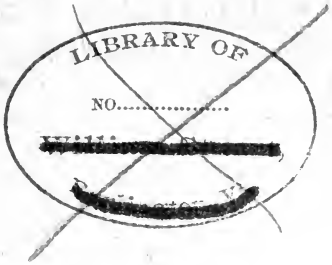
Congress of horticulture.
1st, Jamestown, 1907.

Proceedings.



Proceedings

Congress of Horticulture

Jamestown Exposition,
September 23, 1907

National Council of Horticulture

PROCEEDINGS

OF A

Congress of Horticulture

HELD AT

JAMESTOWN EXPOSITION

September 23, 1907

CONDUCTED BY THE

National Council of Horticulture

AT THE REQUEST OF R. H. SEXTON
Chief of the Bureau of Congresses and Special Events of the Exposition

---

H. C. IRISH, Secretary
Missouri Botanical Garden, St. Louis, Mo.

PATRONS—

Publication of these proceedings has been made possible by contributions from the following:

BRASLAN SEED GROWERS' CO., San Jose, Cal.
W. ATLEE BURPEE & CO., Philadelphia, Pa.
HENRY A. DREER, Philadelphia, Pa.
ELLWANGER & BARRY, Rochester, N. Y.
A. C. KENDEL, Cleveland, O.
F. R. PIERSON CO., Tarrytown, N. Y.
STORRS & HARRISON CO., Painesville, O.
VAUGHAN'S SEED STORE, Chicago, Ill.

NATIONAL COUNCIL
OF
HORTICULTURE

J. C. VAUGHAN, *Chairman*
Chicago, Illinois

H. C. IRISH, *Secretary*
Mo. Botanical Garden, St. Louis, Mo.

DELEGATES AT LARGE

PROFESSOR W. B. ALWOOD, Charlottesville, Va.
PROFESSOR S. A. BEACH, Ames, Iowa
PROFESSOR L. R. TAFT, Agricultural College, Mich.
PROFESSOR S. B. GREEN, St. Anthony Park, Minn.
PROFESSOR E. J. WICKSON, Berkeley, Calif.
PROFESSOR W. W. TRACY, Washington, D. C.
H. C. IRISH, St. Louis, Mo.
J. HORACE MCFARLAND, Harrisburg, Pa.
J. H. HALE, South Glastonbury, Conn.

DELEGATES FROM SOCIETIES

Society of American Florists
ROBERT CRAIG, Philadelphia, Pa.
JOHN K. M. L. FARQUHAR, Boston, Mass.

American Association of Nursery
C. J. MALOY, Rochester, N. Y.
CHAS. T. SMITH, Concord, Ga.

American Seed Trade Association
C. E. KENDEL, Cleveland, Ohio
J. C. VAUGHAN, Chicago, Ill.

National Nut Growers' Association
PROF. F. H. BURNETTE, Baton Rouge, La.
J. F. WILSON, Poulan, Ga.

CONTENTS

PROCEEDINGS

OF

CONGRESS OF HORTICULTURE

Jamestown Exposition, September 23, 1907

Chairman J. C. Vaughan of the National Council of Horticulture called the Congress to order in Convention Hall, Jamestown Exposition Grounds, 10 a. m, September 23, 1907. He outlined the origin of the call of the Congress and stated the reason for its existence.

He then introduced S. A. Robinson of Charlottesville, Virginia, Vice-President of the Virginia State Horticultural Society, who welcomed the visitors. Lieutenant-Governor J. Taylor Ellyson welcomed the Congress on behalf of the Exposition authorities. Chairman Vaughan presented Warren H. Manning as chairman of the morning session, owing to the absence of J. H. Hale, of South Glastonbury, Conn., who was detained at home by sickness. The papers were read as follows:

"Soils," by Professor F. H. King, Madison, Wis.

"Plant Diseases," by Dr. A. F. Woods, Washington, D. C.

"Insect Enemies," by A. L. Quaintance, Washington, D. C.

"Florists' Flowers," by W. N. Rudd, Mt. Greenwood, Ill.

The discussion of all papers read was taken up at the end of each session.

AFTERNOON SESSION.

The afternoon meeting opened at 2:15 with Professor L. R. Taft of the Agricultural College, Mich., in the chair, in the absence of Professor Green, of St. Anthony Park, Minn. The following papers were read:

"Garden Vegetables," by W. W. Rawson, Boston, Mass.

"Cut Flowers," by F. R. Pierson, Tarrytown, N. Y.

"Forest Trees," by Professor F. W. Rane, Boston, Mass.

"Local Conditions in Canada," by Professor W. T. Macoun, Ottawa, Ontario.

"Local Conditions in the Eastern States," by John K. M. L. Farquahr, Boston, Mass.

"Local Conditions in the Central West," by L. A. Goodman, Kansas City, Mo.

"Our National Forests," by W. L. Hall, Washington, D. C.

Professor L. R. Taft, H. C. Irish and J. C. Vaughan made some brief remarks on the work of the National Council of Horticulture.

Adjournment was had at 5:15 to the auditorium room of the Inside Inn and on invitation of Messrs. Rawson, Pierson, Kendel and Vaughan the delegates as a body proceeded to the balcony cafe of that hostelry, where fifty persons sat down to dinner at 6:00 o'clock. Warren H. Manning presided and J. C. Olmsted and Mrs. Olmsted were guests of honor.

EVENING SESSION.

Professor S. A. Beach of Ames, Ia., in the chair. Beginning at 7:30 the following papers were read:

"Civic Horticulture," by Warren H. Manning, Boston, Mass.

"Landscape Gardening," by John C. Olmsted, Brookline, Mass.

"Schools and Experiment Stations," by Dr. A. C. True, Washington, D. C.

"The Horticultural Press," by Leonard Barron, New York City.

"Government Aid," by Dr. B. T. Galloway, Washington, D. C.

"Federation and Co-operation," by J. C. Vaughan, Chicago, Ill.

The discussion of these valuable papers, particularly those of Messrs. Manning, Olmsted, Drs. True and Galloway, was very general and continued until nearly 11 o'clock, when the general Congress adjourned.

The following were noted among those in attendance:

Wm. B. Alwood, Charlottesville, Va.
H. Augustine, Normal, Ill.
J. Lyman Babcock, Norfolk, Va.
S. A. Beach, Ames, Ia.
G. B. Brackett, Washington, D. C.
C. P. Close, College Park, Md.
Mrs. C. P. Close, College Park, Md.
Chas. S. Crandall, Urbana, Ill.
Albert Dickens, Manhattan, Kan.
C. H. Dutcher, Warrensburg, Mo.
E. M. East, New Haven, Conn.
J. K. M. L. Farquhar, Boston, Mass.
W. T. Flournoy, Marionville, Mo.
Dr. B. T. Galloway, Washington, D. C.
L. A. Goodman, Kansas City, Mo.
Mrs. L. A. Goodman, Kansas City, Mo.
Wesley Greene, Des Moines, Ia.
W. L. Hall, Washington, D. C.
E. V. Hallock, Queens, N. Y.
Orlando Harrison, Berlin, Md.
J. L. Hartwell, Dixon, Ill.
U. P. Hedrick, Geneva, N. Y.
Dr. B. von Herff, New York City.
H. L. Hutt, Guelph, Ontario.
W. N. Hutt, Raleigh, N. C.
Mrs. W. N. Hutt, Raleigh, N. C.
H. C. Irish, St. Louis, Mo.
Miss Emma Jacobson, Chicago, Ill.
L. B. Judson, Ithaca, N. Y.
C. E. Kendel, Cleveland, O.
F. H. King, Madison, Wis.
E. W. Kirkpatrick, McKinley, Tex.
W. R. Lazenby, Columbus, O.
R. S. Mackintosh, Auburn, Ala.
W. T. Macoun, Ottawa, Ontario.
Warren H. Manning, Boston, Mass.
A. McNeill, Ottawa, Ontario.
A. P. Mitra, Calcutta, Ind.
John C. Olmsted, Brookline, Mass.
Mrs. John C. Olmsted, Brookline, Mass.

F. R. Pierson, Tarrytown, N. Y.
A. L. Quaintance, Washington, D. C.
F. W. Rane, Boston, Mass.
W. W. Rawson, Boston, Mass.
W. Routzahn, Chicago, Ill.
W. J. Stewart, Boston, Mass.
Wm. Stuart, Burlington, Vt.
L. R. Taft, Agricultural College, Mich.
Dr. A. C. True, Washington, D. C.
H. E. Van Deman, Washington, D. C.
J. Van Lindley, Pomona, N. C.
J. C. Vaughan, Chicago, Ill.
Dr. Roger T. Vaughan, Chicago, Ill.
C. L. Watrous, Des Moines, Ia.
H. S. Wayman, Princeton, Mo.
John T. Withers, Jersey City, N. J.
Dr. A. F. Woods, Washington, D. C.

MORNING SESSION.

Chairman Vaughan: Gentlemen, it becomes my duty to call to order this Congress of Horticulture, the organization of which is due to Mr. Warren H. Manning more than anyone else. Through him the authorities of the Jamestown Exposition saw fit to call for a Congress of Horticulture, and incidentally asked the National Council of Horticulture to arrange for this Congress.

I hardly need say that on national occasions like this a great exposition is made of what man has done with things material. It has been thought wise to have meetings which consider the laws according to which these things are made, and which may be produced again at will. The Congress of Horticulture will seem to be as important as an exposition of plants, fruits and flowers.

At this Congress we aim to bring down to date a résumé of what has been accomplished since our last Congress; to survey our chosen field, horticulture, on all sides and at each to summarize in a broad way about as follows: First, where are we? Second, what are we doing? Third, what are our prospects? The papers which will be presented to you have been prepared in the main on these lines, and I believe will not disappoint those who have traveled far to be here, nor that world-wide audience which will later read them.

Originally the program was intended to cover two days, but finding a possible conflict the last day with the opening session of the Pomological Society, which is holding its regular biennial session here, the program committee arranged to close with the evening session.

ADDRESS OF WELCOME.

S. A. Robinson, Charlottesville, Va.

Mr. Chairman and Gentlemen of the Horticultural Congress, it is a pleasure to welcome a body of such men as you to the State of Virginia, and it is eminently proper that the first meeting of this Congress should be near the spot upon which probably grew the first domestic fruit trees brought to this continent. It would be very interesting to know how many of the 78 varieties described by Ray in 1686

were imported into this country about 300 years ago. No doubt many of them were. I hope some of you learned delegates will enlighten us with regard to what they were and when they were brought here. We, of Virginia, have such an abiding faith in horticulture that we propose to get into close company with the best of you, and to know you better and to have you know us better. Virginia was fourteenth in the number of trees at the last count of apple trees in the states of the Union, but only fifth in the production of apples, so it is doing pretty well. I am confident that she can produce as choice fancy apples and as many to the acre, within her area, as any state in the Union, so you ought to feel that you are in a country where you are at home. That is just what we want.

I am going to make the claim which some of you may dispute, but I do it for the purpose of learning; namely, that Virginia has the record of the world for the length of time the trees have been growing and the commercial value of the output. There is an orchard of fifteen trees at Covesville, Albermarle County, in Virginia, whose trees have been bearing for over eighty years. One year a single tree produced 22 bushels of apples which were sold for $5.00 per bushel at the tree. The fifteen trees have produced $700.00 worth of apples in one year. Those old trees are bearing to-day. I visited them about four days ago and they are worthy of being handled by the Hood River Apple Growers' Union. Their apples will average $50 a tree this year. Until within three years, they were never sprayed, never properly pruned, never fertilized in any way nor cultivated, and had no attention whatever. Those men planted trees and trusted to Providence and the favorable soil and the genial climate of that part of the state to secure them a remarkable profit. Much of our area will produce good commercial fruit, but there is no part of the country that has a very large area that will produce the choicest fancy fruit, which fact you probably know better than I.

Leaving this question of rivalry aside, which I merely bring up to show what has been done, I want to say that you are most welcome here, and I want to tell you that the hospitality of Virginia shines brightest in its homes. You must visit us at our homes and come under the enchantment of the sweet voices of the graceful, beautiful and winsome women of this state in order to feel the full spell of the hospitality of Virginia. If you will linger long enough to do that, you will indeed taste of the lotus of Virginia's hospitality and we shall expect you to return, because those who once tasted, hunger for it ever after.

ADDRESS OF WELCOME,

J. Taylor Ellyson, Lieutenant-Governor of Virginia.

Mr. Chairman and Gentlemen, you had the courage of a very lofty aim when you undertook to have a Congress, a National Congress of Horticulture, but you had an aim worthy of your best endeavors, and

you have come together in the hope of achieving results that will redound to the greatest good of that which you represent. We have long ago learned, certainly men of my age, that strength and usefulness are not always in numbers. Who can tell who commanded at Balaklava the army of men in that famous charge who in Tennyson's poem have won an immortality of fame? And so it is, whether on the field of battle or in the more peaceful contests in which we are now engaged, it is the men who do something that will count, and the men who have done great things, although not always recognized, have been the men who sit before me and those whom you represent. Look about you. If a member of this organization who happens this morning to be your presiding officer desired you to know what he has done he would have to adopt the motto of Sir Christopher Wren and say: "If you wish to see my monument, look about you." And you will find in the beautiful creations along the line of his chosen work on these grounds some of the most charming results of that most charming department of work, landscape gardening.

I am very glad to be able to welcome you on the part of the Exposition. I feel that it will not be fair to occupy your attention today, or to interrupt your discussion, more than to tell you that we are glad to see you and to express the hope that you will remain with us until you have known something of what we have here to show you, and I think that when you shall have done that, you will be able to say of many of the departments, what was said of our historical collection by one of the most eminent men in this country who had the pleasure of visiting it a few days ago and who is a high authority on such work, that there never had been gathered in this country a finer collection of historical material than we have in the History Building on these grounds, and so you will find it in other collections. Take time to look at it, and I am sure that you will enjoy it. Above all, be certain that whatever else may befall, you will not fail to have had a warm and generous welcome on behalf of the Jamestown Exposition Company.

Chairman Vaughan: Mr. J. H. Hale, our chairman for the first session, being absent, Mr. Warren H. Manning has consented to preside.

Chairman Manning: We will take up the papers consecutively, and call upon Professor F. H. King, Madison, Wis., for his paper on "Soils." I wish to say that Professor King and Professor Babcock were the pioneers in the study of soils, and it is largely from this investigation that the Government Department of Soils has grown, and those who know the vast amount of benefit that comes from the Department publications to all who have to do with outdoor affairs will recognize how important this pioneer work was. Professor King's book on soils, in the Rural Science Series, and also the many pamphlets in the Government Department upon the same subject are also an authority upon farm buildings, ventilation, and other matters, as well as upon soils.

SOILS.

THEIR PRODUCTIVITY AS INFLUENCED BY COMPOSITION AND STRUCTURE.

F. H. KING, MADISON, WIS.

Soils are an aggregation of rock and mineral fragments carrying an admixture of organic debris, together with substances in soluble and colloidal condition. The productivity of soils is determined by their composition, by their structure, by their climate, and by the life activities within them. By composition we refer to their mineral and chemical nature; by their structure we refer to the size of the soil grains and the segregation of them; by their climate we refer to their water content, their temperature, their aeration, their drainage; by life activities we refer to the interaction of the roots of plants and micro-organisms upon one another, upon the soil grains, upon the organic matter, upon substances in solution and upon colloids.

COMPOSITION.

The composition of soils, and their structure so far as it influences weight, determines the absolute amount of plant food elements per unit volume, per cubic foot, per acre-foot or per acre-four-feet, which is the depth to which most crops are able to feed, to which they send their roots if all the factors of productivity are at their best. Composition, therefore, determines the endurance of a field, the outermost limit of its productive capacity. This statement is not in accord with the teaching of our national Department of Agriculture where it affirms:

"That practically all soils contain sufficient plant food for good crop yields, that the supply will be indefinitely maintained and that this actual yield of plants adapted to the soil depends mainly, under favorable climatic conditions, upon cultural methods and suitable crop rotations."

It is safe to say that no statement in recent years, designed to direct agricultural practice and issued by high authority, is further from the truth than this. Few statements could be more misleading and land agents are using it, both in good faith and unscrupulously, to sell at high price low grade lands. Much nearer the truth is the statement: No soils contain sufficient plant food for maximum yields when all other factors are at their best; and the best cultural methods, with rotation of crops, only hasten the exhaustion of soils.

The Department's teaching has resulted from confusing plant food elements with plant food. Analysis has demonstrated that primary rock, crushed to the fineness of soil, may carry per acre-four-feet 78 tons of potassium, 250 tons of calcium, 133 tons of magnesium and even 8 tons of phosphorus. So, too, an acre-four-feet of good soil may carry as much as 100 tons of potassium, 45 tons of calcium, 35 tons of magnesium and even 12 tons of phosphorus, and there is this much foundation in fact for the statement criticized. But these enor-

mous amounts of *plant food elements* present in the root zone of field crops are no more to be regarded as *plant food* for those crops than they are food for the animals feeding upon pasture grass.

The food of plants, derived from the soil, is only certain substances which are dissolved in the soil moisture or which are carried in the soil in a form which may be readily so taken up; and the amounts of these, present in the root zone of field crops at any one time, is relatively very small when compared with the amounts of plant food elements from which they are derived. Much more is a soil like a pasture where plant food grows than like a bank or granary where it is stored, and just as a rich pasture may produce sufficient grass to carry a large herd so may a fertile soil produce, from day to day, plant food sufficient for good crops. Just as pastures differ in the amounts of herbage on the ground and in the amounts they are able to add to this as it is fed away, so do fields differ, both in the amounts of plant food present in the root zone at any one time and in the amounts they are able to add as this is withdrawn. Our own observations, published by the Bureau of Soils, have demonstrated that four good soils, observed to produce two and a half times the yield per acre of corn and potatoes that four poorer soils did under identical treatment, also gave up, when washed three minutes in five times their weight of pure water, 2.58 times as much plant food. Not only was there this difference in the amounts of plant food carried in water-soluble form in the best and in the poorer soils, but the amounts of this same plant food taken out of like areas of field by like numbers and kinds of plants during the same time was 3.2 times as great in the sap of the plants which gave the highest yields. Such observations would appear to fully justify the general conviction that increased yields should be directly attributed to better feeding and that better feeding is a direct result of larger amounts of plant food available to the crop. It is taught, however, by the Bureau of Soils, that all soil solutions are sensibly identical in composition and in concentration; that they are strong enough for large yields and that this strength will be indefinitely maintained. From these conclusions the Bureau further teaches that mineral fertilizers, green and stable manures and a good rotation of crops owe their efficiency to the power they have of neutralizing toxic principles which tend to accumulate in cultivated soils, rather than to any power of increasing available plant food, an abundance of which, at all times and in all soils, is held to be present.

While it is true that good soils may yield to pure water two, three and more times the amounts of plant food that poorer soils will, and while the absolute differences may be as 3,200 pounds per acre-four-feet to 1,200 pounds, yet these quantities are so small in proportion to the total water present in the soil that one may in truth say, from the standpoint of the chemical balance, as Professor Whitney does, that the composition and concentration of all soil solutions are sensibly the same. Nevertheless it is undoubtedly true that soil solutions are measurably different, both in composition and con-

centration, and from the standpoint of plant functions they must be profoundly so for organic life is almost inconceivably sensitive to small quantities of matter.

Our published results show, too, that we are able to recover from the surface four feet of good soil as much water-soluble plant food of both potassium and phosphorus as would be removed from a field by nine 40-bushel crops of wheat, and from poorer soil as much as would be removed by six such crops, and here again is what has been thought a safe foundation for the contention that even in water-soluble form the poorest soils contain plant food enough for good yields. So there is, in absolute quantity but not in available quantity. For example, a three-horse tread-power may be in such condition that when one horse is put upon it no work is done; adding a second horse may yield only half an available horse-power, but when the third horse is put in place its whole weight may yield effective power so that the available work becomes three times what it was with two horses. So it may be with soils. Plant food enough for perhaps many crops must be present in order that enough for one may become available.

So far as we know, either from published data or on *a priori* grounds, there is no foundation for the hope that the supply of plant food in soils may be indefinitely maintained simply by good tillage and suitable crop rotations which make positive additions only of nitrogen to the soil. The only way Nature has ever produced crops, and this is the way she has always maintained soil fertility, has been to return to the field the whole crop, and working along this line for a thousand years together she never did and never can bring all her soils to an equality in productive capacity as should be the case if all soils carry an abundance of plant food.

A very simple calculation based on well established data will show that an exhaustion of the *plant food elements,* large as these amounts are, must necessarily follow any system of cropping which involves no return to the soil other than nitrogen. The amounts of plant food removed by certain crops are definitely known; the absolute amounts of plant food elements carried by good soils are known and, taking 20 tons of potassium per acre-foot, which is about the amount carried, a quantity equal to the whole of this would be removed in about 1,400 years by wheat yields of 40 bushels per acre; and the entire amount of phosphorus carried by the surface foot is equivalent to only about 400 such crops. Careful records have shown that the Mississippi river carries out to sea annually enough material to lower its entire drainage area one foot each 4,000 to 6,000 years, which means that the surface foot of soil may be completely removed and replaced by a corresponding layer from below at the same rate; but the rate of removal of potassium by a 40-bushel crop of wheat is three to four times as rapid as this, and the crop exhaustion for phosphorus is ten to fifteen times as rapid as rock is being converted into new soil on the average, over the Mississippi valley. Were Professor Whitney's contention true the mean productive capacity of the soils of the Mississippi valley should

be no more than three to four bushels of wheat per acre, for this is the rate at which rock weathering and erosion are supplying phosphorus to the soil from below.

STRUCTURE.

From the standpoint of structure soils differ very widely, both in the extent of their internal surface and in the character and extent of the segregation of their particles. These differences are fundamental and very important in determining the relative productive capacity and in directing agricultural practice. An acre-four-feet of one foot granite blocks would possess an internal surface of 24 acres to which water might adhere, upon which plant food might develop and where it might be stored, over which the roots of plants might spread and feed, and where soil organisms might dwell. To reduce the diameters of these cubes from one to one-thousandth of a foot would increase the internal surface one thousandfold, making it aggregate 24,000 acres per acre of field. But even this surface is too small to maintain a high productive capacity. Our coarsest sandy soils possess an internal surface per acre-four-feet exceeding 45 square miles per acre of field; our loams, 270 square miles, while our finest clay types possess an internal surface exceeding 1,300 square miles per acre of field. It is clear, therefore, that there must be wide differences in the productive capacity of soils due to differences of internal surface alone, even when their chemical natures may be identical. This must be so because where there is more surface more water can be retained, plant food may form more rapidly and more may be stored and held in reserve and even accumulated during intervals of small demand as well as retained against loss by leaching.

The innermost portion of water films investing soil grain surfaces, in our judgment, is held there with so much force as to be little subject to change, by either drainage or capillary movement, and also becomes highly charged with plant food which likewise is strongly retained, escaping only by the slow process of diffusion when the roots of plants are placed in contact with the soil grain surfaces or when the excess of hydrostatic and capillary portions of water are moving by. We have found, for example, that when a chemically cleaned sand was charged with a solution of potassium nitrate ten repeated washings in twice its weight of distilled water left in the films of moisture retained by the sand grains enough of the nitrate to represent 244 pounds per acre-four-feet. Plant food so retained by soils may still be available to crops for their root hairs are similarly invested with water films and when placed in apposition with the soil grains the water films become common to the two and simple diffusion permits the root to feed upon the plant food so retained.

This brings me to consider a principle underlying proper land drainage. It is very important that when rain falls upon a field the excess water remain only just long enough on its way through the open water passages to saturate the soil; anything longer than this

provides time and opportunity for the most valuable plant food materials carried in the water films about the soil grains to diffuse out into the moving water and so become lost in the drainage. Thus we have an explanation of a seeming paradox, namely: properly drained fields lose less of their soluble plant food by underdrainage than do those poorly drained.

Next in importance to internal soil surface, among the physical factors which determine the productive capacity of soils, is the segregation of their soil particles into granules, crumbs or kernels. Without it all but the extremely sandy soils must be sterile, even though they carry an abundance of plant food. Without segregation we have the puddled soil or clay, but with segregation highly developed we have the light, deep, tractable, mellow fertile loams so congenial to the widest range of crops.

The low producing power, or absolute sterility, so invariably associated with puddled soils and with those too close in texture, we believe to be primarily due to a lack of available moisture, notwithstanding the seeming paradox that they are carrying an excess of it. It is a familiar fact that crops wilt and cease to grow in close textured clayey soils still carrying 8 to 12 per cent of water, while they may grow luxuriantly in coarse sandy soils possessing but 1 to 3 per cent. So, too, we often find desert types of vegetation growing in humid climates on extremely close grained clayey soils and more strangely still in peat swamps where the water content is excessively high. To understand these facts it must be remembered that there is a certain thickness of water film which is held so firmly to the soil grain surfaces as to be wholly unavailable to the crop. Portions of this layer cannot be driven off completely even at the temperature of boiling water. When all of the facts shall have been worked out we believe it will be found that the thickness of the unavailable water about the surface of soil grains is essentially the same whether these be large, as in the coarse sandy types, or very small as in the finest clays; and if this is the case the absolute amount of unavailable water must increase as the internal surface of the soil becomes greater and as the diameter of the soil particles decreases.

The coarse sandy soils, with their relatively small internal surface, carry a correspondingly small amount of unavailable water and hence in them small rainfalls in dry times have a relatively high efficiency. So, too, must soluble plant food and fertilizers, when applied to them, for the same reason, have a relatively high efficiency. But in the finest clay soils, especially if they are not strongly granulated, the amount of unavailable water is very large and hence it is that heavier rainfall during drought periods and more liberal applications of fertilizers are required to produce the same relative increase. But it is possible to have the finest clay soils so completely puddled, or separated into their ultimate grains, and the effective soil surface thereby so enormously increased, by the minuteness of the particles, that nearly the whole of the water, even when the soil is saturated, becomes unavailable to plants and for the simple reason that the water

films are too thin and therefore too strongly held to be removed. From the standpoint of plant function, we have the paradoxical condition of a sandy soil, containing perhaps one per cent of water, being effectively more moist than a puddled clay soil containing 20 to 30 per cent or than a peaty soil containing perhaps 40 to 50 per cent.

But when the finest clay soils are put in a highly granular condition, with the kernels having the order of coarseness of the sandy soils, these compound grains may themselves become invested with water films which are thick and therefore available to crops. By such a change of structure, therefore, the clay soils not only retain their enormous surfaces, carrying water in which plant food may develop and accumulate, but by the bunching of the fine particles there has been superadded to the already enormous surface an additional large area which now is able to retain much water in available form and so advantageously placed that the plant food from the moisture within the soil kernel can diffuse out into the available film and thus also become available to the crop. Tilth, or the physical condition of the soil, then, must be of very great importance in determining the productive capacity of fields, first of all because it limits the availability of the soil moisture and through this, at the same time, the availability of plant food itself. Without the coarse grained texture and openness of structure there must be imperfect drainage, inadequate soil ventilation and a lack of freedom for movement and of room for the proper development of either the roots of crops or the multitudes of soil organisms whose activity is so indispensable to the maintenance of soil fertility. The full significance of this openness of structure may be better appreciated when it is stated that exact measurement has shown that when soils of the coarse sandy, loamy and finest clay types are reduced to their single grain condition the rates of air and water movement through them become as 900 to 36 to 1; the flow being 900 times as rapid through the coarse sandy soil as through the finest clay type. Put in another way, if 2.5 hours are required to remove an excess of rainfall from the coarse sandy soil, then four months would be insufficient to effect the same result in a field of the finest clay type when in the condition of its single grain structure; while some four days would be required for the loamy soil, and this is longer than the average interval between rains in humid climates. More than this, in the properly open soils there is but 2.5 hours between rainfalls during which diffusion can carry the soluble plant food into the water draining away, while in the other condition this loss by drainage is continuous.

If a high productive capacity of fields is to be secured and maintained then in some manner must all soils be given an openness of structure approaching that possessed by our coarse sandy types. The factor of paramount importance in securing prime tilth, or the best possible structure, is an abundance of organic matter deeply and thoroughly incorporated in the soil; and with this must always be associated ample underdrainage which fortunately generally exists where structure is right. For ordinary field conditions this incorporation of

organic matter must be secured through deep plowing which aims to turn all waste refuse and occasionally green and stable manures. Going with this practice there must be an intelligent rotation of crops which includes the legumes, to accumulate nitrogen from the air, and to fix it deeply in the soil in their tubercle and root growth; which includes the grasses having dense root systems tending to both deeply and finely divide the soil by the close ramification of their roots and to make the granules so formed more rigid by the cementing action of substances rendered soluble by the carbonic acid transpired through their roots and which accumulate in the granules by diffusion to become precipitated there as the soil is deeply and thoroughly dried by the action of the roots in supplying the plant with water. The cereal, vegetable, fiber and sugar crops exert but a feeble structure-building effect upon the soil. They tend rather to weaken soil structure by the removal of the soluble plant food ingredients which have accumulated there, thus rendering it both structurally defective and deficient in immediately available plant food. These last crops, therefore, make chiefly the financial earnings while the grasses and legumes are largely restorative but may be earning crops as well. It must be remembered, however, that their restorative effect lies wholly in their power to mend structure and in adding the single element nitrogen to the soil. Other plant food elements they never add but may, to some extent, help to make them more available and thus permit larger yields to follow them, but whose removal, when no return is made to the soil, hastens its ultimate exhaustion.

Composition, first, and structure, second, are the master factors which determine the productive capacity of fields. Let me close by illustrating this through the practice of composting soils preparatory to their use on the benches of forcing houses. With the practical man his first choice is a rich sod, his second a rich mellow loam. To the soil he adds from a third to a half its volume of good stable manure, perhaps supplemented with phosphates, lime and potash. The whole is thoroughly mixed, put in good moisture condition and given opportunity for fermentation under conditions of frequent turning. By this treatment he secures a soil whose structure is ideal and which is at the same time carrying a heavy charge of plant food in highly available form. A strong blue-grass or timothy sod is itself a guarantee of thorough and strong crumb structure. Because the volume of the soil is small it is imperative that the root system be brought in effective contact with the whole of it, that the available surface shall be as large as possible and that the soil with which the roots come in contact shall be heavily charged with essential plant food. The decay of the manure in contact with the soil grains leads to their becoming highly charged with plant food in water-soluble form. Quite likely, too, at the time of planting, the manure and other substances will be supplemented by sodium nitrate.

It seems idle to think that soils like this, selected at the start because they are in evident good condition and reasonably productive, should require such excessive amounts of manure and fertilizers to

simply neutralize toxic principles which may be present in them, and we may be reasonably certain that we are dealing simply with an abundance of plant food in highly available form, placed under ideal conditions for the crop to put itself in touch with it.

Chairman Manning: Shall we take up the discussion of Professor King's paper?

Mr. Vaughan: We have so many papers, and the program is possibly going to be so long that we could better defer the discussion until opportunity comes.

Chairman Manning: Is it the sense of the meeting that the discussion of the papers be postponed to the end of the session?

Motion to postpone was carried.

PLANT PATHOLOGY.

A. F. Woods, Washington, D. C.

Your secretary has asked me to review as far as possible in ten or fifteen minutes our actual knowledge of plant diseases, the best methods of combating them, the progress that has been made, together with a suggestion or two as to some improvements that may be expected in the future. I have accepted the invitation, knowing fully that I could not in so short a time begin to cover so much ground with a sufficient degree of thoroughness to give an adequate idea even of the most important bearings of pathology on horticulture, but I concluded that the committee must have had in mind that I would use their request as an illustration of the greatest failing, not only in pathological investigation but in the application of methods recommended for the control of diseases, namely, *too much haste and lack of thoroughness.* These are failings incident to work in a new country under great pressure, where the field is large and the workers few. There has been a good measure of economic justification for the mistakes of the past, and they are teaching us valuable lessons for our guidance in the future. What we need now to do is to study carefully these successes and failures and determine as accurately as may be possible their causes as a basis for improved practice. The old conditions are rapidly changing. The new times require more careful and intensive methods.

One-crop farming, too short and unwise crop rotations, improper methods of fertilizing and culture, with destruction of humus and the life and fertility of the soil, careless methods of propagation and seed selection, the use of varieties not adapted to soil and climate, or other limiting conditions, are responsible for loss from diseases in a larger degree than is realized. An orange, a plum, or peach or apple or any other tree or shrub, whose cambium responds to a few warm days in winter or early spring, is not a safe variety to plant in localities where such warm periods occur. Plants of northern range, accustomed to respond to lower initial heat stimulus, are thus subject tc

winter injury in more southern latitudes. On the other hand, plants of southern range planted north start later, are less subject to late frosts, but may be injured by early frosts. These cold injuries are often hardly noticeable, but they are sufficient to weaken the plant and open the way for trunk cankers and numerous other parasitic diseases which the trees could otherwise resist.

A soil slightly too acid or alkaline for a particular variety, though not enough to prevent growth, may nevertheless weaken the root system and, in fact, the whole plant, making it subject to serious disease. So also the moisture or temperature fluctuations of the soil and its aeration may be unfavorable to a particular variety, making it less resistant to disease, if not actually causing a pathological condition in itself. Too little attention has been given to these factors by the farmers and horticulturists as well as by the pathologists.

An important duty in this new century will be to develop a better appreciation and more accurate understanding of the relation of these factors to health and disease. The cropping system of a farm or orchard, the planting of a nursery or a park to be satisfactory and successful in securing healthy growth must be undertaken only after a careful consideration of all these factors involved. Like the architect, the horticulturist and the farmer must have a carefully thought-out plan and as nearly as possible see the end from the beginning.

RESISTANCE AND IMMUNITY.

Our ideal, of course, is to cultivate plants that can in the largest measure consistent with other requirements fight their own battles. Observation and experience have given us a large amount of information on adaptability to conditions and resistance to disease, which remains to be classified and digested in order to be made generally available. We often neglect to reap the benefits of a destructive drouth, a cold wave, an epidemic of disease, or the failure of a crop, *by neglecting to study and save what is left.* The few straggling plants left do not appeal to the average man. He plows them up or turns in the hogs. But the man familiar with Nature's methods sees in these survivors resistant strains and saves the few straggling plants for seed, with the hope that the few survivors may have some peculiarity transmittable to progeny, making them resistant to the factor that caused the general destruction of the crop. In this way originated the wilt-resistant cotton, wilt-resistant cowpeas and flax, and cowpeas and tobacco resistant to nematode or root-knot. Strains of red clover resistant to anthracnose (a disease which in many sections of the South makes it impossible to grow ordinary non-resistant clover) were also originated in this way. Strains of corn, oats, wheat, rye, clover, alfalfa, sugar beets, and other grains, forage plants, and vegetables resistant to cold, alkali and drouth have been developed from such selections, in some cases made purposely by subjecting the crop to these conditions, in others by simply taking advantage of what occurred naturally. In some of the older and more thickly populated parts of

the world necessity has forced the saving of the last straw. This is why we find the drouth-resistant durum wheats in the dry regions of Russia and Asia and around the Mediterranean, the alkali and drouth-resistant alfalfas and other forage crops in the same regions, a cold-resistant alfalfa in Siberia and northern Manchuria, the cold-resistant winter wheats of Russia, and other crops too numerous to mention. Hundreds of years of culture and selection, forced by poverty and necessity under forbidding conditions of cold and drouth and disease, have made those sections veritable storehouses of good things, but what nature and necessity have not produced for us we can in large measure do for ourselves. We can combine the cold-resisting quality of the trifoliate inedible orange with the fruit qualities of the tender sweet orange; the disease-resistant quality of the citron with the fruit quality of the edible melons; the rust-resistant quality of the durum wheat with the berry of the Blue Stem; the cold-resistant quality of the wild crab with the fruit of our finer apples. The possibilities of such composite breeding have scarcely been touched or appreciated. In such work many factors must be taken into account and great care and foresight exercised.

PATHOLOGICAL INVESTIGATION.

Coming now to the scientific study of plant diseases, there is almost unlimited room for improvement. Compared with what there is still to discover, our knowledge of most diseases is still meager and one-sided. The brain of the pathologist is his most important instrument in such investigation. It must be trained to work with precision in all of the various directions and fields involved in such study. This is not now generally the case, and our colleges must be awakened to their duty. To most successfully combat a disease, we should know the causes that contribute to it and as much about the causes as possible. We should understand the pathological reaction of the diseased plant. Only in this way shall we be able to remove the causes or protect the plant against them or assist it to recover.

SPRAYING.

In the cases of disease due to attack of parasitic organisms, we are often able to protect our crops by spraying. Spraying, like a coat of mail, is a protection against entrance to the tissues by invading organisms. If there are any holes in the coat of mail or if it is made of poor material or is put on after the arrow has pierced the flesh, it may be of no avail. Much of our spraying has holes in it. The tissues are not properly coated during the periods of attack. Much of the new growth is left unprotected during the critical period. The parasite gets in through these places, and we find too late that hasty, careless spraying is of little value.

Improperly made mixtures or mixtures made of poor materials are often no protection and may be as injurious as the disease. Even good Bordeaux mixture can not safely be used on some plants, like

peaches, and in some seasons is slightly injurious to apples. The apparatus for spraying is as a rule poorly constructed, clumsy, and in great need of general improvement and adaptation to particular conditions. Demand good machinery and pay for it. It is essential to success. Those who know these things must teach, *by demonstration,* those who know imperfectly or do not know at all. Literature is valuable as an aid to demonstration teaching but can never take the place of it. Too much dependence on literature is one of our great educational mistakes. Send out fewer bulletins and more men.

Briefly, then, we shall improve on the pathology of the last century if we take time to be careful and thorough. Study the causes of failure and profit by the results. Demand better-trained minds and improved apparatus, and depend in our teaching more upon men and less upon books.

INSECT ENEMIES.

A. L. Quaintance, Washington, D. C.

The protection of crops from insect injuries is one of the important cultural problems. There is scarcely a wild or cultivated plant but which furnishes food for a score or more of insects, and the number of species which may attack a given crop in many instances runs up into the hundreds. Thus in the United States the apple furnishes food directly or indirectly to some 280 different kinds of insects; the grape upwards of 200, and about the same number has been recorded as attacking the peach. Corn is fed upon by at least 50 fairly important destructive insects, and wheat and oats together by perhaps twice that number. Clover furnishes food for somewhat more than 80 species, while so new a crop as the sugar beet is attacked by at least 70 different insect pests.

Not all of these insects are injurious every year, but any one of the species which at present may be comparatively unimportant is liable at any time, under changed conditions of environment, to become seriously destructive; as witness the outbreak the past spring in the grain fields of the middle west of the so-called "green bug," a species of plant louse; that of the pea louse a few years ago in Maryland and Delaware; and the pear thrips, which at the present time is doing great injury to the deciduous fruit interests in portions of California. These two latter species were quite unknown to science previous to their appearance in such destructive numbers. There are, however, a considerable number of species that vary comparatively little from year to year, chronic pests, so to speak, that may confidently be counted on to put in appearance at their stated times, and these are responsible for our principal insect losses.

LOSSES FROM INJURIOUS INSECTS IN THE UNITED STATES.

The actual damage inflicted by insects to crops is very difficult to estimate, but attempts have been made from time to time to express in

terms of dollars and cents the annual shrinkage in value throughout the United States from insect attack. By reason of the enormous value of the annual production of the farm and forest a very small percentage of loss from insect injuries gives, in the aggregate, figures that at first thought might seem extravagant. Agricultural statistics for 1889 and subsequent years indicate an annual value of farm products of about $5,000,000,000. To those who have followed the destructive work of insects from year to year to produce of the orchard, farm, and garden, in the field and stored, and to live stock, a shrinkage in value on account of insect injury, for the country as a whole, of 10 per cent will, I believe, appear conservative. In fact this percentage of loss will more often be exceeded than otherwise, as illustrated by the ravages of orchards by the San Jose scale; the apple crop by the codling moth; peaches, plums, and apples by the curculio; grain crops by the Hessian fly, joint worms, the chinch bug and grasshoppers; cotton by the boll weevil and boll worm, and the losses to live stock through the agency of the cattle tick, the transmitter of the serious malady of cattle known as Texas fever. A 10 per cent shrinkage in value of the total farm production means a loss of $500,000,000, and to this must be added losses to forests and lumber and to forage crops, stored grain, and miscellaneous products, which on a similar conservative basis amounts to $200,000,000. We therefore have as the approximate annual loss by insects in the United States the enormous sum of $700,000,000, an amount which exceeds the entire annual expenditure of the National Government.

ECONOMIC STATUS OF INSECTS AS A CLASS.

But it should not be understood that all insects are destroyers of crops. Broadly speaking, insects are good or bad as they favor or interfere with man's interests. There is a popular misconception in the minds of a great many that insects as a class are decidedly injurious. As a matter of fact this is far from being the case. The class *Insecta,* in point of species, comprises about four-fifths of all animals, and the number of species which is thought to exist has been variously estimated at from one to ten million. Of this enormous number not more than 400,000 have as yet been actually described and named. From North America are recorded only some 40,000 species, and of these perhaps not more than 1,000 or 1,200 ought to be regarded as injurious. The great proportion of our insect fauna feed upon plants of no special economic importance, as on wild plants, weeds, etc. A large number feed upon animal substances, including those which are parasitic and predaceous upon other insects. In respect to their relations to man's interest as a class, insects have been grouped as follows:*

---

* Economic Status of Insects as a Class, by L. O. Howard, Science, n. s. Vol. IX, p. 233.

Insects are injurious:

(1) As destroyers of crops and other valuable plant life.
(2) As destroyers of stored foods, dwellings, clothes, books, etc.
(3) As injuring live stock and other useful animals.
(4) As annoying man.
(5) As carriers of disease.

Insects are beneficial:

(1) As destroyers of injurious insects.
(2) As destroyers of noxious plants.
(3) As pollinizers of plants.
(4) As scavengers.
(5) As makers of soil.
(6) As food (for man and poultry, song birds and food fishes) and as clothing and as used in the arts.

Thus insects are about equally divided as to their injurious and beneficial characters. Their injuries to farm and forest products and their role in the transmission of diseases in man and live stock doubtless include the principal losses which they occasion. Notwithstanding the enormous destruction of useful products caused each year by insects their injuries are largely offset by the assistance which the beneficial forms render in the destruction of noxious species and in the pollination of plants. The beneficial influence of insects in these ways is but little understood by the public in general. It is perhaps not too mu h to say that our very existence depends on these friendly insects which insure our crops by effecting the fertilization of plants and keeping down injurious species.

In nature, insect and plant species have gradually evolved together, and there has come about a very complex though well balanced relationship between the plants and insects, and between the insects themselves. The destruction of the native plants of the prairie and forest and the planting of cultivated plants has quite changed the natural conditions surrounding our native insects, and they have been forced, or from preference have attacked the succulent cultivated crops and by reason of its great abundance individuals of a species are able to develop in enormous numbers. While we have numerous native species of first-class importance, as the peach borer, potato beetle, etc., the considerable majority of our worst insect pests have come to us, at various times, from other countries. In practically all instances, these introductions have here become more destructive than in their native homes, for reasons not always explainable, but in numerous instances from the fact that their insect enemies which at home serve to keep them reduced have not been brought over with them. The idea was early suggested that the native country of a given imported species be determined, and its natural enemies be introduced to prey upon it. It is a pleasing proposition to thus array the forces of nature against each other, but that it should uniformly be successful involves a good deal more than is at first apparent.

Important as are these, and other natural agencies, as rains, windstorms, forest fires, heat and drouth, in the destruction of noxious in-

sects, it is nevertheless necessary for man to supplement their work by the use of insecticidal substances. The applied science of economic entomology had its foundation in this necessity.

It would be of interest, did time permit, to briefly outline the development of economic entomology in America, as constituting a most interesting chapter in the history of our phenomenal agricultural growth. Insect problems of national importance have, one after another, presented themselves for solution, and a knowledge of methods of insect control has become more and more necessary in agricultural and horticultural operations. At the present time in the United States and Canada, some 150 persons are devoting their time, in whole or in part, to the scientific study of injurious insects, and this number would perhaps be doubled, if account be taken of those engaged in the enforcement of crop-pest laws. Some $300,000 are annually spent in work pertaining to destructive insects, not including emergency appropriations by the Federal Government, as for the cotton boll weevil, the gypsy moth, the eradication of the cattle tick, etc.

Neglecting, however, this phase of the subject, attention will be called to some of the methods, and their efficiency, at present employed in reducing insect injuries.

Broadly speaking, our present battery for insect warfare is about as follows:

(1) Various poisons, as Paris green, arsenate of lead, hellebore, etc., for biting insects, which are sprayed or dusted on their food plants.
(2) Various caustic, soapy and penetrating sprays, as lime sulphur wash, whale oil soap, kerosene and crude petroleum emulsions, etc. These are more especially for sucking insects, and destroy them by corroding or penetrating their bodies, or by stopping up their breathing pores.
(3) Poisonous gases, so used as to poison the air breathed by insects, as hydrocyanic acid gas, carbon bisulphide, and sulphur dioxide.
(4) The utilization of parasitic and predaceous insects, and parasitic fungous and bacterial diseases.
(5) Cultural methods, as timely planting, cultivation, fertilization, fall plowing, rotation, pruning, etc.
(6) The employment of plants or parts of plants more or less resistant to insect attack, as for grafting stock.
(7) Mechanical methods, as worming for borers, jarring for curculio, etc.
(8) Legislation, to prevent the introduction and dissemination of noxious species.

Spraying.—The first two mentioned classes of insecticides, namely food poisons and contact remedies, are used mostly as sprays, and spraying without doubt is our most effective way of controlling insects. It is especially valuable for the orchardist, and for the grower of small fruits and truck crops. Of field crops, potatoes, tobacco and cotton are

profitably treated, but for most staple crops other methods must be employed.

The process involves numerous special features as applied to different insects and crops, but the object in all cases is to thoroughly distribute the insecticide over the plants. Spraying low growing plants, as potatoes and truck crops, is largely mechanical, and requires no comment. In the treatment of orchards, spraying finds its greatest development, and correct spraying is really an art. The thoroughness of the work and consequent results, will depend on the ideas and experience of the man using the nozzle rods. While there is an increasing adoption of spraying among fruit growers, there has not been corresponding improvement in regard to thoroughness in the work. Dormant tree spraying of deciduous fruits as opposed to applications during the growing season, is well illustrated in the use of lime sulphur wash against the San Jose scale.

In this case a very strong wash is used, which would be quite unsafe after the foliage has appeared. Its caustic action destroys the San Jose scale, and numerous other insects which may coexist on the trees, such as other scale pests, pear leaf blister mite, eggs of aphids, larvae of the peach moth, etc. The wash is also most useful as a fungicide, and is practically a specific for peach leaf curl. Its increased use in the control of the scale on peaches, has greatly lessened curl leaf, giving the industry a stability it did not previously possess.

Spraying during the growing season is best illustrated in the case of the apple, and is restricted in the East largely to the use of an arsenical as Paris green or arsenate of lead in Bordeaux mixture, effecting a combination treatment for insects and diseases. A schedule of applications has been determined for various parts of the country, based on an accurate knowledge of the trouble to be controlled, affording almost complete protection from such insects as the codling moth, curculio, green fruit worms, canker worms, and among diseases, the scab, bitter rot, fruit blotch, leaf spot, etc. The spraying of apples is more highly specialized than is the case of other fruits and no crop perhaps shows a greater percentage of benefit.

In the above remarks liquid sprays entirely have been meant. Rather recently the so-called dust spray has come into more or less of use, especially in portions of the middle west, and considerable difference of opinion has arisen as to the relative merits of the two methods. If effective, dust spraying has much to recommend it as not requiring the use of water and the lightness of the outfit permits its use on steep and hilly ground.

A less fortunate condition exists in regard to summer spraying of stone fruits, especially the peach. Even neutral arsenical sprays, such as arsenate of lead, are likely to cause serious shot holing and dropping of the leaves, and scalding of the fruit, while more caustic arsenicals, as Paris green, may actually kill the twigs and limbs. The control of the curculio on peach, to which it is a very serious enemy, could readily be accomplished, were a safe arsenical available. At the present

time no suitable insecticide is known for use on the peach during the growing season.

Fumigation.—The destruction of insects by poisoning the air which they breathe is practicable with several classes of pests, and has the decided advantage over other methods of complete extermination. An indispensable condition is that the object to be treated must be in an air tight inclosure. Principally three fumigants are used, namely hydrocyanic acid gas, carbon bisulphide and sulphur dioxide. Fumigation with hydrocyanic acid gas has become the standard treatment for nursery stock, greenhouse plants, flour mills, warehouses, private dwellings, etc. Gassing is also largely practiced in California in the control of insects on citrus trees, and to a limited extent in Florida for the orange white fly. A few years ago, the practicability of fumigating deciduous fruit trees in the East for the San Jose scale was thoroughly tested in Maryland, New York and Illinois, but the practice was never adopted to any extent.

Carbon bisulphide finds its greatest usefulness as an insecticide for destroying insects in stored grain and cereal products. It is convenient to use and very effective. This substance is also employed in the destruction of root inhabiting insects as the wooly apple aphis, cabbage root maggots and still to a limited extent against the phylloxera in France, where at one time it was a very important remedy for this pest.

Sulphur dioxide, or sulphur fumes, has long been in use for the destruction in rooms or dwellings of certain insect pests, but the bleaching effect of the gas in the presence of moisture has made it much less popular than the above two fumigants. Sulphur fumes are further very destructive to plants, as witness the injury to vegetation in the vicinity of smelting works. Nevertheless, sulphur dioxide will be more or less useful in special cases. Thus it has been adopted by the North German Lloyd Steamship Company, for the extermination in vessels of insects, in grain, of rats and other vermin.

PARASITIC AND PREDACEOUS INSECTS, AND FUNGOUS DISEASES.

Introduced insect pests are almost invariably much more destructive here than in their original home, supposedly on account of the influence of natural agencies which there operate to keep them reduced. It is one of the resources of economic entomology to import from the original home of an introduced pest any enemies which it may have, in the hope of bringing about its control. This sort of work had its greatest inspiration in the notably successful importation from Australia into California of the Vedalia to prey upon the cottony cushion scale which threatened to destroy the citrus industry of that state. This markedly successful instance of controlling a pest by one of its natural enemies led to much effort of a similar character. Many importations of predatory and parasitic species have been made, some with fair success, but on the whole without marked effect on the abundance of the injurious species. The introduction from China, the nativity of the

San Jose scale, of a lady-bird beetle which there keeps the scale in check is familiar to most of you. While the lady-bird thrived for a while in its new home, it became itself the object of attack from other predatory insects, and the absence of suitable scale food, due to the general spraying of orchards, where it had been introduced, led to its extinction, except perhaps in one or two localities in the South. At the present time large importations into Massachusetts from Europe are being made of enemies of the gypsy and brown tail moth, but the outcome of the work cannot yet be indicated. In a few instances insects have been found to be quite susceptible to bacterial or fungous diseases, and attempts have been made to propagate and disseminate these to secure their destruction. Notable instances are the use of the so-called "Muscardine" fungus years ago in the middle west against the chinch bug; the more recent use in Florida of the fungus *Sphaerostilbe* against the San Jose scale, and the work at the present time in the same state with the *Aschersoriia* diseases of the orange white fly.

Cultural Methods.—Numerous methods may be practiced for avoiding insect injuries by the farmer and fruit grower, which involve no outlay in time and labor not essential to proper crop culture, such as clean culture and fall plowing where practicable, the early destruction of crop remnants, the use of fertilizers to keep plants in vigorous and healthy condition, crop rotation, and in orchards prompt removal of diseased and dying limbs and trees, etc. Indeed in the case of staple crops, such operations are about all that may be done.

Winter wheat is largely protected from the fall swarm of the Hessian fly by delaying seeding in the fall until the insects have made their appearance, and died without ovipositing. Injury from the cotton boll weevil is best avoided by planting the crop as early in the spring as possible, and forcing a quick production, by chopping the plants out wide in the rows, the liberal use of fertilizers, and frequent cultivation. In this way, a profitable crop of cotton may be insured before the weevils are sufficiently abundant as to destroy the squares as fast as they are produced. The early picking of the crop and destruction of the plants in the fall and before the beetles go into hibernation destroys them in enormous numbers, as they feed only on cotton. The cultivation of vineyards in the spring as the shoots are pushing out, largely destroys the soft helpless pupae of the grape root worm then near the surface of the ground. Similarly the plum curculio may be reduced to an important extent by cultivation of orchards during a period of a month, beginning about six weeks after blooming. Liberal use of fertilizers will often enable plants to outgrow insect attack. This is well illustrated in the case of the black peach aphis; in Michigan, where the pest is quite troublesome, trees suffering from aphis attack are readily brought out by liberal use of stable manure. Many similar instances might be cited. In the use of cultural methods it should be borne in mind that the work must be done advisedly as in the case of spraying and with special reference to the particular insects to be controlled.

Resistant Varieties.—Entomologists have given but little attention to the selecting or breeding of varieties of plants, resistant or unpalatable to insects. A few examples may be cited as indicating possibilities along such lines of work. The solution of the grape phylloxera problem of France and California has come about by the use for grafting stock for the European grape of the roots of American vines. Numerous observers have commented on the relative freedom from the woolly apple aphis of apple trees grafted on roots of the Northern Spy, and certain other varieties. Doctor Webber found that one of his citrus creations, the Drake star orange, was resistant to the Phyptoptus rust of the orange. Orton has found that a variety of cow pea, the "Iron," is immune to attack from the so-called root knot, a nematode affection of the peach and many other plants, especially troublesome in the light sandy soils of the South. The comparative immunity from attack by the San Jose scale of Kieffer and Le Conte pears, the quince and sour cherry, is unique in view of the almost omniverous habits of this insect, and the determination of the reason might be of practical value. Certain strains of plums, especially the Americana group, are but little injured by the plum curculio, and varieties of apples vary considerably in regard to susceptibility to codling moth injury. This practically untrodden field should receive more attention from entomologists.

Mechanical Methods.—Only brief reference is required to what may be termed mechanical methods in fighting insects. Under this caption may be included such practices as worming for borers, jarring for the plum curculio, destroying insects by hand picking, etc. In general such methods are resorted to because no better plan is available. Some first-class pests at present must be treated in these ways, though future discoveries may afford more practicable treatment.

Legislation.—The advent into the East of the San Jose scale was the primary cause of the adoption by many states of laws designed to prevent its distribution on nursery stock and secure its eradication or control where established in orchards. Numerous other insect and fungous pests were brought under the operation of the laws, and on the whole the legislation has been productive of great good. That it should uniformly secure the results desired was perhaps more than should be expected. A recent census of insect legislation in the United States shows that only eleven out of the forty-eight states and territories are yet without crop pest laws, and some of these will present bills for enactment shortly. Thirty different insect species are specified as noxious pests, and provision in many laws is made for the designation of other insects when deemed expedient. The San Jose scale is the only species mentioned common to all laws, which well illustrates the diversity of requirements of the various states. For some years, representatives of the National Nurserymen's Association and of the Official Horticultural Inspectors have endeavored to devise a more uniform system of certification of nursery stock for interstate shipments which is greatly to be desired. So far however, no arrangement has thus far apparently been effected. The establishment of a quarantine and inspec-

tion system by the National Government of all plants brought in from abroad has been more or less agitated recently, and the wisdom of such action cannot be questioned. The State of California has maintained such quarantine for many years, and has no doubt kept out many undesirable insect immigrants.

In conclusion, the speaker would say, that while our battery for insect warfare may appear somewhat formidable, he believes that it will steadily improve in the future. Our present losses from insect attack must be greatly reduced and this will result from a more detailed knowledge of the insects themselves throughout their range of distribution, and a general adoption by those interested, of the recommendations which have proven to be of value.

VEGETABLE BREEDING.

W. VAN FLEET, LITTLE SILVER, N. J.

The breeding of vegetables doubtless began when primitive man ceased wholly to rely on the wild products of nature. The dawning intelligence that made the beginnings of plant culture would soon lead to discrimination in varieties and the perpetuation by various propagative means of the better rather than the inferior types of herbs, roots and seeds found desirable for his use. Thus in all probability was born selection—the most powerful of all forces in the modification of vegetable life by man. So potent and far reaching is selection consistently carried through successive generations, and so widely do modern cultivated forms differ from the original stocks, that the majority of vegetables of the present day cannot with reasonable certainty be traced back to their primitive species. The experiments of Vilmorin showed that an edible root similar to the Student parsnip of modern gardens could be evolved in less than five generations of critical selection from the common, sémi-poisonous wild European parsnip, so we may imagine the profound influence of continuous selection, running back to far prehistoric ages, on the plants used as culinary vegetables. What family of plants first claimed the attention of primitive man we cannot with certainty know, but from the shadowy evidence of ancient remains it would appear that beans, peas and related legumes were among the earliest cultivated vegetables. Potent from the very outset, notwithstanding the desultory manner it may have been practiced, varietal selection yet remains the most certain and powerful method of moulding vegetable life to meet the needs or fancies of man. It is the truest form of breeding, the genuine pedigree work, by which we have slowly climbed toward the goal of vegetable perfection. Violent climatic changes, distant removals, intense fertilization and the little known forces of mutation or bud variation have all had their influences, but they are small indeed compared to that of continued selection. Modification by intentional hybridization or cross-pollination, though a powerful means of adding new characteristics, is of such re-

cent practice, beginning in fact almost with the closing years of the last century, that it has made but limited impression on vegetable types. The present standard varieties are with few exceptions the outcome of selection alone. Hybridization, coupled with the all-necessary selection, is likely to have an increasing share in future vegetable breeding. Following is a brief résumé of the principal modern vegetables with reference to the general manner of their production.

Asparagus.—The cultivated varieties of asparagus all appear to have been developed by age-long selection from the common European species, A. officinalis. A few modern kinds are claimed to be cross-bred, but whether intentionally so, we are not informed. Asparagus, being largely dioecious in blooming habit, is readily cross-fertilized when two or more varieties are grown in near vicinity. A Massachusetts society has undertaken breeding experiments with asparagus both on the lines of pure selection and well considered crossing, with the hope of producing varieties more resistant to rust than those now cultivated.

Beets.—Modern garden beets are admirable examples of critical selection for untold generations of culture. Certain varieties leave little to be desired in elegance of form, coloring or quality. The present effort appears to be toward uniformity of type rather than refinements of the above mentioned features. The use of beets for sugar production has, however, led to wonderful development of forms suitable for that important commercial purpose. The sugar content of the beet has been more than doubled in less than forty years of concentrated breeding work largely under government supervision. Selection of the best sugar-producing individuals for successive generations has been the all-powerful means, but cross-pollination is now beginning to play its part. One of the important objects sought by the breeders of our Department of Agriculture is the production of a reliable strain of one-germ beet seeds in order to lessen the expense of thinning the young plants. Everyone knows that ordinary beet "seeds" are merely coherent multiple fruits, usually containing several true seeds, which may germinate close together. The Department breeders employ both selection and crossing in the furtherance of their work.

Cabbage and related Brassicas are without doubt bred almost wholly by selection. Profound indeed have been the changes wrought in developing our hard-heading cabbages, our cauliflowers, Brussels sprouts, kales and even Kohl-rabis from the loose-tufted wild cabbage of Britain. Varieties cross with some freedom when planted near-by and useful variations may have arisen in that manner, but the tendency is carefully to segregate seed plantings so as to reduce natural crossing to the minimum. The writer has made crosses between green-leaved and highly glaucous cabbage varieties with the production of offspring having leaves of intermediate coloring, but retaining the heading characteristics of both parents in different individuals. Prolonged attempts to hybridize Chinese cabbage species, Brassica Petsai and B. Chinensis, with garden cabbages entirely failed. Apparently distinct species of cruciferous genera are not easy to cross. We have European reports

of successful crosses between the hairy leaved turnips and the rutabaga, but none appears to have risen to commercial importance.

Celery.—Appears wholly a product of evolution by selection. The present tendencies on one hand are to breed for early maturity and quick bleaching and on the other to seek in the deep-green leaved varieties good keeping quality and resistance to bacterial disease.

Cucumbers and Melons.—Intentional as well as natural crossing plays an important part in the development of these popular vine fruits. Most strains of forcing or glasshouse cucumbers are the results of crossing our white spine variety with the long smooth cucumbers so extensively grown abroad. In these dilute variety-hybrids the white spine type of fruit prevails, but the vigor of plant of the European kinds is retained. Glasshouse melons appear to an even greater extent to be the direct results of crossing. In most instances records of parentage are preserved, as being of commercial importance. Among outdoor varieties hand-made crosses are less in evidence, the seed grower practicing careful selection and isolation of varieties to maintain purity of type, but crossing is so readily affected by natural agencies that most distinct varieties probably originated in that manner, to be later perpetuated by selection.

Table Corns.—Are cross-bred with comparative ease and certainty. Three years of selection will usually fix a desirable cross sufficiently for dissemination. Many successful crosses have been made for purely local uses. By far the greatest interest in corn breeding lies in the vast efforts being made by experiment stations, societies and individuals to increase productiveness and develop special characteristics in field corn varieties.

Lettuce.—Has hitherto been developed by selection and wonderful variations have been produced. The U. S. Department of Agriculture, however, announces that a successful cross has been made between the loose-leaved Grand Rapids type and a large heading variety, like Big Boston, probably the first intentional cross-breeding achieved in this important salad vegetable.

The Onion.—Is one of the most ancient and widely dispersed of aromatic vegetables. Various species of Allium are cultivated in different parts of the world and it would appear that fair opportunities for methodical hybridization exist. Attempts to intercross varieties of A. cepa, the garden onion, with A. Porrum, the leek, and A. fistulosum, the Welsh onion, in the hands of the writer completely failed. The crossing of Prizetaker, a large Mediterranean variety of garden onion, with Red Wethersfield resulted in attractive intermediate offspring that reproduced quite true from seed.

Peas and Beans.—Are constantly subject to the most careful selection, yet a considerable number of the most prized varieties, especially among peas, are products of intentional crossing. Beans are rather difficult subjects to artificially pollinate, yet successful hybrids between the Lima and garden pole bean, belonging to fairly diverse species, have been made by more than one breeder. Investigations show that these garden legumes, while popularly supposed to be self-

pollinating, as the anthers mature in the bud, are quite subject to natural crossing by the agency of minute pollen-bearing insects that enter immature blooms.

The Pepper.—Is a very neat subject for crossing and useful varieties may be produced with tolerable precision. It appears development by pure hereditary selection has played a smaller part with the pepper than with most vegetables.

The Potato.—As the most important vegetable propagated by division, has a different status from its congeners. New varieties are produced by selection among seedlings grown mostly from chance or self pollinated seeds. It appears certain that intentional crossing or hybridization has played a minor role in the development of potato varieties. The breeding of the potato is more ardently pursued at the present time than that of any other vegetable yet few experimenters are willing to claim they have actually produced crosses or hybrids. Every available species of tuber-bearing Solanum is apparently being used by breeders in different countries in the hope of imparting vigor to the cross-bred progeny. The paucity of results, up to date, is quite remarkable, and appears to indicate that for practical results we must return to the old plan of growing seedlings in quantity from the best available varieties. This, in view of the progressive sterility of our best commercial varieties, is becoming an increasingly difficult matter.

Tomatoes.—The tomato is such a modern addition to our list of really important vegetables, that its development from an ornamental curiosity to the most widely grown and valued of garden fruits lies almost within the memory of living men. Selection, as usual, was the potent and comparatively rapid means of changing the original small, flabby and seedy fruits to the large, solid and shapely tomatoes of today, but critical crossing has within the past 15 years become an important factor in the production of superior varieties. Many breeders find the tomato a fascinating and practical subject for their efforts. It requires four or five years of rigid selection to sufficiently fix a cross-bred variety, if of markedly diverse parentage. There appears to be a particular tendency toward reversion to primitive forms in the third generation of cross-bred tomatoes. The classic development of the Trophy tomato by 20 years of selection from the original cross of primitive tomato or "love apple" with the angular garden tomato of 1850, made by Dr. Hand of Baltimore, Md., has never been equalled and is not likely to be excelled by hurried modern introducers.

The practical vegetable breeding of the immediate future would seem to lie rather in efforts to produce varieties resistant to current diseases than in continual refinements of the edible portions. Increased vigor and resistance to germ infection appear to be of the highest importance in many varieties. Substantial progress has been made by varietal selection in opposing asparagus rust, potato blight and corn smut. A reasonably blight-resistant melon is at the present time most ardently desired. Many factors go to make up the complex modern demands on vegetable growth. All are important, but vigor and disease resistance are so in the highest degree.

THE BREEDING AND PROPAGATION OF FLORISTS' FLOWERS.

W. N. Rudd, Morgan Park, Ill.

The coupling of these two subjects together seems eminently proper, as the present situation—especially with regard to the carnation—is that the breeders are yearly producing new and better varieties, and the grower is just as rapidly destroying them by improper methods of propagating and growing.

Perhaps a short summary of the extent, or better, the limitation, of the writer's experience may be of use in estimating the value of any ideas advanced in this paper. For some eighteen years I have been actively engaged in growing cut flowers for market purposes, largely carnations and chrysanthemums, and for the last thirteen years have been interested in the breeding of carnations—with no very striking success so far as the putting out of phenomenal new things is concerned. The work has been conducted strictly from the commercial standpoint and, like all work of this kind conducted from this standpoint, has but little value in a scientific way. Questions of economy, the saving of time, labor and greenhouse space compel the dropping of any line so soon as it shall appear not to offer reasonable chances for gain. We cannot study retrograde or degenerate movements. Failures—that is, undesirable types—are at once destroyed and replaced by what seems to give more chance of gain, and no proper study is, or can be made of the causes of the retrogression or degeneracy. This same commercial pressure and desire to economize time, leads us to keep incomplete records and lays us open to more than a suspicion of inaccuracy. General statements, summaries or conclusions, no matter how positively put forth by us, are open to suspicion also, because we have no true conception of what scientific accuracy means. Many of us entirely fail to study the scientific work which has been done, or is being done in breeding and heredity, while the best of us can hardly lay claim to more than a superficial knowledge of it, gained through digests, reviews and summaries.

On the other hand the scientific student of these matters is not primarily concerned about the commercial value of his products, and will preserve for careful study degenerate or sickly individuals which the commercial breeder will promptly discard. Failures are failures, simply, to the one, while to the other they are often subjects for careful study as possibly containing the key to the cause. The one is concerned solely with the value of the resulting individual, and has neither the time, knowledge nor inclination to search deeply into the cause. To the other, the cause is the main matter of interest, and the possible commercial value of the result is a subordinate one. The commercial breeder has a thorough knowledge of commercial values, and a highly cultivated, almost instinctive selective sense for progressive or valuable traits. The scientific student is quite generally deficient in knowledge of commercial values.

These conditions of wide variance between the two classes of men as to knowledge, methods and aims will explain the state of mild contempt frequently shown by each for the other. The commercial breeder takes a tumble when he attempts to draw scientific conclusions from his work, and the scientist is often left at the post when he ventures to discuss or assign commercial values.

It is far from my intent to belittle the work of the scientist. He has worked miracles and is doing so daily. What future work in the close study of the breeding of plants will do, no man can say. It is safe to believe, however, that many problems, the answers to which we cannot even guess at present, will be solved. At the risk of being called a Philistine, however, I am compelled to say that, so far as regards the commercial breeder of florists' plants, the scientist, so far as science has been assimilated, has done little more for him than to enable him in certain cases to make a little shrewder guess. The term scientific breeding, as applied to our subject, is a misnomer. The breeding of florists' flowers remains today almost a pure art.

There are two principal recognized methods of breeding florists' flowers, by selection to fix a type and by cross breeding. The two methods are not so different as they might seem. Success in each depends—barring occasional accident—on the same qualities in the operator. The cross may almost be considered a minor matter. It is the fine, almost instinctive, power for the perception of minute variations, both progressive and retrogressive, on which most largely depends success, and the lack of it in either case means failure.

This same power of minute observation enables the cross breeder to become acquainted, as it were, with his subjects, to learn their individual potencies and combining powers and year by year, if he is careful about introducing foreign blood, to predict more and more closely the results of his crosses; and yet he will often be unable to give to you or me any good and sufficient reason why he selects or rejects, or why makes or avoids certain crosses, any more than the painter can give you rule or reason for all the varying form or color in his masterpiece.

Breeding and propagating in floriculture have widely varying objects. One is a process for producing (I had almost said creating) new forms; the other is a process for increasing the number of individuals of one form. An attempt to discuss methods of propagation is unnecessary.

Florists' plants that are propagated by seed do not generally deteriorate for long periods, as the seed is commonly grown by expert specialists, carefully rogued and kept up to standard. In the plants commonly propagated from cuttings, rapid deterioration is often noticed. This is due to one or several of many causes. A poor cutting may be taken from a good plant, or an apparently good cutting from a starved, sickly or overfed plant. The cutting may be weakened by too high a temperature in the propagating bed, or by having to sustain itself too long without roots by reason of too low a temperature in the sand, or by remaining too long after rooting without potting. At-

tacks of disease or improper growing, of course, hasten the deterioration of a variety but do not concern us at this time.

Granting that the mechanical part of the work is properly done, the sand good and clean, watering and ventilation properly attended to and soil and after culture all that can be asked, there is still deterioration in many cases. A sickly or diseased plant gives its own warning, and only the most careless grower will take cuttings from it. By far the most insidious danger lies in the strong vigorous plant producing fine blooms, but overfed. Here is the great danger and here, I believe, lies the prime cause of deterioration, especially in the carnation. A plant once overfed seems a changed individual and this changed condition extends to its progeny by cuttings, to a great degree.

When we have taken cuttings from healthy plants in vigorous growing condition, and which we know not to have been over stimulated; when we have given them perfect conditions and perfect care, from cutting to flowering time and back again, year after year, there will often be noted a steady decline in productiveness with a possible retention of good health and vigor. We have failed to learn our lesson of the breeder, we have selected with only one object in view and have overlooked the difference in productiveness of our individual plants. When we learn to scrutinize every cutting as to its quality, and every plant from which a cutting is made, not only as to its health and vigor, but also as to its flower producing qualities, and to reject all but the very best, then will we hear less of the deterioration of varieties.

In a word, success in breeding, success in propagating, in fact, success in all floricultural operations is due to that quality by which some writer has defined genius—an infinite capacity for taking pains.

CARNATION NOTES.

The following notes, though hardly proper to be included in the reading of this paper, may be of some interest if subsequently printed.

It has been our custom to so time our crossing as to ripen seed for March sowing. These seedlings have been planted in frames and allowed to bloom in the open, those showing desirable qualities being removed to the greenhouse for subsequent trial, the undesirable ones being destroyed, and those not blooming before frost being disregarded. experience having shown them to be generally worthless.

The first bloom has been from July 15th to August 8th, varying in different years. The plants blooming earliest have been generally singles and those double enough for commercial purposes but of medium or small size, with very few of the over double or bursting form. The early bloomers have quite generally been found the freest in bloom through later trials. The bursters have increased in number later, while the singles, though still showing, have not been so numerous. The larger number of desirable varieties have flowered from two to four weeks after the first bloom, and seldom have any been saved after September 15th. A record of each cross has of course always been

kept, and for several seasons a brief record of each seedling blooming, as regards doubleness and color. These records cover 2,170 separate plants and during a season of confinement to the house were tabulated and summarized in various ways. It should be noted that the records did not cover the entire number of plants from any cross except in a few cases, as sickly or plainly undesirable forms were at once pulled up, and many had not bloomed when freezing weather came on. With these exceptions the notes are believed to cover the ground reasonably well, and to be fairly accurate. No distinction was made between those bursting from over doubleness and those from malformation.

SINGLENESS OR DOUBLENESS.

733 individuals (one season's crosses) gave singles		161
	Commercial doubles	361
	Over double or bursters	211
1437 individuals gave singles		385
	Commercial	706
	Bursters	557
2170 individuals gave singles		546
	Commercial	1067
	Bursters	557

It will be noted that the sum of the singles and bursters approximates quite closely the total of the commercials.

The earlier crosses seemed to produce more singles and less bursters. The crosses made December 10 to January 1 where plants were at their best, before feeding commenced, produced very nearly an equal number of singles and bursters, with the commercials showing a slight increase over the sum of the other two. The late crosses showed the bursters in excess of the singles and the early and late crosses showed the sum of the singles and bursters in excess of the commercials.

The above should not be considered as at all conclusive, as the mid-season crosses were very much in excess in number of the early and late ones.

Crosses of one female by various males and the reverse, when there were 100 or more individuals, did not vary largely from the proportions of the 2,170 individuals noted before.

COLOR.

A large number of tabulations were made and much care was exercised in making them, but they all lead back to one conclusion, that is: the color of the seedling is a matter depending entirely upon the individual potency of the parents. The most potent parents as to color were those which were the result of many generations of previous breeding to color. Some reproduced their color better as males, others as females, and others equally well in either case. Special search was

made for some indications that the theory that the male has the greater influence on color was true. It is a positive fact that in these 2,170 crosses, the theory does not hold. I could get no tabulation, the results of which would not be changed by the withdrawal of certain male crosses and the substitution of certain other female or vice versa. It is true that certain mongrel crosses did show a slight preponderance of the male color in the seedlings, but they were few in number and the withdrawal of a very few crosses would have changed the result to the other side.

Chairman Manning: I think we have time to give some discussion to the papers that have been presented, and I presume it will be desirable to limit the period of each speaker to three or five minutes in order that all who are interested may have something to say on the subject.

I will call upon Mr. Rawson, who I think has had some experience in irrigation in New England, to open the discussion of Professor King's paper.

Mr. Rawson: I do not know that I can say anything very beneficial to you on the paper that you have asked me to discuss. I enjoyed it very much and I know that we are speaking to-day to gentlemen who represent not only the section here, but all parts of the United States. Probably no representative gathering equal to this one, ever came together before although we may not be so great in number as we have been on other occasions.

The subject of irrigation is one in which I have been interested for the last forty years, and probably I was one of the first irrigators in the East. You all know that irrigation is very beneficial to the growth of plants, because all plants contain from 70 to 90 per cent moisture, and it is therefore the largest part of the plant, and for that reason it is an article that must be supplied. It follows therefore, that those of us who have irrigation plants and use them to any great extent are the most successful ones in producing crops, not only in the East, but in every other section of the country where irrigation has been practiced. The subject of irrigation is in its infancy. There are various ways of doing it; there is sub-irrigation, but the irrigation which we in the East practice is that of supplying in some way about one inch of water to the surface of the soil once a week. That is equal to the amount of the natural rainfall which is nearly fifty inches a year, and if we can supply one inch of water per week to the soil, we will get a good crop, no matter what we grow. I know that the cost of irrigation plants in many sections of the country is equal to more than the cost of the land which they irrigate, but as the land which we cultivate is used as a machine and as the water which we supply is nourishment to the plant, it seems to me the most important thing for us to have is nourishment and for that reason we have expended large amounts of capital amounting to $10,000, $25,000 and even $50,000 in some cases for irrigating plants and we get our money back very

quickly on the investment. I have known many cases where crops would produce $2,000 and $2,500 per acre, where if we had not irrigated, the land would have yielded not more than $1,000. In these cases we not only get our money back but we get good interest for all years to come, and for that reason the intensive farmers of the East all have their irrigation plants and put them to practical use.

Chairman Manning: Dr. Galloway, may we ask you to say a few words on this subject?

Dr. Galloway: It is not necessary to go into the details of this paper, except possibly to emphasize the point that he strongly brought out, namely, that the soil can no longer be considered a simple proposition. If we go back in history we find now and then some individual or set of individuals who claim that they have discovered the secret of handling soils by some chemical process. Years ago it was the doctrine of the chemist that by chemical analysis we could determine the needs of the soil. That has been discredited, and the point I wish to make is that Professor King has pointed out that the soil is a great laboratory wherein this work is being carried on and there is any one of two, three or a half a dozen things to which we can attribute success of crops, but we must look at the combination of things and study the proposition from that standpoint.

Chairman Manning: I will call for a discussion of Dr. Woods' paper on "Plant Diseases."

Professor Rane: I might say the subject was very broadly treated and I am sure we are all interested. It seems to me all of the papers we have heard this morning dovetail into each other very closely. The more I listened to the subjects the more I was impressed with the fact that after all the soil is one of the fundamentals of crop growth. I have been in educational lines for a number of years, and I think that if there is anything that I have been impressed with more than anything else, it is that if we do not have much soil, there is no use of anything else. The more you know about a soil the greater chances there are of success. I am of the candid opinion that oftentimes many of our diseases and many of our insect depredations are brought about more from certain conditions of soil than any other thing. Take Mr. Rawson's business about Boston and the other men that are in the market gardening work. One of the first things is to make proper soil for the particular crops they are endeavoring to grow. I have been before their association every year and discussed with them various subjects. I find those men are men of but comparatively little education on the question of depredations. The most essential thing is proper soil, then provide against the different depredations as a part of the culture of the crop. I appreciate most highly all the work that has been done along these lines, but I think we ought to emphasize more and more the importance, as these papers have brought out, of getting in the first place a proper soil, then get at the proper method of handling it.

Professor Alwood: Dr. Woods said something in his paper that I want to repeat, because I thought perhaps I have been a great sinner

in the line of many publications, little leaflets, bulletins and so on, and I long ago came to the conclusion that what we needed was not so many publications, but to train young men to do the work, and I tried in a small way, a few men that came under my care. The government is publishing vast quantities of literature, bulletins—we are bulletined to death, while the stations are also publishing vast quantities of bulletins, tons and trainloads of them every year, and yet they are not training men enough to fill the places that are open for them. It now seems to me that much of the time put upon bulletins and other publications of the stations and by the government, most of which are thrown away, had better be spent in teaching men to do things and to go out into the fields and do things well and thus accomplish something, come in contact with the growers and show them how to do some things well.

Mr. McNeill: In regard to that recommendation to publish fewer bulletins, I would say—don't do it. The bulletin is just as essential to the success of all these movements as the men. As a matter of fact, the bulletin is the pioneer.

Until you can make a thing familiar to the people, and to the general public by printed matter, your men's time is largely wasted. The training of men is an expensive operation. Good men are rare articles. There are only a few of them and we have got to take care of them very carefully. Do not publish fewer bulletins but rather train more men, and support those colleges more liberally that are training men in a first-class manner. The McDonald College in our own country and a thousand and one of that sort here in the States, are all practical sources of help.

Mr. Quaintance: In Mr. Woods' paper he spoke of our men going into the fields with the growers. I wish to emphasize that, and I think there is need at the present time for more experienced men to go into the field and gardens and actually show and demonstrate what they are teaching.

Mr. Robinson: I want to supplement a remark by Professor Alwood. In Albemarle County, Virginia, we had read bulletins and literature of all kinds and with very little result. More was done by Mr. Scott of the Department of Agriculture, whom Professor Alwood trained, coming there and by illustrating orchard work, teaching how to combat codling moth, bitter rot, etc., than by all the bulletins put together that ever came into that county, and I have half a ton of them.

Mr. McNeill: If it had not been for the John the Baptist of the Bulletin, you never would have got the Savior. You would still be crying in the wilderness.

Dr. Galloway: In regard to the question of plant diseases, I would like to call attention to what has been said that bore pretty hard on the soil, and the inference might be drawn that if you take any kind of soil and put plenty of moisture with it, a crop can be grown. I hold that something else must be put with the soil and that is gray matter. Unless you have the right kind of brain matter, the soil is not worth

very much. I remember some years ago I had a young man interested in plant diseases; he said, "If we had the kind of soil that they have in ———, anybody could grow lettuce; it is not a question of the man, it is a question of the kind of soil." I said, "Do you really think it? Let us send up there and get some." We got half a dozen wheelbarrows full and put up a bed of lettuce, and it was the worst diseased bed of lettuce we ever had.

Mr. Pierson: Something that was said along this line started me to my feet. I do not think that I can subscribe to the thought, that the soil is the ne plus ultra, I believe the man behind the gun has more to do with it. Of course we all recognize the fact that the soil is a very important factor; we cannot grow anything good on poor soil, but you must have gray matter behind it.

I believe on the question of plant diseases, we are paying too much attention to remedies. We should pay more attention to the removal of causes that permit the plant diseases. Take for example black spot, which is so injurious to the rose under glass. You hardly ever hear black spot mentioned in these days, but the question is to find the cause that permitted black spot; to try to cure a plant that has been infected with black spot, is like trying to cure a man of consumption. The thing to do is to start with a young, healthy plant and keep that plant healthy, so I think our object in plant diseases is to look at what produces the cause at first and then remedy it.

Mr. Vaughan asked about melon diseases in certain districts in Colorado.

Mr. Pierson: I think in those localities that were mentioned the climatic conditions are such that there are no diseases that interfere with the healthy growth of the melon, and necessarily where the foliage and plant are intact, the fruit must be of high quality, so outside crops are largely the result of accident we might say, rather, of such locality where the conditions are favorable to such plant growth. Of course, under glass one can have more control of circumstances and look for the causes that produce diseases and obviate them by getting rid of the cause that produces them.

Professor Van Deman: There is one other thing that has not been touched upon, which I think has a great deal to do with this whole subject, and that is climatology. The climatic conditions very largely control the fungous diseases. We come into the arid regions and they are very free from them; for instance, there are certain fruits that may grow in certain climates almost irrespective of soil. The cherry for example will grow nowhere in the United States as large as on the Pacific coast, especially in Oregon and Washington; the cherries in that region are not equalled anywhere in the United States and it is largely a matter of climate. They may be left alone, planted and almost absolutely neglected and yet they grow successfully because of the peculiarly favorable climatic conditions, and while we are discussing this matter of soil and all those other parts of the subject, we must take into consideration the climate as one of the factors.

Professor Taft: Along this same line I want to refer to an instance we had in Michigan. As many of you know, we have a section in the southwest of Michigan where there are thousands of acres of grapes and for years they were free from black rot. They have a well-drained soil and at the time I am speaking of had a number of years of extreme dry weather in August and September, and as a result of this condition, they grew the grape without spraying and without black rot for two or three years, then had excessive rainfall you might say in the summer time and the result is this, that the disease has come in there and has seriously injured the grape and is gradually spreading until it covers the entire section. Right here was the need of remedies and this question was taken up and we found we could control this rot by spraying. This year the unsprayed vineyards have lost the entire crop, and where they have sprayed thoroughly, perhaps five or six times and have done the work thoroughly, they have saved the crop, there is hardly a grape to the bunch that is destroyed, and when it comes to fighting insects and diseases we ought not only to consider the soil and climate, but the extreme thoroughness in application which I think was referred to by both speakers. Where they have tried to spray and control rot, by two or three applications, it has been largely a failure. We have had the same thing too with our apple orchards this year. We found that the men who sprayed the longest and those who were the most thorough in their applications had the best success. They sprayed five or six or seven times and had fruit free from scab, while the unsprayed trees, or those sprayed two or three times, have suffered seriously.

Mr. Kendel: Dr. Woods spoke about frosts and it recalled to my mind a visit I made a couple of weeks ago with a florist who was protecting himself against early frosts in my section of the country; we are apt to have a frost in October and then six weeks of nice weather following. Two years ago it occurred the 20th of September when it touched the corn, squashes and all kinds of crops. This man had a tent as large as this room constructed of mosquito netting that he has used for three years for covering his dahlias. The first year he put this up the outfit was paid for from cuttings of dahlias that were under the tent after the first frost. Outside of the tent everything was destroyed and under it everything was saved. I do not know the accuracy of a statement which I read some time ago, that the frost created an acid in the plant that destroyed it. I have my doubts whether that is true, because some years ago I had a Chinese lily growing in my bedroom and the fire of the furnace went out and the plant froze solid, the water in the dish was also frozen solid. I set that Chinese lily, which was in full bloom, into my wash basin and sprinkled it with ice water. That night the Chinese lily was blooming as though nothing had happened. Now, if the frost put acid into the plant, then the cold water took it out again. Possibly there is some remedy in that direction for preventing damage from an early frost.

Chairman Manning: I think this question of protection that Mr. Kendel speaks of is very important in avoiding the effects of frost.

Dr. Galloway: A great deal of work is being done in the matter of frost protection, so that on the Pacific coast where late frosts sometimes cause damage to citrus fruits, there the fruit is protected by smudging, by water spraying and other processes. The question of frost protection is in a measure a pathological question, and the method of frost injuries is also a pathological question. The question the gentleman just raised with reference to the cause is something that is well known to those who have had experience with frost troubles, that is, if you can prevent the frost from quickly going out of the plant, as the common expression is, you can prevent injury, hence water upon a growing plant produces that effect, simply due to changes brought about in the cell.

A Member: I think we might take up the subject of Florists' Flowers.

Mr. Pierson: I am a practical florist rather than a breeder or experimenter. I am rather inclined to look at the profit, or discern as far as possible the market value. I have rather prided myself on the ability to see the dollars and cents; Mr. Rudd has mentioned in his paper that he does not find time to devote to the scientific aspect of the case, but Mr. Rudd's article is full of thought; Mr. Rudd is a thoughtful man and anything that he writes always makes people think. He speaks of the relation between the variations by sports and seedling variations and shows that they are not vastly different. I think he is right in that. I think the ordinary deterioration in cuttings comes from the very fact that we are not the close observers that he says we should be, and make too many cuttings from deteriorated parts of the plants, for we look at them collectively rather than individually, even in one particular variety. Take for example our native tree fruits of the forests, and there are probably hundreds or thousands of varieties or distinct types of these trees, which if propagated by grafting would be perpetuated, but we are not close observers and do not pick out those particular types of trees and do not appreciate them. With the florist's flowers you will find this quite marked in some cases. You will remember the Pierson fern which was sent out some time ago. That was an accident if we may so term it. One of my young men who was a close observer saw in the small plant as it came from the original plant a marked variation in the evolution of the leaf. It was called to my attention, laid aside and developed into a plant that was absolutely distinct from the original. This was not so wonderful in itself, but it is in the fact that from this variation so many different and unique forms of this species were developed. Now we have the elegantissima, showing the tendency of this particular plant to undergo bud variation the same as seedlings so often do. He speaks about carnations deteriorating. I think we often assume that varieties deteriorate because they are sent out before they become well fixed. They do not stand the test of time, consequently we are apt to hastily say that they deteriorate. I claim they never ought to have been christened.

The best varieties like the Lawson and some of that type will not necessarily deteriorate. We should be more careful in the selection of buds and perpetuate the type which is most desirable. We want thoroughness, we want to be closer observers and many things we hastily say are wrong are simply due to the fact of our superficiality.

Professor Alwood: I would like to call on Dr. Woods on bud variations.

Dr. Woods: Referring to the case of the fern varieties just discussed, might it not be possible that these were really hybrids instead of varieties produced by bud variation? It is well known, of course, that the crossing of ferns is readily accomplished through the transfer of spermatozoids—small bodies corresponding to the pollen of higher plants. While some variation might occur in ferns as a result of feeding and of changed environment, or as a result of what might be called mutations, it seems to me more probable that such variations are to be explained as a result of some previous crossing or hybridization, probably accidentally accomplished. The difference between a bud variety and a variety produced by hybridization is, as Mr. Rudd has pointed out, often not very great. But variations of the order of mutations are sometimes produced by high feeding or by change in environment. This is particularly noticeable in bringing tropical plants north, where they tend to break up into a large number of varieties through the influence of climate. No new potentiality, however, can be introduced into a plant by this process of breeding, and at best it is a chance method of securing variation. On the other hand, by hybridization or crossing, distinct potentialities of different individuals can be mixed in almost any desired relation, and, if the work is intelligently done, it can be made much more effective than dependence upon bud variation as a method of securing new varieties.

AFTERNOON SESSION.

CHAIRMAN, PROFESSOR L. R. TAFT.

NUT CULTURE IN OUR RURAL ECONOMY.

WM. A. TAYLOR, WASHINGTON, D. C.

Discussion of the attractiveness and profit of nut culture has in recent years awakened much interest among our people in the possibilities of this rather newly developed industry. Among dwellers in cities and towns the idea of nut culture appears to be particularly attractive and in the case of the average person to suggest as its principal feature the sylvan shade and bosky dell of the nut harvest rather than the hard work essential to success in other lines of orcharding.

As the result of considerable attention to the subject, the writer has been forced to the conclusion that in the mind of the average person the term nut culture stands for:

1st. A very pleasant harvest time in which a bountiful crop of beautiful nuts of fine quality is garnered to be later sold at very remunerative prices.

2nd. The production at low cost and ultimate sale at high prices of a considerable quantity of valuable chestnut, walnut, hickory or other nut tree timber to be derived from the thinning out of the superfluous trees of the grove or orchard.

In short, the general conception of nut culture among our people is decidedly visionary and highly tinged with sentiment. Doubtless because of the fact that almost our entire domestic supply of tree grown nuts has until very recently been derived from the forests, there is a deeply imbedded conviction in the average American mind that nut culture is a phase of forestry rather than of pomology; that it is closer kin to timber production than to fruit growing. With the species known to the writer this view is entirely and essentially erroneous.

The production of straight grained, sound and valuable timber necessitates close planting with a view to forcing an erect and relatively tall trunk. This in turn is accompanied by the rapid and continuously progressive smothering of the lower branches as the crown of the tree reaches upward with the rising forest floor. The result is a tall pole with a relatively small tuft of young branches such as alone are capable of producing blossoms and nuts. The apparent abundant yields of chestnuts, walnuts or pecans occasionally observed in the crowded forest would not in fact be large yields at all if reduced to the basis of bushels or pounds per acre.

The production of good crops of nuts of most species on the contrary necessitates the development and maintenance of a relatively large head of strong growing young wood which can only be done under such conditions as provide an abundance of air and sunshine. All experienced nut growers agree to the above statements. I take it though there is still much difference of opinion among them as to the necessity of cultivation, fertilizing, pruning and in specific instances, spraying to control injurious insects and diseases. Many maintain that the leaf imbedded, unstirred soil of the forest constitutes the ideal soil condition provided other factors be right. The writer is strongly of the opinion, however, that where nut trees are planted primarily for the crops they yield rather than as windbreaks or for road side ornamentation or shade near dwellings, systematic cultivation including judicious use of suitable cover crops will be found essential. The leaf mold mulch method of humus production is not practicable under the sunlight and moisture dispelling conditions of the orchard, so man must exercise a directing influence over the conditions of plant growth if he desires more regular and abundant crops than the species concerned ordinarily produces in its natural state. The fact is that Nature's methods do not promote maximum productiveness nor highest quality of product as judged from the standpoint of man's needs. Heavy crops of nuts in the forests are at most invariably followed by very short crops or even total failure in many cases apparently through inability of the unaided tree to set a normal crop of well developed fruit buds while maturing a heavy yield of nuts. As with our pomaceous and stone fruits we must steady the yields by furnishing or rendering available sufficient fertility and conversely in some

cases by reducing the set of nuts in full crop years by judicious pruning or even by hand thinning of over productive varieties of some species. Regularity of abundant cropping is the exception rather than the rule under the forest condition and doubtless the most certain and economical way of insuring it is by systematic orchard cultivation. At least this has been found true with the almond and the Persian walnut on the Pacific coast where the production has assumed most importance. There may be exceptions to this general rule as with the pecan on alluvial soils that are abundantly fertile and moist and there may be cases where the cheapness of the land and its inadaptability to other profitable uses may justify an investment in nut growing where only occasional full crops may reasonably be expected as with the sprout grafted chestnut orchards of the rough lands of the Alleghany and Blue Ridge mountain regions. But the important commercial development of the industry now under way and likely to show large increase during the next decade will undoubtedly be along lines of orchard practice not differing much in principle from those now recognized as essential in the production of the deciduous tree fruits.

Of the present status of nut culture in the United States little can be shown in statistical form. The figures as compiled from the twelfth census, covering the crop year of 1899, were as shown in the following table:

Nut trees and product in Continental United States, census of 1900:

	Trees.	Pounds.
Almond	1,649,072	7,142,710
Cocoanut	48,664	136,650
Pecan	643,292	3,206,850
Persian or English Walnut	726,798	10,668,065
Miscellaneous nuts	634,460	380,224
	Acres.	Bushels.
Peanuts	516,654	11,964,109

Value of tree nuts, $1,949,931. In all U. S., $1,950,161.
Value of peanuts, $7,270,515.
Total value of nuts produced, $9,220,446.

No statistics nor reliable estimates of later date relating to the entire country are available, but by combining the known data on imports of almonds and walnuts with the commercial estimates of the yields of those nuts in California a fair notion of the quantity of those nuts required to meet the present demands may be gained.

Approximate quantity of almonds and walnuts consumed in United States, 1902-3 to 1906-7:

ALMONDS.

	1902-3. lbs.	1903-4, lbs.	1904-5, lbs.	1905-6, lbs.	1906-7, lbs.
Imported	8,142,164	9,838,852	11,745,081	15,009,326	14,233,613
Home grown	6,540,000	6,400,000	1,600,000	4,200,000	1,400,000
Total	14,682,164	16,238,852	13,345,081	19,209,326	15,633,613

WALNUTS.

	1902-3, lbs.	1903-4, lbs.	1904-5, lbs.	1905-6, lbs.	1906-7, lbs.
Imported	12,362,567	23,670,761	21,684,104	24,917,028	32,597,592
Home grown	17,140,000	11,000,000	15,180,000	12,800,000	12,000,000
Total	29,502,567	34,670,761	36,864,104	37,717,028	44,597,592

These figures appear to indicate an increasing consumption of almonds and especially of walnuts and though the data on other nuts are lacking there has unquestionably been larger consumption of pecans, filberts, chestnuts and peanuts in recent years and a considerably increased home production. It should be noted that we are still importing much the larger portion of the almonds and walnuts that we are consuming, domestic production not having yet overtaken home consumption.

Our total imports and exports of nuts for the last year were as follows:

IMPORTS OF NUTS, FISCAL YEAR 1906-7.

	Pounds.	Value.
Almonds	14,233,613	$2,331,816
Cocoanuts, free		1,349,562
Cocoanut meat, broken, or copra, not shredded, desiccated or prepared, free	7,064,532	302,132
Cream and Brazil, free	252,538	650,488
Palm and palm nut kernels, free		39,329
Walnuts, dutiable	32,597,592	2,969,649
All other free		
All other dutiable		2,100,274
Total imports		$9,743,250

EXPORTS OF DOMESTIC NUTS, FISCAL YEAR 1906-7.

Peanuts	6,386,012 lbs.	$278,236
All other		103,929
Total exports		$382,165

Of the large number of species of nuts that enter into consumption in this country those that appear to offer greatest promise to the grower are the almond, Persian walnut, pecan, Japanese and European chestnuts. The efforts at filbert culture thus far made in the United States have not warranted extensive commercial plantings though the impossibility of profitable filbert culture has by no means been demonstrated. The improvement of the native chestnut and chinkapin, the Eastern and the California black walnuts, the butternut, the shagbark and the shellbark is well worthy of the attention of the amateur and the breeder.

Two species, the almond and the Persian walnut, may be said to be upon a sound economic cultural basis on the Pacific coast, and one—

the pecan—is approaching that status in the Gulf and South Atlantic States.

Numerous questions affecting the nut industry are pressing for solution, the rapidity with which plantings have been made having prevented the acquirement of enlightening experience as a guide to the commercial planters.

The important questions of self-fertility or sterility of varieties, relative congeniality and adaptability of grafting stocks, resistance to diseases and insects, etc., as well as the broad and important question of relative adaptability of varieties to soils and regions demand thorough and systematic investigation if the industry is to have healthy and normal economic development.

COMMERCIAL GROWING OF GARDEN VEGETABLES.

W. W. Rawson, Boston, Mass.

The culture of vegetables is one of the most interesting and profitable of the many branches of agriculture, and from the fact that the demand for fresh vegetables is so great in our larger towns and cities the growing of these crops has become a business followed by many situated near the large markets. The business as carried on to-day is termed market gardening to distinguish it from the old-fashioned farming. It requires a vast amount of knowledge and experience to be a successful market gardener and one must not only know how to grow but also what to grow. There are many crops of vegetables which may be termed annual products, but there are a number of varieties which may be grown to a high point of perfection at all seasons by the use of glass.

The kitchen garden, as it is often termed, includes many of these varieties and especially those which are most desired by the market gardener, namely, lettuce, cucumbers, cabbage, onions, radishes, spinach, beets, celery, carrots, parsnips, tomatoes, cauliflower, squashes, peas, beans and corn.

A good many of these may be called luxuries and are quite difficult to grow, but there exists a large demand for them in our larger cities and towns and those market gardeners who specialize in the above varieties and grow them successfully have built up a business or profession which is very profitable.

It is a well known fact that it is more difficult to grow crops in the field than under glass and those who have the best knowledge of the business grow many of the finer vegetables in that way.

To be successful requires not only a large capital and good land, but also a thorough knowledge of the business. While in field culture, we use the land for what it will produce with a little cultivation and some fertilization, under glass we use land as a machine, putting into it such a crop as we wish to produce and using such fertilizers as that special crop requires.

As the manufacturer puts into his machine the materials which with proper care and attention turn into the finished product, so it is with the grower producing his crop from the soil.

The largest material necessary to produce any crop is moisture or water, consequently no vegetable grower or market gardener can succeed without an irrigation plant. This is true in the field as well as under glass, though under glass the water can be regulated according to the requirements of the crop, while in the field the rains are oftentimes so heavy as to cause more damage than benefit.

The fertilizers are applied before the crop is planted and as the crop to be grown demands.

There is only one satisfactory complete fertilizer and that is stable manure which is applied in such quantities as the crops require. Wherever stable manure cannot be obtained it is desirable to use some form of commercial fertilizer possessing the required amount of nitrogen and potash for that particular crop and soil, but for a general fertilizer there is nothing equal to stable manure.

Many wonder how the land can stand so much stable manure applied many times a year and for many years without a rest, but it does stand it and will produce the best of crops even after a continual treatment of forty or fifty years.

There is however one complete fertilizer that has been used to some extent the past two or three years and that is sheep manure. When used as a top dressing for second crops in the houses I have found it to be very satisfactory. It should be used sparingly, however, and only in the pulverized form, which hastens its availability.

Where stable manure is impossible to obtain sheep manure may serve as a substitute better than the commercial fertilizer, as it is a complete manure, thereby possessing all the elements necessary for plant life.

In the hothouses there are many insects, weeds, and fungi that get into the soil and endanger the crop, but these are eliminated by a system of sterilization or cooking of the soil at a temperature of 212 degrees.

This process will renovate the soil and produce astonishingly large and perfect crops.

After sterilizing and getting the soil into perfect condition with an application of 20 to 30 cords of manure the crop surely should grow with proper care and attention. All crops require a certain amount of light, heat, air and moisture and it depends wholly on the application of these four items how well the crop will grow and how perfectly it will mature.

During the short days of winter we are deficient in light, but this can be supplied by the use of electric arc lights which will quicken the crop about 15 per cent. The air should be always pure and so regulated by ventilation as not to hurt the growing crop by a draft.

The heat is supplied by the sun and by steam conducted from the boilers by pipes to all portions of the houses. The amount of steam can be regulated by valves placed near the boilers, thus giving in each

house the necessary amount. Large boilers are required to produce steam at as low a pressure as possible to heat large territories of glass, that is, by the acre. The use of hot water is an ancient process to the modern market gardener. When heating by steam the pipes are placed 3 or 4 feet above the surface of the soil at such distances apart as the desired temperature requires, and only enough pipes to give the highest temperature required in the coldest season.

The moisture or water is supplied from pipes arranged similar to the steam pipes and used as the crops demand. I have spoken of the use of electricity in the giving of light, but we have found that it is equally as beneficial when applied to the soil by means of a current passing through the soil from a battery at each end of the bed and connected with a wire.

The circulation is manifest through all the soil to a marked degree. The amount of this has to be tested at all points of the bed until the proper amount of current is obtained, otherwise if too high the crop will show a forced growth. This experiment has only just begun and when we can regulate the current to that amount which is of the greatest benefit without forcing the crop too much it will prove of the greatest value to the modern market gardener. I have tried the experiment in one of my houses in a bed 400 feet long, and the difference in growth between that bed and one not treated was quite marked.

Now a word about greenhouses and their construction. The foundation should be of cement, the frame of iron and the purlins in cold climates of wood. The glass should be as large as possible, 20 in. by 30 in. having been found to be the most economical. As to the size of the houses, I would recommend one 20 feet wide to be 100 feet long; one 30 feet wide to be 200 feet long; one 40 feet wide to be 300 feet long; and one 50 feet wide to be 400 feet long. These proportions have proved to be the most satisfactory, but I should recommend the larger size as being much more economical to heat and regulate.

I have only mentioned the way to produce crops as a whole in the market garden. Each one of the crops mentioned above could easily be made the subject of a lecture by itself, but I have not the time to go into the matter now. This subject of the commercial culture of vegetables has been studied deeply in New England and the prosperity of the majority of our market gardeners shows with what success.

There are many branches of agriculture and horticulture which may be familiar to many men, but the method to-day is to intensify and specialize, and the truly successful man is the one who cultivates only a few crops, those to which his land and climate are best adapted and those which have the greatest demand in his market. We have found in New England that while we depend upon the farmers of the West and South for many of the necessities, they look to us for many of the finer vegetables to supply them at certain seasons of the year.

While corn, wheat, oats and potatoes are their agricultural products, lettuce, cucumbers and celery are ours.

Massachusetts is not an agricultural state, but she produces annually at the present time $65,000,000 worth of products, her largest crop being cucumbers under glass.

In the little town of Arlington there are to-day over 100 acres of glass where thirty years ago there was not one acre, and we produce there more products for our acreage than any other town in the country, and I may say, the world. There are many hundreds of acres under glass in the State of Massachusetts, all producing crops of lettuce and cucumbers where forty years ago no glass was used.

The men of those days did well on their outside growing, but by the intelligent use of all the new methods and inventions great changes have been made. The sons of those men followed their fathers and are cultivating successfully to-day the same land with the improved methods and ever looking forward to still greater improvements and thereby larger and better crops. The most successful of these present market gardeners confine themselves to a few crops having a ready sale all the season, thereby having a continuous crop and steady returns.

All of these men will testify that the business can be made as profitable as any other business and they can live better, feel better and know that what they enjoy really belongs to them and is not obtained by speculation.

The time is coming when the business of agriculture will stand as high as any calling and in the future those engaged in it will be looked up to as men of intelligence and knowledge and be respected as exponents of the leading industry of mankind.

To the young men of today I would say, "study agriculture. Apply yourself to that part of it to which you are adapted and which you like best and you may be sure there is no calling in which you will take greater pleasure." The profit is sure to come to those who follow it and among the first branches of agriculture will be found the commercial growing of vegetables.

COMMERCIAL GROWING OF ORNAMENTAL PLANTS.

W. H. Taplin, Chambersburg, Pa.

The past decade has witnessed great advances in the production of ornamental plants for commercial purposes in the United States, the trade having in some instances attained to the dignity of being specialized.

It is true that there are but few specialists in this department of the trade as yet, the majority of plant growing establishments being divided into various sections, rather than confined to a single specialty.

However, there are a few such places, and these are almost entirely confined to the Eastern States, the specialists of the West devoting themselves in most cases to the cut flower industry, in which many of them are remarkable examples of success.

Broadly speaking, our cultural methods are adaptations of the methods long in vogue in Europe.

By adaptations is meant that climatic differences have had to be observed and some of our methods adapted to those differences, as for example, the intense sunlight of our summer season makes necessary rather more shading on the glass than is required in some parts of Europe, and again the longer period of hot weather in the central and southern portions of our country give us an advantage in the rapid growth of heat-loving subjects.

As a rule, American plant growers are impatient of delays in the production of marketable stock, the consequence being that the slower growing plants are not handled to any great extent, such subjects being imported from Europe, where labor is a little cheaper, and where time seems to be less of an object.

As a result of these conditions such plants as bay trees, box bushes, Aspidistras, Azaleas and various other plants that require much time and labor in their culture, are imported from Europe.

The palm industry has made wonderful advances of late years, but up to the present time there have not been enough palms of all sizes to supply the demand, this condition causing the importation of large quantities of these beautiful plants from Belgium each season.

It is true that a few small palms have been occasionally exported from this country to Europe, but these exports do not approach the imports in value.

The centers of commercial palm growing in this country at the present time are New York, Philadelphia and Boston, the neighborhood of these three cities doubtless producing more palms than all the rest of the country together, and from those cities is shipped the choicest stock of this description that is offered in the interior cities and towns, even out to the Pacific coast.

By far the larger part of the palms that are annually sold in the United States are grown here from seed, the imported stock being chiefly in the larger sizes, such as are used for decorating.

The species thus used are few, and but little change will be noted in the catalogues from year to year, as the qualifications of a useful commercial plant are somewhat exacting.

To fulfil the requirements of a plant for this purpose it must needs be a species that is readily obtainable, so that a regular supply of seeds may be had each season, and it must also be of reasonably quick growth, of considerable grace and beauty, and have foliage of an enduring character. Thus we find that out of a possible hundred of new species of palms that have been introduced to cultivation in the past thirty years, there are less than a dozen to be found in the average trade lists.

The most popular palms of the present day are the Howeas (otherwise and more generally known as Kentias) the seeds of which are imported by the million each season from a certain small island in the South Pacific ocean.

The Howeas, or Kentias, are grown best in a night temperature of about 60 degrees, and this may be considered as the *low* average temperature for palm growing, in comparison with the *high* average palm

temperature of 68 degrees that is ordinarily given to Areca lutescens. There are more pinnate leaved palms in the florists' lists than there are of the fan-leaved section, the latter finding less favor with the general public, about the only representatives of the fan-leaved section of palms that are grown in quantity being a few species of Livistonas and Chamaerops.

Some of the date palms, or Phoenix, are used for decorating, and these are also used quite extensively for outdoor planting in the extreme South and Southwest. As already hinted, there is a dearth of novelties of real value in the palm trade, but among the few of recent introduction there is one Phoenix that is being taken up extensively, namely P. Roebelinii, a very charming dwarf species from Siam, this palm now being procurable in quantity, owing to a more liberal supply of seeds that has been received in this country during the past three years.

Next in importance to the palms among the commercial ornamental plants are the ferns, and to one unfamiliar with the trade, the numbers of these plants that are annually distributed in our large cities would seem marvelous.

The fern trade may properly be divided into two sections, the first comprising those that are grown into specimens in pots of five-inch size and upwards, and the second including the various ferns that are grown for the purpose of filling table ferneries and making other decorations.

These latter ferns for small ferneries are grown by the million in small pots, 2-inch to 3-inch being the sizes most used, and while the wholesale prices are not high, yet the crop is grown in a reasonable time and is fairly remunerative.

The species most in demand are various species of the Pteris and Nephrodium groups, the chief essentials for a plant that is to be thus used being rapidity of growth, compactness of habit and distinctness of foliage.

Among the ferns that are grown into larger sized plants for house and store decorations, we find a greater variety, there being some of the Maidenhairs or Adiantums, a number of Nephrolepis, some Pterises, and an occasional representative of the tree ferns, among the most notable being Cibotium Schiedei.

These ferns are all grown in moderately rich earth, but are given just as much fresh air and light as they will stand, this resulting in a sturdy growth of fronds that will endure much more abuse than those that are grown in closely shaded houses and potted in light soil.

The methods of propagation vary with the species, some being gotten from divisions of the crowns, others from runners, and those used in the small sizes for table ferneries being raised from spores almost exclusively.

As a business proposition, the fern department offers some inducements to the expert grower, but stock of this character must be of first-class quality to ensure a prompt and profitable sale.

The main crop of small ferns for ferneries is sown during the preceding autumn, the time required from the sowing of the spores

until the seedlings are large enough for potting varying between six and nine months, the practice being to sow the spores while fresh, as some species lose their vitality by long keeping.

The supply of spores is usually a home product, and requires the exercise of judgment in gathering and preservation. Palm seeds are almost entirely of foreign origin, the Howeas being brought from Lord Howe's Island, Arecas from Brazil, Cocos Weddeliana from the same country, Livistona chinensis is sometimes home grown and is also sent from Cuba and South America, Phoenix is rather widely spread, and Livistona rotundifolia is grown in Hawaii, though a native further south.

Ficus elastica and Ficus pandurata are both grown extensively in the florists' trade, and both are admirably decorative for the dwelling, besides being most enduring in foliage.

Dracaenas in several species and varieties are also grown in quantity, the brightly colored varieties being especially in favor at Christmas time.

Crotons in many varieties find a ready sale at the holidays, those with high-colored leaves in which red, orange and yellow predominate being quite largely used in window decorations and plant baskets at that season.

Pandanus Veitchii is still grown extensively, and is more used than any other member of its family.

The Dracaenas, Crotons and Pandanus are all heat-loving plants, and with a rich soil and plenty of sun and moisture make rapid growth and develop rich coloring.

Brightly berried plants are in demand at Christmas, and for this purpose those most in favor are Ardisia crenulata (some of which are home grown, and some imported from Japan), and one or two species of Solanums.

Insects, and the means with which to fight them, are problems of interest to the commercial plant grower, and while progress has been made in this line, yet the perfect insecticide is still in the future.

Probably the most satisfactory thus far are some of the nicotine preparations, the results from these having been better than the various soluble oil preparations. The latter are more likely to injure tender foliage than the nicotine when carefully used, but the disadvantage of the nicotine preparations is found in their high cost.

In the matter of fertilizers, the progressive plant grower is also frequently experimenting, for soils vary so greatly that it takes time to find out the needs of each.

In palm growing, the best commercial fertilizer is one that contains a good proportion of phosphoric acid, but manures strong in nitrogen are also used to some extent, though an excessive use of the latter produces brittle stems and foliage.

Among the other plants briefly noted in this paper various manures are used, beginning with stable manure and running through bone dust, dried blood, spent hops, soot, nitrate of soda and others.

The future of the plant trade in this country looks encouraging, for the garden is a youthful institution in our land as yet, and its pleasures and possibilities are only beginning to be realized, and while the proportion of profit to investment is probably less than in cut flower growing, yet there is abundant room for all the well-grown plants that are likely to be offered for some time to come.

COMMERCIAL GROWING OF CUT FLOWERS.

F. R. Pierson, Tarrytown, N. Y.

The development in the commercial growing of cut flowers in this country during the last thirty years is phenomenal. What might be dignified as the commercial growing of cut flowers practically had its beginning less than thirty years ago. Prior to that time, the quantity of flowers produced was insignificant, the quality, compared with present standards, inferior, and the methods of culture crude in the extreme. With the increase of wealth, there has been a marvelous progress in the production of cut flowers, both in the quality and the immense quantities produced.

It seems incredible now that the writer, less than thirty years ago, was advised by one of the foremost florists of that time not to go into the cut flower growing part of the business, because it would soon be overdone. This seems the more incredible when one considers that to-day many single establishments are producing more cut flowers than the entire greenhouse production of the United States probably amounted to at that time.

New York, which is one of the greatest cut flower centers in the world, thirty years ago depended on Boston for its supply of roses. The leading varieties of roses in those days were Safrano, Isabella Sprunt, and Bon Silene, all of which have practically disappeared, having been superseded by improved sorts, and to-day these one-time popular roses are almost unknown. In carnations, at that time the leading variety was President De Graw. A long-stemmed carnation was then unthought of, as many buds being allowed to develop on one stem as possible, and the flowers were cut with no stems. Loose, long-stemmed flowers were then an unknown quantity. These short-stemmed flowers were supplemented by wooden stems and wires, and made up into baskets, bouquets, etc., in the most formal and artificial arrangement—in fact, the inferior quality of the flowers permitted nothing better. The best flowers then produced would simply be unsalable to-day, on account of their small size and short stems. At that time so few roses and carnations were grown that they were necessarily supplemented by French and Dutch bulbs, which in those days were forced in comparatively large quantities.

In the earlier days of the cut flower industry, European methods of culture were in vogue. The few roses and carnations that were grown were grown mostly in pots, the greenhouses of those days being very primitive. Up to that time, the buildings erected for the produc-

tion of cut flowers were very small and insignificant and comparatively crude affairs. With the introduction of some of the finer roses, like Perle, Cornelia Cook, Catherine Mermet, Bride and Bridesmaid, a great impetus was given the cut flower industry, and then came the queen of all roses—American Beauty.

I believe that the present up-to-date methods of rose growing had their beginning in the vicinity of Madison, New Jersey. The old pot method was discarded, and roses were grown on shallow benches in light, sunny, airy houses, and the results obtained were exceedingly satisfactory and profitable. Large ranges of rose houses were constantly erected in that section, along the line of the Delaware, Lackawanna and Western Railroad, and at that time Madison, Summit, and other towns in that vicinity were known as the Rose Belt of America; but since then immense ranges of glass for the cultivation of roses have been erected in so many different localities around New York, Chicago, Boston, and other large cities that no one place in the country can boast of any particular supremacy.

The same development that occurred in the rose took place in the carnation, but at a considerably later period, and the present fine varieties of carnations that are now grown have all been produced within the last decade. First came Mrs. Thomas W. Lawson, which marked an epoch in carnation growing. This variety was the forerunner of such fine varieties as Enchantress, Mrs. M. A. Patten, Beacon, White Perfection, Winsor, etc. The trade was quick to discern that while these improved carnations *could* be grown in the old-time houses, they could be grown much better in the improved houses that were devoted to rose culture.

Another flower which has become one of the most important is the violet. In the earlier days violets were grown in cold frames, covered with sash and straw mats; and, of course, with our severe winters, the supply was small and uncertain. The same improved methods of culture that have taken place with the rose and carnation followed with the violet; and to-day violets are grown in large quantities in light, airy houses—entirely under glass—a method of culture that fifteen or twenty years ago was unheard and unthought of. The violet business has been largely centralized for many years in the Hudson River valley, especially in the vicinity of Poughkeepsie and Rhinebeck, which has become famous as a violet-growing section, where the variety called Marie Louise is principally grown. Princess, the large single violet, which is not so difficult to grow, has been grown in other sections where Marie Louise has not been grown successfully or profitably. Immense quantities of Princess are grown, especially in the vicinity of Boston, and also in some of the large Canadian centers.

One of the most phenomenal improvements that have been made in any flower has been made in the chrysanthemum, which has been developed to such an extent that one who knew it twenty-five or thirty years ago would not recognize the immense blooms grown to-day.

Another very important flower for the florist is the Easter lily, which was grown only in very small quantities until the introduction of

the Bermuda Easter lily twenty-five years ago. Prior to that time, lily bulbs were obtainable only from Japan and Holland, and the sources of supply were very uncertain, besides which, the bulbs often reached this market too late to force for Easter. Under these circumstances, the advantages of the Bermuda Easter lily were immediately recognized, as the bulbs could be brought here in July and August, so that not only was it possible to force them for Easter, but they could even be brought into flower by the holidays, so that the Bermuda Easter lily has become one of the most important flowers, especially for the Easter season, and is now grown in immense quantities.

I introduced the commercial culture of the Bermuda Easter lily in Bermuda about twenty-five years ago, and for many years I believe that one-third of the revenue of the Bermuda Islands was derived from the culture and sale of this bulb. It has been grown there in immense quantities, the normal output for many years being two million bulbs and up, one year having reached as high as four million. Unfortunately, with bad cultural methods, the quality of the bulb has deteriorated; still, the Bermuda-grown lily is an important factor. But the Japanese bulbs have made great inroads into the demand for the Bermuda bulbs, on account of the lower price for which the former can be supplied, and the fact that by reason of more rapid steamers and transcontinental railroads, it is possible to bring the bulbs here as early as September; so that the Bermuda lily does not occupy the important position to-day that it did fifteen years ago.

Among other bulbous flowers, the lily of the valley is one that has held its supremacy. This always has been, and probably always will be, in great demand; while other bulbous stock, like tulips, narcissi, and especially hyacinths, do not occupy the prominent place to-day that they did in former years. In the larger cities, especially in the East, they are not very profitable. They are more largely grown in the middle west and in interior towns, where the supply of roses, carnations, and the other finer flowers is more or less limited. Bulbous stock is more largely grown in Europe than in this country, because, owing to the lack of sunlight there, roses and carnations can not be produced as easily as they are here; so that the Europeans are more dependent on bulbous stock; but, recently, English growers have found that by following the American method of using shallow benches and building very light houses, very good results can be obtained. This is especially so with carnations, English growers having learned that they can do much better with our improved American varieties than with the varieties that they have grown heretofore, and there is beginning to be a large demand for our newest and best sorts.

In the character of the greenhouses devoted to the cultivation of cut flowers there has been a wonderful advancement in the past twenty-five years. Twenty-five years ago 11-foot houses were in the majority. Then came houses 18 to 20 feet in width, and when, fifteen years ago, we built a range of four iron houses, each 20 feet by 300 feet, it was considered a model range, being much in advance of anything that had been built up to that time; but during the last five years especially,

there has been a marked increase in the size of the houses erected, and to-day we believe that the best house that can be built is one ranging anywhere from 50 to 60 feet in width. We are now building houses 56 feet in width, running east and west, in which we use 16 by 24-inch glass and reinforced concrete sides, and we believe that houses of this kind are the most economical in construction and operation. While houses 56 feet in width are seldom seen to-day, I do not believe that the limit of size has been reached by any means, and I believe that the tendency will be toward still wider houses.

Large ranges have been built of the narrower ridge and furrow connected houses, in an effort to obtain large areas under one roof, but we do not consider this style of construction as advantageous as the large separate, wide houses. Ten years ago no one had any idea that such houses as are being built to-day were even practicable. To-day the tendency is to gather under one roof more area than ten years ago would have comprised an entire establishment. The reason for this is the tendency toward specialization and the growing of one or two varieties of flowers by different growers, one grower devoting his attention to one variety of roses, like American Beauty, one concern alone growing as many as a hundred thousand of this variety. The same thing applies to carnations—some concerns growing between one and two hundred thousand carnations alone; and, of course, with the increased quantities of one variety, much larger houses have become a necessity.

The tendency here in greenhouse construction is to increase the size of the house and the size of the glass, and, by the use of steel rafters, to eliminate as much woodwork as possible in order to get the maximum amount of sunlight, thus enabling the grower to produce the largest number of flowers during the short midwinter days when flowers bring the highest prices.

To-day flowers are no longer considered a luxury, but rather a necessity. In this connection, we might say that few people realize what it costs to produce the finest flowers, especially during the short midwinter days. In fact, I believe that in midwinter, when flowers seem to bring phenomenal prices, they are actually produced at a loss, when one takes into consideration the capital invested, the fuel consumed, and the labor involved. Even with the prohibitive prices at the holidays, I doubt whether they give the grower an adequate return for the capital invested. Even in California, that land of flowers and sunshine, where Nature is so kind, it is necessary to grow flowers of good quality under glass, so that there, where one would naturally expect that flowers would have little or no value, it costs considerable to produce flowers of high quality. In the East, during midwinter, when there is little or no sunshine and when the amount of fuel required is enormous, it is doubly so.

Looking back at the progress that has been made during the last twenty-five years, and the improvements that have been made even during the last five years, one wonders what the next twenty-five years have in store for us. Certainly, the end is not yet, for we have reason to expect as much advancement in the future as has occurred in the

last quarter of a century. Twenty-five years ago, anyone could have gone into the florist business with little or no capital, and if careful and industrious, failure could hardly result; but to-day, with the large amount of capital invested in large establishments and the consequent ability to produce flowers more cheaply, larger capital is required, and first-class, up-to-date business methods must be practiced. A man cannot hope to succeed under the conditions that exist to-day as he would have been able to succeed in the earlier days of the business—in fact, the florist business, as it is conducted now in the larger establishments, is fast assuming the proportions of a flower factory, and the same up-to-date business methods will have to be observed as in any other manufacturing business to ensure success.

In the future, the man who will make the most marked success is the man who is located in the right place; that is to say, where labor is plentiful, where he can obtain a supply of coal at the least possible expense—preferably near a large city, where the shipping facilities are quick and frequent—where an abundant supply of water is to be had, and where the soil is first-class. One of the most important considerations is the selection of a proper location. Heretofore most greenhouse establishments have been located without much reference to this, as they have been developed from small beginnings; but the proper location is a large element to be taken into consideration if one would be successful.

I believe that to-day America leads the world in the production of fine cut flowers, and, while we have many large establishments that we may well be proud of, I believe that the business is only in its infancy, and that we may expect to see marvelous progress in the future.

Chairman Taft: We have had very practical and helpful papers. As you are all aware, Mr. Pierson is one of the largest rose growers in the country and consequently a very successful one and he has given us of his own knowledge a thoroughly useful talk on modern methods. We are now getting out from under the glass and are going to take to the woods, and our next paper on commercial growing of forest trees is by Professor F. W. Rane, of Boston.

FOREST PROBLEMS.

F. W. Rane, Boston, Mass.

Mr. Chairman, Ladies and Gentlemen.—Mr. Rawson is responsible for my being here. I have just returned from the National Irrigation and Forestry Congress held in Sacramento, Cal., and not having a paper, you will excuse me for taking the subject up offhand. I am sure I will not want for something to talk about as the subject of forestry is boundless. Those of you who have kept in touch with forestry, even if not in very close touch, will recognize, I am sure, that at the present time the forest problem is one of the great economic problems before the nation. Until more recently our forest products have been of low

value and little appreciated; the time has come, however, when things have changed and to-day the forest product from the standpoint of an agricultural crop is of as much importance as almost any other crop.

As the President of this Congress said in his address, this morning, the main questions for discussion are: First, Where are we? Second, What are we doing? and, third, What are our prospects? Now, when we come to the subject of forestry, unlike my predecessor's subject in its being old in the sense of gradual growth, forestry on the other hand is not. We are just beginning to realize in this country that the forest product, as I have said before, is a great economic problem before the nation. We have thousands and millions of acres of waste land that heretofore were covered with beautiful forest growth. Particularly is this true in the eastern section of the United States. These lands to-day are practically idle. Heretofore, it has not perhaps been thought profitable to farm them from the tree standpoint, but I am sure the more we look into it, the more we will see where the grand possibilities are.

It seems to me the thing that is needed as much as anything else in our farming is getting down to some system and having a definiteness of purpose. We must educate the farmers of to-day, from the standpoint of taking, for instance, an inventory of the farm, selecting what are the best lands for concentrated agriculture and horticulture, from market gardening to fruit growing and field crops. There are plenty of lands on most farms, known as barren, stony, rocky, sandy, etc., that will produce a forest growth which will yield a profit in nothing else. I addressed a New England lumbermen's association last winter. Strange to say, in that large organization of men who have been in business for years, many of them, in fact the majority, had not even seen white pine seed. Now, gentlemen, what is needed? It is not the higher problems. When you come to forestry, it is the simple problems that must be demonstrated. People have to be taught that pine trees grow from seed and other equally fundamental forestry principles must be shown. It is the A B C of forestry that is needed the most.

I find in New England that more can be accomplished in the desired lines of forestry if people can be interested in the fundamentals first. Lumbermen who cannot be convinced at once that thinning is practical and who believe in cutting clear, nevertheless take very kindly to restoration by seeding and transplanting. Once the entering wedge is started ultimate results will follow. The men who purchase stumpage should be encouraged to study the practicability of restocking this land and before they will do this they must be induced to purchase land and all. Show them that in forty years as a long time investment, it is a sure investment and these business men are going to reforest our lands. Particularly is this true in our eastern section of the country where we have Nature as an assistant. Why, if we were to move out from New England, bag and baggage, I believe in fifty to one hundred years we would have a wilderness. What does that demonstrate? It demonstrates that we have a natural forest country and the condition that we are in is due to the wanton destructiveness of man himself. Our

people do not know what seeds are. Our forest seeds drop off the trees, quantities of them that are practically unused except in Nature's way. One man at a lumbermen's association recently in New England, a man who had been a State Senator and a very prominent man in the state, interrupted me when giving a talk before the association. I was explaining what we were endeavoring to teach in the Agricultural College, with which I was connected, and started out to say, that we teach the young men to collect pine cones, extract and plant the seeds, etc. "Now, hold on, right here," he said, "I have been a lumberman for the last thirty-two years, and during that time I have picked up hundreds of cones in my meanderings through the forest and I have yet to find a pine seed, after breaking open cones upon cones; how can you explain that?" To his great astonishment, I explained that the seeds dropped out before the cones fell off the trees and that the cones he had picked up probably had lost their seed before they reached the ground.

Now, I have letters upon letters from these men and their friends wanting to know where they can get seeds and seedlings and this year we have been trying in Massachusetts to get boys and other people to collect the tree seeds. Some of this work simply leads right along to later results.

The subject of forestry is so large and the opportunity so great that we cannot begin to deal with its commercial aspect and do it justice in this short talk. I have just returned from the Pacific Coast. I have read a great deal of what the government is doing and I had a good opportunity to look into it, to see a number of the men that are superintendents of reserves and talk with them and see how they are systematizing and carrying out the work. Now, it is certainly encouraging to see what our government is doing there. I think, however, we people in the East ought to awaken to an equal degree of interest in our forestry interests in the East. The same is true with the eastern lumbermen as in the West and in the Northwest. I visited some very large mills in the State of Washington that were interesting. I was told they were shipping into the States largely until of late; this year they have not been dependent on the United States alone, as ships come in and load up and their lumber goes to South America, Africa and Australia. They do not depend upon our country, but on the markets of the world; that shows that our export trade is increasing and that our lumber tracts from many sections which we are expecting to look to in the future are getting smaller. It is a world-wide problem, not just a national one.

Now, the next question is, What are we doing? We are endeavoring to do a great deal. I think the time is ripe, people are ready to act, but the main difficulty is to get at the central principle of how to establish fundamentals and build up the idea of a definite forest. The lumbering end of forestry, as the digging of potatoes, is after the crop is planted. It seems to me that the point is to get these lands back into forests. Let Nature seed them where she will, and let us assist her artificially when it can be done in a practical manner. There is no

trouble in collecting seedlings from the forest, or, better, having one's own nursery. The farmer can afford to start a nursery even in the garden and enlarge upon it as he gains experience. I visited D. Hill's large evergreen nurseries at Dundee, Ill., and I saw, with a great deal of interest, their beds of pine seedlings. Mr. Hill grows upon an area four feet wide and forty feet long, from ten to fifteen thousand seedlings. These seedlings have been sold at $4.00 to $8.00 a thousand in New England. We have been sending for the most part clear out to the prairies of Illinois and shipping these pines back to New England where they are indigenous. Every farmer ought to be able to collect his forest seeds just the same as he would any other crop. We ought to be able to grow pine seedlings for at least $2.00 a thousand and it is just as easy to grow them as almost any vegetable crop in the garden.

Lastly, what are our prospects? I think our prospects are bright, but, on the other hand, it is going to take lots of interest from the standpoint of men who have influence, like the men that compose this Congress. The subject of forestry is one of the great economic problems, not of the present alone, but the future. In our mines we can take out all the gold and silver and leave them worthless. On the other hand, if we take our lands and carry them on systematically, we can expect a financial annual income. Look at Germany. From some of her forest lands she is getting so much an acre annually. Their method of management would keep up agriculture and would foster industries.

There are many other points I would like to take up, the subject of forestry management, the subject of the price of lumber and why it is going up, for example. Box boards nine years ago were selling at $9.50 per thousand in Boston; this past winter, these box boards sold at $20.00 per thousand. When I first went to New England twelve years ago we were buying, for example, Georgia pine from the South, shipped into Dover, N. H., paying from $16.00 to $18.00 a thousand. At the present time, it is selling at $30.00 and upwards. When I was a youngster in southern Michigan, I can remember that my father bought pine lumber at from $12.00 to $14.00 a thousand, most of which was practically free from knots. To-day Michigan clear pine lumber is worth over $100.00 a thousand. In regard to forest fires, it is a question to be taken up by the various states who shall regulate it and get at the natural channel whereby we can stop fires; we can educate the lumbermen and farmers to make forestry a definite system of agriculture. It seems to me this is undoubtedly one of the great problems of to-day. Our National Government is doing a great deal; it is doing magnificent work along this line, but every state ought to be doing equally strong work and our individual lumbermen and our farmers as well. I thank you.

Mr. Manning: There is a state law in Massachusetts in regard to forest reserves and in their great public reserves the forests are retained primarily for their beauty, and this is a phase that ought to be

seriously considered, because of their value as an asset in the community and in the state. You all know how little of the primeval forest is now standing. I have in mind one instance in Wisconsin where a lumber mill was about to give up its operation, it having exhausted the territory that it had been operating in for perhaps forty or fifty years. Near the mill was a very beautiful grove of old pine, and in going along that stream, I called the attention of one of the owners of the company and pointed out to him the fact that if he could save certain lines of trees along the edges of the stream, that he could retain all that beauty and still make a very considerable cutting. Next year I went over the ground again and that mill had been pulled down and they had saved over a million feet of lumber. That shows what will be done by the owner of a forest in many cases if the matter is simply called to his attention. They do appreciate the beauty of the forest and are glad to save it. In a part of Massachusetts a grove of pines was about to be cut by a man who operated in a small way in the eastern part of the state and he was willing to yield up his cutting if the money be secured by subscription to warrant him in holding it. It was the only remnant of a very old pine grove that was in eastern Massachusetts.

Professor Lazenby: I am certainly gratified that this subject finds a place in this Congress of Horticulture. Forestry is perhaps somewhat alien to strict horticultural work, but I believe all horticulturists should be interested in this subject. The particular phase in Ohio that is being carried on now with some degree of success is the planting of those quick growing species that are valuable for posts and poles, mainly such as the catalpa, the yellow locust, the mulberry and osage orange. These are being planted now quite generally. I think out of our eighty-eight counties there are plantations in certainly eight of the counties to a greater or less extent that have been made within the last three years. In some of the counties many plantings had been made before, but in one of the central counties of the state over one hundred acres of catalpa were planted this past spring.

I should like, while I am on my feet, just to emphasize if I could the importance of timber growth, the importance of looking upon it, as Professor Rane says, as a farm crop. Farm forestry is the only forestry we will have in time, but then somebody has said that our whole civilization rests almost wholly on wood. I do not believe unless we think of it a little bit, that we realize how wood follows us right from the cradle to the grave. When we are born, the first thing we are put in is a wooden cradle or basket; as soon as we can sit up, we sit on a chair or bench that is made of wood, and we continue to use that material all through our lives. We never sit down to read without sitting before a table of wood, when we read a newspaper it is made of wood, and when we die, without exception we are put in a box that is made of wood. It is not, however, for the wood alone. I am glad that Mr. Manning made the plea on the esthetic side, and I hope that we will emphasize that side of the question also. There is great beauty in trees. I never see a fine speci-

men of a tree without feeling like taking off my hat and saying to it with all oriental courtesy and certainly all oriental sincerity, "May your shadow never grow less," and the only way we can keep the shadow from growing less is to plant trees and if ever one is cut down we should see to it that another tree is put in its place. The condition in Ohio is a little different from most other states, and yet it is no less a problem there than elsewhere. We have no waste land. There is scarcely an acre of land that people think they cannot use for any other purpose. All the state was so heavily wooded that the trees were regarded as a sort of enemy, and we have to excuse this lack of interest in forestry. When the great work of the state in the past was to cut down trees and get them out of the way, it was very hard to get them interested. We are turning a sharp corner, to get them interested in the growing of trees.

Chairman Taft: We would like to have Mr. Goodman tell us something about Missouri.

Mr. Goodman: Missouri is a very wooded state and we have had no occasion to plant. I wish to tell you of an instance or two which occurred where I had a hand in planting down in southern Kansas nearly thirty years ago. Robert Douglas, from Waukegan, Ill., was employed to plant a thousand acres of catalpa and other trees down in the southern part of the state, and it is hard to tell you how much money that thousand acres has brought in, the cost of which at that time was $25 per acre for prairie land. I cannot tell you the amount of money that land has brought in for the last twenty years, and the property to-day is worth a thousand dollars per acre with the timber that is on it. Mr. Monk, Mr. Underwood and others also have large plantations of catalpa trees, and I am probably safe in saying that had I planted catalpa trees instead of orchard trees, as I have planted them there by the thousand, I believe I would have made $100 where I have made one, and I have made some money in the orchard business. Down in Hutchinson, Kansas, are two large plantations, one owned by Mr. Yaeger, who tells me he has sold from that plantation of 800 acres, 10,000 trees a year. A part of the plantation is now making its third growth of forest trees in thirty years. He cuts those catalpas down and in one year a sprout will come and when grown it will get eight or ten and in some instances fourteen feet high and some of those have been cut twice within thirty years. They sell the poles for telephone posts and that sort of work. They do not get large enough for the lumber business, but it is still a money-making proposition in the western country.

Mr. Augustine: Mr. Chairman, I want to say that if Mr. Goodman planted anything but the speciosa variety I should consider his land worth less than it was before planting. The great danger in planting catalpa for timber is the difficulty of getting the genuine speciosa seed, and it is quite difficult to tell the genuine until the trees attain a considerable size. Therefore great care should be taken, as the other varieties of catalpa are worth little if anything for timber. There is no doubt in my judgment that Catalpa speciosa is among the

most valuable of all woods for planting in the central part of the United States, if not the most valuable.

Mr. Jesse Fell, probably the greatest tree planter of the Mississippi valley, whom some of you probably knew, once gave me a beautifully polished piece of Catalpa speciosa wood, telling me that it had been buried in the ground at Cairo, Ill., for 125 years, and also told me of a foot log that had been across a stream in southern Illinois for 65 years, and both of these were seemingly as sound when removed as ever. Mr. Fell also showed me how to distinguish between speciosa seed and that of other varieties. The fuzzy end of the speciosa is spread out the same width as the body of the seed, while the other varieties come to a point and curl up like "a dude's mustache," as he expressed it. To convince me of the hardiness of the tree he took a seedling tree in August about three feet in height, with heavy foliage and unripened wood and split it from top to bottom, stating that the cut would heal over by fall; later he called my attention to it and it had healed perfectly and was a tree with two branches.

I think that this society could be very helpful in assisting seedling growers and planters in securing the genuine speciosa.

Professor Rane: The great trouble in taking up the problem of forestry seems to be especially with our financiers, because they think it takes so long to get any returns. They seem to think it will be the next generation that will reap the reward of the work. Last winter I had some bills before our General Court in Massachusetts, and one of the men who appeared before the committee was Mr. Augustus Pratt, whose name I believe has been mentioned more or less in some of the publications in the United States Forestry Bureau Report. He said when he was a young man twenty years of age. upon his father's farm were three and one-half acres of land that was used for pasture purposes in which they were driving cows back and forth about a mile from the barn. He suggested to his father that this land be planted to white pine. He did the work himself, planting the seed by dropping three or four in a place. These grew until seven years ago, when he sold the crop at the rate of $5.00 a thousand on the stump and that area netted him at the rate of 50,000 feet per acre, which was $250.00. That was on land not adapted to general agricultural purposes, but land on which the brush had to be kept down in order to use it for pasture. He was a man seventy years of age, and he said that if he had waited until the present time the same stumpage would sell at $7.00 instead of $5.00, making therefore a net profit from one yield on the stump of $350.00 per acre. Now that experience can be duplicated over and over again and more particularly when seedlings are grown and are transplanted.

Speaking of the esthetic side we have in Massachusetts a Forestry Association of some eight hundred members, people that are enthusiastic and delighted to do almost anything; I think it was Mr. Manning who suggested retaining a few acres of large original standing pines; the people were delighted to buy it up and retain it. But, on the

other hand, our lumbermen are men that have been after the lumber end and it has been absolutely necessary to get in touch with them. Our lumbermen are business men and if we can get them to collect the seeds and replant, they will assist in the esthetic side by virtue of the fact that they will be covering up these unsightly conditions. I believe the time is coming when both the practical and esthetic men will get together and see that they are both working toward the same end.

Mr. McNeill: I hope that you are not overlooking the ordinary sugar maple in this connection. It is a tree that is very valuable for its sugar products, frequently adulterated, but the laws in the various states and provinces are now making it very hard indeed to deal in anything except the genuine sugar. There are a very few trees now and they are of very high value per acre as a lumber tree. There is an unlimited demand, the demand for maple timber is increasing much more rapidly than the supply, and I believe that there are many parts of the New England states, certainly parts of the Provinces of Quebec and Ontario that will yield large returns planted to sugar maple.

Dr. Galloway: There is a phase that has not been touched upon and that will probably be of interest to the members of the Congress, namely, the introduction and encouragement of growing bamboo in this country. The bamboo constitutes the chief wood supply of important countries like Japan and India, and has long been the only source of wood supply. The last two or three years we have had a line out in that direction and I have a man in Japan and in India making a special study in relation to their utilization in house construction, bridge material, furniture and so on, and we have secured the services of that man and are now importing considerable quantities of bamboo, with the idea of putting that out in the sections of the United States where these other woods do not thrive so well, namely, in some of the swampy regions of the South. Bamboo must be grown where it is quite wet and we have been doing considerable in the way of investigations in that line.

Professor Van Deman: While I am a fruit grower and have had a great deal more to do with the destruction of forests than I have had to do with in any way increasing them, because I have destroyed 110 acres of pine within the last three years in southern Florida and put it out to citrus fruits and some other fruits of a semi-tropical nature, and in Louisiana I am now engaged in deforesting over 1,000 acres of the finest Mississippi bottoms, yet it is something that has always deeply interested me, and this thought has occurred to me with regard to the preservation and reforestation of the Appalachian mountain chain, if we could in some way prevail on these great-hearted millionaires, if we could get those men to open their hearts and buy these vast tracts of practically worthless farming lands in the Appalachian mountains and donate to the government, it would certainly be a wonderful step. I do not know that such a thing could possibly be brought about, but if we could get it to become fashionable for

these great moneyed men to buy these lands and donate them to the public, we certainly would have made a wonderful step. If these forests could be thus preserved for all time to come, they would be a pleasure as long as our country lasts.

HORTICULTURAL CONDITIONS IN CANADA.

W. T. Macoun, Ottawa, Ont.

The title "Local Horticultural Conditions," given on the program, seems too restricted to apply to a country so vast as the Dominion of Canada; a country larger than the United States, including Alaska, by nearly 200,000 square miles. It might be thought, however, by those not knowing the conditions that Canada was, for the most part, a land of frost and snow, but when it is stated that in the prairie provinces alone, which are now being rapidly populated, there are estimated to be 171,000,000 square miles suitable for cultivation, of which at least one-fourth could be planted to wheat annually, producing an estimated crop of over 800,000,000 bushels, it will be readily seen that the future possibilities of the country are great. The United States at the present time produces less than 700,000,000 bushels of wheat and supplies her population of over 80,000,000 and has some for export.

It may be asked, What has all this to do with Local Horticultural Conditions? What we first desire to show is the great future of Canada, which has much to do in shaping horticultural conditions as the thousands of people who are pouring into the prairie provinces of Canada want fruit and, with the exception of tropical fruits, it will be grown for them in Canada.

The fruit areas of Canada are large, large enough to produce enough fruit to supply Canada, and the rest of the world for that matter, with some kinds of fruit, and particularly the apple, for many years to come.

Beginning with the great province of Ontario, 220,000 square miles in area, larger than the States of New York, Ohio, Illinois and Michigan together, we have large districts where apples, pears, peaches, plums, cherries, grapes and the small fruits can be grown to perfection. The province of Quebec is considerably larger than Ontario and while the tenderer fruits do not succeed, apples are being grown in increasing quantities yearly. From east to west in the provinces of Quebec and Ontario there is a belt where apples and other hardy fruits can be grown, of about 700 miles in length, while in the province of Ontario alone the best winter apples, pears and plums can be grown successfully over an area about 350 miles long by from 30 to 150 miles in width. The successful culture of peaches in Ontario is confined to the Niagara district and some points along Lake Erie, but the area suitable for growing this fruit is extensive enough to supply a large population.

Nova Scotia has long been noted for her apples. The most favored districts are the Annapolis and Cornwallis valleys where apples, pears, plums and cherries can be grown and where even peaches can be successfully raised. These valleys have a total length of about 100 miles and vary in width from six to eleven miles. Fruit culture is not confined to this district but over most of the province the hardier fruits can be grown successfully. New Brunswick has not yet developed her fruit industry to any great extent, but in some of the valleys apples and other hardy fruits of the finest appearance and best quality can be and are produced.

Prince Edward Island, the smallest province of the Dominion, produces excellent tree fruits, and owing to the late season the apples grown there keep better than in any other part of the Dominion.

British Columbia, the area of which is about 370,000 square miles, or more than twice the size of California, has large sections of country splendidly adapted to fruit culture. Like the states of Oregon and Washington, with which her natural conditions may be compared, British Columbia has a number of districts where the conditions differ from one another. Three of these are first, in the damp coast climate of Vancouver Island and the lower mainland; second, in the dry interior country where irrigation is, as a rule, necessary, and third, in the Kootenays, east and west, where irrigation is necessary only in places. In these districts all the best fruits, including peaches, can be grown to great advantage.

The prairie provinces of Manitoba, Saskatchewan and Alberta and the great districts to the north produce excellent bush fruits, but the tree fruits have for the most part not done well up to the present, although the time is coming when these provinces will be producing at least apples and plums of their own.

These are the possibilities of fruit culture in Canada. What are the actual facts?

When the last census was taken in 1901 the total number of fruit trees in Canada was 21,201,239, and it is thought that the number has increased by at least 10 per cent since that time, making the total number now over 23,000,000 trees, occupying about 410,000 acres, with a capital value of nearly $75,000,000.

There is an annual export of apples from Canada of from 1,200,000 to 1,500,000 barrels, the province of Ontario supplying about 1,000,000 of these and Nova Scotia from 300,000 to 500,000, a limited quantity going from some of the other provinces. British Columbia, which is now producing increasing quantities of fruits of many kinds yearly, is bending her efforts to supplying the prairie provinces, and has been very successful in placing her fruits on these markets in good condition. Ontario is a close competitor of British Columbia for this trade at present, but the increase in population is so rapid that it will take both provinces to supply the demand for a long time to come.

What are the influences affecting Canadian horticulture to-day? They may be discussed but briefly. The Dominion experimental

farms, now seven in number, work upon which was begun over twenty years ago, have played an important part in developing Canadian horticulture. There are the Provincial agricultural colleges, of which there are four, with their experiment stations which disseminate information both through the students who are trained, and by literature. The Provincial experiment stations and model orchards which in all are between fifty and sixty in number, are also doing much to demonstrate the possibilities of fruit culture in their several districts. Seven Provincial fruit growers' associations lend their aid in spreading a knowledge of the best methods of fruit culture and of uniting the growers for purposes of co-operation and legislation. The horticultural literature of Canada, although represented by few papers has done much to aid fruit, flower and vegetable growers.

The farmers' institutes and orchard meetings organized by the Provincial governments and assisted by the Dominion government are very practical and helpful. The horticultural societies assisted by the Provincial governments, of which there are about fifty in the province of Ontario, are doing splendid work in awakening a greater interest in horticulture and in spreading information.

All these factors affecting horticultural conditions and progress in Canada have been made to bear still better fruit by the co-operative movement which has in recent years made such strides in Canada. In the province of Ontario alone there are forty co-operative associations which now have a central organization where plans affecting the welfare of all the associations are discussed. These associations are doing much to make the fruit sold of a more uniform character and to bring better returns to the producer.

One of the best influences affecting horticultural conditions in Canada is the Fruit Marks Act, passed in 1901, and operative over the whole of Canada. By this Act growers are compelled to pack their fruit according to certain standards and are liable to fine if they do not do so. Inspectors are stationed at packing houses, on the markets and at the ports of export, who examine the fruit and see if it has been packed according to law. A marked improvement has been noticed in the Canadian fruit exported since this law went into effect. There are also standard apple barrels and boxes and baskets for the whole of Canada, all of which make the packages for the different fruits more uniform. It may be said that Canadians are taking advantage of all these influences for good and are adopting the latest and best methods in horticultural practice.

The development of floriculture in Canada has been rapid. Notwithstanding the more severe winters than those to the south of us, the plant and cut-flower trade has developed wonderfully, the increase in the value of trade being 400 per cent during the past ten years. It has been estimated that the amount of capital invested in greenhouse equipment, stock, etc., is $5,000,000, with an annual value of trade transacted of $2,000,000. This is but a beginning, as Canadians love flowers.

We must not omit the growing of vegetables, with which Canadians are well supplied. The truck interests are growing rapidly as our cities increase in population.

At the beginning of the 20th century Canada has about 6,000,000 of population or approximately as much as the United States had at the beginning of the 19th century. It has been said that the 19th century was for the United States but that the "Twentieth Century is for Canada." We believe that this is true in regard to horticulture as in other matters.

HORTICULTURE IN THE EASTERN STATES.

JOHN K. M. L. FARQUHAR, BOSTON, MASS.

Representing as I do at this Congress the section of this country first settled by the white race, it affords me the greatest satisfaction to point to the very early date at which interest in horticulture found expression. The very name of their vessel, the Mayflower, must have brought oftentimes to the recollection of the Pilgrims during their long voyage the fragrant and beautiful hedgerows of white or pinkish hawthorne, which, in England, they had called mayflower, a name which they soon bestowed upon the choicest and sweetest of the spring flowers of their adopted country. Long before they saw the mayflower bloom, however, the Pilgrims had raised their voices in praise of the beautiful garden products of the new world. The explorers they sent out, November 16, 1620, reported that they had found divers fair Indian baskets filled with corn, some whereof was in ears, fair and good, of divers colors, which seemed to them a very goodly sight, having seen none before, of which rarities they took some to carry to their friends on shipboard, like as the Israelites' spies brought from Eschol some of the good fruits of the land.

In 1621 Edward Winslow describing the new country wrote: "Here are grapes white and red and very sweet and strong also; strawberries, gooseberries, raspberries, etc.; plums of three sorts, white, black and red, being almost as good as a damson; abundance of roses. white, red and damask, single but very sweet indeed."

In the spring of 1621, the Pilgrims at Plymouth planted 20 acres of corn and six acres of barley and peas. The corn did well, but the peas were not worth gathering, having been sown too late and become sun scorched while in bloom. Numerous records of farm and garden crops planted by the Pilgrims have come down to us, and many evidences still exist in the locality they occupied of their zeal in garden work. At first the colonists of necessity imported tree fruits and vegetables for their sustenance. Within twenty years of the landing of the Pilgrims, Governor Winthrop of the Massachusetts colony at his farm in Charlestown, Governor Endicott of the Salem colony, Governor Prince of the Plymouth colony and Governor Stuyvesant of New Amsterdam had established nurseries, dealt in fruit trees or plants and were promoters of horticulture. Fruits, vegetables and a large variety

of herbs were imported and sold. Flowers were too great a luxury for the colonists and with the exception perhaps of a few roses, honeysuckle and pink milfoil, were not grown.

FLORICULTURE.

Not until the beginning of the eighteenth century was there opportunity to give much attention to flowers. About that time the wealthier citizens of Philadelphia, Boston and New York began to cultivate large gardens, usually arranged in terraces after the English style of that period, about their residences. One of these estates in the very heart of Boston, was the residence of Governor Belingham, and afterwards of Andrew Faneuil, who built upon it the first greenhouse in New England. On his decease it became the property of his nephew, the famous Peter Faneuil, who presented to the city of Boston the cradle of liberty. So beautiful was the garden that it became known as Faneuil's Seven-Acre Eden.

The revolution stopped further progress in horticulture until the country became settled under the new government. Then began an era in garden work, marked by a greater enthusiasm than ever before—enthusiasm which got its impetus from Washington, as he surveyed grounds at Mount Vernon and made plans indicating the location for trees and shrubs, many of which he collected or imported from Europe, and which upon arrival were planted by the same busy hands that earlier in their existence had cut down the immortal cherry tree and which later in life made pruning their favorite exercise—enthusiasm which drew with it the second and third presidents of the United States, John Adams and Thomas Jefferson, as well as many other notables of the eighteenth century—enthusiasm so perennial and vigorous that all predictions of progress have been more than fulfilled.

A. J. Downing, in his excellent work on landscape gardening, published about seventy years ago, said: "In the United States it is highly improbable that we shall ever witness such splendid examples of landscape gardens as those abroad," referring to Blenheim, Chatsworth, Woburn Abbey and Arundel Castle. That which Mr. Downing deemed improbable has taken place and gardens more elaborate and costly are being constructed at the present time in the United States than in any other country. Take for example, the beautiful gardens of James B. Duke at Somerville, N. J., which have been under construction for six or seven years, under the guidance of that genius of landscape art, Horatio Buckenham, employing 1,200 persons and involving an annual expenditure of $500,000 or more—a garden covering an area of 10,000 acres.

The pioneers of horticulture of 100 years ago were the wealthier citizens; there were really no professional gardeners then. The Pennsylvania and Massachusetts Horticultural Societies were organized by those interested amateurs. A similar society was organized in New York in 1818 but ceased to exist in 1837.

The first professional gardener to come to this country was John

Hasketh, who settled in Hallowell, Me., in 1797, and was not afterwards heard of. In 1824, André Parmentier, from Enghien, Holland, settled in Brooklyn and established nurseries where he gave an example of the natural style of laying out grounds. As the first American landscape gardener, Mr. Parmentier soon had many clients from all parts of the country, and even from Canada, to whom he furnished plans and plants. Mr. Downing considered that Mr. Parmentier had done much more for landscape gardening in America than any other individual. It is our turn to pay the same compliment to Mr. Downing, whose masterly works on landscape gardening, although written about seventy years ago, are still the standards.

In the economic line of horticulture there has been progress also. In New England we have now not only delicacies for the sick and luxuries for the wealthy, as our ordinary garden vegetables and fruit were considered in the early days, we go much further—we have gardeners who produce asparagus, cucumbers, tomatoes, string beans, melons, etc., as freely during December, January and on to June or July, as they are produced in the open ground in their season. One Newport gardener ships to his employer in New York a bushel or two of melons weekly. Another on the north shore of Massachusetts sent in during March a daily supply of fresh peas, sweet corn, etc.

COMMERCIAL HORTICULTURE.

In commercial floriculture the East has made great progress. I need only recall Lawson and Enchantress carnations raised by Peter Fisher of Boston; the work of the Waban Rose Conservatories, the recent new roses of M. H. Walsh of Woods Holl, Mass., which are quite as popular in Europe as they are here.

The concentration of wealth in New York ensures for the eastern florist the highest price for choice flowers. It also affords the private gardener the largest opportunity for the pursuit of his profession. Within the past five years there seems to have been much greater interest on the part of the wealthy class than formerly, in horticulture and rural life. This may be accounted for partly by travel, and a desire to have such gardens as are seen in Europe, but I think it is due rather to the fact that the automobile has rendered the country home more accessible to the business man. The interest of the well-to-do in horticulture is further manifested by their support and activity in societies for its promotion, as the New York Botanical Society, the Massachusetts Horticultural Society and others.

The three largest eastern cities have each much to be proud of horticulturally. Although the Bowery is no longer the Governor's garden, New York has a notable horticultural institution in Bronx, Philadelphia has her beautiful Fairmount park, sections of which are notable gardens of the past two centuries. Boston has always been at the front in horticultural work. No institution in the country has done as much as the Massachusetts Horticultural Society. The names of General Dearborn, H. H. Hunnewell, Marshal P. Wilder, C. M. Hovey

and F. L. Olmsted are too well known for the great works they have accomplished to necessitate my reviewing them.

But we have in Boston to-day one who is doing a greater work for horticulture than anyone who has preceded him. I refer to Professor C. S. Sargent. To him Boston and the country is indebted for the finest arboretum in the world, in which there are now growing 5,000 species and varieties of trees and shrubs. He has traveled over the greater part of the globe seeking new material and his collectors are now busy in hitherto unexplored regions, collecting new material for shipment to Boston with which to enrich American horticulture. Daily he spends hours in his office personally examining and describing species and varieties of trees and shrubs for his "Silva," the greatest work relating to horticulture ever undertaken in this country. The magnitude of the work at the Arnold Arboretum may be better understood when it is learned that 350 varieties of Crateagus have been planted. There are approximately 150 varieties of Syringa vulgaris, 70 of Prunus, 40 of Malus, and about 400 species and varieties of willows.

Another medium of horticultural progress is the Gardeners' and Florists' Club which has over 500 active members. Meetings are held monthly for the discussion of garden topics and a class devoted to the study of landscape gardening meets twice a week during the winter months. The magnificent private estates of the East, including those of Bar Harbor, Boston and the Massachusetts coast, Lenox, Newport, Long Island, N. Y., overlooking the Hudson, along the New Jersey coast, and in the vicinity of Philadelphia demand from the gardener the highest degree of energy and progress.

HORTICULTURE IN THE CENTRAL WEST.

L. A. Goodman, Kansas City, Mo.

If the West brags, "We can beat the world," we also prove it by our study and work, by persistence and energy we bring about rapid improvement and advancement. The horticulture of the West is fast coming to the front and the East is adopting many of its improved methods and advanced ideas. It is as though the westerner's sense of power and ability were an electric current derived from the consciousness of walking, living, working on a star—of having the privilege of living in a grand universe, and of improving at least a small portion of it. Our spirit is that of the pioneer trying new shores, going on to unknown plains and forests; his love of exploration and investigation persists, his faith in better things is never discouraged, but with these goes a balance of good sense, patience and work.

We are pushing the insect war, studying and applying sprays against insects and diseases. Our scientific men are practical, not buried in the laboratory, our growers are becoming scientific students. The movement for agricultural education is growing, the agricultural college and stations are spreading their information and their influence. The Prairie Farmer of Illinois helped to educate the people to

the need of public schools before 1855, when they were established by law in that state. Illinois early began the campaign for instruction in natural sciences and in 1872 secured a law requiring the examination in this line of her school teachers.

Because of our distances from markets, because of our extensive plantings, we have had to study the questions of storage and distribution. The cold storage methods are yet to be perfected and it now seems that it will be necessary to cool the fruit before it is put into refrigerator cars. New districts are opening up as markets for our large yields of fruits. The Northwest will support a vast population that will need fruit from the South. Not one-half of the land now in farms is improved, not one-fifth of the land area of the United States is improved. "The farms now existing," says the Secretary of Agriculture, "could be made to produce enough to feed many times the country's present population, were the best and most intensive agricultural methods of European countries applied, and still have a surplus for export."

Fifty years after the discovery of America and sixty-five before the landing at Jamestown, the first white man, a Spaniard, put his foot on Missouri soil. Two hundred and seventy years later (1812), Missouri was admitted as a territory, and in 1821 as a state. The development of the central west has progressed since then and is the result of the natural locality, the physical and geological conditions, the climate and also of man and his work. This latter begin in 1735, and seventy years ago reached as far as Kansas City in the person of Mr. Evans, father of our Col. J. C. Evans, of Kansas City, Mo.

From the influence of famous eastern pomologists, horticultural societies have been organized in most of our states, and the impulse toward study, experimenting and co-operation thus stimulated. The exhibitions, large orchards, our advertising, the changed plans of orcharding, of pruning, different choice of varieties—all have contributed to make this central west the wonder of the world, for its capability, adaptability, possibilities and financial ability. The pall of soil robbery which has devastated the fertility of all our eastern land has begun to settle upon our central west, but clover, cowpeas, alfalfa are being utilized to their best and we hope to see the great spectre averted and our soil fertility preserved. Each state has partaken in the advancement.

From Wisconsin, J. C. Plumb suggested in 1877, what has already taken place: the Northwest has indeed and according to the urgency of the case, created a pomology of its own; new varieties adapted to its climate have been produced both by introduction and modification of foreign kinds, and by the origination of seedlings on its own soil, by its own horticultural citizens. The Wisconsin Horticultural Society maintains four trial orchards, and so its good work goes on, and not for "Badgers" only but for neighbors as well. The horticulturists of Minnesota share in and assist in the producing and adapting of varieties; South Dakota and other states are doing the same. All are energetic and deeply in earnest. Kansas leads with a law requiring of

census takers, a collection of statistics regarding horticultural plantings and crops in the state. The fruit men of Ohio have for three generations developed the horticultural industry there. Longworth and others have produced new varieties and are encouraging this and other lines of the work.

Twenty years ago Kentucky in her Horticultural Society meetings was preaching better culture, larger attendance at meetings, less ignorant and credulous acceptance of tree-peddlers' stories, more imitation of Yankee enterprise (now we say western!), more of thrift and business sense, more attention to details, and more love for the business. We have climbed to a higher plane but the sermon is still good for us.

Iowa has helped along wonderfully. She has given us Budd and Secretary Wilson and C. G. Patten. Of the latter, "He has originated many varieties by cross-breeding," says M. J. Wragg, "that are perfectly adapted to any good orchard soil in Iowa or south Minnesota." Mr. Patten is honored in the presidency of the Northeast Iowa Horticultural Society, and he rejoices, that "under the most trying climatic conditions we find the most heroic efforts. Many things that were problematical a few years ago have now become fixed facts and beyond the experimental stage."

Colorado's fruits are sought by many, and fancy prices are the consequence. They are "self-sellers." Specimen boxes of apples sent to Germany and Great Britain created an *instant* demand. Colorado is among the leaders in effective horticultural inspection laws. The largest size fruits are not desirable in Germany because they are sold by the pound and the people there (with eight or more in family), want more than two or three apples to the pound. This mountain state is trying the dwarfing of peach trees, so that they can be protected in winter. Dry-farming, it is believed, will bring to the semi-arid plains homes, orchards and fields. Already she ships to twenty-two different states, besides Canada and Mexico. President Coburn of the Horticultural Society, says to the young men, "plant orchards, our apples are the most perfect and longest keepers produced in America."

Oklahoma is not afraid of radical propositions in the way of better rural education—provided that the means are immediately effective of improvement. Oklahoma's first report is a model of system, having its subjects grouped in sections, as: The Board of Agriculture, Gardening and Truck Farming, Fruit Growing, Field Crops, Dairying, etc., etc. Her peaches are already known in London.

Illinois has besides its State Society, three sectional ones, for the north, south and central portions, and fifteen experimental stations, each specializing under its own superintendent.

Michigan was the first state to have an agricultural college. It was established in 1857, though the Morrill bill was not signed by President Lincoln until 1862.

The advancement along horticultural lines has been truly marvelous. Some of us can well remember when the shipment of fruits from our central west began. First in a small way, but now trains of cars carry the products of our orchards to every section of the

country. We find ourselves dazed at the tremendous bulk of this business. Orchards small and commercial are constantly multiplying. Fruit growers are organizing to co-operate in the business of selling. Gathering and packing must be scientifically as also artistically done. All divisions of the industry demand system, conservatism, knowledge and experience—and still the plantings, the crops increase—so that even now the railroad and refrigerator car companies are pushed to extremities to supply the cars to carry to market the immense quantities of fruit products.

"What a field of research and promise is open before us!" said Marshal P. Wilder. "What a vast enterprise to fill our ever-expanding area with fruits suited to our various climes! What a noble and benevolent work, to furnish the luscious fruits of earth for future generations!" If after thirty years of organization President Wilder could express wonder at the great advances made, at the opportunities and resources before us, how much more can we, and the end not yet in sight. Our work is of great magnitude, embracing an entire continent, opening up to us new resources and demands, and calling for constant and untiring energy and enterprise.

"We have made great advances during the thirty-one years of our history, and experience from the best sources is flowing in to us every day. The spirit of investigation is now thoroughly alive, and we have opportunities for improvement such as have never been afforded to any other Pomological Association on the globe. Our resources are abundant and so kindly does Nature co-operate with us under the benign influence of man, that he can mould her almost to his will, and make of the rough and acrid wilding a most beautiful and delicious fruit, and thus go on producing indefinitely as fine varieties as we have ever seen. When we review what has already been accomplished in a country so varied in soil and climate, who can set the bounds to our progress?"

LESSON FROM THE CANALS OF MARS.

Thirty years ago an Italian astronomer noticed what appeared to be canals on Mars. This discovery has been verified by an American, Percival Lowell. The lesson to us is *unity*. The canal system covers the planet reaching from each polar sea to the equator. They are constructed on geometrical lines by skilled engineering. Without them Mars would be an arid desert, and all life would perish, but as it is, each spring sends the water to irrigate the whole planet and great circles and bands of vegetation come to life. What a centralization of effort is revealed here! What a unity of interest binding that globe!

There is evidence of thorough and sympathetic organization of all the people in labor and love for a work that covers the entire planet. Here is an ideal for us (for them achieved) to strive towards and believe in. Our efforts should be (and are becoming more and more) united in study, in labor, and in recognition of the human brotherhood on this planet, earth, of the common needs and aims of men. We must join forces, every state with every state, every nation with every

other, every one of us with every neighbor, the near at hand and the distant ones, all for the subdual of this star-world, that the best of life here may be shared by each. There are many of us on this speck of a world, but there are many yet lacking their fair share of its products, its beauty, its joy. President Aylesworth of the Colorado Agricultural College has said, "Let us work shoulder to shoulder with our faces set toward a high ideal and don't let anything make us miss our goal."

OUTLINE OF SOUTHERN HORTICULTURAL CONDITIONS.

F. H. Burnette, Baton Rouge, La.

In the time given for this topic, it will be possible to touch only a few points. Speaking from the standpoint of the middle gulf section, there is present to-day a feeling of serious unrest in agricultural affairs, due to the onward march of the cotton boll weevil. This insect no doubt will eventually infest the entire field of cotton growing, and cause a complete change in the agricultural practices of the whole section. In this general shake-up, horticultural pursuits will receive their share of attention. Already floods of inquiries are coming to the experiment stations, seeking the best information concerning many lines of agricultural endeavor outside of the growing of cotton. The growing of vegetables, fruits and nuts has received marked attention. The lack of canneries and evaporators precludes the growing of the common horticultural products, except for local city use, or long-distance trucking along the trunk lines of railways—hence there are many things to come before this can be changed. Along the trunk lines are large truck sections, where immense quantities of vegetables, berries, and fruits are grown and sent to the far North. These sections are prosperous, and while the growers have difficulties to overcome, the boll weevil and the cotton gambler are not to be found among them. These horticultural sections are increasing in size, and with the advent of new railway lines will become great factors in the material welfare of the South. In Louisiana, the truck sections approximate three millions of dollars in value of products. These products include the vegetables, berries and oranges. The growers are now being organized, and they produce and market their crops in a systematic manner, which insures the best returns.

The greatest disadvantage to be found is connected with the labor question, which while it differs slightly in color from the labor question in other sections is just as difficult to overcome. The leaders in our horticultural affairs are taking advantage of everything that is up-to-date in the cultivation of their crops. Improved implements are used, intense systems of cultivation are employed and the use of the spray pump has become familiar to them.

The newest departure in horticultural affairs is the interest that is being developed in the pecan industry. People generally throughout the gulf section are beginning to realize the possibilities connected with the growing of pecans commercially. Pecan orchards are being set

with the finest varieties, and there seems every reason to believe that the South, unrivaled as it is in the production of this, the finest nut in the world, will reap great material benefit from the industry. Orchards of several hundred acres are now being planted to varieties that seldom find their way to the market to-day. The United States spends several millions of dollars annually for nuts which are inferior to the pecan in food value; surely there is great encouragement for this branch of horticultural effort.

The time is ripe for other efforts along horticultural lines. Untold quantities of various canned products are consumed in the South, that could be grown and put up in the South. The character of the labor to-day prevents this, but the time will come when the South will produce her share of canned goods. From a general survey of southern conditions, surely the future is full of promise to the careful southern horticulturist.

Chairman Taft: We have with us a gentleman from Alabama, and I want to ask him to tell us something about the fruit and horticultural conditions in Alabama. I want to call upon Professor Mackintosh, of Auburn, Alabama.

Professor Mackintosh: I have not put my thoughts on paper and so I cannot do justice to the subject. We have big problems to look after and we need more light. The growing of the cotton, as one crop system, prevails to too large a degree, but the coming of the boll weevil is one thing that is going to change that, and getting rid of the cattle tick, that was spoken of this morning, and I look forward to many things to take place that will make the South very much better and to grow better fruits than it has grown heretofore.

OUR NATIONAL FORESTS.

Wm. L. Hall, Washington, D. C.

Massed together and laid over Eastern United States, the national forests would cover New England, as far southward as the south line of Virginia and westward including Pennsylvania and most of West Virginia. They are not massed together, nor do they lie in Eastern United States. They are separated into 156 unit areas, and they lie entirely west of the Mississippi River. For the most part they are west of the east line of Colorado. Not considering Alaska or the insular possessions, their extent is 146 million acres, or 7 2-3 per cent. of the total land area.

PURPOSE AND USE OF NATIONAL FORESTS.

The national forests are all portions of the national domain which have been set aside permanently for forest production. Two great purposes are fulfilled through a forest so set apart. It may be chiefly valuable for the production of wood, or for the protection of the water supply. The law underlying the establishment of national forests

recognizes both purposes, and it would be hard to say in the case of the present national forests which purpose is of the greater importance.

A national forest, while setting apart the land for forest production, does not withdraw it from other uses, so far as it is adapted to them. The great industries of agriculture, mining, grazing, and lumbering are not excluded, but may go on to such an extent as will not interfere with the main purpose for which the forest is set apart.

A glance at the map of the western states shows how irregular in most cases the boundaries of the national forests have been made in order to include only lands of greater importance for forest than for other purposes. The boundaries are made irregular to include the mountain ranges and to exclude agricultural lands which lie in the mountain parks or in valleys along the streams. But however carefully the boundaries are located, large tracts of a million acres or more, such as many of the national forests, can not be made entirely to exclude agricultural lands. Recognizing this fact, the law now requires that the agricultural lands within forest reserves shall be thrown open for homestead entry. As rapidly as possible the national forests are being examined, and lands suitable for agriculture are being opened for settlement.

Mining is not inimical to forest production, and hence goes on in the national forests unrestricted. A vigilant outlook is maintained, however, to prevent the taking of valuable timber lands through mining laws where no evidence of minerals exists.

The mountain ranges of the West, which constitute the national forests, contain large areas of grazing lands. For many years these lands have been the range of millions of live stock. Their exclusion would mean great and unnecessary loss to the live-stock industry of the West. On much of the forest land grazing can go on, and does go on, to an extent not dangerous to the reproduction and growth of the forest. During the season of 1906, 1,105,148 cattle and horses, and 5,763,100 sheep were grazed in the national forests, and the income from grazing for the season was $550,000. Under management, the range is rapidly improving. Its carrying capacity may be expected to increase constantly for several years.

Lumbering also goes on in the forests belonging to the government. As one of the prime objects of the national forests is to produce wood, it follows that this timber, when mature, must be cut and used. There is a large amount of mature timber in the western forests, and it is being cut wherever there is a demand for it. It is not cut by the government; it is sold on the stump to lumbermen, who cut the trees under the supervision of the Forest Service. During 1906, the income from lumbering was $386,000.

In addition, the forests are being used in many other ways—for the development of water powers, for the location of hotels, stores, summer resorts, and for various rights of way. For some of these purposes a fee is charged.

Altogether, over a million dollars was received as returns from the forests in 1906, which shows considerable use on the part of the

people. The use should and will greatly increase. For 1907 the income from grazing was $875,000, as against $550,000 in 1906. The total income for 1907 will probably be 50 per cent greater than for 1906.

Not only are these wild lands being used—they are being developed. The use which is being made of them by the public results in development. Railroads, wagon roads, trails, canals, flumes, power and telephone lines, reservoirs and bridges are being built, many of them at private expense. In addition, the government itself is constructing many permanent improvements. During the present season it will construct 2,200 miles of telephone line, 2,500 miles of trail, 100 bridges, 500 rangers' cabins, 200 miles of roadway, and 500 miles of fence.

The result will be to open up the forests for greater use. New forest and grazing areas will be made accessible and better arrangements made for handling the business. The forest-system of the government will undoubtedly be self-sustaining within a few years.

INFLUENCE OF NATIONAL FORESTS ON THE WESTERN TIMBER SUPPLY AND ON THE PROTECTION OF WESTERN STREAMS.

There are estimated to be upwards of 350 billion feet of timber in the national forests, an amount large enough to supply the United States for all purposes about three and one-half years (for our annual use is about 100 billion feet). Considering the country west of the Mississippi River, where are found only 25 per cent of our people, the national forests would supply wood for its uses for fourteen years. But the main part of the trans-Mississippi timber supply, namely, about 750 billion feet, is in private hands. This total supply of 1,100 billion feet should be sufficient for the population west of the Mississippi at the present rate of use, for over forty years. With this large present supply and the great area which the Government from this time on will have under protection and management, it is safe to conclude that the timber supply for the western part of the country is on a fairly good basis.

Considering stream protection, we may note that every important western stream which rises in the high mountains has its headwaters protected by national forests. There will be no further denudation of these important watersheds. The timber, while of course it will be cut, will be cut conservatively, without impairing in any degree the protective value of the forest cover. Protection from fire will result in the reproduction of the forest in some localities where it has been swept away. Important watersheds where natural reproduction is hopeless will be planted. The western water supply, like the western timber supply, is in good condition, and will be constantly improved for many years, because of the protective influence of the national forests.

SHOULD THE NATIONAL FORESTS BE EXTENDED TO THE EASTERN STATES?

The states east of the Mississippi originally were almost entirely wooded with the finest commercial timbers—white pine in the North,

hardwoods in the central states, and yellow pine in the South. It needs not to be repeated how these forests have been cut and destroyed. These states are estimated to contain now only about 900 billion feet of lumber, which, according to our present rate of use, means only twelve to fifteen years' supply.

The Federal Government has no forests anywhere east of the Mississippi. The states have reserved about two and one-half million acres. All the rest is under private ownership, which system has resulted in the reduction of the commercial forest from the original to the present condition. Private ownership shows little evidence of changing from the original methods of exploitation. Lumbering still means the exhaustion of the forest. Over most of the region fires still burn without hindrance. The forest is being used faster than ever before. The increase in the use of wood equals if indeed it does not exceed the increase in population. As an index of the changed situation in the timber supply in the eastern states in ten years, one has but to note that the prices of our leading woods have advanced from 25 to 75 per cent.

From whatever side the timber situation in the eastern states is viewed, one is forced irresistibly to the conclusion that remedial measures must be taken, and that quickly, or we shall be in the midst of a timber famine.

The only remedy yet proposed which meets the situation is for the Federal Government to undertake the establishment of national forests in the eastern states similar in purpose to those in the West. There is but one region in the East where such a system could properly be established—the Appalachian Mountains. This is the only region in the East more valuable for timber than for other crops and at the same time the source of important interstate streams.

EASTERN NATIONAL FORESTS WOULD HELP TIMBER SUPPLY.

The importance of national forests to help the eastern timber supply, especially the hardwood supply, needs strong emphasis. Although the Appalachians bear pine, spruce and hemlock, they are essentially a hardwood region. They probably contain more than half the nation's available supply of hardwoods, and in 1906 they furnished 46 per cent of the country's hardwood lumber. The Appalachians are the only hardwood region we shall have in the future. In other regions hardwoods stand upon agricultural soil, where the forest must rapidly give way to farming. The Appalachians are fundamentally a forest region. They are profitable for no other use. Farming fails, fruit-growing fails, and likewise grazing, because in the principal mountains a cover of grass is insufficient to hold the soil in place.

Through poor methods of cutting and lack of protection, the entire region is producing but little wood compared with what it might produce. The great value of the government forests, so far as timber is concerned, would be that they would allow the mountains to produce the timber which they are capable of producing and of which the coun-

try from this time on will stand in greatest need. There is no question but that with right management the Appalachian Mountains would produce permanently 75 per cent of the hardwood timber required in the United States.

The need of Appalachian forest reserves from the standpoint of hardwood timber supply is a great national need, affecting directly all the people of the United States.

IMPORTANT FOR STREAM PROTECTION.

The number of important rivers which rise in the Appalachians far exceeds those which have their source in the western mountains, and they directly affect the welfare of a vastly greater number of people. As the forests have been cleared from the mountains everywhere in the Appalachians, the extremes of high and low water have been increased, water powers have decreased in efficiency, mountain slopes have been eroded, and the sediment has filled the streams and harbors below, navigation has been retarded, and property along the streams has suffered damage from the increased floods. It is difficult to realize the damage which is possible in these directions. The United States Weather Bureau made a careful estimate of the damage along the Ohio River in the floods of January and March of this year, and found that the property loss, not including damage to soil and river channel, amounted to $9,900,000. To this must be added also the loss of time, which in itself would amount to millions, and the depreciation of rentals, which in Pittsburg alone has amounted to a huge sum. Taken together, this represents but the loss during three months in two tributaries of the Ohio River. It is but little compared with the losses we must expect over the whole region if the mountains are not kept under forest.

Correspondingly great will be the gain to our industries if the nation does hold these mountains for purposes for which Nature intended them.

A NUMBER OF APPALACHIAN FORESTS NECESSARY.

How extensive and where the Appalachian forests will have to be, no one knows at present. Acting under instructions from Congress, the Forest Service is now preparing a report in which these points will be covered. This report will be submitted at the next session of Congress.

To protect the important watersheds there must be, not one great area in some particular part of the mountains, leaving other sections unprotected, but a number of areas, each large enough and properly located to protect one or more important streams. Such reserves would have to be irregular in outline, and would frequently be disconnected. While serving for the protection of streams they would also improve the timber supply. The fact that they may be scattered would also be of advantage in that the timber could more readily be distributed from them.

This assumes that the timber from these reserves will be cut as it reaches maturity. It is needed and must be used. But we may remember this, that the mature timber can be cut and the forest be in no wise injured in its protective, scenic, or sanitary value. This is the advantage of forestry over lumbering.

OBJECTIONS.

As with all national movements, objections have been raised against government forests in the Appalachians. Fortunately, these objections can be met. Some of them are as follows:

1. The government would have to buy the land.

This is true. The title to the land has passed to private hands. Unlike the case of the western national forests, the government would have to buy and pay for the land before it can take it under control. But the money would not be lost. It would begin to come back in a few years, just as the money comes back which the government invests in the irrigation of western lands. Timber land is so sure an investment, that the government stands to gain rather than lose in the undertaking. Had it purchased these lands eight years ago, when the matter was first pressed, its profits already would have amounted to millions.

2. Such an undertaking would lead to endless expenditure on account of the vast areas to be purchased.

The Forest Service is covering this point in its present investigation and will report to Congress next winter the extent of the lands which should be purchased. Congress will then be able to see the size of the undertaking before it begins it.

3. It is a problem for the several states, not the Federal Government.

So far as the forests are necessary to insure the timber supply, it is by no means a state problem. It is incumbent upon no state to provide a timber supply for the rest of the country. So far as the forests are necessary to protect the watersheds of interstate streams, it is not a state but a federal problem. By no sort of logic can it be established that North Carolina must protect the headwaters of the Yadkin and Catawba Rivers because the water powers of South Carolina are being damaged, nor that West Virginia must protect the Monongahela because Pennsylvania, Ohio and Kentucky suffer on account of the floods which arise on its denuded watersheds. Practically all the important Appalachian streams are interstate streams. Both from the standpoint of timber supply and stream protection, the situation is one which distinctly calls for federal action.

4. Appropriations for this purpose will open the door to fraud.

In the light of the government's experience with its present commercial operations, this objection cannot be supported. The government to-day through its own employees is conducting far larger enterprises without the slightest trace of corruption, indeed in the settled conviction that it is thereby pursuing the most economical course.

Government engineers are building the Panama Canal and great irrigation works; are building them cheaper, better and faster than private capital could build them. Government engineers and architects are building great battleships; are building them as efficient in all respects and as cheaply and quickly as private contractors can do.

Let it not be said that the government cannot handle large business affairs. Present experience shows that it can. If it can dig the Panama Canal, construct great irrigation systems, and build enormous battleships, it can purchase and manage the lands necessary for national forests in the Appalachian Mountains.

EVENING SESSION.

CHAIRMAN, PROFESSOR S. A. BEACH.

CIVIC HORTICULTURE AND CIVIC IMPROVEMENT.

WARREN H. MANNING, BOSTON, MASS.

Civic improvement is the work that organizations and individuals plan and execute to improve their surroundings and civic horticulturists are they who so cultivate ornamental plants in public or private grounds as to give pleasure and benefit to the public as well as themselves. Ornamental plants become in the hands of the civic horticulturists the garments of civic improvement, for they clothe parks, buildings, lawns, streets and landscapes.

The broadest aspect of the civic improvement movement, however, lies in permanently preserving and improving the natural beauty of a region and securing convenient and attractive access thereto for all citizens. Toward this end vast numbers of powerful interests have been unconsciously working while they have at the same time been destroying nature.

Railroads are now the national parkways to nearly all sections having special landscape interests, and they recognize very clearly the value of such interests as an asset in the extension of their lines, in the acquirement of land adjoining their right of way to protect beautiful outlooks and in the almost universal improvement of right of way and station grounds; they often are the only attractive objects in unattractive outlooks. Their rails have now largely superseded the river and canal with all their charm for the traveler, but having a limited out look, as compared with the rapidly shifting vistas and broad panoramas of the train.

Electric roads, state roads, merging into national roads are opening up regions of even greater beauty and variety and electric cars and automobiles are making the range of pleasure driving so wide now that a fraction of a day's ride only is required to cover a city park system, although some cities have included therein as much as one-sixth of their total area and the average park area of the fourteen cities above 300,000 population is one in twenty-eight acres.

City systems have broadened to county systems, as in Essex County,

New Jersey, and the Boston Metropolitan system extends into four counties. There are also many state parks, water supply, irrigation and forestry reservations of a thousand acres more or less, national military reservations of various kinds—some of six thousand acres or more, and the national forest reserves of 140,000,000 acres.

The engineers, civil, railroad, hydraulic, army and others;—the forester, the landscape designer, industrial concerns, real estate men and many men in business and professional life, who have urged or directed movements for public reservations have been responsible for much of this.

The horticulturists have generally taken an interest in this work and the professions that have been especially identified with the development of public reservation systems; such as the designers of landscapes and foresters, have been quite largely recruited from the horticulturists' ranks. Dr. John A. Warder, who first warned against forest destruction and organized one of the first national forestry associations, was a horticulturist. The Honorable J. Sterling Morton, who established Arbor Day, was a farmer. Frederick Law Olmsted, who established the modern practice of designing landscapes, went from his farm to plan and build Central Park in New York.

I have indicated progress already made toward a national system of public reservations, that will include and connect the present isolated holdings, as well as a large share of land having great natural beauty, but from which little revenue can be produced from crops or industries under private ownership. It is such land of little value that should be included in public reservations, rather than that having a high productive and taxable value.

The permanent value of such work in any locality is greatly enhanced if the town and the individuals direct their efforts toward the ultimate completion of a comprehensive plan that has been carefully studied out in advance. Such a plan ought to be made to fit the surface, that is, to take advantage of the natural beauty of surface, contour, rock outcrop, water and vegetation, transportation lines, drainage, buildings and other artificial structures, and provide for the future development of such features in a way that will gain for the community the maximum of convenience and beauty, with a minimum of expenditure in construction and maintenance. Such plans should, of course, be sufficiently elastic to provide for the contingencies of time. Generally in such a plan upon an irregular surface, roads would follow valleys, gradually climb the slopes on curving lines and easy grades with a minimum of cut and fill, while on flat lands they would be straight with diagonals running from centres on lines of greatest travel.

This outline of the broader aspect of civic improvement should lead to a greater appreciation of the importance of civic horticulture. Each horticulturist, and you will note that my definition may include about every one who can control a piece of land or a window box, should be vitally interested in and help to advance the civic improvement movement of his own locality. The work of landscape and ornamental gardeners, employed by towns and commissions, is planned and executed

for the public benefit and many owners of private land do consider the public interest in the arrangement and planting of their own ground; this even to their own disadvantage when they throw their own grounds wholly open to public gaze.

If this civic horticultural work could be directed toward the ultimate execution of the preconceived plan referred to above, very much more effective results would come from the same expenditure of effort and money. In such a plan, after main subdivisions, the means of intercommunication, park, garden and play-ground reservations, the location of civic and other centres, are prepared to cover the town site and its future extension, there should follow detailed plans and estimates. Of these the civic horticulturist would be especially interested in:

(1) The treatment of natural vegetation to develop its greatest beauty and usefulness and the treatment of artificial plantations. Upon such details would be indicated roads, trails, vistas, thinning, the selection of trees and shrubs and the additional plantations of exotic trees, shrubs and herbs.

(2) Street plans, showing trees best suited to each street and an arrangement of trees that will give desirable uniformity, but not necessarily a uniform spacing that disregards egress and outlook from private places.

(3) Suggestions for the treatment of front lawns that in residential sections are so often kept open through the length of the street, giving a greater breadth and openness that distinguishes our streets in a manner that is distinctly American. The objection, however, to this is, that the owner has no privacy in his home grounds.

(4) Suggestions to owners to overcome the above objection by establishing screening plantations between the front lawn that is held open for the pleasure of the public and the back lawn and gardens made private for the family.

(5) Suggestions regarding the use of enough of one plant in these private plantations to give each street a special distinction. One street for example having lilacs at intervals throughout its length, another magnolias, another hydrangeas, etc.

It is such suggestions to the general public, backed by an efficient organization and a definite plan, that will help to make the whole town a park and secure the active interest and assistance of all citizens. I conceive it to be the duty of village improvement societies and park superintendents to direct their attention to the preparation of such an organization and plan rather than to expend all their efforts and money on a small area or upon minor improvements at haphazard, or upon general clearing up operations, street lighting, and the like, that should be executed by the town officers, through their regular appropriations.

There is now a rapid trend toward the ideal I have outlined, not only in cities, but in many small towns. My own experience is that with such plans and public interest, the whole aspect of a community will be transformed in from five to eight years. There must of course

be a leader in the movement, however, who is big enough to grasp the whole conception and persistent enough to hold fast against criticism until it is well under way. It always means self-sacrificing effort on the part of the few, as does any advanced movement for the general welfare, but the results and the ultimate general approval of those whose opinions are of value, will well repay this effort. I believe it is not necessary, however, to place the work on a sentimental ground for almost invariably the execution of a well considered plan leads to increases in land values that make it a good business proposition.

No body of men are in a better position than the ones before me to advance such work, for many of you are educators in charge of parks, experiment stations, schools and large horticultural establishments frequented by many people of influence and education. You can help advance the school garden and vacant lot farms, one of the most potent new agencies for the development of efficient civic horticultural knowledge among the mass of people. You can lead in the preparation of such plans as I have outlined. You can supply a vast amount of useful information through bulletins and catalogues to those that you reach directly.

There is need in the promotion of the work of civic horticulturists of a better class of material for plantations. We need pedigree trees of various species. I need not describe to you the numerous forms of the American elm. Some with upright trunks and branches and a graceful canopy of foliage forming ideal street trees. Others round and symmetrical. Others drooping to the ground. These forms of the American elm are not cultivated. We only have forms of European trees propagated at high cost by grafting and offered in small quantities. We need also the various marked forms of the red cedar, some very narrowly fastigiate, others broad spreading, for our formal gardens.

Those who know how many of the nursery purple beeches and Weir's cut leaf maple are raised from seed and who have noted the predominance of a special form of native trees about the parent will recognize the practicability of raising pedigree trees.

More care is needed to secure hardy forms of native trees. For example, trees of the Douglass spruce from the Oregon and California coast range are not hardy in the East, whereas those from the Rocky Mountains are. Black walnut, red-buds, calycanthus and other plants further north are quite hardy.

There is need of a more general knowledge of the value of native collected plants in artificial plantations and the success which attends the collection of many species if done in a proper manner. It opens the way for pleasure outings in which the family may secure material for the decoration of their home grounds and wild gardens. When you know that practically all the trees, shrubs and hardy perennials planted upon these Exposition Grounds are natives collected on or near these grounds; that many of the ground cover plants were collected in the beginning at the cost of thirty cents per thousand, the deciduous shrubs collected and planted as low as $20.00 per thousand, you

will recognize that the natives may fill a place both as regards cost and immediate effect that nursery plants cannot fill

Nurserymen should grow more well furnished large specimens of shrubs and trees, more large and well trained vines, more formally trained shrubs and trees for gardens and pots and they should recognize that there is a growing demand for the healthy vigorous forms that are easily propagated and can be sold at a low rate in large quantities, and a declining demand for abnormal horticultural forms that are expensive and difficult to propagate.

In closing let me call attention to the statement of the morning's session regarding the need of a greater unity of action of all the various occupations represented by this Congress.

Mr. Withers: Mr. Chairman, I should be glad to say a few words in reference to Mr. Manning's able paper on Civic Improvements. I have been connected with civic improvement work in different parts of this country for some years, and I heartily endorse all that Mr. Manning has said.

There is one subject that I am particularly interested in just now, and that is the treatment and care of the trees in different towns and cities of the United States. I am at this time engaged on the restoration of one of the largest and most historical trees in the country, which is called the "Liberty Tree of Maryland." It is a tulip tree (Liriodendron tulipifera). It is 104 feet 3 inches high, 37 feet 3 inches in circumference, at the base. It has a cavity which is open on one side to a height of 20 feet, the opening will average 4 feet in width. After cleaning out the decayed wood, it leaves the tree standing on a shell the average thickness of which is about 15 inches. This great cavity extends from the main trunk up into a huge branch the entire length of which is fifty feet six inches from the ground level. After cleaning it out and washing with a fungicide we filled this great cavity with reinforced concrete, fifty-one tons of sand, stone, bricks, cement and iron being used. The foundation of this concrete centre extended 2½ feet below the surface of the ground. The age of this tree is estimated at over six hundred years. It was under this tree that the treaty between the Colonists and the Susquehannock Indians was signed in 1654. The Liberty speech was made here about 1776, General Washington being present at the time. A reception was given to General Lafayette in its shade in 1825. In 1820 a native of Annapolis, a Mr. Claude, wrote an ode dedicated to this old tree bidding it good-bye because he thought it could not live much longer. He spoke of its crumbling away, which proves that a great cavity must have existed at that time in its base.

During the Civil War the soldiers were encamped around the tree, the college building being used for hospitals, and while the soldiers were encamped there a large branch fell, tearing away a great piece out of its side, causing the cavity to extend upward. Our filling is now in place, and there are no dead limbs, or decayed spots, that have not been removed or treated. With a slight feeding, I think, the tree is good for another five or six hundred years. I mention my work in

this connection because, I think, it is the largest undertaking of its kind ever attempted. I also think that it is the largest tree anywhere in the eastern or middle states, and should be glad, if any member of the Council, should he find a larger one, let me know of it.

We are also treating a fine avenue of tulip trees on the estate of Mr. James T. Woodward, at Collington, Md.; amongst them are some giants, one or two of them being about nine feet in diameter with some very bad cavities to fill. We are also treating the street and campus trees around St. John's College, Annapolis, Md. Here I find great damage done to the trees by the wires of the electric light, telephone and telegraph companies; they having used the trees as guys for their poles, the wires are girdling and fast killing the huge branches, and in many cases the entire tree. I called the attention of the authorities to this fact, and advised them that the companies should remove their wires, but if they wished to accommodate the different companies by allowing them to use the trees as guys for their poles they could do so without any injury to the tree, and I showed them how an eye-bolt could be put through the tree using a plate and nut at the straining point, which we would countersink into the tree, and then cap with cement, so that the bark would grow over the bolt. The companies could then transfer their wires from the tree to the eye of this bolt, which would give them a much more perfect guy than the ruinous method adopted. All parties were very much pleased with this suggestion, and the companies authorized us at once to place the bolts in position at their expense.

I think that every town and city in the United States should insist wherever the wires of the electric light, telephone or telegraph must run through or near the trees that the running of these wires through the trees and the guying of the poles to the trees should be done under the supervision of a competent forester. In doing so the trees could be utilized without any injury to them whatever.

The preservation of the tree, I think, is one of the essentials of civic improvement. Mr. Manning in his article mentioned the fact unknown to the general public, that there was a great deal of private interest in civic improvements. This is, I think, clearly shown in the case that I have called to your attention.

The work I am doing on the old Liberty tree at Annapolis is the gift of James T. Woodward, of the Hanover National Bank of New York. Mr. Woodward is much interested in St. John's College, and in the old Liberty tree. Few people realize how great a gift this work is.

LANDSCAPE GARDENING.

JOHN C. OLMSTED, BROOKLINE, MASS.

Landscape Gardening is the art of improving grounds for use and enjoyment with due regard to beauty.

Landscape gardeners should be educated in architecture, civil engineering, and horticulture—in architecture, because all works of land-

scape gardening should be designed or planned in a way analogous to that in which buildings are planned to combine utility with beauty; in civil engineering, because to plan the improvement of ground involves surveys, topographical maps, draughting of plans, profiles, cross sections, drainage and masonry plans, specifications and other technical training such as civil engineers get; in horticulture (including arboriculture), because almost every landscape gardening design calls for either trees, grass, shrubs, vines, hardy and tender plants or some or all of these.

To many it may seem unreasonable to place, in the education of landscape gardeners, a training in architectural design ahead of a knowledge of civil engineering and of horticulture. It is true that most of the time of architectural students and practitioners is taken up with matters that would be of comparatively little or no use to the landscape gardener, but in the absence of adequate means for thoroughly educating landscape gardeners in the esthetic side of their profession, a training in architectural design is at present the best available for the purpose. It must not be inferred that architects can easily practice landscape gardening. The fact that they appreciate certain fundamental esthetic principles, no more fits them to practice landscape gardening than landscape painting or any other art to which those principles apply. It is certainly better that most architects should confine themselves to architecture.

Civil engineers should not be too much elated by the statement that a good knowledge of and experience in certain branches of civil engineering is more important in the education of landscape gardeners in the ability to design well than horticultural knowledge. Indeed such a claim may seem paradoxical when we call to mind how many obstrusively ugly works of civil engineering there are in all parts of this country, and on the other hand how much horticulturists are concerned with beautiful flowers and garden plants.

The reason why a certain kind of engineering knowledge is more important to the landscape gardener than horticulture, as a means of developing his general designing ability, is that it has to do with larger and more complex problems of fitting land for human use.

The ability required to successfully design important municipal, railroad, river, canal and harbor works and other extensive plants, involves a capacity for investigating physical and human and financial conditions, requirements and limitations and for evolving a logical solution of each problem which is similar in a general way to the capacity possessed by successful architects. Engineering schools do more to educate that capacity than the ordinary methods of educating horticulturists do.

The most essential esthetic requirement of conspicuous works of civil engineering is that they should accomplish their purposes in an appropriate, pleasing and satisfactory way,—not that they should be made pretty by means of ornament applied as an after-thought.

The main object of this paper is to call the attention of horticulturists to that particular idea—the importance of the esthetic princi-

ple that all visible works of man should be expressive and beautiful in their general form and main features before they are ornamented with mere decorative detail.

Esthetic ideas are difficult to explain without illustrations.

Among large constructions, we find a general regard for good appearance has always controlled ship builders. They made many mistakes, from a scientific point of view; they did not always make fast ships; they compelled sailors and passengers to submit to unnecessary inconveniences; but they strove always for such beauty of form and outline of hull and fittings, rake of masts, taper of spars, cut of sails that sailing vessels have always been the delight of artists. And how conspicuously absent is all surface decoration and applied ornament!

It is shocking to imagine the hideous job the engineer of an elevated railroad would make of an order to build and rig a steel sailing ship, if he should entirely ignore the traditions of ship building and use stock dimension rolled steel beams, bars, angle irons, tubes, rods, and so forth, as he uses them in his elevated railroad trusses and columns and brackets! How much simpler and cheaper it would be for the deck of a ship to be straight from bow to stern and to pitch straight from center to sides like a flat tin roof! Yet all the demands of the shrewd owners for economy, and all the power of competition were unable to make shipwrights for countless generations build a ship that way. They knew it would be ugly and they wouldn't do it.

The beauty of the typical sailing vessel is a good illustration of the superiority of beauty of form and proportion, of graceful adaptation to useful purposes over a purely scientific and economical but ugly general form superficially decorated. Let us hope that investors and public opinion will more and more encourage civil engineers to take to heart this great esthetic principle that visible structures should be beautiful in form whether there is superficial decoration or not.

If a knowledge of horticulture and its allied crafts and sciences is to be regarded as less essential to the landscape gardener than a training in general architectural designing and in certain selected branches of civil engineering, it is not intended thereby to belittle the importance of a practical knowledge of hardy trees and other plants used in landscape gardening works and of their cultivation, cost and esthetic qualities. Such knowledge is absolutely essential.

The point sought to be enforced is that the landscape gardener should be educated to design first the general plan for a given work, then its constituent parts and details in such a way that they will produce a consistent, well balanced, harmonious whole and to always keep in mind that the inherent, essential beauty of the whole, and its obvious and graceful adaptation to its main purposes are far more important than its superficial ornamentation.

Horticulture is the art of the cultivation of garden plants as distinguished from farm crops. Those horticulturists who raise or sell plants for their beauty are florists. Most florists advise as to or direct the use of ornamental plants. Many florists also branch out into the practice of landscape gardening because their technical knowledge

enables them to do so well enough to satisfy those who employ them. Similarly druggists sell drugs without prescriptions of physicians, dealers sell spectacles without prescriptions of professional oculists.

Nevertheless all who can afford it should get advice on matters of landscape design from the best available professional landscape gardener, just as they should get advice as to matters of health from a competent physician. Florists should therefore avoid competing with competent landscape gardeners.

This principle of specialization of knowledge and its application to human affairs is well known to florists, but for one reason or another they do and will continue to practice landscape gardening and it must be acknowledged that to a certain extent and under certain circumstances they are justified in doing so.

The direction in which the work of florists in the field of landscape gardening is usually most open to criticism is in its esthetic qualities.

The mind of the florist is usually occupied either by practical details or in considering the beauty of particular flowers or plants. This tends to unfit him as a landscape designer. If he is to practice landscape gardening, he should subordinate beauty of plants to the beauty of the composition or design as a whole. In doing so he cannot succeed unless he studies first the requirements of the case, the utilization of its opportunities for landscape beauty, its financial limitations and so on. Then he must form in his mind, or on paper, a general plan or solution of the problem embodying such qualities as fitness, harmony, contrast, simplicity or intricacy, proportion, relation of masses, colors and so on.

But even if he refrains from designing landscape the florist should be an artist.

The very existence of florists depends upon the public demand for beautiful flowers and garden plants. If the florist is to succeed in the esthetic side of his business he must be endowed with certain esthetic faculties and cultivate them to the point of efficiency. A mere love of flowers is not sufficient, any more than an ear for music would indicate the existence of the qualities required for a successful musician. There must be the power to observe and study, to imagine combinations and modifications of things seen or learned of, to mentally test them by various standards and rules and by the known effects of similar things that have been or can be seen. There must be the critical faculty, the weighing of advantages and disadvantages, the power to curb impulses and first impressions until reason has passed judgment. Perception, selection, memory, imagination, reason, application, patience and above all, will power, are some of the more important qualities required for a successful designing florist. All these faculties gain by experience and training and by a favorable environment.

The visual memory must be stored with beautiful things. Nature is a great storehouse of beautiful things, as well as of ugly things, so a lad should be brought up in a beautiful bit of country rather

than amid long blocks of plain brick houses. But there is much in nature that is beautiful that cannot be used in the florist's work. Lichens and toadstools, for instance, include varieties having beautiful colors, yet they are not used in carpet bedding owing to practical difficulties. Therefore the visual memory is stored by visiting gardens and exhibitions, and by studying illustrations, horticultural books and trade catalogues.

The selective faculty is trained by determining what is worth remembering. We must put some things in the front row of the memory, so to speak, where they can be availed of instantaneously. Other things are set behind and labeled by some bit of detail, a leaf or a bit of color or a word or a taste or smell or by name. For very many things that may be useful the memory must refer back to the cyclopedia, an indexed periodical, a scrap book, so and so's catalogue, and so on.

The visual memory is trained by repetition, by close application forced by the will power. It is aided by association with other sensations, by the sentiments, by novelty, by superlative characteristics and so on.

The imagination is based on memory. We can imagine nothing that has not come into our minds through the senses or that is not due to some combination of ideas previously so gained. Hence the importance of storing the memory with things worth remembering. The imagination must be guided by reason and will power to be useful, but it must be exercised and developed mainly in youth, even by the aid of beautiful things that are not useful. The imagination is stimulated by beautiful things to imagine other beautiful combinations and modifications. An ancient necklace or a decorated book cover, seen in a museum of art, may excite the imagination many years after in the designing of flower decoration. That may be both a pleasant and a useful training of the young florist's imagination, but the study of veined marble, or cloud effects or a specimen of marine alga might be pleasant but probably useless to the florist.

The reasoning faculty may be trained in various ways, but may best be trained by the study of cause and effect in the natural sciences dealing with the materials to be handled or controlled by the florist. If he learns scientifically why certain color combinations are pleasing and certain others displeasing he can act as the result of reasoning when the time comes instead of trusting to his own sensations or to what people say or to tradition. If he has studied agricultural chemistry and plant physiology and meteorology he may sometimes avoid mistakes which others fall into through the misapplication of traditional wise saws, which often for the sake of brevity or of a catching rhyme convey a half truth or even a falsehood.

The training of other faculties need not be enlarged upon. The inference to be drawn is that if the florist is to have such an education as will fit him to produce beautiful floral decoration and to make his vocation compare in esthetic standing with that of the architect and the artist, mural decorator and (let no offense be taken) the

landscape architect, he should cultivate his creative esthetic faculties at least as thoroughly and by much the same means of art schools, museums, reading, converse with artists, travel and observation and by the solution of many problems of artistic design.

HORTICULTURAL SCHOOLS AND EXPERIMENT STATIONS.

Dr. A. C. True, Washington, D. C.

In the United States education and research in horticulture are mainly carried on in connection with the state agricultural colleges and experiment stations and the United States Department of Agriculture. Some horticultural work is done by all of the sixty experiment stations in the continental United States and in Alaska, Hawaii, and Porto Rico, except in the State of Wyoming, whose station is located more than 7,000 feet above sea level and has thus far undertaken work in only a few restricted lines of plant production. As reported to the Office of Experiment Stations for 1906 the stations employed 101 horticulturists. The station work in horticulture covers a very wide range. It includes all branches of horticulture and a great variety of horticultural plants, both in the greenhouse and in the field. It ranges from an attempt to select and develop plants suited to arctic conditions, as in part of Alaska, to experiments with mangoes, cacao, coffee, and numerous other tropical plants, as in Hawaii and Porto Rico. Practically all kinds of horticultural plants suited to temperate and semi-tropical conditions are receiving some attention. As regards its character, the work varies from scientific research of a high order on fundamental problems, for the determination of general principles or underlying causes, to the simplest practical tests of varieties and cultural methods. In addition, our stations are doing a considerable amount of work in chemistry, botany, vegetable pathology, and entomology directly relating to horticulture.

All but seven of the stations are organized as departments of the agricultural colleges and are thus brought into close relations with, and in fact are usually in organic union with, the horticultural departments of instruction in these colleges.

The methods and results of station horticultural work are therefore easily and naturally brought to the attention of students of horticulture in these institutions, and many of these students have some participation in the station work. The progress of agricultural research in horticulture in foreign countries, as well as in the United States, is systematically reported every month to our horticultural investigators, teachers and students through the Experiment Station Record so that on its information side at least there is little excuse if instruction in horticulture in this country does not keep pace with the progress of horticultural research throughout the world.

Practically all the agricultural colleges give some instruction in horticulture. The extent and scope of this instruction varies greatly

in different institutions. We have yet at least one living example of such a monstrosity as a professor of agriculture, horticulture and botany, and in a number of colleges, and even in a university, one man has plenty of room to recline at full length on the settee of two such vast subjects as horticulture and forestry. But we are doing better than we used to in this respect, and in recent years the general movement for the differentiation and specialization of agricultural subjects and instructors has affected and greatly benefited horticultural courses in our colleges.

Fourteen colleges announce four-year horticultural courses in connection with which an effort has been made to systematize instruction in horticulture and co-ordinate the work in this subject with that in other subjects in the curriculum so as to make a more or less satisfactory technical course.

In addition, several state universities have broad elective courses and offer a sufficient number of courses in various branches of horticulture to enable the student to arrange quite thorough technical courses and even to specialize to a considerable extent in some horticultural line to which he proposes to devote himself as a profession.

In some of the colleges the course which horticultural students must pursue in seeking a bachelor's degree is prescribed during two or three years and electives are offered in the third and fourth years in such a way as to enable the student to specialize in horticulture at least to a certain extent.

Short courses in horticulture are offered by 19 colleges. These courses vary in duration from two years to two weeks.

At the University of Illinois, where the elective system prevails, 29 courses are offered under the head of horticulture, besides a somewhat elaborate professional course in landscape gardening. Five of these courses are of a general and somewhat elementary character, 19 are for advanced undergraduates and graduates, and five are exclusively for graduates.

Among the special courses in this list are those in spraying, viticulture, nut culture, evolution of horticultural plants, experimental horticulture, amateur floriculture, and landscape design. Two courses in forestry are also included under horticulture.

The horticultural faculty proper includes one professor, three assistant professors, and one instructor. There is no professor of horticulture, but a professor and an assistant professor of pomology, assistant professor of olericulture, assistant professor of landscape gardening and an instructor in floriculture. The professor of botany and two field assistants in pomology also take part in the horticultural instruction.

Cornell University offers 13 courses in horticulture and the horticultural faculty consists of one professor, one assistant professor and two instructors.

The University of Missouri offers 9 courses, given by one professor, one assistant professor, and two instructors.

Michigan Agricultural Colleges offer 17 courses (two of which are especially for women), given by one professor and four instructors.

Massachusetts Agricultural College offers 9 courses, given by one professor and three instructors, and is making special effort to develop work in landscape gardening.

The University of California, with a horticultural faculty of two professors, two assistant professors, and one instructor, offers 8 courses, two of which are for graduate students.

The University of Ohio and the Texas Agricultural College, with one professor and one assistant professor, each offer 13 courses in horticulture.

While there are certain advantages, as regards the higher lines of work in the organization of horticultural courses in connection with colleges and universities, the instruction in such institutions will inevitably be largely of a theoretical and severely technical character. It should, therefore, be supplemented by the establishment of special horticultural schools in which young men and women may be trained for the practical business of horticulture. Some attempts have been made to do this in this country, but we have not as yet any horticultural schools of this character which will compare with those at Ghent and Vilvorde in Belgium, or the National School of Horticulture at Versailles, France.

The station horticulturists are doing a large amount of useful work and they enjoy in large measure the confidence and esteem of practical horticulturists. With the increase of the resources of the stations they are getting better facilities for work, and are enabled to specialize more and to undertake more substantial enterprises. They are now giving more attention to problems connected with a broader organization of their work and with the conduct of more fundamental investigations. On the one hand they desire to cover more completely the field of horticulture and on the other to establish the practice of horticulture more securely on a rational and scientific basis. To accomplish the first of these objects, the necessity for more workers and increased specialization is apparent. To attain the second there will be required the multiplication of more thorough investigations and the acquirement more largely of the scientific spirit and attitude.

Besides the special studies made by individual workers, there should be a broad inquiry, preferably by some organization of horticulturists, with a view to determining in a general way the scope and limitations of scientific horticultural work. In other words there should be an organized effort to define and establish a science of horticulture, differentiated from, but indissolubly linked with the practice of horticulture. This is all the more important because the great body of practical horticulturists embraces more intelligent and progressive men than any other great group of workers in the general field of agriculture. I have lately heard of one of our leading scientific horticulturists expressing his difficulty in keeping pace with the professional advancement of practical horticulturists and doubting whether there were any subjects to be discussed among scientific horticulturists which

might not be just as well discussed in assemblies of practical horticulturists. I do not believe that he expected to be taken too literally, but there is food for thought in this remark.

To achieve and maintain leadership the experiment station horticulturists must be able to do certain things better than the practical men, and as I believe must chiefly depend on their ability to establish principles, to work out methods and to discover causes or the rationale of practice. When they leave this field and put themselves in competition with commercial horticulturists they run great risks of failure. It is only in rare cases that experiment station horticulturists are likely to have the means to make tests and selections and to do other things done in commercial practice on as broad a scale as the commercial growers do them. How often have experiments in horticulture, as well as other lines of agriculture, fallen into contempt because they were undertaken on too small a scale. The besetting sin of the station horticulturist has been the yielding to the temptation to undertake too many things at one time, to try this and that and the other thing in a picayunish way. His more or less valid excuse too often has been that many of these things were forced upon him by the imperative demands of his horticultural constituency.

Both parties must learn more thoroughly the proper functions and limitations of experiment station work in horticulture. The station man must come to see more clearly that his proper work is to attack problems which the practical man is not prepared to undertake and the latter must recognize that it is folly to impose additional burdens on workers already overloaded and that his efforts should rather be mainly directed toward increasing funds and workers in horticulture at the stations. As an aid to the discussion of the problems connected with the establishment of the science of agriculture room was made for a course in horticulture at the National Graduate School of Agriculture held at the University of Illinois in 1906, and provision for a similar course is being made for the session to be held at Cornell University and the Geneva Experiment Station in 1908.

With the enlargement of the scientific basis of horticulture, mainly through the broadening work of the experiment stations, it should be possible to organize instruction in horticulture in a sounder pedagogical manner and to extend this instruction both inside and outside the colleges so as to reach many more students and benefit horticultural practice much more widely. The formulation and discussion of horticultural courses for different grades of schools should be encouraged. A valuable contribution in this line was made by Professor F. W. Rane in his paper before the Association of American Agricultural Colleges and Experiment Stations at its meeting at Washington in 1905 (Office of Exp't Stat. Bul. 165). The preparation of horticultural text-books, manuals and illustrative materials should also be promoted.

Especially, efforts should be made to secure the more thorough organization and equipment of horticultural departments in some of the agricultural colleges, located in states where horticulture is a great agricultural industry. We need more of such specialization of develop-

ment by agreement among our agricultural colleges. While all of them would do well to maintain respectable departments of agronomy, horticulture and animal husbandry, one or the other of these lines might properly be emphasized in individual institutions in accordance with its relative local importance. Thus in New York and California and a few other states we may reasonably expect the development of horticultural departments or schools more comprehensive and thorough than anything in this line elsewhere in the world. State boundaries should not prevent students from assembling themselves in large numbers where they can receive the instruction of the most competent specialists under the most favorable conditions.

I believe there is plenty of opportunity for every state agricultural college to make itself pre-eminent in some line of education or research, and thus while doing good service to its state also greatly benefit the nation.

Dr. Galloway: I have been greatly interested in Dr. True's statements relative to education and training along horticultural lines. There is one feature of this work, however, that has not been touched upon here and I would like to call attention to it. I mean the real or apparent gap between the thoroughly trained practical horticulturist, especially the man who is engaged in intensive lines of work, and the man who has been trained at one of our colleges in the sciences underlying horticulture.

For a good many years I have been occupied in securing men and fitting them into places in our work in the Department of Agriculture. Some of the men who come to us from the agricultural colleges are pretty well trained in the sciences underlying horticulture, but I believe I can say that all come to us with a woeful lack of appreciation of the fact that practical horticulturists who have been for years working in intensive lines have accumulated a vast amount of valuable information which would be exceedingly useful if accepted, digested and used by the scientifically trained mind. It is to be regretted, however, that few, if any, of the young men who come to us have any just appreciation of the value of this information, so easily available. On the contrary it is not unusual for these young men to assume an air of superiority, both in matters of science and matters of practice, which has a tendency to isolate them from the practical man. A curious fact about the whole question is that, as a rule, the practical man understands the situation perfectly, but out of respect for the things which these young men represent, he is too considerate to complain. Not so with the young man from the college. He is imbued with the absolute necessity of impressing his knowledge, or sometimes lack of knowledge, on the practical man to the end that it brings about a separation of interests that ought to be avoided.

I attribute this difficulty largely to a lack of proper training in the early educational work. My experience has been that men who have come up from the proper horticultural environment, or, in other words, who have lived as it were in horticulture prior to their going to

college, give us, as a rule, our best type. I enter the plea, threfore, for instruction that will bring these fundamental facts to the minds of students in such a way that they will appreciate and understand them when they leave college. It would seem to me that this National Council of Horticulture might do good service by bringing about such a movement.

Mr. Kendel: Mr. Chairman, the more I have to do with this matter of school gardens the more I believe that the beginnings of gardening will have to be taught in the public schools of our cities. District schools are too small to make the necessary rivalry that city schools have, to carry on such work successfully.

Our Home Gardening Association of Cleveland, O., made an experiment this year that has been successful enough to encourage us very much. We secured the use of a three-acre tract of land in the heart of the city and the committee that was placed in charge of it fenced off about one acre, built a good tool house, hauled eighty loads of manure on it and plowed it in. We divided this area into four sections, each section into five plots, with a boy for each plot. Our plan was to make this garden a training school for boys who wished to make gardening a business, which was to stand in the same relation to the school gardens as the high schools do to the grammar schools. We wanted boys that had had a preliminary training of a year or two in the school gardens to continue their training in advance lines. We decided to make comparative tests of a number of varieties of different kinds of vegetables, which could not be done in the schools on account of the necessary small beds available, giving each group of five boys all the varieties and placing each such group in competition with the other three. Each boy had six beds 5x22 feet and each group tested about fifteen varieties of lettuce, as many peas, perhaps a dozen varieties of radish and the same of beans and beets. They also had two varieties of tomatoes and peppers and one of egg plant, sweet corn and later on turnips. Each boy had at most three of each kind.

They were shown how to grow successive crops on most of these beds. Radish was sown between the rows of lettuce and when both were gone, beets were transplanted into the same beds from the beds in which the seeds were sown. Beans followed peas. Late crops of beans were also planted between the rows of corn apparently to the benefit of both crops.

Of course we made a few mistakes for we had it all to learn, nothing like it having ever been attempted so far as we could find out. We learned, however, and this is in line with the point already referred to by one of the speakers, that some boys have the knack for gardening and will make gardeners and others have not.

It seems to me we will not have to wait until the boy is grown to find out if he is suited for this business; it develops very young. I do not think the oldest of our twenty boys was over fourteen and they ranged down to nine or ten.

Now it seems to me that in our school gardens is the place to begin to educate our future agricultural college professors and at a time

when they can learn easiest and this Council of Horticulture could undertake nothing more worthy than to foster this work as much as possible, if we really wish to further the interests of agriculture and horticulture in our country.

GOVERNMENT AID TO HORTICULTURE.

B. T. Galloway, Washington, D. C.

Under the title assigned to me, namely "Government Aid," I propose to briefly outline the scope of the work now being conducted by the national government along purely horticultural lines. Much work, such as pathological, entomological, and other investigations, is also being done, but as these lines bear indirectly on horticulture and have been treated by others, I will not touch upon them here. To make my remarks better understood, I will say that the investigations of the Bureau of Plant Industry, where practically all the directly horticultural work of the government is being conducted, are divided into definite and specific projects. These projects, for administrative purposes, are grouped under separate and distinct heads, with responsible men placed in charge of each group. The Department of Agriculture is now expending for purely horticultural work approximately $175,000 a year. It is co-operating with a large number of state experiment stations in all lines of the investigations which will be briefly described. The groups of projects which we will now discuss are as follows:

(1) Horticultural explorations.

(2) Introduction, propagation and dissemination of seeds and plants secured from foreign countries.

(3) Securing, propagating and disseminating new and rare seeds and plants originated in this country, which can not be disseminated through the regular channels of trade.

(4) Plant breeding investigations.

(5) Tropical and semi-tropical work, including the testing, propagation and dissemination of seeds and plants adapted to tropical sections.

(6) General horticultural investigations in connection with farm management work.

(7) Experimental studies, demonstrations and tests at the Arlington Experimental Farm.

(8) Systematic horticultural studies in reference to the identification and description of fruit varieties, the simplification of fruit nomenclature, etc.

(9) Fruit marketing investigations, including experimental export shipments of fruits.

(10) Fruit transportation and storage—prevention of injury in transit, etc.

(11) Viticultural investigations.

(12) Fruit district investigations—the determination of the adaptability of fruit varieties to different sections.

(13) Demonstrations, experiments and other work in connection with plants under glass.

(14) Vegetable variety testing.

(15) Bulb culture, including experiments in the home growing of Dutch and other bulbs on a commercial scale.

(16) School garden work.

The results accomplished in these lines of work may be briefly summarized as follows:

HORTICULTURAL EXPLORATIONS.

For several years the Department of Agriculture has conducted systematic exploration work in foreign countries in search of rare and valuable seeds and plants for introduction into the United States. We now have a trained explorer in the regions of North China and Manchuria searching for new plants and seeds worthy of being transplanted to this country, and for wild forms of our cultivated fruits and vegetables which may have characters of hardiness or unusual vigor that will make them useful for the plant breeders of the United States. Shipments of scions and of seeds representing hundreds of interesting things have been received from our explorer and are now growing in the trial grounds of the Department. New hardy persimmon varieties, interesting varieties of the English walnut, the Chinese pistache, wild and cultivated apricots, the wild peach from its supposed original home, hardy apples, and a very remarkable lot of Chinese grape varieties are among the most recent things secured in this way. The persimmon varieties mentioned are of the seedless type known as the Pekin, which has been tested and found to be superior in flavor to any of the Japanese persimmons, as well as hardier.

INTRODUCTION, PROPAGATION AND DISSEMINATION OF SEEDS AND PLANTS SECURED FROM FOREIGN COUNTRIES.

In connection with its foreign exploration work the Department maintains field testing gardens where the seeds and plants so secured may be propagated with a view to their dissemination if found valuable. The principal one of these gardens, located at Chico, Cal., is more than 80 acres in extent and is actively engaged in the testing and distribution of numerous things received through our explorers. A total of 53,270 plants were distributed from this garden during the past year. Much attention is being given to the introduction and culture of the pistache nut. New hardy stocks of this promising dry-land nut crop have been secured from Turkestan, China and the driest deserts of the Old World. About 16,000 seedling pistache trees were propagated at the Chico garden last year for distribution throughout California, Texas, Arizona and adjacent localities.

Another promising horticultural crop which is being introduced is the date palm. The palms which have been introduced by the Department into southern California and Arizona have borne hundreds of

pounds of delicious fruit, indicating that our work on this unique desert culture will pass from the stage of a pure experiment to that of a new industry. We are now conducting extensive life history investigations of the date palm, in order to ascertain its exact soil, climatic and cultural requirements. Similar work is also being applied to the fig, pistache and other crops with promise of valuable results.

One of the introductions to which particular attention has been given is the Japanese salad plant Udo, which grows well in many sections of this country and is handled and served very much like celery. To secure the extensive use of the plant, however, will probably take considerable time, as the taste for it is a cultivated one, like that for the olive, mango, etc. It is a promising introduction, however, and is already being widely disseminated and distributed.

SECURING, PROPAGATING AND DISSEMINATING NEW AND RARE SEEDS AND PLANTS ORIGINATED IN THIS COUNTRY, WHICH CAN NOT BE DISSEMINATED THROUGH THE REGULAR CHANNELS OF TRADE.

This work is largely incidental to other lines of horticultural work, and is well illustrated by our annual distribution of the new citrus fruit varieties developed by the Department, which I shall presently describe. It is our policy wherever a new and promising variety is secured in any of the various lines of work, to propagate the variety extensively for distribution to growers for co-operative tests. In this way we are able to ascertain fully the worth of any new variety, as well as to exploit it where it is likely to prove the most valuable.

PLANT BREEDING INVESTIGATIONS.

Through the Bureau of Plant Industry the Department of Agriculture is conducting much work in the improvement of plants by breeding and selection. A number of horticultural crops are receiving attention in this way, including citrus fruits, pineapples, sweet corn, lettuce, potatoes, etc. The work on citrus fruits and pineapples, which has been very successful, has been conducted by Dr. Herbert J. Webber, formerly in charge of our plant breeding investigations and now in Cornell University. Many valuable new sorts of citrus fruits have been produced by hybridization. The new hardy oranges, or citranges, are being distributed to numerous growers for trial. These form an entirely new class of citrus fruits, and are believed to be of great value for cultivation as home fruits in the region from 300 to 400 miles north of the present orange belt. In addition to these, other new fruits have been developed, including the tangelo, a cross between the pomelo or grape-fruit and tangerine orange, as well as new limes, tangerine oranges, etc.

The pineapple breeding work has been conducted through a number of years, and has resulted in the development of new sorts possessing many improved characters that are believed to fit them for general cultivation and to recommend them above other varieties now cultivated. Among them are a number of smooth or spineless-leaved

varieties, very distinct from the Smooth Cayenne, which was the only smooth-leaved variety cultivated when the experiments began.

In the breeding work on sweet corn the object has been to secure improved strains for canning purposes. In certain localities it has been demonstrated that an excellent quality of sweet corn seed can be grown and that, with good care, it will germinate much better and produce better than seed obtained from other localities. The breeding work with lettuce is conducted in connection with other intensive horticultural work, and many promising hybrids have been secured. This work, in which I have been personally interested, has been conducted during the past three or four years by Mr. George W. Oliver, who has succeeded admirably in crossing lettuces—something, so far as I know, never attempted before. We have worked largely with lettuces for growing under glass. Our aim has been to secure types better adapted to the needs of the eastern United States and the middle west. Some work has been done in the improvement of potatoes, the breeding of rust-resistant asparagus, and the production of a wilt-resistant watermelon. These lines, however, are conducted incidentally to other work and do not call for extended comment.

TROPICAL AND SEMI-TROPICAL WORK, INCLUDING THE TESTING, PROPAGATION, AND DISSEMINATION OF SEEDS AND PLANTS ADAPTED TO TROPICAL LATITUDES.

For some years the Department has devoted considerable attention to tropical and subtropical horticulture, and we now have two stations located in the southernmost portions of the United States. The older of these gardens is located at Miami, Fla., the other having only recently been established on the Fort Brown Military Reservation at Brownsville, Tex. At our Miami gardens we are conducting many lines of work in plant improvement, propagation, acclimatization, etc. Attention is here being given to the propagation of the mango, avocado, guava, and other tropical fruits, as well as of new varieties of seeds and plants secured by exploration in foreign countries. Much attention is also being given to the propagation of citrus fruits. Frequent distributions of seeds and plants for trial are made from the Miami gardens.

At our Brownsville garden we propose to ascertain the possibilities of south Texas in subtropical horticulture, and work is already under way in the growing of citrus fruits, grapes, the date palm, etc.

Some work on tropical fruits and vegetables is also being conducted in connection with other lines of work. Especially is this true in relation to our foreign exploration work, the many new varieties which are secured being sent to the subtropical gardens for trial.

GENERAL HORTICULTURAL INVESTIGATIONS IN CONNECTION WITH FARM MANAGEMENT WORK.

In connection with its Farm Management Investigations the Bureau of Plant Industry is making detailed investigations of the

methods of cultivating various truck and garden crops. Considerable attention is being given in this way to potatoes. The results obtained in growing potatoes in rotation have been carefully noted, as have been the fertilizer requirements and other features. Some attention is also being given to the marketing of farm products, and on the diversification farms conducted by the Office of Farm Management a detailed study of methods of truck farming has been made. In all these lines of work useful information is being obtained.

EXPERIMENTAL STUDIES, DEMONSTRATIONS AND TESTS AT THE ARLINGTON EXPERIMENTAL FARM.

Several years ago Congress authorized the establishment on the Arlington estate in Virginia, which is within easy access from Washington, of a general experimental farm for the work of the Department of Agriculture. This farm has proved of great value to the work of the Department. The horticultural work now under way at the farm includes experiments in vegetable and fruit growing, the growing of vegetables and flowers under shade, and tests of various garden crops. The fruit nursery on the farm now contains several thousand trees, and one acre of the farm is devoted to a model kitchen garden. Tests of both Irish and sweet potatoes are being made to determine the yield and keeping quality of various sorts, and other factors. Similar work is also being conducted in co-operation with several state experiment stations. During the past year the Department entered into a co-operative agreement with the Virginia experiment station in the establishment of a truck station near Norfolk, Va.

Various field investigations are conducted in connection with the Arlington farm, and an important feature of this work is the publication of Farmers' Bulletins dealing with the cultivation of various crops. Among the field work under way is an investigation of the Bermuda onion industry in Texas and Louisiana, demonstrations in the growing of truck crops on rice lands, and a comprehensive truck crop survey. For the latter feature Congress provided additional funds during the past year.

SYSTEMATIC HORTICULTURAL STUDIES IN REFERENCE TO THE IDENTIFICATION AND DESCRIPTION OF FRUIT VARIETIES, THE SIMPLIFICATION OF FRUIT NOMENCLATURE, ETC.

During the course of the year many fruits are submitted to the Department for identification and description. In connection with this work a pomological collection is maintained. During the past year 1,596 fruits were submitted for examination by orchardists and fruit growers.

Considerable work in the simplification of varietal nomenclature has been carried on, and several catalogues of revised terminology have been published. The lack of simplicity and uniformity in nomenclature of American fruits has been in the past a source of great losses,

and the Department is co-operating with the American Pomological Society in the purification of varietal nomenclature.

FRUIT TRANSPORTATION AND STORAGE—PREVENTION OF INJURY IN TRANSHIPMENTS OF FRUITS.

Experimental studies of the methods of harvesting, packing and forwarding perishable fruits have been conducted by the Department for several years. In these investigations an effort is made to ascertain the relation of varieties, packages, methods of packing, etc., to the requirements of long distance shipment, with special reference to conditions experienced in ocean transit. For this purpose experimental export shipments of fruits, chiefly to European markets, have been made during the past few years. The export trade in Bartlett and other early pears is an outgrowth of this experimental work, and the total exports of this fruit now approach a million dollars annually. Experimental shipments of both summer and winter apples have also been made, and the practicability of establishing an export trade in these fruits has been demonstrated.

FRUIT TRANSPORTATION AND STORAGE—PREVENTION OF INJURY IN TRANSIT, ETC.

In close relation to the fruit marketing work, just described, the Department is carrying on extensive demonstrations of improved methods of shipping and storing perishable fruits, with special reference to the citrus fruit industry of California and Florida. Large quantities of oranges handled in different ways have been under observation in transit in order to determine the temperature changes that occur in the fruit and in the air of the cars. It is planned the coming year to completely equip an experimental refrigerator car for use in this work. These investigations have had the active support of growers, shippers, and transportation interests; and on account of the thorough organization of the industry it has been possible to put into practice the results of the investigations. Mechanical injuries to the fruits are being reduced; packing houses are being remodeled in the direction of simplicity; and the transportation companies have shown a disposition to make their service conform to the facts developed by these experiments.

The work on fruit storage has been conducted as incidental to the larger work on transportation, and special attention has been given to the farm storage house problem.

Apart from the regular fruit transportation and storage investigations, some work on methods of curing lemons has been inaugurated during the past year. It is recognized by fruit dealers that while the American lemon is in most respects a very superior fruit, it is deficient in keeping qualities after it reaches the market. To what cause this deficiency is due is an open question. In the hope of getting some light on it, investigations into the methods of handling lemons have

been begun in southern California. The work has been of a preliminary nature but has developed some promising lines along which to attack the problem. A study of lemon storage will be a necessary forward step in this work.

VITICULTURAL INVESTIGATIONS.

For several years past the Department has directed a special effort toward the maintenance and upbuilding of the grape industry. The chief part of this work is now located in California, although considerable attention is also being given to the rotundifolia grape industry of the South. In California we have a number of co-operative experimental vineyards where a great number of varieties are being tested, including specially imported European stocks.

A considerable part of this work consists in the dissemination of information regarding grapes and grape products. Several publications dealing with various viticultural problems have been issued from time to time, and a great quantity of correspondence is conducted with co-operative grape growers and others.

In the rotundifolia grape investigations a special study has been made of the various requirements of this type of grape. The marked differences found in the size, color, flavor, and quality of the varieties in cultivation, most of which are wild vines or accidental seedlings, indicate great possibilities of improvement under systematic effort, and bid fair to bring into profitable culture considerable areas of unused land in the south Atlantic and gulf states.

FRUIT DISTRICT INVESTIGATIONS.

This work is directed toward the determination of the adaptability of fruit varieties to different conditions and their value for specific purposes as influenced by the conditions under which they are grown. Owing to the nature of the work it must be continued through a course of years in order to arrive at intelligent and conclusive results. The work is being prosecuted in several sections of the country, including the Piedmont and Blue Ridge areas of the southern states, the Shenandoah and Cumberland valleys, comprising the great Appalachian valley, and the Ozark region of Missouri and Arkansas. Chief attention is being devoted to orchard fruits in these regions.

DEMONSTRATIONS, EXPERIMENTS AND OTHER WORK IN CONNECTION WITH PLANTS UNDER GLASS.

In connection with its general greenhouse work the Department carries on special investigations relating to the growing of plants under glass. This work includes experiments in forcing tomatoes, the propagation of tropical fruits, and also some work on florists' crops. The latter phase covers such crops as carnations and chrysanthemums. The Department conducts an annual chrysanthemum exhibit in connection with this greenhouse work, which is largely attended.

Some work on greenhouse crops is also conducted on the Arlington farm, where a special study of the influence of heat, light and moisture on plants grown under glass is being made.

VEGETABLE VARIETY TESTING.

A special line of horticultural work which has been conducted for several years is the testing and standardization of American varieties of vegetables and the publication of monographs of the various garden vegetables. These tests, which have now covered a period of ten years, have included more than 15,000 samples. The first tests were confined to experimental plots near Washington, D. C., but in recent years the scope of the work has been extended to all sections of the country, co-operation with the state experiment stations and others being largely practiced. Three bulletins have been prepared containing monographs of certain vegetables, the most recent of which, now in press, is devoted to the American varieties of garden beans. The object of this work is to establish, as far as practicable, a standard of perfection that will be a guide in making selections of variety types and serve as an authority among vegetables.

This descriptive work has been carried on in a general way with all the garden vegetables, but before publishing a monograph of a certain vegetable it is necessary to determine more closely the exact differences in season, productiveness and other characters which are in dispute among varieties, as well as to decide which types of the different varieties shall be adopted as the correct ones. We are endeavoring here, again, as in the work previously mentioned with regard to fruits, to simplify in every way practicable the varietal nomenclature by adopting approved variety names and by recommending the discontinuance of confusing, long-worded, or inappropriate names.

For a number of years the Department has been endeavoring to ascertain how far the local conditions where seed is grown affect the character of the plants developed from such seed. Special work of this kind has been carried on with sweet corn and cabbage.

BULB CULTURE.

Investigations are being carried on in the encouragement of the production of tulips, narcissuses and hyacinths on the Pacific coast. At the present time three gardens are being maintained in that region under the supervision of the Department. The climatic conditions of the Puget Sound region are especially favorable to the development of tulip and narcissus bulbs, and it is probable that the corner stone of the American bulb industry will soon be laid in that region. We are co-operating with commercial men who are endeavoring to develop the industry, and plans are already under way for a considerable extension of the work.

SCHOOL GARDEN WORK.

For a number of years the Department of Agriculture has been interested in the encouragement of school garden work. To this end

it has co-operated with the school authorities of Washington and other cities in giving special information regarding horticultural work. In Washington opportunities have been given the Normal School students to study practical horticulture in connection with the work being carried on in the Department greenhouses and upon the Department grounds. Aid has also been rendered in the matter of lectures before the students. From 80 to 100 Normal School graduates finish their course each year, and these have all had special training in horticulture and are applying this training in the teaching of the graded schools. Garden work as a system of manual training has been inaugurated, the beautification of the school grounds has been taken up and completed, and the work is being extended to the beautification and ornamentation of the homes of teachers and pupils. With a view to extending this work as far as practicable special collections of seeds have been prepared and distributed to schools throughout the country. Brief discussions of the aims and objects of the school garden work have been published and are distributed with the seeds.

The foregoing brief summary covers the main features of work in the matter of government aid to horticulture. Necessarily many of the details have had to be omitted, especially those relating to our co-operation with horticulturists throughout the states in the experiment stations and colleges, and with private individuals. Altogether I think it may be said that horticulture is receiving attention in proportion to other lines of work. Although there are many problems yet to be undertaken the outlook is hopeful, and it is confidently believed that rapid progress will be made in the future.

FEDERATION AND CO-OPERATION.

J. C. Vaughan, Chicago, Ill.

Following a general horticultural meeting at the World's Fair, St. Louis, November 10th, 1904, and a second meeting of a committee of seven at Chicago, July 20th, 1905, the National Council of Horticulture was organized. Its objects, as then stated, were:

1.—To fraternize and concrete the horticultural interests of North America.

2.—To consider questions of public policy and administration which are common to these organizations.

3.—To act as a bureau of publicity in the interests of reliable information pertaining to horticulture in its broadest sense.

Its composition is as follows:

1.—The membership shall consist of two delegates elected or appointed by each national horticultural society, with nine delegates at large.

2.—The Council shall elect an executive committee of nine persons, at least five of whom shall be delegates at large.

This Council has held approximately semi-annual meetings since that date, and while these meetings have not been largely attended, number three of the stated objects has been carried forward with remarkable success, mainly through the earnest and unselfish labor of its Secretary, H. C. Irish.

So effective and obviously valuable to the seedsmen, florists and nurserymen has this Publicity Bureau proven, that the national societies representing these three interests have, at their annual meetings, after full consideration and discussion, voted liberal sums to carry on this work, and I believe that no one of such organizations has ever voted similar sums for a work practically established outside of its membership, and I am sure that no cause has been similarly supported by all of them.

It is not denied that any one of the horticultural interests in America having a national organization could undertake similar work, but it is contended that with the moderate funds available and obtainable from each society, a much better showing can be made, and with greater economy, by carrying forward the work as it has been undertaken by the Council, and its position in this regard is now well established.

One word further as to the possibilities and value of this enterprise to the commercial interests above mentioned. So urgent has become the demand for reliable horticultural information from the leading daily and weekly newspapers of the country, that bureaus have been organized to supply this information, and such articles are being sold regularly, although the articles supplied by the Council of Horticulture have been sent out free. I am satisfied that if the Council had more funds to work with, enabling it to produce desirable newspaper articles, these having so far been written free of charge, that we might almost establish the bureau on a self-supporting basis by selling some of the articles to a selected list of the largest daily newspapers. It will be readily understood that the articles sent out under the authority of the Council of Horticulture carry weight and could be more readily sold than those undertaken by private individuals.

Now as to the second object for which the National Council of Horticulture was organized—*to consider questions of public policy and administration which are common to the national horticultural organizations.* All who have attended with reasonable regularity the meetings of our national societies realize how much time is spent and often wasted on discussion of subjects most properly handled by committees, and further how often the work of such committees is the same in the different societies. I may mention as examples the subjects civic improvement, transportation, customs, postage and some sides of the nomenclature question. Now the work of each of the above committees from a single society, were it done in connection with another national society, would be much more effective, and still more were they all combined. A committee on customs, or on transportation, with the backing of all the national societies in horticulture, would mean something when presenting their claims for consideration to the

proper authorities. Instances are not lacking where similar combinations, representing all the branches of a great industry, have appeared before the officials of a great national exhibition and insisted upon and secured the proper recognition and awards, which would never have been given them or even have been considered, had not such a general committee been in existence.

The need for fair consideration of horticultural interests at the national exhibitions is well known to everyone who has marked the very apparent errors in buildings, in classifications, and in premiums at many of them, and certain it is that horticulture in its broadest sense has not been rightfully considered at these exhibitions, and never will be until our interests act together as they can do through the representation they now have in the National Council of Horticulture, by regularly elected delegates, and by the co-operation which this brings about.

The Council, because of the few actual workers available in its ranks, the difficulty of frequent meetings, and because of the widespread locations of its members and its lack of funds for traveling expenses, has not taken up actively the other lines of its work above mentioned, but it must be done, and the growth of the Council and the willingness of its membership to contribute funds, prove that its further work will surely be taken care of in the reasonably near future. As soon as more frequent meetings can be had and a fair attendance be counted on, the broader questions of nomenclature and international co-operation on similar lines will be in order.

It is not, and has never been, the object of the Council of Horticulture to take up any work which up to the present time is the exclusive work of any single national interest, but to act only as a representative body of these various interests on lines which are common to them all and which no one can claim the right or privilege to take up and do for the others. For instance, the organization of a National Congress of Horticulture would hardly be the duty of the national apple growers, florists, or nurserymen, but can well be conceded as coming within the province of a council like this, organized and supported by these separate interests and made up in its membership by actual delegates from the various societies, combined with noncommercial members interested in the educational side of horticulture, and without commercial interests, against whom no charge of commercialism or commercial interest in the work can be made.

It is the intent of the Council to elect from its noncommercial members its permanent chairman. While the present temporary chairman is from the commercial delegates, yet it has been his aim to so conduct the affairs of the Council that no charge of commercialism could be made.

[redacted]	SB10
Congress of horticul-	A6
ture. 1st, James-	1907
town, 1907.	
Proceedings.	
[redacted]	
[redacted]	
transfer	

[redacted]