BULLETIN NO. 142.

DECEMBER, 1897.

DIRECTOR'S REPORT FOR 1897.

W. H. JORDAN.

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Address all correspondence, not to individual members of the staff, but to the NEW YORK AGRICULTURAL EXPERIMENT STATION, GENEVA, N. Y.

The Bulletins published by the Station will be sent free to any farmer applying for them.

* Connected with Second Judicial Department Branch Station.
† Connected with Fertilizer Control.
BULLETIN NO. 142.

DIRECTOR'S REPORT.

W. H. JORDAN.

To the Honorable Board of Control of the New York Agricultural Experiment Station.

Gentlemen: I have the honor to present herewith the report of the New York Agricultural Experiment Station for 1897.

A statement of the efforts and progress of the past year can be no more fittingly prefaced than by an acknowledgment of the earnest support and wise direction which you have given me as your executive officer. I am sensible also of the loyal cooperation of the members of the Station staff in the prosecution of the work which we have undertaken. Moreover, the press of the State and the leaders of agricultural thought and practice have given us most hearty and efficient assistance in securing the means necessary to the development of our equipment; and I am conscious that the intelligent agricultural masses have stood in such an attitude of sympathy towards this institution as to constitute a strong stimulus to vigorous effort in their behalf. This combination of favorable conditions has conspired to make the record of the Station for the year 1897 one which it is pleasant to review.

In my report for 1896, attention was directed to the need of strengthening the work of the Station at several important points. The recommendations which I then made have met with your approval and much has already been accomplished towards reinforcing old lines of effort and establishing those which are new.
ADDICTION TO THE STATION STAFF.

Editor and Librarian.—This most important position has been filled by the selection of Frank H. Hall, B. S., formerly connected with the Office of Experiment Stations in the U. S. Department of Agriculture.

Mr. Hall is a native of Michigan, and graduated from the Michigan Agricultural College in 1888.

After graduation he was elected to an instructorship in mathematics in his alma mater, from which he resigned to accept a position on the U. S. Geological Survey.

In 1893, Mr. Hall became connected with the Office of Experiment Stations as librarian and proof reader and when he resigned on April 1, 1897, to enter upon his present duties he was connected with the editorial staff of the Experiment Station Record as editor of the department of field crops. His fitness for the peculiar work which he has undertaken in this institution is already shown by the favor with which his popular expositions of the Station bulletins have been received and by the way in which he is proceeding to bring the Station library into a condition of efficiency and availability.

Bacteriologist.—Mr. H. E. Harding, B. S., of the University of Wisconsin, has been elected to the position of bacteriologist. He is to enter upon his duties on January 1, 1899.

Mr. Harding is a graduate of the University of Wisconsin in the class of 1896. For nearly three years he has been pursuing special studies in bacteriology with Dr. H. L. Russell, chiefly with reference to the bacteria of the farm. He has had an intimate knowledge of, and considerable connection with the detailed investigations which resulted in the recent important discoveries of Babcock and Russell concerning the curing of cheese. In June Mr. Harding will go to Europe for study until he takes up his work here.

Dairy Expert.—It was felt that this position should be filled by some one not only entirely familiar with the best methods of the manufacture of butter and cheese, but also with the difficulties and problems which confront New York dairymen. The qualifications of the gentleman selected for this work meet both of
these requirements. Mr. George A. Smith is well known in the State of New York not only as the efficient Director of Farmers' Institutes for three years, but also as one of the dairy experts of the New York State Department of Agriculture. Mr. Smith is an accomplished cheese-maker, and through his intimate and long continued contact with the farmers of the State, he has become well acquainted with the peculiar needs of New York dairying. It is felt that the confidence which the farmers of the State have in Mr. Smith will strengthen the Station with its constituency.

Botanist.—A Station botanist has not yet been chosen. He will be selected with reference to his fitness to take up investigations in plant pathology which, in consideration of the large fruit and vegetable growing interests of the State of New York, is a most extensive and important field of effort.

Other changes.—During the year Mr. W. W. Parker and Mr. E. C. Worden, assistant chemists, have closed their connection with the Station and Mr. E. B. Hart and Mr. Firman Thompson have been elected to take their places.

Mr. F. C. Stewart, mycologist at the Second Department Branch Station, has been granted a year's leave of absence for further study.

BUILDING EQUIPMENT.

Biological and dairy building.—In accordance with the unanimous decision of your Board, the legislature of 1897 was asked to appropriate forty-one thousand dollars for the erection of a new building to be devoted to biological and dairy research. This request was granted, there being no apparent opposition. Leading dairymen and horticulturists all over the State contributed to this result by expressing to their representatives in the legislature their belief that this appropriation would advance the agricultural interests of the State. It must be conceded, moreover, that there is at the present time a tendency on the part of both the national and state legislatures to recognize generously any just demand coming from farmers.

The money for the erection of this building became available early in April, but the plans and specifications were not placed in the hands of your Building Committee until nearly the middle of
August. Such a delay was exceedingly unfortunate because it has obliged the contractor to proceed with his work during cold weather.

The contract for the erection of the building was awarded to Mr. A. B. Morrison, of Geneva, N. Y., on very satisfactory terms, and its construction has proceeded with expedition so that the walls and roof are practically completed. It is hoped that the building may be available for our use by midsummer.

The following is a summary of the facilities that this building will afford, a somewhat detailed description of which will appear in a subsequent report:

1. Dairy Department. This includes a milk receiving room, pasteurizing room, cheese-making room, butter-making room, cold storage room, six cheese-curing rooms and dairyman's office.

The first four rooms are wainscoted in glazed brick with vitrified tile floors and are to be equipped with the very best apparatus for investigation work.

The cheese-curing rooms are to exhibit some unique features in the way of control of temperature and moisture.

3. Bacteriological Department. This includes a laboratory, incubator room, culture room, general work room and office. The temperature of the incubator and culture rooms will be under automatic control, and their use will be shared with the Station botanist.

These rooms will be supplied with compressed air, steam at high pressure, hot and cold water, fuel and lighting gas and with the most modern apparatus for bacteriological investigations.

3. Botanical Department. The rooms in this department will be a laboratory office and museum with a joint use of the incubator and culture rooms. The equipment of compressed air, steam, water and gas will be the same as in the bacteriological department, and the equipment of apparatus will be no less efficient.

4. Horticultural Department. The space for this department will include the horticulturist's laboratory, horticulturist's office, assistant horticulturists' office, and two large museum rooms. In many respects these rooms will be equipped similarly to those of the other departments mentioned.
5. Entomological Department. This will contain an office large enough to afford laboratory facilities and a museum room.

The heat for this building will be supplied from twin boilers of twenty-five horse-power each, which will carry a pressure of from sixty to seventy-five pounds, the pressure on the radiators being reduced to five pounds. These boilers will furnish steam for a twenty horse-power engine, which will supply power for running the dairy machinery, the compressor of the refrigerating plant, an automatic compressed air pump, a water pump and other apparatus.

The building is to be equipped with one of the most approved forms of refrigerating apparatus which will be used to secure a low temperature in the cold storage room and such temperatures as are desired in the cheese-curing, bacteriological, cheese and dairy rooms.

The temperature of the building will be automatically controlled by a pneumatic system of temperature regulation. In the offices, laboratories and working-rooms of the dairy department, this control will be applied directly to the valves of the radiators. In the cheese-curing rooms, and to a partial extent in the culture and incubator rooms, the temperature will be regulated through the operation of dampers opening or closing hot and cold air tubes.

New forcing house.—A new building has been added to the forcing house plant, the dimensions of which are 100 by 20 feet. This is to be utilized for investigations in plant nutrition.

Poultry house.—The facilities for poultry investigation have been increased by the erection of a new house. The special features of this building are an incubator cellar where uniformity of temperature can be secured, a series of brooders warmed by hot water, breeding pens of the most approved plan, storage for a large variety of foods, a room for the poultryman and a cooking room.

General repairs.—During the past eighteen months the buildings of the Station have been put in thoroughly good condition. The two houses occupied by Mr. Beach and Mr. Wheeler have been enlarged and renovated throughout, and have been equipped with bathrooms and new heating apparatuses. The chemical
laboratory, the three barns and other outbuildings have also received exterior coats of paint.

Further needs.—I desire to recommend the erection in the near future of a tool shed which shall accommodate all of the machinery which is used on the farm. It will also be wise to build potting sheds with accommodations for various mixtures of forcing house soils in the immediate vicinity of the forcing houses.

LIBRARY.

The three rooms on the west side of the Director's house have been set apart for a library. They have recently been repainted and repapered and are now in a very attractive condition. The largest one is supplied with the tables and chairs necessary in a general reading room. The number of books in the library has been largely increased during the past year by the purchase of complete sets of the journals giving the records of investigation and of such other literature as is useful in an institution of this kind. It has been found possible, also, to practically complete the sets of bulletins and reports of other American Stations and of the United States Department of Agriculture. These have been attractively bound and form an important part of our reference library.

In view of the fact that the members of the staff should keep in touch with the current literature of investigation, it has been decided that one-half day of each week shall be set aside as library day. It may be desirable to keep the library open evenings in order that as much time as possible may be available for consulting the journals and other serial publications, the file of which will soon number about one hundred.

PUBLICATIONS.

Reference was made in my last report to the desirability of modifying in some respects the character of the publications from this Station. It was there proposed that the bulletins written by the members of the staff, to be called the Complete Bulletins, should be full in detail and as scientific in discussion as appeared desirable to the writers. It was also suggested that instead of
issuing these bulletins to the entire number of persons whose names are on our mailing list, popular bulletins should be written on the basis of the more complete form which should convey to the agricultural public the results of our work in more simple and less technical language. This plan has been put into execution, and if we may judge from the expressions of approval which have come to us from farmers and from those engaged in work at other Stations, this departure is likely to prove both popular and successful. It is decided, in addition, that the annual reports shall consist only of such matter as is published in the complete bulletins. There seems to be no good reason for printing any great amount of matter in the annual report which does not appear in the bulletins. If any fact or conclusion is worth publishing at all it is proper to give to it the fullest possible circulation among those for whom it has special value.

The Station editor also prepares press reviews which are sent with the Bulletins to all newspapers on our mailing list. It is a matter of gratification that these reviews are very fully and widely printed. This plan not only secures a more widespread attention to our bulletins but also insures accuracy of statement in regard to our conclusions.

MAILING LIST.

The mailing list of this Station includes several divisions: (1) The officers of the United States Department of Agriculture and of all other experiment stations; (2) The newspapers of this State and a few outside; (3) Those persons who desire to receive our complete bulletins; (4) The main list, or those who receive the popular bulletins. The latter list now numbers about thirty thousand names. In two years our mailing list has increased about ten thousand names.

WORK IN THE SECOND JUDICIAL DEPARTMENT.

The expenditure of the appropriation for work in this Department has been along much the same lines as in the past years. The needs of the farmers and market gardeners in this section of the State clearly indicate the directions in which they should receive help. The concentration of vegetable and fruit growing,
both out of doors and under glass, in the vicinity of New York for so many years has brought about a corresponding concentration of injurious fungi and insects. The aid, therefore, which this Station is able to give to the agriculture of Eastern New York is chiefly in studying new diseases and insects and in illustrating how these pests may be held in check. There seems to be no question but that the policy which has heretofore prevailed in the management of this special work should be materially changed. An attempt has been made to carry on at Jamaica, where this branch effort has its headquarters, more or less scientific research. Such research necessitates an equipment of apparatus and a reference library, and if it is successfully maintained under the present plan, apparatus and library facilities must be duplicated, a policy which is certainly unwise and wasteful. There is no question but that the concentration of the scientific work in the laboratories of the Station at Geneva will be in the interests of economy and efficiency. In this way much more varied and extensive experiments, illustrative and otherwise, can be conducted in different parts of the Second Judicial Department. It is gratifying to know that one of the most intelligent and active agricultural societies in this department has already, by unanimous resolution, approved this change of policy. A very encouraging feature of this action by such a body of farmers was the accompanying declaration that one special line of experiments had already saved to the agriculture of one section of Long Island at least seventy-five thousand dollars. In view of the considerations here presented, I shall recommend that this special fund be expended chiefly in maintaining experiments in the field and in forcing houses, which shall be an attempt to illustrate the application to practical agriculture of the facts discovered in our laboratory research.

It now appears probable that in 1898 attention can be most profitably given to the potato and pickle interests of Long Island. With this in view arrangements are already being made to locate experiments at least eight different points, chiefly with reference to the use of fertilizers in potato growing and to the application of a spraying mixture in controlling the diseases which prey upon cucumbers.
Experience teaches that it is not enough merely to discover a fact and point out its relations to practical agriculture. The extreme conservatism of the agricultural class seems to render it necessary to go even farther and by illustration and by precept upon precept to overcome indifference and scepticism. It is true that such instructional efforts as this are outside of the proper function of the Experiment Station, but conditions seem to require them.

CHEMICAL DEPARTMENT.

Fertilizer analysis.—The demands upon this Station for the inspection of commercial fertilizers are steadily and rapidly increasing. The records show that in no other State are the requirements for this work so heavy as is the case in New York. During the year 1897 one hundred and eighty-four manufacturers have filed in this office the required statements concerning one thousand seven hundred and twenty-eight brands of fertilizers. Not all the registered brands are actually sold in the State but the real number is unnecessarily and even absurdly large. There is not a single good reason for this multiplication of names in the fertilizer trade, but many reasons why such a state of things should not exist. It is a cause of confusion and of unnecessary expense and should hasten a change to a more economical system of buying and selling plant-food.

During the season of 1897 three traveling agents were employed by the Station for the collection of samples of fertilizers in different parts of the State. These agents were at work during about four and one-half months and they collected one thousand and five samples representing seven hundred and forty-eight different brands. This is less than the entire number of brands sold. It is impossible with the funds now at the command of the Station for fertilizer inspection to search out and sample in any one year every brand that is sold or offered for sale within the boundaries of the State. As a matter of fact, the work of this kind that is now done is really costing the Station more than the sum appropriated for this purpose. It is entirely safe to say that the appropriation for fertilizer inspection in New York is less in proportion to the necessary work than is the case in any other state. The situation is somewhat perplexing. It would be desirable if some
means could be devised to check this useless multiplication of brands, at least so long as it is necessary for the State to inspect them. This could be done possibly, by imposing an analysis fee upon each brand sold or offered for sale. There are reasons why it would be just to do this. For instance, one company registered in 1897 two hundred and forty-two brands and the effort required for the inspection of these, provided they were all sampled, is a large proportion of the work for the year. This company imposes upon the State an expense which is greatly disproportionate to its sales as compared with other companies offering a greatly less number of brands. It is very certain that if the fertilizer trade continues its present development, either an analysis fee must be imposed or else the State appropriation must be considerably increased. As the matter now stands, a large share of the time of the chemist-in-chief and of four assistant chemists, besides a good deal of attention on the part of the Director of the Station, is devoted to fertilizer inspection. The result is that the efforts of certain Station officers in the direction of investigation are unfortunately limited by this burden of routine work to an extent not justifiable from any point of view. I commend this matter to the attention of your Board as one worthy of serious and careful consideration.

Sugar beets.—Considerable attention has been devoted to sugar beet analysis. This was made necessary by the present active and widespread discussion of sugar beet production in New York.

About one hundred and fifty samples of beets were analyzed and a general summary of the results is given in Bulletin 135, showing that the average percentage of sugar in the beets was 15.3 per cent. The present indications are that this work will be largely increased in 1898.

Plant nutrition.—Investigations are in progress concerning the plant-food needs of fruits and vegetables and the effect of certain compounds in fertilizers upon the quality of fruits.

The composition of cider and vinegar.—A study of the composition of cider and cider vinegar is now going on with a view to discovering some means of distinguishing between real and artificial or adulterated cider vinegar.
DEPARTMENT OF HORTICULTURE.

Of the nine horticultural bulletins issued by the Station in 1897 five discuss plant diseases and the methods of treating them, and one relates to apparatus used in treating insects and diseases which are injurious to plants. It should not be inferred from this that subjects relating to plant pathology occupy two-thirds of the time of the horticultural staff, although it is true that much attention is devoted to work of this kind.

Plum leaf spot.—For several years questions pertaining to the treatment of the leaf spot of plum and cherry have been under investigation. The work which Mr. Fairchild started in 1891 to determine the best means of preventing injury to plum and cherry nursery stock was followed until a satisfactory line of treatment could be confidently recommended. Investigations were then undertaken with the same disease in the orchard. A report of the progress of this work in 1895 was given in Bulletin 98 and the Annual Report for that year. The experiments were continued in 1896 to determine whether the disease may be controlled by two treatments with Bordeaux mixture, 1-to-11 formula, and if so when these treatments should be made. The results, as set forth in Bulletin 117, show that two timely and thorough treatments with this mixture may control the disease on plums in some seasons, but three treatments generally give the best results. The Italian Prunes, which were given this treatment, showed an average gain of 24½ pounds of fruit per tree at an extra cost of less than one cent per pound.

Cherry leaf spot.—Cherries ripen so early in the season that it has not yet been found practicable to give them the thorough treatment which is necessary to control the leaf spot, without spotting the fruit with the spray so as to injure its appearance when ripe. This question is still under investigation.

Raspberry anthracnose.—In Bulletin 124 Mr. Paddock gives the results of three seasons' work with the raspberry anthracnose. He finds that it is best to set none but healthy plants and practice a short rotation of crops. The spread of the disease in infested fields was successfully prevented by treatment, but the yield of fruit was not increased enough to make the spraying profitable.
Oat smut.—The treatment of oat smut can hardly be called a horticultural operation, but the general importance of the subject to the agriculture of the State and the need of a bulletin to furnish correspondents with instructions for treating this disease made it desirable that some investigations concerning it should be undertaken. In Bulletin 131 Mr. Close sets forth clearly the results of investigations which were conducted in 1897 partly at the Station and partly on the farm of Messrs. King and Robinson, Trumansburg, Tompkins County. Lysol, a fungicide which has not heretofore been tried against grain smuts, gave excellent results. The most inexpensive treatment, soaking with 0.2 per cent formalin solution, cost for the material 1.4 cents per bushel of seed treated.

Gooseberry mildew.—We have long wished to know something definite as to the comparative value of potassium sulphide and Bordeaux mixture for preventing gooseberry mildew. Mr. Close’s investigations on this point are published in Bulletin 133. The best results were obtained when the treatment was begun early in the season, and potassium sulphide proved superior to Bordeaux mixture, lysol and formalin for preventing the disease.

Spray pumps and mixtures.—The constant demand for elementary instruction concerning the use of spray mixtures and spray pumps made it necessary to make further tests of apparatus and revise former instructions so as to include the most recent developments in this line. This has been done by Mr. Paddock and the results are given in Bulletin 121 on Spray Pumps and Spraying.

Effect of wood ashes upon apple scab.—For five years one of the apple orchards at the Station has been devoted to an investigation of the question whether fertilizing the soil liberally with wood ashes may make the apples more resistant to the scab. The results in this investigation are set forth in a bulletin on this subject in which it is shown that, with the conditions under which this investigation was made, immunity from apple scab is not at all increased by liberal applications of hard-wood ashes to the soil.

Forcing tomatoes.—Methods of training and benching tomatoes in the forcing house are discussed in Bulletin 125. The conclusion is reached that, at least in this climate, single stem training
is clearly superior to three stem training in forcing tomatoes. Plunging small pots containing the young tomato plants in the soil of the bench to see whether confining the roots thus would bring the plants into bearing earlier or increase their productiveness, showed that practically nothing was gained by this treatment and when used with three stem training it was a detriment.

**Varieties of fruit at the Station.**—But two bulletins have been prepared in 1897 on the varieties of fruit which are growing at this Station. These are Bulletins 127 on Strawberries and 128 on Raspberries, Blackberries and Dewberries, both by Mr. Paddock. The following shows the number of varieties of commonly cultivated fruits in the Station collection at the close of 1897, not including plants which were received in the fall of 1897 nor those currants and gooseberries which are grown here simply to illustrate the species to which they belong.

<table>
<thead>
<tr>
<th>Fruits</th>
<th>Number of Station seedlings now growing</th>
<th>Number of varieties added in fall of '96 and spring of '97</th>
<th>Total number of varieties now growing at the Station</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pomaceous fruits.</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apples</td>
<td>50</td>
<td>108</td>
<td>671</td>
</tr>
<tr>
<td>Crab apples</td>
<td>—</td>
<td>1</td>
<td>22</td>
</tr>
<tr>
<td>Pears</td>
<td>39</td>
<td>19</td>
<td>240</td>
</tr>
<tr>
<td>Quinces</td>
<td>—</td>
<td>2</td>
<td>11</td>
</tr>
<tr>
<td><strong>Stone fruits.</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apricots</td>
<td></td>
<td>11</td>
<td>36</td>
</tr>
<tr>
<td>Cherries</td>
<td>1</td>
<td>21</td>
<td>75</td>
</tr>
<tr>
<td>Peaches</td>
<td>—</td>
<td>17</td>
<td>147</td>
</tr>
<tr>
<td>Plums</td>
<td>18</td>
<td>43</td>
<td>243</td>
</tr>
<tr>
<td><strong>Small fruits.</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grapes</td>
<td>446</td>
<td>6</td>
<td>675</td>
</tr>
<tr>
<td>Currants</td>
<td>53</td>
<td>10</td>
<td>102</td>
</tr>
<tr>
<td>Gooseberries</td>
<td>256</td>
<td>5</td>
<td>479</td>
</tr>
<tr>
<td>Blackberries</td>
<td>1</td>
<td>3</td>
<td>34</td>
</tr>
<tr>
<td>Dewberries</td>
<td>43</td>
<td>—</td>
<td>49</td>
</tr>
<tr>
<td>Raspberries</td>
<td>23</td>
<td>6</td>
<td>123</td>
</tr>
<tr>
<td>Strawberries</td>
<td>53</td>
<td>27</td>
<td>113</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>983</td>
<td>306</td>
<td>3020</td>
</tr>
</tbody>
</table>
DEPARTMENT OF PLANT PATHOLOGY.

A new disease of sweet corn.—Mr. Stewart has given considerable time to the study of a new disease of sweet corn to which the early varieties of this crop are much subject in the market-gardens of Long Island. He has demonstrated that this disease is bacterial in its nature, which is the first step necessary to a discovery of methods of prevention. The subject needs further study, and no remedial measures can now be recommended. Prevention may perhaps be secured by care in the selection of seed and by the planting of resistant varieties.

Potato scab.—The ploughing in of a crop of green rye had no effect in preventing potato scab. The disease appeared to be aggravated rather than checked.

Potato stem blight.—This was not communicated by planting diseased tubers, neither were peppers, tomatoes, egg plants or plants of other species infected by contact with diseased potato tubers.

Carnation rust.—The application of a solution of common salt neither prevented the rust nor benefited the growth of the carnation plants.

Downy mildew on cucumbers.—The early cucumber and pickle industry of Long Island has been in danger of destruction from the ravages of this disease. The experiments of Mr. Stewart in 1896 resulted in materially checking its development by spraying with Bordeaux mixture.

These experiments were repeated at two points in 1897 with similar results. On a small plat of early cucumbers at Floral Park, spraying caused an increased yield of over 30,000 fruits per acre.

On the farm of Mr. Robert Colyer an acre of late cucumbers was sprayed under the direction of Mr. Stewart. The resulting crop was about 102,000 fruits, the average yield with growers who took no pains to control the mildew being not over 20,000 fruits per acre. It is probable that other growers can produce equally large crops when the spraying is done with equal intelligence and thoroughness.
DEPARTMENT OF ENTOMOLOGY.

Insectary.—A portion of one of the large greenhouses is being remodeled for use as an insectary. Among other important features it will contain breeding cages of necessary sizes and shapes in which various species of injurious insects can be isolated and their habits studied, root cages for studying insects which attack the roots of plants and fumigating boxes to be used in testing the effects of various gases upon insects in different stages of development. A dark room also forms an important part of the equipment of the insectary.

The collection of insects.—About 200 species have been added to the Station collection of insects besides valuable biological material illustrating the life histories, habits and injurious work of some of the species already in the collection. The collection now numbers nearly 2,600 species.

Illustrations.—An important part of the work during the past season has been the making of illustrations, photographs and drawings, showing the structure, life histories and habits of injurious insects and their natural enemies. A large number of these illustrations have been made during the past summer. They are kept on file for use in bulletins as needed.

Inspection of nursery stock.—Nursery stock inspection has been continued again this season, but to a less extent than the season previous. About fifteen nurseries have been visited with the result that ten species of insects, all more or less injurious, have been found on young trees about to be shipped, showing that these insects are distributed by means of nursery stock. The species referred to are as follows: The woolly aphis, peach tree borer, the pistol-case-bearer, oyster-shell bark-louse, scurfy bark-louse, plant lice of various species, the bud moth, the New York plum Lecanium; the oak scale and Aspidiotus ancyclus. The San José scale has also been found in a small nursery in Western New York. Infested stock has possibly been shipped from this nursery for six or eight years past. The present owner is going out of the business and is clearing the land for fruit.

Experiments in dipping young nursery trees infested with plant-lice.—Young nursery trees infested with plant-lice cannot be
sprayed to advantage as the lice cause the leaves to curl. The lice congregate in great numbers on the under sides of the leaves at and near the tips of the young trees. By dipping these infested tips the insects may be killed. The objects of the experiment was to determine the proper strength of the solution (a solution of whale-oil soap) to use. The expense of treating the trees was so slight that no record of it was kept. It was shown that whale-oil soap will kill the lice and may be safely used for this purpose at a strength of one pound to seven gallons of water, but that a stronger solution, one pound to three gallons, will injure the foliage. The weaker solution kills the lice as effectually as the stronger.

Experiments in spraying young nursery trees.—One-year-old apple grafts were sprayed with green arsenite (Scheele's green) one pound to 100 gallons. The trees were badly infested with the canker-worm. This application was made late in June and was so effectual in destroying the canker-worms that another application was not necessary.

Young cut-leaf birch trees, badly infested with thrips, were sprayed three times with a whale-oil soap in solution to which was added one ounce of flowers of sulphur to one gallon of the soap solution. This combination proved highly successful, showing that this serious pest can be controlled.

Experiments in fumigating nursery stock with hydrocyanic acid gas.—These experiments are not yet completed but the indications now are that nursery stock can be successfully fumigated in large frost-proof cellars where the trees are ordinarily stored over winter, without going to the expense of building houses for this purpose where stock can be fumigated in small lots only.

Spraying experiments with green arsenite.—These experiments form a part of a series of experiments with green arsenite begun in 1896, their object being to test the value of green arsenite as compared with Paris green.

Fourteen large trees owned by O. L. Jackson, at Rushville, were used for the experiments and were sprayed three times. Examinations made soon after the first application showed that only the young worms, those about one-fourth inch long, had been killed by the spray. After the third application the trees
were practically free from worms, the older ones having finally succumbed.

This indicates that green arsenite may be slow in its action but where the trees were sprayed three times it was effectual.

*Investigations and experiments with plant lice.*—Four species of plant lice have been under observation during the past season, two infesting the plum and two infesting the currant. The work of studying out the complete life histories of these species is not yet complete. The best progress has been made with *Hyalopterus pruni*. All stages but one have been observed and drawings made. In all the other species studied, with the probable exception of *Myzus*, new facts concerning their life histories have been brought to light, and their various forms figured for the first time. Nine species of the natural enemies of these insects have also been studied and illustrations made showing the different stages in their development.

Experiments in spraying currant bushes and plum trees showed that these lice may be destroyed if a whale oil soap solution, one pound to seven gallons of water, is properly used.

*The cotton-wood leaf beetle.*—The investigations and experiments with this insect were finished during the past season.

The field used the previous year was sprayed with green arsenite, former experiments having shown that this insecticide would probably prove the most effectual of any tried. Three applications were made, with the result that the plat was kept almost entirely free from the insects.

In comparing the cost of spraying and running the "bug machines," or "drags," it was found that the spraying could be done at about two-thirds the expense of the other method. It was also found, however, that under ordinary circumstances the best results would be obtained by using the "machine" for a few days soon after the last application of the poison.

DEPARTMENT OF ANIMAL INDUSTRY.

*Feeding experiments with chicks and capons.*—From an extended test of the relative efficiency of whole and ground grains in feeding chicks and capons it was learned that more food was eaten
and a more rapid and profitable gain was made when the ground grain was fed.

Source of milk fat.—An extended and somewhat elaborate investigation concerning the source of milk fat was begun early in the year and the results so far as reached were published in Bulletin 132.

The data show clearly that food fats are not essential to the formation of milk fat, and that the milk fat was not derived wholly from the metabolism of protein; but that probably its origin was partially in the carbohydrates of the food, as has been demonstrated to be the case with body fat.

PRODUCTION OF FIELD CROPS.

An important series of experiments has been begun on the Station farm for the purpose of studying the relative economy of certain systems of maintaining soil fertility.

EDUCATION IN ROAD BUILDING.

The U. S. Department of Agriculture, among other efforts, is endeavoring to disseminate information concerning the construction and economy of good roads. To this end a bureau known as the Office of Road Inquiry has been established.

As one means of accomplishing its purposes this Office is cooperating with the Land Grant Colleges and the Experiment Stations in building in proximity to these institutions samples of roads which shall be an object lesson, especially to rural communities.

The first of these roads was built at New Brunswick, N. J., and the second at Geneva. The latter was built by the united efforts of the Office of Road Inquiry, private citizens, the village of Geneva and the Experiment Station, and is located on North and Castle streets. It extends about twelve hundred feet along the northern boundary of the Station property and runs the entire length of Castle street, the whole distance being about one and a quarter miles.

The manner of construction is what is known as McAdam, the covering of the road bed consisting of broken stones to the depth
of eight inches. On North Street the road is eight feet wide and on Castle Street the width is fourteen feet for the greater part of the distance, the remainder being twenty feet.

The lower five inches of the covering was obtained from common field stone, and this was surfaced with three inches of broken Hudson River trap rock.

The cost, details of construction and other related facts will be given in the report of the Department of Agriculture. As this road was completed only last October it is too early to draw conclusions as to its quality and durability. It is satisfactory so far and has changed the streets between the Experiment Station and the city from a condition which at times was almost unbearable and prohibitive of travel to one of convenience and comfort.

BULLETINS PUBLISHED IN 1897.

The following is a list of the bulletins issued by the Station for the year 1897. All of these are included in this report excepting Nos. 114, 115, 116, 120, 122, which were presented in the report for 1896.

No. 117—March.—Treatment of leaf spot in plum and cherry orchards in 1896. S. A. Beach. Pages 9.
No. 119—March.—The downy mildew of the cucumber: What it is and how to prevent it. F. C. Stewart. Pages 30.
No. 121—March.—Spray pumps and spraying. Wendell Paddock. Pages 23.
No. 125—July.—Forcing tomatoes: Comparison of methods of training and benching. Note on a tomato disease. S. A. Beach. Pages 32.
No. 126—November.—Feeding experiments with chicks and capons: The relative efficiency of whole and ground grains as commonly fed. W. P. Wheeler. Pages 19.
No. 128—November.—Variety tests with raspberries, blackberries and dewberries. Wendell Paddock. Pages 11.


No. 131—December.—Results with oat smut in 1897. C. P. Close. Pages 14.


No. 133—December.—Spraying in 1897 to prevent gooseberry mildew. C. P. Close. Pages 12.


No. 138—December.—Experiments and observations on some diseases of plants. F. C. Stewart. Pages 18.


No. 140—December.—Wood ashes and apple scab. S. A. Beach. Pages 27.


W. H. JORDAN,

Director.

N. Y. Agr'l Exp't Station, Geneva, N. Y.

Dec. 31st, 1897.