New York Agricultural Experiment Station.

GENEVA, N. Y.

DIRECTOR'S REPORT FOR 1911.

W. H. JORDAN

PUBLISHED BY THE STATION.
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HAROLD J. CONN, Ph.D.,
Associate Bacteriologist.

†JAMES K. WILSON, B.S.,
Godfrey L. A. Ruehle, M.S.,
Assistant Bacteriologists.

FRED C. STEWART, M.S.,
†John G. Grossenbacher, Pd.B., A.B.,
Botanist.

Associate Botanists.

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Assistant Botanist.

LUCIUS L. VAN SYLKE, Ph.D.,
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†ALFRED W. BOSWORTH, B.S.,
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RUDOLPH J. ANDERSON, B.S.,
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MORGAN P. SWEENEY, A.M.,
JAMES T. CUSICK, B.S.,
OTTO MCCREARY, B.S.,
Orrin B. Winter, B.S.,
Assistant Chemists.

GEORGE A. SMITH,
Dairy Expert.

FRANK H. HALL, B.S.,
Editor and Librarian.

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

* Riverhead, N. Y. † Absent on leave. ‡ Connected with the Chautauqua Grape Work.

[400]
BULLETIN No. 342.

DIRECTOR'S REPORT FOR 1911.

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

GENTLEMEN.—I have the honor to submit herewith a report of this institution for the year 1911. This includes, among other matters, the expenditures for the fiscal year ending September 30, 1911, a statement of the needs of the Station in view of the enlarging demands made upon it, and a brief review of the main results obtained as shown in full in the text of the complete bulletins which make up the body of the report.

ADMINISTRATION.

THE STATION STAFF.

During the past year the following persons have absented themselves from the Station for the purposes of further study:

Martin J. Prucha, Associate Bacteriologist, and James K. Wilson, Assistant Bacteriologist, are pursuing biological studies at Cornell University.

Alfred W. Bosworth, Associate Chemist, is resident at Harvard University giving especial attention to biological chemistry; and J. G. Grossenbacher, Associate Botanist, at the University of Wisconsin for work in botany.

Notwithstanding the desirability of granting such leaves of absence for the purpose of further study, it cannot be denied that this policy may easily do serious harm to the work the Station is carrying on, through the interruption of the study of problems that must be under consideration during long periods of time. It is for this reason that your Board adopted the rule that an assistant or associate of the staff shall not be granted a leave of absence before three years' residence at the Station.

It is worthy of note that during the past three years ten of the younger members of the Staff have withdrawn from the Station, either temporarily or permanently, in order to pursue advanced study. For this purpose they have sought the advantages of the
larger centers of learning and have distributed themselves among the following universities: Chicago, Columbia, Cornell, Harvard, Wisconsin and Yale.

It is a significant fact that these young men came to see their need of larger scientific knowledge in special directions rather than a greater familiarity with agricultural practice. This is testimony to the fact that, other things being equal, the man best equipped for agricultural investigation is the man most severely grounded in the fundamental sciences. The agricultural technics related to any line of inquiry are more easily acquired outside of college halls than is the necessary scientific training. Indeed, the practice side of agricultural investigation is nowhere so well learned as in the midst of practice. As related to future efficiency it is a matter for congratulation when young men seek larger acquirements and it is gratifying to believe that the Station environment has been such as to stimulate such ambitions.

The following appointments have been made to the Staff:

Rudolph J. Anderson, B. S., as Associate Chemist. Mr. Anderson graduated from Tulane University in 1906. For several years he was engaged in pharmaceutical work. The last two years previous to his appointment were spent in advanced study at the Universities of Upsala and Berlin, chiefly at the latter.

Joseph F. Barker, M. S., in charge of soil investigations. Mr. Barker is a graduate of the Ohio State University in the class of 1908. As a result of graduate study in the Iowa State College he was granted the degree of M. S. by that institution in 1910. At the time of his election to the Station Staff he held the position of Assistant Professor of Agronomy in the Iowa State College.

Harold J. Conn, Ph. D., as Associate Bacteriologist. Dr. Conn took his undergraduate course at Wesleyan University. Later he spent three years in advanced study at Cornell University, chiefly in soil bacteriology, in consideration of which the degree of Ph. D. was conferred on him in 1911.

Godfrey L. A. Ruehle, M. S., as Assistant Bacteriologist. Mr. Ruehle is a graduate of Washington University (Seattle), class
of 1908. He was given the degree of M. S. by the same institution in 1910.

Orrin B. Winter, B. A., as Assistant Chemist. Mr. Winter is a graduate of the University of Michigan, class of 1909. At the time of his appointment he was serving as Assistant Chemist in the Michigan Agricultural Experiment Station.

MAINTENANCE FUNDS.

The State appropriations for the maintenance of the Station during the fiscal year ending September 30, 1911, were as follows:

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salaries</td>
<td>$47,000</td>
</tr>
<tr>
<td>Labor</td>
<td>15,800</td>
</tr>
<tr>
<td>Maintenance of the work of the Station departments</td>
<td>22,500</td>
</tr>
<tr>
<td>General expense, heat, light, water, repairs, etc.</td>
<td>5,500</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$90,800</strong></td>
</tr>
</tbody>
</table>

Expense of chemical work in analyzing samples of fertilizers and feeds submitted as required by law by the Commissioner of Agriculture:

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fertilizer inspection</td>
<td>$10,000</td>
</tr>
<tr>
<td>Feeding stuffs inspection</td>
<td>3,500</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$13,500</strong></td>
</tr>
</tbody>
</table>

For investigating the conditions affecting the grape industry in Chautauqua County

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$7,500</td>
</tr>
</tbody>
</table>

The following are the appropriations for the current fiscal year:

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salaries</td>
<td>$52,000</td>
</tr>
<tr>
<td>Labor</td>
<td>15,800</td>
</tr>
<tr>
<td>Maintenance of the work of the Station departments</td>
<td>22,500</td>
</tr>
<tr>
<td>General expense, heat, light, water, repairs, etc.</td>
<td>5,500</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$95,800</strong></td>
</tr>
</tbody>
</table>

Expense of chemical work in analyzing samples of fertilizers and feeds submitted as required by law by the Commissioner of Agriculture:

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fertilizer inspection</td>
<td>$10,000</td>
</tr>
<tr>
<td>Feeding stuffs inspection</td>
<td>3,500</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$13,500</strong></td>
</tr>
</tbody>
</table>

The appropriations for 1911-12 are less, by $16,700, than the amount requested by your Board. The sum of $5,000 was added to the salary item, but the other items were finally made the
same as for the previous year, excepting that the appropriation for investigating grape problems was cut out entirely. Any considerable increase of one item alone, as occurred with that for the payment of salaries, throws the maintenance funds out of balance because an addition to the working force of an institution necessitates a larger expenditure for apparatus, traveling, printing and so on.

THE PURCHASE OF ADDITIONAL LAND.

The Legislature of 1911 made a much needed appropriation of $15,500 for increasing the experimental area at the Station. This appropriation has been used in the purchase of the so-called Crittenden Farm located in the Town of Geneva and cornering on the northwest corner of the Station property. This farm contains about eighty-seven acres, all of which is of excellent quality and is all available for crop and fruit production. There are on the property two dwelling houses, one of which can be made to comfortably house three small families. These houses will prove very useful in enabling the Station to accommodate its workmen.

Already fifty-three acres of the farm are occupied by field and orchard experiments that would not be possible under previous conditions.

NEEDS FOR THE FISCAL YEAR 1911-12.

The demands upon the modern agricultural agencies sustained by the nation and state are constantly increasing and in many directions. Any scientific institution that serves the complex agricultural interests of a state like New York must consider a great variety of problems that pertain to general farming, dairying, fruit growing and other special lines. This requires the attention of a fairly large group of specialists, and increasingly so. With an increase in the number in a station staff the expenses of operation correspondingly increase. It is the policy of the state of New York to classify its appropriations to this institution under several heads such as salaries, labor, maintenance expenses and so on. For the current fiscal year the funds for labor and those providing for the maintenance of the station activities are too small in proportion to
the salary fund. For this reason an increase is requested in the appropriation items assigned to labor and maintenance of departments.

The fund assigned to fertilizer analyses and to the publication of results is now insufficient to do this work as thoroughly as it should be done. It is now desired to study the forms in which nitrogen exists in the various brands of fertilizers, a most essential part of the inspection for which a method has recently been devised and which is time consuming. Another chemist should, therefore, be placed in the fertilizer laboratory in order to extend the analyses into this new field.

Similar conditions prevail in the inspection of feeding stuffs. Recent changes in the law governing this inspection make both chemical and microscopical examinations necessary, the object of the physical examination being to ascertain the nature of the ingredients out of which the feeding stuffs are compounded. Such examinations require much time on the part of a competent chemist and nearly double the work of inspection. More funds are needed in this direction. The expense of the fertilizer and feeding stuffs bulletins is large, amounting with each from $1,500 to $1,800 annually.

Repairs. The amount expended in repairs during the next year should be considerable. The chemical laboratory has practically gone without repairs since its erection in 1891-2 and it should be neglected no longer. All the Station buildings should be painted in 1912. Some of the buildings acquired by the Station in connection with the new farm are in need of repair. In all, considerable more money than is available in the maintenance funds of the Station is needed for these several repairs. An item of $6,000 is asked for in the Supply Bill in order that funds may be available before the next fiscal year.

INVESTIGATIONS RELATING TO THE GRAPE INDUSTRY IN CHAUTAUQUA COUNTY.

The Legislature of 1909 authorized an investigation into the conditions of grape growing in Chautauqua County and made an
initial appropriation of $10,000 for that purpose. It is obvious that such an investigation into methods of culture, varieties of grapes and the suppression of fungus and insect pests not well understood must necessarily cover a period of years if reliable conclusions are to be reached. The Station promptly entered upon its work and in pursuance of a carefully considered plan leased land for a period of ten years, and located a squad of men in the county to study special problems. The Legislature of 1910 continued to support this effort by an appropriation of $7,500. In 1911 a similar appropriation passed the Senate and Assembly but was disapproved by the Governor. Fortunately a sufficient balance existed from the previous appropriation to carry on the work until February or March, 1912, and if at that time no further funds are provided the work must be discontinued. It is advised that a special bill should be passed early in this session of the Legislature providing for the work until the beginning of the next fiscal year, as an item in the Supply Bill would not be available sufficiently early. The amount needed would be approximately $4,000.

**NEW BUILDING.**

For four successive years the need of a new building at this institution has been presented to the Legislature. The Legislatures of 1909 and 1910 passed bills making an appropriation for an Administration and Demonstration building but in both instances the bill failed to receive the Governor's signature. The reasons why this building should be provided are restated here as given in my report for 1910:

1. There is no place at the institution where an audience can be assembled, excepting out of doors in the pleasant days of the warm season. This is wrong; for the work of the Station stands in such relation to educational interests and farm practice that some way of assembling audiences on the Station ground and bringing them into close range with the Station activities and results should be made possible.

2. It is extremely desirable that space shall be provided where the results of Station work can be illustrated in a concrete form.
We have many visitors who state that they come to see what the Station is doing, not realizing that in the progress of our inquiries they can only see a single point in the progress of an experiment or investigation, which to the untrained eye may be meaningless.

Space is needed for the objective display of results that have been reached in dairy work, in the study of farm pests, field experiments and in other directions. Such an exhibit would be especially useful and instructive in connection with meetings here of horticultural societies and other bodies interested in special lines of production.

(3) The number of the scientific staff is now such that more office room is needed. This can be provided by removing the museum collections in the building now occupied by the departments of bacteriology, botany, dairying, entomology and horticulture, to the proposed new building.

(4) The building now used for administrative and library purposes is needed for other uses. It has come to be necessary to arrange for boarding the unmarried members of the staff at some point nearer than the city. Rooms are now available on the Station grounds, but arrangements for meals near the Station are now difficult and uncertain, sometimes impossible. With slight expense the building now used for offices and library could be adapted to the uses indicated and it would be a much needed convenience. Getting a noon lunch a mile or a mile and a half away occasions either much loss of time or such haste as is equally detrimental to health and good work.


<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>For salaries (resident scientific and clerical staff)</td>
<td>$52,000</td>
</tr>
<tr>
<td>For labor</td>
<td>17,000</td>
</tr>
<tr>
<td>Maintenance of the work of the various Station departments</td>
<td>25,000</td>
</tr>
<tr>
<td>General expense, heat, light, water, repairs, etc.</td>
<td>5,500</td>
</tr>
<tr>
<td>For conducting grape investigations in Chautauqua County (salaries and expenses)</td>
<td>7,500</td>
</tr>
<tr>
<td>Expense of chemical analysis of samples of fertilizers and feeds submitted as required by law by the Commissioner of Agriculture:</td>
<td></td>
</tr>
<tr>
<td>Fertilizer inspection</td>
<td>12,000</td>
</tr>
<tr>
<td>Feeding stuffs inspection</td>
<td>5,000</td>
</tr>
<tr>
<td>Administration and Demonstration building</td>
<td>60,000</td>
</tr>
</tbody>
</table>
Bulletins in the two forms, complete and popular, are now issued approximately as follows:

**Popular Bulletins.**

<table>
<thead>
<tr>
<th>Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residents of New York</td>
<td>39,000</td>
</tr>
<tr>
<td>Residents of other States</td>
<td>2,815</td>
</tr>
<tr>
<td>Newspapers</td>
<td>785</td>
</tr>
<tr>
<td>Experiment stations and their staffs</td>
<td>1,514</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>100</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>44,214</strong></td>
</tr>
</tbody>
</table>

**Complete Bulletins.**

<table>
<thead>
<tr>
<th>Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiment stations and their staffs</td>
<td>1,514</td>
</tr>
<tr>
<td>Libraries, scientists, etc</td>
<td>245</td>
</tr>
<tr>
<td>Foreign list</td>
<td>308</td>
</tr>
<tr>
<td>Individuals</td>
<td>4,018</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>100</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>6,185</strong></td>
</tr>
</tbody>
</table>

The Plums of New York, the third in the series of fruit publications, is now ready for distribution. The edition is nine thousand copies, five thousand copies of which are delivered to members of the Legislature, two thousand copies to the Commissioner of Agriculture and two thousand to this institution. Persons desiring this work may note that the chances of getting a copy from their members of the Legislature are more than twice as great as they are by request of the Station. The effort is made to confine the distribution of the Station copies to libraries, schools, teachers and those persons actually interested in a material way in plum culture. It is a misuse of these volumes to send them to those who simply wish to possess a fine book containing attractive pictures. Attention is again called to the fact that second-hand book stores are liberally supplied with these fruit publications which they dispose of at very generous profits. This constitutes a prostitution of state funds.

The preparation of other publications in this fruit series is now underway, the completion of which must not be expected for several years.
A NEW DEPARTMENT.

The election to the Station staff of a specialist in soil investigations means a much fuller development of soil studies than has heretofore been possible. A soil investigation laboratory has been equipped and the organization of field work has begun in Chautauqua County and on the new farm recently purchased. It is hoped that field work will be developed in other parts of the state.

A wide difference of opinion exists as to the place and value of field experiments in a search for knowledge concerning soil management and crop production. It is significant that the fundamental knowledge we now possess is largely the result of laboratory studies. What we know of the essential constituents of plants, the supply of plant food in the soil, losses from the soil under varying conditions, the influence of soil texture upon temperature and water supply, soil inoculation for the growth of legumes and other important facts and principles has come almost entirely from chemical and bacteriological studies. The results of field experiments are end results that are influenced by a great number of factors such as soil composition and texture, water supply, soil flora, and climatic conditions, a situation so complex that it is practically impossible to assign to any one factor its relative influence upon crop production in any particular field experiment. Field experiments show that in a certain locality with a given soil, different methods of treatment give different results in crop production but as a rule these results are not self-explanatory and they may or may not serve as a guide to practice in some other locality. The conditions of individual farms are so variable that a system of soil management must usually be developed on the basis of general principles rather than by imitating practice that is successful in some other locality.

Long-time field experiments give the most reliable results, but it is worth while inquiring as to the extent that the Rothamstead field work covering sixty or more years, and the work at the Pennsylvania State College for nearly thirty years, will serve as a
guide to practice in general, excepting as the long continued treatments furnish an opportunity for important chemical and bacteriological studies. It is the business of a scientific agency working in the interests of agriculture to search out fundamental facts and principles and anything less than this smacks of empiricism.

CHAUTAUQUA GRAPE INVESTIGATIONS.

The financial status of this enterprise has already been presented. The work as outlined in my report for 1910, especially as summarized in Bulletin No. 331, has been somewhat enlarged. Soil experiments have been instituted under the direction of Mr. Barker, with especial reference to drainage, deep tillage and the introduction of large quantities of lime and fertilizer when vines are set. It is believed that the results already reached in the control of fungus and insect pests will repay many times the expense incurred. The culture experiments will not furnish a basis for intelligent comment until after several years.

WHY AGRICULTURAL INVESTIGATION IS EXPENSIVE.

The question is often asked by those not especially familiar with the methods of scientific investigation why this investigation is so expensive; in other words, why does an experiment station need so much money in order to maintain its activities? This question can best be answered by a description of the way in which certain problems must be studied in order to reach a solution that is worth while.

Just now the Department of Bacteriology is engaged in a study of the effect of certain factors upon the sanitary quality of milk, including the milking machine, form of milk pail, cleanliness of cow and of the milker, condition of the interior of the stable and other factors. This inquiry will necessarily cover two or more years, during which time a very large number of cultures of bacteria must be made and counted, requiring the laboratory time of one man while the work is going on, besides much attention to barn details.
The knowledge we now have of the chemistry and bacteriology of cheesemaking is the cumulative result of several years of careful chemical and bacteriological investigations.

The matter of the economical manufacture and efficient use of lime-sulphur wash has employed two chemists during several months with experimental mixtures and the field studies have involved the spraying of a large number of trees with close and extended observations as to results.

The study of a new plant disease sometimes requires the attention of an investigator during two or more seasons, as has been the case with currant blight or wilt. It was necessary in this inquiry to make laboratory cultures, perform numerous inoculation experiments and carry on a series of field observations. The degree of control that has been secured over apple scab and potato blight was made possible first of all through elaborate botanical studies and later through a long series of experiments with various fungicides.

The depredations of a new injurious insect must be attacked first of all by a study of its life history, the transformations into the four stages of life covering a whole year, with the necessity of sometimes repeating the observations. The field of inquiry must then be transferred from the laboratory to the field in order to test means of prevention.

The Horticultural Department is engaged in extensive plant-breeding work. There is first the careful processes of pollenization, then the growth of the vine, shrub or tree to the time of fruiting, with careful observations all along the line. A fertilizer experiment with fruits covering a period of fifteen years has just been reported. The data given include the yield of fruit, the size of stems and twig and leaf growth, to say nothing of culture and the application of experimental fertilizers during the period of time mentioned.

Several years ago the Station took up the much discussed question of the food source of milk fat which no former inquiry had fully answered. It was necessary to provide food from which the
fat had been extracted, analyze it, feed cows on weighed rations for several months, weigh and analyze the milk during this time and collect, weigh and analyze the feces and urine.

The above are but illustrations of the many problems that await solution, only a few of which can be taken up at any one time. It often happens that a single problem requires the attention of two or more men during several months or even years. Scientific investigation of the complex problems of agriculture had better not be undertaken unless it can be made severe and be carried to safe conclusions and this means that results will be reached slowly and expensively. But when we consider the immense interests affected by new knowledge that improves practice or defends the farmer against devastations, the expenditures for agricultural research seem small in comparison to the benefits derived therefrom.

INVESTIGATION.

DEPARTMENT OF BACTERIOLOGY.

Publicity and payment based on quality as factors in improving a city milk supply.—In Bulletin No. 337 were recorded the results of a study of the influence upon a city milk supply of publicity regarding the sanitary conditions under which the milk was produced and of payment to the producer on the basis of the sanitary quality of the product.

In comparing dairies the sanitary conditions surrounding the production and handling of the milk were reduced to a numerical basis by means of a score card. In order to make these numerical results easily understood they were grouped under the following heads: Poor, including filthy conditions; medium, where conditions were merely dirty; good, where the conditions were fairly clean; excellent, where they were both clean and sanitary.

There is every reason for thinking that the sanitary conditions of this city supply at the beginning of this study were as good as the average of the cities of the State. A careful initial inspection showed that 37.5 per ct. of the dairies were "poor," 57.5 per ct. "medium" and 5 per ct. "good."
At end of one year 2.9 per ct. of the dairies ranked as "excellent," 58.9 per ct. as "good" and 38.2 per ct. as "medium."

At the end of the second year 8.6 per ct. of the dairies ranked as "excellent," 82.6 per ct. as "good" and 8.6 per ct. as "medium."

At the end of the third year 12.8 per ct. of the dairies ranked as "excellent," 74.4 per ct. as "good" and 12.8 per ct. as "medium."

At the end of the first quarter of the fourth year 12.8 per ct. of the dairies ranked as "excellent" and 87.2 per ct. as "good," the "medium" grade having finally disappeared.

While a lack of co-operation between the health authorities and the milkmen is ordinarily the factor which retards improvement in city milk supplies the limit of improvement is set by the disinclination of the consumer to pay a fair price for the labor and expense necessary in the production and sale of clean milk.

DEPARTMENT OF BOTANY.

Seed testing.—As announced in Bulletin No. 333, samples of agricultural seeds sent to the Station will be tested for purity free of charge. During 1910, 947 samples were tested—566 of alfalfa, 200 of red clover, 69 of alsike clover, 13 of white clover, 77 of timothy and 22 of miscellaneous seeds. Many of the samples received were too small for a dependable analysis. Of the alfalfa samples 11.13 per ct., and of the red clover samples 3.5 per ct., were infested with dodder. Only four samples (3 of alfalfa and 1 of alsike clover) were found to be adulterated. The frequent occurrence of the seed of Centaurea repens in the alfalfa samples indicates that much of our alfalfa seed is imported from Asia minor. Seeds of roquette (Eruca sativa) were found in several samples of alfalfa seed. A few farmers have reported the occurrence of roquette in their alfalfa fields. Little is known of its capabilities as a troublesome weed.

Spraying to eradicate dandelions in lawns.—An experiment made at this Station during the past two years indicates that the spraying of lawns with a solution of iron sulphate for the purpose of eradicating dandelions is unlikely to be successful in New
York. In 1909, a strip of lawn on the Station grounds was sprayed six times between April 23 and September 24 with a solution containing 1.5 lbs. iron sulphate in each gallon of water. In 1910, the same strip was again sprayed six times between April 15 and June 29, using two pounds of iron sulphate per gallon. In both seasons the blooming of the dandelions was almost wholly prevented and many of the plants were killed outright by the treatment. Yet, on an area of 1,000 sq. ft., there were 1,085 live dandelions in July, 1910, when the treatment had to be discontinued because of the danger of ruining the lawn. After each application (with one exception) the sprayed area was black and unsightly for several days. Apparently, the treatment did not materially injure the grass during the first season; but in the second season, with more frequent applications of a stronger solution, the grass was considerably injured. The details of this work appear in Bulletin No. 335.

*Potato spraying experiments.*—During the season of 1910 the potato spraying experiments begun in 1902 were continued along the same lines as in previous years. The results have been published in Bulletin 338. In the ten-year experiment at Geneva six sprayings increased the yield 63 bu. per acre, while three sprayings increased it 22 bu. In the duplicate of this experiment at Riverhead, Long Island, the gain due to five sprayings was 19 bu. per acre and to three sprayings 8.33 bu. In twelve farmers' business experiments, including 218 acres, the average gain due to spraying was 19.1 bu. per acre; the average total expense of spraying was $4.04 per acre and the average net profit $4.39 per acre. Five volunteer experimenters reported gains averaging 68 bu. per acre.

*Currant cane blight or wilt.*—This is a disease in which certain shoots or sometimes whole canes suddenly wilt and die. It is caused by a parasitic fungus, *Botryosphaeria ribis*, which attacks the canes, killing the bark and discoloring the wood. In the Hudson valley it is very destructive. An exhaustive investigation has been made of the life history, parasitism and biology
of the causal fungus and the results published in Technical Bulletin 18. This investigation has shown that three types of spores are developed on the host, although the fungus usually remains sterile in pure cultures.

When young shoots incompletely hardened are killed by new infections, the fungus usually develops its simplest spore-form on the withering tips. In early summer of the season following the blighting of bushes the dead stems exhibit numerous more or less complex, black, spore-bearing bodies broken through the outer bark. These bodies contain a second type of spore, and they commonly produce also a third type a little later.

Several fungi may appear saprophytically on the dead bushes. One of the most prevalent of the saprophytes (*Nectria cinnabarina*) has been erroneously considered the cause of the disease. As a result of the extensive inoculation experiments undertaken in this investigation, two facts require notice in this connection: (1) *Nectria cinnabarina* is not parasitic on currants; (2) associated with the causal species of *Botryosphaeria* there is a form of the fungus morphologically similar which seems usually to be a saprophyte. Early in 1908, while growing on a great variety of culture media, sub-cultures of the fungus obtained at different times from the pith of currant stems blighted during 1907, the parasitic form was easily distinguished from the closely related saprophytic associate by a physiological characteristic,—the pathogenic species producing a purplish-pink color on alkaline starch-paste.

Since the study of the life-history of this fungus shows that the spores are produced on dead stems and branches of the host from early to late summer, and since currants seem to be most commonly infected about mid-summer or a little later, it appears highly probable that the disease induced may be considerably checked or reduced by carefully pruning blighted plantations during the month of May, instead of practicing winter-pruning, as is at present customary. The prunings should be burned before the end of May, instead of allowing them to remain in heaps about a plantation throughout the summer.
DEPARTMENT OF ENTOMOLOGY.

Screening cabbage seed beds.—As has been indicated in previous reports, one of the problems being investigated by the Department of Entomology is the control of root-infesting maggots, especially those attacking the cabbage. One of the important phases of this problem is the protection of cabbage seed-beds. The Station has advocated screening as a practicable means of combating these insects, and Bulletin 334 largely deals with tests covering a period of four years with the use of cloth screens as a means of protecting cabbage seed-beds from maggots. The injury to the seed-bed not only renders the cultivation of the cabbage crop more difficult and expensive, but in some years the number of young plants destroyed is so large that farmers are frequently unable to secure the necessary seedlings for their plantings. The insects that are responsible for most of the injury are the turnip flea-beetle (Phylilotreta vittata Fab.) and the cabbage maggot (Pegomya spp.). The flea-beetles are injurious chiefly by eating round holes in the cotyledons, while the work of the maggot is confined to the roots of the young plant. Experience has shown that it is not possible to avoid losses in seed-beds by varying the time of planting for the reason that the growth period of the plant coincides with the period during which oviposition occurs and the first brood of maggots develop. Many experiments have shown conclusively that injury by flea-beetles and maggots can be prevented by using cheesecloth of proper mesh. Besides affording protection from insects, the screen conserves the moisture and prevents baking of the soil. The young cabbage plants are shallow-rooted and very tender. They do not thrive in dry or cool weather, and the difference in screened and unscreened plants may often be attributed to more congenial conditions for growth. The plants raised under cloth grow faster during most seasons and attain the size desired for transplanting about ten days or two weeks sooner than plants grown in the customary open beds. The extra cost of screening plants ranged from six cents to twenty cents per 1,000 plants. In the opinion of many growers this cost is more than met by the saving in seed. In addition, some growers
prefer to screen their beds because they may obtain earlier sets than from the open beds. Usually the cabbages that are set early are the first harvested and consequently bring better prices in the market.

DEPARTMENT OF HORTICULTURE.

Newer varieties of strawberries and cultural directions.—In Bulletin No. 336 are recorded descriptions of varieties of strawberries fruiting on the Station grounds in 1909 and 1910. Severe injury by drought is emphasized by tabular statement of rainfall in June and July for the past five years. A brief description is given of the local conditions under which the plants were grown and the method of culture followed.

The important characters of both plant and fruit are fully described. The apparent value of the variety as shown by its behavior on the Station soil is given for each variety.

Special emphasis is given by summaries to those varieties which have most prominently marked such features as vigor of plants, resistance to disease, plant-making, productiveness, sex, blooming season, size of fruit, desirability.

A brief report is given of three promising seedlings sent out by this Station in 1908. The bulletin closes with general directions for the culture of strawberries, laying special emphasis on the fact that the suggestions are not specific and that details must vary in each locality to meet local conditions.

Is it necessary to fertilize an apple orchard? — This bulletin, No. 339, is a report of a fifteen-year experiment to determine whether it is necessary to fertilize apple orchards.

Current recommendations for fertilizers in orchards are unreliable because there have been few investigations of the subject which have furnished trustworthy information. Present practices are largely based on the fertilization of field and garden crops, but the needs of apples cannot be compared, in the least, with the needs of herbaceous crops because of the great differences in the habits of growth of the two kinds of plants.
This experiment has to do with apples — not apples and grass. Attention is called to this fact because most of the investigations of fertilizers for apples have been carried on with trees in sod. In all such experiments the interactions of soil, apples, grass and fertilizers are so complicated that a crucial test is impossible.

The experiment under discussion was carried on in a Station orchard, the soil of which is a clay loam rather too heavy for a good orchard soil and not better than the average clay soil in the farm lands of western New York.

There are twelve plats in the experiment with fertilizers applied each year as follows:

- None.................. Plats 3, 5, 7, 11.
- Stable manure....... Plats 1 & 9, average per tree 415.15 lbs.
- Acid phosphate...... Plats 2 & 8, average per tree 12.66 lbs.
- Muriate of potash.... Plats 6 & 10, average per tree 7.26 lbs.
- Acid phosphate....... 12.6 lbs.
- Muriate of potash.... 7.26 lbs.
- Acid phosphate...... Plats 4 & 12, average per tree 12.6 lbs.
- Nitrate of soda...... 3.67 lbs.
- Dried blood.......... 12.84 lbs.

The fertilizers were put on only underneath the branches of the trees so that an excess of each has been used and the experiment, therefore, throws light on the question as to whether excessive fertilization is deleterious to trees.

The apple in the experiment is the Rome top-worked on Ben Davis, the Rome buds all having come from one tree and the stocks having been selected carefully. Cross-pollination is provided for, there being over a hundred other varieties separating and bounding the plats.

The results of the experiment are gaged by the yield, size, color, flavor, maturity and keeping quality of the fruit, the diameter of tree, amount, color and weight of foliage and the length and weight and the annual growth of the branches. A summary is as follows: 1. The fertilizers have had no sensible effects upon the yield of fruit in this experiment. 2. The size of the apples
is possibly increased by the fertilizers since the percentage of culls and seconds is a trifle higher in the check plats. 3. The several current generalizations as to the effects of fertilizers on apples find no verification in this experiment. 4. All of the trees in the several plats have borne crops very uniform in maturity, keeping-quality, texture and flavor of apples. 5. A study of the tables giving the diameter of the trees in the experiment shows no differences outside the range of variation in the several plats. 6. The foliage in the plats receiving nitrogen was greater than in other plats during the last season, the first difference to be certainly counted as an effect of a fertilizer. 7. There was also a measurable effect of the nitrogen in the weight of the leaves. 8. There is slight evidence that the trees on plats to which nitrogen is applied are marking a greater annual growth of branches.

The fact is pointed out that there seems to be but one interpretation of the results of this experiment. At the time the experiment was begun there was, in the upper foot of soil, enough nitrogen per acre to last mature apple trees 183 years, of phosphoric acid, 295 years, of potash, 713 years. From this storehouse, tillage, cover-crops and good care have made available the plant food these trees needed. The conclusion is reached that it may be necessary to fertilize apple orchards on sandy and gravelly soils, on lands very subject to drought, on very shallow soils and on soils quite devoid of humus. Some other soils may require one of the chief elements of fertility; some, though few, indeed, need the three which usually constitute a complete fertilizer. A fruit-grower may assume that his trees do not need fertilizers if they are vigorous and making a fair amount of new wood. If the trees are not vigorous the drainage, tillage and sanitary condition of the orchard should be looked to first and the fertilization afterward if then found necessary. Lastly, before using fertilizers the fruit-grower should obtain positive evidence by experimentation as to whether an orchard needs fertilizers, and what ones.

Pruning and training the grape.—Circular No. 16 contains concise directions for pruning and training grapes and photo-
graphs illustrating how grapes are pruned by several different systems. There is also a discussion of the system best adapted to various localities and for the leading varieties of grapes together with directions for making grape trellises.

*Grafting and propagating plants.*—Circular No. 17 discusses the propagation of plants by grafting, budding and by means of cuttings and layers. The different operations are illustrated by photographs. There is also a discussion of the best stock for the tree fruits grown in this climate.

**PUBLICATIONS ISSUED DURING 1911.**

**BULLETINS.**


No. 341. October. Report of analyses of samples of fertilizers collected by the Commissioner of Agriculture during 1911. Pages 100.

**TECHNICAL BULLETINS.**


**CIRCULARS.**


Agricultural Experiment Station, Geneva, N. Y., December 30, 1911.

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Director.