

New York Agricultural Experiment Station



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JANUARY, 1897.

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DIRECTOR'S REPORT FOR 1896.

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W. H. JORDAN.

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GENEVA, N. Y.

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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 Branch Station in Second Judicial Dept.  
†Connected with Fertilizer Control.



THE DIRECTOR'S HOME AND OFFICE.

## DIRECTOR'S REPORT.

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

*Gentlemen* :—I have the honor to present the report of the New York Agricultural Experiment Station for 1896. It is not necessary for me to remind you that I assumed the duties of Director on July 1, 1896, and that during the first half of the year Dr. L. L. Van Slyke, as Acting Director, ably and faithfully administered the affairs of the Station. A sense of obligation impels me to acknowledge my indebtedness to him for the aid he gave me in taking up my new work, and I am equally grateful for the consideration shown to me by all members of the Station staff. I am confident that this pleasant beginning is a forecast of such coöperation and sympathy as are essential among a body of men who are intimately associated in a common effort.

### THE STATUS OF THE STATION.

It seems entirely proper that when an institution passes over to the immediate charge of a new executive head, there should be presented to the governing board a definite and comprehensive statement of its condition. This is desirable as furnishing the necessary starting point from which to proceed to whatever changes or enlargements that may seem advisable.

I take the liberty, therefore, of laying before you a review of the condition of this Station as I found it on July 1.

*Location and general surroundings.*—It is a matter for congratulation that the Station is well located, both agriculturally and socially. It is in the midst of one of the most fertile and prosperous farming regions of the state which has an almost world wide reputation for its production of nursery stock and fruit. It occupies a desirable situation, commanding an outlook over a section of country which in its beauty and evidences of prosperity is seldom, if ever, excelled. The Station grounds in their arrangement and appearance give pleasing evidence of the painstaking care and good taste which have brought them into an unusually attractive condition.

Moreover, the Station has a desirable social environment. The village of Geneva is one of the oldest in the state, and has long

been the home of a cultivated people who have received the Station as an institution in which they have a peculiar and abiding interest. This is fortunate, because the prosperity and efficiency of any work which calls together a body of educated men is greatly enhanced by a loyal local support and agreeable social relations.

The officers of the Station are also in immediate contact with a class of agriculturists of more than average ability. It is noteworthy that wherever the production of fruit is a leading industry, there will be found farmers who are progressive and in sympathy with an intelligent study of methods. This is especially true of that portion of New York from which has been shipped millions of dollars worth of nursery stock to all parts of the United States, and that is one of the finest fruit growing regions in the world.

*The financial basis of the Station.*—The Station is at present maintained by three separate funds known as the "General Fund," the fund for "Expense of Bulletins and enforcing the Provisions of the Fertilizer Law," and the "Appropriation for Horticultural Investigations, etc., in the second Judicial Department."

The first fund serves to maintain the work of experiment and investigation carried on at the Station, the second pays for printing bulletins and the expense of sampling and analyzing fertilizers, and the third supports the work of the Branch Station located at Jamaica, Long Island.

*The Station Staff.*—The scientific staff proper now includes fifteen persons besides the Director. Of these seven belong to the chemical department, three are engaged in horticultural work, two are entomologists, one is giving attention to poultry culture and other matters pertaining to animal industry, one is studying plant diseases, and one has the immediate charge of the farm and is superintendent of labor. Two of the staff are detailed for work at the Branch Station in the second Judicial Department, which is located at Jamaica, Long Island. The preponderance of chemists over those in any other single line of work is explained by the fact that the Station is now analyzing six or seven hundred samples of fertilizers annually. It should be remarked that there is scarcely any line of investigation in which the Station engages where the aid of the chemist is not required.

*Clerical and labor force.*—Three persons are at the present employed as clerical assistants to the scientific staff, and the janitors, dairyman, poultryman, forcing house assistant, gardeners, herdsman, teamsters, mailing assistant, and watchman number about sixteen more. Besides these permanent employees, day laborers are hired during the summer as they are needed. The lines of work carried on are so varied and the details are so elaborate that a large labor force is a necessity. This is especially the case where so extensive a fruit plant is to be managed in an experimental way.

*The Library.*—One of the most essential aids to scientific research is a fairly complete record of what has previously been accomplished. Few persons can afford the private ownership of a scientific library sufficiently extensive to meet the needs of the investigator, but it is nevertheless important that he should have access to the data which other workers have collected.

For these reasons it is highly desirable that the library of the Station should be made much more complete in the literature of investigation. Although it has recently received valuable additions, it is still deficient in material and is without proper classification and arrangement. Outside of recent purchases, the larger part of the books contained in the library is of comparatively little value as a record of recent scientific research in those lines related to agriculture.

*The Station Farm.*—This farm is located in one of the finest fruit districts of the state of New York, and is largely made up of soil that not only sustains the successful growth of a great variety of good fruit, but is well adapted to general farming. It includes about 130 acres, only a small area of which is unfit for the purposes of tillage. A few acres are occupied by the buildings and grounds and about thirty acres are taken up by fruit, the remainder being devoted to a variety of experiments in forage and grain production. Nearly all the farm has at one time been underdrained and is on the whole in very good condition for the purposes for which it is intended.

*The Station Buildings.*—Exclusive of the forcing-houses and some minor structures, the Station building equipment consists of a Director's house which also contains offices, a chemical laboratory, five residence houses, three barns, and a cold storage

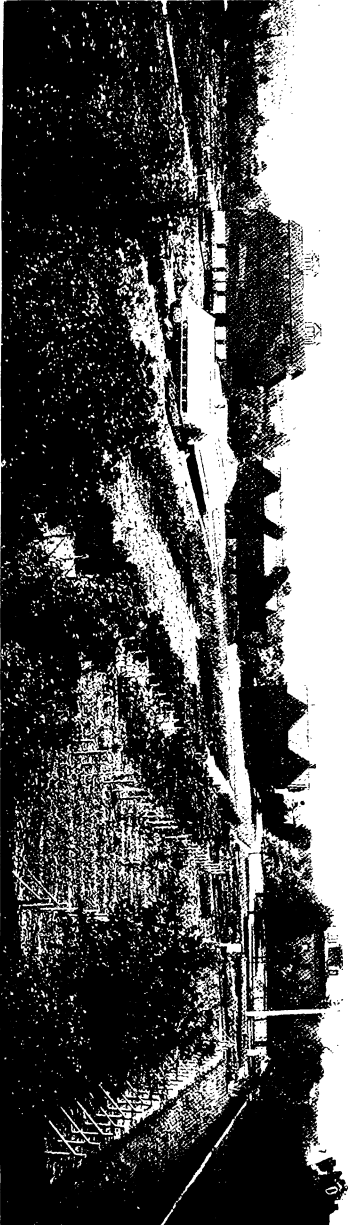
house, eleven in all. The forcing-houses include something less than 4,000 square feet of glass.

Many of these buildings are comparatively new and all are being kept in good repair. I wish to emphatically call attention to the fact that only one of these buildings is adapted to work of a strictly scientific character. With the exception of the chemical laboratory, no one of them can be utilized to domicile any of the scientific departments of the Station. Desirable space in which to conduct botanical, bacteriological, horticultural, and entomological studies is largely wanting. Nevertheless, the Station is forced by the demands made upon it to carry on investigations in all these lines, although at present under great disadvantages.

It is noteworthy, moreover, that no dairy building is included in the list given above. To be sure, the Station possesses a small one of very inferior quality, but it is convenient only for making a limited amount of butter and has no facilities for cheese work. This is an unfortunate condition for the Station to be in when supposed to efficiently aid the immense dairy interests of the state of New York—one which should be promptly remedied.

The present cattle barn is comparatively new and is built in a substantial manner. In accordance with a custom prevalent in the state of New York, the cows are tied in the basement. In this case, at least, the arrangement is open to criticism. The basement walls are of stone, the lighting is unsatisfactory, and the space occupied by the animals cannot be regarded as ideal in its hygienic conditions. In view of this fact and of the proposal to enter into dairy investigation on a scale that shall admit of a study of commercial problems, which will perhaps require a larger herd of animals, it would be wise and may be necessary either to attach a wing to the barn which shall be well lighted and ventilated, in which the more valuable permanent herd can be kept, using the main building as storage for food and other necessary purposes, or to enlarge the basement windows to increase the light and sheath the walls to diminish the dampness.

In naming the building equipment no mention was made of the poultry houses, although the Station is in possession of three small ones of the ordinary kind. They are entirely



Cattle Barn. Forcing Houses. Small Barn. Stable.

VIEW OF BUILDINGS AND GROUNDS.

Director's House.



inadequate, either in extent or construction, for certain lines of experimental work in modern methods of poultry culture. As the poultry interest is large, and as it is comparatively neglected by experiment stations, it appears that the Station could develop no more promising line of investigation. If this is done it will be necessary to provide a modern outfit.

The farm is also lacking that most essential of all minor buildings, a convenient tool shed. At present the farm and garden machinery is scattered through several buildings in a very inconvenient way, and is occupying space in the barns that is needed for the proper storage of experimental crops and foods. This causes dirt and disorder in places where it is extremely undesirable. A separate tool shed, conveniently planned and located is certainly needed.

*Apparatus and other equipment for scientific work.*—The chemical laboratories appear to be well supplied with apparatus, as indeed, they must be in view of the very large number of analyses which are required. After certain minor changes and additions of apparatus are made, these laboratories may be regarded as among the most convenient and efficient of any in the country.

As much could not properly be claimed for the scientific equipment for biological investigation as it existed on July first. This should be of the best. Microscopes, section cutters and other pieces of apparatus of the most approved forms necessary to botanical and entomological research should be available. It is a waste of means to associate good men and poor apparatus. As will be seen later, this condition of things is being gradually remedied.

*Fruit plant.*—In one direction the Station is exceptionally well provided with the means of observation and experiment. Reference is made to the collection of fruits that are now being grown on the Station grounds. These now number 3088 varieties, and constitute a notable opportunity for horticultural study. As the value of what is known as "variety testing" is called in question by many, special reference is made further on to this department of Station work.

*Dairy animals.*—It is very well known that the Station is in possession of cows from several breeds which for some years have been used in what is known as a breed test. It cannot be claimed

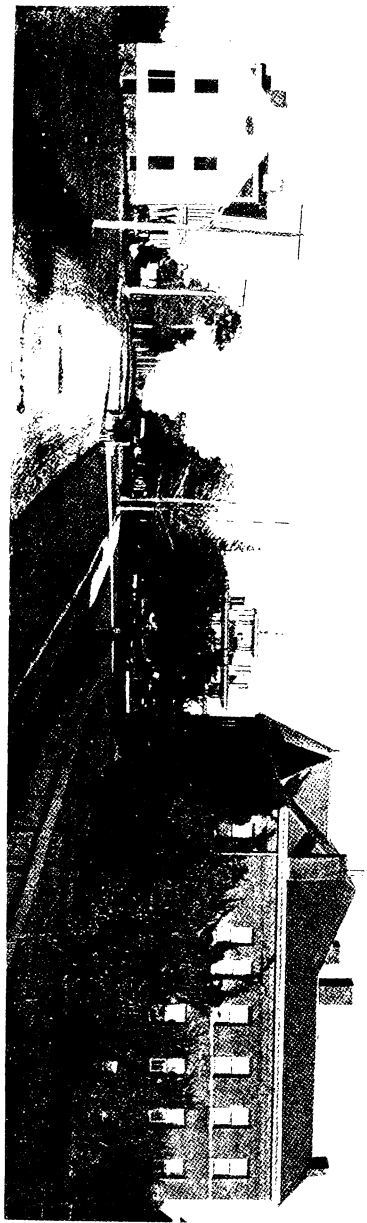
that these animals are in all respects satisfactory as good specimens of the breeds which they represent, although they include some individuals of excellent quality. It is probable that as a breed test alone, it would not be profitable to continue longer the collection of data such as has been recorded during the past four or five years. Any additional figures will be essentially a repetition of those we now have. But as we need a herd of cows to use in an experimental way, it will be possible to keep up a breed classification of the records with but little expense, and it is certainly desirable to complete, if possible, the life-history of some of the animals.

#### THE DISTRIBUTION OF INFORMATION BY THE STATION.

*The bulletins.*—These are published by means of a special state appropriation made for that purpose. The present edition of each bulletin is 27,000. This covers the mailing list and leaves a supply of copies with which to meet subsequent requests and to fill incomplete sets for the officers of other stations.

A newspaper summary, written concisely and in a popular style, is now prepared for each bulletin. This is mailed to all state papers and to some others, and is copied wholly or in part by nearly all the papers which publish agricultural matter. The outcome of this must be to call widespread attention to the work which the Station is doing.

It seems desirable that one other step should be taken towards rendering more available and popular the information contained in the Station publications. Everyone who has had experience realizes the great difficulty and even impossibility of writing an account of an investigation that shall give reasonably full data and at the same time shall be sufficiently simple and clear to be understood by the great mass of unprofessional readers. It is to be feared that the present somewhat extended bulletins, requiring as they do close attention to discover the lessons which they teach, sometimes discourage rather than encourage those who are beginning to seek for aid. At the present time the full bulletins are issued to the entire mailing list of twenty-five thousand names. It is not improbable that the larger part of these fails to accomplish much in the way of imparting



THE CHEMICAL LABORATORY.

information, and the expense of printing them is too great to allow their waste.

It is necessary, though, both to write the extended bulletin and to convey its lessons to the agricultural public, and the plan which it is proposed to follow in the future is to print a sufficiently large edition of each complete bulletin to cover the experiment station and professional exchange list and to meet the requests that will come from the higher class of readers, and then to send to the large mailing list a popular and practical resume of the bulletin, written, if possible, in a manner that shall prove attractive and helpful. This plan will be less expensive than the present one and can scarcely fail to augment the value and influence of the Station.

*The Annual Report.*—This is printed by the state printers, and sometimes is not issued for nearly a year after the copy is put in their hands. Only a few copies of the Report for 1895 have so far been received. It is possible that the delay is unavoidable, but it is none the less unfortunate. If the Station was not given the means and authority for promptly publishing its results in the form of bulletins, the conclusions would be stale and often useless when finally in the hands of the public. It would be a great improvement if the Annual Report could be printed on a better grade of paper and be given such a mechanical finish as would place it in appearance on a par with the reports of many other stations. The general appearance of any volume has much to do with its popularity and value. It is obvious that the state of New York can as well afford as any other to give to this report a high order of typographical excellence.

*The preparation of the Station publications.*—One of the most important duties pertaining to the successful management of an experiment Station is the editing of its publications, especially where the report is so large and the bulletins so numerous as is the case at this Station.

It is evident that the work should be done by one person in order to insure uniformity, and the maintenance of our publications up to a desirable standard of arrangement, illustration and typographical quality will require much time and effort. Reference has been made to a desirable change in the manner of publishing

bulletins and someone must be charged with the duty of writing the proposed popular summaries.

The purpose to enlarge and organize the library has also been mentioned. These several duties will surely require the full time of one person who must give to them a high order of special ability. No present member of the Station staff can be taken from his present duties for this work, and it is gratifying to know that steps have been taken to add a new officer to the Station force who shall give his entire time to the preparation of Station literature and the building up of a library.

*Station correspondence.*—It is estimated that annually the Station officers respond by letter to not less than five thousand requests from New York farmers for information touching agricultural practices. These inquiries relate chiefly to fertilizers, crops, foods, dairy products, fruits, and injurious insects and fungi. It is impossible to determine accurately the benefits of the correspondence, but in some instances they are known not to be insignificant. It is certainly proper that the Station should serve as a bureau of information on a great variety of scientific and practical subjects, and if it was more fully consulted the farmers of the state would make fewer mistakes and suffer less seriously from conditions that might be avoided.

*The mailing list.*—There are now approximately twenty-five thousand names on the Station mailing list, chiefly of New York farmers whose mail is received at nearly twenty-three hundred postoffices. During the year the postmasters of these offices have been asked to correct the lists of names of those to whom the Station was sending its publications, and in that way several hundred errors were discovered. The mailing list has for some time been increasing rapidly and is now receiving generous additions. It could be enlarged to enormous proportions by indiscriminately adding names which might be obtained in various ways, but it is believed to be wise to limit the additions to those persons who are sufficiently interested to make a request for the publications.

#### THE FUTURE WORK AND DEVELOPMENT OF THE STATION.

The New York Experiment Station was established nearly fifteen years ago and has, during its existence, gradually enlarged its activities and influence. Notwithstanding the extent of its

work at the present time, it should not be imagined that there is no further profitable development possible. Such development is not only possible but appears to be demanded by the conditions and problems which face New York farmers. In urging that the state enlarge the scope and increase the efficiency of the Experiment Station, it is proper to review the considerations which appear to justify this policy. Two questions are pertinent in this connection :

1. Is it reasonable to regard the experiment station as a permanent and necessary adjunct of modern agriculture?

2. In what directions should this Station be most active in order to best serve the interests of New York farmers?

*The permanence of experiment stations.*—These stations give great promise of permanence because they are in entire harmony with the whole trend of modern life. They are a necessary outgrowth of the scientific activity of the age. They are an avenue through which science is bringing to agriculture the same beneficial results that it has secured to other industries. It would be remarkable if, in the midst of the great world-movement towards the application of exact knowledge to practical affairs, the industry which is fundamental to all others, should fail to receive due recognition, and as science is more and more fully modifying and controlling man's activities, we may expect that agricultural experiment stations will remain as permanent and increasingly necessary institutions.

Again, the growth of experiment stations in number and importance during the past twenty-five years gives promise of permanence. The first one was established in this country as late as 1875 and now there are fifty-five. For the support of these our government expends nearly a million of dollars annually, an appropriation which appears to be made without objection by any member of Congress and which is popular throughout the country.

One of the most important bureaus of the United States Department of Agriculture exists for the sole purpose of promoting the work and efficiency of the stations. It is not too much to claim that these institutions are firmly entrenched in our governmental departments, and what is more important, in the good will of the people in whose interests they were established.

The influence which these stations now exert is indicative of vitality and strength. They are consulted on all sides concerning the more difficult problems of agriculture, and their investigations form the basis of the most reliable and important current agricultural literature. They are largely concerned in the official inspection of fertilizers and foods and have to a great extent become a court of final appeal in all agricultural contentions that lie outside ordinary experience.

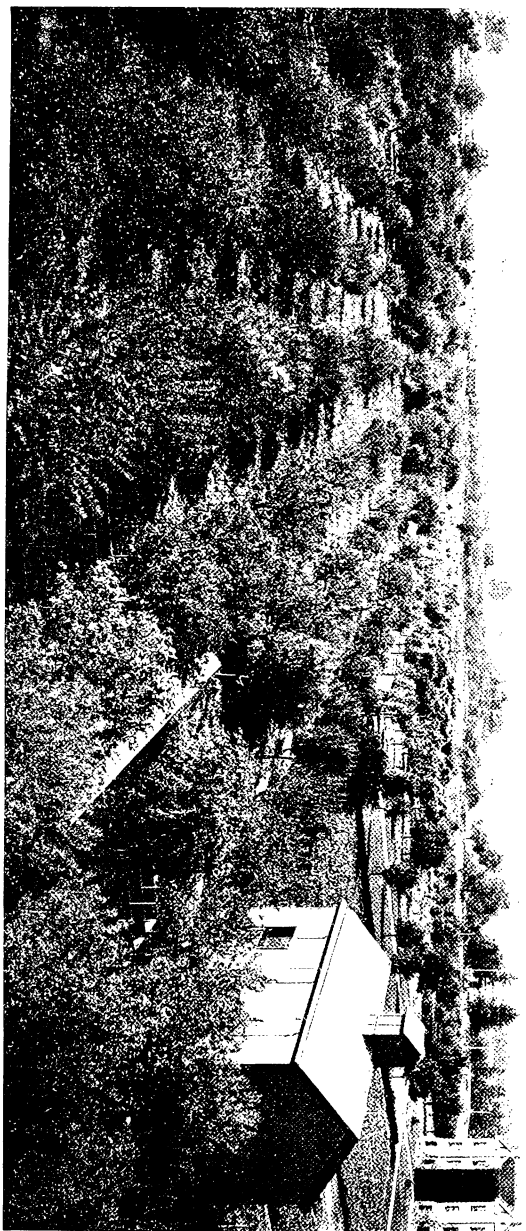
These stations should continue because of the unsolved problems which confront the agriculturist. Just enough has been learned to show clearly the vast gain that must come from further investigation. To stop where we are would be to lose richer rewards than have yet been gained. For these reasons we must conclude that the experiment stations have come to stay—that they are a fixed and essential factor in modern agriculture. This being the case it will be readily conceded that this Stations entitled to such support as will enable it to render the best possible service to the people of the state.

In what manner and along what lines can this service be most surely rendered?

*The general character of the investigations.*—If we base the reply to this question upon experience, the answer must be that the farmer will be best served even from a business point of view by a rigid inquiry into the facts and principles which underlie his practice. The knowledge which, in its application to agriculture, has been in the past fruitful of the best results, is that which has come from investigations in the field of pure science, and this will undoubtedly be true in the future. Tests of theories and illustrative experiments in matters pertaining to the business of farming are useful and even necessary, but all safe and permanent advance must proceed primarily from a study of fundamentals. Judged in the light of these statements, then the real function of the experiment station is to conduct severe scientific inquiry in those lines related to the practice of agriculture and therefore the controlling policy of this Station should be to strengthen and develop its facilities for making such research exhaustive and conclusive.

*The particular field of investigation.*—The most profitable field for this research should be determined by the relative importance of the various agricultural industries in the state. It is certain

PARTIAL VIEW OF STATION ORCHARDS.







ONE OF THE CHEMICAL LABORATORIES.

that at the present time, and there are no indications of a change of conditions, dairying and horticulture occupy a commanding position in New York agriculture. Both are greatly aided by our proximity to the largest home markets in this country. The former can scarcely become less important because of the great increase in the consumption of dairy products, especially of raw milk, and the latter must always be fostered in this state in view of the unexcelled natural advantages for the production of small and large fruits. Everything points therefore to the conclusion that the experiment stations of this state should give prominent consideration to whatever will promote these two lines of practice.

*Dairy Investigations.*—The problems which confront the dairy interest pertain on the one hand to the feeding of dairy stock, and on the other to the manipulation of milk in the manufacture of butter and cheese. The Station is already in a fairly satisfactory position to study questions involved in the production of forage crops and in the compounding of rations, but as has previously been intimated, it possesses no equipment for investigating certain facts fundamental to dairy processes. Dairy bacteriology now appears to be furnishing the needed explanations of many phenomena that are observed in cheese and butter making, and here is a very promising field of inquiry. The two additions, therefore, which the Station needs for entering upon this line of research are a dairy bacteriologist and a building adapted to the dairy work on a commercial scale.

*Horticultural and allied investigations.*—The practical side of horticulture is already well developed at the Station, and is being pushed by a corps of able, earnest workers whose chief drawback is that they are sadly in need of proper office and laboratory conveniences. Just now four men are at work in one office, which also serves as their only laboratory.

Much more attention should be given, moreover, to a study of plant diseases. If the grower of vegetables or fruit could more successfully combat his fungoid enemies, his success would be more uniform. Old plant diseases are imperfectly understood and new ones are constantly appearing, the life-history of which should be learned. The success which now attends spraying warrants the assertion that the control of the fungoid diseases of vegetables and fruits may be greatly extended. Should a vegetable pathol-

ogist be appointed to take this line of research at the Station, he must have laboratory facilities and should be given the use of a forcing-house as a plant hospital.

Economic entomology is an important and necessary adjunct of all lines of agricultural practice and cannot be ignored in our attempt to aid the gardener and fruit grower. Two entomologists are now doing as good work for the Station as the facilities at command will permit. An insectary should be provided, however, this being indispensable to an all-year study of insects and their depredations. It will be necessary, moreover, to furnish and equip rooms for the Entomologist at the Station, as he is now allowed the use of only a part of one room in the chemical building.

*Museum.*—Much material now comes into the possession of the Station which should be permanently preserved. Conveniently arranged working collections of plants and insects are indispensable. At present the Station is without any space in which to locate such collections. This should be provided at once and it should be such as to reasonably insure against loss of the materials by fire.

The various recommendations relative to the Station staff, equipment and work are briefly summarized.

*Additions to Station staff.*

1. A Dairy Bacteriologist.\*
2. A Botanist and Mycologist.\*
3. A Station Editor and Librarian.

*New buildings needed.*

1. Biological and dairy building containing offices and laboratories for horticulturist, botanist and mycologist, and entomologist, and a first-class equipment for the investigation of practical dairy problems.
2. A plant disease forcing house.
3. An insectary.
4. Additions to the poultry plant, including an incubator cellar, breeding pens and brooder houses.
5. A new wing to the cattle barn or changes in the basement of this barn.
6. A tool shed.

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\* Possibly one department under a single head.

*Additions to the equipment of scientific apparatus.*

Microscopes section cutter, calorimeter, reference collections, insect cases, etc.

*Library*—A material increase in the literature of investigation.

The most important of these recommendations have already been favorably considered by your Board, and steps are now being taken to carry them into execution. These needed additions cannot wisely be made at once, but should be the subject of definite arrangements during the coming year. Every possible effort should be put forth to begin the erection of the biological and dairy building in the early spring so that in a year from now it may be available for use.

## · THE WORK IN WHICH THE STATION IS NOW ENGAGED.

*Subjects now under investigation.*—The following is a list of the subjects which to a greater or less extent have been under investigation by the Station during the past year. It is obvious that some of these receive attention only at such intervals as season, growth and other conditions may determine, and in certain cases it may be a long time before the results reached will justify the publication of conclusions.

*Plant nutrition.*

Fertilizer requirements of fruit and vegetables.

Composition of fruits as affected by feeding the plant.

Foraging power of different species of plants for phosphoric acid.

Soda as a substitute for potash.

Value of indirect fertilizers.

*Crop production.*

Fertilizer tests with potatoes.

Growth of sugar beets.

Study of varieties of potatoes.

Influence of seed upon the potato crop.

Profitable amount of commercial fertilizers on wheat.

Comparative yield of various forage crops.

*Horticultural experiments, etc.*

Testing spraying machines.

Fertilizing apple trees.

Effect of girdling grapes.

Self-fertility of varieties of grapes.  
 Value of various stocks for plum orchards.  
 Survey of hardiness of varieties of fruits in New York.  
 Successful conditions for forcing radishes.  
 Forcing lettuce, fertilizers, soils and watering.  
 Forcing tomatoes, selection of seed, training.  
 Study of varieties of fruits.

*Diseases of plants, etc.*

Treating leaf spot on plum trees.  
 Treating leaf spot on cherry trees.  
 Prevention of raspberry anthracnose.  
 Peach yellows.  
 Spraying for prevention of Carnation Rust.  
 Application of sulphur for prevention of Carnation Stem-Rot.  
 Methods of spraying potatoes.  
 Prevention of Cucumber Blight.  
 Life history of certain potato diseases.  
 Prevention of Onion Smut.

*Entomological work.*

Efficiency of poisoned bait for cut worms.  
 Prevention of Pear Midge.  
 Destruction of San José scale.  
 Spraying Brussels sprouts.  
 Destruction of cut-worm moth eggs.  
 Life history of Seed-Stalk Weevil.  
 Use of dendrolene.  
 Use of green arsenite.  
 Study of the Pistol Case-Bearer.  
 Study of the Cotton-wood Leaf Beetle.  
 Causes of root galls.  
 Habits of Apple Fruit Worm.  
 Value of trap lanterns.  
 Cause of "pimply" potatoes.

*Animal production.*

Feeding experiment with pigs.  
 Comparison of rations compounded from unlike sources.  
 Sources of milk fat.  
 Study of cheese-factory milk.  
 Study of dairy breeds.

*Poultry Culture.*

- Value of selection in breeding poultry.
- Feeding experiment with chicks.
- Feeding experiment with laying hens.
- Source of lime to growing chicks.
- Relative value of vegetable and animal foods.

*Chemical Work.*

- Analysis of fertilizers.
- Analysis connected with various investigations.

The foregoing seems to be a large number of subjects to have under investigation at one time, and perhaps it is too large, and should be diminished, though the strong tendency is to increase it. New problems are constantly being urged upon the Station by its constituency, and it is much more easy to give favorable attention to such requests than to put them one side. Besides, the officers of the Station do not feel quite sure that they will escape vigorous criticism if they confine their investigations to a few subjects and study them exhaustively, although undoubtedly this is the right course to follow. We have now too many half answered questions, and greater ultimate good would result if the study of a less number of the most important problems could be continued to a definite solution. Past experience justifies this policy, and the time will come when public sentiment will more fully sustain its adoption by American stations.

*Variety tests.*—Probably no American station is so largely engaged in a study of varieties, chiefly of fruits, as is this one, and consequently its officers are specially interested in the adverse criticisms which occasionally appear concerning what is known as variety testing. The two common arguments against this work being undertaken by experiment stations are these: 1. It is a low grade of work which may be successfully done by men of less ability and training than station experts are supposed to possess. 2. Variety tests have little value except in the immediate locality where they are conducted.

It is impossible to ignore the force of these arguments when applied to mere variety testing as often conducted. Certainly much that experiment stations have done in the past in an indiscriminate and brief comparison of varieties has been of very doubtful value, which was temporary at the best. Doubtless this

criticism will, to some extent, apply to the horticultural work of this Station.

This raises a practical and important question, viz: What policy shall be pursued in the horticultural activities of this Station? It has over 3,000 varieties of fruit under cultivation and observation, a collection which attracts the wide spread attention of New York fruit growers, and which receives frequent visits from the horticulturists of other experiment stations. Should this collection be maintained and still further developed, or shall it be reduced in variety and extent to the dimensions which are merely necessary for certain lines of experiment and investigation, such as fertilizing, spraying, etc.? There are several reasons which appear to fully justify the maintenance of this part of the Station equipment on its present scale.

1. Under the conditions existing in Western New York even the variety testing has undoubted value, and it would be done nowhere else. The conditions at the Station are very similar to those prevailing over a large area of a fine fruit country, and any observations of varieties made here are of great interest not only to a large number of fruit growers, but to nurserymen who are producing an immense annual output of nursery stock. This study of varieties has discovered old ones under new names and has greatly benefited nurserymen, as well as fruit growers, by determining the value of new fruits before they have been placed upon the market.

2. This large collection, really a living museum of species and varieties offers what a distinguished horticulturist is reported to have called "a magnificent opportunity" for a botanical study of fruits and vegetables horticulturally important. The study of types and the breeding of varieties to a definite purpose requires just such conditions as these.

3. Problems connected with plant diseases and with injurious insects, because of the varying susceptibility of different varieties to these pests, are most successfully investigated in connection with such a collection of large and small fruits as the Station possesses.

#### IMPORTANT RESULTS IN 1896.

In order to make clear to those interested the extensive and important relations of the work of this Station to the agriculture

of the state, a brief resume is herewith given of the important data and conclusions which are to be found in the publications for the year, or which will be presented in bulletins about to be issued.

CHEMICAL DEPARTMENT. *Inspection of commercial fertilizers.*—The new fertilizer law of 1896 requires all fertilizer manufacturers doing business in the state to file at the Station a statement of their place of business and the name and guaranteed composition of all brands they are to offer for sale in the state during the year. The Station Director is authorized to make analyses of samples selected from such of these brands as are found in the market, in order to determine whether they correspond to the guaranteed composition.

During the year 126 manufacturers have complied with the law and have registered 1,126 brands. The Station has selected at different points and analyzed 760 samples representing 577 brands. In the main the goods have been as good as the guarantee, averaging better. In comparatively few brands has the percentages of valuable ingredients fallen below the advertised standard to an important extent. The deficiencies in available phosphoric acid have been more frequent than in the case of nitrogen or potash.

It is evidently very generally the purpose of the manufacturers to keep their goods up to the registered standard. In some instances the deficiencies in composition constitute a violation of the law, but it is not the purpose of the Director to advise legal action by the Attorney-General until it is clearly shown that the manufacturers concerned are purposely and persistently trying to sell fertilizers that are poorer than represented. The conditions involved, as for instance the sampling from a small portion of a large output of goods, are such that the application of a penalty for a single deficiency in one ingredient might be very unjust. The rights of both the farmers and the manufacturers will be respected, but there will be no hesitancy in giving prompt attention to an evident attempt at fraud. It should be remembered that the figures published in our bulletins constitute more of a menace to the manufacturer who is inclined to dishonesty than does the fear of legal action.

It was found necessary to call special attention to a fertilizer sold in the state under the name of "Natural Plant Food." This



mixture was being sold at a price greatly above the cost of entirely similar materials, and the claims made for it were so stated as to seriously mislead farmers. The complaints made by farmers who used this fertilizer on hoed crops are justified by the facts discovered. The guarantee was so worded, however, that no ground exists for legal action.

*Dairy investigations.*—The data secured by Dr. VanSlyke from a study of the composition and yield of milk during a whole season from fifty herds of cows contain lessons of great importance to the dairyman.

1. Aside from furnishing certain useful facts relative to the changes in the composition of milk, the investigation shows that the yield of cheese in June was about forty per cent. larger than in August, a result largely due to the insufficient food supply during the latter month. A careful comparison with a herd that was liberally fed with soiling crops shows that this decrease was mostly unnecessary and certainly unprofitable.

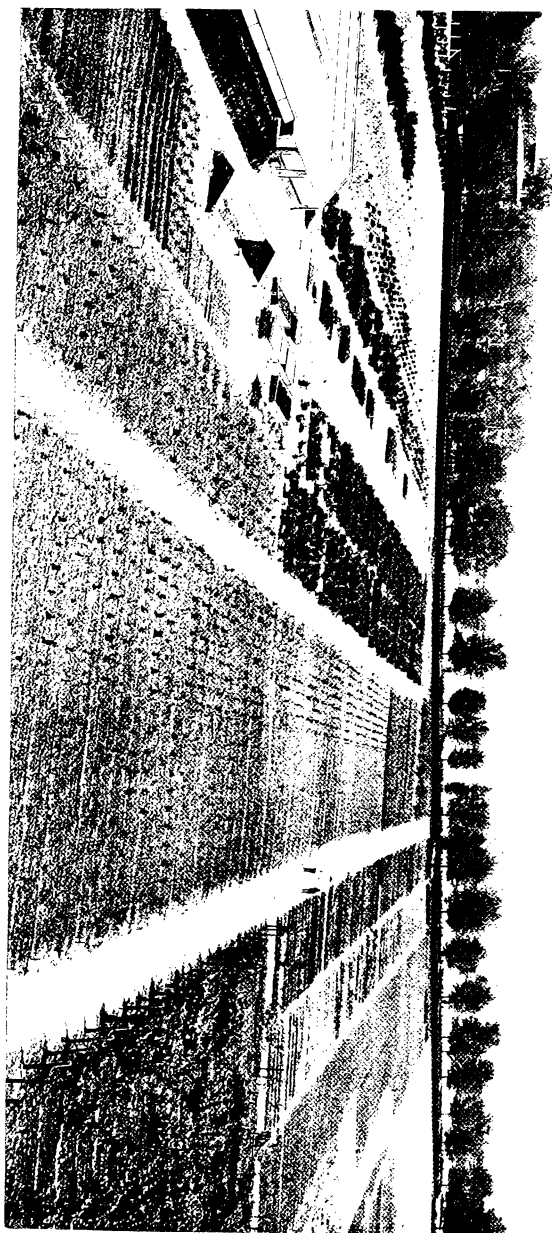
2. Further evidence is obtained in proof of the claim that the cheese values of different milks are very closely proportional to the percentages of butter fat which they contain, and that the purchase of milk of varying quality at a uniform price is a most unbusinesslike operation, unjust alike to producer and buyer.

*Use of fertilizers on potatoes.*—Experiments conducted on Long Island for the purpose of comparing the relative profits from using 1000 lbs. and 2000 lbs. of commercial fertilizer per acre on potatoes showed, (1) that the smaller quantity was the more profitable and (2) that in the single application of 2000 lbs. of fertilizer per acre twenty-five per cent. more nitrogen, nearly five times as much phosphoric acid and not far from sixty-five per cent. more potash were added to the soil than were removed in two crops. This indicates that Long Island potato growers may be incurring serious losses by applying too much of an improperly compounded fertilizer.

HORTICULTURAL INVESTIGATIONS.—During 1896 the horticultural investigations at this Station have been conducted largely along the following lines :

1. *Testing fruits.*—This necessitates the keeping of permanent records of the very large number of varieties which are now included in the Station collections. In many cases photographs,

STATION SMALL FRUIT EXPERIMENTAL PLATS.



drawings and herbarium specimens are preserved. The accompanying report includes the results of comparative tests of apples, strawberries, raspberries, blackberries, gooseberries and grapes, together with descriptions of different varieties of these fruits.

2. *The origination of new fruits for the purpose of securing improved sorts.*—Station seedlings of apple, pear, cherry, plum, grape, currant, gooseberry, blackberry, dewberry, raspberry and strawberry, 1,111 varieties in all, are being tested. With but few exceptions these are crosses, hybrids or pure bred seedlings, the parents of which, both male and female, have been selected for a definite purpose; in other words, they are the result of systematic plant breeding.

3. *The treatment of plant diseases.* (a) *plum leaf spot.*—Gratifying results have followed the investigations as to the best time for making the applications and as to the fewest number of treatments with Bordeaux mixture by which plum leaf spot in bearing orchards may be practically controlled. The experiments have been in progress for two years, during which period 693 trees in all have been under treatment. They have been conducted on a scale sufficiently extensive to insure reliable results, and a definite course of treatment based on this work is now confidently recommended. In the course of these experiments a marked increase in yield of the sprayed trees has been recorded. One of the varieties which was treated, the Italian Prune, yielded 45 per cent. more marketable fruit where sprayed than where not sprayed. The fruit also ripened later on the sprayed trees which in this case resulted in securing better market prices.

(b.) *Cherry leaf spot.*—Experiments with cherry leaf spot similar to those conducted with plum leaf spot have not given sufficiently marked results to permit of recommending a line of treatment for this disease in bearing orchards. During a considerable portion of the time when the treatments should be given, the use of Bordeaux mixture is objectionable because it sticks to the fruit till it is ripe and so injures its market value.

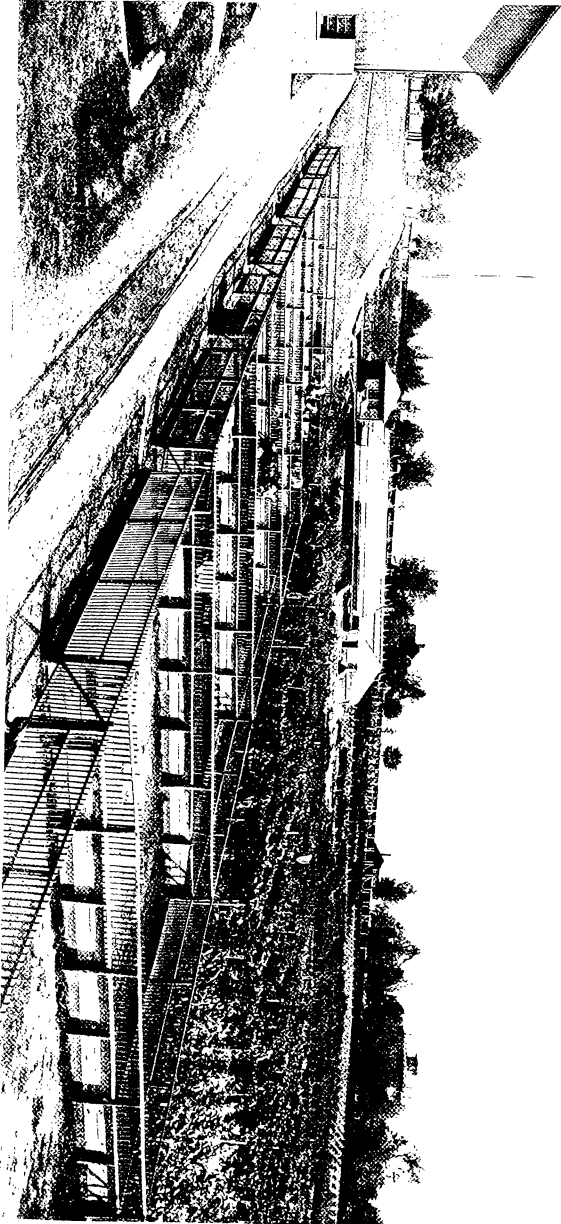
(c.) *Apple scab.*—Some of our prominent fruit growers have advocated the idea that liberal applications of wood ashes to apple orchards increases the healthfulness of the foliage and enables the leaves and fruit to better resist the attack of the scab

fungus. One of the Station orchards has for four years been devoted to an investigation of this question.

4. *A comparison of different kind of spraying apparatus.*—The improvements in the apparatus designed for spraying orchards, vineyards and field crops have been progressing very rapidly in recent years. Two years ago a report on the various kinds of spraying devices was issued by this Station. Since that time Mr. Paddock has given special attention to this subject and has prepared for this report an account of recent modifications of spraying apparatus.

5. *A report of the winter injury which was sustained in 1895-6 by the varieties of fruit which are grown in this state.*—Not since the Station was established has the temperature been so low here as it was in February, 1896, when at one time the mercury registered 21 degrees below zero. All fruit buds of peaches, apricots and sweet cherries were killed; plums, except natives, suffered almost as severely, and sour cherries and pears were damaged to a considerable extent. It was thought that since the winter was unusually destructive to fruit buds throughout the state, and in many cases to the trees as well, this condition afforded an unusually good opportunity for learning the relative hardiness of different varieties of fruit. An effort was made to secure a correspondent in every town in the state to report on the condition of fruit and the amount of winter injury. The names of nearly seven hundred correspondents were furnished to the Station and about two-thirds of them responded to the inquiries which were sent them. From the mass of data which was thus secured the report on this subject which is given in the following pages has been compiled.

6. *A series of experiments in thinning fruit* has been undertaken to study the influence which the practice of thinning fruit, continued systematically for a series of years, may have on the vigor and productiveness of the tree and the size, color and quality of the fruit. By the account of progress of the experiments with apples which is given in this report it is seen that the trees which were thinned in 1896 gave fruit of a higher color and a larger per cent. of No. 1 grade than did the trees which were not thinned. The total amount of fruit per tree borne by the former was so



CATTLE YARDS.

much superior in appearance that it is estimated it would usually bring fifteen per cent. more in price.

PLANT DISEASE INVESTIGATIONS.—*Spraying potatoes*—The experiments of 1895 reported in Bul. 101 on spraying potatoes with Bordeaux mixture showed three definite results:

(a.) The early blight was largely prevented, and the late blight did not appear at all on the potatoes. The unsprayed vines were badly diseased.

(b.) Spraying five times increased the yield of merchantable tubers sixty-two bushels per acre.

(c.) The injuries caused by the cucumber flea-beetle were much diminished by the spraying.

In 1896 neither of the two common potato blights appeared, but nevertheless the spraying was accompanied with excellent results.

*Cucumber Blight.*—The pickle industry of Long Island is an important one and it has lately been threatened with destruction by downy mildew. Many cucumber growers are reported to have about decided to give up the business on this account.

An experiment made by Mr. Stewart has pointed out a successful and practical remedy for this disease, an account of which will appear in a future bulletin.

*Spraying for Carnation Rust.*—At the present time a large amount of money is received by forcing house men from the growth of carnations. One obstacle to this industry is the ravages of the rust, and much attention is being given by the Station to this matter.

The results so far reached indicate that spraying with a solution either of copper sulphate or potassium sulphide, preferably the former, may, at least partially control the disease. In one experiment 58 per cent. of the plants of a very susceptible variety were kept free from rust, the unsprayed plants being all affected.

ENTOMOLOGICAL INVESTIGATIONS.—*Cause of pimply potatoes.*—A condition of the potato tubers which is termed "pimply" has been noticed in south-eastern New York and other places, the cause of which has heretofore been unknown.

An investigation instituted by the Station has brought to light

the fact that this injury is caused by larvæ of the Cucumber Flea-Beetle feeding upon the tuber.

As this flea-beetle is discouraged from feeding upon the vines by the use of Bordeaux mixture, spraying with the liquid is recommended as a preventative of "pimply" potatoes.

*Prevention of insect ravages.*—The reports of the entomologists advise, on the basis of careful experiments, that the injuries due to certain insects can be wholly or in part prevented by the several methods mentioned below.

(a.) Attacks of Colorado potato beetle and flea-beetles are avoided by spraying with Bordeaux mixture.

(b.) The squash borer can be controlled by cultural methods.

(c.) The onion thrips can be kept away by planting set onions on the margin of the field, to be sprayed frequently with kerosene emulsion.

(d.) The red spider is largely kept from raspberries by raking and burning the leaves in the fall and spraying with kerosene emulsion in the spring.

(e.) The application of kainit in June diminishes the damage done by the pear midge.

Cultivation of the orchards is equally beneficial.

(f.) The cabbage-looper was killed in the open field by the use of a poisoned resin-lime mixture.

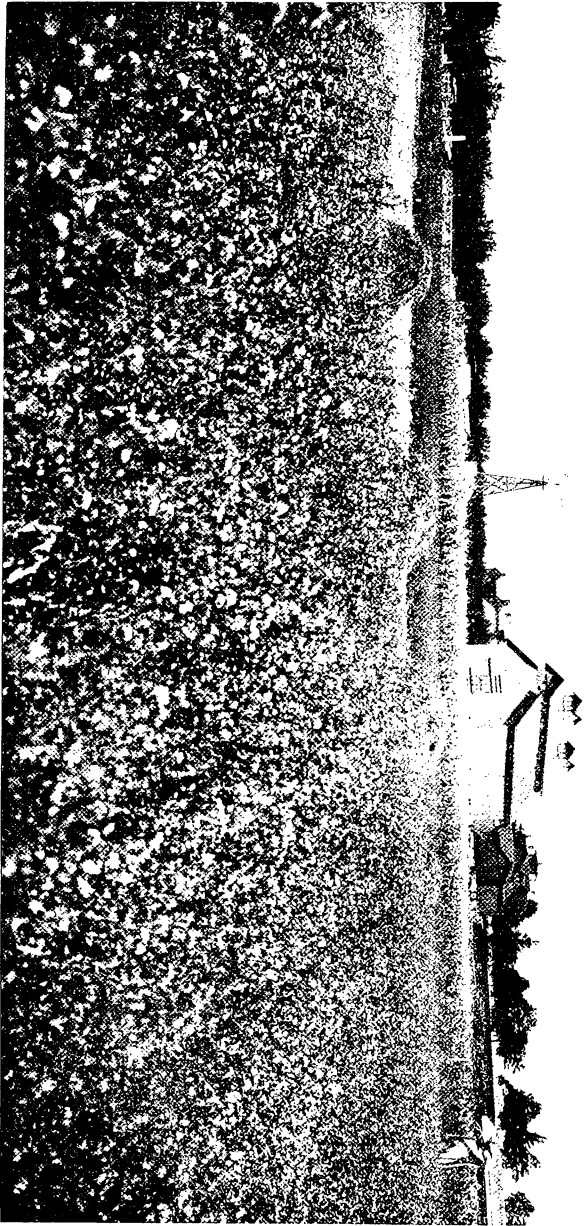
(g.) The use of a mixture of dry bran or middlings and Paris green was found to be a cheap and efficient means of preventing the destruction of onions by cut worms.

This is an important result in view of the extent of onion culture in Orange County as it is estimated that during the past year 46 per cent. of the crop was ruined by this pest.

(h.) The experiments of the past season indicate that spraying with Green Arsenite and lime can be successfully used against the apple fruit worm, pistol case-bearer, cotton-wood leaf beetle, apple flea-beetle and the potato beetle.

*Outbreak of the Army Worm.*—The Station was able to render prompt and extensive assistance in controlling the outbreak of the army worm in this state during the past season.

*Tests of Insecticides.*—A thorough test of Dendrolene showed that is dangerous to the trees and that as a preventive of the canker worm it is unsatisfactory.



STAYTON ALFALFA FIELD.



*Collections of insects.*—Good progress has been made in increasing the reference collections. The Station now has about 5,000 specimens representing 2,395 species of insects, chiefly those that are injurious.

**CROP PRODUCTION.** *Alfalfa.*—A record is being kept on the Station farm of certain forage crops. The most noteworthy of these is alfalfa. During three years a field of several acres of this legume has yielded an average of approximately 17.5 tons of green fodder per acre. This has been equivalent to about 8,400 pounds of dry matter per acre, or 5,000 pounds of digestible material. During the past season the older alfalfa fields produced four cuttings of a most excellent green food which was greatly relished by the cows. This is by far the most successful soiling forage crop which is grown by the Station, and our experience with it will soon be made the subject of a bulletin.

*Silage Corn.*—In maintaining a herd of twenty-five animals without pasturage, the Station places great dependence upon the corn crops. From eight to ten acres of corn are grown annually, nearly all of which is put into the silo. It is allowed to mature until the kernels begin to glaze, and in this condition produces silage of uniformly good quality which serves as a supply of succulent food during the entire winter season. The milk from cows which eat as much as fifty pounds of the material daily is excellent in quality and flavor. The experiences of several years on the Station farm and on many successful dairy farms justify the assertion that the silo has passed beyond the experimental period. It is an economical adjunct of animal husbandry and its use is consistent with the manufacture of dairy products of the highest quality.

During the year the Station has issued a bulletin entitled, "Silos and Silage" written by Mr. Wheeler, which is an admirable resume of such facts as are valuable to those who wish to consider the subject.

**ANIMAL PRODUCTION.** *Tests of dairy breeds.*—During two years a large amount of unpublished data has accumulated from this test, which is now being arranged and digested for publication.

*Feeding experiments with swine.*—Tests have been made of the comparative growth of crossbred pigs including Tamworth-York-

shire, Yorkshire-Tamworth, Tamworth-Duroc, Tamworth-Poland China, and Ohio Improved Chester-Poland China. Considered in connection with trials of former years the main result is favorable to the Tamworth crosses.

*Poultry feeding experiments.*—A test of the relative value of whole and ground grains as food for laying hens, continued during two years, showed a marked advantage for the ground grains in feeding Leghorn and the reverse in feeding Cochins.

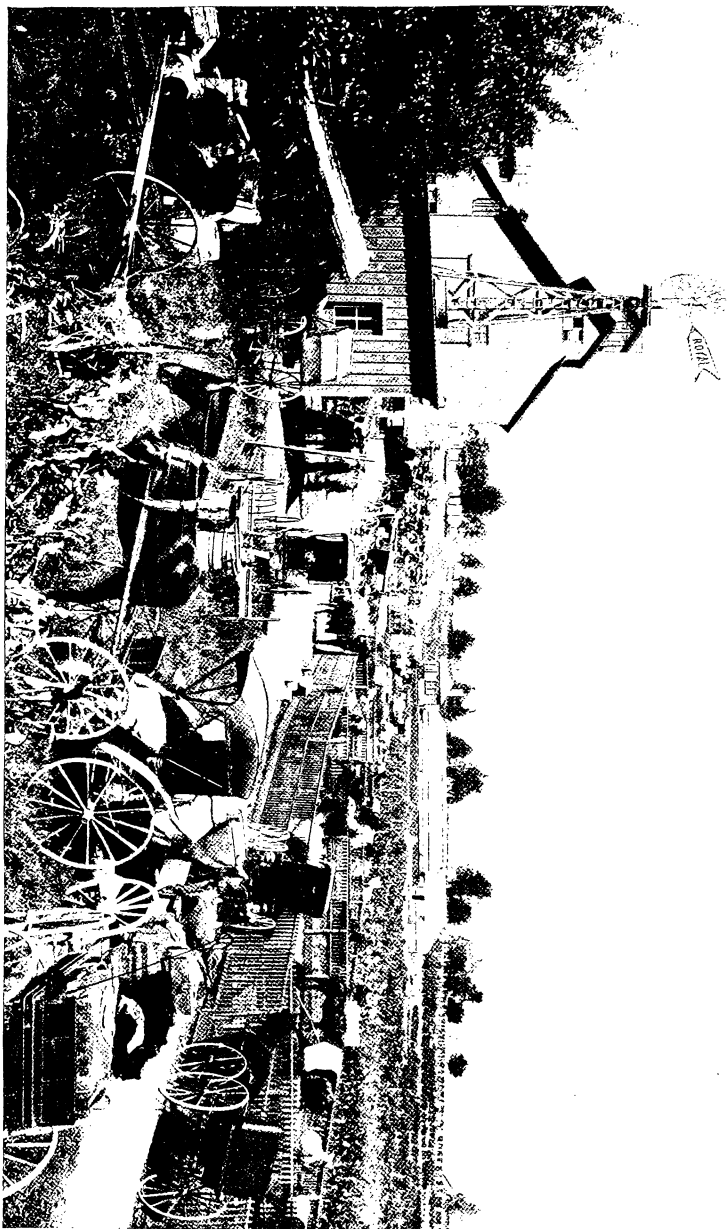
#### EXPERIMENTS CARRIED ON OUTSIDE OF THE STATION PREMISES.

The larger part of the data herein presented was secured in the laboratories and on the farm connected with the Station. It is sometimes necessary however, in order to find the conditions required for particular experiments, to secure the privilege of using land, trees, or other facilities owned by private parties. In 1896 several interesting and profitable tests of varieties, spraying, thinning fruit and girdling grape vines, have been carried on in the orchards and vineyards of private fruit growers. The following are the gentlemen who have kindly and faithfully assisted the Station in this work.

- W. D. Barns & Son, Middle Hope. Test of varieties.
- S. A. Hosmer, Clifton. Spraying for raspberry anthracnose.
- T. C. Maxwell & Brothers, Geneva. Spraying for plum leaf spot.
- E. Smith & Sons, Highland. Girdling grapes.
- Frank Smith, North Hector. Thinning plums.
- L. Rice, Manchester. Spraying for raspberry anthracnose.
- Walter F. Taber, Poughkeepsie. Girdling grapes.
- T. B. Wilson, Hall's Corners. Thinning apples.

#### SPECIAL WORK IN THE SECOND JUDICIAL DEPARTMENT.

The appropriation for three years which has been made for the maintenance of investigations in the Second Judicial Department is a recognition of the special conditions that prevail in the territory adjacent to the great markets of New York and Brooklyn. In the expenditure of this fund the Station evidently has endeavored to give due consideration to the agricultural practices of most importance in south-eastern New York. A branch Station has been established at Jamaica, from which as a center,



FARMERS' PICNIC AT THE STATION, 1896.

experiments and investigations have been conducted with reference to relieving the most pressing difficulties encountered, especially by market gardeners and forcing-house men. While the control of the work remains with the Station at Geneva, the men at Jamaica have been more or less thrown upon their own resources, and much credit is due to them for the efficient and practical manner in which they have performed the duties that were assigned to them.

In 1896 five bulletins were printed by this fund. Some important results have been reached. Leaving out of consideration much other valuable information gained, it is safe to assert that if the facts demonstrated by Messrs. Stewart and Sirrine relative to spraying potatoes and cucumbers and the control of the cut worm that attacks onions would be heeded by the farmers of Long Island and Orange Co. alone, the benefits would annually pay the entire expense of the Experiment Station several times over. For account of these results reference is made to the previous summary and to the detailed report herewith presented.

This appropriation provides for instruction as well as investigation, and in 1896 eight farmers' institutes were held in the Second Department at Southold, Riverhead, Southampton, Jamaica, Northville, Newburgh and Goshen. Twelve more are already planned for 1897.

#### THE RELATION OF NEW YORK FARMERS TO THEIR EXPERIMENT STATION.

It is gratifying to note how generally the agriculturists of this state are in cordial sympathy with the work of their experiment station. This is very encouraging to the officers of the Station. They recognize that the coöperation of the farmers is essential to the success of their efforts. There must be on the one hand the search for truth and on the other the disposition to learn and practice it. Effort is demanded no less on the part of the farmers than from those who are attempting to serve their interests. Bulletins must be written in order that they may be read, but they must be read,—yes, studied, before they effect any good.

We suggest, therefore, that while the Station officers are being held to faithful and vigorous work, farmers shall consult their own interests by giving careful consideration to whatever facts

the Station lays before them, either to approve and utilize or to form the basis of criticism and inquiry.

BULLETINS PUBLISHED IN 1896.

Sixteen bulletins have been published during the past year, containing 317 pages.

No. 98. Plum leaf spot. Cherry leaf spot. Fruit rot. By S. A. Beach.

\*No. 99. The spinach leaf maggot or miner. By F. A. Serrine.

\*No. 100. Combating carnation rust. By F. C. Stewart.

\*No. 101. Potato diseases on Long Island in the season of 1895. By F. C. Stewart.

No. 102. Silage and silos. By W. P. Wheeler.

No. 103. Provisions of the new fertilizer law of New York. By L. L. Van Slyke.

No. 104. Notes on the recent invasion of the army worm. By V. H. Lowe.

No. 105. Effects of drouth upon milk production. By L. L. Van Slyke.

No. 106. Feeding experiments with laying hens. The relative efficiency of whole and ground grains. By W. P. Wheeler.

No. 107. Report of analyses of commercial fertilizers for the spring of 1896.

No. 108. The real value of "natural plant food." By L. L. Van Slyke.

No. 109. Strawberries. By Wendell Paddock.

No. 110. Milk-fat and cheese yield. By L. L. Van Slyke.

No. 111. Variety tests with blackberries, dewberries and raspberries. By Wendell Paddock.

\*No. 112. Economy in using fertilizers for raising potatoes. By L. L. Van Slyke.

\*No. 113. The cucumber flea beetle as the cause of "pimply" potatoes. By F. C. Stewart.

Five of these bulletins (\*) were issued under the authority of the laws of 1895 and 1896 which provided for special work in the Second Judicial Department.

W. H. JORDAN,  
Director.

New York Agricultural Experiment Station,  
Geneva, N. Y., Dec. 31, 1896.