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New York Agricultural Experiment Station.

GENEVA, N. Y.

DIRECTOR'S REPORT FOR 1899.

W. H. JORDAN.



PUBLISHED BY THE STATION.

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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 Fertilizer Control.

†Connected with Second Judicial Department Branch Station.

BULLETIN No. 168.

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 progress and work of the New York Agricultural Experiment Station for the year 1899.

The year 1898 was characterized by large and important additions to the building and apparatus equipment, but the past year has been occupied chiefly with the quiet study of certain important problems.

It is a pleasure to report to you that without exception the members of the various departments of the Station are giving to their work a very gratifying measure of diligence and efficiency. The pursuit of knowledge with the attendant vicissitudes of original observation and research requires enthusiasm and courage, especially when the long delay of results may cause public criticism; and he who keeps on his way in a spirit of loyalty to truth and with a proper sense of responsibility for his utterance is deserving of his full meed of praise. I believe the members of your Station staff recognize the high standard to which they should attain and are striving to reach it.

THE STATION STAFF.

After more than three years of efficient service at the Station as Assistant Horticulturist, Mr. C. P. Close resigned his position in September last to accept the chair of Botany and Horticulture in the Utah Agricultural College. A successor to Mr. Close has not yet been selected.

Mr. Lowe was granted a six months' leave of absence and is now pursuing special zoological studies at the University of Chicago.

STUDENT ASSISTANTS.

So far in the history of American experiment stations the number of well trained young men available from which to choose

investigators has been altogether too limited, especially in biological lines. Graduates of our colleges when fresh from laboratory instruction seldom have much facility in making a logical attack upon a difficult problem affecting practice until after they have been for a time in the atmosphere of real research. It was felt that it would be possible to associate with our work young men having taste for investigation in experiment station lines, in such a way as to derive mutual benefit. In view of this conclusion and in accordance with authority granted me by you, a circular letter containing the following statements was addressed to a large number of the land grant colleges:

"By authority of the Board of Control of this Station, we are prepared to admit to our laboratories three student assistants; one in each of the departments of botany (plant pathology), bacteriology (dairy) and entomology. In order to be eligible to these positions, candidates must be graduates of a four years' course in science, preferably at a land grant college where the sciences are taught with especial reference to their bearing upon the art of agriculture. It is essential, moreover, that such candidates shall have pursued studies specially fitting them to undertake work in one of these departments and that they shall have shown such proficiency and enthusiasm in special directions as will warrant their choosing one of these lines of study and investigation for a life work.

"As their main work, it is proposed, under the guidance of the heads of departments, to associate these assistants with one or more important subjects of investigation with the understanding that they shall devote a minor proportion of each day, perhaps two hours, to the care of the laboratories, preparation of materials and other routine duties. They must be prepared to enter immediately, under proper direction, upon a study of one or more problems without spending a considerable period of time in acquiring the necessary preparatory knowledge and skill of a fundamental character. For instance, the student assistant in bacteriology should be familiar in a practical way with the technics of making cultures.

"Full credit will be given in our publications for work accomplished.

"It is hoped that the observation and experience gained by such close association with the actual research work of an experiment station will constitute a valuable training for those who are ambitious to connect themselves with experiment stations as investigators.

"The selection of these assistants will properly and necessarily be based upon their records as students and upon such knowledge of their personality as may be gained in various ways.

"It is expected that they will remain at the Station not less than

one year. Board, rooms and laboratory materials will be furnished free of charge, no other compensation being offered."

From the applicants for these positions, two were selected, Mr. L. A. Rogers, as student assistant in Bacteriology and Mr. E. D. Merrill, as student assistant in Botany. Both men graduated from the University of Maine and had received some post-graduate training. Mr. Rogers had spent a year at the University of Wisconsin, giving special attention to dairy bacteriology and Mr. Merrill had had a year's experience as instructor in the department of natural history at his alma mater. The former entered upon his work in June, but the latter on the day in which he reported to us for duty received an offer of a position in the U. S. Department of Agriculture which he felt that it was for his interest to accept. Since that time Mr. F. M. Rolfs, a graduate of the Iowa Agricultural College, and a teacher of considerable experience, became an applicant for the position of student assistant in Botany, received the appointment and entered upon his duties on December 21st.

As there was no application for the position in Entomology, it remains unfilled.

NEEDED CHANGES AND ADDITIONS.

The time has come when it is necessary to provide larger and more efficient accommodations for the various administrative offices and the library. These are now mostly located in a building the upper floors of which are occupied by the Director as a home, an arrangement which is unsatisfactory in every respect. There is at present only one general office in which are the desks of the Director and two clerks, a combination which results in great inconvenience. The mailing department is temporarily located on the second floor of the Chemical Laboratory, rendering it necessary to carry up and down stairs many tons of mailing matter yearly. All of the administration work of the Station and the library should be newly installed under one roof, for reasons of space as well as economy of labor.

Two general ways of accomplishing this have been considered: One proposition is to erect a new administration and library building and convert the house where the offices now are wholly

to domestic purposes; the alternative is to build a new director's house and turn over the mansion house wholly to office and library uses. The arguments in favor of the former course are that the administration and library building should correspond in dignity and attractiveness to the other structures on the Station grounds, and besides new construction would give an opportunity to make the offices models of convenience and efficiency, without being hampered by the limitations of an existing structure. This is the more costly plan, involving an outlay of not far from \$32,000. On the other hand a new house would place the director on a more comfortable and economical living basis than would be the case if the somewhat overlarge house in which he now lives were given over wholly to his occupancy, while this building is probably large enough for the administrative offices and library, though if reconstructed for these purposes it would fail, as has been stated, of the dignity and convenience of a new building. The probable cost of the second proposed plan would be somewhere from \$16,000 to \$19,000. The argument of less cost is with the second proposition.

It seems proper to state in this connection that the water supply of the Station is in some respects very unsatisfactory. It is furnished by the city at an annual cost of \$501, and if the pressure on the hydrants was such as to insure protection against fire, and at the same time provide a constant and uniform flow of water in the laboratories, there might be no good reason for considering a change. The conditions which prevail are the reverse of these, however, especially during the summer. Whenever hydrant pressure is available it averages less than twenty pounds, and at times it is a minus quantity, a condition which often causes great inconvenience in laboratory work and especially in running the refrigerating machine, besides being practically useless for fire purposes. It seems desirable for your board to consider whether any improvement in our water supply is possible.

INSPECTION OF FERTILIZERS AND FEEDING STUFFS.

The Legislature of 1899 made two enactments which both modified and enlarged the inspection work of the Station.

The Fertilizer Law was so amended as to require the payment

of a license fee of \$20 on each brand of commercial fertilizers sold or offered for sale in the State, thus bringing New York into line with the other twenty-eight states in which fertilizer laws exist. The money received from such fees is to be devoted to paying the expenses of inspection, which renders unnecessary the appropriation heretofore made by the state for this purpose. In 1898 the number of brands of fertilizers registered at the Station by manufacturers was 2,226, and it now seems probable that in 1899 it will fall to less than 500. This decrease is not caused wholly by the imposition of license fees, but without question is due in part to the formation of a fertilizer combination or trust. Some have thought that the advance in prices is also the result of the exaction of license fees, but this surely cannot be so, because the total annual expense of such fees to the fertilizer industry will not exceed an average of six cents per ton on the quantity of goods sold.

Other conditions are responsible for the increased cost to the farmer of his commercial plant food.

A new law, quite similar in its provisions and operation to the amended fertilizer law, the author of which is the Hon. D. P. Witter, was also enacted for the control and inspection of concentrated commercial feeding stuffs. As with fertilizers, manufacturers of feeding stuffs must register at the Station a guaranteed composition and pay the annual license fee on each brand sold or offered for sale, the proceeds thus derived to be used in the yearly collection and analysis of samples by the Station and the printing of results. It now seems that the brands registered will not exceed one hundred, so that the revenue produced by this law will not be large. Attention is called to the fact that in the case of both laws, the license fees are paid into the state treasury and the amounts of money thus received by the state only become available for their legitimate uses after appropriation by the legislature.

THE MAILING LIST.

The present status of the mailing list is as follows:

Popular Bulletin List.

Residents of New York.....	30,337
“ “ other states.....	992
Newspapers.....	744
Experiment Stations and their staffs.....	778
Miscellaneous.....	131
Total.....	32,982

Complete Bulletin List.

Experiment stations and their staffs.....	778
Libraries, scientists, &c.....	257
Foreign list.....	55
Individuals.....	902
Miscellaneous.....	131
Total.....	2,123

The above figures show a small increase in the popular bulletin list for residents of New York. During the past year this list has been revised, resulting in taking off the names (not less than 2,000) of those who had died or changed their place of residence. There has been a steady registering of new names, however. This growth is normal and not forced, coming as it does almost wholly from individuals who personally ask to receive the bulletins of the station.

THE STATION LIBRARY.

A good library is a most necessary part of an experiment station equipment. Research can neither be entered upon safely nor its results discussed intelligently unless the investigator has access to the records of what has been learned previously concerning the subjects under consideration. Access to current literature and particularly to the journals which are the organs of research, is especially important in this connection.

The library of this Station has developed rapidly during the past two years, but it is still small and in some respects quite insufficient for our needs. A fairly large number of journals is

received, but complete sets of them should be obtained as rapidly as possible. The present number of bound volumes and pamphlets in the library is approximately five thousand.

A list of the papers and journals obtained by subscription and donated to us by exchange or otherwise is appended to this report.

THE STATION PUBLICATIONS.

The public is not unnaturally inclined to measure the usefulness of an experiment station by the quantity of literature which it publishes. If this standard is applied to the New York State Station, the year 1899 will appear to be less profitable than some which have preceded. As a matter of fact, however, there probably has not been a period in the history of the Station when so much hard study has been applied to so large a number of problems as has been the case during the past twelve months.

The number of pages of printed matter which a station issues has no necessary relation to the actual magnitude of the effort of investigation. A bulletin of one hundred pages, which is merely a compilation of existing knowledge, may be begun and finished within the limits of a few weeks, whereas the data derived from one or more years of laborious observation may be summarized for public use on ten pages.

Two facts are likely to restrict the literature emanating from this Station to a less quantity than may seem to some to be consistent with its equipment:

(1) It is deemed to be a proper policy on the part of the Station to issue comparatively few bulletins of compilation of a purely informational character. More or less discussion of existing knowledge is necessary in order to give to the results of research a proper setting and illumination, but it is certainly not the function of the Station, now that its existence and purposes are well understood, to engage in the work of popular instruction. To do this would be to encroach upon the province of the school and of current literature. It might seem justifiable for this Station to digest and summarize for the use of New York farmers the knowledge gained by the stations in other states, were it not for the fact that the U. S. Department of Agriculture is doing this admirably through the Office of Experiment

Stations. It is conceded that when emergencies arise or when an entirely new situation faces the agricultural public like the sudden inroad of devastating insects or the establishment of the sugar beet industry, farmers are justified in looking to the Station for information of a general character. This is a different matter, however, from writing general treatises on a great variety of subjects. This institution, in my judgment, will do well to restrict its efforts quite closely to the work of experimental research.

(2) It has become imperative that this Station attack some of the more difficult scientific problems relating to agriculture. Many of the "easy questions" have been asked and answered and for this reason, and also because the "hard answers" are the ones we most need to know, we should begin to probe more deeply and laboriously beneath the surface of things. There is, moreover, a pronounced tendency now evident in many quarters to withhold the publication of conclusions until they are abundantly justified by data, a most healthy and encouraging symptom in experiment station activity. The members of this Station believe in trying to enter upon the policy thus outlined and it is to be hoped that in so doing they will have the sympathy and loyal support of New York farmers.

It should be remembered that this policy means the publication of fewer bulletins than might otherwise be issued if the practice of compilation and profuse writing were adopted.

THE WORK OF THE STATION DURING 1899.

On subsequent pages there may be found summaries of the work carried on during the year 1899 by the various departments of the Station. These include a brief review of facts and conclusions contained in the year's bulletins as well as a statement of the nature and bearing of experiments and investigations, the data from which are not yet sufficiently complete and concerning which nothing has yet been published. It so happens that just now the unfinished work is large. It embraces several investigations in plant nutrition, animal nutrition, cheese curing, horticulture, bacteriology and plant pathology:

The availability of certain insoluble phosphates to several varieties of plants.

The relative importance of potash and soda in plant nutrition.
 The effect of fineness upon the availability of crude phosphates.
 The plant food needs of fruits and the effect of certain plant food elements upon their quality.

Relative economy of different systems of feeding crops.

A study of apple cider and vinegar.

The source of milk fat and observation on the use of food by milch cows.

The chemistry and bacteriology of cheese curing.

Study of cheese curing troubles such as rust, and sweet and bitter flavors.

Conditions of cheese curing.

The prevention of onion smut.

The prevention of asparagus rust.

A study of black knot.

The irrigation of small fruits.

Chestnut growing.

CHEMICAL DEPARTMENT.

(1) *Fertilizer inspection*.—The fertilizer trade has continued to present during 1899 its usual grotesque features. One hundred and ninety manufacturers, sixty-seven of whom are located outside of New York, registered at the Station 2,268 different brands. For various reasons the number of brands sold in the State is much short of registration. This burdensome and unsatisfactory state of affairs will doubtless end with 1899, as the number of brands registered is likely to drop to 500 or less, for reasons already explained.

(2) *Paris green and insecticide supervision*.—Twenty-five samples of Paris green were secured and analyzed. Twenty different manufacturers represented. Arsenious oxide found in Paris green varied from 55.34 to 60.16 per ct., indicating a good degree of commercial purity.

(3) *Plant nutrition*.—Work is being continued in investigation relating to the plant-food needs of fruits and the effect of certain plant-food elements upon the quality of fruits. Results are being held for additional data before publication.

(4) *Composition of cider and vinegar*.—This work has been continued two years and valuable results are being secured, but

another year's data are desired before publishing the results of investigation.

(5) *Cheese work*.—Data for publication will probably be obtained in addition to those on hand during the coming year. Chemical work has been directed in two lines :

(a) Studying the influence of moisture and temperature upon the composition of cheese, working with the temperatures 55°, 60°, 65° and 70° F.

(b) Studying the chemical compounds formed in cheese by the breaking down of milk casein.

HORTICULTURAL DEPARTMENT.

The fertilization of self-sterile grapes.—It has been shown in Bulletin 157 and other prior publications of this Station, that certain kinds of American grapes are either self-sterile or very imperfectly self-fertile. When self-pollinated the former bear no fruit and the latter produce very imperfectly formed clusters or usually none at all. In considering the practical bearing of these discoveries upon the selection of varieties for planting and the advantageous arrangement of them in vineyards for securing well filled fruit clusters, the question arose whether any other variety which blooms at the same time with the one which is to be fertilized will perform the necessary cross fertilizing successfully or whether some kinds of grapes are better fertilizers than others. Scarcely any definite information on this subject could be found. The matter being one of obvious practical importance to viticulturists, some investigations concerning it were begun in 1899. Very marked results have already been secured, indicating that a variety which is more or less incapable of fertilizing itself generally fails in the fertilizing of other self-sterile varieties, while on the other hand the self-fertile varieties have usually been successful in fertilizing the self-sterile sorts upon which they have been tried. Further investigation is necessary to determine whether any grape may be more successful in fertilizing some varieties than others. Various other tests need to be made before a final report is given stating definitely the conclusions which may be drawn concerning the question under investigation.

The treatment of diseases and insects is of perennial interest to fruit growers. A bulletin has been prepared on this subject by the collaboration of the Horticulturist, the Botanist and the Entomologist for the purpose of presenting up-to-date directions for fighting these enemies of the fruit grower and showing the particular instances in which various diseases and insects may be combated with one general treatment. The preparation of spray mixtures and the apparatus for applying them are treated in Bulletin 121, prepared by Mr. Paddock. This has been supplemented by publishing an appendix which treats of recently improved apparatus and gives formulae for the preparation of various spraying mixtures.

Thinning apples.—Experiments have been in progress for four years for the purpose of gaining definite information concerning the effect which thinning the fruit of apple trees may have on the remaining crop and whether the practice if followed systematically year after year tends to secure greater regularity in bearing or increased yield in succeeding seasons.

The results show that with certain varieties the size and color of the fruit is generally improved where thorough and timely thinning is done and the percentage of the higher grades of fruit is increased, although the total yield of marketable fruit is often lessened. It appears that under certain circumstances, and especially with certain varieties, the thinning of apples in commercial orchards would be profitable.

With mature trees which have come into full bearing and which are properly fertilized, pruned, sprayed and generally well cared for, it is doubtful whether thinning the fruit in any one season will materially increase the yield in succeeding seasons. It should be borne in mind that young trees which have not come into full bearing may be seriously impaired in vigor and in subsequent fruit production by being allowed to mature too heavy crops.

It appears that, with the exception noted, the principal source of profit from thinning fruit in orchards which are well cared for is to be looked for chiefly in preventing the breaking of overloaded limbs and in the increased market value of the fruit of the current season.

Thinning, to be most effective, should be done early in the season—at the time Baldwins and Greenings are from three-fourths of an inch to an inch in diameter. In New York State it should be completed in June.

Thinning stone fruits.—Experiments in thinning apricots, plums and peaches have been in progress three seasons. With these fruits as with apples the effect of thinning is not always as pronounced the following year as had been expected. In some cases there appeared to be real permanent advantage and an increased yield in succeeding seasons, and again the effect, if any, on the crop of the following year, was in some cases obscured by causes not understood and no advantage from the previous year's thinning of the fruit could be seen. In some cases trees which were heavily loaded and not thinned gave even greater yields the following season than were obtained from corresponding trees on which the fruit had been severely thinned.

Early and severe thinning in general increased the percentage of the higher grades of fruit. Where the fruit grower can obtain correspondingly better prices for fancy fruit the thinning may doubtless be made profitable with selected varieties of peaches and apricots and in some cases with plums also.

Chemical analyses of fruits which were picked at different stages were made in the chemical department which showed that the amount of potash in the fruit of one variety of peach increased 493 per ct. from June 24 to July 21. The nitrogen increased 240 per ct. and the phosphoric acid 327 per ct. in the same period. The amount of potash in the fruit of a certain variety of plum increased in the same period 296 per ct., the nitrogen 222 per ct. and the phosphoric acid 156 per ct. This indicates how rapidly the fruits take up plant food in the very early stages of their growth and emphasizes the importance of doing the thinning very early in the season.

Fertilizers for forcing lettuce.—Complete commercial fertilizers which differ from each other only in material from which the supply of nitrogen is secured are being tried both alone and in combination with varying proportions of stable manure, on soils for forcing lettuce. Each formula is tried with head lettuce and with loose lettuce, both on medium heavy clay loam and on very

light sandy loam. The object of this work is to throw some light on the question as to whether, in the forcing of lettuce, commercial fertilizers may be profitably substituted either wholly or in part for stable manure. It is desirable that the results which have been thus far obtained should receive further confirmation before being published.

Treatment for gooseberry mildew.—Because of the destructive character of gooseberry mildew and the economic importance of this disease in all parts of America where gooseberries are cultivated, experiments have been conducted for the purpose of treating the disease on a commercial scale. Potassium sulphide has been compared with other fungicides for this purpose and very early treatments have been compared with later treatments so as to learn if possible just when to spray and what to spray with in order to hold the mildew in check most successfully. This particular line of investigation has been in progress since 1897. The results as set forth in Bulletin 161, show that the use of potassium sulphide has been followed with better success than the use of Bordeaux mixture, lysol or formalin. Bordeaux mixture proved comparatively useless; formalin was somewhat more effective and lysol gave promising results, ranking next to the potassium sulphide. Very early spraying generally gave better results than when the first treatment was made medium early or late. Winter treatment was tested only one season. It did not give sufficient advantage to justify the expense of making it.

Apple canker.—A disease of apple tree limbs has done and is doing an immense amount of damage to the orchards of New York as well as in many other states. The disease is not new but the injuries resulting from its attack have been thought to be due entirely to the sun-scald so it has escaped the notice of workers in this line.

The investigation of this disease was undertaken in the spring of 1898 and was continued through the present season. It has been proven that the cankers are produced by the attack of a fungus known as *Sphæroopsis malorum* Pk., the same that produces the black rot of apples, pears and quinces. The experiments also indicate that the fungus occurs on a number of other plants.

Experiments in treating the disease are not yet complete, but it is known that in a majority of instances orchards that have been well sprayed with Bordeaux mixture for a number of years and otherwise well taken care of are much freer from canker than orchards that have not received such treatment.

As a preventive measure we feel warranted in recommending that the orchards be put in the best growing condition and then as a further preventive that they be sprayed thoroughly with Bordeaux mixture, spraying the limbs as well as the foliage and fruit; the spraying to be made at the time the trees are ordinarily sprayed for apple scab, supplemented by an earlier one given about the time the leaf buds begin to unfold.

DEPARTMENT OF BOTANY.

Leaf-scorch of sugar beet, cherry, cauliflower and maple.—A peculiar disease of sugar beets occurring to a destructive extent in some fields in Yates and Ontario counties has been determined to have been caused by weather conditions. In early August the foliage was suddenly scorched by excessively dry, hot weather. Cherries and hard maples in the vicinity of Geneva and cauliflower on Long Island have suffered from the same cause.

Fruit-disease survey of the Hudson Valley.—A thorough survey has been made of the fruit diseases occurring in the Hudson Valley. On account of the unusually dry season fruits generally have suffered less from disease than for several years past. Peach leaf-curl, so destructive in 1898, has been almost wholly absent. Such common destructive diseases as apple scab, pear scab, pear leaf-spot and plum leaf-spot have been injuriously abundant only in a few localities. The black rot of grapes and the fruit-rot of plums and cherries have been much less destructive than usual. The most important fact brought out by this survey is the discovery that there exists throughout the entire Hudson Valley below Albany a destructive cane blight of currants caused by a sterile fungus about which but little is known.

Miscellaneous studies on plant diseases.—In 1898 a serious rot of onions occurred in Orange County. It has been determined that this rot was caused by bacteria working in the presence of water. The prompt removal of surface water from the onion

fields is probably the best that can be done to prevent the rot.

Dodder has been found on greenhouse cucumbers and a powdery mildew on field cucumbers.

The brown sunken spots on Baldwin apples have been shown to be of non-parasitic origin.

A new fungus leaf-spot disease of carnations has been discovered.

Unfinished work.—Considerable work has been done upon the stem-rot diseases of the carnation, and an investigation of the black knot disease of plums and cherries commenced.

DEPARTMENT OF BACTERIOLOGY.

Pasteurization for butter making.—A fundamental investigation of this problem has been begun in connection with the Dairy Department, the first step being a study of the effect of the various temperatures to which milk can be exposed in the "continuous" machines. A momentary exposure at 158° F. was not found satisfactory, 176° F. is much better and in many cases 185° F. is desirable. When the most acceptable temperature is decided upon the subject of pasteurized *vs.* unpasteurized butter will be taken up.

Cheese faults.—Rusty spot in Cheddar has received considerable attention. A germ has been isolated which on being added to a vat of milk produced rusty spots in the resulting cheese. Work will be continued with a hope of finding the way in which the trouble gains entrance to the factory as well as the best method of removing it.

Work has also been done on *sweet* or *fruity* flavor but owing to the obscure nature of the trouble little headway has been made. *Bitter* flavor in Neufchatel has been reported and the trouble found due to the presence of certain acid forming bacteria. This investigation is still in progress.

Cheese ripening.—Several experiments have been carried out, alone, and in conjunction with the Department of Chemistry. The attempt has been made to exclude the action of germs in order that the activity of the enzyme naturally present in the milk and cheese might be more carefully studied.

Black rot of cabbage and cauliflower.—In collaboration with the

Department of Botany field experiments on the treatment of the black rot of cabbage and cauliflower have been conducted at Phelps and on Long Island; but owing to the unusually dry season the disease was not prevalent and consequently few results were obtained. These experiments will be repeated next season.

ANIMAL INDUSTRY.

Animal food in poultry feeding.—It was found in a number of feeding experiments with chicks, ducklings and laying hens that rations containing animal food gave almost invariably better results than did those consisting entirely or very largely of vegetable food. For convenience "animal meal" was made the principal animal food. Many grain foods were used; but when rations were so arranged that the proportion of protein was alike for two rations the one with the animal food contained generally more fat and always a much larger percentage of mineral matter.

The first series of experiments did not definitely indicate the cause for the superiority of the one ration. It appeared that the more favorable results when animal food was fed might be due either to the more efficient forms of the nitrogen compounds or with the rapidly growing young birds and the laying hens to the much larger proportion of ash consisting largely of phosphates.

Subsequent experiments have shown that while ducklings require a certain amount of animal food, hens and chicks are able to do well on wholly vegetable food, supplemented by ash rich in phosphates. In these experiments, rations of vegetable food, to which bone ash was added to make up the assumed deficiency of ash, in growing chicks gave identical results with those from rations containing animal food. With laying hens the rations were equally efficient for most of the time but good results were not sustained quite so long by the vegetable food ration. The addition of bone ash did not, however, enable ducklings to make as good use of a ration wholly of vegetable foods; such a ration being decidedly less efficient than one containing animal food.

BULLETINS PUBLISHED IN 1899.

- No. 158—May.— Combating the striped beetle on cucumbers. F. A. Sirrine. Pages 32, plates 2.
- No. 159—October — The forest tent caterpillar. V. H. Lowe. Pages 30, plates 6.
- No. 160—October.— Report of analyses of commercial fertilizers for the spring of 1899. L. L. Van Slyke. Pages 90.
- No. 161—November.—Treatment for gooseberry mildew. C. P. Close. Pages 12, plates 2, diag. 1.
- No. 162—November.—Leaf scorch of the sugar beet, cherry, cauliflower and maple. F. C. Stewart. Pages 14, plates 6.
- No. 163—December.—The New York apple-tree canker. Wendell Paddock. Pages 28, plates 6.
- No. 164—December.—Notes on various plant diseases. (A bacterial rot of onions; powdery mildew on field-grown cucumbers; dodder on cucumbers under glass; Baldwin fruit-spot; a *Fusarium* leaf-spot of carnations; *Chaetomium contortum* on barley seedlings.) F. C. Stewart. Pages 15, plates 4.
- No. 165—December.—Report of analyses of Paris green and other insecticides. L. L. Van Slyke. Pages 10.
- No. 166—December.—Commercial feeding stuffs in New York. W. H. Jordan and C. G. Jenter. Pages 42.
- No. 167—December.—A fruit disease survey of the Hudson Valley in 1899. F. C. Stewart and F. H. Blodgett. Pages 34, plates 3, map 1.
- No. 168—December.—Director's report for 1899. W. H. Jordan. Pages
- No. ———December.—Fertilization of self sterile grapes. S. A. Beach. (In press.)
- No. ———December.—Diseases and insects injurious to fruits. S. A. Beach, V. H. Lowe and F. C. Stewart. (In press.)

- No. ———December.—The efficiency of a continuous Pasteurizer at different temperatures. H. A. Harding and L. A. Rogers. (In press.)
- No. ———December.—Report of analyses of commercial fertilizers for the fall of 1899. L. L. Van Slyke. (In press.)
- No. ———December.—Animal food for poultry. W. P. Wheeler. (In press.)

W. H. JORDAN, *Director*.

New York Agricultural Experiment Station,
Geneva, N. Y., Dec. 30, 1899.

APPENDIX.

PERIODICALS RECEIVED BY THE STATION.

Acker und Gartenbau Zeitung	Complimentary.
Agricultural Education	"
Agricultural Epitomist.....	"
Agricultural Gazette of New South Wales.....	"
Agricultural Student.....	"
Agricultural Students' Gazette.....	"
Albany Journal.....	Subscription.
Allegan Gazette.....	Complimentary.
American Agriculturist.....	Subscription.
American Chemical Journal.....	"
American Chemical Society, Journal....	"
American Cultivator.....	Complimentary.
American Entomological Society, Transactions.	Subscription.
American Fancier.....	"
American Fertilizer.....	"
American Florist.....	"
American Gardening.....	"
American Grange Bulletin.....	Complimentary.
American Journal of Physiology	Subscription.
American Monthly Microscopical Journal.....	"
American Museum of Natural History, Bulletin	Complimentary.
American Naturalist.....	Subscription.
American Philosophical Society, Proceedings..	Complimentary.
American Stock Keeper.....	"

Analyst.....	Subscription.
Angelica Every Week	Complimentary.
Annales Agronomiques.....	Subscription.
Annales de l' Institut Pasteur.....	"
Annals and Magazine of Natural History.....	"
Annals of Botany.....	"
Archiv der gesammte Physiologie (Pflueger) ..	"
Archiv fuer Hygiene	"
Association Belge des Chimistes, Bulletin	Complimentary.
Baltimore Weekly Sun.....	"
Beet Sugar Gazette.....	"
Berichte der deutschen botanischen Gesellschaft	Subscription.
Berichte der deutschen chemischen Geslleschaft	"
Boletin do Instituto Agronomico do Estado de Sao Paul.....	Complimentary.
Boletin de Agricultura, Minería e Industrias...	"
Boletin de Agricultura Tropical	"
Boston Society of Natural History, Proceedings	Subscription.
Botanical Department, Jamaica, Bulletin.....	Complimentary.
Botanical Gazette	Subscription.
Botanische Zeitung.....	"
Botanisches Centralblatt.....	"
Botaniste, Le.....	"
Buffalo Society of Natural Sciences, Bulletin...	Complimentary.
Canadian Entomologist	Subscription.
Canadian Horticulturist.....	Complimentary.
Centralblatt fuer Agrikultur-Chemic.....	Subscription.
Centralblatt fuer Bakteriologie und Parasiten- kunde.....	"
Chemical News.....	"
Chemical Society, Journal.....	"
Chemiker Zeitung.....	"
Chemisches Centralblatt.....	"
Chicago Dairy Produce.. ..	Complimentary.
Cincinnati Society of Natural History, Journal.	"
Columbus Horticultural Society, Journal.....	"
Commercial Gazette.....	"
Cotton Planters' Journal.....	"
Country Gentleman.....	Subscription.
Country World.....	Complimentary.
Dairy and Creamery	"
DeRuyter Gleaner.....	"
Detroit Free Press.....	"
Dietetic & Hygienic Gazette.....	Subscription.
Deutsche landwirtschaftliche Wochenschrift...	Complimentary.
Elgin Dairy Report.....	"

Elisha Mitchell Scientific Society, Journal.....	Complimentary.
English Catalogue of Books.....	"
Entomological News.....	Subscription.
Entomological Society of Washington, Proceedings.....	"
Entomologische Zeitschrift	"
Entomologist	"
Entomologist's Record.....	"
Fanciers' Review.....	Complimentary.
Farm and Fireside.....	"
Farm and Home.....	"
Farm, Furnace and Factory.....	"
Farm Journal.....	"
Farm News.....	"
Farm Poultry Semi-Monthly.....	"
Farm, Stock and Home.....	"
Farmers' Advocate	"
Farmers' Guide	"
Farmers' Home	"
Farmers' Magazine.....	"
Farmers' Tribune.....	"
Farmers' Voice.....	"
Feather	Subscription.
Feathered World.....	"
Florist's Exchange	"
Fuehling's landwirtschaftliche Zeitung.....	"
Garden	"
Gardeners' Chronicle	"
Gardening.....	"
Geneva Gazette.....	Complimentary.
Gleanings in Bee Culture.....	"
Green's Fruit Grower.....	"
Hedwigia.....	Subscription.
Herd Register.....	Complimentary.
Hoard's Dairyman.....	"
Homestead	"
Indiana Farmer.....	"
Industrie Laitiere.....	"
Irrigation Age.....	"
Ithaca Democrat	"
Jahresberichte der Agrikultur-Chemie	Subscription.
Jahresberichte der Nahrungs-und Genussmittel	"
Jersey Bulletin	Complimentary.
Journal d' Agriculture Pratique.....	Subscription.
Journal of Applied Microscopy.....	"
Journal de Botanique.....	"

Journal of Experimental Medicine.....	Subscription.
Journal fuer Landwirtschaft.....	"
Just's Botanischer Jahresbericht.....	"
Landwirtschaftlicher Jahrbuecher.....	"
Landwirtschaftlichen Versuchs-Stationen.....	"
Live Stock Journal.....	"
Long Island Farmer.....	Complimentary.
Louisiana Planter.....	"
Meehan's Monthly.....	Subscription.
Milk Zeitung.....	"
Mirror and Farmer.....	Complimentary.
Montana Fruit Grower.....	"
Monthly Weather Review.....	"
National Nurseryman.....	"
National Stockman and Farmer.....	"
Naturae Novitates.....	"
Naturaliste.....	Subscription.
Naturaliste Canadienne.....	Complimentary.
Nature.....	Subscription.
Nebraska Farmer.....	Complimentary.
New England Farmer.....	"
New York Academy of Science, Annals and Transactions.....	Subscription.
New York Botanical Garden, Bulletin.....	Complimentary.
New York Entomological Society, Journal....	Subscription.
New York Farmer.....	Complimentary.
New York Produce Review.....	"
New York State Granger.....	"
North American Horticulturist.....	"
Northwest Pacific Farmer.....	"
Oesterreichische Chemiker Zeitung.....	Subscription.
Ohio Poultry Journal....	"
Olean Herald.....	Complimentary.
Oregon Agriculturist.....	"
Pacific Coast Dairyman.....	"
Pacific Coast Fanciers' Monthly.....	Subscription.
Pacific Rural Press.....	"
Pomona Herald.....	Complimentary.
Popular Agriculturist.....	"
Poultry.....	Subscription.
Poultry Herald.....	"
Poultry Keeper.....	Complimentary.
Poultry Monthly.....	"
Practical Farmer.....	"
Prairie Farmer.....	"
Plattsburgh News.....	"

Progress Agricole et Viticole.....	Subscription.
Psyche	"
Queensland Agricultural Journal.....	Complimentary.
Revue Generale de Botanique.....	Subscription.
Revue Horticole.....	"
Revue Mycologique.....	"
Royal Horticultural Society, Journal.....	"
Rural New Yorker.....	"
Rural Topics	Complimentary.
Salt Lake Herald.....	"
Saint Louis Academy of Science, Transactions.	"
Sanitary Inspector.....	"
Science.....	Subscription.
Society of Chemical Industry, Journal.....	"
Societe Entomologique de France.....	Complimentary.
Societe Mycologique de France.....	Subscription.
Southern Planter.....	Complimentary.
Southern Farm Magazine.....	"
Southwest	"
Southwestern Farmer and American Horticulturist	"
Stazione Sperimentale Agrarie Italiane.....	"
Strawberry Specialist	"
Suffolk Bulletin.....	"
Sugar Beet.....	"
Torrey Botanical Club, Bulletin & Memoirs...	Subscription.
Vermont Farmers' Advocate.....	Complimentary.
Wallace's Farmer.....	"
Watkins Review.....	"
Waverly Free Press.....	"
West Virginia Farm Reporter.....	"
Western Plowman.....	"
Wiener illustrierte Garten-Zeitung	Subscription.
Woman's Home Companion	Complimentary.
Zeitschrift fuer analytische Chemie.....	Subscription.
Zeitschrift fuer Biologie.....	"
Zeitschrift fuer Entomologie.....	Complimentary.
Zeitschrift fuer Fleisch und Milch Hygiene....	Subscription.
Zeitschrift fuer Pflanzenkrankheiten.....	"
Zeitschrift fuer physiologische Chemie.....	"
Zeitschrift fuer Untersuchung d. Nahrungs-Genuissmittel	"
Zoologischer Anzeiger.....	"