New York Agricultural Experiment Station.

GENEVA, N. Y.

DIRECTOR'S REPORT FOR 1900.

W. H. JORDAN.

PUBLISHED BY THE STATION.
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FRANK E. NEWTON,
JENNIE TERWILLIGER,
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ADIN H. HORTON,
Computer.

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 Fertilizer Control.
† At Second Judicial Department Branch Station, Jamaica, N. Y.
‡ Absent on leave.
DIRECTOR'S REPORT FOR 1900.

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

Gentlemen: I have the honor to submit herewith a report of the New York Agricultural Experiment Station for the year 1900.

It is a matter for sincere congratulation that I am able to report to you the completion of another year's work of an apparently useful character and unattended by any serious disappointments or disasters.

THE STATION STAFF.

Mr. Wendell Paddock, after serving the Station faithfully and efficiently for nearly seven years as Assistant Horticulturist, resigned his position on September 15th to accept the chair of Botany and Horticulture in the Agricultural College of Colorado. Mr. Heinrich Hasselbring, B.S.A., a graduate of Cornell University from the Course in Agriculture, and for a year assistant in botany at that institution, was appointed to fill Mr. Paddock's place. Mr. Hasselbring entered upon his duties Nov. 1st, 1900.

During the year, acting upon your authority, assistants have been appointed in the departments of Bacteriology, Chemistry and Entomology, as follows:

Lore A. Rogers, B.S., Assistant Bacteriologist, July 10th.
Andrew J. Patten, B.S., Assistant Chemist, August 1st.
Percival J. Parrott, A.M., Assistant Entomologist, August 1st.

Mr. Rogers graduated from the Course in Agriculture at the University of Maine in 1896, and as special preparation for his work spent two years in bacteriological studies, one at the University of Wisconsin, and one at this institution.

Mr. Patten was a graduate from the Chemical Course of the University of Maine in 1897, and for three years was Assistant Chemist in the Maine Agricultural Experiment Station.
Mr. Parrott graduated from the Kansas State University in 1897, and until his appointment to this staff was Assistant Entomologist at the Kansas Agricultural College.

Two members of the staff are now away on leave of absence, Mr. Edwin B. Hart and Mr. A. D. Cook. The former is studying in Europe and the latter at Cornell University.

BUILDINGS AND THE GENERAL CONDITION OF THE STATION PROPERTY.

The much needed appropriation for the erection of a Director's house was granted by the Legislature of 1900. Contracts for completing this building within the appropriation have been let and its construction is well under way.

The completion of the plan for improvement which you adopted, requires that the building now occupied by offices and the living rooms of the Director's family shall be reconstructed internally so as to furnish convenient facilities for the entire administrative work of the Station and the library. It is to be hoped that means for doing this will be provided by the Legislature of 1901.

It may be said that in general the property of the Station is in excellent condition. The Chemical Laboratory which has been occupied nearly ten years without repairs will soon need more or less attention, and a partial reconstruction of the interior arrangement of the cattle barn should be accomplished.

FINANCIAL CONDITION.

The work of the Station has so developed during the last five years that it requires careful planning to bring the expenses of the institution within its present income, an income for which no increase has been asked of the State during the past six years, notwithstanding a considerable enlargement of our staff and activities. As a matter of fact, the annual appropriations for maintenance which are raised by taxing the citizens of the State are $10,000 less than they were previous to 1900, because the fertilizer inspection, for which $10,000 was formerly appropriated annually, is now self-supporting.

There is no good reason why the income of the Station should permanently remain at its present amount. So long as our efforts
can be enlarged and strengthened in the service of the agriculture of the State and to its satisfaction, it will be found profitable to increase the expenditures in the interests of our greatest industry. In consideration of its environment and opportunities and of the wealth and position of the commonwealth which maintains it, this Station is entitled to attain a leading position in its equipment and in the character of its work. The citizens of this State may well make it a matter of pride to insist that this high condition of efficiency be reached and maintained.

THE MAILING LIST.

At the present time the bulletins of the Station are distributed as follows:

**Popular Bulletin List.**

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<thead>
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<th>Quantity</th>
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**Complete Bulletin List.**

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**Farmers' Institute Work.**

The members of the Station staff continue to serve as speakers at farmers' institutes under an arrangement which tends to economize time and energy. It is understood that such service shall not exceed a stated length of time and shall be confined to not more than two periods of absence from the Station. The reasons for such limitations as these are obvious.

**Inspection Work.**

This department of activity is gradually broadening. The Station is now responsible for inspection along four lines; fertilizers, concentrated feeding stuffs, insecticides and the Babcock glassware used for commercial purposes at creameries and cheese
factories. The first two lines are rendered self-supporting through the license fees required by law. For the maintenance of the two latter no provision is made except as special appropriations may be granted.

The requirements of the fertilizer law are very fully met by the trade. It is safe to say that few brands of fertilizers are illegally sold in New York. It is still more satisfactory to note that manufacturers are, as a rule, very careful to maintain the standard of their goods up to the guarantee.

All this is due to a general acquaintance with the terms of the law and to the recognition of the fact, through experience, that the legal restrictions are beneficial to both manufacturer and consumer.

The concentrated feeding stuffs law has been in operation but little more than a year. It has been complied with very cheerfully and promptly by the leading manufacturers and jobbers and there is evidence that it is growing in influence and favor. Without question its provisions will in time be as fully met as is now the case with the fertilizer law, and its beneficence will be as fully recognized.

The detailed results of inspection along all lines will be mentioned later.

EXPERIMENTS IN CO-OPERATION WITH FARMERS.

Experience is demonstrating that one very useful, and even essential, means of carrying on a certain class of experiments is the coöperation with farmers. In this way conditions can be secured which are not available on the Station farm.

During 1900 experiments of a coöperative nature have been carried on as follows: The use of commercial fertilizers in growing potatoes, with H. L. Hallock, Jamesport, W. A. Fleet, Cutchogue, W. L. Jagger, Southampton, and R. H. Robbins, East Williston; the use of commercial fertilizers on onions with Stephen Mars, Florida; prevention of cabbage rot, with D. White, Phelps; prevention of onion smut, with Stephen Mars, Florida; prevention of asparagus rust, with Arthur L. Downs, Mattituck; prevention of peach leaf curl, with George D. Robinson, Riverhead; treatment of apple canker, with Harry Chapin,
East Bloomfield; prevention of San José scale by fumigation and spraying, with W. & T. Smith, W. & T. Cass and C. H. Darrow, of Geneva, C. W. Ward, Queens, White & Rice, Yorktown, and G. H. Scudder, Huntington; spraying orchards in bloom, with George H. Bradley & Son, Lake Road, J. B. Collamer & Son, Hilton, F. D. Gardner, Barker, and T. B. Wilson, Halls Corners; investigation concerning the degeneration of varieties and an experiment in chestnut growing, with W. D. Barns & Son, Middle Hope; fertilizing fruit tree blossoms by bees, with S. D. Willard, Geneva; irrigation of strawberries, with W. F. Taber & Son, Poughkeepsie. In all these cases the Station is given access to property and more or less control over it, and in some instances the parties mentioned assume partial responsibility in conducting the experiments. The officers of the Station are under obligation to the persons mentioned for cordial and faithful assistance.

THE RESULTS OF INSPECTION WORK.

Inspection of fertilizers.—The new fertilizer law has proved very efficient in diminishing the number of brands of fertilizers offered for sale. In 1900, 113 manufacturers paid license fees and complied with the provisions of the law relative to 600 different brands. The number of brands registered in 1899 was 2268, offered by 190 supposed manufacturers.

The number of samples collected between April 5th and Oct. 1st was 638, representing 450 brands, each manufacturer being represented by from 1 to 28 brands. The results of the inspection during the year show that few brands fell short of the guarantees to any important extent.

Inspection of concentrated feeding stuffs.—The concentrated feeding stuffs law practically became effective at the beginning of the year 1900. Eighty-two manufacturers registered their goods and paid license fees on one hundred and four brands. During the year many samples of feeding stuffs were selected at different points in the State, one hundred and four of which were analyzed, the results being published in Bulletin 176. The results of the inspection show that in the main the leading manufacturers are meeting their guarantees. It also appears that some feeding stuffs were sold illegally, which is not surprising in view of the
short time during which the law has been in operation. There are
evidences that the law is meeting with favor and that it is exert-
ing a valuable educational influence.

*Inspection of Paris green and other insecticides.*—Twenty-seven
samples of Paris green and other insecticides were taken and
analyzed. The general result is to show a good quality of Paris
green in the market. One brand was found to be wholly unfit
for use. The law under which we are operating is seriously
defective in several points and it is proposed to ask the legislature
of 1901 to amend it.

*Inspection of Babcock test glassware.*—The Legislature of 1900
passed a law requiring that all Babcock glassware used by
creameries and cheese factories which buy milk on the basis of
the Babcock test shall be examined by the Station and marked.
During the year 2259 bottles have been received, 76 of which
were inaccurate. The new bottles were, as a rule, fairly correct,
the largest variation being in those made in the early history of
the test. Some bottles of that character showed a variation of
one per ct. from the true scale.

**DEPARTMENT OF BACTERIOLOGY.**

The following work has been carried on by the Bacteriological
Department with the active cooperation of the Dairy Expert on
all points which called for a knowledge of practical conditions.

*Fishy flavor in milk.*—An outbreak of this trouble was traced
to the milk of a single animal. This cow seemed in good health
but the milk possessed this intensely disagreeable flavor when
freshly drawn. By tainting all the milk with which it was mixed
the product of this one cow had caused a marked falling off in
the business of a city dealer. All trouble ceased when the milk
of this one animal was rejected. No biological cause for the
flavor could be discovered.

*Bitter flavor in Neufchatel cheese.*—An outbreak of the trouble
in a factory was studied and found due to the activity of certain
kinds of bacteria. By making cheese from samples of the milk
of each patron the source of the trouble was located and removed.

*Sweet flavor in Cheddar cheese.*—Work upon this subject has
been continued throughout the year. It has been found that
while yeasts occur but rarely in clean-flavored cheese they are regularly present in considerable numbers in all cheese selected for our study by cheese experts as typical examples of sweet flavor. This opens up an entirely new field concerning the relation of yeasts to bad flavors in cheese and work is being continued along this line.

*Rusty spot in Cheddar cheese.*—Reports seem to show an increase in trouble from this source during the present year. The bacterium causing the trouble was isolated from the product of factories in three different counties and its action studied when it was introduced into the cheese vat. When cultures of the germ were mixed with the milk before adding the rennet, little discoloration of the cheese resulted; but when introduced into the vat after the curd was cut, the cheese became very red.

This would seem to indicate that the time of introduction is important, and that infection from the factory and utensils is a more probable source of harm to the cheese than introduction directly through the milk of the patrons. Work upon this subject will be continued.

**DEPARTMENT OF BOTANY.**

*A parasite of carnation rust.*—It has been discovered that the carnation rust fungus is frequently attacked by a parasitic fungus, *Darluca filum.* *Darluca* is a well known parasite of rust fungi, but, heretofore, it has not been known that it attacks carnation rust. The parasite is not likely to be a very important factor in the control of the rust.

*Anthracnose and stem rot of the snapdragon.*—The cultivated snapdragon, *Antirrhinum majus,* is subject to a destructive fungous disease which spots the stems and leaves. It is called anthracnose and is caused by an undescribed fungus to which we have given the name *Colletotrichum antirrhini.* In an experiment on the treatment of this anthracnose, plants sprayed once a week with Bordeaux mixture continued in perfect health, while unsprayed plants in an adjoining row were completely ruined by the disease. Upon the results of this experiment we base the following recommendations: Spray thoroughly with Bordeaux mixture once a week, commencing as soon as the
plants are rooted and continuing until they are put into the greenhouse in the fall. If later sprayings seem necessary use ammoniacal solution of copper carbonate instead of Bordeaux. Take cuttings only from healthy plants.

Stem rot is another disease of the snapdragon in which succulent shoots suddenly wilt and die. It has been shown by inoculation experiments that the cause of this trouble is a fungus belonging to the genus *Phoma*.

*The sulphur-lime treatment for onion smut.*—Smut is the most destructive disease of the onion. It kills large numbers of the seedling plants. During the past five years we have been conducting extensive field experiments in Orange County on the prevention of smut by the use of sulphur and air-slaked lime. Where these substances were scattered in the open rows before the seed was sown the yield was increased at the rate of from 40 to 100 barrels per acre. The results of the experiments were so satisfactory that we can unhesitatingly recommend the treatment for fields on which smut has caused a loss of as much as one-third of the crop. The proper quantity to use appears to be 100 pounds of sulphur and 50 pounds of lime per acre. It will not do to apply the sulphur and lime broadcast, as they seem to have no effect upon the smut when applied in that way. The application must be made in the open rows before, or while, sowing the seed.

*Plant diseases caused by Rhizoctonia.*—*Rhizoctonia* is a form-genus including several species of sterile fungi which cause root-rot, stem-rot and damping-off diseases of various cultivated plants. In Europe, considerable attention has been given to *Rhizoctonia* diseases, but in this country their investigation has been neglected, although it appears that such diseases are common here and some of them very destructive,

This Station in coöperation with the Cornell University Agricultural Experiment Station, has undertaken an exhaustive study of *Rhizoctonia* diseases. A preliminary report of the investigations was published as Bulletin 186.

*Fruit-disease survey of Western New York.*—In the season of 1900 the Station made a fruit-disease survey of western New York similar to the one made in the Hudson Valley in 1899. This survey has brought to light several new and important facts concerning
fruit diseases. Among other things, it has been discovered that there exists in this State a destructive raspberry cane-blight which is caused by a fungus belonging to the genus *Coniothyrium*. This disease will be made the subject of a special investigation during the coming season.

**DEPARTMENT OF ENTOMOLOGY.**

*The palmer worm.*—The life history of this species, *Ypsolopus pometellus*, has been worked out during the past season. Apple leaves and young apples constitute the principal food of the caterpillars. Although well distributed throughout Western New York the insect was most destructive in Wayne, Monroe, Orleans, and Niagara counties.

*Fruit bark beetle.*—Observations upon this species, *Scolytus rugulosus*, were begun last season and are being continued. It has been supposed that the beetles usually confine their attacks to sickly trees but the past season's investigations have shown that they will also attack and deposit their eggs in healthy vigorous trees. In some of the large peach orchards in Niagara County the beetles worked extensively in the bark of the trunks and large limbs causing a copious exudation of sap. Cherry trees were also attacked but to a less degree. Eggs and larvæ were found late in the fall in the sapwood of the smaller branches into which the beetles had made short channels.

These habits of the insect indicate two methods of treatment: First, the application of a caustic wash to the bark and larger limbs during July; and second, the careful cutting out of the infested branches during the winter as explained in Bulletin 180.

*Quince mealy-bug.*—A species of *Dactylopius* attacking quince trees. The life history of this species has been worked out in part. The studies will be continued until completed.

*Wheat sawfly.*—An investigation into the cause of "lodging" of wheat showed that a species of sawfly is probably responsible for much of the injury attributed to the Hessian fly. The sawfly larva feeds within the straw from the root to the head but finally weakens it just above the crown of the root so that the wind causes it to break very low down. Hence wheat "lodged" as a result of the work of this insect lies close to the ground the
full length of the straw. The kernels are but little affected. The insect passes the remainder of the summer and the winter in the crown of the root appearing in the spring as a small four winged fly.

The origin and early stages of parthenogenetic and sexual eggs of aphids.—These investigations have to do with some of the fundamental problems of insect development. They were begun a year ago and are being continued. Up to the present time the details of the formation of the polar body in the parthenogenetic egg have been worked out.

San José scale.—These investigations may be divided under two heads: (1) The development of the insect and (2) the methods of control. During development the insect passes through three well defined periods: (1) The period of activity (2) the period of growth, and (3) the period of reproduction. The duration of all of the periods varied greatly with the temperature. During the active period the larvæ migrated readily over smooth surfaces. Numerous insects representing five orders were found from time to time with larvæ clinging to them. Ants, bees and wasps apparently do not carry them. During the period of growth the scale is formed. The average number of young produced per day by female of the fall broods was a little over two.

Experiments with kerosene oil, 100° fire test and 150° fire test, showed the former to be dangerous to the trees at the lowest percentage, when mixed with water, required to kill the scale. The latter gave similar results with peach trees and injured plum trees to a very slight degree when used strong enough to be effective to the scales. Apples and pears were uninjured. Experiments are also being made with crude petroleum and hydrocyanic acid gas. A fumigator for orchard trees has been devised which was successfully used in the experiments.

DEPARTMENT OF HORTICULTURE.

Fumigation of nursery stock.—The best known way of killing San José scale on dormant nursery stock is by fumigation with hydrocyanic acid gas. This treatment is valuable not only against San José scale but against all scale insects which do not winter in the egg stage. It will doubtless also check the spread
of some other kinds of injurious insects which are liable to be distributed on nursery stock.

Plain directions for fumigating dormant nursery stock with hydrocyanic acid gas are published in Bulletin 174 together with suggestions as to the location and construction of fumigation houses or chambers.

Spraying fruit trees in bloom.—The effect of spraying fruit trees when in bloom with the common insecticides and fungicides which are used in orchards has been under investigation during the past season. The work was carried on both in the laboratory and in the orchard. In the laboratory the germination of pollen grains and the growth of pollen tubes in cultures which contained none of the poisons used in spray mixtures were compared with the germination and growth in cultures which contained either some insecticide or some fungicide, or both.

In these cultures both the Bordeaux mixture and copper arsenite of the strength commonly used in spraying apple orchards practically prohibited the germination of the pollen grains with which they came in contact. In cultures containing but 2 per ct. of the 1-to-11 Bordeaux mixture pollen germination occurred only in rare cases; while even the presence of only 1 per ct. of this mixture had a decidedly adverse influence on the germination of pollen and the development of pollen tubes.

In the field investigation an effort was made to learn what effect the spray mixtures have upon (a) the essential organs of the flower, (b) upon the yield of fruit and (c) upon the fungous diseases and insects which are injurious to the crop.

In almost all cases where the blossoms were hit in the center by the spray they failed to set fruit. In some cases the spray caused the stamens and pistils to wither prematurely. Occasionally when the spray hit the stigmatic surface the pistils remained green for an unusually long time awaiting pollination but at last they withered and set no fruit. The laboratory cultures showed that the pollen could not grow in the presence of even quite dilute spray mixtures. It seems, therefore, that the spray mixture on the stigmatic surfaces, in the cases just cited, by preventing the growth of any pollen which may have reached the stigmas caused the blossoms to fall away without setting fruit.

Tests were made in four apple orchards besides those at the
Experiment Station to see what effect spraying in bloom would have upon the insects and diseases which may be injurious to the crop and also upon the yield of fruit. The investigations gave no information as to whether or not the injurious insects and diseases may be controlled by spraying in bloom better than by earlier and later treatment, because the orchards under experiment were quite free from these troubles at spraying time.

Even with trees which had a great abundance of blossoms spraying in bloom decreased the yield on the average from one-third bushel to one and a half bushels per tree. Spraying trees at several different times while they were in bloom so as to hit both the early and the late blossoms with the spray ruined the crop of fruit.

Second report on New York apple-tree canker.—Since Bulletin 163 on the New York apple tree canker was published, Mr. Paddock has continued his investigations on this subject. He finds the fungus which causes this trouble, *Sphaeropsis malorum*, occurs on several hosts, including apple, pear and quince fruits and apple, pear and hawthorn trees. Sunscald and sunburn undoubtedly have much to do with with the susceptibility of some varieties of apple trees to the canker. The fungus which causes the canker in such cases undoubtedly gains entrance to the cambium through the tissue which has been injured by the sunscald or sunburn. In some parts of the country where sunscald and sunburn are much more injurious than they are in the apple-growing sections of New York State some make a practice of spraying trees in winter with whitewash to prevent sunscald, and train the trees to thick low heads to prevent injury in summer from sunburn. Mr. Paddock recommends spraying with Bordeaux mixture as a preventive of canker.

He has found that *Nectria ditissima*, which is a serious canker fungus in European orchards, occurs on apple trees in New York and Nova Scotia.

**CROP PRODUCTION.**

Experiments in plant nutrition.—During the years 1898 to 1900, inclusive, forcing house experiments were conducted relative to the much discussed substitution of soda for potash in plant growth. Several series of observations were made which were consistent within themselves and with the investigational results
of the past. It was clearly shown that while soda may be substituted for potash in quantity, it cannot supply the place of potash in physiological function. Incidental observations raised the question of the necessary proportion of potash in the plant which is to be made the subject of future studies.

Commercial fertilizers in potato growing.—Experiments in potato growing conducted for four years on four Long Island farms with fertilizers varying in quantity from 500 lbs. to 2,000 lbs. per acre showed that on the average the largest profit was realized from the use of 1,000 lbs.

In comparing mixtures the so-called Long Island formula, 4, 8 and 10, proved to be superior to a potato formula, 7, 4 and 10.

Other experiments with varying quantities of potash gave results which do not justify the use of such large quantities of this ingredient as are now being applied to potato growing by many Long Island farmers whose conditions are similar to those under which these tests were made.

One incidental result of these experiments was to make it clearly evident that a large supply of available plant food does not necessarily insure a satisfactory crop. Other conditions which largely pertain to culture, such as texture, humus and water supply exercise a controlling influence, and when these conditions are unfavorable the situation is not overcome by heavy applications of fertilizer.

DAIRY DEPARTMENT.

Influence of the temperature of curing upon the quality of cheese.—

The experiments in cheese-curing which have been conducted for two years have results of the highest importance from the commercial standpoint. Cheeses have been cured at temperatures varying from 55°F. to 80°F., the higher temperatures representing the common factory conditions.

Of the cheeses made in 1899 those cured at 60°F. and below scored, on the average, almost 5 points higher in flavor and 2.5 points higher in texture, than those cured at 65°F. and above. In 1900, the average difference in flavor of the lower temperatures was 5.1 points on flavor and 2.7 points on texture.

This is a matter well worth the attention of all cheese factory managers, because these differences in commercial quality are sufficient to cause important differences in the selling price.
BULLETINS PUBLISHED IN 1900.

No. 174. March.—Fumigation of nursery stock. S. A. Beach. Pages 8, figs. 2.

No. 175. April.—A parasite upon carnation rust. Frederick H. Blodgett. Pages 5, plates 3.


No. 180. December.—Miscellaneous notes on injurious insects: The forest tent-caterpillar; the fruit-bark beetle; a mealy-bug attacking quince trees; two apple leaf miners; injury to peaches by the tarnished plant-bug. V. H. Lowe. Pages 22, plates 8.


No. 186. January, 1901.*—The sterile fungus Rhizoctonia as a cause of plant diseases in America. B. M. Duggar and F. C. Stewart. Pages 30, figs. 9. (In cooperation with Cornell University Agricultural Experiment Station.)


No. 188. December.—Spraying for asparagus rust: I. Tests with resin Bordeaux mixture. II. The Downs' power asparagus sprayer. F. A. Sirrine. Pages 48, plates 12.


W. H. Jordan, 
Director.

New York Agricultural Experiment Station, 

* So dated to correspond with Cornell Bulletin 186 with which this is practically identical.