From the nature of the till it is evident that nothing like definite water-bearing beds can occur in it and that different parts of this mass can contain different amounts of water. Where the clays and sands are arranged in roughly parallel position the conditions are favorable for heavy water supply. Where the amount of clay is very large the conditions are not favorable. In general the till is of sufficient coarseness to contain a large amount of water, but it is difficult to predict the character of the water supply or its amount.

Where till layers rest directly on the rock, particularly on hill slopes, conditions are favorable for springs, and many springs and wet water seeps of this type are found throughout the State. Till occupies most of the highlands of Connecticut and is spread generally over the bed rock to a thickness varying from a few feet to over 100 feet. The till in valleys is generally underneath the stratified sands and gravels.

Stratified Drift is made up of materials deposited by glaciers, but the materials have been carried by water from the melting of the great ice sheet and distributed over the valleys and lowlands, so that as the material is now found it has the appearance of water deposits rather than glacier deposits. Because of its method of deposition stratified drift is always in layers and the coarse material and fine material are separated from each other. Layers of coarse gravels and sands of different grades and classes are interbedded, and a section cut through the stratified drift shows ordinarily considerable variation in texture. These sands and gravels contain a large amount of pore space and water occupies them up to 30 or 40 per cent. of their volume. Sands are the great water-bearing beds and wells sunk in them below the level of the ground water are certain to have an adequate supply. However, the level of ground water in sand is liable to fluctuate more than that of bowlder clay or bed rock, and it is advisable to sink wells to a depth somewhat below the water table. So great an amount of water is contained in stratified drift that it is the custom in Connecticut to sink a number of wells in close proximity to a considerable depth below the level of ground water and to use them as a single reservoir. For instance, on the New Haven plain the sands are saturated at a depth of less than 20 feet, and wells sunk to depths below that point have a supply of water in proportion to their depth. The gymnasium at Yale University is supplied by twenty of these wells driven closely together.

The water supply of Connecticut constitutes the mineral wealth of the State. Abandoned lands are being bought for summer homes and the essential condition of purchase is an adequate and satisfactory water supply from lake, spring, or well. Moreover, there are few farms in the State which would not give greater yields of hay and grain crops if the amount of available water were increased. I expect to see the day when irrigation is generally practiced in Connecticut. There is abundant water in rivers and lakes for the purpose; it needs only to be differently distributed. A careful detailed study of the water supply of the State and of the geological factors which control it would, I think, result in added wealth of crops and added value of the State as a summer resort.

OFFICIAL LIST OF AGRICULTURAL SOCIETIES HOLDING FAIRS IN 1905.

Name of Society.	President.	Secretary.	Treasurer.
New London County,	E. J. Miner,	T. W. Yerrington,	Chas. W. Hill.
Windham County,	Frank H. Deming,	J. B. Stetson,	Preston B. Sibley.
Beacon Valley,	Wm. J. Noble,	Wm. L. Lloyd,	W. G. Hard.
Berlin,	C. M. Jarvis,	W. W. Christian,	W. H. Upson.
Branford,	Edwin Doolittle,	J. P. Callahan,	J. P. Callahan.
Colchester Grange,	J. R. Dutton,	M. R. Abell,	Isabel L. Strong.
Danbury,	S. H. Rundle,	G. M. Rundle,	John W. Bacon.
Farmington Valley,	O. F. Perry,	E. A. Hough,	Benj. F. Case.
Granby,	Geo. O. Beach,	Theodore G. Case,	Stanley W. Edwards.
Greenfield Hill Country Club,	N. H. Sherwood,	Mrs. D. B. Adams,	A. C. Acker.
Guilford,	A. Miner Leete,	Robert DeF. Bristol,	Wm. C. White.
Harwinton,	Wm. J. Barber,	Lewis O. Catlin,	P. H. Hogan, Jr.
Mad River Grange,	Arthur J. Pierpont,	Henry B. Cook,	W. LeRoy Garrigus.
New Haven Co. Hort. Society,	R. D. Pryde,	Thomas Pettit,	David Kydd.
New Milford,	J. LeRoy Buck,	J. E. Hungerford,	Edwin J. Emmons.
Newtown,	R. C. Mitchell,	P. H. McCarthy,	Henry G. Curtis.
Orange,	W. S. Woodruff,	A. D. Clark,	Edward L. Clark, Jr.
Putnam Park Ass'n,	M. R. Joy,	E. M. Arnold,	Richard Gorman.
Rockville Fair Ass'n,	Andrew Kingsbury,	A. L. Martin,	F. A. Randall.
Simsbury,	E. A. Hoskins,	Geo. C. Eno,	Charles E. Curtiss.
Stafford Springs,	E. C. Dennis,	C. F. Beckwith,	Robert H. Fisk.
Suffield,	Waldo S. Knox,	W. L. Stiles,	J. O Haskins.
Union (Somers, etc.),	C. A. Arnold,	Henry D. Fletcher,	Chas. A. Thompson.
Waterbury Driving Co.,	O. G. Camp,	N. W. Heater,	D. E. Cronin.
Horseshoe Park Agri. Ass'n,	Chas. A. Gates,	T. R. Sadd,	Fred A. Sanderson.
Woodstock,	Chester E. May,	L. H. Healy,	Armin E. Brunn.
Conn. Dairymen's Association,	H. O. Daniels,	J. G. Schwink, Jr.,	B. C. Patterson.
Conn. Pom. Soc.,	J. C. Eddy,	H. C. C. Miles,	Orrin Gilbert.

RETURNS OF AGRICULTURAL SOCIETIES, 1905.—Finances.

SOCIETIES.	Cash on hand.	Single Admission Tickets.	Membership or Season Tickets.	Grand Stand.	Donations and Unclaimed Premiums.	Entrance Fees, Trials of Speed.	Other Entrance Fees.	Rent of Grounds.	Other Sources.	State Appropriation, 1905.	Totals.
New London County,	$87.77	$3716.30	$165.00	$704.25	....	$555.00	$62.50	$467.00	$46 00	$234.55	$6037.37
Windham County,	....	1105.95	18.00	162.55	$15.00	27.50	101.40	284.00	107.15	244.67	2066.02
Beacon Valley,	61.05	876.15	62.00	47.50	55.00	175.50	41.25	176.00	22.10	186.48	1703.03
Berlin,	10.30	2717.25	302.00	203.25	538·50	35.00	....	343.90	322.44	128.14	4600.78
Colchester Grange,	....	68.30	....	....	17.10	....	9.50	12.50	57.62	100.00	265.02
Farmington Valley,	36.60	919.60	....	182.75	....	330.00	77.75	202.50	643.14	144.97	2537.31
Granby,	48.55	598.15	....	127.20	....	297.50	....	85.63	113.05	229.47	1499.55
Greenfield Hill Country Club,	603.17	1931.55	129.25	378.50	321.70	....	93.00	19.00	1755.85	....	5232.02
Guilford,	816.44	178.35	126.50	....	6.00	....	5.50	38.00	128.53	143.87	1443.19
Harwinton,	221.65	3.25	....	....	....	....	28.95	387.30	72.60	126.63	840.38
Mad River Grange,	....	439.65	....	....	14.50	....	....	8.00	527.62	....	989.75
New Haven Co. Hort. Society,	246.90	331.25	80.00	....	326.00	....	....	....	112.50	155.07	1251.72
New Milford,	66.61	990.70	....	160.45	....	547.50	....	846.20	....	137.57	2249.03
Newtown,	1124.45	959.08	....	314.20	100.00	430.50	5.00	210.50	198.31	141.24	3483.28
Orange,	1786.32	1685.25	124.00	316.15	9.00	413.25	71.00	252.05	126.71	186.17	4969.90
Putnam Park Ass'n,	82.36	1474.17	....	581.00	....	291.00	220.50	200.40	350.00	....	3199.43
Rockville Fair Ass'n,	1158.55	2689.15	122.00	653.50	....	296.67	148.50	423.75	40.00	227.02	5759.14
Simsbury,	....	625.10	....	....	50.00	250.00	....	86.50	26.53	104.80	1142.93
Stafford Springs,	87.44	3560.50	197.00	1205.50	....	182.50	228.00	818.65	298.80	252.00	6830.39
Suffield,	27.90	1451.20	....	118.40	....	....	630.00	168.75	199.80	100.00	2676 05
Union (Somers, etc.),	997.51	....	8.00	....	3.00	....	....	21 .00	168.35	122.19	1320 05
Horseshoe Park Agrl. Ass'n,	63.03	2424.85	72.00	506.00	....	200.00	23.40	520.15	159.00	415.12	4413.55
Woodstock,	16.64	1015.95	83.00	293.65	68.00	114.00	66.60	247.50	196.67	224.20	2326.21
Conn. Dairymen's Ass'n,	772.45	....	200.00	....	....	....	....	....	254.92	885.81	2113.18
Conn. Pom. Soc.,	92.01	....	493.00	....	....	....	....	....	....	141.70	736.71

RETURNS OF AGRICULTURAL SOCIETIES, 1905. — FINANCES, CONTINUED.

SOCIETIES.	Expenses of Fair.	Premiums for Speed.	Premiums for Amusement.	Other Premiums and Gratuities.	Permanent Improvements.	Other Expenses.	Cash on hand.	Total.	Indebtedness of Society.	Real Estate.	Personal Estate.	No. of Members.	No. of Stockholders.	Capital Stock.	Admission Tickets.	Season Tickets.	Grand Stand.
New London Co.,..	$1,309.19	$1,210.00	$704.00	$1,111.30	$325.00	$1,137.24	$230.64	$6,037.37	$3,700.00	$10,000.00	....	191	......	....	$0.35	$1.00	$0.25
Windham County,	508.41	373.21	275 00	1,023.10	119.21	....	....	2,299.02	75.15	5,000.00	$300.00	675	......	....	.35	......	.20
Beacon Valley,....	467.31	375.00	325.00	385.50	151.00	....	......	1,703.81	0.78	....	....	67	15	....	.25, .15	1.00	.15
Berlin,............	1,202.95	200.00	551.75	41.25	2,456.88	74.00	73.95	4,600 78	7,550.00	12,000.00	125.00	302	.....	....	.25	1.00	.10
Colchester Grange.	62 09	....	18.00	102.80	....	....	82.13	265.02	1,300.00	2,000.00	225.00	66	......	....	.25	......	....
Farmington Valley	714.78	780.00	....	424.25	287.07	265.58	35.63	2,537.31	1,900.00	9,203.07	93.00	......	70	$5,000	.25	......	....
Granby,...........	154.07	680 00	140.11	249.35	45.50	191.25	39.27	1,499.55	1,000.00	2,500.00	....	......	......	....	.25, .15	......	....
Greenfield Hill Country Club,...	1,579.73	....	3.00	799.45	1,129.70	1,150 00	570.14	5,232.02	4,735.00	9,380.00	1,000.00	176	......	....	.25, .15	.75	1.00, .50, .25
Guilford,..........	173.13	....	32.50	468.35	....	121.00	648.21	1,443.19	....	....	....	254	......	....	.15	.50	....
Harwinton,........	229.54	....	....	276.05	....	206.41	128.35	840.38	500.00	700.00	200.00	......	135	....	....	......	....
Mad River Grange,	371.35	....	66.00	374.80	....	177.22	.40	989.77	100.00	....	....	4	......	.. ....	.25	......	....
New Haven County Hort. Society,...	351.92	....	....	566.00	....	75.64	258.16	1,251.72	181.00	....	....	80	......	....	.25	......	....
New Milford, ...	571.58	1,030.00	....	316.25	150.00	136.00	12.20	2,249.03	2,600.00	....	....	......	......	....	.25		
Newtown, ...	....	868.75	....	408.70	1,100.00	1,105.83	....	3,384.28	1,000.00	....	6,000.00	......	125	5,000	.25		25, .50
Orange,...	604.01	950.00	249.40	783.25	1,408.42	852.99	121.83	4,969.90	....	....	4,000.00	124	......	....	.50	......	.25
Putnam P'k Asso.,.	972.79	804.00	702.50	499.09	207.87	....	13.18	3,199.43	2,500.00	10,000.00	....	......	76	5,000	.25	......	....
Rockville, F. Asso.,	1,184.93	995.00	880.90	1,214.20	13.75	48.00	1,422.36	5,759 14	....	7,000.00	....	......	123	3,330	.35	1.00	.25
Simsbury, ...	170.41	530.00	40.00	....	57.65	86.84	40.05	924.95	....	....	....	.. ..	......	....	....	......	....
Stafford Springs,..	1,984.62	1,280.50	1,245.10	1,407.26	....	715.25	197.66	6,830.39	500.00	15,000.00	500.00	.. ..	56	5,000	.35	1.00	.25
Suffield,...........	2,099.00	1,100.00	125.00	100.00	....	764.00	577.05	2,676.05	1,020.00	7,000.00	....	......	515	3,075	.15, .35	......	.10
Union (Somers, etc.)........	....	....	43.50	170.85	....	119.50	986.20	1,320.05	....	....	....	363	......	....	....	......	....
Horseshoe Park Agrl. Asso.......	458.82	880.00	786.00	841.35	....	1,103.40	343.98	4,413.55	500.00	....	4,474.11	......	49	2,025	.35	1.00	.25
Woodstock,.......	549.98	306.00	380.10	819.55	....	238.00	2.58	2,326.21	125.00	8,000.00	600.00	530	......	....	.25	.. ..	.20
Conn. Dairymen's Asso.,..........	....	....	....	302.00	....	1,571.51	239.67	2,113.18	....	....	....	......	......	....	....	......	....
Conn. Pomological Asso.,..........	194.05	....	.. ..	373.75	. ...	....	95.75	....	....	....	....	660	......	....	....	......	....

ANALYSIS OF PREMIUMS AND GRATUITIES PAID.—FARM STOCK.

SOCIETIES.	Bulls.	Milch Cows.	Heifers.	Calves.	Working Oxen.	Steers.	Fat Cattle.	Horses.	Horses, Speed.	Sheep.	Swine.	Poultry.	All other Stock.	TOTAL.
New London County,	$59.00	$201.75	$31.75	$25.25	$62.00	$19.50	$15.00	$165.50	$1,210.00	$86.00	$28.00	$141.75	...	$2,049.00
Windham County,	42.00	46.00	74.00	20.20	75.00	69.00	...	146.00	373.24	13.00	12.00	26.50	$40.00	936.74
Beacon Valley,	12.00	22.00	18.50	6.25	18.00	9.00	6.00	27.75	375.00	7.50	9.00	90.10	4.15	605.25
Berlin,	28.00	71.00	17.50	10.50	9.50	3.00	6.50	18.00	241.25	22.00	34.00	71.75	37.00	573.00
Colchester Grange,	3.75	4.00	3.75	1.00	5.50	4.00	...	5.50	...	2.00	2.00	3.00	1.00	32.50
Farmington Valley,	35.00	46.00	40.00	14.00	21.00	10.50	5.00	11.00	780.00	...	...	126.95	50.50	1,139.95
Granby,	14.00	58.00	33.50	7.75	17.00	17.00	...	16.00	...	4.00	...	24.00	12.50	203.75
Greenfield Hill Country Club,	13.25	18.75	16.25	16.00	79.75	2.50	2.00	70.40	...	2.25	15.00	27.00	174.25	437.40
Guilford,	2.50	8.50	1.50	1.50	24.50	12.00	3.00	23.00	...	...	4.00	42.00	11.50	134.50
Harwinton,	4.50	3.05	3.40	...	20.50	...	1.00	21.75	...	1.00	5.25	60.90	...	121.35
Mad River Grange,	16.80	56.00	21.00	5.00	55.00	12.00	6.00	22.00	...	...	...	27.00	6.00	226.80
New Haven County Hort. Society,	...	...	...	...	...	...	...	...	...	...	...	...	...	...
New Milford,	16.00	45.50	12.00	6.00	43.00	6.00	14.00	21.00	1,030.00	...	...	4.25	...	1,197.75
Newtown,	10.50	18.00	14.50	6.50	38.50	26.00	7.00	38.50	868.75	...	...	7.25	4.50	1,040.00
Orange,	12.50	46.00	7.50	1.00	90.00	18.00	12.00	108.25	950.00	7.00	8.00	28.25	22.75	1,311.25
Putnam Park Association,	...	...	...	...	...	...	...	...	...	...	...	6.25	...	6.25
Rockville Fair Association,	28.50	50.50	14.00	11.50	58.50	3.00	6.00	42.00	995.00	13.00	8.00	381.75	...	1,611.75
Simsbury,	...	...	...	...	...	...	...	...	...	...	...	17.00	154.13	171.13
Stafford Springs,	35.00	85.00	27.00	28.00	66.00	32.00	9.00	55.00	1,280.50	20.00	19.00	544.41	26.00	2,226.91
Suffield,	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Union (Somers, etc.),	...	18.00	4.00	5.00	9.00	6.00	...	13.00	6.00	...	2.00	26.50	3.00	92.50
Horseshoe Park Agri. Association,	14.50	74.00	102.00	36.00	81.00	28.00	13.00	42.00	880.00	11.00	4.00	29.25	160.10	1,477.85
Woodstock,	25.00	115.00	75.00	26.00	25.00	33.00	...	104.00	306.00	20.00	26.50	62.25	...	817.75
Conn. Dairymen's Association,	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Conn. Pomological Society,	...	...	...	...	...	...	...	...	...	...	...	...	...	...

ANALYSIS OF PREMIUMS AND GRATUITIES PAID.—Continued. FARM PRODUCTS.

SOCIETIES.	Indian Corn.	Wheat.	Rye.	Barley.	Oats.	Beans.	Buckwheat.	Grass Seeds.	Potatoes.	Carrots.	Beets.	Parsnips.	Turnips.	Onions.	Other products.	Total amount for Grain and Root Crops.
New London County,...	$2.50	....	$1.25	....	$0.75	$2.00	$0.75	....	$4.50	$1.25	$2.75	$0.75	$2.75	$4.00	$105.50	$128.75
Windham County,......	1.25	....	.75	....	.75	....	.50	....	....	....	....	....	....	....	40.50	43.75
Beacon Valley,.........	4.60	$0.75	3.50	....	6.50	4.25	.25	....	28.75	1.25	.75	3.50	2.75	2.50	8.25	67.60
Berlin,.................	8.50	.50	1.50	$0.50	1.50	1.25	1.25	....	11.50	2.25	1.75	....	1.75	3.50	20.75	56.50
Colchester Grange,.....	1.50	....	.40	....	.60	.25	....	....	1.45	.40	.60	.60	1.80	.80	....	9.40
Farmington Valley,....	1.10	....	....	....	....	1.70	....	....	10.70	1.80	1.90	....	.30	1.70	5.95	25.15
Granby,...............	50	....	....	....	....	....	....	....	....	.25	.25	....	....	....	2.75	3.75
Greenfield Hill Country Club,...............	3.00	.75	.75	....	.50	....	....	....	15.50	2.75	7.25	2.25	2.25	3.25	4.55	42.80
Guilford,..............	7.00	2.75	1.00	.75	.75	.90	.50	....	12.25	4.75	3.25	2.00	2.25	1.50	37.00	76.65
Harwinton,............	6.00	.50	....	....	.50	1.00	.80	$0.50	7.50	.50	.50	.30	.30	2.00	4.80	25.20
Mad River Grange,.....	3.20	....	.50	....	.50	2.50	.50	....	15.25	.50	.50	.50	2.25	3.60	3.80	33.60
New Haven Co. Hort. Society,............	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
New Milford,...........	2.00	....	.75	....	.75	.75	....	....	25.00	.75	.75	.75	.75	2.50	14.50	49.25
Newtown,..............	4.50	....	....	....	....	1.75	....	....	3.75	1.50	4.25	....	2.25	3.75	45.50	67.25
Orange,...............	6.25	....	1.00	....	....	....	....	....	16.00	.50	1.75	.50	1.00	6.75	33.50	67.25
Putnam Park Asso'n.,..	2.00	....	.25	....	....	1.50	....	....	19.50	2.25	8.75	....	....	5.50	....	44.75
Rockville Fair Asso'n.,	5.25	1.50	3.00	....	2.50	4.50	1.50	....	98.00	1.25	3.00	.75	2.25	.25	62.50	186.25
Simsbury,..............	....	....	....	....	....	....	....	....	....	....	....	....	46.85	....	....	....
Stafford Springs,.......	17.95	1.00	2.75	1.00	2.75	1.75	1.75	....	105.50	4.00	1.00	.25	2.00	2.20	....	143.90
Suffield,...............	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Union (Somers, etc.),...	1.25	5.75	.50	....	.50	.50	....	....	5.25	.75	.75	....	.75	.75	7.25	24.00
H0rseshoe Park Agricultural Association,.	....	....	....	....	....	4.75	....	....	50.25	1.75	....	....	.75	9.25	32.75	109.50
Woodstock,............	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	31.55
Conn. Dairymen's Association,.........	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Conn. Pomological Soc.,	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....

ANALYSIS OF PREMIUMS AND GRATUITIES.—Continued. FARM PRODUCTS AND MISCELLANEOUS.

SOCIETIES.	Fruits.	Flowers.	Other Cult. Crops.	Butter.	Cheese.	Honey and Wax.	Bread and Cake.	Sugar, Syrup, Preserved Fruit.	Total Farm Products.	Agricultural Implements.	Mechanical Inventions.	Fine Arts and Fancy Articles.	Decorated Carts and Trains of Oxen.	Plowing at Exhibition.	Grange Exhibit.	Medals.	Diplomas.	Total Miscellaneous.
New London County,....	$15.75	$13.50	......	....	....	$ .75	$8.30	$2.25	$169.80	$4.00	$3.00	$95.50	....	......	......	....	13	$102.50
Windham County,........	73.35	25.00	$1.00	$4.50	$3.50	1.75	15.70	13.00	137.80	7.00	167.00	52.20	$26.85	......	$25.00	1	1	278.05
Beacon Valley,..........	48.25	9.00	......	2.25	....	.75	12.15	3.25	143.25	......	....	12.00	....	......	......	....	....	12.00
Berlin,..................	37.25	15.50	78.00	4.50	....	....	14.75	3.25	209.75	......	10.25	....	20.00	......	......	....	....	30.25
Colchester Grange,.......	4.50	2.75	5.20	1.25	....	1.35	3.35	3.50	21.90	......	15.15	20.85	....	......	......	....	....	36.00
Farmington Valley,.......	15.80	2.70	......	1.00	....	....	5.40	4.65	29.55	......	....	9.60	....	......	......	....	....	9.60
Granby,..................	8.00	1.35	......	2.50	....	1.00	6.50	2.50	28.60	......	....	20.00	....	......	......	....	....	20.00
Greenfield Hill Country Club,..................	38.20	16.25	60.70	2.00	....	1.00	6.00	12.75	179.80	......	8.50	87.50	10.00	......	......	....	....	182.00
Guilford,................	64.50	16.50	......	3.00	....	.75	15.00	15.85	192.25	......	9.25	68.85	63.50	......	......	....	....	141.60
Harwinton,...............	14.75	3.00	......	.55	.20	....	10.35	2.25	56.30	......	....	12.40	86.00	......	......	....	....	98.40
Mad River Grange,........	47.00	.50	6.00	1.25	....	....	6.25	11.80	106.40	16.00	....	19.75	....	......	......	....	....	35.75
New Haven County Horticultural Society,.......	32.00	496.00	38.00	....	....	....	....	....	566.00	......	....	....	....	......	......	....	....	....
New Milford,.............	95.50	7.00	......	....	....	....	13.00	14.00	129.50	......	....	55.50	....	......	......	....	....	55.75
Newtown,.................	63.50	8.25	......	2.50	....	6.75	10.50	8.75	100.25	......	....	57.45	12.50	......	......	....	....	69.95
Orange,..................	60.50	5.25	......	....	....	....	13.00	3.00	149.00	......	....	45.00	228.00	......	......	....	....	273.00
Putnam Park Asso'n,.....	19.50	21.25	......	....	....	1.00	20.75	....	107.25	......	....	79.20	....	......	......	....	....	79.20
Rockville Fair Asso'n,....	164.20	28.55	......	3.00	....	....	25.00	67.45	474.45	......	....	103.00	20.00	......	......	....	....	123.00
Simsbury,................	....	....	......	....	....	....	....	....	....	......	....	....	....	......	......	....	....	....
Stafford Springs,.........	51.50	....	56.60	.25	....	.40	6.30	13.30	271.25	......	41.70	91.90	55.00	......	......	....	.30	188.60
Suffield,.................	....	....	......	....	....	....	....	....	....	......	....	....	....	......	......	....	....	....
Union (Somers, etc.),.....	11.00	....	......	2.50	....	....	3.65	....	17.15	12.00	....	10.00	3.50	......	......	....	....	29.50
Horseshoe Park Agricultural Ass'n.............	33.25	3.75	......	2.50	....	1.00	8.75	10.00	59.25	......	....	74.75	....	......	.10	....	....	74.75
Woodstock,...............	52.05	23.50	20.00	10.00	4.00	2.50	19.70	7.00	138.75	......	55.25	82.25	30.00	......	......	....	....	167.50
Conn. Dairymen's Association,...............	....	....	......	....	....	....	....	....	....	......	....	....	....	......	......	....	....	....
Connecticut Pomological Society,...............	396.25	....	......	....	....	....	....	....	....	......	....	....	....	......	......	....	....	....

NUMBER OF ANIMALS EXHIBITED.—1905.

SOCIETIES.	Bulls.	Milch Cows.	Heifers.	Calves.	Oxen (pairs).	Steers (pairs).	Fat Cattle.	Horses.	Horses — speed.	Sheep.	Swine.	Poultry (coops).	All other Stock.
New London County,	23	148	20	23	43	32	10	45	42	59	26	195	...
Windham County,	23	22	33	20	35	40	...	35	...	27	11	46	...
Beacon Valley,	14	24	29	11	14	6	3	32	18	15	19	150	22
Berlin,	20	50	28	17	7	7	2	76	12	20	186	165	35
Colchester Grange,	5	6	5	2	6	8	...	8	...	12	4	8	2
Farmington Valley,	15	19	24	9	11	12	4	7	...	...	...	...	...
Granby,	8	71	38	21	8	19	...	10	...	7	...	21	...
Greenfield Hill Country Club,	11	20	24	19	44	6	2	81	...	4	8	185	204
Guilford,	3	20	3	7	59	8	4	49	...	...	9	140	27
Harwinton,	5	5	7	...	60	...	4	12	...	1	16	104	...
Mad River Grange,	12	38	21	6	20	7	6	17	...	...	...	78	16
New Haven County Horticultural Society,	...	...	...	...	...	...	...	...	...	...	...	...	...
New Milford,	11	61	14	7	24	6	11	20	...	...	...	14	...
Newtown,	8	24	16	10	21	18	5	19	...	...	...	12	7
Orange,	6	57	15	4	25	13	12	47	...	8	10	61	48
Putnam Park Association,	...	...	...	...	...	...	...	...	...	...	...	...	...
Rockville Fair Association,	14	46	27	16	24	5	11	28	...	17	15	775	...
Simsbury,	...	...	...	...	...	...	...	...	...	...	...	...	...
Stafford Springs,	10	35	14	18	12	7	6	...	...	22	18	...	...
Suffield,	...	...	...	...	...	...	...	...	...	...	...	...	...
Union (Somers, etc.),	...	9	1	3	4	3	...	5	3	...	1	26	4
Horseshoe Park Agricultural Association,	9	38	51	27	42	31	4	...	...	15	1	50	...
Woodstock,	10	80	40	22	9	22	...	34	...	...	...	101	...
Connecticut Dairymen's Association,	...	...	...	...	...	...	...	...	...	...	...	...	...
Connecticut Pomological Society,	...	...	...	...	...	...	...	...	...	...	...	...	...

AGRICULTURAL FAIRS IN CONNECTICUT.—1905.

SOCIETIES.	PLACE.	DATE.	ATTENDANCE.						
			Monday.	Tuesday.	Wednesday.	Thursday	Friday.	Saturday.	Total.
New London County,	Norwich,	Sept. 12-14,	....	....	3,000	10,000	2,000	....	15,000
Windham County,	Brooklyn,	Sept. 12-14,	....	100	2,000	1,500	....	....	3,600
Beacon Valley,	Naugatuck,	Sept. 4,	....	....	5,000	....	....	....	5,000
Berlin,	Berlin,	Sept. 20-22,	....	....	6,000	10,000	8,000	....	24,000
Colchester Grange,	Colchester,	Sept. 19,	....	300	....	....	....	....	300
Farmington Valley,	Collinsville,	Sept. 6-7,	....	....	900	3,000	....	....	3,900
Granby,	Granby,	Sept. 27-28,	....	....	900	2,000	....	....	2,900
Greenfield Hill Country Club,	Greenfield Hill,	Sept. 12-15,	....	....	1,807	4,376	1,908	....	8,091
Guilford,	Guilford,	Sept. 27,	....	....	6,000	....	....	....	6,000
Harwinton,	Harwinton,	Oct. 3,	....	15,000	....	....	....	....	15,000
Mad River Grange,	Waterbury,	Sept. 13-14,	....	....	400	1,500	....	....	1,900
New Haven County Hort. Society,	New Haven,	Nov 7-9,	247	518	560	....	....	....	1,325
New Milford,	New Milford,	Sept. 12-15,	....	20	1,000	2,000	700	....	3,720
Newtown,	Newtown,	Sept. 26-28,	....	1,000	3,000	2,000	....	....	6,000
Orange,	Orange,	Sept. 4-5-6,	....	2,500	1,500	....	....	....	4,000
Putnam Park Association,	Putnam,	Sept. 2-4-5,	500	4,000	1,500	....	....	....	6,000
Rockville Fair Association,	Rockville,	Sept. 26-28,	....	2,000	10,500	5,400	....	....	17,000
Simsbury,	Simsbury,	Oct.	....	....	....	....	....	....	....
Stafford Springs,	Stafford Springs,	Oct. 3-4-5,	....	2,000	12,000	6,000	....	....	20,000
Suffield,	Suffield,	Sept.	....	1,200	3,800	....	....	....	5,000
Union (Somers, etc.),	Broad Brook,	Sept. 20,	....	....	400	....	....	....	400
Horseshoe Park Agri. Asso.,	Willimantic,	Sept. 19-21,	....	500	7,000	2,000	....	....	9,500
Woodstock,	So. Woodstock,	Sept. 18-20,	....	1,890	1,722	....	....	....	3,612
Conn. Dairymen's Asso.,	Hartford,	Jan. 17-18, 1906,	....	....	....	....	....	....	....
Conn. Pomological Society,	Rockville,	Sept. 26-28,	....	....	....	....	....	....	....

OFFICIAL DIRECTORY

OF THE

CONNECTICUT PATRONS OF HUSBANDRY

FOR 1906.

OFFICERS OF CONNECTICUT STATE GRANGE.

Master, O. S. Wood, Ellington.
Overseer, B. A. Peck, Bristol.
Lecturer, L. H. Healy, N. Woodstock.
Steward, F. P. Johnson, Warren.
Assistant Steward, H. W. Andrews, Brookfield Center.
Chaplain, Rev. F. Countryman, Stony Creek.
Treasurer, N. S. Platt, New Haven.
Secretary, H. E. Loomis, Glastonbury.
Gate-Keeper, E. F. Hutchinson, Andover.
Ceres, Mrs. Nellie A. Cook, Hamden.
Pomona, Mrs. Addie C. Hyde, Brooklyn.
Flora, Mrs. Hattie J. Welton, Plymouth.
Lady Steward, Mrs. May K. Taylor, Lebanon.

Annual Meeting the Second Tuesday in January.

Executive Committee.

H. F. Porter, North Haven, . . .	Term expires 1907
P. B. Sibley, Danielson, . . .	" " 1908
J. H. Hale, South Glastonbury, . .	" " 1909
O. S. Wood, *ex officio*, ...	" " 1908
H. E. Loomis, *ex officio*, . . .	" " 1908

Finance Committee.

H. C. Dunham, Middletown. J. H. Blakeman, Oronoque.
G. A. Hopson, East Wallingford.

COMMITTEES FOR 1906.

Woman's Work.

Mrs. Mary W. Phipps, Prospect.

Deputies.

Geo. A. Hopson, General Deputy, East Wallingford.
Central Pomona, No. 1, Hubert S. Blake, New Britain.
Quinebaug Pomona, No. 2, C. H. Potter, North Woodstock.
East Central Pomona, No. 3, Andrew Kingsbury, Rockville.
Mt. County Pomona, No. 4, J. H. Putnam, Litchfield.
New Haven County Pomona, No. 5, W. S. Hine, Derby.
New London County Pomona, No. 6, C. E. Staples, Colchester.
Excelsior Pomona, No. 7, F. M. Candee, Naugatuck.
Seaview Pomona, No. 8, E. H. Wright, Clinton.
Fairfield County Pomona, No. 9, W. J. Wood, Westport.
Hou't'ic Valley Pomona, No. 10, Gilbert A. Vincent, Kent.

Board of Arbitration.

The Executive Committee, Overseer, and Lecturer.

The Patrons' Mutual Fire Insurance Company.

President, Geo. Austin Bowen, Woodstock.
Vice-President, D. H. Carrier, Glastonbury.
Treasurer, B. C. Patterson, Torrington.
Secretary, Chas. E. Bacon, Middletown.

Annual Meeting, Third Tuesday in February.

OFFICERS OF THE GRANGES.

Name.		Master.	Lecturer.	Secretary.
Pomona Granges.				
Central Pomona,	No. 1,	Henry C. Dunham, Middletown,	Mrs. B. B. Robbins, Bristol,	Chas. E. Bacon, Middletown.
Quinebaug Pomona,	2,	Everett E. Brown, Pomfret Center,	Jennie M. Robinson, Webster, Mass.,	W. F. Day, Danielson.
East Central Pomona,	3,	Andrew Kingsbury, Rockville, R.F.D.	Mrs. Fannie L. Tilden, Ellington,	Mrs. Laura J. Brewer, Hockanum.
Mountain County Pomona,	4,	Geo. F. Douglass, Collinsville,	Silas E. Stockman, East Morris,	Arthur B. Ferry, Winsted.
New Haven Co. Pomona,	5,	Bennett J. Dickerman, Mt. Carmel,	Mrs. C. A. D. Allen, Wallingford,	Oscar L. Smith, North Haven.
New London Co Pomona,	6,	Carroll E. Staples, Colchester,	F. N. Taylor, Lebanon,	O. L. Pultz, Lebanon.
Excelsior Pomona,	7,	Wilson L. Pierpont, Waterbury,	Lewis Garrigus, Waterbury,	Mrs. Martha E. Judd, Southbury.
Seaview Pomona,	8,	A. D. W. Chalker. Saybrook,	Myron G. Skinner, Higganum,	D. Eugene Smith, Madison.
Fairfield County Pomona,	9,	Joseph Adams, Westport,	Mrs. D. A. St. John, New Canaan,	Mrs. F. E. Blakeman, Oronoque.
Housatonic Valley Pomona,	10,	H. W. Treat, Bridgewater,	G. H. Smith, Kent,	F. S. Peet, Kent.
Subordinate Granges.				
Washington,	No. 11,	Ralph J. Averill, Wash. Depot,	Mrs. Anna Clark, Wash. Depot,	Frederick J. Ford, Wash. Depot.
Tunxis,	13,	F. L. Granger, Jr., Bloomfield,	Mrs. Geo. K. Marvin, Bloomfield,	Geo. K. Marvin, Bloomfield.
Hope,	20,	Eugene Wadhams, Torrington,	Mrs. Mary French, Torrington,	K. K Kimberly, Torrington.
Lebanon,	21,	Otto L. Pultz, Lebanon,	Mrs. Hortense E Pultz, Lebanon,	F. N. Taylor, Lebanon.
Cheshire,	23,	Willis B. French, Cheshire.	Frederick Doolittle, Cheshire,	S. A. Buckingham, West Cheshire.
Berlin,	24,	Earl Cooley, Berlin,	Mrs. Walter L Atwater, Berlin,	W. H. Shumway, Berlin.
Union,	25,	D. H. Bennett, Plantsville,	M M. Frisbie, Southington,	James W. Upson, Marion.
Glastonbury,	26,	Stancliff Hale, South Glastonbury,	William H. Carrier, Glastonbury,	Miss Lucy E. Miller, So. Glastonbury.
Suffield,	27,	Edw F. Newton, Agawam, Mass.,	John S. Gardner, Suffield,	Ralph E. Moody, Suffield.
Meriden,	29,	Julius I Ives, South Meriden,	Mrs. Mary A. Ives, South Meriden,	Mrs. Mabel A. Francis, Wallingford.
Wapping,	30,	J. Edward Collins, Burnside,	Miss Emily M. Lane, Rockville,	Miss S. Rosa Dewey, Buckland.
Manchester,	31,	Arthur E. Loomis, S. Manchester,	Miss Mabel J. Loomis, S. Manchester.	Keeney B. Loomis, South Manchester.
North Cornwall,	32,	Mrs. A. T. P. Brush, W. Cornwall,	Noah Rogers, W. Cornwall,	Mrs. Niles Scoville, West Cornwall.
Wallingford,	33,	Franklin Hill, Wallingford,	Mrs. Jennie Hough, Yalesville,	Flora E. Hough, Wallingford.
Cawasa,	34,	John Crowley, Canton,	Mrs. Sarah Johnson, Collinsville,	Mrs Annette E. Case, Canton.
North Haven,	35,	Hobart J. Brockett, Clintonville,	Mrs H. F. Potter, North Haven,	Myron R. Brockett, North Haven.
Little River,	36,	Austin E. Pearle, Hampton,	Mrs. Mary Litchfield, Hampton,	Mrs. Angie M. Burnham, Hampton.
East Hartford,	37,	Archie Evans, Hockanum,	Charles R. Risley, Silver Lane,	Miss Charlotte C. Smart, Silver Lane.
New Canaan,	38,	J. Howard Hoyt, New Canaan,	Frank N. Horton, New Canaan,	William C. Durham, Darien.
Burritt,	39,	Charles H. McKirdy, New Britain,	Miss Lila Clark, New Britain,	Mrs. F. H. Sharpe, New Britain.
Senexet,	40,	Chas T. Lindeman, Putnam,	Joseph Spalding, Woodstock,	Chauncey S. Child, Woodstock.
Konomoc,	41,	J. B. Bliven. New London,	Mrs. J B. Bliven, New London,	A. E. Bliven, New London.
Mattabessett,	42,	Richard Atkins, Middletown,	Mrs. Jennie Birdsey, Middletown,	Miss Fannie W Prior, Middletown.
Brooklyn,	43,	Leroy E. Pearle, Brooklyn,	Fred Page, Wauregan,	Miss Gladys Stone, Brooklyn.
Newington,	44,	Charles L. Luce, New Britain,	Howard E. Dabney, Newington,	Mrs Nellie L. Eddy, New Britian.

OFFICERS OF THE GRANGES.— Continued.

Name.		Master.	Lecturer.	Secretary.
Subordinate Granges — *Cont.*				
Ellington,	46,	Harrison L. Hamilton, Ellington,	Mrs. Emily Parsons, Ellington,	James M. Marks, Ellington.
Bolton,	47,	C. N. Loomis, Jr., Manchester,	Miss Adelia N. Loomis, Bolton,	Miss Maude E. White, Bolton.
Whigville,	48,	A. D. Carnell, Forestville,	Mrs. Ida Lowrey, Bristol,	Robert Carnell, Forestville.
Westfield,	50,	Edward A. Smith, Middletown,	Charles Congdon, Middletown,	Mrs. Mary Addis, Middletown.
Tolland,	51,	C. Hibbard West, Rockville,	Mrs. S. E. Edgerton, W. Willington,	Mrs. EdytheN. Edgerton, W. Willi'gton.
Vernon,	52,	Charles W Bradley, Rockville,	Mrs. Geo. Webster, Rockville,	Mrs. Emma D. Pitkin, Talcottville.
Plainville,	54,	Henry Tyler, Plainville,	Mrs. Louise Ryder, Plainville,	Mrs. W. H. Plummer, Forestville.
Stafford,	55,	I. P. Booth, Stafford,	J. M. Larned, Stafford Springs,	Mrs. Abbie Ide, Stafford.
East Haddam,	56,	Robert W. Bingham, Little Haddam,	Edwin W. Crocker, Moodus,	S. E. Williams, Colchester.
Durham,	57,	C. W. Coe, Northford,	Mrs. W. L. Davis, Durham Centre,	W. L. Davis, Durham Center.
West Hartford,	58,	A. B. Alderson, West Hartford,	L. W. Harvey, West Hartford,	Edwin H. Munger, West Hartford.
Saybrook,	59,	Geo. E. Sheffield, Saybrook,	Mrs. Mary S. Clark, Saybrook,	Mrs Marion A. Chalker, Saybrook.
Crystal Lake,	60,	Ward G. Holman, Eastford,	Miss Alice J. Carpenter, Eastford,	Mrs. L. A. Keith, Eastford.
Wolf Den,	61,	Everett E. Brown, Pomfret Center,	Mrs. Alice E. Wilbur, Abington,	Mrs. Anna L. Badger, Abington.
Eureka,	62,	G. C. Beckwith, Nepaug,	G. F. Goodenough, Torringford,	H. G. Douglas, Collinsville.
Middlefield,	63,	Almon D. Emmons, Middlefield,	Miss Lucina C. Miller, Middlefield,	Mrs. Clara E. Goodrich, Middlefield.
Mansfield,	64,	H. L. Garrigus, Storrs,	H. D. Edmund, Storrs,	W. A Stocking, Jr., Storrs.
Quinnatisset,	65,	Henry M. Thomson, Thompson,	Mrs. Alice Elliott, Thompson,	Calvin Ballard, Thompson.
Killingworth,	66,	Burton G. Waugh, Higganum,	Chas. H. Coe, Clinton,	Mrs. Hattie M. Davis, Clinton.
Cromwell,	67,	Ira M. Barrows, Cromwell,	Geo. S. Butler, Cromwell,	Miss Lottie M. Sage, Cromwell.
Natchaug,	68,	Burton M. Welch, Chaplin,	Helen A. Litchfield, Chaplin,	Clarence E. Chester, Chaplin.
Shetucket,	69,	Jarred Fuller, Scotland,	Mrs. Eva Kimball, Hampton,	Leon J. Moffit, Hampton.
Canterbury,	70,	Lemuel N. Carpenter, Canterbury,	Mrs Grace I. Barrows, S. Canterbury,	Levi N. Clark, So. Canterbury.
Mad River,	71,	Arthur J. Pierpont, Waterbury,	Mrs. Jeanie S. Judd, Waterbury,	Mrs. Anna Hall Pierpont, Waterbury.
Plymouth,	72,	Herbert W. Cleaveland, Plymouth,	Harry D. Emmons, Plymouth,	Edith E Sutliffe, Plymouth.
Indian River,	73,	Fred M. Smith, Milford,	Albert N. Beard, Milford,	Geo. S. Clark, Milford.
Winchester,	74,	Chas. E. Johnson, Norfolk,	Hopson H. Hurd, Winsted,	Edward L. Humphrey, Winsted.
Coventry,	75,	Oliver C. Hall, Coventry,	John E. Kingsbury, Rockville,	Andrew Kingsbury, Rockville.
Andover,	76,	Dwight A. Clark, Andover,	Mrs. Anna E. Phelps, Andover,	Mrs. Emma C. Clark, Andover.
Clinton,	77,	Selden S. Carter, Clinton,	Mrs. Sarah E. Bronson, Clinton,	William H. Kelsey, 2d, Clinton.
Colchester,	78,	Carroll E Staples, Colchester,	Mrs. Ida Wagner, Colchester,	Mrs. Hattie J. Strong, Colchester.
Housatonic,	79,	Harry Wilcoxson, Stratford,	R. O. Spamer, Oronoque,	Geo. Meachen, Stratford.
Colebrook,	82,	Geo. H. Mills, Winsted,	Miss Grace I. Allen, Winsted,	Mrs. S. Ellen Northrop, Colebrook.
Foxon,	84,	Andrew J. Granniss, New Haven,	Franklin Countryman, N. Branford,	F. M. Sperry, East Haven.
Waugumbaug,	85,	Frank A. Spaulding, So. Coventry,	Mrs. Florence Trask, So. Coventry,	Helen M. Potter, Willimantic.
Webutuck,	86,	J. S. Chaffee, Amenia Union, N. Y.,	Mrs. F. R. Rundall, Amenia Union, N.Y.,	H. V. D. Reed, Amenia Union, N. Y.
Hillstown,	87,	Chas. G. Strickland, So. Manchester,	Hattie E. Brewer, Hockanum,	Laura J. Brewer, Hockanum.

OFFICERS OF THE GRANGES.—CONTINUED.

Name.		Master.	Lecturer.	Secretary.
SUBORDINATE GRANGES.— *Cont.*				
Ekonk,	89,	E. Byron Gallup, Ekonk,	Mary E. Gallup, Ekonk,	Miss Esther G. Gallup, Ekonk.
Seymour,	91,	E. J. Leavenworth, Seymour,	Miss May R. Holbrook, Seymour,	Miss Mary A. Hull, Seymour.
Harmony,	92,	Homer E. Clarke, Stepney Depot,	Miss Ethel J. Wales, Stepney Depot,	Edwin C. Shelton, Stepney Depot.
Border,	93,	Chas. E. Little, Willimantic,	Mrs. Louise A. Goss, Willimantic,	Mrs. Lillian M. French, Willimantic.
East Windsor,	94,	W. W. Thompson, Warehouse Pt.,	Dr. H O. Allen, Broad Brook,	Mrs. K. E. Stoughton, Warehouse Pt.
Jewett City,	96,	Henry W. Morse, Jewett City,	Ervia L. Barnes, Norwich,	William R. Palmer, Jewett City.
Hamden,	99,	Oscar L. Smith, North Haven,	Mrs. Catherine Beecher, Hamden.	Thomas Dunn, Mt. Carmel.
Taghhannuck,	100,	Mrs. A. C. Buckley, Amenia, N. Y.,	Mrs. C. L. Palmer, Sharon,	Mrs. Ella B. St. John, Sharon.
Mashapaug Lake,	101,	Levi M Reed, Stafford Springs,	Mrs.Nancy E.Howard,Stafford Spr'gs,	H. R. Howard, Stafford Springs.
Beacon Valley,	103,	F. M. Candee, Naugatuck,	Belle F. Fowler, Naugatuck,	R. C. Fowler, Naugatuck.
Somers,	105,	S. Dwight Percival, Somers,	C. J. Stephenson, Somers,	Miss Ida Ray Kibbe, Somers.
Litchfield,	107,	F. B. Plumb, Litchfield,	J. H. Putnam, Litchfield,	Ida E. Plumb, Litchfield.
Woodbridge,	108,	Arthur H. Doolittle, Bethany,	Chas. A. Bond, Westville,	Leroy C. Beecher, Westville.
East Hampton,	109,	Otis Goff, East Hampton,	Mrs. Ola West, East Hampton,	J. H. Stocking, East Hampton.
Preston City,	110,	Nathan H. Hall, Norwich,	Allen B Burdick, Norwich,	Herbert F. Brown, Norwich.
Hebron,	111,	Henry A. Spafard, Turnerville,	Arthur E. Hutchinson, Gilead,	Mrs. Flora E. Buell, Gilead.
Killingly,	112,	P. B. Sibley, Danielson,	Ray Pellett, Danielson,	C. Ella Day, Danielson.
Highland,	113,	Jason J. Martin, So. Killingly,	Mrs. Emma Vaughn, So. Killingly,	Mrs. Fralie A. Sanderson, Moosup.
Wethersfield,	114,	Franklin G. Welles, Wethersfield,	Miss Catherine Smith, Wethersfield,	Dudley Wells, 2d, Wethersfield.
Rocky Hill,	115,	Everett E. Wright, Rocky Hill,	Mrs. Edna Button, Rocky Hill,	Fred L. Belden, Rocky Hill.
Bristol,	116,	Elbert W. Gaylord, Bristol,	Chas. F. Olin, Bristol,	Mrs. Mary C. A. Perkins, Bristol.
Unity,	117,	Ellsworth A. Lynde, Deep River,	Frederick L'Hommedieu, Deep River,	Mrs. Flora M. Dudley, Deep River.
Beacon,	118,	E. A. Hopkins, Thomaston,	Chas. Huline, Thomaston,	Miss Leila L. Peck, Northfield.
Morris,	119,	Wm. F. Kirchberger, Thomaston,	Miss Gertrude Randall, Thomaston,	Silas E. Stockman, East Morris.
Bethlehem,	121,	James W. Flynn, Bethlehem,	Mrs. Carrie Hill, Bethlehem,	Geo. W. Percy, Bethlehem.
Watertown,	122,	Orrin D. Estey, Watertown,	Mrs. O. D. Estey, Watertown,	James A. Black, Watertown.
Westbrook,	123,	Horace E. Kelsey, Westbrook,	Mrs. Annie E. Heflon, Westbrook,	David C. Dibble, Westbrook.
Higganum,	124,	August B. Carlson, Higganum,	Frederic Kelsey, Higganum,	Eugene O. Burr, Higganum.
Hollenbeck,	125,	Miles L. Blodgett, Falls Village,	Miss Nettie M. Call, Falls Village,	Mrs. L. Ganser, Huntsville.
Pleasant Valley,	126,	Arthur N. Skilton, Woodbury,	Michael F. Skelley, Woodbury,	Mattie E. Barnes, Woodbury.
Goodwill,	127,	Alfred E. Hollister, Glastonbury,	Mrs. Rose E. Goodale, Glastonbury,	Harold B. Waldo, Naubuc.
Orange,	128,	A. S. Crosby, Orange,	Mrs. W. S. Hine, Derby,	Irving A. Andrew, Orange.
Pohtatuck,	129,	John J. Northrop, Newtown,	Allison P. Smith, Newtown,	Mrs. Hattie M. Northrop, Newtown.
Farmill River,	130,	D. P. Loverin, Shelton,	Miss Daisy Card, Shelton,	Miss Eleanor L. Wooster, Shelton.
Columbia,	131,	Joseph N. Clarke, Columbia,	....,.......,	Amelia J. Fuller, Columbia.
Wichita,	132,	Wm. C. Welton, Cornwall Bridge,	Fred'k P. Johnson, Cornwall Bridge,	Chas. F. Perkins, Cornwall Bridge.
Greenfield Hill,	133,	Simeon Pease, Fairfield,	W. Sanford Jennings, Fairfield,	D. Frank Brown, Fairfield.

OFFICERS OF THE GRANGES.— CONCLUDED.

NAME.		MASTER.	LECTURER.	SECRETARY.
SUBORDINATE GRANGES.— *Cont.*				
Trumbull,	134,	H. S. Beach, Trumbull,	Mrs. H. S. Beach, Trumbull,	E. T. Nichols, Bridgeport.
Silver Lake,	135,	Geo. B. Hamlin, Sharon,	Miss Emeline Palmer, Sharon,	Miss E. D. Scott, Sharon Valley.
East Canaan,	136,	W. W. Howland, East Canaan,	Miss Clara Bottum, East Canaan,	Mrs. Minnie Howland, East Canaan.
Middlebury,	139,	Arthur F. Greene, Woodbury,	Miss Addie J. Fenn, Waterbury,	Mrs. Martha E Judd, Southbury.
Plainfield,	140,	Turner E. Greene, Plainfield,	J. Maude Olin, Plainfield,	A. H. Matthewson, Plainfield.
Brookfield,	141,	Clarence B. Hawley, Hawleyville,	Lillian Blackman, Brookfield Center,	Juliette W. Sagendorf, Brookfield C.
Rock Rimmon,	142,	O. D. Buckingham, Beacon Falls,	Mrs. Hortense Rice, Beacon Falls,	Mrs. Jennie Burton, Beacon Falls.
Goshen,	143,	Karmi Kimberly, Torrington,	Miss Hepple Miles, Goshen,	Dr. J. H. North, Goshen.
Prospect,	144,	Charles S. Fenn, Prospect,	Mrs. Mabel Griswold, Prospect,	Mrs. Sara S. Talmadge, Waterbury.
Rippowam,	145,	Cyrus Sarles, Springdale,	Geo. Bennett, Stamford.	Mrs. Mable W. Criesey, Stamford.
Norfield,	146,	Iverson C. Fanton, Westport,	Mrs. Carrie L. Bradley, Westport,	Arthur C. Bradley, Westport.
Lyme,	147,	William Marvin, Hamburg,	Mrs. Lizzie Bill, Lyme,	Mrs. Mary R. Fosdick, North Lyme.
Westport,	148,	Wm. J. Wood, Westport,	Mrs. Geo. W. Guyer, Westport,	H. B. Fairchild, Westport.
Easton,	149,	Jesse H. Wheeler, Bridgeport,	Miss Florence Candee, Bridgeport,	W. S. Gillette, Long Hill.
Woodstock,	150,	Chas. H. Killam, Southbridge,	Chas. H. Potter, Southbridge,	Leonard H. Healey, N. Woodstock.
Enfield,	151,	Harry J. Bridge, Hazardville,	Mrs. Amy R. Pease, Thompsonville,	Sophia L Copley, Hazardville.
Cannon,	152,	Harry Miller, Cannon,	Miss Sadie Sturges, Cannon,	Nelson Hurlbutt, Cannon.
Bridgewater,	153,	Albert B. Mallett, Bridgewater,	Mrs. Emily R. Northrop, Bridgewater,	Willis E. Frost, Bridgewater.
Kent,	154,	Gilbert A. Vincent, Kent,	Geo. H. Smith, Kent,	Miss Mildred S. Page, Kent.
Danbury,	156,	A. B. Brundage. Danbury,	Mrs. Esther M. Starr, Danbury,	Chas. H. Brundage, Danbury.
East Lyme,	157,	Frederick O. Ernesty, East Lyme,	Miss Eunice Burch, East Lyme,	Silas J. Weaver, East Lyme.
Chester,	158,	Geo. Wilcox, Chester,	Mrs. Georgia T. Wood, Chester.	Chas. R. Wooster, Chester.
Salisbury,	159,	Chas. S Phelps, Chapinville,	Mrs. Chas. S. Phelps, Chapinville,	James R. Harrison, Salisbury.
Aspetuck Valley,	160,	Sheldon B. Hendrix, New Milford,	Mrs. C Eliza Abbott, New Milford,	Daniel Marsh, New Milford
Bozrah,	161,	E. Judson Miner, Fitchville,	Mrs. Maude A. Kahn, Yantic.	Charles A. Johnson, Fitchville.
Old Lyme,	162,	Eugene D. Caulkins, Old Lyme,	Joseph S. Huntington, Old Lyme,	Wilbur F. Ashley, Old Lyme.
Redding,	163,	Albert A. Gorham, Redding,	Mrs. E. V. Bradley, Redding Ridge,	Mrs. F. O. Sanford. Redding Ridge.

REPORT OF THE TREASURER.

Chas. A. Thompson *in account with*

State Board of Agriculture.

			Dr.	Cr.
1904				
July	1.	Balance amount in treasury,	$3,293.80	
"	16.	D. W. Patten,		$19.60
Aug.	11.	Case, Lockwood & Brainard Co.,		120.95
Nov.	10.	L. A. Clinton,		61.00
"	"	B. C. Patterson,		129.79
Dec.	16.	Sedgwick & Casey,		5.00
"	"	Allyn House,		251.75
"	"	F. H. Stiles,		75.00
"	"	M. F. Delano,		40.50
"	"	Martha Van Rensselaer,		50.00
"	"	For railroad fares of delegates,		125.00
"	"	New Dom,		34.00
"	20.	Wm. H. Honiss,		90.00
"	"	James B. Palmer,		129.50
"	"	L. B. Harris,		29.94
"	28.	Herbert E. Gregory,		25.00
1905.				
Jan.	3.	I. C. Fanton,		20.75
"	"	E. G. Seeley,		78.09
"	"	C. A. Thompson,		43.62
"	"	Edmund Halladay,		29.25
"	"	Seaman Mead,		30.92
"	"	Charles E. Chapman,		29.10
"	7.	N. S. Platt,		8.88
"	"	N. G. Williams,		13.74
"	"	Case, Lockwood & Brainard Co.,		97.20
"	"	J. E. Wing,		77.00
"	5.	One-half State appropriation,	$1,750.00	
"	7.	H. I. Spalding,		20.00
"	"	W. F Andross,		25.00
"	"	D. W. Patten,		15.25
Feb.	2.	James F. Brown,		644.02

Feb. 2.	L. A. Clinton,			$33.01
" "	John Coombs,			15.00
Mar. 25.	L. A. Clinton,			5.00
Apr. 26.	Will H. Barron, Jr.,			5.78
" "	Burroughs & Hopkins Co.,			4.74
May 1.	Edmund Halladay,			33.25
" "	L. A. Clinton,			15.13
" "	A. D. Shamel,			38.77
" "	R. W. Simpson,			5.26
June 6.	Charles F. Roberts,			80.10
" "	C. L. Beach,			11.78
" "	C. A. Thompson,			9.49
" 20.	Cooper Curtis,			15.50
" 29.	F. A. Holden,			1.65
" "	By one-half State appropriation,		$1,750.00	
July 1.	J. C. Fanton,			45.60
" "	I. C. Fanton,			34.55
" "	Charles E. Chapman,			34.60
" "	N. G. Williams,			21.17
" "	Charles A. Thompson,			58.35
" "	James F. Brown,			661.07
" "	Edmund Halladay,			35.30
" "	James B. Palmer,			26.57
" "	E. G. Seeley,			21.50
" "	Seaman Mead,			5.30
" "	Case, Lockwood & Brainard Co.,			63.10
" "	Balance amount in treasury,			3,192.38
			$6,793.80	$6,793.80

This is to certify that we have examined the accounts of the Treasurer of the State Board of Agriculture and found them correct.

Seaman Mead,
D. W. Patten,
Chas. E. Chapman, } *Auditors.*

July 1, 1905.

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