UNIVERSITY OF IDAHO

AGRICULTURAL EXPERIMENT STATION

Work and Progress of the Agricultural Experiment Station for the Year Ended December 31, 1924

BULLETIN NO. 135 JANUARY, 1925

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UNIVERSITY OF IDAHO AGRICULTURAL EXPERIMENT STATION

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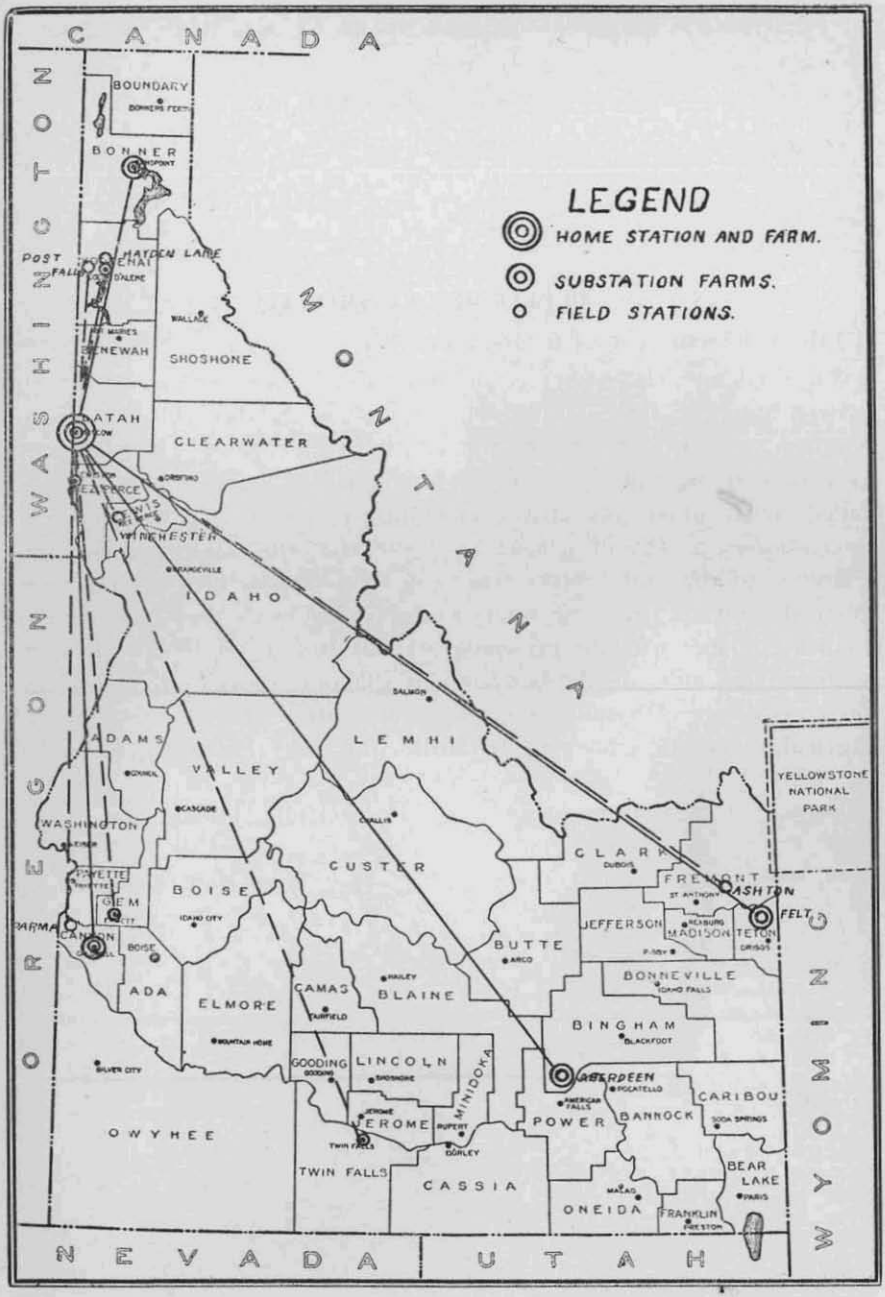
*In cooperation with U. S. Department of Agriculture.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LEGEND
HOME STATION AND FARM.
SUBSTATION FARMS.
FIELD STATIONS.

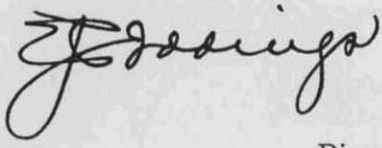
LETTER OF TRANSMITTAL

To the President of the University of Idaho:

The Federal Hatch Act establishing Experiment Stations and approved March 2, 1889, provides that it shall be the duty of each of said Stations annually, on or before the first day of February, to make to the Governor of the State or Territory in which it is located, a full and detailed report of its operations, including a statement of receipts and expenditures, a copy of which report shall be sent by each of said Stations, to the said Commissioner of Agriculture (now Secretary of Agriculture) and to the Secretary of the Treasury of the United States.

In accordance with the provisions of this Act, I am submitting herewith for transmittal to the Governor of Idaho a report of the work and progress of the Agricultural Experiment Station of the College of Agriculture of the University of Idaho, for the year ending December 31, 1924.

Respectfully submitted,



Director.

UNIVERSITY OF IDAHO
AGRICULTURAL EXPERIMENT STATION

REPORT OF THE DIRECTOR
FOR THE YEAR ENDED DECEMBER 31, 1924

The Idaho Agricultural Outlook

Farming is by far the most important economically and the most permanent of all the industries of Idaho. Approximately three-fifths of the State's total area is adapted to the production of various kinds of crops including forage for animals. This does not include the forest areas that now either are covered with merchantable timber or are adapted to the reproduction of trees.

The pioneer stage of acquiring natural resources free of charge, or at low cost, is past. A large part of the grazing areas is now in the forest reserves. The public domain, consisting of approximately five million acres, is not under central control or supervised, but those parts of that domain most easily secured by homestead or other method are being utilized for grazing. The non-irrigated lands that have annual precipitation sufficient for successful farming are nearly all in private ownership. Those lands easiest to reach with irrigation canals are now provided with permanent water rights.

The day of free or nearly free lands, therefore, is over. The development of the future, and there will be great development and progress in Idaho farming in the next few years, must come from applied technical knowledge and skill. The genius of trained engineers will be utilized in taking water to lands difficult of access and in providing storage facilities and water rotation schemes. The cut-over lands will be cleared and science will point the way to their most profitable utilization. Improved methods of farming, including the introduction of the keeping of animals and the development of rotations, will enable the farmers of the non-irrigated belts to attain a high degree of success in their operations. New crops and new methods will make possible a successful agriculture where great difficulty is now encountered in the attempt to operate at a profit.

New high yielding cereals and forage crops and improved methods in feeding and managing livestock and in protecting the crops and the farm animals from diseases and pests will help the farmer to increase his returns, reduce his losses and assure himself success in his farm opera-

tions. Improved machinery will permit greater efficiency and lower production costs. Wider and more accurate knowledge of the state's possibilities in the way of production and of the demand for our products, both from nearby regions and from distant lands, will enable us to adjust our farm practice to best fit the average market demand. Organized assemblage and distribution will aid in reducing overhead and in properly meeting the needs of consumers and contribute to the success of the individual farmer. Greater knowledge of science and of economic forces will enable the farmer to better meet the problems of modern farming and contribute to the development of a successful and permanent form of agriculture in Idaho.

It is the duty and function of the Agricultural Experiment Station to serve this new period in the progress of our farming when greatest success upon the farm undoubtedly will be closely correlated with greatest knowledge of the forces that control plant and animal development and have to do with the most successful disposal of the products of the farm. The Experiment Station is organized to secure new knowledge and make it available to the State.

Farmers Request Aid

The people of Idaho have indicated this year a greater dependence than ever before upon the Experiment Station and its staff members for advice and assistance in meeting their problems. One call came from the extreme southeast to aid in the determination of the feasibility of a proposed drainage project. It was necessary during the summer to send men to the Twin Falls area to determine the nature of a plant disease that was threatening the bean crop of that region, totalling approximately 40,000 acres. At the request of the United States Bureau of Reclamation the Station assisted in a study of the soil and water resources of the Owyhee Project. From every section of the state where potato growing is at all important came requests for information and advice with reference to the securing of proper seed and the control of potato diseases. Several problems of great importance in the progress of the dairy industry came to the attention of the dairy husbandry department during the year. In many other ways there are indications of the reliance of the farmers upon the Experiment Station for guidance.

Work Is State Wide

Attention again is called to the fact that the work of the Agricultural Experiment Station is organized to serve the entire state. Environmental conditions in Idaho vary so widely that regional substations are necessary if the research program is to be effective. The substation farms, four in

number, are well located with reference to regional problems to properly serve the state. These four farms are as follows:

Aberdeen Substation, at Aberdeen, 80 acres;
Caldwell Substation, at Caldwell, 320 acres;
High Altitude Substation, at Felt, 200 acres;
Sandpoint Substation, at Sandpoint, 170 acres.

It has been found advisable to have other points of contact with important agricultural problems through temporary field stations. The field station is located for convenience in solving one or more specific problems and easily may be transferred elsewhere as occasion demands. During the past year, field stations have been maintained as follows:

Entomological investigation, primarily with alfalfa weevil and the snowy tree cricket, at Parma;

Entomological investigations with the leaf roller at Emmett, Twin Falls, Post Falls and Lewiston;

Studies of tomato and vegetable production under irrigation and the investigation of tomato blight at Lewiston;

Experiments in control of potato diseases at Parma, Ashton, Aberdeen, Twin Falls, Winchester, Coeur d'Alene, Hayden Lake and Sandpoint;

Tests with orchard fertilizers at Coeur d'Alene and Lewiston;

Peat soil studies at various points in Bonner and Boundary counties;

Experiments with soil and crops for cut-over sections at Winchester.

Mailing List

The Station mailing list contains the following names:

Residents of Idaho	10,789
Residents of other states	3,540
Foreign	177
Total	14,506

Publications

The bulletins and circulars published during the year have been written in popular style and have been in much demand by the farmers. Investigations of a more fundamental nature have been reported in technical papers and published in various scientific journals. The list of publications follows:

Bulletins:

133. Work and Progress of the Agricultural Experiment Station for the Year Ended December 31, 1923, E. J. Iddings.

134. The Value of Certain Protein Feeds for Production of Quality in Eggs. Three Years Work 1920-1923, R. T. Parkhurst.

Circulars:

33 Miscellaneous soil samples—Their value, Ray E. Neidig and G. R. McDole.

34 Alfalfa Weevil and Its Control in Idaho, Claude Wakeland.

35 Federation Wheat, A. E. McClymonds and C. B. Ahlson.

36 Publications Available for Free Distribution, E. J. Iddings.

Research Papers:

25 Poultry Science, The Effect of Accessory Food Factors on Egg Production, R. T. Parkhurst and Ray E. Neidig.

26 Journal of Economic Entomology, Vol. XVII, No. 2, April, 1924, New Developments in Alfalfa Weevil Activity and Control, Claude Wakeland.

27 Phytopathology, Vol. XIV, August, 1924, Witches' Broom of Potatoes in the Northwest, Chas. W. Hungerford and B. F. Dana.

28 Soil Science, (accepted for publication) Alkali Studies I—Tolerance of Wheat for Alkali in Idaho Soil, Ray E. Neidig and H. P. Magnuson.

29 Soil Science, Vol. XVIII, No. 3, September, 1924, The Relation of Moisture and Available Nitrogen to the Yield and Protein Content of Wheat, Ray E. Neidig and R. S. Snyder.

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

Alkali Investigations:
1—Tolerance of crops for alkali.
2—Chemical aids to reclamation of alkali soil by drainage.
3—Drainage surveys.
4—Alkali survey.
5—Effect of alkali salts on bacteriological activities of soils. (In cooperation with Bacteriology.)

Chlorosis studies.

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 goitor.

The mineral content of sunflower ash.

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. (a) The effect of various feeds upon gains made and quality of pork produced. (b) The physiological effect of feeding rations restricted to Canadian field peas on growth and reproduction in swine.

In cooperation with Horticulture
Leaf roller control studies.

In cooperation with School of Forestry
Tolerance of trees for alkali.

Agricultural Engineering

The application of irriagtion water.

Investigation of the factors controlling the design of drainage systems for irrigated lands.

Duty of water.

Relation of dust to motor operation.

Agronomy

*Small-grain improvement. (In cooperation with the substations.) (a) Wheat, (b) Oats, (c) Barley, (d) Rye, emmer, flax and miscellaneous grains.

Forage investigations. (a) Grasses and legumes for hay and seed. (b) Cultural tests with alfalfa. (c) Orchard grass selection and improvement. *(d) Introduction and testing of miscellaneous forage crops. (e) Seed production.

Field and garden pea investigations. (a) Classification studies. (b) Cultural experiments. (c) Breeding and improvement.

Corn breeding and improvement. (a) Cultural experiments. (b) Breeding and improvement.

Weed eradication investigations.

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

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

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

Rotation and fertility investigation.

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

Animal Husbandry

Steer-feeding investigations at Caldwell.

Lamb-feeding investigations at Caldwell and Aberdeen.

Effect of various feeds on gains made and quality of pork produced.

Growing rations (winter) for ewe lambs.

Hogging off field crops.

The effect of Canadian field peas on the skeleton of swine.

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.

Surface tension and bacterial growth.

Dairy Husbandry

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

*Inbreeding and line breeding compared with outcrossing as regards their effects 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.)

Dairy farm management. (In cooperation with Caldwell Substation.) (a) To encourage the introduction of dairying as a type of farming for this area of the state. (b) To determine the 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 management.

Entomology

Alfalfa weevil: Study of climatic conditions affecting control; further experiments in control; breeding and liberation of 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 with 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.)

Forestry

Experimental tree planting.

Relative durability of Idaho woods.

Studies of farm woodlands.

Agricultural possibilities of logged-off lands.

Grazing studies.

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

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.)
The testing of new spray materials.
Cherry pollination studies.

**Plant Pathology*

Mosaic and leaf-roll of potatoes.
Soil moisture and soil temperature in relation to bunt infection.
Inoculated sulphur for potato scab control.
Comparison of various treating agents for grain smut control.
Potato seed treatment investigations.
Study of western tomato blight. (In cooperation with Horticulture.)
Bean disease investigations.
*Study of stripe rust of grains and grasses. (In coperation with the Office of Cereal Investigations, U. S. D. A.)
*Investigations of the eelworm of clover and alfalfa. (In cooperation with the Office of Cotton and Truck Crops Disease Investigations, U. S. D. A.)

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.
The value of certain vegetable protein feeds supplementing sour skimmilk in a ration for laying hens.
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.

Pure Seed

Seed analysis.
Seed certification.
Grain standardization.
Weed control.

**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 seeding 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, (c) Alfalfas and clovers.
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.
Lamb feeding investigations.

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."

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

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. (d) Rate of planting oats.

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. (c) Effect of sweet clover upon crop yields.

Horticultural investigations. (a) The introduction and testing of apples, pears, and plums and some 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.

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 and date of planting winter wheat and barley and spring wheat. (c) Rate of planting peas and oats. (d) Oat varieties for peat soils.

Forage crop invesitgations. (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 tests. (f) Vetch variety tests, (g) Grass seed production.

Silage crop investigations. (a) Rate and date of planting sunflowers. (b) Variety test of corn.

Root crop investigations. (a) Tuber-unit potato breeding. (b) Comparison of different selections of potatoes. (c) Variety test of potatoes. (d) Rate and date of planting potatoes. (e) Comparison of eye and stem end upon yield of potatoes. (f) Comparison of various root crops for forage and seed.

Soil investigations. (a) Use of legumes in building up soil fertility. (b) The value of lime, gypsum and phosphate as fertilizers. (c) Rotation experiment. (d) Effect of cultipacking upon yield of grains. (e) Effect of continued cropping upon the yield of spring wheat. (f) Effect of sweet clover upon nitrogen accumulation and crop yields.

Sheep management. (a) Cost of production.

Needs

If the Experiment Station is to best serve the state, it must have more money for publication, additional facilities in the way of land and buildings, and adequate technical help.

Because of lack of funds for publication, few bulletins and circulars have been issued during the past year. A number of departments have accumulated data that should be made to serve the farming interests. There are at the present either already written or in the process of preparation approximately 20 manuscripts intended for publication as bulletins, circulars or scientific papers.

There is popular demand for investigation in the field of agricultural economics. The farm management investigations have been exceedingly valuable in supplying information with reference to efficiency in farm operation and in furnishing facts to serve as a basis for changes and readjustments of farm practice. Work of this kind should be continued and new investigations initiated in the related fields of storage, distribution and other phases of farm marketing.

The land problem at the central station at Moscow is dealt with at length in the report for 1923. Suffice to say that the Experiment Station work is seriously handicapped because of the small amount of land available for field investigations. The lease on the Substation farm at Aberdeen expires in September, 1926. This branch experimental farm has

rendered great service to the irrigated sections of the state, and it is of the utmost importance that title be secured to the land. A plan to purchase on a ten-payment basis has been tentatively agreed upon with the owners of the property.

The lack of buildings for properly handling the work at Caldwell presents a serious problem in the operation of the Caldwell Substation. It is impossible, with the present facilities, to do some experimental work with dairy cattle that should be initiated at the earliest possible date. The recommendation for buildings includes a substantial but plain barn to be used for stabling the herd at milking time, an open shed for protecting cows and young stock during the winter and a milk house for handling the products of the dairy in a sanitary manner. Because of the shortage of funds and the lack of time to construct the plant, the egg-laying contest contemplated at Caldwell Substation this year has been postponed.

In former years livestock for feeding have been obtained by loan or partial purchase. This has been highly unsatisfactory and it is most urgently recommended that a fund be set aside for purchasing of animals for feeding, which could be made to serve as a revolving fund, in order that the Station may own and have full control of the animals from the initation of feeding operations to the final determination of slaughter data.

The success of investigational work depends largely upon the careful organization of the work and the accuracy of the staff with reference to matters of detail. Adequate technical help is, therefore, an important consideration.

The whole program of the past year has been carried on at very low cost and has been made efficient by the exercise of economies and by diligent and earnest effort on the part of members of the staff. Additional facilities mentioned as seriously needed will mean for a more effective experimental program and will contribute to increased success in farming and added wealth in the state.

Summary of Results of Investigations

The Agricultural Experiment Station, through the investigations of its staff members, has pointed the way to practices that have made farming more successful and profitable; it has developed and made more effective methods of warding off insect pests, plant diseases and other destructive agencies; it has raised the farmers' expectation of yields from crops and animals by the introduction of new varieties and new methods; it has served as a connecting link between the farmers of Idaho and the helpful agencies of modern science.

All of the Station work is organized on a project basis. Each investiga-

tion in progress at the present time is conducted according to a written plan, a copy of which is on file in the Director's office and copies provided for the use of those conducting the work. A list of projects is found in the earlier pages of this report. A summary of the work of the various departments and of the substation farms follows:

AGRICULTURAL CHEMISTRY

Tolerance of crops for alkali

Much progress has been made during the past year in securing data on the tolerance of crops for alkali. These studies have included wheat, alfalfa, corn, sweet clover, barley, oats and beans. The data on wheat already have been published, that on alfalfa, corn and sweet clover accepted for publication, and data are being assembled at the present time on barley and oats. Four crops of barley and four crops of oats have been grown and much interesting information is made available on the effect of alkali on succeeding crops. This is the first attempt to study the effect of alkali salts on more than two successive crops. Much of the tolerance studies now available deal only with one crop, or in a few instances with two crops. Idaho Station results indicate that more than two crops of any plant should be grown before definite conclusions can be drawn.

Due to the important part that beans play in the farming operations of south Idaho, they have been included in the tolerance studies. A report on beans will be available during the coming year.

Chemical aids to reclamation

Laboratory experiments have been conducted during the past year to determine the effect of various chemical treatments, when combined with drainage, to reclaim alkali lands, especially in those areas where sodium carbonate salts predominate.

Drainage surveys

Another feature of the alkali investigations consists of a study of the various drainage systems in different parts of the state to determine their relative effectiveness in removing alkali salts from saturated soils, or in preventing their accumulation. These studies are being carried on in cooperation with the United States Department of Agriculture and the following data will be collected on the chief types of drainage systems:

(1) Efficiency to relieve and prevent excess water.
(2) Efficiency to relieve and prevent excess alkali.
(3) Cost of installation and maintenance.
(4) Relation of water table to alkali accumulation.
(5) Methods of irrigation management.
(6) Extent and amount of influence of drainage on neighboring lands.

The intensive survey will be made on the Banida, Franklin County, drainage project, which was completed during the past year.

Data on efficiency of drainage projects also are being collected in the Caldwell, Boise and Payette valleys.

Alkali survey

New districts are being surveyed for alkali, noting the kinds and relative amounts present as well as conducting follow-up samplings over areas already examined to determine the increase or decrease of alkali salts. It is proposed to advocate preventative measures which will keep at a minimum the area of salted out lands.

Chlorosis studies

During the past year some intensive studies have been undertaken in an attempt to determine the cause of chlorosis of plants. Soils from the southern and southeastern parts of the state, showing chlorotic conditions of growing plants, have been analyzed in comparison with similar soils not showing chlorotic tendencies. Various soil treatments are being made to find remedial measures. Strawberry plants are used because of their susceptibility to chlorosis.

Sunflower investigations

Results have been completed and data submitted on the mineral composition of sunflowers when cut at different stages of growth under different systems of planting. Sunflowers draw heavily on the supply of plant foods in the soil, especially potassium. This accounts in part for the low yields usually obtained when sunflowers are followed by a cereal crop.

Slick spots in soils

The past year's work with slick spot soils has been confined mainly to field trials and observations using treatments and methods that appear to benefit these soils under greenhouse conditions. Because of the slow process of reclamation, no rapid improvement can be noted. There appears to be, however, a gradual improvement in these soils when properly treated. Even with chemical treatments and heavy subsoiling by blasting, time is the important factor necessary for complete reclamation.

Coniferous timber soil studies

This work has been continued thruout the year. Data are now available showing the effect of fertilizers with and without additions of lime. The crops so far grown show that nitrate is the only fertilizer that materially increases yields. Applications of well rotted manure did not show increased yields in any way comparable with the nitrate additions. Lime did not seem to be of material benefit in increasing yields. The work to

date shows little indication of ammonifying and nitrifying action of bacteria in the soil.

Since there appears to be a growth-retarding toxic material in this soil, an attempt was made to isolate and identify such substance. A resinous-like body was successfully isolated. This material, when added to a neutral salt solution, markedly depressed the growth of wheat seedlings. Ultimate analyses have been made on portions of the purified material and empirical formulas will be assigned to these substances. Bacteriological studies are under way in cooperation with the bacteriologist of the Station. These should throw additional light on the bacterial activities of this soil and their relation to crop growth.

Feeding experiments

The use of field peas in comparison with other rations for fattening hogs has been studied during the past year. The results indicate that there need be no fear of producing soft pork in feeding a ration consisting entirely of field peas. Work is under way to determine the effect on the skeletion of swine of feeding a ration consisting entirely of field peas.

Rotation experiments

Ten years' data have been collected on the yield and protein content of wheat when grown under different systems of crop rotation. The total and available nitrogen of the soil were determined in soil samples collected in 1920, and the total nitrogen determined on each soil in 1922. A report of progress will appear as a research publication. The work includes the following rotation systems: Continuous wheat; wheat, oats and peas; wheat, oats and corn; wheat, oats and potatoes; wheat, oats and fallow; wheat, barley, oats and corn; wheat, barley, oats and potatoes. The effect of manurial applications to each of these rotation systems also is included in the study. From this investigation it is hoped to discover the best rotation system for producing large returns in crops and for maintaining a high state of soil fertility. Both are essential to permanent agricultural practices. A report of the first ten years' results is now ready for publication.

Several projects that require considerable time from the chemist and his assistants are conducted in cooperation with other departments. Results secured in these cooperative investigations are briefly set forth elsewhere in this report.

AGRICULTURAL ENGINEERING

The members of the department of agricultural engineering gave some attention during the year to conveniences for the farm home, farm water supply and sanitation. It is anticipated that considerable demand again

will be found for this work with the improvement of the financial situation of the farmers.

Owyhee project studies

During the summer, the irrigationist gave largely of his time to investigation of the economic factors involved in the irrigation of the Owyhee Project. The Station cooperated in this endeavor with the United States Bureau of Reclamation. A series of articles dealing with water problems in a year of water shortage were prepared and given wide circulation, the recommendations in the articles being based upon previous investigations of the irrigationist.

Irrigation and drainage projects

Three general projects have been outlined dealing with irrigation and drainage problems. These are as follows: Application of irrigation water; an investigation of the factors controlling the design of drainage systems for irrigated lands; and duty of water.

During the summer of 1924 work was started on a study of the rate of influent seepage of water into soils. This is the first sub-project of the investigation dealing with the application of water. A study of the literature on the general subject of the movement of water in soils shows that very little work has been done, or at any rate very little published, on the rate at which water enters the soil. A great deal of work has been done on the rate at which water, both gravitational and capillary, moves thru the soil after it has penetrated the surface. The project as proposed will cover laboratory studies on the effect of such factors as texture, alkali content, condition of surface, moisture content and temperature of the soil, the depth of ground water, the proportion of soil surface covered and the depth of water. Field studies will include the slope of land, length of run and velocity of flow.

A new project on the depth of drains required in alkali lands is being started in cooperation with the department of agricultural chemistry and the division of agricultural engineering of the United States Department of Agriculture. Work will be started next season on a study of the proper time for irrigating such crops as sugar beets and field peas, in cooperation with the Aberdeen Substation.

Air cleaners for gas engines

A study of the efficiency of air cleaners on internal combustion engines has been started in cooperation with the department of mechanical engineering of the College of Engineering. This experiment is expected to yield valuable information on the effect of road and field dust under

Idaho conditions on the life and upkeep cost of tractor and automobile engines.

AGRONOMY

Climatic conditions and effects

The thirty year normal rainfall at Moscow for the first six months of the year is 12.35 inches. In 1924 only 7.36 inches fell during this period, leaving a deficiency of nearly 5 inches. This condition played an important part in crop production. Fall seeded grains which had secured a good start from the precipitation of the previous fall were least affected. The yields of all spring sown crops were greatly reduced because of the lack of sufficient moisture.

Forage crop seedings that ordinarily produced good stands when broadcasted in early spring and covered by harrowing failed to produce satisfactory stands. It was possible to secure good stands this year only by drilling and following with a roller or sub-surface packer. The yields of established stands of the various forage crops were much below normal and seed failed to set in sufficient quantities to harvest.

Yields of corn silage were below normal. On the other hand, the season seemed well adapted to the production of corn for grain. Seldom if ever has better ear corn been produced at Moscow.

Small grain investigations

Fall sown grains nearly always have produced higher yields than the same varieties spring sown. Of the winter wheats that have been grown for a period of seven years or more, Triplet, a soft red winter wheat, leads with an average yield of nearly sixty bushels. This variety is closely followed by Jenkin and Turkey.

During the past few years a number of new wheats have been introduced. Several of them are smut resistant. Two of the outstanding varieties in this smut resistant group are Ridit and White Odessa. These two varieties yielded at the rate of 52.8 and 60.3 bushels in 1924. Ridit already has been distributed by the Washington Experiment Station.

Mosida, the new variety introduced last year by the Idaho Station, produced very satisfactory yields in northern Idaho in 1924. In practically every case it outyielded the variety with which it was compared. It shattered slightly and is not resistant to bunt, altho it is less susceptible than many of the varieties now commonly grown.

The fact that bunt, or stinking smut of wheat, is an important factor affecting the yield of winter wheat was shown quite conclusively. Seed treatment reduced the percentage of smut in Triplet and Mosida wheat 63.4 per cent and 42.6 per cent and increased the yields 50 per cent and 30 per cent respectively.

Ten years tests of spring wheat show little to choose between Jenkin, Little Club, Baart and Bluestem. Of the newer introductions Red Bobs, a hard red spring variety, and Federation, a white wheat, have shown the most promise. These two wheats are high in yield for the years grown.

White winter has been the leading variety of barley for many years at the Idaho Station. When spring seeded this variety ranks third in yield, being outyielded by Trebi and Peruvian.

Idamine, Albion, Victory and Richland have been the outstanding oat varieties during the past five year period. This season a new introduction, Markton, a smut resistant variety, outyielded Idamine by nearly eighteen bushels. The new variety makes a good growth, has a stiff straw and appears to have possibilities of becoming our leading oat variety.

Forage crop investigations

Four years trial with strains of red clover from all parts of the United States and many foreign countries show Idaho grown-seed to be superior. While winter killing is not the most important factor in selecting red clover seed, the lower yields secured from foriegn seed justify the use of native Idaho grown seed on Idaho farms. Besides, there is always the danger with imported seed of securing infestations of new weed pests.

Drill calibration records have shown that the various sized pea varieties must be seeded at different rates, depending upon the size of the seed, if maximum yields are to be obtained. Too light seeding undoubtedly is one of the reasons why large seeded varieties of field peas have not given larger yields in northern Idaho. For the larger sorts the drill must be set at maximum capacity if sufficient seed is to be planted.

Sweet clover again demonstrated its ability as a desirable, drought resistant pasture crop for non-irrigated conditions. Not only did the two year old seedings survive and grow exceptionally well thru the dry season but also considerable pasturage was secured from an early spring seeding. In addition, satisfactory hay yields were secured from the two year old seedings.

Sunflowers produced satisfactory yields of silage considering the climatic conditions. An average yield of approximately twelve tons to the acre was obtained. It has been found, however, that sunflowers are a poor crop to precede fall sown wheat, probably due to the fact that they remove from the soil large amounts of plant food and moisture. Spring wheat after sunflowers produces on the average about thirty bushels to the acre.

Flax was tried for the first time at the Central station at Moscow. While the results were rather unsatisfactory because of poor stands, it seems

possible that fair seed yields may be obtained. The results of seeding flax in combination with wheat were unsatisfactory.

Weed eradication

Practically all of the experimental work on weed eradication has been devoted to control measures for bindweed or wild morning glory. At present, cultivation would seem to be the cheapest and most effective means of eradication. Experimental work with carbon bisulphide indicates that this chemical when properly applied will eradicate bindweed. However, the treatment will be too expensive except for small areas. "Sure Shot," a material prepared and guaranteed by the Weedicator Company of Los Angeles, was not effective in the control of bindweed.

Soil investigations

It has been demonstrated that the peat soils of northern Idaho need applications of both phosphorus and potash if maximum yields are to be obtained. The season of 1924 showed conclusively that head lettuce could be grown profitably upon these soils. Oats and wheat produced very good yields when properly fertilized.

The use of legumes, especially sweet clover, and manure, has been most effective in reclaiming alkali soils. The use of gypsum and blasting have not been as effective as was hoped.

Soil survey

Approximately fifty per cent of the Bancroft-Soda Springs soil survey had been completed when a request came from the Reclamation Service to assist in the survey of the Owyhee Project. The rest of the season was spent in mapping the soils of the Idaho portion of this project. Some assistance was given by the soil technologist toward the completion of the economic survey of the project.

ANIMAL HUSBANDRY

Animal feeding investigations

The experimental feeding plant maintained at Caldwell on the Caldwell Substation affords excellent facilities for feeding both steers and lambs and is near the sources of supply of feeder livestock.

The Station was fortunate in 1924 in being able to follow both the steers and the lambs, 50 head of steers and approximately 500 head of lambs, thru the market and obtain their shrinkage enroute and at market the influence of fill, and the selling and the slaughter data. The marketing information thus secured materially influences the interpretation of feed-lot gains and has been of great value in the extension program in beef, cattle and sheep husbandry.

A summary of the results of the steer and lamb feeding experiments completed in 1924 is found under Caldwell Substation.

Studies in swine nutrition

In a study of the influence of Canadian field peas on the quality of pork, thirty-two uniform, thrifty Duroc-Jersey fall pigs averaging 120 pounds were fed for 76 days as follows: Lot I, cracked peas; Lot II, cracked peas 3 parts, rolled barley 7 parts; Lot III, rolled barley 15, tankage 1; and Lot IV, cracked corn 9, tankage 1.

The gains made in all lots were quite uniform, about one and one-third pound ped day. The total feed required for 100 pounds of gain in the various lots was respectively as follows: 378.4; 410.9; 438.34 and 409.52. The dressing percentage of the different lots ranked as follows: Lot III, 79.1; Lot IV, 78.5; Lot II, 74.2; and Lot I, 74.0.

In a second phase of the experiment, forty four spring pigs averaging about 100 pounds were divided into four lots and fed as follows: Lot I, hogging off peas; Lot II, hogging off peas in addition a one per cent rolled barley ration; Lot III, alfalfa pasture and a four per cent ration of rolled barley, 15 parts and tankage 1 part, Lot IV, alfalfa forage and a four per cent ration of corn 12 parts and tankage 1 part. The daily gains in pounds were respectively as follows: 0.95; 1.07; 1.17 and 1.30.

Subsequent to the forage period the pigs were fed for thirty days the following rations in the dry lot: Lot I, cracked peas; Lot II, cracked peas 7 parts, rolled barley 2 parts; Lot III, rolled barley 14 parts, tankage 1 part, and Lot IV corn 10 parts, tankage 1 part. Daily gains were as follows: 1.49; 1.64; 2.02; and 2.01 on the following feed requirements for 100 pounds of gain: Lot I, 362.2; Lot II, 393.4; Lot III, 411.3 and Lot IV, 414.7.

The carcasses from all of the above hogs were carefully followed thru the curing process and melting points secured on the back and leaf fat and iodine values determined. The data obtained do not show any appreciable difference between the pork produced on the various rations. Peas may be fed with apparent safety.

An investigation of the physiological affect of feeding rations restricted to Canadian field peas on growth and reproduction of swine was undertaken with twelve purebred gilts averaging about 185 pounds. They were fed in three lots, of four each, as follows: Lot I, a grain mixture of peas 150 pounds, barley 100, oats 100, corn 100, wheat 100 and all the alfalfa meal they would consume; Lot II, a grain mixture of peas 100, barley 200 and alfalfa meal; Lot III, peas alone. During a period of 150 days, inclusive of the gestation period, the daily gains were slightly less in Lot III and there was a tendency in this lot toward occasional lack of appetite.

The litters farrowed by these gilts showed some variation in weight with the smallest average weight from the gilts of Lot III. No appreciable

variation was observed in Lots I and II in average weight and vigor of pigs. In Lot III the tendency toward somewhat less vigorous pigs seemed to prevail. Further study of this series will be made next year.

A study of the effect of field peas on the skeleton in swine is under way. Rations restricted to field peas are compared with rations made up from different sources and a mineral mixture for the purpose of determining the effect of peas on the skeleton.

BACTERIOLOGY

Northern Idaho soils

During the past three years a rather extensinve study has been made of the timbered soils of Northern Idaho. These soils are known to be unproductive for a considerable period after the timber is removed. A definite cause of the low yields from these soils has never been established. Bacteriological studies already completed have shown that nitrification does not proceed normally and in many cases entirely fails. This study has been continued to include the nitrogen fixing organism, B. azotobacter.

Progress made in study of timber soils

One hundred and six samples of timbered soils, covering a radius of approximately 20 miles, were collected aseptically and brought to the laboratory. These samples were then examined to determine the presence of the nitrogen fixing organism. The organism was present in but 24 of the 106 samples examined. These soils were divided into five classes grading from virgin timber to many years of cultivation. There seemed to be no correlation between cultivation and presence of the organism. Cultivation, which generally stimulates the development of the organism, did not increase its distribution in these soils. The samples collected under virgin timber were found to contain the organism in a slightly greater number of cases than the cultivated soils.

These soils were tested as to their ability to support the nitrogen fixing organism when innoculated. One hundred gram portions of each soil were weighed into wide mouth bottles and heavily inoculated. The moisture was then brought to optimum and the bottles incubated at 28 degrees Centigrade. The moisture lost by evaporation was regularly replaced each week for a period of two months. After that time the replacement of moisture was irregular, at times allowing the samples to dry out completely and then replacing the moisture at a later date. These samples were tested at intervals over a period of 18 months for the presence of the nitrogen fixing organism.

In all, sixty of the samples were tested as above described. The entire number supported the nitrogen fixing organism for a considerable period of time. All but fourteen of the sixty still had the organism after 15 to 18 months.

The hydrogen ion concentration of each of the 106 samples was determined by the electrometric method. The results of these tests were as follows:

Range of Acidity	Number	Number Having Azotobacter
Distinctly acid .....Ph. 5.1 to 6.0	3	1
Very slightly acid to neutral .....Ph. 6.1 to 7.0	16	2
Very slightly basic .....Ph. 7.1 to 8.0	35	9
Basic .....Ph. 8.1 to 9.2	27	10
Not yet determined	25	2

These results are quite striking in that they show the majority of these soils to be neutral to basic as determined by the hydrogen electrode. The more common acidity tests, such as the Truog and the Veatch tests, show these soils all to be acid. Here we find a discrepancy between the results obtained by these methods on the one hand and the hydrogen electrode on the other. Experiments have shown that these soils do not respond to applications of lime, which would uphold the validity of the electrometric method.

Effect of woods and tree products on nitrogen fixation

Sawdust, leaves and needles were collected from the trees common to the Idaho forests. These products were finely ground and tested as to their effect on nitrogen fixation in solution by B. Azotobacter. Each product was added to 100 cubic centimenter portions of Ashley's medium in 1, 2 and 3 gram amounts. The solution was then inoculated with the organism and analyzed after an incubation of two weeks. The gain in nitrogen, after deduction of the amount in the added product, represented that fixed by the organism. The products tested were the leaves, needles, and bark from ash, maple, cedar, larch, white pine, yellow pine, white fir and red fir.

Many of the products inhibited nitrogen fixation. In general the needles were more toxic than sawdust from the same tree. Cedar proved the most toxic, followed by the pines. These results with the nitrogen fixing organism indicate that tree products which litter the soil are toxic to the nitrogen fixing organism.

Effect of alkali salts on bacterial activities

A neutral silt loam soil was treated with various amounts of combinations of sodium carbonate, sodium chloride and sodium sulphate to determine the effect on ammonia formation from blood, nitrate formation from ammonium sulphate, and on the growth and yield of wheat. Samples of the treated soils were taken at regular intervals to determine the bacterial activities and total water soluable salts. The results are presented

in two periods, one representing the period the first crop was growing and the second the period of growth of the second crop.

There is a gradual decrease in total water soluble salt as time progresses after application of the salts.

Sodium carbonate stimulated the ammonification of blood and nitrification of ammonium sulphate but was decidedly toxic to plant growth in the first period. At the second period both ammonifications and nitrification were stimulated at all concentrations employed, while the crop yield showed stimulation only at the two lowest concentrations. No crop could be obtained at a concentration of .319 per cent of recoverable water soluble salt, while .202 per cent greatly reduced the yield.

Sodium chloride at the first period was toxic toward ammonification and slightly toxic toward nitrification. Only the highest concentration employed, .286 per cent, was toxic to plant growth. At the second period the salt was slightly toxic to ammonification and nitrification but stimulated plant growth.

Sodium sulphate at the first period was toxic toward ammonification but had little or no effect on nitrification or crop yield. At the second period it was slightly toxic to ammonification and nitrification but stimulated plant growth.

In the two salt combinations, at the first period there was toxicity toward ammonification in every case and toxicity to plant growth in all cases except two. There is in general a stimulation of nitrification. At the second period the toxicity to ammonification has decreased, nitrification in general is increased and the crop is greatly stimulated.

In three salt combinations at the first period all resulted in reduced ammonia formation, six combinations obviously decreased crop yield and the majority increased nitrification. At the second period ammonia formation was still decreased while nitrification was increased and crop yield was greatly stimulated.

Surface tension and bacterial growth

The study of the effect of tree products on nitrogen fixation in solution by B. Azotobacter led to a study of the effect of surface tension on bacterial growth. Azotobacter develops in a film on the surface of the medium and it was thought that any added substance which affected the surface tension of the solution might affect the growth of the organism.

Soaps were used as a means of depressing the surface tension. These soaps were prepared from castor oil, palmitic acid, olive oil and cocoanut oil. The fat was saponified by adding an alcoholic solution of sodium hydroxide in excess and boiling under a reflux condenser for several hours. The resultant mixture was neutralized with a solution of hydro-

chloric acid in absolute alcohol. By repeated concentration and dissolving in absolute alcohol a final product was obtained which, in each case, gave a clear solution when added to liquid culture media and did not change the hydrogen ion concentration. These depressants were prepared in 2 per cent solutions and added in that form to lower the surface tension. The "depressing efficiency" of these soaps varied considerably.

The four soaps were employed in order to avoid attributing to surface tension observed phenomena which were in reality due to toxicity of depressant. This precaution was justified because in every case some one soap proved toxic to the organism being studied.

Surface tension measurements were made by the method of Fahrenwald. It was found that this method gave results somewhat lower than the drop weight method, but compared more closely with the method of de 'Nuoy.

The soaps were added in small quantities to stock broth. Broth so treated varied in surface tension from 30 dynes to 49 dynes. Tubes so treated were inoculated with twenty-four hour culture of B. subtilis, B. anthrasis, Serratia marcesens, Pseudomonas aeroginasa, Eberthelli typhi and Staph. aureus and incubated at 28 degrees centigrade. Observations were made after 48 hours and after one week.

All the soaps except palmitic seemed somewhat toxic to both B. subtilis and B. anthrasis. Palmitic soap stimulated the growth of B. subtilis at 48 hours but this difference was not noted at the end of one week. Pseudomonas aeroginasa and Serratia marcesens developed heavier pellicules and deeper pigment formation in all tubes containing soaps. It was found on further experiment that this stimulation was due to the soap and could not be correlated with surface tension. Eberthelli typhi was apparently unaffected either by the soap or by the changes in surface tension. The soaps were toxic to Staph. aureus in the higher concentrations. All these tests failed to produce any change which could be ascribed to surface tension.

The surface tension of broth was varied from 37 to 49 dynes and the effect on the thermal death time of Eberthalli determined. The surface tension did not effect the thermal death time.

The surface tension of Ashby's medium was varied by soap additions and the effect of the surface tension change on nitrogen fixation determined. There was little difference between the treated and untreated flasks in so far as growth or nitrogen fixation was determined.

The above broth experiments were repeated using dextrose broth and inoculating the Strept. lactis. The very little effect noted could not be attributed to surface tension. An attempt was made to cultivate ana-

erobes in aerobic cultures by lowering the surface tension of the medium but all attempts resulted in failures. Thus far but one case of benefit from reduced surface tension has been observed and that will be reported at a later date.

Preparation and distribution of legume cultures

The department of bacteriology, during the past year, has prepared and distributed cultures for the inoculation of 12,255 acres of legumes. These cultures are prepared in solid media in bottles containing sufficient inoculum for three acres. They are sold to the farmer at 75 cents per bottle, which barely meets the cost of preparation. The 1924 season gave an approximate increase of 4000 acres over the 1923 season.

The most of culture sent out by the Station this year was for peas and alfalfa. Other crops, such as sweet clover, clover and beans, represented only a small percentage of the entire output.

Public health work

The department, as a courtesy to the state department of public health, takes care of the bacteriological analyses of all waters of questionable purity located in the northern part of the state. During the year, 143 samples of water were analyzed.

In addition to the water analysis, various specimens of public health nature are sent in for diagnosis. These are composed of diphtheria swabs, gonorrhea slides and blood tests for syphilis.

Miscellaneous work

Tests for contagious abortion of cattle were started at a charge of 10 cents for each test. This plan was carried out for a short time. Because of a desire to encourage the work, the charge was discontinued. During the past year approximately 150 such tests have been made.

One entire flock of about 400 birds was tested for bacillary white diarrhea of chickens. The agglutination test was employed. A very high percentage of the flock was found infected. This is the first extensive application of this test made at this Station.

DAIRY HUSBANDRY

High records made by Station cows

Official testing of the Station cows was continued the past year. Seven records of over (20,000) twenty thousand pounds of milk in a year and three of over (900) nine hundred pounds of butter were completed in the Holstein herd. The Holstein herd contains 22 females of milking age and of that number only 15 are old enough to have completed their second lactation period. The Holstein herd now contains ten cows with milk records ranging from 20,000 to 30,000 pounds, three cows with 1000

pound butter records, and six cows that have passed the mark of 900 pounds of butter in a year. The herd also contains five cows with records of over thirty pounds of butter in seven days.

The Jersey herd showed much improvement during the past year. Waikiki's Altamont Maid 481903 produced 14,882 pounds of milk and 671.22 pounds of fat at two years, ten months and twenty-seven days of age, thereby breaking the state record for milk and fat production for Jerseys and establishing a new world's record for milk production at that age for the Jersey breed. The second silver medal cow in the state was developed in the herd during 1924 and another record of 645 pounds of fat on a junior two year old deserves mention. The University of Idaho dairy herd now holds three out of seven of the class leaders for state agricultural college owned cows within the Holstein breed and two out of seven within the Jersey breed.

Official testing

The department of dairy husbandry is charged with the supervision of all official testing in this state. During the past year the following number of two-day tests were conducted: 32 Guernsey, 177 Holstein and 77 Jersey. In addition, 7 one and one-half day Guernsey tests were conducted, making a grand total of 293 supervision periods, or a decrease of 11 per cent as compared with the twelve-month period from December 1, 1922 to December 1, 1923. In addition to the above tests, 147 days were spent on short time official tests, making a total of 847.5 testing days conducted by representatives of the Experiment Station.

Breeding studies

The project on breeding studies with dairy cattle, comparing line breeding and out-crossing and inbreeding with outcrossing was continued and as the project is outlined for eight more years only a progress report can be given.

This project has been in progress four years and in the first section conducted with the Holstein herd has yielded 20 first generation female progeny and one second generation offspring. Some are in milk and detailed records are being kept. The Jersey herd is used to compare line breeding with outcrossing. Ten first generation females are now in the herd. Both sections of the experiment have been handicapped by the loss of bulls.

Study of growth of cattle

The project on growth studies of dairy cattle was summarized but the data are too limited to permit definite conclusions. The work will be continued. The results to date seem to indicate that the Holstein heifers in the Station herd are larger in both height and weight than the previous

published standards for normal growth. The figures for the Jersey breed do not indicate so much difference. The rate of growth of Holstein males is not great until about the fifth month and from then on the males continue to increase their rate of growth over the females.

Birth records

In studying the birth records of calves in the Station herd, the average gestation period was found to be 280 days. Male calves were carried in utero 2.4 days longer than females. The first gestation period appears to be shorter than the normal. The average weight of 13 Holstein bull calves in this herd is 103.8 pounds and 41 females averaged 93.3 pounds, making an average of 98.7 pounds for both sexes. In the Jersey herd 18 male calves averaged 64.3 pounds and 16 females averaged 54.2 pounds, making an average of 59.5 pounds for all calves of this breed. These are larger averages than shown in previously published data and the numbers in the case of the Holsteins would justify some definite conclusions. The data assembled indicate that Holstein calves weigh more in proportion to the weight of their dams than do Jerseys. The results on the Holstein breed seem to indicate that first lactation heifers have smaller calves than the normal for the herd.

Influence of pregnancy on weight

In summarizing the results pertaining to the influence of pregnancy upon the weight of dairy cows it was found that the Holsteins and Jerseys seemed to increase at about the same percentage over normal weight each month. Young Holstein cows increased slightly more than the mature ones. This is to be expected since they are still growing. The increase was much more rapid after the seventh month.

Leasing of bulls

The project of leasing bulls to bull associations has been tried out for two years with six bulls loaned to farmers for the purpose of making available more proven bulls and for improving Idaho dairy cattle. The results thus far are gratifying.

Sweet clover experiments

Sweet clover silage was compared with corn silage as a succulent feed for dairy cows. It is planned to check first year results by another trial. Not only is there a possibility of making available another desirable silage crop but the ensiling may prove to be the best way to utilize the sweet clover that has grown too rank for pasture.

An experiment is under way to determine the effect of sweet clover pasture and sweet clover silage, when fed to cows, on the flavor and quality of milk, cream, butter and cheese.

Overrun of ice cream

In studying the effect of neutralizer on the overrun (swell) of ice cream it was found that good quality, well flavored ice cream could be made from slightly acid products after the same were properly neutralized. In comparing calcium hydroxide and sodium hydroxide as neutralizers, it was found that the average loss in overrun caused by the calcium hydroxide was 16.9 per cent while the use of sodium hydroxide gave an average loss of 8.85 per cent. A loss in overrun must be expected, therefore, when a neutralizer is used and sodium hydroxide is superior to calcium hydroxide as a neutralizer for products used in ice cream manufacture.

ENTOMOLOGY

Alfalfa weevil investigations

Owing to seasonal variation, the alfalfa weevil (*Phytonomus posticus gyll.*) matured earlier in 1924 than it ordinarily does and injury from it was less pronounced. Experimental work this season indicated that a single spray application was sufficient to obtain satisfactory control. Investigations of this and former seasons established the fact that the alfalfa weevil may be economically controlled in south Idaho, by one spray application or by two, the number depending on the general climatic conditions of the season.

Dusting experiments this season indicated that where calcium arsenate was used with sulfur or Mab sand, results compared favorably with those obtained by spraying. The imported parasite (*Bathyplectis curculionis*) of the alfalfa weevil was about four times more numerous in southwest Idaho than in 1923, and in a few instances parasitism reached as high as 25 per cent.

It was concluded jointly with the state veterinarian, after an investigation of a reported case of arsenical poisoning of dairy cattle, that the cattle were made sick by a sudden change of feed from dry, old hay to partially cured, wet, new hay, and that sickness was aggravated to a minor extent by calcium arsenate on the hay. Hereafter in all spray recommendations growers will be cautioned not to feed sprayed hay until it is well cured and dry.

The clover weevil (*Hypera punctata*) was found to be doing serious injury to Ladina clover.

Colorado potato beetle control

The first outbreak of the Colorado potato beetle in commercial potato growing districts of south Idaho was discovered this season. The infestation was limited to a single field. By cooperation with the owner a vigorous campaign for eradication was conducted. The infested field was

sprayed, hand-picked and constantly patrolled during the growing season. It is believed that effective work was done toward the stamping out of the pest. This program should be followed up for one or two more seasons. Eradication is a problem of interest to the entire potato growing portion of south Idaho, and the individual cannot be expected to finance such an undertaking. Limited funds for entomological investigation handicap control efforts of this kind.

Life cycle studies of wire worms

Life cycle studies of the two most injurious species of false wireworms were completed during the season. This work has been in progress for three years and data have been collected on the life cycle and control of false wireworms (larvae of Eleodes beetles) to be published in bulletin form in 1925.

Experiments with fruit tree leaf roller

Experiments in the control of the fruit tree leaf roller (*Cacoecia argyrospilla* walk.) by spraying egg masses with miscible oil were continued. It has been found that the egg masses can be killed by using several of the commercial oil emulsions and home-made preparations. Of the commercial oils, best results were obtained with Dormoil. Best results with home-prepared mixtures were obtained with Diamond parafin potash fishoil soap oil emulsion. On the average, home-prepared emulsions gave better results than proprietary emulsions at a great reduction in cost. Satisfactory control may be obtained by use of several of these emulsions, but results vary in accordance with degree of thoroness of application, and favorable weather is necessary before effectiveness can be assured. Severe injury by some brands of oil was caused by a sudden drop in temperature immediately following application of oils.

Snowy tree cricket control

Good progress was made in the control in prune orchards of the snowy tree cricket (*Oecanthus niveus* Deg.) Effectiveness and cost of various strengths of calcium arsenate dust and lead arsenate spray were determined by conducting tests and keeping records on 70 acres of prunes. It was determined that almost complete eradication is secured from a single application of calcium arsenate dust or lead arsenate spray at a cost for poison materials of $3.00 to $6.00 per hundred trees. Studies also were conducted on the life history of the snowy tree cricket. Two other species of tree crickets were found in Idaho. On recommendations of the Idaho Experiment Station extensive spraying and dusting work was undertaken to control the snowy tree cricket in prune orchards this season, with results that were very satisfactory.

FARM MANAGEMENT

The farm management investigations closed out in 1923 yielded a mass of data that are being compiled and prepared for publication. This informatoin deals with farm organization and cost of production studies in both irrigated and non-irrigated sections. 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—Farm practice and farm organization, a bulletin written especially for popultr distribution.

FORESTRY

During the past year the school of forestry has carried on several projects which have a bearing on agriculture.

Experimental tree planting

Particular attention has been given to the question of trees suitable for woodlot planting at the higher altitudes. Black locust has been found to succeed well in commercial plantations up to altitudes of 4,000 feet, or even 4,500 feet in sheltered places. It also has been found that the merits of catalpa warrant its planting far more extensively than has been the practice. It cannot be recommended, however, for commercial planting in altitudes much above 3,000 feet.

Windbreak studies

A study of a typical farm woodlot indicates that after the first two or three years the woodlot begins to be useful as a windbreak, increasing in efficiency as it grows older. Catalpa makes a somewhat denser windbreak than black locust, but does not grow so rapidly in height. White ash makes about the same height growth as catalpa.

Farm woodlot studies

A farm woodlot study was conducted in the irrigated sections of south Idaho and the results obtained from a fourteen year old woodlot in the vicinity of Parma may be taken to represent the average of a score or more of woodlots of which the School of Forestry now has authentic records.

Yield and value of Black Locust and Hardy Catalpa in terms of posts, reduced to an acre basis:

Black Locust

	Posts per acre	Value per acre
First class	1,179 @ 40c	$471.60
Second class	785 @ 25c	196.25
Third class	654 @ 10c	65.40
Total	2,618	$733.25

Hardy Catalpa

	Posts per acre	Value per acre
First class	1,119 @ 40c	$447.60
Second class	1,159 @ 25c	289.50
Third class	908 @ 10c	90.80
Total	3,185	$827.90

It will be noted in the table that catalpa shows a higher present yield in the total number of posts than black locust. The difference is largely accounted for, however, in the fact that most of the cutting in the past has been done in the black locust block.

Preservative treatment of posts

Considerable work was done the past year on the preservative treatment of western red cedar fence posts with coal tar creosote, but the work has not yet progressed far enough to warrant the drawing of any conclusions. This project will be continued and it is hoped to obtain some results which may be distinctly valuable to the agricultural interests of the state.

Effect of alkali salts on durability of wood

This work, altho having only an indirect bearing on agriculture, indicates that in certain cases, at least, the average life of wood in contact with alkali soils of certain composition may be shorter than the average life of the same kind of wood in contact with ordinary soils.

Rate of growth of yellow pine

In north Idaho there are many farms having areas of considerable size covered with dense, fairly uniform stands of second growth western yellow pine. Very few of the local inhabitants realize the potential value of the young growth and often it even is considered a nuisance. In many cases it is doubtful whether agriculture can be made successful on these areas. The data secured in this project indicate that these stands of yellow pine are growing at a very rapid rate and that in many cases it may be profitable to hold and protect them for future supplies of fuel wood, fence posts and even lumber.

Grazing studies

Actual work on this project was again suspended on account of lack of funds. It is hoped that the work may be resumed the coming year.

HORTICULTURE

Apple breeding project

During the season of 1923, fruit was harvested from 1790 seedling trees as compared with 1363 in 1922. The new trees that have come into bearing have given a wider range of crosses and have made available for study considerable material markedly different from that studied in pre-

vious years. Most of the seedlings that came into bearing in former years had Ben Davis as one parent. In the 1922 annual report it was stated that when Ben Davis was one of the parents only two promising seedlings had been found out of over 800 trees. During the past two years the work has been centered on a study of the new seedlings which do not have Ben Davis as a parent.

Seedlings fruiting in 1922-23

Cross	Number bearing 1922	Number bearing 1923
Ben Davis x Jonathan	279	273
Jonathan x Ben Davis	453	605
Spitzenburg x Ben Davis	122	88
Ben Davis x Spitzenburg	87	38
Ben Davis x Wagener	32	88
Wagener x Ben Davis	242	243
Jonathan x Wagener	39	128
Wagener x Jonathan	91	165
Rome x Newtown	5	24
Wagener x Rome	2	26
Rome x Wagener	4	22
Rome x Spitzenburg	1	7
Jonathan x Spitzenburg	2	4
Spitzenburg x Jonathan		2
Delicious x Jonathan	2	2
Jonathan x Jonathan	1	1
Den Davis x Ben Davis	3	1
Ben Davis x Rome		6
Rome x Ben Davis	2	64
Ben Davis x Winesap	1	
Ben Davis x Newtown		9
Spitzenburg x Newtown		4
Wagener x Spitzenburg		4
Jonathan x Rome		1
Jonathan x Arkansas Black		3

Leaf roller

Work was continued on apple tree leaf roller control in the Lewiston and Post Falls districts. Previous studies with arsenicals gave contradictory results, hence were not included in the 1924 tests. Ten different combinations of oil sprays were tested out at both places. The efficiency of the various applications ranged from 92 to 100 per cent kill in the Lewiston district and from 69 to 91 per cent at Post Falls. Lime sulfur gave only 18.2 per cent kill. This difference in efficiency may be partly accounted for by the fact that at Post Falls there was a much heavier infestation and the applications were made between showers. The heavy wind also made it difficult to make a thoro application. At both places the applications were made at approximately the same stage of bud development, namely, when the buds were starting to open. The home mixed lubricating oil emulsion gave as good results as the proprietary brands.

Orchard fertilization

Experiments in orchard fertilization have been conducted during the past three years in the Moscow, Coeur d'Alene and Lewiston districts. Commercial fertilizers in various combinations have been tested, but thus far there has been no material increase in yield over the check plots. A general survey of the various fertilizer blocks show no difference in character of leaf, health and vigor of trees or color and size of fruit.

Testing the value of spreaders

Several commercial brands of spreaders have been carefully tested during the past three years and the results and observations show very little difference in efficiency between them. In a block of apple trees sprayed with arsenate of lead to which a spreader had been added for all sprays, the average of three years gave 8 per cent better control than in the check plot. Where a spreader was used in all sprays except the calyx spray, 4 per cent better control was secured.

Potato production

Several years of experimental work with different varieties of potatoes demonstrates that yields can be consistently maintained by the introduction of new seed. Notwithstanding the unfavorable weather of 1924, the yield for all varieties was fairly good. With 22 lots consisting of 12 different varieties, the yield ranged from 332 bushels to 100 bushels. Of the late varieties, the Idaho Rural has headed the list for the past two years, yielding in 1923, 234 bushels per acre and in 1924, 332 bushels. The Bliss Triumph has outyielded the other early varieties during this period.

Two years' data show that planting the seed during the month of May produced the highest yields, but the potatoes were rougher and not as true to type as those planted in June. July plantings were unsatisfactory as far as yield and size were concerned.

In the Palouse and other non-irrigated sections where certified seed potatoes are produced, the past few seasons have been unfavorable for the production of potatoes true to type. Heat, drought and other climatic factors seemed to effect type and approximately 75 per cent of the potatoes proposed for certification were not approved. Work was undertaken to determine whether these off-type potatoes were desirable for planting. One year's results are as follows:

Kind of seed planted	Yield per acre, bu.	Per cent marketable
Certified potatoes	236.09	88.76
Large potatoes, over 12 oz.	181.9	91.55
Small potatoes, under 2 oz.	246.7	77.7
Off-type potatoes	206.2	82.59

Vegetable seed production

Important data on this subject accumulated during the past six years are being compiled for publication. Results thus far indicate a field for seed raising in some sections of the state. The yields for most crops run above the average for the United States as a whole. By planting turnip seed in the fall and thinning the plants to 4 inches apart in the spring, an average yield of 1633 pounds of seed per acre has been secured as compared to 260 pounds for the United States.

Variety tests of head lettuce

Tests made of a large number of varieties of head lettuce show that the Tom Thumb, Mignonette, and May King are ready for use approximately fifteen days before the New York head, which is the leading commercial variety grown in the state. These varieties while small in size, are of excellent quality and are exceptionally fine for growing in the home garden. Mid season varieties showing up well are Salamander, Unrivalled, and Big Boston. A study of 12 different strains of New York Head showed little variation in germination, shape and trueness to type.

Fertilizer experiments conducted the past season indicate that liberal applications of phosphorus and potash will increase the yield of lettuce seed.

Tomato project

This experiment has been in progress for a period of 5 years in an attempt to find a better variety of tomato than the Earlianna for north Idaho conditions. A study also has been made of a large number of varieties as to their resistance to western tomato blight. Varieties which compare favorably with Earlianna in yield are Puget Sound Special, Atlantic Prize, June Pink, Dwarf Ponderosa, King of Earliest and Moore's Early. Of these varieties the Puget Sound Special has produced an average yield of 16811 pounds per acre.

There is no named variety which appears to be immune to western tomato blight. Out of approximately 90 varieties tested, the Dwarf Champion is apparently the most resistant. The Puget Sound Special and a few selections made by the Station also appear to be resistant.

Other investigations

The cherry pollination studies have been held in abeyance pending the coming into bearing of the station cherry orchard containing more varieties than can be found in some of the commercial orchards of the state. Growers now making new plantings are following the advice of the horticulturist relative to pollenizers.

The vegetable work receiving particular attention has been the growing

of special market garden crops under irrigation. The experimental work on pruning and training young trees is being continued and soon should yield some interesting results. The testing of new spray materials for the control of insect pests receives considerable attention each year. During the 1924 season a number of oil sprays were tested for the control of San Jose scale at Lewiston and in a number of cases 100 per cent kill was recorded.

PLANT PATHOLOGY

Plant pathology research work during 1924 was conducted on ten projects.

Mosaic and leaf-roll of potatoes

This investigation has been continued as a major project thruout the year. Especial attention has been given to three phases of the problem: Insect transmission studies carried on at Moscow and at Parma by means of insect-proof cages; studies on the relation of environment to the development and spread of these diseases; testing of various sprays and dusts for the control of insect vectors.

Results of cage experiment

Fifty cages were operated both at Moscow and at Parma. The following insects were tested to see if they were capable of transmitting mosaic: flea beetle, thirp, Colorado potato beetle, tarnish plant bug, apple leaf hopper, pink and green rose aphis, peach aphis, and false chinch bug. Negative results were secured with all of them except the pink and green rose aphis, *Macrosiphum solanifolii*. The tubers from plants grown under cages receiving various treatments will be grown next year under controlled conditions to learn if infection may have occurred which was not apparent this year.

The russet dwarf type of mosaic was studied in the cage experiment this year. This mosaic apparently is quite similar to the rugose type described by Schultz and Folson as occurring in Maine and has, under Idaho conditions, caused very rapid degeneration of apparently healthy stock in one season. Progeny from hills inoculated by means of aphids late in the season often are very much dwarfed, badly curled, and crinkled, and have both parenchyma and vascular necrosis to a very marked extent. The yield of diseased hills, the first year after infection, has been found to be about one-sixth of the yield of healthy hills.

Leaf roll, another one of the so-called "virus" diseases of potatoes, has been included in these investigations. It has been found that this disease also may be carried by the pink and green aphis. None of the other insects tested was found capable of transmitting it. The effect upon yield is about the same as with russet dwarf mosaic.

A disease called "witches broom" by the Station pathologist, has appeared in rather alarming amounts in some seed lots the last two years. There is some indication that this disease may belong to the virus group. Transmission by artificial methods has been attempted, but it is too early to draw any conclusions. A preliminary report upon this disease was published during the summer in cooperation with the Washington Agricultural Experiment Station.

Relation of environment to mosaic and leaf-roll

Isolated plantings of various lots of seed were made at Aberdeen, Ashton and Parma in southern Idaho, and at Winchester, Sandpoint and two locations near Coeur d'Alene in northern Idaho. Three varieties were used for this work: Netted Gem, Idaho Rural and Bliss Triumph. All lots were isolated at least one quarter of a mile from all other potato plantings and were carefully rogued thruout the season. All plants showing even slight symptoms of disease were removed.

Much interesting information has been secured during the last three years in connection with this series of tests. It has been found comparatively easy to keep either the Netted Gem or the Idaho Rural varieties free from mosaic by adequate isolation and by careful roguing. It is much more difficult, however, to keep the Bliss Triumph free from disease. This variety especially seems to be susceptible to the "witches broom" disease as well as to mosaic. All of the observations seem to indicate that the seed lots which are most free from this virus group of diseases are those which have been grown in isolated settlements for a number of years without chance for contamination from introduced seed stock.

Soil moisture and soil temperature in relation to bunt

Preliminary experiments have been started to test the influence of various types of soil upon bunt infection. This work will be carried on in cooperation with the soil technologist of the Station.

Inoculated sulphur for potato scab control

The results secured the last three years in the experiments with sulphur for the control of potato scab do not warrant recommending its use, at least without more evidence in its favor. Altho some control has been secured each year in the plots at Hayden Lake, control has not been absolute, nor have the results in every case been consistent. The experiments will be repeated again next year in the same locality. Potatoes also will be planted on the plots treated with inoculated sulphur in 1923 in order to ascertain if there is a residual action in the soil sufficient to control scab after two years.

Comparison of various grain smut treating agents

Extensive experiments have been conducted this year with both wheat and oats. Forty eight tests were made with various chemicals for bunt control in spring and fall planted wheat. Twenty six treatments were made for oat smut control. Various brands of copper carbonate, various concentrations of formaldehyde, bluestone and furfural, and various mercury compounds recently put out by commercial concerns were used in these trials.

In general, it has been found that in winter wheat three ounces of copper carbonate per bushel of wheat, containing at least 50 per cent metallic copper of standard fineness, has given as good control as the standard bluestone treatment. Two ounces of copper carbonate per bushel appear to be sufficient for spring sown wheat. These results have been confirmed by a large number of field tests on farms in Latah County carried on in cooperation with County Agent O. S. Fletcher.

Some of the organic mercury compounds appear to be promising. Of all of the treatments tested for oat smut control, only the dip and the spray formaldehyde methods gave satisfactory control.

Treatments for control of Rhizoctonia

The results obtained, this year, again show that presprinkling the seed potatoes before treating, greatly increased the efficiency of the treatments in nine cases out of twelve. By presprinkling is meant, a thorough wetting of each tuber in the lot to be treated, at least twenty-four, preferably forty-eight hours, before treating. During this interim, the potatoes are covered to keep them moist.

The best control was obtained with Dupont dust No. 15 applied at the rate of 3 ounces per bushel, to presprinkled seed. This chemical increased the percentage of clean tubers from 31.7 per cent average of two checks, to 90.3 per cent clean.

Furfural (1-60), Dupont dust No. 12, (.1666 per cent solution), semesan dust (3 ounces per bushel), semesan (.125 per cent solution) and copper carbonate dust, (3 ounces per bushel) all proved less efficient than corrosive sublimate (1-1000) presprinkled and formaldehyde (1-120, 55 degrees Centigrade, 4 minute immersion, presprinkled.)

Control of tomato blight

The tests of various varieties and selections and the study of the relation of cultural practicees to control of western yellow tomato blight have been continued again this year both at Moscow and at Lewiston. This disease was more severe in 1924 than it has been for years. Even the most resistant varieties and selections blighted severely.

The following table gives the percentage of blighted plants in several

promising selections at Lewiston this year in comparison with several lots of Dwarf Champion, a very resistant variety, secured from various seed companies. In all, 73 varieties and selections were tested. The range of percentage of all other tests is given for comparison.

Results of tests of various varieties and selections of tomatoes for resistance to western yellow tomato blight, Lewiston, 1924

Variety	Percentage blighted
Dwarf Champion, Burpee	58
Dwarf Champion, Inland	58
Dwarf Champion, Dreer	58
Dwarf Champion, Thorbur	50
Dwarf Champion, Wedge	38
Dwarf Champion, Livingston	74
R H $\frac{1}{7}$ —1	44
R H $\frac{7}{4}$ —1	42
R H $\frac{3}{1}$ —$\frac{1}{5}$	44
R H $\frac{3}{1}$ —$\frac{1}{2}$	44
R H $\frac{5}{2}$ —1	45
John Baer (Ave. of 5 tests)	82
Limits of percentages of all other tests	58—100

The John Baer variety was the one used as a basis for the selections listed above and is, therefore, included. As will be noted above, the resistance of these selections is twice as great as the commercial stock of the John Baer variety. Many of the diseased plants among the various selections were only slightly blighted and the effect upon the yield was not serious.

Bean disease investigations

Requests for aid in connection with bean disease epidemics have come this year from both Twin Falls County and Latah County, the two principal bean growing regions of the state. Investigation has shown that the losses in Twin Falls County were primarily due to the fungus disease known as dry root-rot of beans, caused by a species of Fusarium. Investigations have been initiated to determine the environmental factors which are responsible for the development of an epidemic of this disease and also to attempt to work out methods of control.

Bean mosaic has been appearing in increasing amounts in various parts of the state during the last few years. This disease caused very serious damage in Latah County this year and a preliminary survey was made of the county in cooperation with County Agent Fletcher to try to locate mosaic-free seed stock. The survey showed that the percentage of mosaic in various fields varied from 10 per cent to 100 per cent. The robust variety which has been found to be resistant to mosaic in the east

is being tried in several parts of Idaho. It has proven resistant to mosaic, but there is some question about its desirability on account of the fact that it is rather late in maturing.

Study of stripe rust of grains and grasses

Work has been conducted along three principal lines in the cooperative stripe rust investigation, namely, life history studies, host relationships and histological studies to determine, if possible, the nature of resistance to stripe rust. Progress has been made along each of these lines. Several new grass hosts for this rust have been found. The variety of rust specialized to wheat has been found on several varieties of barley and other barley varieties have been artificially inoculated. A large number of microscopic slides of infected resistant and susceptible hosts have been prepared for study.

The celworm disease of clover and alfalfa

A survey was made in Twin Falls and Canyon Counties for these diseases during the summer of 1924. In Twin Falls County, two fields were found infested with the alfalfa nematode, while 63.4 per cent of all clover fields surveyed were found infested with the clover nematode. It was estimated that the average stand in infested fields was 73.1-3 per cent while the average stand in healthy fields was 86 per cent.

Plant disease survey

Lack of funds and help made it impossible to make any extended survey for plant diseases. Three diseases new to the state have been reported during the year. Stem nematode of alfalfa was found near Twin Falls. Head smut was found on corn near Orofino, and stalk smut of rye was found near Sandpoint.

Surveys also were made for clover nematode in Canyon and Twin Falls Counties and for bean diseases in Twin Falls and Latah Counties.

POULTRY HUSBANDRY

Poultry breeding investigations

The number of birds in the breeding flock has been increased from 69 in 1922 to 121 in 1924. In 1921, 35 per cent of the birds in the breeding pens had laid over 200 eggs during their first year and none had laid over 250 eggs. In 1924, 56 per cent of the breeders had laid over 200 eggs and 9 per cent were above 250 eggs.

During 1923-1924, the characteristics were recorded of the eggs of 68 of these hens, observing in all 4897 eggs. In color, 17.3 per cent of the eggs were chalk white, 75.6 per cent slightly creamy, 7.1 per cent creamy and 0.1 per cent brown. In texture, 37. 6 per cent were O. K., 48.8 per cent rough, 13.6 per cent porous. In shape, 50.1 per cent were normal,

6.7 per cent round, 10.5 per cent slender and 33.7 per cent irregular. The average weight of the eggs was 59 grams or slightly over 2 ounces. The observation of characteristics of 1316 eggs, laid by 44 pullets in 1923-1924, gave an average egg weight of 54 grams. In color, 30.1 per cent were chalk white, 67.2 per cent were slightly creamy, 2.5 per cent were creamy and 0.2 per cent were brown. In texture, 59.4 per cent were O. K., 28.9 per cent were rough and 11.7 per cent were porous. In shape, 55.6 per cent were normal, 15.9 per cent round, 13.3 per cent slender and 15.2 per cent were irregular.

A statistical analysis was made of the pullets in the breeding experiment during 1923-1924. A positive correlation was found between the winter record and the November 1st to November 1st record of the first year. Birds that laid the largest number of eggs during the period from November 1st to March 1st laid the most eggs from November 1st to November 1st. A negative correlation was found between the number of days from the date of hatch to the day of the first egg, and the November 1st to November 1st egg record. The results indicated that the earlier the maturity, the higher was the yearly egg production. There was no significant correlation between the size of eggs laid and the number laid. One pullet laying large eggs may or may not lay more eggs than another pullet laying small eggs. The comparison showed that the large-sized birds laid larger eggs than the small birds.

Pullets entered at the Western Washington Egg-Laying Contest in competition with 120 other breeding establishments of the United States finished 26th. The five birds laid in 12 months respectively, 276, 234, 227, 212 and 212 eggs.

Progeny tests

The study of inheritance of winter egg production, egg characteristics and fertility and hatchability in the Single Comb White Leghorns has been continued this year into the fourth generation. Results are not yet sufficient to justify definite conclusions.

Poultry feeding investigations

The feeding investigational work during 1923-1924 has been confined to the study of the value of feeds high in vitamins, constituents of sour skimmilk and feed supplements to peameal in the rations of laying hens.

Value of feeds high in vitamins

There has been a heavy mortality in the pens in which no additional vitamin feeds were added to the basal ration. The basal ration consisted of wheat in the scratch feed. The dry mash consisted of bran, shorts, white cornmeal and ground oats. No green feed was given. The lowest

mortality in this comparison was in the pen getting cod liver oil at the rate of one pound of oil to forty five pounds of wheat. Under the conditions of this experiment, dry yeast proved of little value in increasing egg production, maintaining health or increasing fertility and hatchability. Next to cod liver oil, the orange juice pen gave the most favorable results indicating that vitamin C may play some part in maintaining the health of laying hens. The results so far show that the vitamins contained in cod liver oil, and possibly those contained in orange juice, are valuable in maintaining health when used with a ration low in animal protein and with one in which no green feed is given.

Source of value of sour skimmilk

An experiment was started in November, 1922, to determine the value of certain constituents of sour skimmilk. The results to November 1, 1924, show that milk curd or cottage cheese contains most of the valuable nutrients of sour skimmilk.

The lactic acid and milk salts from sour skimmilk did not increase production, aid in increasing size of eggs or in any other way indicate value for poultry feeding. Milk casein gave slightly better results than milk whey or protein-free sour skimmilk, but not as good as milk curd. As casein is the principal protein contained in sour skimmilk, there apparently are other substances supplementing casein in both milk curd and sour skimmilk that are valuable for egg production. The sour skimmilk has, so far, given higher production and greater profits than any of its constituents. The pen getting unlimited sour skimmilk laid 52.2 per cent production for the year. The pullets in this pen averaged 191 eggs each, made a profit over feed cost of $2.79 each and produced eggs at 11 cents per dozen, and only 14.4 ounces per dozen in weight.

Meatmeal and meatscraps

Fifty per cent protein meatscraps consistently gave better production and greater profit over feed cost than did the 60 per cent meatmeal. Both feeds gave about the same size of eggs.

Peameal and mineral mixture

A 4 per cent mineral mixture, supplementing a 40 per cent peameal mash, did not give as good results as rations in which the mash contained 20 per cent peameal and 20 per cent meatmeal or meatscrap. A mineral mixture may be of material value in maintaining the health of laying hens, but does not supplement peameal in such a way as to make it equal the value of meatmeal or meatscraps in the ration.

Other supplements to peameal

Sour skimmilk in unlimited quantities proved for the fourth year the most valuable supplement to peameal. When 10 per cent of the peameal was replaced by 10 per cent of meatmeal, the production and profit over feed cost were both lower. Semi-solid buttermilk did not prove as valuable as sour skimmilk, but gave slightly better results with peameal than did meatmeal or meatscraps.

The following table shows the results of the fourteen rations for laying hens for 1923-1924.

SUMMARY OF AVERAGES OF FEEDING EXPERIMENT 1923-1924

	No. 1 Check pen	No. 2 Codliver oil pen	No. 3 Orange juice pen	No. 4 Dry yeast pen	No. 5 Peameal meatmeal pen	No. 6 Peameal meatscrap pen	No. 7 Peameal min.-mix. pen	No. 8 Peameal S. S. B. M. pen	No. 9 Peameal meatmeal S.S.M. pen	No. 10 Peameal sour skim-milk pen	No. 11 Sour skim-milk pen	No. 12 Protein-free S. skimmilk pen	No. 13 Milk curd pen	No. 14 Milk casein pen
No. pullets per pen	17.1	24.5	22.4	19.7	24.3	24.0	25.0	23.4	23.0	24.5	23.0	22.5	24.9	23.5
Per cent production	15.6	17.3	18.6	15.9	33.3	38.0	27.5	38.4	50.7	52.3	42.2	38.1	51.7	41.6
Eggs per pullet	57.0	63.0	68.0	58.0	122.0	139.0	101.0	140.0	185.0	191.0	191.0	139.0	189.0	152.0
Income per pullet	1.43	1.42	1.59	1.32	2.82	3.20	2.30	3.34	4.60	4.53	4.62	3.28	4.57	3.46
Profit over feed cost	.43	.21	–2.57	.02	1.47	1.74	1.01	1.87	2.68	2.53	2.80	1.67	2.61	1.07
Feed cost per pullet	1.00	1.21	4.16	1.30	1.35	1.46	1.29	1.47	1.92	2.00	1.82	1.61	1.96	2.39
Average feed cost per dozen eggs	.21	.23	.73	.27	.13	.12	.15	.13	.12	.13	.11	.14	.12	.19
Grain consumed	38.6	33.1	32.70	37.5	33.6	39.3	38.2	24.2	40.9	39.0	39.9	39.7	39.1	40.30
Mash consumed	15.8	21.5	22.30	18.4	17.7	19.89	18.8	21.9	13.1	18.0	15.8	20.9	23.2	18.20
Milk consumed	——	——	——	——	——	——	——	3.04	154.2	157.0	156.0	152.0	22.0	3.30
Shell consumed	1.08	1.13	1.19	.98	1.59	1.50	1.40	1.96	2.63	2.62	3.19	1.87	2.79	2.30
Grit consumed	.74	.59	.78	1.32	1.18	.76	.94	1.09	1.30	1.06	.76	.66	1.06	.61
Per cent of all eggs produced:														
Weighing—22 ozs.	50.7	45.0	47.50	51.5	28.2	27.5	36.1	32.5	16.7	16.4	14.4	34.50	22.5	36.60
Weighing—22-24 ozs.	35.6	33.9	33.00	38.1	41.9	41.8	43.2	35.4	40.6	36.6	35.6	41.20	41.6	38.50
Weighing—24-28 ozs.	14.7	21.1	19.50	10.4	29.9	30.7	20.7	32.1	43.7	50.0	50.0	24.30	35.9	26.90

Abbreviations:
S.S.B.M. for semi-solid buttermilk.
Min. Mix. for mineral mixture.
S.S.M. for sour skimmilk.
S. for sour.

The feeding work of the three years, 1920-1923, was published as Station Bulletin No. 134.

Investigations for 1924-1925

A new pen has been started in which beanmeal, made by grinding cull beans, is used. The beanmeal makes up 20 per cent of the dry mash and unlimited sour skimmilk is given. Another new pen has 20 per cent peameal in a dry mash and unlimited milk whey. Further work is being done to determine the value of feeds of high vitamin content and different milk constituents in the rations for laying hens.

PURE SEED

The pure seed law enacted by the legislative session of 1912 provides for inspection, analysis and tagging of seeds offered for sale in Idaho and provides for a means of determining the quality of seeds produced within the state. Since activities aimed at seed improvement are almost entirely educational in nature, the administration of the act is entrusted to the Agricultural Experiment Station.

Quality of seed improves

Fewer samples of small seed were received for purity analysis this year than in the past five years but germination requests have increased.

Year	Purity Tests	Germination	Total
1922	2,229	248	2,477
1923	2,046	224	2,270
1924	1,881	443	2,324

The reasons for the decreases are due chiefly to three commercial causes, namely, keen competitive buying on account of general seed crop shortage thruout the world, the shipping of seed out of the state in the dirt and the better quality of seed grown.

The last of the reasons assigned is backed by the opinions of the most careful buyers and by laboratory records. The drouth the past season checked the rank growth and maturity of troublesome weeds and in addition the growers generally practiced great vigilance in watching the small seed fields for weeds, especially those bearing seeds inseparable in the commercial product.

Further evidence of higher quality of Idaho seeds grown in 1924 is indicated in the report of the seed analyst. This shows that only 12.5 per cent of the samples analyzed were condemned on account of noxious weeds. The decrease in per cent of samples condemned on this account since 1920 is shown by the following data:

Year	Per cent condemned
1920	54
1921	46
1922	26
1923	20.5
1924	12.5

Grain standardization and certification

Ten hundred fifty acres of grain representing 7 growers were inspected for certification. Federation wheat is becoming more popular, especially in Bingham, Cassia and the southwestern Idaho counties. Mosida wheat shows promise of becoming a standard variety for certain sections in Idaho.

Certified seed is sealed and tagged upon request. Practically all growers have submitted their final recleaned samples for inspection. These will be exhibited at the Idaho State Show, February 3-6, 1925.

Weed control

Six counties in the state this year declared weed districts. Six weed commissioners were hired during the summer months to superintend the destruction of the most noxious weeds. Educational campaigns were continued for the destruction of those weeds detrimental to the production of high quality seed.

Tests were conducted by most of the county agents on the destruction of weeds by such chemicals as sodium arsenite, carbon bisulphide and "Sure Shot." Applications of sodium arsenite followed by cultivation seems to be effective in killing weeds with underground rootstalks. Carbon bisulphide is partially effective in killing such weeds. High cost makes it impractical to use "Sure Shot," a commercial preparation.

Seed certification

The Idaho Grimm Alfalfa Seed Growers Association, consisting of 225 members, has a total of approximately 5000 acres of Grimm Alfalfa. This acreage was chcecked this year and certificates given. In addition, the following acreage represents growers not members of the association.

Year	Growers	Acreage
1922	48	1,191.5
1923	119	3,686.5
1924	233	7,546

The state's total acreage of genuine Grimm alfalfa is 12,546. Three hundred twenty-seven and one-half acres of Cossack alfalfa are covered by certificates. All seed eligible for certification must be sealed at the machine. The sealing was done by committees and re-sealed at the cleaning plants by deputies. At the machine all re-cleaned Grimm is tagged with uniform blue, red or yellow tags, depending on quality, and marketed

as Idaho grown Grimm alfalfa. Approximately 2,000,000 pounds of Grimm alfalfa were sealed for final sale.

Value of pure seed work

The various pure seed activities are as follows:

1. Protection of farmers against the dealer who offers low quality seed.
2. Protection of the Idaho dealer against the outside dealer shipping low grade seed.
3. Maintenance of a seed laboratory where the farmer, as well as the dealer, may have:
   (a) Assistance in selecting good quality seed.
   (b) Identification of weeds and weed seeds.
   (c) Samples tested for purity and grades.
4. Certification of seed for farmers to meet the demands of eastern buyers for a certified product.
5. Information service for growers on market demands and on control measures for noxious weeds.

ZOOLOGY

The studies on spermatogenesis, oogenesis, and se-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.

ABERDEEN SUBSTATION

Work with cereals

The Aberdeen Substation primarily is a cereal station and is operated in cooperation with the cereal office of the U. S. Department of Agriculture. This experimental farm is one of a few in the United States where the new importations of wheat, oats and barley are sent for first trials. A representative of the cereal office is at the Substation each year from April to October, devoting his entire time to the breeding of cereal plants. Seven hundred fifty varieties of barley, 350 varieties of wheat and 400 varieties of oats were grown in the cereal nursery the past year. These are grown in five foot and rod rows as well as in the plots and general fields. A large number of crosses were made and grown during 1924. These are closely observed and tried out for their economic value.

The Trebi barley, Idamine oats and Federation wheat were first grown in the Aberdeen Substation experimental plots. They were developed at Aberdeen and distributed to the farmers over the state. Other wheats and oats are being tested that show promise of being of even greater commercial value than those mentioned. The varieties of wheat, oats and barley have all been head selected and pure lines have been isolated and increased for distribution to the farmers thruout the state.

Pea investigations

Experiments are conducted with field and garden peas. The Everbearing garden pea was developed on the Aberdeen Substation and it is one of the best market garden peas. This pea combines high yield with exceptional flavor and it is growing in popularity wherever it has been tried.

Clover and Corn

A new strain of red clover is being developed that shows exceptional forage qualities combined with seed yielding ability.

A strain of Rustlers White Dent is being grown and distributed from the Substaton to the farmers of the upper Snake River valley. This corn is a very early maturing variety and yields well.

Seed production

Alfalfa seed production studies are under way having to do with cultural methods for seed production, and irrigation experiments to determine the exact stage of the plant when water can be applied to the best advantage for seed production. Investigations also are carried on in clover seed production and potato seed growing.

Pure seed distribution

Trebi barley is being improved and increased on the Substation farm for distribution thruout the state. Idamine and Victory oats are being distributed for commercial purposes. In 1923 Federation wheat was distributed to 14 counties of the state.

McAdoo field peas and Everbearing garden peas have been given wide distribution during the past few years. Rustlers White Dent corn is being supplied to farmers who are growing it successfully. Flax has been distributed and grown successfully in the upper Snake River valley and the Substation is the source of potato seed for a large number of growers.

Rotations

A study is under way dealing with various systems of crop rotation for the Snake River valley region. The various legumes are under trial as to their effect on the following crop. Alfalfa, clover, peas and sweet clover are being tested to see which is the best legume to grow for desirable effect on the following crops. Rotation experiments require a period of years for securing reliable results. The time and cost, however, are usually well justified by the new and valuable agricultural knowledge yielded by these lines of work.

Substation is source of knowledge

The Aberdeen Substation conducts a large amount of investigational work on the various problems of irrigated crop farming. Some of the experiments are intensely practical, returning results that immediately

can be applied to the farm. Other investigations deal with scientific problems of fundamental importance to agriculture and of value to the student and research worker, but not of immediate concern to the farmer. The development of new seeds and their distribution to the farming regions and new information with reference to the growing of crops and handling of soils have been of great value to the irrigated sections of Idaho. The strictly scientific investigations deal largely with plant breeding and study of plant characteristics and plant behavior. This work, too, has in the long run great economic importance in crop production.

Federal cooperation has high value

The cooperation given by the United States Department of Agriculture is of great value to the Substation and thru it helps the farmers of Idaho. Aberdeen is the port of entry for Idaho for new and better varieties brought to the United States. The Substation tests soon reveal whether the new strains of plants should have any place in the agriculture of Idaho.

CALDWELL SUBSTATION

Experiments in soil improvement, breeding and feeding tests with a high grade herd of dairy cattle, pure bred sheep for cleaning up the ditch banks and testing of Idaho grown feeds in various combinations for fleshing steers and lambs for market have constituted the program at the Caldwell Substation.

Soil improvement

The corrective treatments for "slick spots," carried on with the assistance of the Station chemist and Station soil technologist, are proving effective in increasing the productivity of the soil of the Substation. Results from applying gypsum and sulphur are not definite enough to justify final conclusions. The large amount of manure available in the steer and lamb feeding lots makes possible the annual covering of a large portion of the farm with reasonably well decomposed animal manure. The general application of this manure to the fields and heavy treatments of "slick spots" have resulted in a gradual increase in yield of all crops grown on the Substation.

Feeding investigations

The plant for Idaho animal feeding investigations is at the Caldwell Substation. The steer and lamb feeding experiments are conducted as a cooperative enterprise of the department of animal husbandry and the Substation. A brief summary is presented of the results of steer and lamb feeding investigations completed in 1924.

Steer feeding

Fifty head of two year old steers were fed in five lots of ten each

various rations based upon alfalfa hay as follows: Lot I, alfalfa hay (cut) and barley; Lot II, alfalfa hay and barley; Lot III, alfalfa hay and corn; Lot IV, alfalfa hay and corn silage; and Lot V, alfalfa hay, corn silage and barley. All grain was ground. The various lots of steers averaged 894 to 900 pounds at the beginning of the experiment. The experiment lasted 150 days, from November 27, 1923 to April 25, 1924.

Lot I was fed 20.70 pounds of alfalfa hay and 9.7 pounds of barley per head daily, gaining 1.896 pounds daily. For each 100 pounds gain 1093.61 pounds of hay and 511.45 pounds of barley were required. The daily hay waste amounted to 1.29 pounds, or 6.23 per cent.

Lot II was fed 23.80 pounds of alfalfa hay and 9.7 pounds of barley per head daily, gaining 1.793 pounds daily. For each 100 pounds gain, 1324.7 pounds of hay and 540.96 pounds of barley were required. The daily hay waste amounted to 4.82 pounds, or 20.31 per cent.

Lot III was fed 24.30 pounds of alfalfa hay and 9.7 pounds of corn per head daily, gaining 1.849 pounds daily. For each 100 pounds gain, 1313.67 pounds of hay and 524.57 pounds of corn were required. The daily hay waste amounted to 4.11 pounds, or 16.91 per cent.

Lot IV was fed 23.4 pounds of alfalfa hay and 22.5 pounds of corn silage per head daily, gaining 1.457 pounds daily. For each 100 pounds gain, 1608.88 pounds of hay and 1543.44 pounds of silage were required. The daily hay waste amounted to 5.08 pounds or 21.61 per cent.

Lot V was fed 19.8 pounds of alfalfa hay, 14.3 pounds of corn silage and 9.2 pounds of barley per head daily, gaining 2.1115 pounds daily. For each 100 pounds gain 936.68 pounds of hay, 677.96 pounds of silage and 429.04 pounds of barley were required. The daily hay waste amounted to 4.76 pounds or 24 per cent.

The cost of 100 pounds gain ranked as follows: Lot V $10.92; Lot IV $11.06; Lot I $11.61; Lot II $11.79; Lot III $12.86.

The condition of the steers is shown by the selling price at Salt Lake. They sold as follows: Lot I, II, III and V sold for $8.30 and Lot IV sold for $7.65 per 100 pounds.

The profit per steer ranked as follows: Lot II $6.12; Lot I $5.78; Lot V $3.77; Lot III $2.54; Lot IV $1.18.

Lamb feeding

Five hundred lambs were fed in seven lots of approximately 70 lambs per lot on rations as follows: Lot I, alfalfa hay, barley and corn silage (average 2 pounds); Lot II, alfalfa hay, barley, corn silage (average 1 pound); Lot III, alfalfa hay and corn; Lot IV, alfalfa hay and wheat, 3 parts and oats 1 part; Lot V, alfalfa hay (limited waste) and barley; Lot VI, alfalfa hay (cut) and barley; and Lot VII, alfalfa hay and barley.

The various lots of lambs averaged about 60 pounds at the beginning

of the experiment, which lasted 100 days, from November 27, 1923 to March 6, 1924.

Lot I was fed 3.53 pounds of alfalfa hay, 0.75 pounds of barley and 1.76 pounds of corn silage per lamb per day, gaining 0.30 pounds daily. For each 100 pounds gain, 1162.6 pounds of hay, 245.6 pounds of barley and 580.7 pounds of silage were required. The waste hay amounted to 1.48 pounds or 41.93 per cent.

Lot II was fed 3.92 pounds of alfalfa hay, 0.75 pounds of barley and 1.00 pounds of corn silage per lamb daily, gaining 0.32 pounds daily. For each 100 pounds gain 1220.9 pounds of hay, 236.8 pounds of barley and 314.2 pounds of corn silage were required. The waste hay amounted to 1.64 pounds, or 41.84 per cent.

Lot III was fed 4.01 pounds of alfalfa hay and 0.75 pounds of shelled corn per lamb daily, gaining 0.30 pounds daily. For each 100 pounds gain 1297.7 pounds of hay and 243.3 pounds of corn were required. The waste hay amounted to 1.51 pounds, or 37.66 per cent.

Lot IV was fed 4.29 pounds of alfalfa hay and 0.76 pounds of wheat (wheat 3 parts and oats 1 part) per lamb daily, gaining 0.29 pounds daily. For each 100 pounds of gain 1496.7 pounds of hay and 266.4 pounds of wheat were required. The waste hay amounted to 1.22 pounds, or 28.44 per cent.

Lot V was fed 3.57 pounds of alfalfa hay and 0.75 pounds of barley per lamb daily, gaining 0.29 pounds daily. For each 100 pounds gain 1224.8 pounds of hay and 258.2 pounds of barley were required. The waste hay amounted to 0.70 pounds, or 19.41 per cent.

Lot VI was fed 3.07 pounds of alfalfa hay (cut) and 0.75 pounds of barley per lamb per day, gaining 0.29 pounds daily. For each 100 pounds gain 1040.6 pounds of hay and 255.5 pounds of barley were required. The waste hay amounted to 0.90 pounds, or 29.32 per cent.

Lot VII was fed 3.88 pounds of alfalfa hay and 0.76 pounds of barley per lamb daily, gaining 0.29 pounds daily. For each 100 pounds gain 1317.8 pounds of hay and 260.8 pounds of barley were required. The waste hay amounted to 1.56 pounds, or 40.21 per cent.

The cost of 100 pounds gain ranked as follows: Lot V $7.52; Lot VI $8.08; Lot VII $8.15; Lot III $8.37; Lot II $8.44; Lot I $9.12 and Lot IV $9.12.

All lambs were sold on the Chicago market with an average profit of $2.85 per lamb.

HIGH ALTITUDE SUBSTATION

Rate, date and depth of seeding winter wheat

This year marked the completion of five years' work on some of the projects of the High Altitude Substation. The rate, date and depth of

seeding winter wheat project was discontinued at the end of 1924 with four years' data now available. The results have been quite uniform thruout the four years, showing very conclusively that September 1 is the best date to seed winter wheat in the upper Snake River high altitude country. Several farmers in the vicinity of the Substation already are taking advantage of the data obtained and are planting their winter wheat about the first of September. A bulletin reporting this work will be published this winter.

Cultural practices

Winter wheat on summer fallow produced double the amount of grain as compared with wheat following wheat on late fall plowed land. Wheat stubbled in yielded less than half that of late fall plowed land planted the same date.

There was very little difference this season in the yield of winter wheat on land plowed May 15, June 15 and July 15. There was a noticeable difference, however, in the yield of the plots receiving the better cultivation of the summer fallow over those receiving medium or no cultivation. The extra yield of grain on the good fallow for each date of plowing has paid good wages for the extra labor involved in keeping up the fallow.

Field peas

In the variety tests with peas, the Bliss Everbearing, a garden pea, has outyielded all the field peas in the test. The McAdoo and Wellwood were the best yielders of the field peas.

Spring wheats

In the spring wheat test for the past three seasons, Bluestem, Dicklow, Little Club and Marquis have yielded the highest. Federation 3733 is doing well but the hard Federation 3734 has not averaged very high in the variety tests. The hard Federation has a short straw making it difficult to cut with a binder.

Winter wheats

Of the winter wheats, Karkof, Kanred, Triplet and Turkey Red are doing the best. Increase fields of the better yielding varieties were planted this year.

The winter wheats have made a higher average yield than the spring wheats. The four highest yielding winter wheats have averaged thirteen bushels more per acre than the four highest yielding spring wheats, all planted on summer fallow.

Barleys

Trebi, Baker and Beldi barley have made the highest yields of the

barleys. In a five year average the Trebi variety has yielded 3.4 bushels more per acre than the next highest yielding variety. Seed of the Trebi variety is being grown and distributed.

Oat varieties

Victory, Idamine and Golden rain oats are doing the best for this region. The Victory in a five year test has yielded six bushels more per acre than any other variety. Several thousand pounds of the Victory and Idamine oats were distributed last spring to farmers of Teton and adjoining counties. One farmer reported that his Victory oats made forty bushels per acre and his other oats from the seed he had been planting were not worth threshing. Another farmer reported that his Idamine oats made twenty-nine bushels per acre on spring plowed ground while the oats from his other seed made only ten bushels per acre under the same conditions.

In the rate test with oats the Swedish Select variety has given the best results when planted at the rate of 35 pounds per acre and the Victory has done the best when planted at the rate of 52.5 pounds per acre.

Potato production

In the variety test with potatoes the Early Rose, Downing, Blue Pearl and Cobblers were the highest yielders.

In a comparison of the size of seed pieces of potatoes it was found that the yield increased as the size of the seed increased up to the half potato, or 4 ounce seed piece. The small seed piece with one eye produced 73 bushels per acre; quarter size seed yielded 103 bushels per acre; half potatoes made 133.4 bushels per acre; whole potatoes, 8 ounce size, yielded 130.3 bushels per acre.

Forage crops

On account of the dry season the grasses on the dry farm did not make satisfactory growth. The brome and slender wheat grass were not worth cutting, while in 1923 they were the highest yielding grasses in the test. Tall meadow oat grass made the highest tonnage of any of the grasses this season with a yield of 1300 pounds per acre. The average yield of this grass for two years was 2890 pounds.

Grimm alfalfa produced more than common alfalfa on both the dry and irrigated farm. Timothy, white sweet clover and western wheat grass made the most hay on the irrigated farm.

Sweet clover is proving a valuable crop for the dry farmers of the Upper Snake River region. Some rotation work with sweet clover will be started in 1925.

SANDPOINT SUBSTATION

1924 season was abnormal

The 1924 crop year yielded a large amount of worth-while data applic-

able to the cut-over sections. From a climatic standpoint the year could be characterized as extremely dry in the spring with cool growing weather during the early summer months and ending with one of the earliest fall frosts that has been recorded. In spite of adverse climatic conditions, good yields were secured from the crops in practically all of the projects. Several investigations were brought to completion and other new projects initiated.

Grain varieties

In the variety test of winter grains Mosida was again the high yielding variety with Washington 128 second. White Winter barley yielded 24.29 bushels and Rosen rye 26.42 bushels. In the spring wheat varieties Jenkin was high and Palouse Bluestem second. White Smyrna was the highest yielding spring barley and Trebi next best. Idamine and Markton oats tied for first place with Banner next in order. Spring rye made a yield of 30.74 bushels and spring emmer 41.54 bushels. The leading variety of field pea was White Canada and McAdoo next in yield.

Dates of planting

The greatest yield for the different dates of planting winter wheat was obtained from the September 7th planting with the August 17th planting second. In the work with spring dates of planting, the highest yield was obtained from spring wheat planted on April 9th. An extensive corn variety test was started but this work failed to give data of value due to the early frost.

Forage crops

The highest yielding winter vetches were Hungarian and Hairy. Hungarian vetch also produced 14.57 bushels of seed per acre, the highest yield obtained in the vetch seed trials. The highest yield of hay from spring vetch was obtained from the Wooly-podded with the Hungarian second. The Purple vetch produced the highest yield of seed for the spring sorts. The largest amount of hay from the various rates of planting of peas and oats resulted from the mixture of 90 pounds of peas and 70 pounds of oats. In the legume variety test alfalfa and sweet clover demonstrated better yielding ability than the common red clovers. Out of 11 different grasses tested, timothy was 9th in production. The average yield of alfalfa hay from the various fields was 4116 pounds per acre.

Sunflowers and root crops

The highest yields of sunflowers were obtained from plantings made on the 21st of April. Sunflowers produced three times as much silage as corn. Carrots again were the highest yielding root crop. The Idaho Rural variety of potatoes was the highest producing of the five different

varieties tried. Whole seed yielded almost 27 sacks more per acre than ordinary cut seed. Good progress is being made in the potato selection work being carried on at this station.

Soil improvement

The largest yield of wheat on the Substation was 48.9 bushels, obtained from a rotation experiment in which Mosida winter wheat followed sweet clover. Gypsum produced marked increases in yield of all the legumes on which it was tried. It doubled the yield of alfalfa and alsike clover, increased the yield of a meadow mixture by one-third and tripled the yield of sweet clover. Lime and phosphate gave only slight increases in crop yield. Reduced to a cash basis the increased return per acre from the use of gypsum for the last three years has amounted to $49.99 on alfalfa; $38.25 on sweet clover; $21.53 on meadow mixtures; $18.89 on alsike; and $18.55 on a red clover rotation.

The most striking increases in yield of spring wheat were obtained from the use of a corrugated roller. This amounted to as much as 40.1 per cent for one of the seedings. In land clearing work done this year on a field of 6.68 acres the cost to prepare the land for crops was $72.15 per acre. A distribution of 2900 pounds of Mosida winter wheat was made from the Sandpoint Substation this year. The second annual field day was held on June 21st. About 150 farmers attended.

FINANCIAL STATEMENT

UNIVERSITY OF IDAHO AGRICULTURAL EXPERIMENT STATION

in Account with the United States Appropriations

Dr.	Abstract	Hatch	Adams
To balance from appropriations for 1922-1923		None	None
Receipts from the Treasurer of the United States for year ending June 30, 1924		15,000.00	$15,000.00
Cr.			
By Salaries	1	11,398.24	11,135.05
Labor	2	1,514.66	1,450.13
Stationery and Office Supplies	3	61.75	13.15
Scientific Supplies, consumable	4	244.05	1,137.95
Feeding Stuffs	5	1,110.79	30.42
Sundry Supplies	6	189.43	214.32
Fertilizers	7		
Communication Service	8		1.33
Travel Expense	9	374.59	695.93
Transportation of Things	10	7.21	53.27
Publications	11		
Heat, Light and Power	12	51.03	52.80
Furniture and Fixtures	13		
Library	14	4.75	
Scientific Equipment	15		160.65
Livestock	16	42.00	
Tools, Machinery and Appliances	17	1.50	26.00
Buildings and Lands	18		
Contingent Expenses	19		29.00
Balance			
TOTAL		$15,000.00	$15,000.00

SUBSTATION

Receipts January 1, 1924—December 31, 1924

	Aberdeen	Caldwell	High Altitude	Sandpoint
Sale of Livestock, Hay, Grain, Potatoes, etc.	$3,090.07	$ 9,567.65	$ 851.79	$ 857.32

EXPENDITURES

January 1, 1924—December 31, 1924

	Aberdeen	Caldwell	High Altitude	Sandpoint	Total
Salaries	$2,520.00	$ 2,475.00	$1,500.00	$1,700.01	$ 8,175.01
Labor	2,189.18	3,964.24	995.00	1,288.80	8,437.22
Expense and Supplies	1,399.87	3,450.13	834.68	1,070.53	6,755.21
Equipment	140.50	639.90	18.21	64.55	863.16
TOTAL	$6,249.55	$10,529.27	$3,347.89	$4,123.89	$24,250.60

LOCAL STATION FUND

Fund Statement

Overdraft, Jan. 1, 1924	$ 255.80	
Recepits, Jan. 1—Dec. 31, 1924	3,060.08	$2,804.28
Expenditures, Jan. 1—Dec. 31, 1924		1,703.60
Balance, Dec. 31, 1924		$1,100.68

Receipts by Departments

Interest on Deposits		$ 82.73
Agronomy Department—Sale of Garden Products		138.61
Horticulture Department—Sale of Orchard Products	$ 823.93	
Sale of Garden Products	430.25	1,254.18
Plant Pathology Department		31.67
Poultry Department—Sale of Eggs	895.00	
Sale of Poultry	657.89	1,552.89
Total Receipts		$3,060.08

Disbursements by Departments

Items	Total	Adm.	Agronomy	Bacteriology	Horticulture	Plant Path.	Poultry
Help	$ 985.82	$41.20	$160.00	$16.80	$380.93	$ 88.03	$298.86
Travel	226.46	17.25	89.18		114.36	5.67	
Stationery and Office Supplies	1.55	1.55					
Laboratory Supplies	285.33			5.00	6.20	48.72	225.41
Repair, Equipment	84.80				12.00		72.80
Registration, Fees	7.50						7.50
Feed and Forage	112.14						112.14
Total Disbursements	$1,703.60	$60.00	$249.18	$21.80	$513.49	$142.42	$716.71