FACTS *about the* GENEVA STATION

1882 1932

FIFTY YEARS OF SERVICE

"Fifty years! Only a start, the embarkation! Agricultural research is a long-time undertaking, a pursuit that cannot be speeded up. Air and water, iron and gold, ether and atoms are inanimate, and can be dealt with in quantity and at all times; but plants and animals are animate and go thru a cycle that the experimenter cannot hurry.

"Fruit trees require several years to mature; grains and vegetables take from three to twenty months to come to seed; calves and colts lie in their mothers' wombs just as long now as they did when Noah led their forebears out of the Ark.

"And then, at its best, life is a bubble that will burst in your hands unless properly humored. You must not expect the revolutionary changes from research in agriculture such as those in the physical sciences which have brought forth the electric light, the radio, and the airplane. Advances in agriculture come for most part from slow accretions of knowledge and fifty years gives time but for the breaking of ground."—*From an address by Dr. U. P. Hedrick, Director, commemorating the fiftieth anniversary of the founding of the Station.*

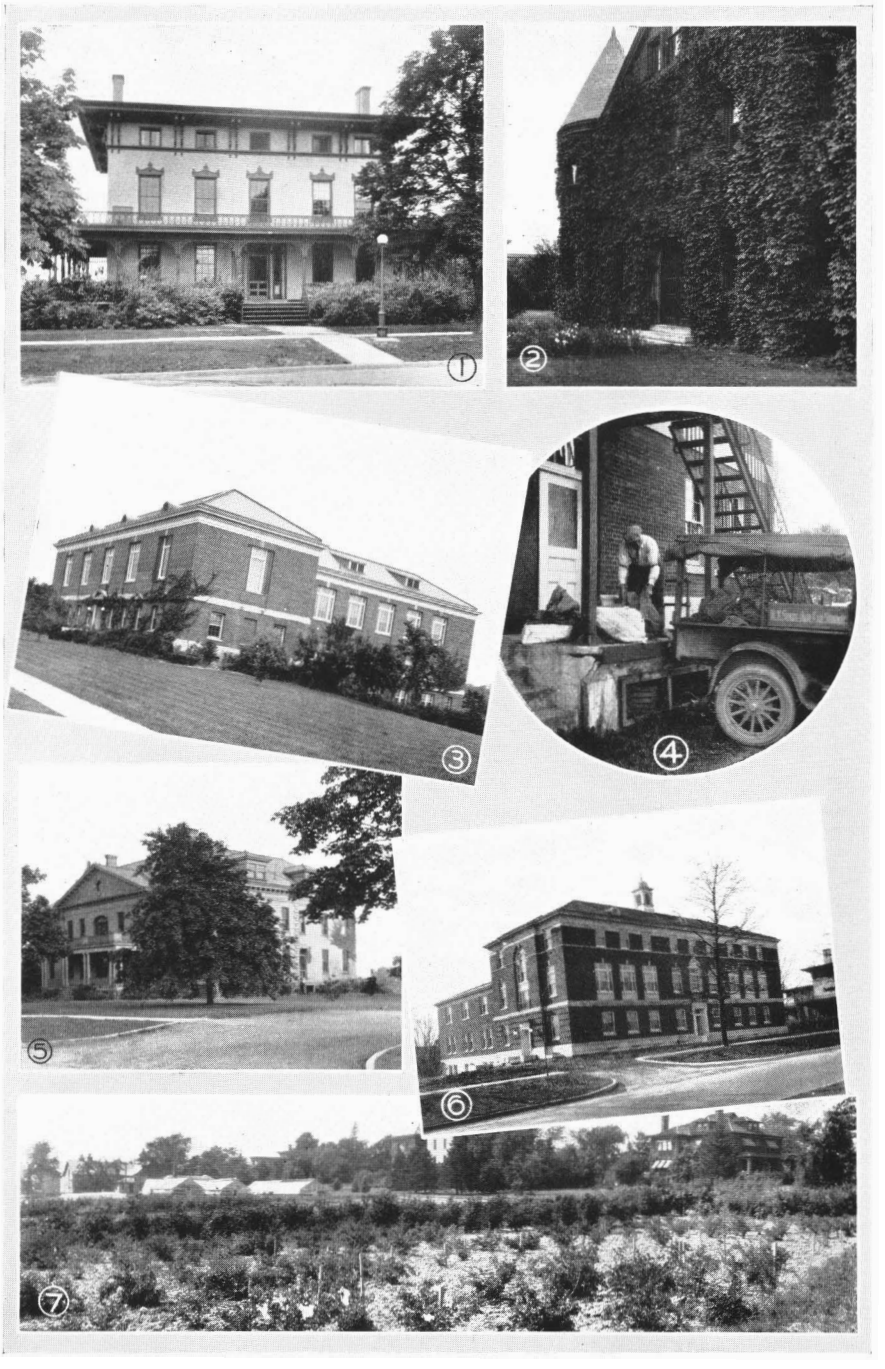
FACTS ABOUT THE GENEVA STATION

NEW YORK STATE AGRICULTURAL EXPERIMENT STATION

GENEVA, N. Y

CIRCULAR No. 136

July 1932



1, Entomology Building; 2, Chemistry Building; 3, Jordan Hall; 4, Bulletins Going to the Post Office; 5, The Dairy Building; 6, Hedrick Hall; 7, General View of Station Grounds.

ADMINISTRATION

DEDICATED TO RESEARCH

THE New York State Experiment Station celebrates its fiftieth anniversary in 1932. On March 1, 1882, Dr. E. Lewis Sturtevant, first Director, took possession of the farm of 130 acres with its farm house and the usual outbuildings which had been purchased by the State earlier in that year. Now the Station owns or rents 356 acres and has five laboratory and office buildings and eleven farm buildings.

In creating the Station, the Legislature stated that it was established "for the purpose of promoting agriculture in its various branches by scientific investigation and experiment." Consequently, the chief work of the Station has been to study, in a scientific way, problems confronting the farmers of the State and the problems of industries dependent upon agriculture for their raw materials, notably dairy manufactures, food preservation, by-product utilization, etc. To do this the Station employs a corps of 62 highly trained specialists, who are engaged on 150 or more main lines of research.

The Station does not attempt to run a "model" farm, nor does it necessarily demonstrate good farm management in its fields and orchards. Rather these are used as outdoor laboratories for carrying on experiments under more nearly natural conditions. In all of its work the Station is attempting to establish facts and principles that shall serve as safe guides in farm practise. Other agencies in the State take the facts developed in the Station researches and show how they can be applied on the farm.

OUTLYING LABORATORIES

In order better to serve the diversified interest of New York agriculture, the Legislature has seen fit from time to time to set up field stations or laboratories in various parts of the State under the supervision of the Experiment Station. At these laboratories problems peculiar to the region receive special attention.

The oldest of these is the Vineyard Laboratory at Fredonia, in the heart of the Chautauqua grape belt. Here every phase of grape culture is under investigation, including methods of controlling the insect pests and diseases that afflict grapes. This laboratory is also used as a center from which to direct studies on other fruit problems in that territory.

The Hudson Valley Fruit Investigations are represented by two laboratories, one at Hudson where the Station maintains a pomologist to study fruit varieties for the Hudson Valley as well as fertilizer and cultural needs of eastern New York orchards, and one at Poughkeepsie where a plant

disease specialist and an entomologist devote their time to solving insect and disease problems under Hudson Valley conditions.

At Riverhead is located the Long Island Vegetable Research Farm where the Station carries on extensive experiments with the numerous truck crops grown on Long Island.

A VARIED PROGRAM

Geneva is situated at the foot of Seneca Lake, about 30 miles south of Lake Ontario, in what is known as the "Finger Lakes" region of western New York. This section is famous for its fruits, orchards, vineyards, and small fruit plantations abounding on every side in the vicinity of the numerous lakes which temper the climate and make possible the production of an abundance of apples, pears, peaches, plums, cherries, grapes, and berries of all kinds. The Station's research program features many problems of importance to the fruit grower.

Also, in the immediate neighborhood of the Station, as well as in many other sections of the State, vegetable growing has become increasingly important in recent years. This has led to a rapid expansion of the Station's vegetable crop investigations, about which more will be said later.

New York's tremendous dairy interests naturally brought to the Station at its very beginning many problems of fundamental importance to the dairy industry. The Station has long enjoyed world-wide renown for its dairy researches, and is recognized today as one of the leaders in the field of dairy research.

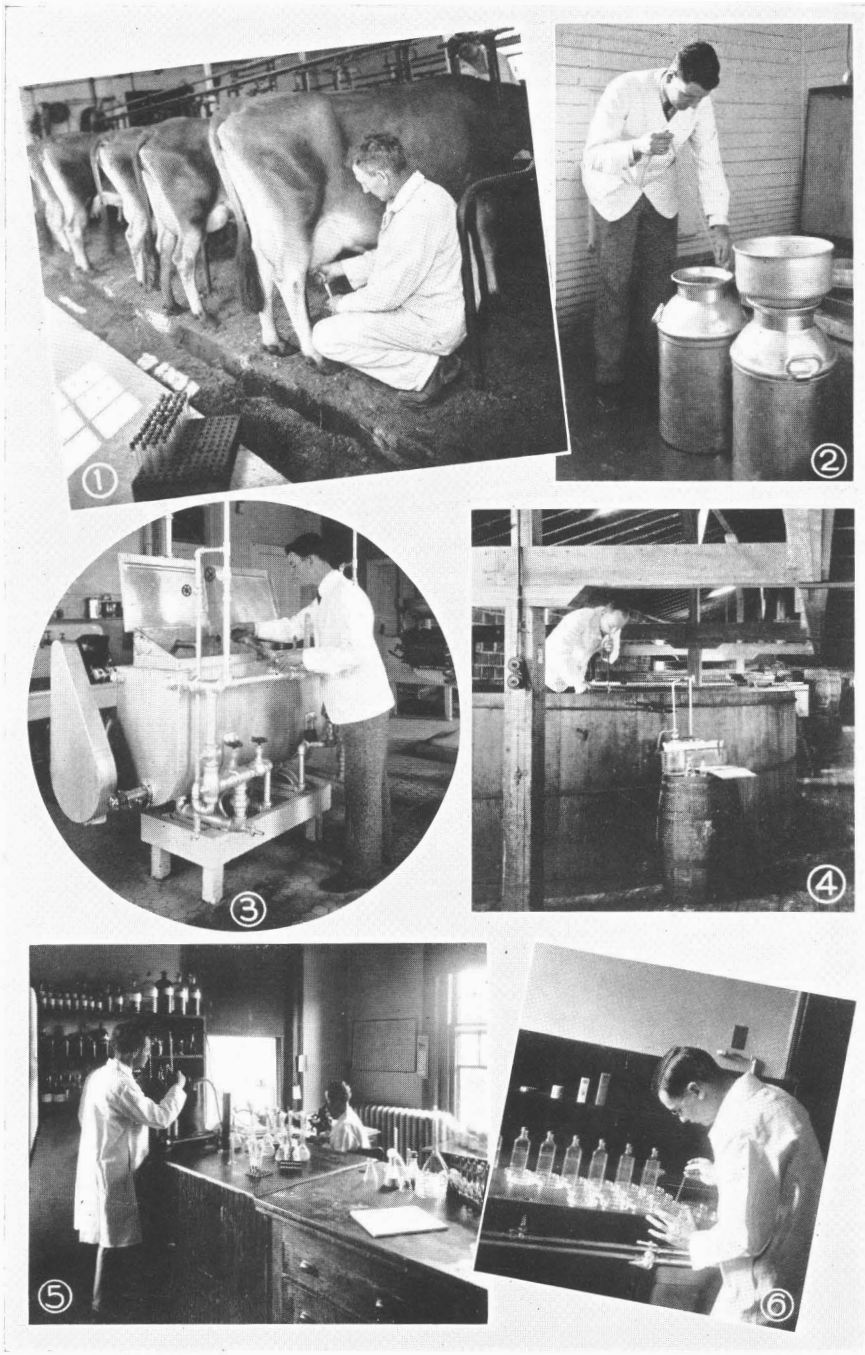
In each of these great farm enterprises—fruit and vegetable growing and dairying—fields of research contribute to the solution of problems peculiar to each, such as the chemistry of dairy products, the control of insect pests and diseases of fruits and vegetables, agricultural bacteriology, soil fertility and plant nutrition—to mention only a few. So it will be seen that the research program of the Station presents a wide array of subjects demanding the attention of the investigator, some of which are discussed more fully in the pages that follow.

REPORTING RESULTS

Equally as important as solving farm problems is the reporting of the results so that those who can make the best use of the information will have it at the first opportunity. At the Experiment Station this is accomplished by means of bulletins and circulars, by brief accounts of new developments in newspapers and farm papers, by radio broadcasts of timely information, and by occasional exhibits.

The printed material issued by the Station in the form of its bulletins and circulars is distributed free of charge upon request to anyone who can make use of the information. Mailing lists are maintained to which post-card announcements of new bulletins are sent at frequent intervals, while notices also appear in the newspapers of the State and are read over the radio as new publications become available.

This little pamphlet has been prepared to give the visitor to the Station and others interested in its work a brief resume of the chief things that are going on in the several research divisions. It is by no means a complete review of the Station's activities, but it is hoped that it will serve, in a small way at least, to make farm research a little better understood.



1, Mastitis Studies; 2, Market Milk Control; 3, Testing Pasteurizing Equipment; 4, Studying Sauerkraut Fermentation; 5, A Bacteriological Laboratory; 6, Examining Legume Inoculants.

BACTERIOLOGY

THE tiny forms of life that we call by the general name of bacteria play such an important and varied part in so many agricultural operations that it is impossible in a limited space to deal adequately with the researches under way in the Bacteriology Division at the Station. To state it as briefly as possible, it may be said that the bacteriologists are concerned chiefly with bacteria in food, including milk, with soil bacteria, and with legume bacteria.

Sauerkraut studies.—The bacteria that bring about the fermentation of sauerkraut are receiving much attention at the Station, as well as the possibilities of controlling sauerkraut fermentation by means of pure and mixed cultures of bacteria. The fact that the Station is in the center of one of the largest sauerkraut-producing areas in the world is an added incentive to the study of this complex product.

Tomato products.—The studies of the bacteriologists upon tomato products have offered assistance to the canner in eliminating the spoilage of tomato pulp as well as affording housewives more information in preparing high quality catsup in the home. The results of these studies have been put to practical use in many homes in New York State.

Flavors in dairy and vegetable products.—Bacteria are known to play an important part in the flavor of many food products. Studies are being made of the organisms affecting the flavor of milk, cheese, dairy starters, tomato products, sauerkraut, and the like. It is hoped that a better knowledge of these bacteria will eventually lead to a control of the flavors produced in a variety of foods.

Food studies.—The spoilage of food products by bacteria, yeasts, and molds offers many problems, both to the housewife and to the canning industry, that the Station bacteriologists are attempting to solve. Included in this is an effort to perfect methods for the better utilization of fruit and vegetable products by improved means of preservation. Many fruits and fruit juices lose much of their fine, delicate flavors by the methods of preserving now employed most of which involve the use of heat.

Sources of bacteria in milk.—Farmers endeavoring to meet sanitary milk standards with the greater stringency in regard to bacterial counts have for years consulted the Station's bacteriologists for aid. This division has studied the sources of bacteria which find their way into milk and as a result of these studies is in a position to offer sound advice to the dairyman to help him in keeping his milk counts at a minimum.

Heat-loving bacteria.—A large part of the bacteriological work at the Station has to do with market milk, especially with the grading of milk on its bacterial content. Recent developments in pasteurizing equipment in milk plants in the State have introduced a new problem to the milk distributor in the control of so-called "heat-loving" bacteria that survive pasteurizing temperatures. These bacteria are harmless so far as the health of the consumer is concerned, but they do affect the flavor and keeping quality of the milk, hence are undesirable. Progress is being made in the control of these organisms by proper handling of the milk and the apparatus.

Bacterial counts.—The Bacteriology Division has long cooperated with the milk distributors and the public health authorities in standardizing methods for making the bacterial counts that serve as a basis of payment of premiums to New York dairy farmers for low-count milk. It is estimated that more than a million samples of milk a year are examined by the direct microscopic method of counting bacteria perfected in the Station bacteriology laboratory.

Milking machines.—The bacteriologists at the Station were among the first to realize the future of the milking machine. However it was soon found that the success of the machine depended largely upon its care from a sanitary standpoint. The bacteriologists have worked out methods of washing and sterilizing machines which have been widely adopted thruout the State.

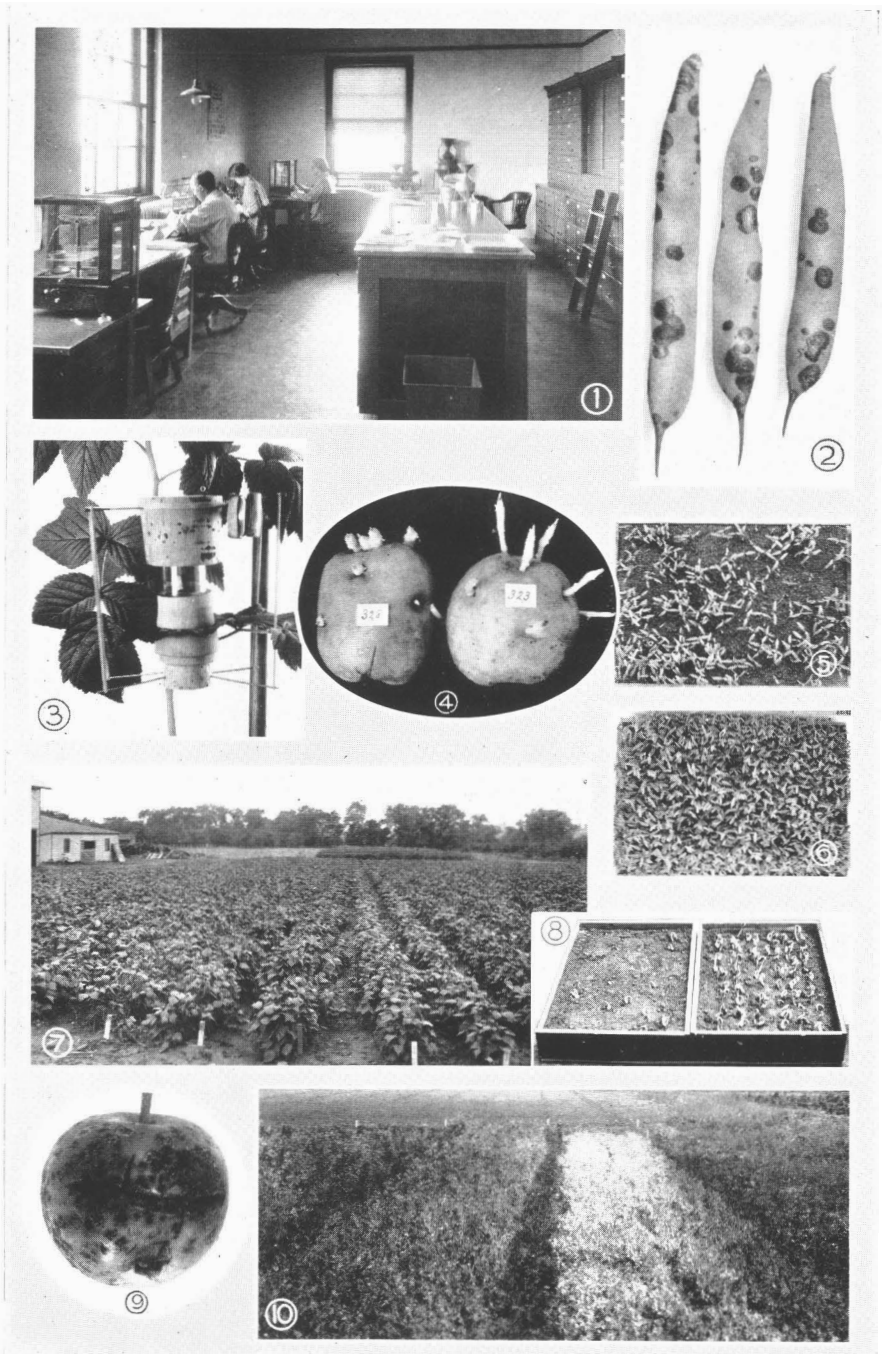
Mastitis or "garget".—The sanitary milk control work under way at the Station has naturally led to a study of the significance of milk from cows suffering with mastitis as a source of contamination of the general milk supply. An intensive study is under way on the detection of mastitis and its treatment to aid dairymen in meeting the regulations imposed by public health authorities. The bacteriologists are studying the organisms that cause this disease with the aim of finding a definite and efficient means of aiding the dairy farmer to control the spread of the infection in his herd.

Soil bacteria.—Bacteria have many important functions to perform in the soil, but the chief interest just at present in the study of these soil organisms in the bacteriology laboratory is the possibility of utilizing them as indicators of fertilizer requirements. This has been suggested by results obtained with bacterial cultures that fail to grow in certain types of soil without the addition of fertilizers, particularly nitrogen. It is rather a technical subject, but if a fairly simple bacteriological test could be de-

vised to determine the fertilizer needs of a soil the practical application of the test is quite obvious.

Legume bacteria.—Recently legislation has been enacted which provides, among other things, that the Experiment Station test samples of legume inoculants offered for sale in this State to determine whether or not they meet the claims of the manufacturer. These tests are made both in the laboratory to determine the actual number of bacteria present in the culture and in the greenhouse to ascertain if the culture will inoculate the legume for which it is recommended. It is expected that these tests, with other information on the cultures that the examination will reveal, will prove helpful to the farmers of the State in safeguarding them against unsatisfactory or worthless cultures.

Bacteriological analyses of miscellaneous samples.—Many requests come to the bacteriological laboratory for the sanitary analyses of samples of water. Local samples are referred to laboratories in the immediate vicinity that are maintained for this type of work. Samples from a distance are referred to laboratories located near the person making the request as it is necessary to have these samples analyzed promptly after they are secured. Much help has been given to individuals submitting requests regarding bacteriological counts from milk, altho it is rarely possible to send milk samples to the laboratory from a distance and have them arrive in satisfactory condition for examination. Various food spoilage problems are under investigation in the laboratory and information regarding such problems is always gladly given. Samples that involve adulterations, misbranding, and the like and all examinations for disease-causing bacteria are referred to the State laboratories maintained for the purpose of examining samples of these types.



1, Section of Seed Laboratory; 2, Bean Anthracnose; 3, Studying the Breathing of Leaves; 4, Leafroll in Potatoes; 5 and 6, Untreated and Treated Tomato Seed; 7, New Strains of Beans; 8, Hardshell in Beans; 9, Apple Scab; 10, Pea Root-Rot Control.

BOTANY

THE work of the Division of Botany may be divided into two major enterprises—one, researches into the cause and control of diseases of fruits and vegetables; and two, the various services of the Seed Testing Laboratory. In addition, the Station botanists are often called upon to identify plants and for suggestions on controlling weeds, poisonous plants, etc.

Apple scab.—Without doubt the greatest menace to the New York apple and pear grower is scab. The prevalence of this disease is influenced so much by seasonal conditions that the prudent fruit grower takes no chances but follows closely the recommendations of the Station specialists in making protective spray applications. Considerable work is being done in various parts of the State on perfecting spray treatments for scab and in trying out new fungicides as they come on the market.

Raspberry diseases.—Raspberry growing, both in western New York and in the Hudson Valley, was at one time a major industry, but a few years ago inroads of a baffling disease or group of diseases, known as virus diseases, practically destroyed commercial raspberry production in this State. Since then, extensive studies at the Station and in various other sections of the State have demonstrated the possibilities of circumventing these maladies by rigid selection of disease-free planting stock and careful isolation of plantings. Something has also been accomplished in developing resistant varieties. The industry is now reviving in all parts of the State and gives promise of once more assuming something of its former importance.

Pea root rot.—Probably the limiting factor in growing peas for canning in New York is a disease condition commonly known as root-rot. Since the return from canning peas is relatively low, special efforts are being made to develop cheap methods of combating root-rot.

Tomato seedlings.—Millions of tomato plants are grown in greenhouses each spring in this State for transplanting later in the field. Occasionally, there are tremendous losses of these seedlings from a disease known as damping-off. Various seed and soil treatments are giving promising results in the control of this trouble.

Other vegetable diseases.—The diseases of several other vegetables, including cabbage, cauliflower, brussel sprouts, cucumbers, lima beans, etc., have been studied, especially on Long Island, and effective control measures worked out. Also, in connection with those diseases of vegetable crops which are carried by the seed or which live over in the soil, studies have been made of different methods of chemical and other seed treatments.

Potato leafroll and mosaic.—Studies of virus diseases of potatoes have been under way at the Station for many years and have led to extensive experiments at Geneva and elsewhere in the State on methods of combating these elusive maladies. Isolation of the seed plat and roguing infected plants have given some measure of control, while studies are under way on factors causing the spread of the diseases.

Potato blight.—Many years ago the Station demonstrated that potato blight could be profitably controlled by spraying year after year, regardless of the prevalence of the disease—a discovery that marked a new era in potato growing in New York because of the severe losses generally sustained from blight. This and other experiments with potatoes have made the Station a much-sought-after source of information on potato growing.

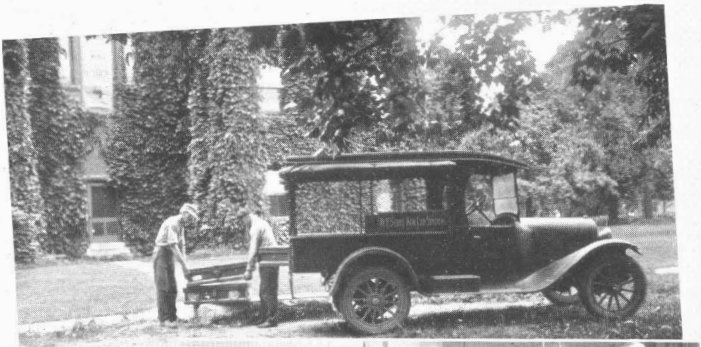
Beans.—A common trouble with shell beans and peas, aptly described by the term "hardshell", has received much attention for the past several years. It is not a disease but a physiological condition that renders the seed coat impermeable to water. This makes the beans or peas slow in germinating, and of even more importance, reduces very materially the quality of the cooked product. An effort is being made to develop new varieties of kidney beans for the canning trade that possess a high degree of freedom from hardshell. Much work is also being done on the control of hardshell by proper storage of the seed.

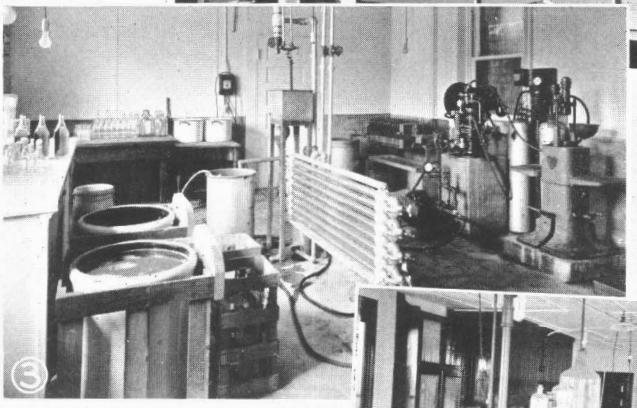
Aster diseases.—The production of aster seed was at one time a thriving business in this State; but with the rising cost of labor and cheap sources of seed abroad, it has gradually disppeared. One consequence of this is that many of the seed-borne diseases are being brought into the State on imported seed. To meet this situation, an effective method of treating aster seed to destroy disease organisms has been devised. In the course of this work better methods of storing aster seed have also been developed which have materially improved the viability of the stored seed.

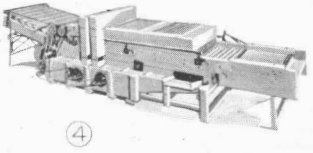
Mushrooms.—Certain problems encountered in the propagation of mushrooms have been under study at the Station in years past, particularly with regard to the preparation of the compost for mushroom beds. Considerable information is also to be had on wild mushrooms to be found in the State and their use for food. The Station botanist is ready at all times to identify mushrooms and toadstools sent to him.

Seed testing.—Each year thousands of samples of field crop seeds, vegetable seeds, and lawn grass mixtures are tested for purity, germination, and planting value. While some of this work is done as part of the official inspection of seed stocks carried on by the State, many tests are

made for farmers of seed stocks grown on their own farms and to be used for planting purposes. Weight for weight, seeds are the most expensive and at the same time the most uncertain commodity that the farmer has to deal with. It is important to know the quality and planting value of seeds *before buying* and most especially *before sowing*. The tests made in the Station Seed Laboratory aid tremendously in arriving at a fairly accurate estimate of this value. The Seed Laboratory is operated as a service and protection to the seed buyer, whether he consciously utilizes its facilities by having seeds tested or unconsciously benefits from its protection by buying only tested and fully labeled seeds. It is providing a type of service of inestimable value to all residents of the State who have occasion to buy or sell seeds.







1, Unloading Fertilizer Samples; 2, Section of Inspection Laboratory; 3, Fruit Juice Laboratory; 4, Fruit Washer; 5, One of the Research Laboratories.

CHEMISTRY

THE work of the Station chemists covers a wide range of agricultural interests. They are studying the chemistry of milk, the utilization of fruit and vegetable products, the factors that affect the quality of canned vegetables, the chemical behavior of insecticides and fungicides, the clarification and carbonation of fruit juices, and many other things as well. In addition, several chemists devote their entire time to analyzing the samples of fertilizers, feeding stuffs, insecticides, and fungicides offered for sale in this State.

Casein studies.—For many years the Station chemists have been studying the composition and properties of this important constituent of milk. Recently, they have found that casein is, in fact, a mixture of three different proteins and not one single substance as was formerly supposed. This discovery has made possible a much more thoro analysis of each of these proteins and the determination of their properties. These studies have many practical applications in the dairy industry and elsewhere.

Behavior of spray materials.—Heretofore, experiment station workers and fruit growers alike have been more concerned with the control of insect pests and diseases of the orchard than with the chemical reactions that go on in the spray material on the tree. More attention is now being given to the effect of temperature and humidity on the spray materials and their influence on foliage injury. Much helpful information is being obtained from experiments now in progress in a cooperative project between the chemists and entomologists.

Spray and other deposits on fruit.—Demands from the public for higher standards in all commodities and discrimination abroad against fruit showing an undue amount of spray residue or other deposits have caused New York fruit growers to give serious consideration to the washing and polishing of apples and pears, especially where they are to go into the export trade. Spray residues on cherries for canning also present a problem in some seasons. The Station chemists have been studying the merits of various methods of removing deposits of all kinds from fruit.

Fruit juices.—A demand for new commercial outlets for the surplus supply of certain fruits has been responsible for the investigations on fruit juices recently started at the Station. Along this line, the Station chemists have experimented with various ways of clarifying fruit juices, particularly apple juice and grape juice, with a view of making them more attractive and saleable to the public. Exceedingly attractive products have been obtained, and now attention is being given to the carbonation of clarified fruit juices in an attempt to develop year-around natural fruit beverages

that will compare favorably with ginger-ale, coca-cola, and other popular soda fountain drinks.

Quality in vegetables.—Canned vegetables, particularly peas, pumpkin, and squash, have been under investigation in the chemical laboratory in order to determine to what extent fertilizer treatments, cultural operations, time of harvesting, or variety of vegetable affected the quality of the canned product. The effect on peas of a diseased condition, such as root-rot, has been studied. An effort also has been made to study the chemical changes occurring in peas during processing at the cannery.

Fertilizer inspection.—Early in its history the Station was charged with the duty of making chemical analyses of samples of the different brands of fertilizers placed on sale in the State. Manufacturers are required to state certain facts about the chemical composition of their products, and it was the duty of the Station chemists to verify these claims by chemical analysis. Failure to live up to his claims brings the manufacturer into conflict with the State Department of Agriculture and Markets which administers the various agricultural laws in New York. Each year 750 to 800 samples of fertilizers are sent in by State inspectors for analysis. On the whole, the commercial fertilizers offered for sale in this State are high grade and come up to the representations made for them by the manufacturer.

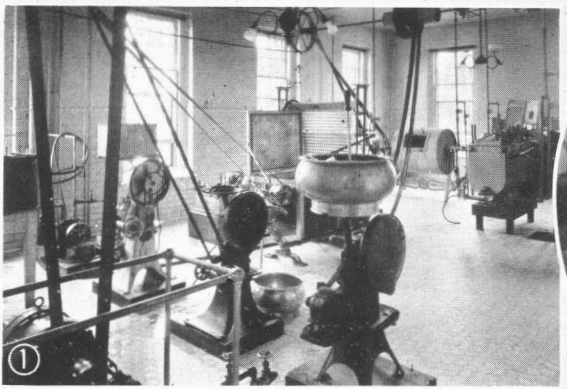
Feeding stuffs inspection.—In a similar way, the chemists examine samples of concentrated feeding stuffs found on New York markets. The last year for which figures are available more than 2,100 samples of feeds were analyzed. In general, the quality of the feeding stuffs sold in New York compares favorably with that of materials sold in other states. About 5 per cent of the samples examined are materially deficient in protein and fat, and about 5 per cent of them are misbranded or unlicensed.

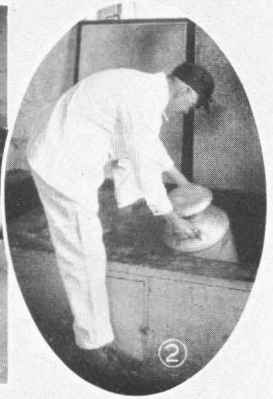
Insecticide and fungicide inspection.—From 150 to 200 samples of insecticides and fungicides are analyzed each year, some of these materials requiring several chemical determinations to arrive at an estimate of their composition. Of the samples in which the analyses have been completed for the current year, 7 per cent have been found to be deficient in active ingredients or improperly labelled as to content. Upon completion of the chemical analyses, the results are published by the State Department of Agriculture and Markets.

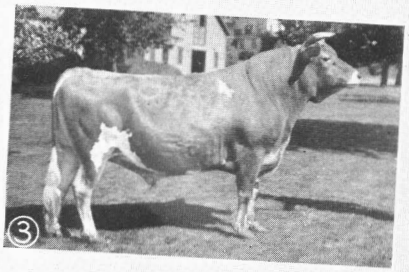
Gelatin.—As a sequel to the work done several years ago by Station chemists on the use of gelatin in ice cream, additional fundamental studies have since been made on gelatin, particularly as to the effects of various salts on certain properties. These studies have led to a better and more complete understanding of the chemistry and behavior of protein substances.

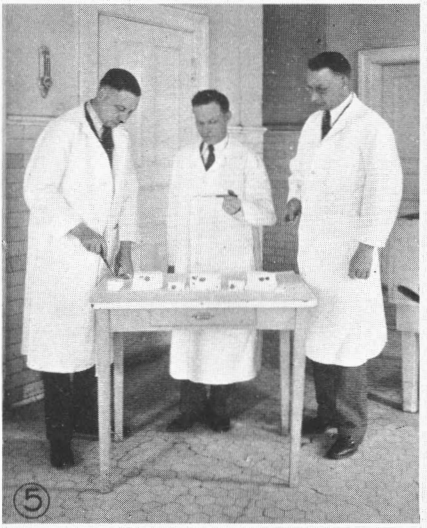
Color development of apples.—During recent years experiments have been carried on to determine the color of light which is responsible for color development in the McIntosh apple. This work shows that light between the visible blue range and the ultra violet is most influential in affecting color formation. The use of artificial light, however, offers only limited possibilities for coloring apples commercially on account of the cost.

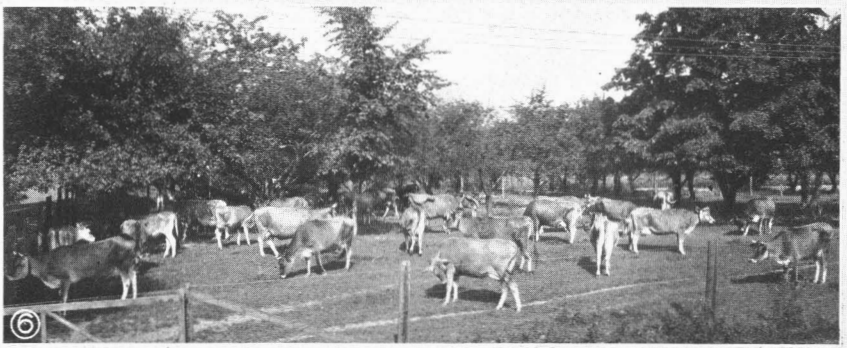
Private testing limited.—As with other divisions of the Station, it is natural that many persons should look to the chemical laboratory for the testing and analysis of various things in which they are interested. However, if all such materials submitted to them were analyzed by the Station chemists, there would be little time or money left for the authorized work of the Chemistry Division. In most cases, therefore, the suggestion is made that the material be taken to a commercial laboratory, unless there is some other State agency that is specifically delegated to analyze the particular material in question. This is especially true of drinking water, foods and drugs, for the analysis of which the Department of Health maintains several laboratories scattered about the State.











1, Section of Dairy Laboratory; 2, Milk Cooler; 3, The Head of the Herd; 4, A Silver Medal Cow; 5, Testing Experimental Ice Cream; 6, The Station herd.

DAIRY

NEW YORK State has a population of over 11,000,000 persons, with more than 9,000,000 living in cities and large towns. This enormous market creates a tremendous demand for all kinds of dairy products, especially for fluid milk and ice cream. It is not to be wondered at, therefore, that New York has long been a leading dairy state and that the Experiment Station has almost from the first found an exceedingly fertile field of research in dairy herd management, sanitary milk production, milk plant operations, and dairy manufactures.

Dairy herd management.—Since 1900, the Station has maintained a herd of purebred Jerseys to furnish milk for the numerous researches by the dairy specialists, the bacteriologists, and the chemists, and also to serve for certain studies on dairy herd management. By careful selection, breeding, and feeding, the herd has been brought up to the remarkable level of 400 pounds of fat per cow per year for all cows in the barn irrespective of the lactation period. Furthermore, the herd has been developed from two heifers purchased in 1900 to its present size (26 milking cows and 2 bulls) at a cost within the reach of any progressive dairyman.

Other herd problems.—Many other interesting problems are under study in the Station dairy barn besides the improvement of the production record by breeding. For example, attention is being given to means of keeping the herd free from tuberculosis, from contagious abortion, and from mastitis by practical methods. Comparisons are being made of two and three milkings and of two and three feedings per day. For many years, hand versus machine milking has been under observation. The entire herd is also entered in the Herd Improvement Registry Test conducted by the American Jersey Cattle Club. Last year's record was 7,643 pounds of milk, testing 5.58 per cent and containing 427 pounds of fat.

Creaming studies.—How the cream layer forms in the milk bottle and the effect of various methods of handling milk, including pasteurization, on its creaming ability are topics of interest to the dairy farmer, the milk distributor, and the consumer alike that have received considerable attention in the Station dairy laboratory. The comparative creaming ability of Holstein and Jersey milk has also been studied. Many practical applications have come out of the creaming studies, particularly as to more efficient operation of the milk plant, and still other applications are under investigation.

Ice cream.—Improvements in the commercial production of ice cream and economies in the preparation of ice cream mixes have been made

possible by researches on a number of factory problems. Several lines of work are under way at present which, if successfully concluded, will still further aid an industry which consumes vast quantities of milk and cream from New York dairy farms.

Uses of dry milk.—Few realize the large amount of skimmilk that is going into skimmilk powder and the place that this by-product of the dairy industry occupies in dairy manufactures. It is estimated that in 1930, over 30 million 10-gallon cans of skimmilk were made into skimmilk powder in this country. These powders differ widely in their physical properties, due largely to methods of manufacture, and the Station dairy specialists have been studying the effect of these differences when the powders are used in ice cream and in cream cheese. These studies are opening up new uses for dry skimmilk, thus expanding the market for this product.

Cream cheese formula.—Development of a new formula for the making of cream cheese of the Neuchatel type which not only makes possible a cheese infinitely superior to the old product in texture, quality, and flavor, but which also reduces the length of time of manufacture from a matter of days to a a period of a few hours and removes much uncertainty as to the quality of the cheese from each batch of milk, has been protected by a public patent for the use of any one interested in this type of cheese. This is yet another instance whereby researches in the Station dairy laboratory aid the dairy farmer by creating a better end-product for the consumer, thus stimulating demand.

Cooling milk on the farm.—A highly practical study from the point of view of the dairy farmer has to do with a comparison of ice and electric refrigeration for the cooling of milk in insulated tanks on the farm. This study has also shed light on the cooling of milk in general, showing for one thing that milk will cool in the can without stirring if the cooling tank is properly refrigerated, is of adequate size, and is well constructed.

Milk strainers.—Rather exhaustive tests have been made to discover the best type of strainer for use on the dairy farm. This has included a comparison of strainer cloths and cotton pads, as well as variously designed strainers. The Station receives a large number and variety of strainers for test and for suggestions on improvement in design.

Milk fat tests.—Variations in milk fat tests are a constant source of annoyance, both to the dairy farmer and to the milk plant operator. Much work has been done in the dairy laboratory at the Station to show that the Babcock test for fat in milk and cream cannot be blamed for these differences, nor can the method of sampling at the milk plant in most cases.

Normal factors affect the fat content of milk to a much greater degree than do differences in methods of handling or in the testing.

Babcock and bacteriological glassware.—One important reason why the Babcock test for milk fat is as accurate as it is lies in the supervision that is given the glassware used in making the test. Every piece of Babcock glassware used in New York State must first be tested for accuracy in the Station dairy laboratory. All inaccurate pieces are destroyed. During the fiscal year of 1930–31, a total of 36,057 pieces of Babcock glassware was examined and only 264 inaccurate pieces discovered. A similar test is made of the pipettes used in bacteriological examinations of milk, and out of a total of 23,059 pipettes examined during the year only 16 were rejected.

Cream viscosity.—When pasteurization was introduced to protect public health, the dairy industry immediately recognized that the process produced cream of very low viscosity which appeared to lack richness. Repeated attempts have been made to correct this difficulty. The Station dairy laboratory has developed a heat treatment of cream applicable to plant practice by which it is possible to increase materially the apparent thickness of cream without affecting its other properties. It is probable that the procedure or some modification will be of practical value in meeting the problem of cream viscosity.

Special services.—Altho the Station Dairy Division is organized specifically for research, there is a constant demand for services along allied lines. The proper sampling and testing of milk samples, checking up on the value of new ice cream stabilizers, trying out and advising on design of new milk strainers, cooperating in tests on special machinery, testing vanilla in ice cream, advice on feeding practices, etc., are some of the numerous services rendered by the Division to the dairy industry.

1, Bordeaux-oil Spraying for Onion Maggot; 2, A Vineyard Sprayer; 3, Experimental Spraying for Apple Red Bug; 4, Naphthalene Dusting for Carrot Rust Fly; 5, Spraying a Cherry Orchard; 6 and 7, Cabbage Maggot Control with Corrosive Sublimate.

THE growing of fruits and vegetables is becoming increasingly specialized with constantly advancing standards and with modern methods of transportation which bring all sections of the country into close competition for a discriminating market. The work of the Division of Entomology reflects this trend in the type of problems with which it deals and in the unremitting search for cheaper and more efficient sprays and dusts with which to combat insect pests. These problems may be grouped roughly under three general headings, namely, orchard insects, pests of vegetable crops, and insects attacking nursery and ornamental plants.

Apple insects.—The spraying of apple orchards in this State is fairly well standardized, thanks to the experiments and observations on the major insect pests of the apple carried on for years by the Station entomologists. Occasionally, however, a new pest will appear in the State, as for example the cranberry root-worm which was recently found working on apples in western New York. But more often, an old and well-known pest will suddenly assume major importance and necessitate a modification of the spray schedule to combat it effectively. The bud-moth, leafroller, and apple maggot are recent examples of this. Then, too, new insecticides must be tried out for the control of such persistent enemies of the fruit grower as the codling moth, the San Jose scale, and the rosy aphis.

Pear insects.—The chief work with pears at present has to do with the development of efficient methods of combating the pear psylla, the pear midge, and the quince curculio which, fortunately, is rather erratic in its attack on pears. Here again, the Station entomologists are seeking to discover new materials that will give greater protection at less cost than those now in use and to perfect the timing and technic of pear spraying and dusting so that the maximum of protection may be realized against these destructive enemies of the pear orchard.

The oriental peach moth.—Peach growers find adequate protection against the usual insect pests of the peach in the standard spray schedule used generally thruout the State, except for the oriental peach moth, a pest that has but recently invaded New York peach orchards. Due to peculiarities in the feeding habits and life history of this insect, it cannot be reached with sprays or dusts. The chief hope of the peach grower lies in the introduction of parasites, and the Station workers are carrying on an intensive campaign of rearing and liberating tremendous numbers of parasites in the peach-growing sections of the State. Encouraging results are being obtained.

Special studies in eastern New York.—The extensive fruit plantings of the Hudson Valley and the Lake Champlain district offer many problems

in insect pest control peculiar to those regions. The Station has found it necessary, therefore, to conduct rather widespread orchard experiments in these sections in order to deal intelligently with the difficulties encountered by fruit growers in eastern New York.

Trapping orchard insects with light.—The use of electric lights in apple orchards to trap moths of the budmoth, the leafroller, and the codling moth is receiving a thoro trial in commercial orchards. Many interesting things are being learned about the habits of these insects and their reactions to light, altho light traps cannot yet be said to have demonstrated their usefulness as a practical means of pest control.

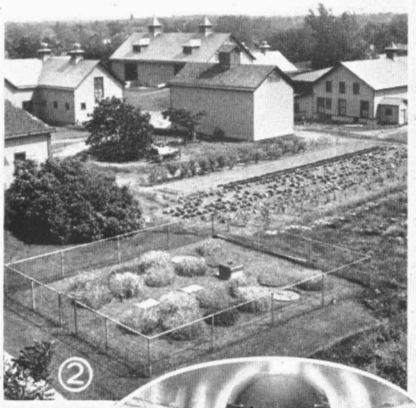
Insect pests of ornamentals.—The nursery industry has long felt the need for reliable information on the identity, habits, and control of destructive insects that attack evergreens and ornamental plants, such as is available for fruits and vegetables. In order to meet this need, the Station has assembled an impressive planting of evergreens and other ornamentals on its own grounds where major pests of these plants can be studied, while other experiments and observations are also being carried on in commercial nurseries.

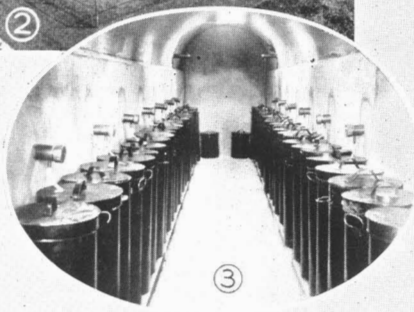
Canning crop pests.—The production and quality of fruit and vegetables grown for the canning factory may be materially affected by various insect pests. Among the more important of these receiving special attention at this time are the carrot rust fly, the cabbage maggot, the seed corn maggot, the cherry fruit fly, and the raspberry fruit worm. Each of these presents some perplexing problem to the entomologist, such as finding an insecticide with killing properties for the particular pest concerned, keeping the cost of control within practical limits, avoiding the use of materials that might prove deleterious to the canned product, and the like.

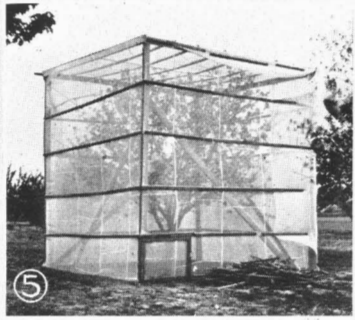
The corn borer.—Since most of the field corn grown in New York goes into the silo, the general farmer has not found the European corn borer the serious pest that it has proved to be in other parts of the country. Sweet corn growers, however, especially in western New York, have sustained serious losses from this insect in some instances. This is true both where the crop has been grown for the green corn market and for the canning factory. The Station experiments deal chiefly with control of the pest by clean-up measures, variety resistance, and delayed planting. Community effort and constant attention to good farm practises that have given a large degree of control of the borer are especially recommended.

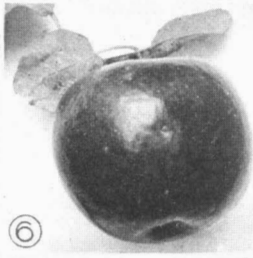
Vegetable pests on Long Island.—The highly developed truck crop interests on Long Island have made necessary special attention to the

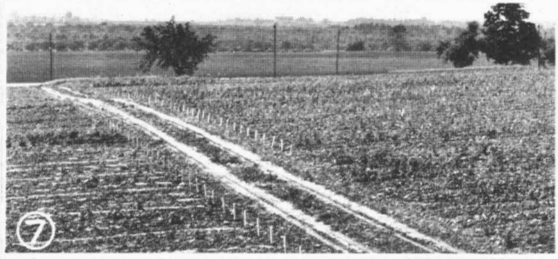
important insect pests attacking vegetables in that region. Efforts are being directed to the control of insects on potatoes, cauliflower, cucumbers, and beans. In connection with the last-named crop, mention should be made especially of the Mexican bean beetle. This is a striking example of invasion of new territory by an insect wholly unknown to the section a few years ago. With the Mexican bean beetle definitely established both in western New York and on Long Island, the bean growers of the State are confronted with a radical change in the production of beans, for it is apparent that the crop cannot be grown without protective sprays once the bean beetle gains in numbers as now seems inevitable.











1, Harvesting Grapes at Vineyard Laboratory; 2, Lysimeters; 3, Tunnel under Lysimeters; 4, Bagged Blossoms in Breeding New Varieties; 5, Tent for Pollination Studies; 6, Cortland Apple; 7, Nursery Stock Experiments.

NEW YORK is one of the three leading states in the Union in the area devoted to fruit growing and in the yield of fruit. In 1930, over 9,000,000 quarts of strawberries were harvested; more than 27,000,000 bushels of apples; better than 25,000 tons of cherries; over 76,000 tons of grapes; over 2,000,000 bushels of peaches; and something over 3,000,000 bushels of pears. The Experiment Station has played a prominent part in the development of the fruit industry in the State.

Testing fruit varieties.—At one time or another there have been under test in the Station orchards all of the named varieties of apples, pears, peaches, cherries, and plums that could be obtained. In a similar way, tests have been made of the named varieties of grapes and of the small fruits. The information obtained in this way has served as the basis for a series of exhaustive monographs on the hardy fruits that are accepted universally as standard treatises on the subject. A comparison and study of the characteristics of these fruits has also served to aid the Station fruit specialists in the breeding of new varieties, discussed in more detail below. Hundreds of varieties of all of the hardy fruits are under test at the present time, and new varieties are being added to the collection from all parts of the world. It is not expected that many of these new sorts will be suited to New York conditions, altho sometimes they are, but occasionally they display qualities that make them valuable as parent stocks in the breeding of new varieties.

Fruit breeding.—Working on the assumption that only by the introduction of superior varieties can any permanent progress be made in fruit growing, the Station pomologists have for years given their chief attention to the breeding of new fruits. That this is a painstaking and time-consuming job is apparent when one considers that it requires 30 years or more to establish a new variety of apple and from 10 to 12 years to prove the worth of a new kind of strawberry or raspberry or other small fruit. It is not surprising, therefore, that the offerings of the Station in the way of proved new varieties is no larger than it is. During the past 25 years more than 80,000 seedlings have been grown on the Station grounds from crosses between various fruits. Of this number a little better than half have fruited, and out of this 40,000 or more less than 100 seedlings have been given names and sent out as new varieties deserving further testing by fruit growers. Some of the outstanding new varieties are Cortland, Macoun, Milton, and Early McIntosh among the apples; Cayuga, Gorham, Phelps, and Pulteney for the pears; the Seneca sweet cherry; Hall and Stanley for the plums; Portland, Ontario, Sheridan, Fredonia, and Golden

Muscat for the grapes; the Fredonia gooseberry; June and Newburgh raspberries; and Clermont, Culver, Camden, and Cato among the strawberries.

The Fruit Testing Association.—The first question that naturally occurs to the fruit grower, either amateur or professional, is "Where can I obtain stocks of these new varieties?" To meet this demand there was created a few years ago a corporation known as the New York Fruit Testing Cooperative Association. The Manager of this Association makes his headquarters at the Station, and the chief purpose of the organization is to propagate the new fruits developed by the Station fruit breeders and distribute the stocks to the members of the Association and others at about cost of production. Membership in the Association is open to anyone interested in new and better fruit varieties upon the payment of a nominal fee.

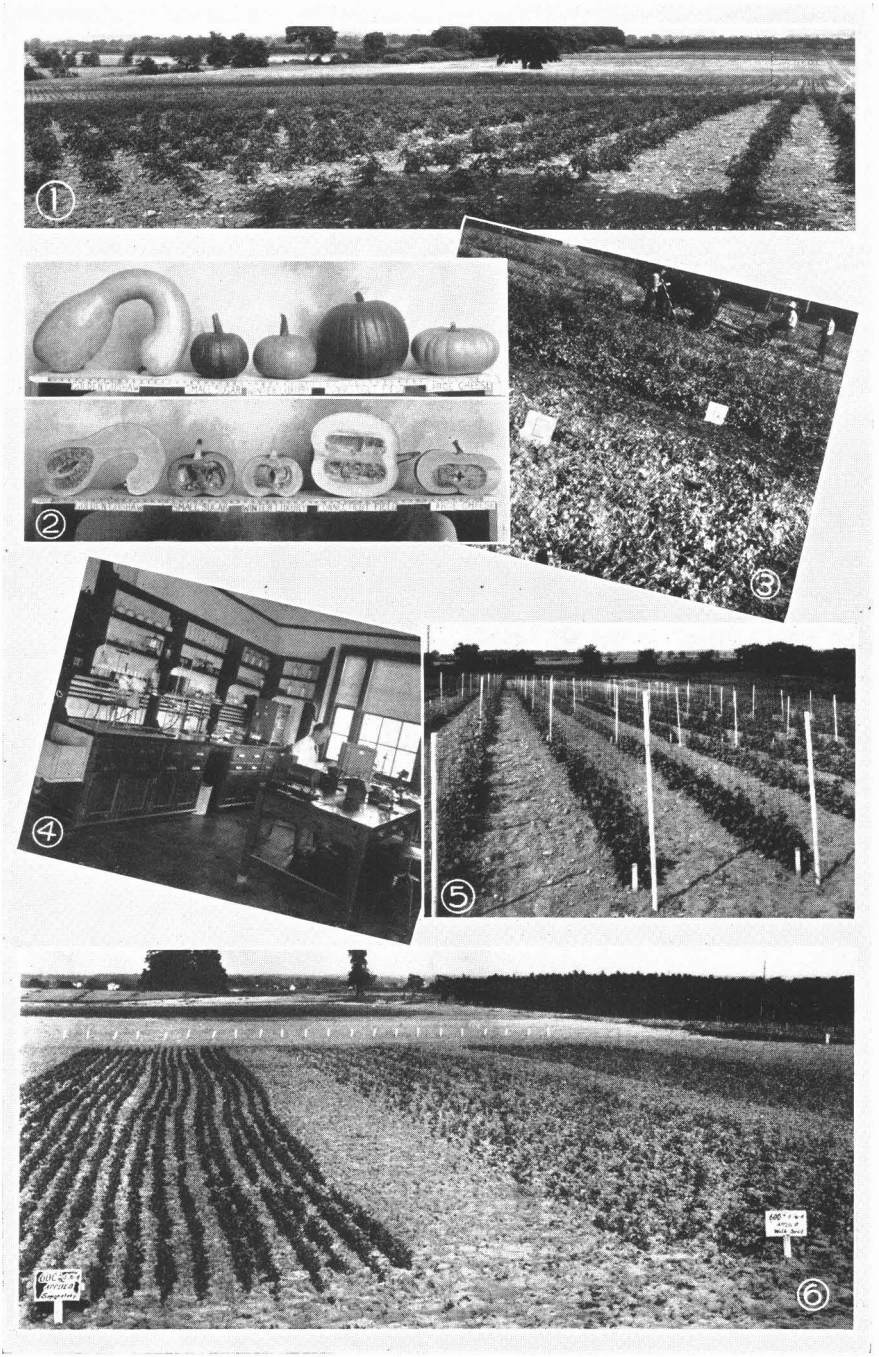
Pollination experiments.—The importance of pollination in the production of fruit has come to be much better understood within recent years, and the Station is carrying on intensive studies on some of the more profound aspects of the pollination problem. Much information has been obtained on the compatability of the different varieties of the several hardy fruits so that fruit growers can now be advised as to the best combination of varieties to set in the fruit planting to insure an adequate supply of suitable pollen.

Identification service.—The rapid growth of the Station herbarium and greatly improved laboratory facilities now make it possible for the Station to aid nurserymen and growers in the identification of trees, shrubs, and fruits. The botanical relationships of the fruits and vegetables are also being studied in the botanical laboratory of the Pomology Division.

Orchard soil studies.—The management of orchard soils presents a complicated problem to the New York fruit grower, for the economics of fruit growing of necessity play an important part in planning the procedure to be followed with respect to the cultural treatment of the orchard. For example, at present there is a pronounced trend from clean cultivation to sod which in turn raises the question as to what fertilizers will best maintain production in sod orchards. It is evident in many parts of the State, too, that even clean-cultivated orchards may need some fertilizer treatment where cover crops are not being turned under regularly to maintain a humus supply. Soil specialists, therefore, are carrying on a wide range of experiments in orchards, in the greenhouse, and in lysimeters to study the fertilizer needs of orchards, together with the nutrition of the fruit tree.

Nursery stocks.—A federal embargo on the importation of nursery stocks from abroad necessitated radical changes in the nursery industry in New York State, which had looked to Europe for its seedling stocks. To meet this situation, the Station began a series of investigations on the propagation of nursery stocks which have now developed into a comprehensive program covering many phases of the nursery industry. While a great deal of this work is of interest chiefly to the professional nurseryman, much is being learned about the handling of fruit and ornamental stocks of a highly practical character that will eventually aid the fruit grower as well as the home gardener.

Outlying laboratories.—Two highly specialized fruit regions in the State have presented so many problems peculiar to themselves that for several years the Station has maintained special laboratories with horticulturists assigned to the study of local problems. One of these is the Vineyard Laboratory at Fredonia in Chautauqua County, where many phases of grape growing are receiving attention. Work with other fruits, particularly some of the small fruits, is also being carried on at Fredonia. Then in the Hudson Valley, with headquarters at Hudson, the Station is conducting what is known as the Hudson Valley Fruit Investigations. These include variety, cultural, and fertilizer experiments with fruits at various points in the Hudson Valley.



1, View of Canning Crops Farm; 2, Squash and Pumpkin Varieties; 3, Harvesting Pea Plats; 4, Research Laboratory; 5, Pole Beans Under Test; 6, Right and Wrong Way to Fertilize Peas.

EXAMINATION of the early reports issued by the first Director of the Station, Dr. E. Lewis Sturtevant, reveal a wide interest in vegetable crops. In fact, Dr. Sturtevant's work with sweet corn varieties, at this Station and elsewhere, was long the most authoritative treatise on the subject. For a period after Dr. Sturtevant's retirement, comparatively little was done with vegetables at this Station until the beginning of the last decade. In the meantime a profound change had been taking place in the agriculture of the State, one of the manifestations of which was an increasing interest in the production of vegetable crops. Since 1922, therefore, the Station has expanded its work with vegetables until it now operates a farm of 60 acres devoted exclusively to the study of various problems bearing on the growing of canning crops, and in addition utilizes extensive acreages in the testing of varieties of vegetable crops.

Rotation and fertilizer experiments.—A large part of the canning crops farm is given over to fertilizer and rotation tests with the leading canning crops including tomatoes, stringless beans, beets, peas, sweet corn, and cabbage, with 14 different kinds and amounts of fertilizers replicated three times. These tests are now in their seventh year.

There are two series of rotations in this experiment which clearly illustrate the value of crop rotation in a permanent system of canning crops production. A 4-year rotation of sweet corn, cabbage, peas with red clover seeded in the peas, and clover hay the fourth year has produced satisfactory crops each year, but peas grown continuously on the same land were a failure after the second year. Another 4-year rotation of tomatoes, stringless beans, beets, and peas with sweet clover seeded in the peas has also proved satisfactory for all crops. Tomatoes grown continuously on the same land produced as well as those grown in rotation for 3 years after which the yield rapidly declined until after 6 years of continuous cropping the yield was only about one-fourth as great as the yield of tomatoes fertilized the same way but grown in rotation. The plan of the experiment has been changed to include cover crops and manure to determine their effect in restoring the crop-producing capacity of the soil which was lost through lack of rotation. Visitors find many valuable object lessons in these experiments, which also supply data upon which the Station specialists base recommendations on cropping and fertilizer practises with canning crops.

The fertilizer experiments show what proportion of the different fertilizer ingredients gives the best result with each crop and what amount of fertilizer per acre will give the most economical increase in yield. It is interesting to note that with cabbage and tomatoes heavy fertilization pays, but with

peas, sweet corn, and stringless beans, the net returns are greater when small quantities of fertilizer are used.

Fertilizer placement.—Equally as important as using the right kind and amount of fertilizers is the placing of the material at a point in the soil in relation to the roots of the plant to make possible the quickest and most economical use of the plant food supplied. Especially is this true with respect to the new highly concentrated fertilizers now being used extensively on vegetable crops. Tests on the canning crops farm are planned to show the best method of applying fertilizers to corn, beans, and peas.

Experiments with tomatoes.—Several experiments are under way with tomatoes in addition to the part this crop plays in the general fertilizer and rotation experiments mentioned above. Side-dressing tomatoes with nitrogenous fertilizers, selecting and breeding experiments, improved methods of growing tomato plants in the greenhouse and cold frame, and the possibilities of getting the plants off to an early start by fertilizing in the seedling flats are some of the special problems under study.

Strain tests of corn for canning.—Remarkable increases in yield have been obtained by growers and plant breeders from the use of what are called hybrid inbred strains of sweet corn. One of the special investigations with corn for the canning factory is a comparison of commercial strains of both yellow and white corn with hybrid inbred strains of the same varieties. Altho the cost of the seed of these special strains is high as compared with seed of a good commercial strain, the net gain to the grower in the increased yield from the hybrid strain will more than justify the extra cost.

Whole kernel sweet corn.—Consumers of canned corn have become familiar during the past few years with a new type of pack known as the whole kernel style in contrast to the so-called cream style of pack. Large-scale tests are under way to compare the two methods of canning corn from the standpoint of returns to the farmer and canner.

Early planted peas.—Peas are one of the most important canning crops in this State. Among the numerous tests under way with peas the one dealing with date of planting is perhaps the most striking as showing certain mistaken ideas in the handling of this crop. Each season four varieties, three of them sweet wrinkled sorts, are planted as early in the spring as the ground can be worked, usually before April 10. Plantings are then made each week for eight successive weeks. Despite the fact that the earliest plantings are sometimes frozen in the ground, they have never failed to give the highest yields. By this method all varieties are planted

early and the desired "spread" at harvest time insured by the natural differences in the ripening intervals of early and late varieties.

Other pea experiments.—New pea varieties and selections from crosses made at the Station are being tried out both for yield and for canning quality. About 20 varieties are compared each year. The results of these tests are watched with great interest by farmers, canners, and seedsmen, because these tests show which of the new varieties will produce better yields for the growers and higher quality for the canners. The control of pea root-rot by means of fertilizer applications and by the use of gypsum is receiving attention. Also, the effect of fertilizers on the quality of canned peas has been investigated jointly with the chemists in an effort to determine if fertilizer treatment has any direct bearing on the percentage of tough peas.

Canning quality and yields of pumpkin and squash.—Field and canning tests of many varieties of pumpkin and squash, aided by chemical analyses made by the Division of Chemistry, are showing what varieties will yield the most and produce a canned product of superior consistency. The results of these studies have demonstrated to growers and canners of this State how to produce a superior product and thus regain a market that had been seriously threatened by competition from the Pacific Northwest.

Preserving vegetables by quick freezing.—Frozen meats, fruits, and vegetables have made their appearance on the market recently, and vegetable growers are particularly interested to know the market possibilities of the quick-freezing process as an outlet for vegetable crops. Thru a cooperative arrangement with a commercial concern, a large number of varieties of peas, beans, rhubarb, asparagus, tomatoes, and sweet corn are being preserved by the quick-freezing process to determine which sorts are most suitable for handling in this way. This may prove to be a very valuable method of expanding the markets for New York State vegetables.

Vegetable variety studies.—Quite apart from the work with vegetables for canning is a large-scale project for testing and describing all of the varieties of the different vegetables obtainable. Thus far, exhaustive tests have been made of the peas and the beans, and monographs on these two vegetables have been published. Work is under way at present on growing and describing sweet corn, cucumbers, muskmelons, pumpkins, and squash.