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PROGRESS OF AGRICULTURAL EXPERIMENTS—1924

A Report of the Director of the New Hampshire Agricultural Experiment Station for the Year 1924, including a Financial Statement for the Fiscal Year Ending June 30, 1924

THE UNIVERSITY OF NEW HAMPSHIRE
DURHAM, N. H.

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A Report of the Director of the New Hampshire Agricultural Experiment Station for the Year 1924, Including a Financial Statement for the Fiscal Year Ending June 30, 1924.

Development of a long-time program which should eventually build anew the agriculture of New Hampshire, repairing the inroads of the past half century, has been for several years the desire uppermost in the minds of those who have thought of the fundamental needs of the state. That such a program is already in process is evident. Extension agnecies, farm bureaus, experiment station, state department of agriculture, and various other associations are working together in the building of it; and during the last biennium the formation of a central state committee for the rehabilitation of New Hampshire has not only brought the problems into better focus but has better co-ordinated the working forces.

From whatever angle one looks into the question of improving the agriculture of the state, however, one soon finds certain unsolved fundamental problems. On these the need for careful scientific investigation is paramount. Unless such investigational work is done, there is opportunity for grave mistake in the building of our program. Principal among these problems are:

Determination of soil types throughout the state, and adaptation of crops to such soil types.

Ascertainment of local market needs and adjustment of community production to fit such needs.

Participation in the forest research program of the northeastern states.

New Hampshire has been presented by Nature with greatly varying soil types. It is not possible—as in many regions of the country—to map out definite areas in which uniformity prevails. From field to field—and often within the field—the character of the soil changes. Sand, loam, clay and rock with all the intermediate variations of these types run in irregular splotches with, of course, varying effects on different crops.

To recommend specific varieties or often even specific crops on these soil types—and particularly to lay down a program to solve the urgent problem of soil fertility—without more thorough investigation than has yet been possible is somewhat like prescribing medicine before the doctor is confident of the diagnosis. The best that we have been able to do has been to draw certain generalizations. The farmer must then make his own experiments to complete the solution of the problem. Granted that some degree of local experimentation and adaptation of generalized knowledge will probably always be necessary on the part of individual farm owners, the present system is still woefully inefficient. It is possible to learn many valuable points about our soil types which we do not yet know. Even though our soils vary so greatly, the different types recur. It should not be necessary for thousands of individual farmers to learn through a lifetime of personal experiences points which regional experimentation could determine. There is an unexplored midground between our present knowledge and the irreducible minimum of farm application.

It is our duty to explore this midground. In the absence of state funds for this necessary work, the best that has been possible in the past has been to do two things: (1) To conduct experimental tests of soils and crops in the vicinity of Durham. Many of these have been carried on in the past, and others are still under way; but the conclusions cannot be applied with sufficient certainty to a large fraction of the state. (2) To encourage representative farmers to carry on tests with some degree of supervision. This has been done in the past; but has been only of importance as showing general trends. It has proved impossible to conduct such tests with the necessary degree of accuracy and control of factors involved; and, in fact, experience has shown that it is unsafe to draw conclusions from any experimental work not under expert guidance.

The solution of our soils problem lies only in carefully plotted and supervised experiments in representative sections of the state. These investigations must be carried on eventually; no program can be complete without them, and their institution has been already too long delayed.

With regard to the marketing problem we are pleased to report that a start has been made during the year. In co-operation with the Bureau of Agricultural Economics of the United States Department of Agriculture a survey of production and consumption has been made in Cheshire County. This is one of the first studies of the kind that has been made in New England and the first to be made in New England in partnership with the Federal Government, and is proving a very effective demonstration of a type of work which must be carried on generally throughout this section. The discovery that one town alone is shipping in several thousand bushels of potatoes, while local farmers are shipping out potatoes or while large areas of adaptable land lie nearby awaiting the efficient producer, is a sample of what we may expect to find in such surveys. We must back up our desire to remedy the weaknesses of our present marketing system by investigational work; else here again we may make false steps.

Similar surveys to that already mentioned should at once be instituted in the other counties; and as soon as such surveys have been completed, determinations based upon them should be made as to what can be done to improve the situation.

With one-half the average New Hampshire farm in woodland, the need for more research work in forestry has long been obvious. The Federal Government, recognizing this need throughout New England, has during the past year established a Forestry Experiment Station for the Northeastern States at Amherst, Mass. A program of forest experimentation for these states has been mapped out by the Forestry Research Council, which serves as an advisory board to this Station. This program is an extensive one; and in order to make it successful the co-operation of the agricultural experiment stations of the individual states has been requested. New Hampshire cannot afford not to do its share in such an important matter, and provision should be made in the state budget to make this possible.

The importance with which research work in agriculture in this region is viewed by agencies outside the state has already been indicated in two instances, viz., the marketing survey instituted by the U. S. Department of Agriculture in Cheshire County and the organization of the Northeastern

Forest Experiment Station. In one other field during the past year similar interest has also been shown. The problem of the use of electricity as a farm power is being attacked in several sections of the country by the National Committee on the Relation of Electricity to Agriculture. With a view to instituting such a study in a typical New England area this committee has during the past year selected the New Hampshire Station as its co-operating partner. Plans for a research project in this line lasting over a three-year period have been outlined and agreed upon; and the work will start soon under funds subscribed by the committee.

Still another project in which outside aid has made possible a greater volume of research work at this Station is the series of nutrition studies, carried on in co-operation with the Nutrition Laboratory of the Carnegie Institution of Washington. This work has been outlined in previous reports.

During the past year the Station has lost through resignation its chemist, Dr. H. R. Kraybill, who leaves New Hampshire with a considerable volume of research work accomplished to take up new duties at the Boyce Thompson Institute. C. P. Spaeth, assistant chemist, and J. T. Sullivan, graduate assistant, also resigned during the year; and their places have been taken by S. R. Shimer and H. F. Schaeffer respectively.

The director of the Station was appointed to membership in the Forest Research Council of the Northeastern States at its institution to serve for a period of three years, and has thus had a voice in the formulation of the forest research program already mentioned. He has also been appointed to a committee of the New England Research Council on Marketing and Food Supply to draw up a New England research program in agricultural economics.

PUBLICATIONS AND PRESS SERVICE.

The following publications have been issued during the year:

Station Bulletin No. 209—Inspection of Commercial Feeding Stuffs for 1923.
" " " 210—Inspection of Commercial Fertilizers for 1923.
" " " 211—Results of Seed Tests for 1923.
" " " 212—Progress of Agricultural Experiments, 1923 (Report).
" Circular No. 23—A Simple Method for Determining the Keeping Quality of Milk.
Technical Bulletin No.26—The Effect of Varying Feed Levels on the Physiological Economy of Steers.
Technical Bulletin No. 27—Experiments on Resistance of Apple Roots to Low Temperatures.
Scientific Contribution No. 21—Toxicity Studies with Some Copper Fungicides.

The system of press dispatches covering results of work at the Station has also been maintained, thus keeping the public informed in a non-technical way of the important research accomplishments. Forty-nine articles were sent out in this service during the year, and were generally printed in the press of the state.

REPORT BY PROJECTS.

The report on the work for the past year will be considered by projects under the headings of the main types of funds: Adams, Hatch, State and Miscellaneous Income. Adams Fund projects are required by federal legislation to deal with the underlying causes of agricultural phenomena. The work under Hatch and State Funds is considered together, as much the same type of activity has been under way in each. Projects carried on under the Miscellaneous Fund are ones which through fees are either in whole or in part self-supporting.

ADAMS FUND.

European Corn Borer.

The study of the life history, habits and means of control of the European corn borer, which was begun in the spring of 1922 as a new Adams Fund project by W. C. O'Kane and P. R. Lowry (Entomology), was continued through the past year along the lines laid out at the beginning. Extensive records and notes were secured which add materially to the knowledge of this insect under New Hampshire conditions.

As in the first year, the details of the work were planned after consultation with the experts who are conducting a study of this insect at Arlington, Mass., on behalf of the Bureau of Entomology of the United States Department of Entomology. In Massachusetts the species has been under investigation for four years and a large amount of data has been accumulated. The purpose of the work in New Hampshire is to extend the inquiry to New Hampshire conditions.

The records for the present year again show the European corn borer to pass through two complete generations in New Hampshire. This has a significant bearing on possible control measures. The over-wintering larvae, which are identical with the larvae of the second generation of last year, began to enter the pupal stage this year on April 28, six days in advance of the corresponding date for last year. The last larva to enter the pupal stage this year made the transformation July 14. The first adult secured from this generation emerged June 11. The last adult emerged July 30. In 1923 the first adult emerged June 2. Thus, the corresponding generation of this year lagged behind that of last year by nine days. The relation of this to temperature and moisture is being studied. Full records are kept, both of air temperature and of that of the soil.

The length of life of the male moths derived from the over-wintering larvae ranged from 6 to 34 days, that of the female moths from 5 to 26 days. The length of the period from emergence of the female moth to first egg-laying varied from two to seven days. The period during which a female moth continued to lay eggs ranged from 2 to 24 days. The number of eggs laid by a single moth of this generation ranged from a minimum of 23 to a maximum of 1131. This maximum is considerably in excess of the corresponding record secured last year.

The progeny of the moths of this over-wintering generation constitute technically the first generation of the current year. The first eggs were laid by these moths June 19 and the last eggs August 14. The first date is 12 days

later than the corresponding date of last year. The length of the egg stage this year ranged from five to ten days. From these eggs the first larvae hatched June 27, which is eight days later than the corresponding date of the same generation of last year. The larval period this year ranged from 25 to 47 days. The last larva hatched this year August 24. It is noteworthy that all larvae that hatched after July 20, representing about 40 per cent of the total, reached only a single generation within the season instead of two. The first pupa was obtained this year July 26, which is seven days later than the corresponding date for last year. The first adult emerged August 9, which is five days later than the corresponding date for last year.

The progeny of these adults constitute the second generation of the current season. The first eggs of this generation were found August 11, which is one day earlier than the corresponding date for last year. The last eggs found were laid September 26, but no eggs that were laid after September 16 hatched. The first larva of this second generation hatched August 22, which is exactly the same date as the first larva of the corresponding generation of last year. The first larva to reach the fifth instar, which is the stage in which the larvae hibernate, attained that period of growth this year September 18, which is nine days earlier than the corresponding date for last year. In other words, whereas the species was late, by nine days, in reaching the adult stage of the overwintering generation in 1924, its transformations were sufficiently accelerated to place it nine days ahead of the 1924 records at the close of the season.

A sequence similar to this has been observed with other species and is probably intimately correlated with variations in temperature and moisture and with accumulated temperature.

The European corn borer is now more widely distributed in New Hampshire than it was in 1923, but has not yet reached sufficient abundance to be found in large numbers in any specific locality. Collections were made at various points in the field through the summer of 1924, but at none of these could more than a few larvae be secured in the course of several hours' collecting. It is presumed that as time goes on the numbers of the species within the infested area will steadily increase.

In the collections of 1924 no parasites were found attacking any of the stages. In 1923 three specimens of parasites were secured. Up to the present time the species is evidently relatively free from attack by parasitic enemies in New Hampshire.

The large amount of data that has now been secured through the accumulated records and observations of two years furnishes a valuable foundation of knowledge of this insect under the conditions prevailing in New Hampshire. This knowledge should be extended and verified. It is a necessary preliminary on which to base any proposed control measures.

Studies on the Effects of Fungicides and Insecticides on Plants.

It is well known that Bordeaux mixture is injurious to certain plants and not injurious to others. During the year studies have been continued by O. Butler (Botany) with a view to determining what effect the composition of Bordeaux mixture had on the injury produced. In general it has been noticed that on

beans, tomatoes and radishes, which have been mostly used, injury is likely to result from the use of an alkaline Bordeaux mixture. The injury when produced only occurs on the young tender leaves and is not increased when the sprayed plants are wet with dew during the night following the application of the mixture. The experiments so far carried out indicate that in the case of plants not sensitive to copper an alkaline Bordeaux mixture may cause injury to the young leaves when a neutral mixture will not. In the case of plants sensitive to copper, as the peach, alkaline washes are more injurious to young foliage than neutral mixtures.

Toxicity of Fungicides to Parasitic Fungi.

When lead arsenate is added to lime-sulphur solution, double decomposition occurs, and soluble arsenic is found in solution, whereas when calcium arsenate is used decomposition does not occur. It is generally considered that the addition of lead arsenate increases the toxicity of lime-sulphur solution, but the situation regarding calcium arsenate has not been clear. Accordingly, W. L. Doran (Botany) has studied the effect of an addition of lead arsenate, calcium arsenate and arsenious oxide in solution, on the toxicity of lime-sulphur to the spores of the apple scab fungus. The results obtained as will be seen from a consideration of the data presented in Table I fully corroborate the view that lead arsenate increases the toxicity of lime-sulphur and that the presence of soluble arsenic sufficiently accounts for the increased toxicity noted.

TABLE I.—*Effect of the addition of lead arsenate, calcium arsenate, and arsenious oxide on the toxicity of lime-sulphur.*

Nature of solution.	Arsenic added to solution.	Spore germination.
	Per cent.	Per cent.
Lime-sulphur solution 1–40 + 0.02 per cent arsenious oxide	0.0150	0
Ditto + 0.01 per cent arsenious oxide	0.0071	0
Ditto + 0.005 per cent arsenious oxide	0.0036	10
Ditto + 0.0025 per cent arsenious oxide	0.0018	10
Ditto + 0.25 per cent calcium arsenate	0.0660	40
Ditto + 0.37 per cent lead arsenate	0.0740	3
Lime-sulphur solution 1–40	0.0000	70

It has also been found that the toxicity of lime-sulphur solution may be greatly increased by the addition of copper sulphate. The results of experiments with the spores of the apple scab fungus are given in Table II:

TABLE II.—*Effect of copper sulphate on the toxicity of lime-sulphur solution.*

Nature of solution.	Spore germination.
	Per cent.
Lime-sulphur 1–50 + 1 per cent copper sulphate	0.0
Lime-sulphur 1–50 + 0.5 per cent copper sulphate	0.0
Lime-sulphur 1–50 + 0.25 per cent copper sulphate	0.5
Lime-sulphur 1–50 + 0.125 per cent copper sulphate	4.0
Lime-sulphur solution 1–50	60.0
Water	70.0

Nutrition Studies.

In this project, which is conducted in co-operation with the Nutrition Laboratory of the Carnegie Institution of Washington, two purebred Shorthorn steer calves just one year of age were purchased to check the problem of metabolism on undernutrition and also that of basal metabolism during growth. These calves, together with the two older steers, used the two preceding years, were therefore studied by E. G. Ritzman (Animal Husbandry), and Dr. F. G. Benedict of the Nutrition Laboratory, under identical conditions. All four animals were subjected to a submaintenance test of about three months, *i.e.*, about the length of time required by the 14 steers, reported on previously, to reach the lowest level of metabolism under similar conditions. They were then subjected to short fasts of five to seven days for a study of basal values. Following this, they were re-fed on hay and grain and used for continuous three-day metabolism experiments in the respiration chamber to correlate the so-called standard experiments (in which the animal, after 24-hours' fasting, is in the chamber for a two-hour respiration experiment) with the entire 24-hour condition. The work has, therefore, been partly that of studying the problems of technique as well as a study of the metabolism of growing steers.

In addition to the work done here, an investigation on the composition of the urine of these steers while fasting was carried on by Dr. T. M. Carpenter of the Nutrition Laboratory. Especial attention was given to the relationship of three forms of sulphur; viz., inorganic and ethereal sulphates and neutral sulphur as affected by various planes of nutrition. The daily urinary nitrogen excretion has been determined over a period of 71 days, and the effect of storage upon the quantity of ammonia has been observed. One objective of Dr. Carpenter has been a simplification of method to determine the potential energy of urine by means of an oxidizing agent.

In addition to Publication No. 324 issued by the Nutrition Laboratory of the Carnegie Institution of Washington on the first two years' investigation, a more condensed report covering the same period of work was issued this year in N. H. Station Bulletin No. 25. This bulletin is a digest of a research on undernutrition in steers, discussing the findings with the particular object of pointing out their economic significance under the extremely varying feed levels such as are commonly met with on the farm and range and their influence on the general practice of feeding live stock. The rate of all vital activities appears to vary closely with the changes in level of the feed. The pulse rate, heat production, glandular secretion, and physical activity all decreased with reduced rations. This whole picture was completely reversed when fattening rations were given. Health was in no single case impaired by nearly four months of undernutrition, and there was no evidence that it limited the regain of flesh and fat lost.

It is shown that the rate of regain in weight of steers which have been brought through a whole winter period on 50 per cent submaintenance is exceedingly rapid. Even those steers which received only pasture grass regained their original weight in less than three months and, in fact, pasturage proved to be the most economic method of recovering the weight lost by undernutrition.

It is also clearly established that rations high in protein are particularly uneconomic in fattening, since the amount of nitrogen that a mature steer can assimilate daily is relatively limited.

The tremendous stimulus that a heavy energy intake exerts on physical and vital activities suggests the advisability of limiting physical exercise as a matter of material economy in feeding.

No significant differences were observed in thoroughness of digestion of either protein or energy on different feed levels or between different individuals, as is so commonly believed to exist. The efficiency of rations which varied in quantity depended rather on the capacity of the individual to make an economic use of the digested food material.

An exhaustive report on fasting metabolism of steers is now being prepared. This will be issued as a monograph of the Nutrition Laboratory of the Carnegie Institution of Washington sometime during the coming year.

Some improvements have been added to the respiration chamber this year which permit of feeding and of collection of feces and urine during a respiration experiment. This will be particularly important in carrying on experiments of 24-hours' duration and over and in the study of the effect that ingestion of feed has on stimulating metabolism.

Sheep Breeding Experiment.

The Station flock now consists of three distinct groups of sheep of entirely different breeding.

One group represents the selected stock from the second and third generation of the inbred (*i.e.*, Mendelized) hybrids with Southdown-Rambouillet foundation. The members of this flock are very uniform in size, conformation and wooling qualities. They are low set, compact and of good mutton type. Furthermore, they produce good lambs for market as shown by the fact that their lambs at four months of age averaged 74.7 pounds in weight and sold for $9.00 per head on the open market. Their wool also is uniform in quality, since all the wool is graded in one-half blood staple or combing class and sold for top price on a competitive market. In other words, they do meet the two essential qualifications of producing to a satisfactory degree an early maturing market lamb and a desirable type of fleece.

The second group consists of a Rambouillet ram and 18 purebred Oxford ewes together with 17 head of F_1 female offspring. The Oxford blood has been introduced here for the purpose of increasing fecundity and milk yield of ewes, and to add somewhat to length of staple in wool.

The F_1 offspring which have so far been obtained are early maturing and produce an excellent quality of wool, but selections on basis of milk yield and fecundity will be made in the F_2 generation. If the latter are satisfactory they will be eventually merged with the Southdown-Rambouillet group.

In addition to the ram and five ewes of multi-nippled sheep received from the estate of Dr. Alexander Graham Bell last year, the estate has turned over to this Station eight more ewes.

These eight ewes were selected on the basis of combining not less than four functional nipples with high-twinning tendency, thus transferring to this Station the further perpetuation of Dr. Bell's achievement.

The work is conducted by E. G. Ritzman and is carried on in co-operation with Dr. C. B. Davenport of the Carnegie Institution of Washington.

Winter Injury Project.

The experiments on relation of conditions of freezing to injury sustained by seedling roots of the apple have been brought to completion by G. F. Potter (Horticulture) and the results published as Technical Bulletin No. 27 of this Station.

Two lines of further work are in progress. The feasibility of propagating the commercial varieties of this section upon a more hardy root stock is being tested. A number of trees are now growing in the nursery which have been propagated upon the Hibernal stock. This stock was found most resistant to cold of all those which were tested, being approached only by the Duchess. No tests of the possibility of using Duchess as a stock root are being carried on, because results secured at the Massachusetts Station indicate that Duchess does not make a suitable root system upon which to work other varieties. The Hibernal root is not only hardy but vigorous, and if compatible with such varieties as Baldwin, McIntosh, and Wagener, it may prove enough better than seedling stocks to warrant the expense of its use in propagation.

Another phase of the work on this project consists of the detailed study of the nature of the injury which results from exposure of the roots to low temperature. A considerable number of microscopic slides have been made showing the development of roots after they are injured by frost. The study of these slides up to date indicates simply that, whereas in the normal root the rows of cells in the meristimatic region are perfectly uniform and regular, roots which have been allowed to start growth after being frozen show these cells to be much distorted and arranged in irregular groups. In order to study the process which brings about this arrangement of the cells, a number of roots were subjected to low temperature and samples preserved in killing fluid.

Three lots of roots were frozen to provide material for sampling. One lot was subjected to a medium low temperature such that it was expected that some of the roots would not be injured and that others would show slight injury. A second lot was subjected to the same temperature, but the rate of temperature fall was made much more rapid so that it was expected that the injury would be more severe and a certain proportion of the roots would be killed outright. A third lot of roots was subjected to a rather low temperature at the usual rate of temperature fall so that it was expected that severe injury would take place. The samples preserved were marked as to the individual root from which they came and include the cortex, cambium, and a small amount of the xylem in each instance. Samples were taken 24 hours after the roots had been frozen, again after three days, at the end of one week and at the end of two weeks. Records of the final stage of injury reached by each root were made. A considerable number of sections have thus been taken and only a beginning has been made on the cutting, mounting, and staining of this material. It is expected that the series will show the various stages of development of the injury in the tissues. A considerable number of the roots were completely killed by the freezing, and the slides from these roots should show the appearance of this tissue after the freezing and before disintegration had actually taken place.

Work is also being undertaken to determine if possible the chemical difference between the tender and hardy individuals of a random sample of seedling roots.

Five hundred roots were divided into three sections, the top and bottom section being subjected to freezing and the middle section preserved for chemical sampling. The results of the freezing test indicated that with certain individuals both top and bottom of the root had been entirely uninjured. It would undoubtedly have been true that if the middle section had been included in the test it would not have been injured. A sample of such sections as these is to be compared with a sample in which both the top and the bottom of the root were completely killed and samples in which both top and bottom showed a medium amount of injury. It is hoped that chemical analysis of these roots which in appearance are exactly similar may indicate what substances are responsible for the variation in individual hardiness.

Fruit Bud Formation Project.

The usual records of yield and growth have been made in the Woodman Orchard by G. F. Potter and S. W. Wentworth (Horticulture).

The yield of this orchard, as noted in previous reports, has been seriously altered because fruit buds were eaten from the trees by ruffed grouse. Thus, the commercial yield of the orchard, which would ordinarily be about 300 to 500 barrels per year, was reduced during the seasons of 1922 and 1923 to an average of about 100 barrels. Owing to the inroad on the spurs made by the grouse and the fact that this disbudding was thought to be similar to a heavy pruning in reduction of the foliage of the tree, no pruning was done in the spring of 1923. A considerable amount of foliage developed upon water sprouts, the buds of which are not attacked by the birds, and the trees appear to have made as good a recovery as might be expected. The commercial yield of the orchard in 1924 averaged about one and one-half barrels per tree.

The number of trees remaining in the sod plots at the present time is relatively small, so that comparisons between sod culture and cultivated culture cannot be drawn with accuracy. The results appear quite definite, however, in that those plots which receive fertilization in addition to cultivation and cover crop are making greater growth than those which do not receive artificial fertilizers. This greater growth during the past 15 years has resulted in a larger and better equipped tree which is now yielding increased crops. It has been noticed in the commercial operations of the orchard that the increased growth of the fertilized trees has made orchard operations, including cultivation, pruning, spraying and harvesting, more difficult and more expensive.

During the present season (1924) records were made of the proportion of fancy, A grade and B grade fruit from each plot, the separations being made on a commercial grading machine and being wholly on a commercial basis. Since there are no differences in the amount of fungous disease or insect injury in the various plots, the variations in the percentage of the different grades received reflect in large measure the amount of color. There is no question whatever that the color is reduced by all fertilizer applications.

Relation of Light to Fruit Bud Formation.

Composition of Fruiting and Non-Fruiting Apple Spurs. During the past year the analytical data in this part of the fruit bud project have been tabulated, and a report of the work will be ready for publication at an early date.

Effect of Defruiting Upon the Chemical Composition and Fruit Bud Formation of the Apple. During the spring of 1922 Duchess apple trees were selected for the purpose of studying the effect upon composition of fruit spurs of removing the fruit at blossom time. Three types of spurs were sampled at frequent intervals throughout the season from these trees as follows: (1) spurs bearing fruit from trees which had not been defruited and which bore a heavy crop of fruit; (2) spurs not bearing fruit from trees which blossomed heavily but which were defruited entirely at blossom time; (3) spurs not bearing fruit from trees which blossomed heavily but which had every other spur defruited at blossom time. In addition the fruit from spurs which were bearing fruit was sampled.

During the past year the analytical work upon these samples has been practically completed, in co-operation with H. R. Kraybill (Agricultural Chemistry). The methods of preservation of samples and of analysis were similar to those of the previous experiment. The following determinations were made: moisture, free reducing substances, sucrose, soluble carbohydrates hydrolyzable by weak hydrochloric acid, starch, acid hydrolyzable material, total nitrogen, total phosphorus and ash.

In the spring of 1923 blossom counts were made upon the spurs remaining upon the trees. These results show that 41.4 per cent of the spurs of the totally defruited trees, 10.3 per cent of the spurs of the 50 per cent defruited trees and 9.2 per cent of the spurs of the non-defruited trees formed fruit buds.

Very significant differences were found in the composition of the spurs under the different treatments. The data are being tabulated and prepared for publication.

Plant Metabolism Studies.

The work during the past year has been devoted by H. R. Kraybill and T. O. Smith (Agricultural Chemistry) to making an analysis of the 22 samples of tomato tissue preserved. A modified system of Koch's method of tissue analysis has been used which consists in separating the material into three fractions as follows: F_1 Lipoid fraction; F_2 water soluble fraction and F_3 water, ether and 80 per cent alcohol insoluble fraction. The work of making the extractions is practically completed and the determination of the distribution of nitrogen, phosphorus and sulphur in the respective frac-tions will be carried out during the present year.

HATCH AND STATE PROJECTS.

Sooty Mould. Sooty mould caused a good deal of concern to apple growers in 1922, and in 1923 some experiments were begun by O. Butler (Botany) for the purpose of studying methods of control in the Baldwin orchard of Mr. Thomas Brackett at Bayside, N. H. The orchard is close to tide water and is subject to fog in late summer and autumn. In 1922 sooty mould was abundant in the orchard, which had never been thoroughly and systematically sprayed. In 1923 a number of plots were laid out and sprayed, as indicated in Table III. On studying the table it will be noticed that the lime-sulphur and Bordeaux mixture employed were used at strengths somewhat different from those in common practice. The difference between 1–40 or $1\frac{1}{4}$–50 lime-sulphur solution and the wash used is, however, less than one-tenth per cent, a difference too

small to be significant; the 2–2–50 Bordeaux mixture used had been found in a previous experiment to give satisfactory control when compared with 3–4–50 Bordeaux mixture and to be somewhat less injurious to the apple, hence its use in the present experiments. The fungicides used were applied by means of a spray gun under a pressure of approximately 200 pounds per square inch.

It is generally considered that a spraying schedule for apple scab is usually sufficient to control sooty mould.

TABLE III.—*Effect of various methods of treatment on the control of sooty mould.*

Dormant spray.	Pre-pink.	Pink.	Calyx.	14 days after calyx.	Sooty mould.
					Per cent.
Lye	Bm. 2–2–50[1]	Bm. 2–2–50	Bm. 2–2–50	L. S. 1–50[2]	2.34
Lye	Bm. 2–2–50	Bm. 2–2–50	Bm. 2–2–50	.....	0.52
None	L. S. 1–50	L. S. 1–50	L. S. 1–50	.....	11.89
None	L. S. 1–50	L. S. 1–50	L. S. 1–50	L. S. 1–50	4.70
None	Bm. 2–2–50	.....	Bm. 2–2–50	L. S. 1–50	0.61
None	Bm. 2–2–50	.....	Bm. 2–2–50	.....	2.11
None	Bm. 2–2–50	Bm. 2–2–50	L. S. 1–50	.....	0.50
None	.....	.....	.....	.....	13.82

[1] Bm. = Bordeaux mixture. [2] L. S. = Lime-sulphur solution.

The figures given in the foregoing table substantiate the above opinion. The data show that four sprayings with lime-sulphur do not give as satisfactory control as even two sprayings with Bordeaux mixture. The most satisfactory schedules were Bordeaux mixture pre-pink and calyx, lime-sulphur 14 days after calyx; and Bordeaux mixture pre-pink and pink, lime-sulphur calyx. The latter schedule is to be preferred to the former, because Bordeaux mixture applied at the calyx russets the fruit and should, therefore, not be used except under necessity.

Apple Scab.

Experiments on the control of apple scab were made by O. Butler on Baldwin and McIntosh apples. In the experiments on Baldwin the following results were obtained:

TABLE IV.—*Effect of various methods of treatment on the control of apple scab.*

(Fungicide used.)

Pre-pink.	Pink.	Calyx.	14 days after calyx.	Scab.	Russetted fruit.
				Per cent.	Per cent.
Bm. 2–2–50	Bm. 2–2–50	Bm. 2–2–50	L. S. 1–50	0.26	56.14
Bm. 2–2–50	Bm. 2–2–50	Bm. 2–2–50	.....	0.22	52.60
L. S. 1–50	L. S. 1–50	L. S. 1–50	.....	22.46	23.32
L. S. 1–50	L. S. 1–50	L. S. 1–50	L. S. 1–50	0.24	17.11
Bm. 2–2–50	.....	Bm. 2–2–50	L. S. 1–50	2.88	67.27
Bm. 2–2–50	.....	Bm. 2–2–50	.....	0.18	52.17
Bm. 2–2–50	Bm. 2–2–50	L. S. 1–50	.....	2.80	50.88
Not sprayed	.....	.....	.....	91.79	.....

The data presented in Table IV are somewhat irregular in regard to the effect produced by spraying with lime-sulphur 14 days after the calyx. When Bordeaux mixture was used for the pre-pink, pink and calyx sprays, or for the pre-pink and calyx sprays, lime-sulphur applied 14 days after the calyx spray was obviously of no value; but when lime-sulphur was used at the pre-pink, pink and calyx sprays, an application of the same fungicide 14 days after the calyx produced very marked results. The per cent of russeted fruit on all the trees sprayed with Bordeaux mixture was high, even an application of this fungicide at the pink stage being injurious.

In the experiments on McIntosh which have been carried on since 1921 the object has been particularly to study the comparative value of Bordeaux mixture and lime-sulphur solution for the control of scab. When the experiments were first begun, the non-sprayed trees were so badly infected with scab that no marketable fruit was produced; but in 1923 while the fruit was quite scabby the greater part of it was marketable. In 1921 and 1922 the control obtained by the use of lime-sulphur was not so good as that given by Bordeaux mixture, but in 1923 under a less severe incidence of scab the protection afforded by lime-sulphur was as satisfactory as that given by Bordeaux mixture.

Effect of Climate on Productiveness of Potatoes.

In experiments carried out in 1921 and 1922 with the Green Mountain potato it was found by O. Butler that seed stock grown at East Kingston was not so productive the second year as the first when compared with the same strain grown in Maine, and it was decided to test the effect of early harvesting on productivity. Seed potatoes were therefore harvested in 1922 ninety, one hundred, one hundred and ten, and one hundred and twenty-three days—full season—after planting and kept over winter in cold storage. The seed was planted in 1923 in alternate rows with stock of the same strain grown in Maine in 1922. The yields obtained make possible no definite conclusion. They were as follows:

TABLE V.

	Yield per acre.
90 days stock	363.26 bushels
100 days stock	344.43 bushels
110 days stock	358.77 bushels
123 days stock	366.07 bushels
Maine grown stock	378.50 bushels

In 1921 and 1922 the East Kingston grown stock not only yielded poorly, but the plants were not sufficiently free from degeneration diseases to meet certification requirements; whereas in 1923 all the East Kingston grown stock met these requirements.

Spraying Potatoes.

The following potato experiments were carried out by O. Butler during the year:

1. Comparison of power sprayer and power duster. No early or late-blight developed in the plots, and the plants in the sprayed, dusted and non-sprayed sections went through the season in good condition without significant difference in yields per acre.

2. Comparison of power sprayer, hand sprayer and hand duster. No early or late-blight developed in the plots, and none of the methods of treatment had any significant effect on yield.

3. Effect of number of nozzles and pressure on control of late-blight. In this experiment a triple-action pump was used, and four applications of an 8–4–50 Bordeaux mixture were given to each plot. Late-blight appeared late in the season, and frost killed the plants before the non-sprayed rows had been seriously damaged. The results secured indicate that if a sprayer applies the mixture under 90 pounds pressure better protection is obtained by going over the row twice—back and forth—than by using three nozzles and going over the row once; 180 pounds pressure, all things equal, gives better protection than 90 pounds pressure, and 90 pounds pressure going over a row twice is not so good as 180 pounds pressure one application; going over the row twice greatly increases the protection afforded, but the expense is not warranted if the sprayer will carry three nozzles per row and apply the mixture under 180 pounds pressure.

Potato Seed Experiments.

1. Comparison of some New Hampshire certified seed with seed from other sources. In this experiment seed from New Brunswick was used by Dr. Butler as the comparison strain, the other stocks being grown in alternate rows with it. In Table VI the yield given for the New Brunswick seed is the mean of all the rows, and the yields for the other stocks are relative thereto. A consideration of the table will show that all stocks used were very free from degeneration diseases and that the New Hampshire certified seed was in no way inferior to that from Maine and New Brunswick.

TABLE VI.—*Percentage leaf-roll and mosaic in and productivity of some New Hampshire and other seed.*

Strain used.	Leaf-roll.	Mosaic.	Yield per acre.
	Per cent.	Per cent.	Bushels.
New Brunswick	0.00	0.00	292.36
Maine	2.00	0.00	298.20
New Hampshire No. 1	1.50	0.50	301.13
New Hampshire No. 2	2.50	0.00	317.43

2. Effect of using small cut seed-potatoes about 2 ounces in weight—and large cut seed-potatoes 2 ounces to 12 ounces in weight—on yield. The seed used in the experiments was certified Irish Cobbler and Green Mountain. The large seed was cut into chunky pieces and the small seed by bisecting along the major axis. The results obtained were as follows:

TABLE VII.—*Yields obtained by the use of Irish Cobbler seed cut from small and large tubers.*

Kind of seed.	Gross yield.	Marketable potatoes.	Potatoes, $1\frac{1}{2}$ to $1\frac{3}{4}$ in.	Oversize potatoes.	Misshapen, cut and bruised.
	Bu. per acre.	Per cent.	Per cent.	Per cent.	Per cent.
Large seed	299.01	90.76	6.95	0.00	0.73
Small seed	267.78	88.56	8.82	0.00	0.78

The yield per acre of marketable tubers from the large seed was 271.38 bushels and from the small seed 237.14 bushels, or a difference in favor of the large seed of 34.24 bushels per acre.

In the case of the Green Mountain potato the following results were obtained:

TABLE VIII.—*Yields obtained by the use of Green Mountain seed cut from small and large tubers.*

Kind of seed.	Gross yield.	Marketable potatoes.	Potatoes, $1\frac{1}{2}$ to $1\frac{3}{4}$ in.	Oversize potatoes.	Misshapen, cut and bruised.
	Bu. per acre.	Per cent.	Per cent.	Per cent.	Per cent.
Large seed	318.20	71.34	2.22	3.07	23.02
Small seed	281.90	79.38	3.13	3.21	13.76

It is interesting to note that in the case of the Green Mountain and Cobbler potatoes the large seed produced about an equal increase in gross yield per acre over the small seed. On grading, however, the small Green Mountain seed produced a higher percentage of marketable tubers than the large seed. The large seed produced 227 bushels per acre of marketable tubers, the small produced 223.77 bushels, which gives a difference of only 3.23 bushels in favor of the large seed. Since, however, small seed of good quality costs very nearly as much as large seed, there is no reason to expect that its purchase will prove profitable when it is used cut.

Potato Seed Certification.

During the year 1923, 55 acres of Green Mountain were inspected and 46.5 acres were passed for certification. The total gross yield of potatoes produced was 15,182.75 bushels, and practically the entire crop was sold within the state.

Soil Rejuvenation Studies.

This project was started in 1920 by H. R. Kraybill (Agricultural Chemistry) and M. G. Eastman (Agronomy) for the purpose of studying the effects of the use of green manures and fertilizers on the productivity of neglected lands which have been cropped in hay continuously for a long period of years.

The yields of hay on the plats seeded in 1921 were obtained for the seasons 1922, 1923 and 1924. The yields of hay on the plats seeded in 1922 were obtained for the seasons 1923 and 1924. The data have been tabulated, but because of the variations in the different plats the probable errors were too

large to draw definite conclusions regarding the relative effects of the different treatments. Very large increases have been obtained upon the treated plats compared with an adjacent check plat which was left untouched. The check plat yielded 335 pounds of hay per acre, while the treated plats ranged from 2124 to 4866 pounds per acre.

Studies Upon the Lime Requirements of New Hampshire Soils.

The work upon this project was continued by Dr. Kraybill in co-operation with the county agents along the same lines as the past three years. The county agents take the samples of soil which the farmers wish to have tested, fill out description sheets giving the location and characteristics of the soil and send them to the department. The soils are tested by the department as soon as they are received and the results reported to the county agents, so that they are available for the immediate use of the farmer. These samples of soils are preserved carefully and kept for future studies. During the past season 359 samples sent in by the county agents were tested, and in addition about 150 samples sent in by individual farmers.

The Stalk Borer.

The stalk borer, *Papaipema nitela Guen.*, has been relatively abundant in New Hampshire for a number of seasons. As opportunity offered, observations on its habits have been made in connection with other work. In the beginning of 1923 a definite study of this insect was approved, to be carried out by P. R. Lowry (Entomology) under the supervision of W. C. O'Kane.

Observations of the larvae in 1923 appear to point to the existence of at least seven larval instars. These observations need amplification and verification. The first pupa was found August 16, and the last pupa September 3. The pupal period ranged from 28 to 36 days. The first adult emerged September 18, and the last adult September 30. Adult male moths lived from 22 to 28 days, and adult female moths from 19 to 26 days. The number of eggs deposited by a female moth range from a minimum of approximately 100 to a maximum of nearly 500.

Of the larvae collected in the field 11.76 per cent were parasitized by species of the family *Tachinidae*.

Black Flies.

The large number of collections and records secured by W. C. O'Kane in several seasons' work with black flies have been in process of study, identification and classification in the course of the year. These are disclosing the fact that there is apparently one species of black fly in New Hampshire that has not hitherto been described or known to science, and that there are several species that have not hitherto been of record as occurring within the state.

The records and collections represent many observations maintained at frequent intervals at more than thirty observation points in various parts of the state. The records include height of water in the streams as well as species found on the dates when observations have been made.

All of this data is in process of correlation and is expected to yield a study in

life history, seasonal abundance and ecology that will constitute a material contribution to the recorded knowledge of black flies. In the course of identifying species and tabulating data it has been found advisable to duplicate collections at various points during the present season because of the fact that lessened or increased stream flow, the drying up of certain streams, and the renewed flow of water in others have an important as well as highly interesting bearing on the occurrence and abundance of various species. The records will probably yield solutions of phases in the life history of this group that have been incapable of satisfactory explanation hitherto.

Celery Project.

An investigation of the changes in chemical composition of celery during storage is being made this year by O. H. Pearson (Horticulture). Three thousand plants of the Golden Self-Blanching variety were grown under ordinary conditions of culture. These were placed in field storage in a pit early in October. Samples for chemical analysis were taken at this time and at intervals of two weeks until Thanksgiving.

In sampling for chemical analysis the celery plant is divided into five portions, as follows: the outside leaves and outside petioles, the part discarded in commercial practice as waste; the inside leaves and inside petioles, the parts ordinarily sold on the market; and the roots. Duplicate samples of each of these parts have been taken and will be analyzed for free-reducing sugar, sucrose, starch, nitrogen (both protein and nitrate) phosphorus, and moisture.

This distribution of samples should indicate what materials are translocated from the old leaves and stalks to those which are growing and may shed some light on the metabolic activity of plants during the period of storage.

Variety Test of Fruits.

In the variety test of apples conducted by G. F. Potter and S. W. Wentworth interest still centers about the search for a high quality apple of late season, to follow McIntosh and compete with Western varieties for fruit-stand trade. The trees of Cortland and Nodhead have made fair, but not exceptional growth. In the orchard set in sod lands in 1923 in which there is a comparative test side by side of about 50 trees each of Red Delicious and Baldwin, Golden Delicious and Wealthy, the trees made a good growth. They were fertilized with between one-half and three-fourths pound nitrate of soda in early spring, and have been mulched with some hay and other litter from outside sources in addition to the grass which grows in the field. The Red Delicious specimens harvested from the small number of trees in the Thompson Orchard now in the fourth season of fruiting are considerably larger and of better type than those previously borne by these trees. The Golden Delicious fruited heavily on top-grafted trees. The quality of that variety makes it very popular locally, although it is the opinion of all those in the wholesale fruit trade in this section that the variety will not sell well on account of its color.

A number of varieties of peaches were received from the New York State Fruit Testing Association and planted in the spring of 1924. No observations could be made on the relative value of the varieties in the present plantation

owing to the fact that all fruit buds of all varieties were killed during the winter. There was a considerable amount of top injury to the trees, but no striking variations between the different varieties.

The quince has not hitherto been represented in the variety tests, and three varieties were planted in the spring of 1924.

In the raspberry plantation the Latham variety, set the previous season, has become badly infected with Mosaic disease.

A considerable amount of interest is manifested in the high bush cranberries, *Viburnum americanum*. Two hundred-odd plants of this species this year bore their first fruit. The pectin content is evidently high and a firm jelly is produced. However, it has an odd flavor which some persons find objectionable.

Pruning Experiment with Apples.

The orchard in which different blocks of trees are being trained to the vase, semi-leader and full leader form, has now passed its sixth season. The data taken in the spring of 1924 by G. F. Potter, covering the growth during the fifth season and pruning at the beginning of the sixth season, are given in Table IX.

TABLE IX.—*Wood removed and growth under different methods of pruning*

	Vase.	Semi-leader.	Full leader.	Unpruned.
Diameter in inches at close of 1923	2.06	2.21	2.23	1.33
Inches increase in trunk diameter, 1923	0.42	0.47	0.50	0.26
Pounds of wood removed in pruning, spring of 1923	1.06	1.47	1.35	....
Weight of prunings relative to size of tree	0.51	0.67	0.61	....

With all of the trees the chief object of the pruning was to maintain a balance between the various foundation branches. It was also necessary to prune to suppress the leaders on the semi-leader trees. In the vase form previous pruning was of such a nature that the trees carried on the trunk only those limbs which it is expected will remain on the tree as permanent foundation branches. In the semi-leader and full leader trees the trunks carried a number of other branches not designed to remain permanently on the trees and therefore requiring to be pruned with relative severity in order to keep them from crowding and competing with the branches which are to remain as permanent foundation branches. On this account it will be noted that the prunings as recorded in pounds per tree are from one-third to one-half greater on the semi-leader and full leader trees than on the vase form trees. However, the semi-leader and full leader trees are somewhat larger than the vase form trees. Taking this into consideration the increase in weight of prunings as compared to the vase form trees is 33 per cent on the semi-leader trees and about 20 per cent on the full leader trees. Growth of the three types of trees has thus far been nearly equal. Growth of the unpruned trees, as has been stated in previous reports, has been unsatisfactory in this experiment owing to the fact that they are located on a relatively infertile knoll.

Fertility in the Peach Orchard.

In early January, 1924, a temperature of −18° F. accompanied by a very high wind occurred following a period of relatively warm weather. As a result 100 per cent of the fruit buds of the previous year were killed and a considerable amount of top injury was sustained by the trees. The entire orchard was pruned with relative severity, and has made an excellent recovery. However, no data could be taken this season except on diameter increase of trunks which indicate, as has been reported, that those plots receiving nitrogen are making greater total growth than those from which this fertilizer is omitted.

Plant Breeding—Sweet Corn.

About one thousand seeds of crossed sweet corn were planted in the spring of 1924. The growth of the plants was practically stopped by dry weather, and at an early date in September the entire field was killed by a hard frost. The pollinated ears were lost, and no data of any significance could be taken.

Effect of Fertilizers on Strawberries.

In 1924 strawberry yields contribute further evidence to show that nitrate of soda is of questionable value as a fertilizing agent for the strawberry.

Sixteen one-thirtieth acre plots were set with Howard 17 plants in the spring of 1923. Three fertilizer treatments were applied, each treatment being repeated on four different plots located at different parts of the field to eliminate errors due to soil differences and moisture variations. Plots 3, 7, 11 and 15 were fertilized with 1000 pounds of acid phosphate per acre. One third of this was applied May 26, 1923; one third, August 18, 1923, and one third in the spring of 1924 about three days before the first blossoms appeared.

Plots 1, 5, 9 and 13 were fertilized with 300 pounds of sodium nitrate per acre applied in one-third installments in the same manner as was the acid phosphate.

Plots 4, 8, 12 and 16 were fertilized with 300 pounds of sodium nitrate per acre about three days before the first blossoms appeared.

Plots 2, 6, 10 and 14 were not fertilized.

The following table shows the percentage increase or decrease in yield over the check plots, which had an average yield of 3598 quarts per acre.

TABLE X.—*Effect of sodium nitrate and acid phosphate on yield of a new strawberry bed, as compared to check plots not fertilized.*

Acid phosphate in one-third installments.		Sodium nitrate in one-third installments.		Sodium nitrate spring of fruiting year.	
Plot.	Per cent increase or decrease.	Plot.	Per cent increase or decrease.	Plot.	Per cent increase or decrease.
3.....	−6.3	1.....	−26.4	4.....	−20.1
7.....	8.2	5.....	−24.8	8.....	− 9.0
11.....	−19.2	9.....	7.2	12.....	−32.5
15.....	12.0	13.....	−23.4	16.....	−12.0
Ave.....	−1.3	Ave.....	−16.8	Ave.....	−18.4

Where nitrate of soda was applied to a new strawberry bed at the rate of 300 pounds per acre, either in the spring just before the blossoms appeared or in one-third installments, a significant decrease in the yield was obtained in seven trial plots out of eight. Less consistent results were obtained from the 1923 plots when seven out of the twelve plots fertilized with nitrate of soda showed a decrease due to the treatment.

A new bed of strawberries was set during the spring of 1924. This bed has been divided into thirty one-twentieth acre plots. Six series of treatments are being tested, each series consisting of five plots. All fertilizer applications were made on August 1, 1924, as follows:

Series A—400 pounds nitrate of soda per acre.
Series B—1000 pounds hen manure broadcast per acre.
Series C—Check plots (no fertilizer).
Series D—1000 pounds acid phosphate per acre.
Series E—300 pounds muriate of potash per acre.
Series F—Check plots (no fertilizer).

Plans are now being made for installing a Skinner irrigation system for this project. Providing this is installed and providing it is apparent that moisture is a limiting factor, it is planned to irrigate during the fruit season all series with the exception of F, or to irrigate Series F only. At the present writing the field is in excellent condition, although possibly the crop may be reduced by the shortage of moisture which occurred during the month of October.

In addition to the above, experiments are also under way to determine what factors influence the size of berry, number of berries per cluster and number of clusters per plant.

The work is in charge of S. W. Wentworth (Horticulture).

Effect of Disbudding on Apple Trees.

Work on the investigation of the permanence of injury to apple trees due to disbudding by birds was continued by H. A. Rollins and G. F. Potter in the orchard of R. T. Gould, at Contoocook, N. H. As was stated in the last Station report, two blocks of Wealthy trees were found in this orchard nearly similar in age and on somewhat similar locations, one of which had been budded by the birds and one of which had not. A small part of the budding was done in the winter of 1921–22, but the major share of the damage was done in the winter of 1922–23. Observations on the orchard were begun in the spring of 1923.

(1) Effect of Growth of the Trees.

One hundred and sixteen trees in each plot were labeled, and the diameter of the trunk at a marked spot was measured. The average diameter of the disbudded trees in the spring of 1923 was found to be exactly four inches. The measurements were repeated in the spring of 1924, and it was found that the trees had on an average gained 0.35 inch in diameter, a gain of 8.7 per cent.

The non-disbudded trees which were one year older than the disbudded trees and possibly slightly more favored by soil and moisture conditions averaged 4.5 inches in diameter in the spring of 1923 and 4.9 inches in the spring of 1924, a gain of 0.40 inch of 8.8 per cent. At least so far as one season's gain in growth is concerned, the disbudding has not seriously affected the increase in diameter of the trunks of the trees. However, the non-disbudded orchard bore a somewhat larger crop in 1923 than did the disbudded orchard which, other things being equal, would tend to reduce its growth. Since with the Wealthy apple there is a decided tendency for those trees which bear heavily one season to have a light crop the succeeding year, the average increase in diameter for two years following the disbudding will eliminate the error due to inequalities in the crop and should provide a more reliable figure as to the effect of disbudding on increase in size than the one recorded here.

(2) Effect of Total Number of Spurs.

Eleven trees were selected at random in each orchard, and in the spring of 1923 counts were made of the total number of spurs on each. The counts were made using automatic hand tallies, and progress was made from branch to branch of the tree in a systematic manner so that it is thought that there was very little or no repetition in counting of the spurs. These counts indicated that the trees in the disbudded orchard had on the average lost 50 per cent of their fruit spurs at the beginning of the season of 1923. Similar counts were made on both orchards in the spring of 1924, and the data are given in Tables XI and XII.

TABLE XI.—*Increase in spurs on non-disbudded trees.*

Tree number.	Spurs present, spring of 1923.	Spurs present, spring of 1924.	Gain in spurs. Spring of 1923 to Spring of 1924.	
			Number.	Per cent.
224	2477	4402	1925	77.7
229	3377	2899	−478	−14.2
232	2698	3452	754	27.9
236	4264	4475	211	4.9
260	4195	4300	105	2.5
264	5705	4992	713	12.5
268	1725	2340	615	35.6
272	2813	3600	787	21.9
295	3947	5268	1321	33.5
299	3496	3887	391	11.2
307	2766	3945	1179	42.6
Average	....	....	.....	23.3

It will be noted that, although most of the non-disbudded trees under observation were bearing a considerable crop of fruit, nearly all of them made a material gain in the number of spurs. In one case, that of tree No. 229, a loss of 478 spurs is recorded. This may be due either to inaccuracy in the counts or to

failure of the tree to make much growth, together with the removal by pruning of some of the spurs present in 1923. The average increase in number of spurs in the non-disbudded orchard is found to be 23.3 per cent. The data on the disbudded trees are given in Table XII.

TABLE XII.—*Increase in spurs on disbudded trees.*

Tree number.	Spurs not budded, spring, 1923.	Total spurs including those budded, spring, 1923.	Live spurs, spring, 1924.	Gain in live spurs, spring, 1924, over spurs not budded, spring, 1923.	Per cent gain in live spurs on basis of total spurs, spring, 1923.	Gain or loss in live spurs, spring, 1924, over total spurs, spring, 1923.	
						Number.	Per cent.
17.....	2262	3186	4168	1906	59.8	982	30.8
20.....	1116	2134	1930	814	38.1	−204	− 9.5
23.....	677	1641	1394	727	44.3	−247	−15.0
40.....	1237	2175	1927	690	31.7	−248	−11.4
59.....	633	1666	1272	639	38.3	−394	−23.6
63.....	1822	3337	3198	1376	41.2	−139	− 4.2
65.....	1831	3075	3867	2036	66.2	792	25.8
82.....	1259	2452	2597	1338	54.6	145	5.9
99.....	1581	3153	3092	1711	54.2	139	0.4
102.....	988	2653	2668	1680	63.3	15	0.6
105.....	1823	3972	3067	1214	31.3	−905	−22.8
Average..	....	....	....	....	....	.....	− 2.1

Relatively speaking, the trees in the disbudded orchard gained a larger number of spurs. In this case gain in spurs includes not only new fruit spurs formed on the tree but any of the disbudded spurs which have commenced new growth from side shoots. If the estimate is made on the gain in number of spurs as compared to the number which should have been present in the spring of 1923, it is found that only five trees show a gain. Six of the trees had not yet regained the number of spurs which they had before the partridges attacked them, and there is still on an average a loss of about 2 per cent. The total number of spurs present in this orchard is approximately that which would have been present in the spring of 1923 if the birds had not attacked the trees.

The total gain on these trees, using the reduced number of spurs as a basis, is greater than the total gain on the non-disbudded trees, being on the average 47.5 per cent.

(3) Effect Upon Fruit Bud Formation.

The proportion of fruit buds on the trees in the spring of 1923 could not have been affected by the budding done during the winter of 1922–23, because it was determined during the previous growing season (1922) or, in other words, previous to the inroads by the birds. The disbudded trees in 1923 had 64.7 per cent of fruit buds, and the non-disbudded trees 57.7 per cent. It may be expected that the fruit bud formation during the season of 1923 might be affected by the budding which occurred during the previous winter. It is unsafe, however, to use the fruit bud formation of a single season because of the tendency to bear in alternate years which has already been mentioned. The tree which

had a high percentage of fruit buds in the spring of 1923 would have a tendency to have a relatively low percentage of bloom in 1924. The percentage of bloom for the two seasons has, therefore, been averaged to eliminate error due to alternate bearing. If the disbudding has an effect upon fruit bud formation it would be expected that the average for the two seasons would be somewhat reduced. The data are given in Tables XIII and XIV.

TABLE XIII.—*Blossom bud formation on non-disbudded trees, 1923 and 1924.*

Tree number.	Number blossom spurs, 1924.	Number non-blossom spurs, 1924.	Total spurs.	Per cent bloom, 1924.	Per cent bloom, 1923.	Average per cent bloom, 1923–1924.
224.....	2811	1591	4402	63.9	17.7	40.8
229.....	2	2897	2899	.1	96.9	48.5
232.....	37	3415	3452	1.1	69.0	35.0
236.....	85	4390	4475	1.9	89.9	45.9
260.....	73	4227	4300	1.7	76.0	38.8
264.....	47	4945	4992	.9	86.3	43.6
268.....	473	1867	2340	20.2	10.9	15.5
272.....	451	3149	3600	12.5	57.1	34.8
295.....	1847	3421	5268	35.1	34.9	35.0
299.....	3545	342	3887	91.2	10.7	50.9
307.....	2959	986	3945	75.0	19.8	47.4
Average....	....	....	....	27.6	57.7	39.7

TABLE XIV.—*Blossom bud formation on disbudded trees, 1923 and 1924.*

Tree number.	Number blossom spurs, 1924.	Number non-blossom spurs, 1924.	Total spurs, 1924.	Per cent bloom, 1924.	Per cent bloom, 1923.	Average per cent bloom, 1923–1924.
17.....	2867	1301	4168	68.8	23.9	46.3
20.....	65	1865	1930	3.4	69.3	36.3
23.....	5	1389	1394	0.3	76.2	39.9
40.....	388	1539	1927	20.1	50.8	35.4
59.....	54	1218	1272	4.2	66.4	35.3
63.....	342	2856	3198	10.7	53.3	32.0
65.....	3207	660	3867	82.9	60.1	71.5
82.....	85	2512	2597	3.3	79.7	41.4
99.....	164	2138	3292	5.0	69.4	37.2
102.....	167	2501	2668	6.3	79.2	37.2
105.....	77	2990	3067	2.5	83.9	43.2
Average....	....	....	....	18.9	64.7	41.4

It was found that the non-disbudded trees averaged 39.7 per cent fruit buds for the two seasons and the disbudded trees 41.4 per cent. This difference of only 1.7 per cent is not large enough to be significant. It may be concluded from this that the disbudding did not reduce the proportion of fruit buds formed. However, an average of the fruit bud formation for the two seasons following the budding will give a more accurate basis for comparison than the present one.

(4) *Effect Upon the Set of Fruit.*

Counts were made of the number of spurs setting fruit and the number of apples on each spur, and the data are presented in Tables XV and XVI.

TABLE XV.—*Per cent set and fruits per spur on non-disbudded trees, 1923 and 1924.*

Tree number.	Total blossom spurs.	Number spurs setting fruit.	Per cent set, 1924.	Per cent set, 1923.	Average per cent set, 1923-1924.	Total apples, 1924.	Average apples per spur, 1924.	Average apples per spur, 1923.	Average apples per spur, 1923-1924.
224....	2811	1162	41.3	62.1	51.7	1715	1.48	2.13	1.80
229....	2	3	100.0	51.1	75.5	3	1.00	2.30	1.65
232....	37	38	100.0	57.4	78.7	68	1.79	1.95	1.87
236....	85	36	42.4	55.7	49.0	51	1.42	1.71	1.56
260....	73	36	49.3	61.3	55.3	46	1.28	1.56	1.42
264....	47	16	34.0	39.3	36.6	17	1.06	1.40	1.23
268....	473	159	33.6	59.0	46.3	207	1.30	1.78	1.54
272....	451	240	53.2	62.1	57.6	339	1.41	1.86	1.63
295....	1847	813	44.0	58.2	51.1	1240	1.53	1.91	1.72
299....	3545	1014	28.6	38.6	33.6	1490	1.47	2.46	1.96
307....	2959	963	32.5	65.4	48.9	1023	1.06	2.30	1.68
Average	....	....	50.8	55.5	53.1	....	1.35	1.95	1.64

TABLE XVI.—*Per cent set and fruits per spur on disbudded trees, 1923 and 1924.*

Tree number.	Total blossom spurs.	Number spurs setting fruit.	Per cent set, 1924.	Per cent set, 1923.	Average per cent set, 1923-1924.	Total apples, 1924.	Average apples per spur, 1924.	Average apples per spur, 1923.	Average apples per spur, 1923-1924.
17....	2867	1305	41.3	64.8	53.0	1787	1.37	1.74	1.55
20....	65	61	93.8	76.7	85.2	133	2.18	2.61	2.39
23....	5	7	100.0	62.7	81.3	11	1.57	2.46	2.01
40....	388	241	62.1	62.8	62.4	343	1.42	2.46	1.94
59....	54	34	63.0	87.6	75.3	47	1.38	2.24	1.81
63....	342	186	54.4	64.0	59.2	326	1.75	2.10	1.92
65....	3207	876	27.3	100.0	63.6	1323	1.51	1.90	1.70
82....	85	57	67.0	54.6	60.8	111	1.95	2.49	2.22
99....	164	99	60.3	84.3	72.3	207	2.09	2.46	2.27
102....	167	148	88.6	83.1	85.8	360	2.43	2.08	2.25
105....	77	46	59.7	49.2	54.4	89	1.93	2.34	2.13
Average	....	....	65.2	71.8	68.5	....	1.78	2.26	2.01

It will be noted that in 1923, when presumably the nutritional conditions of the tree had been disturbed by the foliage loss due to the budding, the average set on the disbudded trees was 71.8 per cent, and on the non-disbudded 55.5 per cent. The effect of the budding which reduced the foliage in the spring of 1923 would be to decrease the proportion of sugars, starches and organic foods available to the spurs and to increase proportionally the amounts of water and mineral substances gathered by the roots. The shift in proportion of these two substances was evidently of such a nature as to increase the number of blossoms setting fruit. In 1924 the disbudded trees again showed a greater set than the non-disbudded trees, the setting being 50.8 per cent on the trees not budded by the birds and 65.2 per cent on those which had been budded. The average set for the two years is 68.5 per cent on the trees disbudded and 53.1 per cent on the trees not disbudded. It was the original plan of the experiment to count the number of apples and determine the average size of the fruits at harvest time on the eleven trees of each plot upon which detailed observation was being

made. However, in each season owing to misunderstanding with the owner of the orchard the fruit was picked before the data were obtained.

Soil Fertility in the Garden.

In 1924 the permanent soil fertility plots in charge of J. R. Hepler (Horticulture) were planted to Blue Hubbard squash. After harvest Plots 3 and 7 were planted to winter rye as a cover crop. The results are shown in Table XVII.

The plots are approximately one-eighth acre each in size. The lower half of each plot is treated with lime at the rate of 2000 pounds per acre every second year. The effect of the lime in 1924 was negligible. By weight an increase of 4.4 per cent in yield of squash was recorded, but it is more likely that this is due to greater moisture than to the influence of the lime. The season was very dry, and the limed plots are on the lower end of the field where there is probably somewhat more moisture available.

On the whole, the squash responded remarkably to applications of readily available plant food either in the form of stable manure, or stable manure with supplementary commercial fertilizers. Four plots show an increase of 100 per cent or more as compared to the plot not fertilized, and one other an increase of 83 per cent.

The benefit resulting from an application of commercial fertilizer alone is illustrated by comparing Plot 3, which received commercial fertilizer in addition to the green manure, and Plot 7, which received a green manure cover crop alone. The yield from Plot 3 is approximately three times that obtained from Plot 7.

That it is possible to substitute commercial fertilizers for a considerable portion of the stable manure customarily used is shown by the fact that Plot 6, which receives only eight tons per acre and a heavy application of commercial fertilizer, yielded approximately the same as Plot 1, which receives thirty-two tons of stable manure per acre.

Tomato Fertilizer Project.

The tomato fertilizer experiment was conducted by J. R. Hepler on the same lines as in the previous seasons, except that additional data on size of plants were obtained. The 32 plots in this experiment received eight different treatments, as follows:

	Treatment per acre.
Plot No. 1.	Manure 40 tons
2.	" 20 "
3.	" " " and calcium sulphate 1000 lbs.
4.	" " " " acid phosphate 1000 lbs.
5.	" " " " " " 500 "
6.	" " " " " " 1000 " muriate of potash 1000 lbs.
7.	" " " " muriate of potash 1000 lbs.
8.	" " " " acid phosphate 1500 lbs.

TABLE XVII.—*Yield of squash on garden soil fertility plots.*

Plot.	Treatment per acre.	Pounds yield squash on unlimed portions.	Pounds yield on limed portions.	Increase due to lime.		Total yield per plot.	Increase over check.		Average size of squash.
				Weight.	Per cent.	Pounds.	Weight.	Per cent.	Pounds.
1.....	32 tons manure.....	1745	1471	274	18.5	3216	1643	104.4	10.4
2.....	32 tons manure, 150 lbs. tankage, 100 lbs. nitrate of soda, 600 lbs. acid phosphate, 150 lbs. muriate of potash.....	1505	1664	− 59	− 3.5	3269	1696	9.6	9.6
3.....	Green manure, 250 lbs. tankage, 160 lbs. nitrate of soda, 500 lbs. acid phosphate, 300 lbs. muriate of potash.....	1505	1382	123	8.9	2887	1314	83.5	8.8
4.....	16 tons manure, 250 lbs. tankage, 160 lbs. nitrate of soda, 500 lbs. acid phosphate, 300 lbs. muriate of potash.....	1760	7141	19	1.1	3501	1928	122.5	10.8
5.....	Check.....	678	895	−217	−24.3	1573			6.8
6.....	8 tons manure, 250 lbs. tankage, 160 lbs. nitrate of soda, 500 lbs. acid phosphate, 300 lbs. muriate of potash.....	1711	1522	189	12.4	3233	1660	105.5	9.4
7.....	Green manure.....	480	408	72	17.6	888	−685	−43.5	6.1
Total....		9484	9083	401	4.4	....	.....	.....	....

This means that four different plots in various parts of the field received exactly the same treatment. The average of results from these plots eliminates differences due to variations in soil fertility and other local conditions.

As in previous years, it was found that the use of acid phosphate causes the crop to mature at an earlier date and increases the total yield for the season. In order to determine how this earlier and increased yield is brought about, the plants were measured and the flower clusters counted once a week. The total vegetative growth was obtained by adding together the length of the main shoots and of the side shoots. An increased early growth was found on the plots receiving acid phosphate, especially Plots 4, 5, and 8.

Counts of the number of clusters per plant showed a close correlation between the total size of the plant and the number of clusters produced at any given date.

The total yield in pounds up to three representative dates in early, mid-season, and late season, also indicated clearly that the yield of ripe fruit is closely correlated with increase in size and number of flower clusters.

A test of the effect of commercial fertilizers on the growth and yield of tomato plants in the greenhouse was run during the winter of 1923–24 for comparison with the outdoor results previously recorded.

The plants of the college strain of Bonny Best variety were set about January 1, 1924, 22 by 24 inches apart in a ground bed, into which a three-inch covering of well-rotted stable manure had been spaded. Each plot consisted of one row of eight plants, and was separated from adjoining plots by boards sunk into the ground. To overcome errors due to differences in temperature and light, each treatment was repeated upon four different plots in different parts of the house.

The rate of ripening under greenhouse conditions was found to be apparently affected chiefly by the temperature, and little difference was found between the different plots. As in the outdoor experiment, the highest yield was obtained from the acid phosphate plots. The use of potash alone gave a slight increase in yield, but potash combined with acid phosphate gave a lower yield than acid phosphate alone. This is in accord with the results obtained in the field plots.

Plant Breeding — Tomatoes.

In 1922 thirty-two selections of high-yielding plants and thirty-two selections of low-yielding plants were made by J. R. Hepler from a strain of Bonny Best variety of tomatoes which had been closely inbred in the greenhouse for six years. During the summer of 1924 the selections were again grown in the gardens and, as has been recorded in previous years, little difference was found in the average yield of the strains. The plants selected for earliness and high yield ripened two pounds of fruit by September 18, and a total of 12.9 pounds for the season. The low yielding and late strain of tomatoes ripened 1.9 pounds of fruit by September 18 and a total of 15.1 pounds for the season. There is a good deal of variation between the different plants of each strain, and apparently the variations upon which the original selections were based were somatic rather than of a heritable nature.

In connection with these strain tests twelve to twenty plants each of a number of the standard varieties of tomatoes were grown and the yield recorded.

The data are of some interest for New Hampshire conditions because they demonstrate that only those varieties designated as early or second early are of value to plant here.

TABLE XVIII.—*Yield of tomato varieties under New Hampshire conditions.*

Variety.	Yield in pounds per plant.		Average size of fruit in ounces.
	To Sept. 18.	Total for season.	
Dwarf Stone	.14	6.3	4.4
Dwarf Champion	1.0	4.5	4.3
Louisiana Red	4.6	10.7	4.4
June Pink	2.8	3.7	5.0
New Globe	2.1	13.2	5.5
Avon	7.8	9.3	6.0
Louisiana Purple	6.4	12.9	5.5
Stone	.3	4.3	4.8
Ponderosa	.7	5.1	6.9
McColloughs Special	2.0	10.3	4.8
Earliana	.5	1.4	5.1
John Baer	7.2	13.7	5.0
Acme	3.2	13.9	5.5
Chalks Jewel	6.7	15.9	7.2
Hudson Valley Maid	1.7	4.9	4.8
Wilt Resistant Marvel	.6	3.9	4.3
Penn. State Earliana	2.3	5.6	5.6

The showing made by the dwarf varieties is particularly poor. Plants of the dwarf varieties are attractive when offered for sale by grocery stores, because they are upright and sturdy. For this reason they are purchased by many people, but rarely if ever yield enough fruit to pay for the original cost of the plant.

Forest Plots.

Two projects are being carried forward by K. W. Woodward (Forestry): the growth of forest plantations, and the thinning of immature stands of white pine.

No new features have developed in the plantation work, but the thinnings have now reached the stage where the good results are becoming more and more evident. There is a striking difference between the thinned and unthinned plots.

The stakes around the active plots are being renewed.

Methylene Blue Tests.

Publication on this project, which has been conducted by J. M. Fuller, H. F. De Pew and B. E. Huggins of the Dairy Husbandry Department to ascertain the desirability of the methylene blue reduction test as a simple and inexpensive method of determining the keeping quality of milk, has been made during the year. The data assembled showed that:

1. Milk could be classified as follows:
   Poor milk—Decolorization time, up to two hours.
   Fair milk—Decolorization time, 2–5½ hours.
   Good milk—Decolorization time, more than five hours.

2. That there is a direct relation between reduction time and keeping quality.

3. That an initial acidity of .19 per cent or less gives no real indication as to keeping quality of milk.

Timothy Selection.

Owing to the extremely dry weather of the past two seasons during June and July, the young transplanted timothy plants have failed to survive. The work, therefore, will have to be started anew from seed of the best parent plants selected in 1922.

Potash Tests on Potatoes.

These tests were begun by F. W. Taylor (Agronomy) in 1922 on quarter-acre plots. The object was to note the effect on yield of varying amounts of potash with like amounts of nitrogen and phosphoric acid. Manure at the rate of 20 loads per acre was applied to all of the plots. The potatoes this year were planted May 21 and were dug October 8 to 10. The middle part of the season was very dry, and the yields were hardly normal. There were no diseases, except a little early blight in patches.

The following table shows the total yields per acre for the several treatments for 1922, 1923 and 1924, with the average for the three seasons:

TABLE XIX.

Fertilizer per Acre.	Kind.	Bus., 1922.	Bus., 1923.	Bus., 1924.	Av. 3 yrs.
1200 lbs.	4–8–0	215.1	242.0	206.6	221.2
1200 lbs.	4–8–3	215.7	252.5	244.4	237.5
1200 lbs.	4–8–4	220.4	256.8	245.8	241.0
1200 lbs.	4–8–6	246.6	226.0	248.6	240.4
1200 lbs.	4–8–10	222.2	214.5	256.1	230.9
None	Check	149.0	192.0	164.0	168.0

The seed used in these tests was certified Green Mountain grown on the University horticultural farm. While the results of these tests are not entirely consistent, they seem to indicate that one year with another, where manure is used for the potato crop, the supplementary fertilizer need not contain more than 4 per cent of potash.

Pasture Improvement.

The one-eighth acre plots laid out in the "reservoir pasture" in 1922 for seed and fertilizer treatments were carefully observed by F. W. Taylor during 1924. No additional seed or fertilizer was applied. The plots which had received the

nitrate in the two previous years showed no apparent improvement, indicating that the effect of the nitrate is for one season only. On the other hand, the plots which had received lime or grass seed were in better condition than the check plots.

Alfalfa.

The one-acre plot of alfalfa seeded in 1923 was cut twice, the first time on June 26 and the second on August 8. On account of dry weather the second cutting was very light. A good third cutting could have been made about October 1, but this was considered too late for the alfalfa to recruit itself for winter quarters.

The strip which was unlimed showed plainly, the plants being short, scattering, and unhealthy in appearance. No difference, however, could be noted in the halves inoculated with soil and with commercial culture, both proving effective. The half which was seeded in June with oats as a nurse crop seemed to be a little more vigorous and mature than the half seeded the first of August alone. Where the land is free from weeds the practice of early seeding with a nurse crop is to be commended. Besides getting as good or a better stand by this method, one can count on securing from one to one and a half tons of hay per acre from the nurse crop.

Five acres of Grimm alfalfa were sown in the field adjacent to the one-acre plot on June 19, 1924. Half of this piece was inoculated with soil and half with commercial culture secured from the Bureau of Plant Industry, U. S. D. A. In August, better than a ton of oat hay per acre was cut. The alfalfa stood a foot high in October, and went into winter quarters in good condition. Another tract of five acres in the same field is to be seeded in June, 1925.

MISCELLANEOUS INCOME PROJECTS.

White Diarrhea Testing.

Approximately 40,000 samples were taken in the white diarrhea testing work. The income received from this work has paid all the expenses. The Poultry Department now has eighty-seven names on its accredited list, and this should mean a larger and larger number of chickens each year which will be produced from these flocks and which will be free from white diarrhea. The requirement is now made that each man whose flock is on the accredited list have 25 per cent of his breeding birds tested each year in order to safeguard against any possible chance infection.

It seems probable that from now on approximately 25,000 to 30,000 birds will be tested annually, and most of this testing will be done on the accredited farms. The state has been quite well covered, and there will probably be comparatively few new flocks to be tested. "The very fact that we have so many free flocks and that these flocks have disseminated so much of their stock," reports Prof. A. W. Richardson, "leads me to believe that practically all of the larger flocks of chickens in the state are either free or practically free from any white diarrhea infection."

Advanced Registry Work.

The total cows on yearly test were:

Ayrshires	56
Guernseys	99
Holsteins	50
Jerseys	60
Shorthorns	6
Total	271

Total for corresponding period 1922–23 was 289.
Total cows on short time tests: 7- and 30-day tests (Holstein), 15.
Total for corresponding period 1922–23 was 14.

Feed Inspection.

Three hundred and forty-nine samples of commercial feeding stuffs were analyzed for the State Department of Agriculture in connection with the enforcement of the state law regulating the sale of these materials. The results of this inspection are reported in Bulletin No. 213. The relative number of feeds in the respective classes is similar to that of the past two seasons, except that the relative number of cotton seed meals and poultry feeds is slightly higher. More feeds were deficient in protein and in fat than in any of the preceding four years. The compounded feeds, cotton seed meals, dairy feeds and poultry feeds show the largest number of deficiencies. The cotton seed meals were decidedly inferior in quality.

Inspection of Commercial Fertilizers.

One hundred and fifteen samples of commercial fertilizers were analyzed for the State Department of Agriculture. The results of this work are reported in Bulletin No. 214. There was a slightly higher proportion of high analysis fertilizers than last year, but the number of deficiencies in guaranteed analysis was slightly greater.

Seed Testing.

A new seed laboratory was fitted up in the spring of 1924. An air blast machine for separating light seeds was purchased, together with new microscopes, balances, tables, and other equipment. A large new germinating chamber equipped for alternating temperatures was also constructed. While the laboratory is small, it is now well equipped for careful and accurate work.

During the season 510 samples of seeds were handled by the laboratory, about half of which were official inspection samples taken by the State Department of Agriculture. The remainder were from farmers, county agents, and seed dealers.

FINANCIAL STATEMENT.

A statement of the sources of income and expenditures during the fiscal year 1923–24 follows:

FINANCIAL REPORT TO THE UNITED STATES GOVERNMENT OF THE HATCH AND ADAMS FUNDS.

For the Fiscal Year Ending June 3. 1924.

DR.	Hatch Fund.	Adams Fund.
Receipts from the Treasurer of the United States, as per appropriations for fiscal year ending June 30, 1924, under acts of Congress approved March 2, 1887 (Hatch Fund), and March 16, 1906 (Adams Fund)	$15,000.00	$15,000.00
CR.		
By Salaries	$10,590.43	$11,910.53
Labor	430.10	842.79
Stationery and office supplies	156.77	24.45
Scientific supplies, consumable	252.10	385.43
Feeding stuffs	.....	372.14
Sundry supplies	180.31	84.37
Fertilizers	73.55	.....
Communication service	247.64	1.55
Travel expenses	363.15	48.31
Transportation of things	278.71	144.79
Publications	699.96	.....
Heat, light, water and power	600.00	.....
Furniture, furnishings, and fixtures	159.70	9.16
Library	342.85	.....
Scientific equipment	490.16	638.45
Live stock	.....	.....
Tools, machinery, and appliances	94.05	209.54
Buildings and land	40.52	328.49
Contingent expenses	.....	.....
Balance		
Total	$15,000.00	$15,000.00

SUPPLEMENTARY STATEMENT OF FUNDS RECEIVED FROM OTHER SOURCES THAN THE UNITED STATES.

For the Fiscal Year Ending June 30, 1924.

Cr.	State.	Hatch Sales.	Adams sales.	Miscellaneous income.	Total.
By Salaries	$4,964.00	.....	.....	$5,590.09	$10,554.09
Labor	162.64	$734.25	$242.75	3,140.93	4,280.57
Supplies	1,066.80	9.00	821.03	2,271.75	4,168.58
Travel	346.24	.....	8.00	1,142.47	1,496.71
Capital expenditures	460.32	.....	.....	360 08	820.40
Total	$7,000.00	$743.25	$1,071.78	$12,505.32	$21,320.35