

UNIVERSITY OF IDAHO  
AGRICULTURAL EXPERIMENT STATION

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WORK AND PROGRESS OF THE AGRICULTURAL  
EXPERIMENT STATION FOR THE YEAR  
ENDED DECEMBER 31, 1923

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# UNIVERSITY OF IDAHO AGRICULTURAL EXPERIMENT STATION

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\*In cooperation with U. S. Department of Agriculture.

## REPORT OF THE DIRECTOR

This report of the Idaho Agricultural Experiment Station deals with the progress of investigations conducted during the calendar year of 1923. The financial statement herein contained covers the fiscal year July 1, 1922-June 30, 1923.

A comprehensive report was published in January, 1923. It has seemed desirable to publish a shorter report on alternate years. Hence, this report will briefly summarize the activities within the various departments of the Agricultural Experiment Station of greatest general interest. The report for the coming year will, in accord with this policy, be more extensive.

There have been no resignations during the past year. Increased effectiveness of investigation has resulted from the continuity of service.

The work of the Station has been characterized by numerous substantial contributions to the progress and success of the agriculture of Idaho. It has pointed the way to practices that have made farming more successful and profitable; it has developed and made known effective methods of warding off insect pests, plant diseases and other destructive agents; it has raised the farmer's average expectation of yields from crops and animals by the introduction of new varieties and new methods; and it has served as the connecting link between the farmer of Idaho and the helpful agencies of modern science. It has created and will continue to create new knowledge invaluable in the state's agricultural progress.

### THE MAILING LIST

Residents of Idaho .....	11,650
Residents of other states .....	3,471
Foreign .....	200
Total.....	15,321

### PUBLICATIONS DURING 1923

#### Bulletin, Title and Author

No.		Pages	Copies
131.	Work and Progress of the Agricultural Experiment Station for the Year Ended December 31, 1922.	72	3,000
132.	Preliminary Report—Business Analysis of 181 General Crops, 11 Dairy and 10 Fruit Farms, Twin Falls County, Idaho, 1921.	20	5,000

#### Research Bulletin, Title and Author

3.	The Clover Aphis: Biology, Economic Relationships and Control. Ralph H. Smith.	80	5,000
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**Circular, Title and Author**

No.		Pages	Copies
30.	Biennial Report of the Director of the Agricultural Experiment Station for 1921 and 1922.	16	300
31.	Report of the Seend Commissioner for the Biennium 1921-1922.	16	1,000
32.	Steer Feeding Experiments 1922-1923.	4	5,000

**Research Papers**

- Journal of the American Society of Agronomy, Vol. 15, No. 3, March, 1923, Factors Affecting the Stand and Yield of Sweet Clover, H. W. Hulbert.
- Soil Science, Vol. 15, No. 4, April 1923. The Aeration Method for Determining Ammonia in Alkali Soils, William M. Gibbs, Ray E. Neidig and H. W. Batchelor.
- Journal of the American Society of Agronomy, Vol. 15, No. 5, May, 1923, Rate of Seeding—A Factor in Variety Tests, R. K. Bonnett and F. L. Burkart.
- Phytopathology, Vol. XIII, No. 5, May, 1923, A Fusarium Wilt of Spinach, Chas. W. Hungerford.
- Journal of Agricultural Research, Vol. XXIV, No. 7, May 19, 1923. Studies on the Life History of Stripe Rust, Puccinia Glumarum (Schm.) Erikss. & Henn., Chas. W. Hungerford.
- Journal of Agricultural Research, Vol. XXIV, No. 9, June 2, 1923. Sunflower Investigations, Ray E. Neidig and Robert S. Snyder.
- Journal of Agricultural Research, Vol. XXIV, No. 9, June 2, 1923. Sweet Clover Investigations, Ray E. Neidig and Robert S. Snyder.
- Soil Science, Vol. XVI, No. 2, August 1923. The Effect of Sulphur, Calcium and Phosphorous on the Yield and Composition of Alfalfa on Six Types of Idaho Soils, Ray E. Neidig, G. R. McDole and H. P. Magnuson.
- Journal of Agricultural Research, Vol. XXV, No. 9, September 1, 1923. Specialized Varieties of Puccinia Glumarum and Hosts for Variety Tritici, Chas. W. Hungerford.
- Phytopathology, Vol. XIII, No. 10, October, 1923. A Serious Disease of Wheat Caused by Sclerotium Rhizodes in Idaho, Chas. W. Hungerford.
- Soil Science, Vol. XVI, No. 5, November, 1923. Equilibrium Studies of Sodium Carbonate and Sodium Bicarbonate in Certain Idaho Soils, Ray E. Neidig and H. P. Magnuson.
- Abstract: Phytopathology, Vol. XIII, No. 11, November, 1923. Preliminary Results of Experiments with Leaf Roll and Mosaic in Idaho, Chas. W. Hungerford.
- Abstract: Phytopathology, Vol. XIII, No. 11, November, 1923. Results of Tests with Copper Carbonate in Idaho, Chas. W. Hungerford.
- Abstract: Phytopathology, Vol. XIII, No. 11, November, 1923. The Effect of Pre-sprinkling with Water on the Hot Formaldehyde and

Corrosive Sublimate Methods of Potato Seed Treatment, J. M. Raeder.

Abstract: *Phytopathology*, Vol. XIII, No. 11, November, 1923. Preliminary Results with the Use of Sulfur for the Control of Potato Scab in Idaho, J. M. Raeder.

Poultry Science (Submitted for publication) The Effect of Accessory Food Factors on Egg Production, R. T. Parkhurst and Ray E. Neidig.

### ACTIVE PROJECTS

The list of active Experiment Station projects follows. All investigations carried on at the substation farms are in cooperation with the various departments of the Home Station:

#### *Agricultural Chemistry*

The protein content and yield of wheat, nitrogen content of the soil, when cropped continuously to wheat and when cropped under a definite rotation system

Cause of unproductiveness of recently cleared coniferous timber soils, relation of toxicity thereto and corrective measures.

The iodine content of Idaho grown foods in relation to the prevalence of goiter.

Tolerance of crops for alkali.

*In cooperation with Agronomy*

Slick spot investigations.

Peat investigations.

Rotation and fertility investigations at Moscow and Sandpoint.

Chemical studies of soil survey samples.

*In cooperation with Dairy Husbandry*

Feeding experiments. (a) The comparative value of various silages for milk production. (b). Winter rations for young dairy stock in Idaho. (c) Feeds for wintering dairy heifers under practical farm conditions in Idaho.

*In cooperation with Plant Pathology*

The control of potato scab by sulphur treatment of soils.

*In cooperation with Aberdeen Substation*

Sugar beet investigations, variety tests.

*In cooperation with Animal Husbandry*

Studies in animal nutrition. I. The effect of various feeds upon gains made and quality of pork produced. II. The physiological effect of feeding rations restricted to Canadian field peas on growth and reproduction in swine.

Steer and lamb feeding at Caldwell.

*In cooperation with Bacteriology*

Effect of alkali salts on bacteriological activities in soils.

*In cooperation with Horticulture*

Leaf roller control studies.

*In cooperation with School of Forestry*

Tolerance of trees for alkali.

#### *Agricultural Engineering*

Investigation of the practicability of irrigating certain comparatively level portions of farms in the semi-arid regions.

A study of pressure exerted in silos by sunflower silage.

Design and installation of farm water systems.

#### *Agronomy*

Small-grain improvement. (In cooperation with the substations.)

(a) Wheat. (b) Oats. (c) Barley. (d) Rye, emmer and miscellaneous grains.

Forage investigations.

(a) Grasses and legumes for hay and seed. (b) Cultural tests with sweet clover. (c) Cultural experiments with sudan grass. (d) Orchard grass selection and improvement. \* (e) Introduction and testing of miscellaneous forage crops.

Field and garden pea investigations.

(a) Classification studies. (b) Cultural experiments. (c) Breeding and improvement.

Corn breeding and improvement.

(a) Classification studies. (b) Cultural experiments. (c) Breeding and improvement.

\*Soil survey.

(a) A detailed survey of a designated area each season as funds permit.

Silage crop investigations. (In cooperation with Agricultural Chemistry and Sandpoint Substation.)

(a) Cultural tests of corn for silage production. (b) Cultural experiments with sunflowers. (c) Improvement of sunflower silage production by selection and breeding.

Tests with commercial fertilizers.

Timber-soil investigations.

(a) Plots located at Sandpoint Substation. (In cooperation with Sandpoint Substation and Agricultural Chemistry.)

Irrigated-soil investigations.

(a) Correction of alkali and "slick spots." (In cooperation with Caldwell Substation and Agricultural Chemistry.)

Soil amendments.

(a) Use of sulphur, lime, gypsum on leguminous crops. (In cooperation with Agricultural Chemistry.)

Rotation and fertility investigation.

Peat soils of Idaho. (In cooperation with Agricultural Chemistry.)

\*In cooperation with the U. S. Department of Agriculture.

### Animal Husbandry

Steer-feeding investigations at Caldwell.  
Lamb-feeding investigations at Caldwell.  
Effect of various feeds on gains made and quality of pork produced.  
Growing rations (winter) for ewe lambs.  
Hogging off field crows.

Different protein supplements with barley and corn for fattening hogs.  
Farm sheep management at Caldwell and Sandpoint.

Physiological effect of feeding rations restricted to Canadian field peas on growth and reproduction in swine.

### Bacteriology

Effects of wood and forest products on bacteriological activities in soil.  
(a) Ammonification and nitrification. (b) Nitrogen fixation.  
Legume culture preparation.

Effects of alkali salts on bacteriological activities in soil. (In cooperation with Agricultural Chemistry.)

The isolation and study of nitrifying bacteria.

### Dairy Husbandry

Official testing for advanced registry of register of merit in Idaho.

\*Inbreeding and line breeding compared with outcrossing as regards its effect upon dairy cattle, their milk and butterfat production, fecundity and general characteristics.

A study of the normal growth of dairy cattle.

Weight of dairy cattle as influenced by pregnancy, age, and methods of handling.

A study of the best methods of feeding calves while receiving milk.

The best winter ration for young dairy stock in Idaho. (In cooperation with Agricultural Chemistry.)

The value of feeding grain to dairy cows during dry-rest period.

The comparative value of various silages for milk production. (In cooperation with Agricultural Chemistry.)

A study of the value of feeding grain with hay and silage for milk production. (In cooperation with Caldwell Substation.)

A comparison of Idaho pasture crops for milk production. (In cooperation with Caldwell Substation.)

Soiling crops versus corn silage as a substitute for pasture in summer feeding of dairy cows.

### Entomology

Alfalfa Weevil: Study of climatic conditions affecting control; further experiments in control; breeding and liberation or parasites.

Eleodes beetles: The life cycle studies for *E. Hispilabris*; experiments in spring poisoning of adults; taxonomy of eleodes beetles of the state.

Codling moth: Life cycle studies at Parma. Fruit tree leaf roller: Control experiments under Idaho conditions.

Snowy tree crickets: Studies of biology and control on prune trees in the Boise Valley.

Wire worms: Locality survey at Parma; studies in bionomics and control; taxonomy of wire worms of the state.

Grasshoppers: Experiments in sprays for protection of alfalfa seed crops.

Spreaders: Tests of value of calcium caseinate under southwestern Idaho conditions.

Cutworms. Taxonomy study of cutworms of Idaho.

Potato Diseases: A study of insect vectors of potato diseases. (In cooperation with Plant Pathology.)

### \*Farm Management and Farm Economics

Investigation of farm organization, including cost of crop production studies, in northern Idaho.

Investigation of farm organization, including cost of crop production studies, in irrigated sections of southern Idaho.

### Forestry

Experimental tree planting.  
Relative durability of Idaho woods.  
Studies of farm woodlands.

Agricultural possibilities of logged-off lands.

Grazing studies.

### Horticulture

Apple breeding.  
Variety testing of fruit trees, small fruits, and vegetables.

Potato-production experiments.

Experiments in seed production.

Experiments in the control of western yellow tomato blight by breeding and selection. (In cooperation with Plant Pathology.)

Testing the value of various spreaders for sprays.

Varietal study and cultural tests in producing head lettuce.

Experiments with various sprays for the control of the leaf roller. (In cooperation with Entomology, and Agricultural Chemistry.)

Pruning investigations.

Orchard fertilization tests. (In cooperation with Agronomy.)

\*In cooperation with the U. S. Department of Agriculture.



*\*Plant Pathology*

\*Investigation of stripe rust caused by *Puccinia glumarum*.

\*Investigation of the eelworm disease of clover.

Relation of soil moisture and soil temperature to bunt infection in wheat.

Investigation of western yellow tomato blight and methods for its control. (In cooperation with Horticulture.)

An investigation of mosaic and leaf-roll of the potato under Idaho conditions.

Experiments with various chemical dusts for the control of bunt in wheat.

A modified hot formaldehyde treatment for the control of Rhizoctonia of potatoes.

Inoculated sulphur for potato scab control.

*Poultry Husbandry*

The influence of feeds of high vitamin content upon the production and hatching quality of eggs and upon the health of the layers.

The inheritance of weight, shape, color and texture of shell of eggs in the Single Comb White Leghorn.

A study of high winter egg production as a factor in the Single Comb White Leghorn.

The comparative value of certain feeds as supplements to peameal for laying hens.

The relation of certain constituents of sour skimmilk to egg production.

*Zoology*

Cytological studies.

(a) Additional cytological studies of the reproduction cells of the mule.

(b) Cytological studies of the reproduction cells of cattle.

(c) Cytological studies of the reproduction cells of sheep.

*\*Aberdeen Substation*

Small-grain investigations.

(a) Varietal experiments with wheat, oats, barley. (b) Cereal breeding and selection in nursery.

Investigations in field and garden peas, and beans.

(a) Varietal experiments. (b) Value of the various pea varieties as nurse crops for alfalfa.

(c) Seed-bean investigations.

Silage crop investigations.

(a) Varietal experiments with corn for silage production. (b) Breeding and selection of corn for eastern Idaho. (c) Rate of seedling sunflowers as related to yield of silage.

Potato investigations.

(a) Varietal experiments. (b) Tuber-unit potato improvement.

Study of trees with respect to environment.

Seed production.

(a) Sugar beets; selection and improvement of sugar beets for high sugar content by propagation of mother beets showing highest percentage of sugar. (b) Production studies with carrot and parsnip seed growing.

To determine adaptability of various ornamental trees to higher elevations of eastern Idaho for the improvement of the homestead.

Soil-fertility investigations.

(a) To determine effect of sulphur on yield of alfalfa.

Pure-seed distribution.

(a) Increase and distribution of pure seed of various crops which have been improved.

*Caldwell Substation*

Dairy farm management.

(a) To encourage the introduction of dairying as a type of farming for this area of the state. (b) To determine the best combination of crops to be grown for a dairy herd. (c) To determine the proper number of animals to be maintained on an 80-acre unit of land and their proper management.

Farm management.

(a) To place the remainder of the farm in condition to produce crops for feed or sale. (b) To determine the cost of certain crops from the standpoint of man and horse labor expended.

Feeding investigations.

(a) Steer-feeding investigations. (b) Lamb-feeding investigations.

Corn investigations.

(a) To determine the yielding capacity of introduced varieties as compared with those locally grown for the production of silage.

(b) Later, a system of corn breeding will be established to produce an improved variety for this section of the state.

Soil investigations.

(a) To determine the needs of the soils of this area. (b) A study of methods of eliminating "slick spots."

*High Altitude Substation*

Small-grain investigations.

(a) Variety tests with wheat, oats, barley, and miscellaneous grains under high altitude conditions. (b) Rate, date, and depth of seeding winter wheat on dry-land. (c) Variety test of cereals for the production of hay.

Field and garden pea investigations.

(a) To determine the varieties best adapted to dry-lands.

Fallow and cultural tests with wheat.

Forage and miscellaneous crop investigations.

(a) To determine the best varieties of grasses and legumes for the production of forage and the most successful cultural practice. (b) The introduction and testing of such crops as flax, buckwheat, sunflowers, corn, etc., for the production of grain or forage.

Horticultural investigations.

(a) The introduction and testing of apples, pears, and plums and small fruits to determine their winter hardiness and adaptability to high altitudes. (b) The planting of ornamental trees and shrubs for the improvement of the homestead.

\*In cooperation with the U. S. Department of Agriculture.

*Sandpoint Substation*

Small grain and field pea investigations.

- (a) Varietal experiments with winter wheat and barley, spring wheat, barley, oats and field peas. (b) Rate of planting peas and oats. (c) Rate and date of planting winter wheat.

Forage crop investigations.

- (a) Various legumes for hay and seed. (b) Method and date of planting legumes. (c) Cultural experiments with alfalfa and red clover. (d) Pasture investigations. (e) Timothy variety test. (f) Vetch variety test.

Silage crop investigations.

- (a) Rate and date of planting sunflowers. (b) Variety test of corn. (c) Comparison of sunflowers and artichokes.

Root crop investigations.

- (a) Tuber-unit potato breeding. (b) Comparison of different selections of potatoes. (c) Variety test of potatoes. (d) Rate of planting potatoes. (e) Comparison of various root crops.

Soil investigation.

- (a) Use of legumes in building up soil fertility. (b) The value of lime, gypsum and phosphate as fertilizers. (c) Rotation experiment.

Sheep raising.

- (a) Cost of production.

**PROGRESS OF INVESTIGATIONAL WORK**

As has been the practice in former years, a brief summary is made of the work of the various departments and of the substation farms. The summaries presented herewith represent the major projects and deal briefly with the more important achievements of the year.

*Agricultural Chemistry.*

Ten years' work has been completed on the crop rotation experiment of the department of agricultural chemistry in which the effect of the different cropping systems on the yield and protein content of wheat was observed. The data are being assembled for publication. Results also have been completed on the effect of moisture on the yield and protein content of wheat where an abundance of available nitrogen was present in the soil. The data have been submitted for publication.

The alkali tolerance of field crops investigation has been vigorously conducted the past year. Data have been completed on five field crops for various alkali salts and concentrations. The effect of these alkali concentrations on bacterial activities have been carried on simultaneously by the bacteriological department. Some very interesting and valuable results are being secured by studying the soil after the second and third croppings. The laboratory studies have contributed some information which should be tried out under field conditions. The field alkali problem will be worked on as rapidly as funds will permit. Additional progress has been made in the study of "slick spot" soils of southern Idaho and in the investigation of coniferous timber soils of the cut-over area.

Many cooperative programs are carried on with other departments as will be seen by inspecting the list of projects.

*Agricultural Engineering.*

The facilities for work in agricultural engineering have been materially improved by removing the farm power section to more spacious quarters and by the installation of a well planned laboratory for work in irrigation measurement.



### *Agronomy.*

The season of 1923 was the most favorable from the standpoint of yield recorded during the past five years. All projects were continued as outlined the past years with the exception of a revision in the rotation and fertilization experiment at Moscow. All of the three year rotations were continued while the plots which had been fertilized with various commercial fertilizers were eliminated. A number of new rotations were started on these plots, including sunflowers, sweet clover, alfalfa and other crops upon which information is needed.

A new series of plots was laid out at Winchester, including a variety test of spring grains, inoculation of legumes, nurse crop test with legume and grass mixtures, effect of gypsum and phosphate on the yield of legumes and grass, and the value of inoculation for red clover and alfalfa.

The use of gypsum and phosphate on the cut-over lands to increase the production of legume crops is showing striking results and the fertilization of the peat soils has made them capable of producing great increases in yield.

Mosida is the name given a new wheat distributed by the department for the first time this season for trial in various sections of the state. This variety was a selection from a cross of Turkey X Fultzo-Mediterranean made at the Colorado Station. A number of these selections were introduced into the nursery at the Idaho Station in 1916. Among the most promising tested in the variety tests during the past four seasons was Mosida. It is a hard red winter wheat, early in maturity, producing a fairly stiff straw, is as resistant to bunt as Turkey and is awnless.

### *Animal Husbandry.*

In the feeding investigations, conducted on the Caldwell Substation, the feeding of alfalfa hay alone for fattening steers seems to be an expensive method. The grains are small and costly and the finish is insufficient to command much of an increase in value over the price of feeders. Straight alfalfa hay feeding is not of the same importance as in former years when more mature steers were fed. Today the feed lots are filled with two year old steers and in some cases with yearlings and calves. Cutting average quality alfalfa hay increases its value eighteen to twenty-five per cent. The better the quality of the hay the less is the advantage of cutting and the higher the price of hay the greater the money value of cutting.

More efficient and economical gains are made when corn silage or a limited amount of grain is added to the alfalfa hay ration. These gains cost more but are larger and the finish higher causing the steers to sell

for enough more to offset the increased feed costs. The western markets apparently are beginning to have a higher appreciation of better finished steers.

Efforts have been made in two tests involving 75 hogs, averaging in weight about 125 pounds, to determine the quality of pork and economy of gains produced by standard rations involving corn, barley and tankage and rations in which peas were fed alone or in combination with barley. The lot receiving peas alone required an average of 370 pounds for 100 pounds of gain; the lot on peas and barley an average of 400; the lot on barley and tankage 425 pounds; and the lot on corn and tankage 410 pounds. While some variation occurred in shrinkages in the cooler in the curing and smoking processes in the packing plant as well as in the chemical analysis of the back and leaf fat from each hog and in the determination of melting points of the fats, it is not probable that the variations were sufficient to justify concluding that any one of these rations produced soft pork.

A test is under way to determine the Physiological Effect of Feeding Rations Restricted to Canadian Field Peas on Growth and Reproduction in Swine in which 12 gilts are used. These are divided into a lot of four on peas alone and two other lots of 4 each receiving in one case a proven ration and in the other a ration in which peas has an important part.

#### *Bacteriology.*

Three research projects have been extensively studied during the past year, namely. Effect of Tree Products on Bacteriological Activities in Soil, Effect of Alkali Salts on Bacteriological Activities in Soil, and the Isolation and Study of Nitrifying Bacteria.

In connection with the first project the effect of tree products on ammonification, nitrification, and nitrogen fixation has been determined. There is a notable toxicity from the various products tested. Soils collected from timbered areas do not contain the nitrogen fixing organism but will support it when inoculated.

The effect of alkali salts on ammonification, nitrification, and crop yield has been determined in carefully controlled pot experiments. The effects have been correlated with accurate chemical analyses for salt content made at regular intervals. Decreasing toxicity is noted as the salts remain in contact with the soil. Attempts to isolate the nitrifying bacteria have thus far proven unsuccessful. The contaminating forms, however, have been isolated and their study has given much interesting information.

During the past year 82 samples of water have been analyzed for bacterial content. These samples came from towns located in North Idaho. A total of 9,848 acres of legume culture was distributed among 709 farmers, an increase of 1800 acres over 1922.

### *Dairy Husbandry.*

Official testing of the Station dairy herd during 1923 was the most successful in the history of the herd. Ten state records were broken by the Holstein-Friesian females. The completed records include nine over 600 pounds, six over 700 pounds, five over 800 pounds, two over 900 pounds, and one over 1000 pounds of butterfat. During the year, this herd broke three out of a possible seven class records for cows owned by state agricultural colleges.

The department of dairy husbandry is charged with the supervision of all official testing in the state. During the year the following number of two day tests were conducted: 39 Guernsey, 173 Holstein, and 118 Jersey, making a grand total of 330 two-day tests, or 52 per cent more than in the previous year. In addition to these, 342.5 days were spent on official short time tests, making a total of 1088.5 testing days conducted by representatives of the College of Agriculture.

The project on breeding studies with dairy cattle, comparing line breeding with outcrossing and inbreeding with outcrossing was continued. This is the third year this work has been conducted in cooperation with the U. S. Dairy Division. Eighteen F<sup>1</sup> females have been produced and F<sup>2</sup> females should soon arrive. The daughters in milk by the bulls leased from the U. S. Department of Agriculture appear very promising.

The project on a study of growth in dairy cattle under northwest conditions is being continued. A study also was made of the birth records, birth weights, and gestation periods on all the calves in the herd.

The project started last year of leasing bulls to bull associations for the purpose of making available more proven bulls thus far has been very successful. Six bulls are under lease at the present time.

Sunflower silage was compared with corn silage as a succulent feed with alfalfa hay for dairy heifers. The corn silage was more palatable and slightly superior. A comparison of chopped alfalfa hay alone with long alfalfa hay alone for wintering dairy heifers showed no advantage in chopping. Both groups gained more on hay alone than the normal suggested by the Eckle's standard. Sunflower silage was compared with corn silage for milk production, being a continuation of the work of last year. The difference slightly favored corn silage, pound for pound, but the milk production per acre favored sunflowers.

### *Entomology.*

The entomological program has been continued with headquarters at Parma. During the past year further progress was made in the study of the eleodes beetle, or false wire worm. The program for control by the use of poison bran mash was found successful in 1922. Life history studies were continued during 1923.

During the summer season nearly all the time of the entomologist was devoted to the investigation of control methods for the alfalfa weevil. It was found that in the lower Snake River basin, where the growing season is longer than in sections where the weevil has heretofore been most active, control is much more difficult. Instead of a distinct peak in numbers of weevil existing in the fields during the active season, there continues a period of abundance that makes necessary the application of two sprays. The spray seems to be the only reliable means of control and liquid spray has been found superior to the application of dust.

Experiments in the control of the fruit tree leaf roller were conducted at five points in the State during 1923, at Post Falls and Lewiston by the Station horticulturist and Station chemist and at Emmett, Apple Valley and Twin Falls by the Station entomologist. The year's work indicates the superiority of oil over lead arsenate for leaf roller control, and the year's experience emphasized the need of great care and thoroughness in the application of oil sprays.

In addition to the projects mentioned above some time was given to experiments with grasshoppers, cabbage worms, snowy tree crickets, wire worms, and San Jose scale.

#### *Farm Management and Farm Economics.*

It was found necessary to discontinue the farm management investigational program at the end of the federal fiscal year. There has been accumulated, however, a mass of data that is being compiled and prepared for publication. This information deals with farm organization and cost of production studies in both irrigated and non-irrigated regions. Three publications are contemplated as follows: 1. A bulletin dealing exclusively with cost of production for the years 1919-1921 inclusive; 2. A publication presenting the farm business analysis of farms studied during the years 1919-1922 inclusive; 3. A farm practice and farm organization bulletin written especially for popular distribution among farmers.

#### *Horticulture.*

During the season of 1923, 1792 seedling trees fruited, as compared with 1364 in 1922. A number of crosses, such as Spitzenburg-Newton, Wagner-Spitzenburg, Jonathan-Rome, Jonathan-Arkansas Black, Ben Davis-Newton, have fruited, and have furnished considerable material markedly different from crosses heretofore studied.

Experiments on the control of the fruit tree leaf roller point to the fact that some of the oil sprays are highly efficient in the Lewiston district. The arsenical sprays cannot be relied upon to control this pest.

Data accumulated on potato production show that varieties will run out

entirely in from three to five years, when no systematic roguing is followed. That off-type potatoes, due to drought and other climatic factors make good seed stock is shown by experiments conducted during the season of 1923.

At the close of the second year no definite conclusions can be drawn as to the value of commercial fertilizers in orchards. Planting turnip seed thickly in the fall and thinning the plants out to four inches in the spring seems to be the best method of growing this crop for seed.

#### *Plant Pathology.*

It has been found in the potato disease investigations that leaf roll may appear late in the season as slight rolling of the younger leaves in otherwise vigorous plants. Progeny from such plants may develop advanced symptoms of the disease and yield practically nothing. It also has been found that the russett dwarf type of mosaic may appear as very slight mottling late in the season and that progeny from such plants may develop very severe cases of the disease. Sulphur and inoculated sulphur were tested in a number of potato growing sections for the control of scab of potatoes. Altho in most of the tests scab was not controlled, in two cases the inoculated sulphur applied at the rate of 300 and 600 pounds to the acre gave fairly good control.

Copper carbonate dust again was tested for the control of stinking smut of wheat. Good control was secured with spring wheat but with winter wheat bluestone gave better control on the average in both tests on the University farm and in demonstration plots on various other farms. This material will be tested again next year.

#### *Poultry Husbandry.*

Three years of investigation with protein feeds show a ration of peameal and sour skim milk to have high value in stimulating production, in producing high quality eggs and making profit over feed cost. During 1922-1923, a pen of Single Comb White Leghorn pullets receiving the peameal and sour skim milk ration averaged 49.6 per cent production for the year, averaged 181.2 eggs per pullet, made a profit over feed cost of \$2.33 per pullet and produced eggs at feed cost of 14 cents per dozen.

Results of three years of feeding work with protein feeds show conclusively that sour skim milk is a valuable poultry feed for laying hens and that it can replace meatmeal or tankage in the ration. It will give higher percentage production, greater income, greater profits over feed cost and produce larger eggs than either meatmeal or tankage. When used as the main source of protein in the ration, it is only slightly less profitable than when it is used with peameal.

Some results have been obtained indicating in a preliminary way the



effect of some of the accessory food factors on yearly egg production and on the health and vigor of the flock, when supplementing a ration known to be deficient for heavy egg production. Pen 1 and pen 2 received the same management, except that pen 2 received, in addition to the feed given pen 1, an ounce of cod liver oil daily. No deaths occurred during the first four months of the experiment. During the month of March, a disease very similar to roup made its appearance in pen 1. During the rest of the year, thirteen birds died of this trouble. Pen 2 did not show this disease. The birds retained their vigor and health.

The results of experimental work with lactic acid and milk salts show conclusively that they are not the factors of sour skimmilk that stimulate egg production.

Data have been compiled on the inheritance of high winter egg production and egg characteristics in the Single Comb White Leghorn.

#### *Zoology.*

The studies on spermatogenesis, oogenesis, and sex-determination in hornless sheep have been completed. Publication of results is being withheld until further studies can be made of tissues from both sexes of horned breeds. Thus far sufficient tissue has not been secured. Research on cytological studies of the reproductive cells of goats is well under way and promises important results.

#### *Aberdeen Substation.*

The Aberdeen Substation has had a very successful year. A great deal of work has been done in improving the Idaho Rural potato. Tuber unit selections were made in 1916. One selection, No. 76, has made an average yield of 20 bushels per acre over the next highest yielding selection and over one hundred bushels more than the lowest yielding strain. Selection No. 76 is being increased as rapidly as possible and will be distributed to the farmers of the state. Other potato improvements have dealt with size of seed pieces and distance in rows.

Cereal varieties that have been distributed from the Aberdeen Substation are Dicklow wheat, Trebi barley and Idamine oats. Federation wheat, an introduction from New South Wales, has outyielded Dicklow in the station plots by 5.5 bushels per acre for a period of 4 years. Eight thousand pounds were distributed for farmer trials which have indicated a distinct advantage of Federation in yield, stiffness of straw and early maturity over other varieties commonly grown in the irrigated sections.

Several promising varieties of oats are being grown. It was a good year for oats, one variety yielding on one of the best plots at the rate of 178.7 bushels per acre. Field peas yielded heavy. Success was had in using flax as a nurse crop for red clover. Some interesting results that



promise to be of value to growers were obtained in cultural tests with sugar beets. Much data are being obtained on various clovers, alfalfas and other legumes for seed and forage. As in former years a very large cereal nursery was maintained in cooperation with the Cereal office of the U. S. Department of Agriculture.

#### *Caldwell Substation.*

A discussion of the animal feeding investigations which constitute one of the most important activities of the Caldwell substation is found under Animal Husbandry. The steers and lambs purchased late in 1923 for the feeding trials of 1923-1924 are owned by the Substation. They will be taken to market by representatives of the Experiment Station to secure shrinkage in transit and at the market prior to killing and data on slaughter to supplement the information collected from the feed lots.

The experiments to eliminate "slick spots" carried on in cooperation with the Station chemist and Station soil technologist have been conducted both in a portion of the farm recently cleared from the sage brush and set aside for the purpose and in the fields used for growing feeds to supply the experimental feeding plant. Plots treated with gypsum and with sulphur seem to show some benefit from the applications of these soil amendments. Individual treatment of the slick spots with heavy applications of manure from the feeding plant has so far produced the most pronounced effects. One of the small fields so treated showed little effect from slick spots in 1923.

Sixty-four and six-tenths acres of barley were grown on the Substation in 1923, giving a total production of 3,876 bushels, an average yield of 60 bushels per acre. The soil improvement program initiated on the Substation five years ago has resulted in a gradual increase of yield of all crops grown on the farm. This is well illustrated in the average yield per acre secured in growing feed barley. The average acre-yield for the two years, 1922 and 1923, is approximately 65 per cent above the average yield per acre for the three years 1919, 1920 and 1921.

#### *High Altitude Substation.*

Climatic conditions at Felt were favorable for all crops on the High Altitude Substation except potatoes.

Three years data are now available on the rate, date and depth of seeding winter wheat. Results on date of seeding have been quite uniform indicating clearly September 1 to be the date of planting most likely to get maximum yields. The seedings have been at two weeks intervals from July 15 to October 15, inclusive. Each season the July 15 planting has made a heavy growth in the fall but has had a dead appearance in the spring. The straw seems to ripen pre-maturely and the quality of grain is poor.

The three year average gives 22.3 bushels per acre for July 15 seeding, 21.8 bushels for October 15, 23.8 bushels for August 1 and October 1, 32.2 bushels for September 15, 34 bushels for August 15, and the peak yield for September 1 seeding of 38.3 bushels per acre. Many wheat growers have considered August 15 the best date to plant winter wheat. September 1 has given a three year average of 4.3 bushels per acre more than the seedings of August 15. At the local price of wheat, a farmer would increase his return on 50 acres of winter wheat, a total of \$161 by seeding September 1 rather than August 15.

The deep plantings have given a small increase over other seedings. In the rate of seeding tests 4 pecks per acre have given the best results. In the variety tests of oats, the Victory has shown its adaptation to the high altitude non-irrigated farming sections. It has out yielded other varieties an average of 4.1 bushels per acre over a period of four years. A four year average gives Trebi an average of 3.2 bushels per acre over any other variety. Two years' tests point to Carlton, Bliss Ever-bearing and Wellwood as highest yielding peas. The highest yielding spring wheats in a three year average are Jenkins Club, Little Club, Bluestem and Marquis. The highest yielding winter wheats in a three year average are Kharkof, Triplet, Turkey Red and Kanred. Sixteen legumes and grasses were seeded in 1922. Several of the grasses have indicated their adaptation to the high altitude farming section. Slender wheat grass made an especially fine showing in 1923 yielding at the rate of 5125 pounds per acre.

The fallow and cultural tests were initiated in 1921. These deal with (1) a comparison of spring and fall plowing in the production of spring and fall wheat in combination with summer fallow; (2) time of plowing and method of cultivation giving best results in storing moisture by means of summer fallow; (3) the effect of early and late fall and spring plowing together with the effect of disking before plowing and the effect of disking in lieu of plowing.

#### *Sandpoint Substation.*

The beneficial result of early seeding of winter wheat was strikingly shown in the yields of 1923. Early planting of spring wheat also showed to advantage over late seeding. Culti-packed spring wheat gave a greater yield than where this practice was not used. The highest yield of combinations of peas and oats was secured from a seeding of 90 pounds of peas and 70 pounds of oats.

In the test conducted with alfalfa and red clover, broadcasting the seed without a nurse crop has shown a distinct advantage over other methods of seeding. It has been shown that by proper methods of tillage satisfactory stands of alfalfa and sweet clover can be obtained from

seedings made as late as July. Seeding on the snow, or on honey-combed ground and in the fall gave poor results. The yields obtained from crops in the legume nursery were very good and comparisons are being made of the various legumes to determine those best suited to the locality. A grass nursery of 21 different grasses has been started.

The highest yield of sunflowers was obtained on plantings made April 27. The eighteen-inch spacing produced the largest tonnage. Corn yielded less than one-third as much as sunflowers for silage.

The Idaho Rural potato was the highest yielding of the late varieties. The Irish Cobbler was the largest yielding of the early varieties. Heavier seeding produced a greater total yield. Whole seed yielded more than cut seed. Selections have been made from Idaho Rural and other varieties to develop superior strains.

The use of gypsum on legumes increased the yield of perennial legumes by approximately 50 per cent. Lime increased the yields about one-half this amount and phosphate gave only slight increases. Sweet clover yielded 9,530 pounds per acre and wheat following sweet clover yielded 29.9 bushels.

A field day was held on the 23rd of June and approximately 100 farmers went over the plots and studied the experiments in the field.

## FINANCIAL STATEMENT

University of Idaho Agricultural Experiment Station in account with the  
United States Appropriations

DR.	HATCH'	ADAMS
To Balance from Appropriation 1921-1923 .....	None	None
Receipts from the Treasurer of the United States for the Year Ending June 30, 1923 .....	\$15,000.00	\$15,000.00
CR.	ABSTRACT	
By Salaries .....	1 \$11,473.98	\$11,320.58
By Labor .....	2 1,972.53	1,609.17
By Publications .....	3 190.26	
By Postage and Stationery .....	4 28.92	17.55
By Freight and Express .....	5 51.50	300.44
By Heat, Light, Water and Power .....	6 49.50	212.50
By Chemical and Laboratory Supplies .....	7 281.50	321.61
By Seeds, Plants and Sundry Supplies .....	8 212.39	109.45
By Fertilizers .....	9 90.00	
By Feeding Stuffs .....	10 56.20	128.75
By Library .....	11	
By Tools, Machinery and Appliances .....	12 53.42	231.45
By Furniture and Fixtures .....	13	
By Scientific Apparatus, Specimens .....	14 65.18	19.38
By Livestock .....	15	
By Traveling Expense .....	16 359.52	652.82
By Contingent Expenses .....	17	
By Buildings and Lands .....	18 115.10	76.30
<b>TOTALS</b> .....	<b>\$15,000.00</b>	<b>\$15,000.00</b>

### RECEIPTS ON LOCAL STATION FUND

January 1, 1923—December 31, 1923

SOURCE	AMOUNT
Balance on Hand January 1, 1923 .....	\$1,107.10
Receipts January 1, 1923—December 31, 1923 .....	2,137.54
Overdraft December 31, 1923 .....	255.80
Total .....	<hr/>
Expenditure January 1, 1923—December 31, 1923 .....	\$3,500.44
Balance December 31, 1923 .....	3,500.44

### RECEIPTS BY DEPARTMENTS

Interest on Deposits .....	\$ 146.65
Refunds on over payments .....	31.65
Agronomy Department—Sale of grain .....	37.89
Sale of equipment .....	125.00
Horticulture Department—Sale of orchard products .....	226.95
Sale of garden products .....	334.85
Poultry Department—Eggs .....	1,046.94
Livestock .....	187.61
Total .....	<hr/>
	\$2,137.54

## LOCAL STATION DISBURSEMENTS

ITEM	Adm	Agr. Chem'	Agron.	Dairy	Hort.	Plant Path.	Poultry	Bact.	Legum	Soil Survey	Total
Help.....	\$ 18.20	\$48.75	\$ 4.03		\$116.90	\$ 91.24	\$ 281.53				\$ 560.65
Travel.....	48.22		29.00		247.11	135.29	35.95	\$15.00		\$58.73	569.30
Printing.....	518.63					27.10					545.73
Library and Reference Books.....	2.00					4.46					6.46
Repair Equipment..	18.25			\$15.45	14.67	29.30	54.56				132.23
Equipment....		125.00				44.75	189.30				359.05
Supplies.....					193.85	9.50	953.28	3.80	\$5.75		1,166.18
Freight.....					91.78	6.25	45.06				143.09
Telephone and Telegraph... Registration Fees.....							1.50				1.50
							16.25				16.25
	\$605.30	\$48.75	\$158.03	\$15.45	\$664.31	\$347.89	\$1,577.43	\$18.80	\$5.75	\$58.73	\$3,500.44

## SUBSTATION FINANCIAL STATEMENT

Receipts Jan. 1, 1923—Dec. 31, 1923

	Aberdeen	Caldwell	High Altitude	Sandpoint
Sale of Livestock, hay, grain, potatoes, milk, etc. ....	\$979.98	\$558.75	\$381.74	\$1,840.20

## EXPENDITURES OF SUBSTATIONS

Jan. 1, 1923—Dec. 31, 1923

	Aberdeen	Caldwell	High Altitude	Sandpoint
Salaries .....	\$3,095.00	\$ 5,224.37	\$2,092.50	\$2,515.99
Labor .....	669.63	1,106.14	458.42	435.43
Expense and Supplies .....	1,887.44	2,700.13	936.18	2,279.75
Equipment .....	415.75	1,602.13	191.00	115.00
	\$6,067.82	\$10,632.77	\$3,678.10	\$5,346.17