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AGRICULTURAL EXPERIMENT STATION

Work and Progress

of

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for the Year Ended

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*In Cooperation with U. S. Department of Agriculture.
†On leave of absence.

REPORT OF THE DIRECTOR*

Each year more people in Idaho are looking to the experiment station for aid in solving their agricultural problems. This year requests for Experiment Station service has again increased, and there is apparent a greater appreciation of the economic importance of agricultural investigation than ever before. It has been possible during the year to increase the quantity and improve the quality of the station's work. A number of new projects have been outlined and several new investigations initiated. New members have been added to the staff and numerous publications have made available the results of completed investigations.

Four members of the Agricultural Experiment Station staff resigned during the year and their places have been filled. Six additional positions have been created. C. E. Lampman from the poultry department of the University of Wisconsin was secured as poultry husbandman to replace R. T. Parkhurst who resigned to accept the directorship of the National Poultry Institute of England. H. A. Bendixen, assistant dairy husbandman, resigned to accept a position in the dairy department at Washington State College and the vacancy has been filled by the selection of D. R. Theophilus of Bowling Green, Kentucky.

Hobart Berseford, assistant agricultural engineer, accepted a position with the Idaho Power Co. and is located in southern Idaho engaged in cooperative investigations in connection with the study of electricity in relation to agriculture. Alfred D. Edgar from Menominee, Michigan, has been secured for this position. L. E. Longley, assistant horticulturist, resigned in order to take graduate work at Cornell University and Leif Verner of Pennsylvania State College fills the position thus made vacant. The investigational work in home economics has been very much strengthened by the employment of Dr. Ella Woods who comes from the University of Wisconsin to the position of home economist of the Experiment Station. George Schilling from Kansas Agricultural College has been added to the staff of the bacteriology department as assistant bacteriologist, to carry on animal pathological work with especial emphasis upon diseases of poultry. Frank Moore, assistant poultry husbandman, from the North Dakota Agricultural College will assist in poultry

*In accordance with established custom this is a brief report, which will be followed next year by a more extensive review. This report was prepared by Dr. C. W. Hungerford, acting director in 1927.

research. Arthur Sowder, M. S. Forestry, University of Idaho 1926, has been employed for farm forestry research. H. C. Engle from the University of Chicago has been secured to take charge of the research in agricultural economics, as agricultural economist. C. F. Wells has been employed on a half-time basis as assistant agricultural economist in cooperation with the Bureau of Crop Estimates of the United States Department of Agriculture. Mr. Wells will be engaged in certain marketing problems.

This much needed expansion of the Experiment Station staff added to the already congested condition of our offices and laboratories makes it imperative that additional space be provided in the very near future.

A significant feature of the year's results is the fact that investigations in agricultural economics have begun to bear fruit. Four publications dealing with the general agricultural situation in Idaho and the poultry, dairy and potato situations have been published and distributed during the year.

The farm buildings and greenhouses on the central station at Moscow have been given much needed repairs and have been painted. The buildings on the Caldwell and Aberdeen substations have been painted and a considerable amount of fencing has been done on the Caldwell station. A new granary equipped with elevator has been built on the Caldwell station and a considerable amount of electrical equipment has been added. A seed house, a small bunk house and a tool house have been built on the substation at Aberdeen and the old seed house has been remodeled into an office building. The horse barn has been moved and the general appearance of the farmstead has been much improved.

MAILING LIST

Residents of Idaho	17,285
Residents of other states	4,878
Foreign	205
Total	22,368

PUBLICATIONS

The publications of the Agricultural Experiment Station are issued in three series: bulletins, circulars and research bulletins. In addition to these regular series research papers are published from time to time in various scientific journals.

Following are the titles of the publications issued during the year ending December 31, 1927:

BULLETINS

146. The Use of Time by Farm Women. Inez Crawford.
147. Sweet Clover—Growing and Handling the Crop in Idaho. H. W. Hulbert.
148. Growing Clover Seed in Idaho. A. E. McClymonds and H. W. Hulbert.
149. Work and Progress of Agricultural Experiment Station for the Year Ended December 31, 1926. E. J. Iddings.
150. Apple Pomace Silage for Milk Production. F. W. Atkeson and G. C. Anderson.
151. The Farming Business in Idaho.
152. The Dairy Situation. F. W. Atkison, D. L. Fourt, G. L. Sulerud, B. H. Critchfield.
153. The Potato Situation. C. F. Well and H. C. Dale.
154. The Poultry Situation. R. T. Parkhurst and G. L. Sulerud.
155. The Snowy Tree Cricket—Its Injury to Prunes and Methods of Combating It. Claude Wakeland.
156. The Beet Leaf-Hopper—A Survey in Idaho. R. W. Haegele.

CIRCULARS

42. Announcement of Prices of Breeding Stock, Hatching Eggs and Baby Chicks, 1927. R. T. Parkhurst.
43. Summarized Report of 1925-1926 Poultry Feeding Experimental Work. R. T. Parkhurst.
44. Feeding and Management of Breeders. R. T. Parkhurst.
45. Recommendations for the Control of Intestinal Worms in Poultry. R. T. Parkhurst.
46. Hatching Chicks Artificially. R. T. Parkhurst.
47. Caponizing the Surplus Cockerels. R. T. Parkhurst.
48. The Physiological Effect of Feeding Rations of Canadian Field Peas on Growth and Production in Swine. J. E. Nordby and R. S. Snyder.
49. Publications Available for Free Distribution.
50. Why Cream Tests Vary. D. R. Theophilus.

43. The Value of Certain Feeds of High Vitamin Content for Laying Hens. R. T. Parkhurst.
Proceedings of the Third World's Poultry Congress, 1927.

45. Seed Treatment Control of Rhizoctonia of Potatoes in Idaho. J. M. Raeder and C. W. Hungerford.
Phytopathology, December, 1927
Vol. XVII, No. 12, Pages 793-814.

46. Dust Treatment for the Control of Oat Smut in Idaho. J. M. Raeder and C. W. Hungerford.
Phytopathology, August, 1927
Vol. XVII, No. 8, Pages 569-570.

47. The Anti-Sterility Vitamin E in Poultry. R. T. Parkhurst.
Science Press, July 15, 1927
Vol. LXVI, No. 1698, Pages 66-68.

48. The Influence of Border Rows and Variety Tests of Small Grains. H. W. Hulbert and J. D. Remsberg.
Journal of American Society of Agronomy,
Vol. 19, No. 7, July, 1927.

50. An Improved Wash Bottle. W. B. Bollen.
Industrial and Engineering Chemistry,
Vol. 18, No. 12, December, 1926.

51. Applicability of the Indirect Method of Analysis to Determination of Sodium and Potassium in Soil Solution. Ray E. Neidig and W. B. Bollen.
Industrial and Engineering Chemistry,
Vol 19, No. 1, Page 154, January, 1927.

52. A Suggestion for Uniformity and Utility of Data in Soil Solution Analysis. W. B. Bollen and Ray E. Neidig.
Soil Science, Vol. XXIV, No. 1,
July, 1927.

53. A Syncephalus Thoracopagus Monster in Swine. J. E. Nordby and B. L. Taylor.
The American Natuarlist,
LXII, January-February, 1928, Pages 34-47.

54. Spermatogonium and Spermatocyte Degeneration in Cryptorchid Testes of the Horse. J. E. Nordby.
Trans. of the American Micro, Soc.
Vol. XLVII, No. 1, January, 1928.

55. The Effect of Castration on the Development of Horns in Rambouillet Ram Lamb. J. E. Nordby.
January Heredity, Vol. 19, No. 1.

ACTIVE PROJECTS

A list of active Experiment Station projects follows. All investigations carried on at the several stations are in cooperation with the various departments of the home station.

Agricultural Chemistry

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

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

Studies in animal nutrition: (a) The effect of various feeds upon gains made and quality of pork production; (b) The physiological effect of feeding rations restricted to Canadian field peas on growth and reproduction in swine. (In cooperation with Animal Husbandry.)

Leaf roller control studies.

Rotation and fertility investigations at Moscow and Sandpoint. (In cooperation with Agronomy and Sandpoint Substation.)

Chemical studies of soil survey samples. (In cooperation with Agronomy.)

A study of certain types of chlorosis as found in Idaho on trees, shrubs and herbaceous plants. (In cooperation with Agronomy and Plant Pathology.)

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

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.

Tolerance of crops for alkali.

Effect of alkali salts on bacteriological activities in soils. (In cooperation with Bacteriology.)

Slick spot investigations. (In cooperation with Agronomy.)

Agricultural Economics

Primary markets for Idaho potatoes, cheese, eggs, beef and mutton and the extent of competition in these markets represented by the products of other states, 1914-1924. (In cooperation with Bureau of Agricultural Economics, United States Department of Agriculture.)

Agricultural economics study of irrigated farming in selected areas of southern Idaho. (In cooperation with Bureau of Agricultural Economics, United States Department of Agriculture.)

A study of the changes that have taken place in the production of beef cattle in Idaho and the reasons for these changes.

A study of the changes that have taken place in the production of sheep and wool in Idaho and the reasons for these changes.

A study of the changes that have taken place in dairying in Idaho and the reasons for these changes.

Business analysis study of apple orcharding in systems of farming in selected areas in Idaho.

Statistical analysis of factors affecting Idaho late potato prices.

The marketing of Idaho apples.

Agricultural Engineering

Relation of dust to motor operation.

The relation of electricity to agriculture.

Factors underlying the economic use of water in irrigation, Sec. III. Drainage and reclamation of water-logged, alkali and overflow lands.

A sub-project "Conditions governing the application of irrigation water" under Sec. I. "Soil and Irrigation Relationships" of the general project "Factors underlying the economic use of water in irrigation."

Study of methods, equipment, organization and cost of seed bed preparation on University farms.

Study of methods of equipment, crew organization and cost of harvesting grain with combines in northern Idaho.

Agronomy

Small grain improvement. (a) wheat; (b) oats; (c) barley; (d) rye, emmer, flax and miscellaneous grains. (In cooperation with the substations.)

Forage investigations: (a) Grasses and legumes for hay and seed; (b) cultural tests with alfalfa; (c) introduction and testing of miscellaneous forage crops; (d) seed production; (e) alfalfa improvement—(1) breeding, (2) hard seed study, (3) identification studies with seedlings.

Field and garden pea investigations: (a) classification studies; (b) cultural experiments; (c) breeding and improvement.

Corn breeding and improvement: (a) cultural experiments; (b) breeding improvement.

Weed eradication investigations.

Silage crop investigations: (a) cultural tests of corn for silage production.

Tests with commercial fertilizers.

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

Rotation and fertility investigation.

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

Soil survey: (a) A detailed survey of a designated area each season as funds permit. (In cooperation with the United States Department of Agriculture.)

Alfalfa seed production.

Animal Husbandry

Studies in the growth of wool.

The influence of Canadian field pea rations on quality of pork produced.

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

The effect of field pea rations on the skeleton development in swine.

Hogging-off field crops.

Protein supplements with barley and wheat for growing and finishing swine.

Cost of keeping brood sows, developing and finishing the market hog, and breeding gilts.

Steer feeding investigations.

Lamb feeding investigations.

Range livestock investigations.

Bacteriology

Studies in udder infection.

Sterility in the bovine male.

Study of scours in dairy calves.

Legume culture preparation.

Bacillary white diarrhoea.

Isolation and study of nitrifying bacteria and contaminating forms with special reference to the use of dyes as a means of isolating nitrifying organisms.

Study on udder infection in dairy cattle. (In cooperation with Dairy Husbandry.)

Dairy Husbandry

A study of the normal growth of dairy cattle.

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

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

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 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.

Breeding studies: Continuous use of proved sires to breed cattle that will be pure in their inheritance for high milk and butterfat production. (In cooperation with the United States Department of Agriculture, Department of Dairy Industry.)

Breeding studies: Investigation of the results of the use of dairy sires of ancestry of known production in cooperative dairy bull associations. (In cooperation with the Department of Dairy Industry, United States Department of Agriculture.)

Relation of the system of feeding and management to production. (In cooperation with Department of Dairy Husbandry, Washington State College.)

The influence of methods of milking on quantity and quality of milk production. (Cooperating with Department of Dairy Husbandry, Washington State College.)

Relation of physical characteristics of cow's mammary system to production. (Cooperating with Department of Dairy Husbandry, Washington State College.)

Studies in the manufacture of cheddar cheese from pasteurized milk with special reference to influence of various pure and mixed cultures on flavor.

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

Entomology

Alfalfa weevel: Control by dusting from an airplane. Breeding and liberation of parasites. (In cooperation with Bureau of Entomology, United States Department of Agriculture.)

Aphids, control on prunes and apples.

Bionomics and control of false wire worms injurious to dry land grains.
Codling moth: Life cycle studies in southwestern Idaho. Control investigations.
Eleodes beetles: Collecting and classifying all species in the state.
Fruit tree leaf roller: Control experiments under Idaho conditions. (On cooperation with Agricultural Chemistry.)
Investigation of sugar beet leafhopper. (In cooperation with Federal Bureau of Entomology and Utah Station.)
Oil sprays: Investigations in preparation and use of oil sprays in the control of orchard insects and their effects upon the trees. (In cooperation with Montana, Washington, California, Oregon, and with the Bureau of Entomology, United States Department of Agriculture.)
Onion thrips: Experiments in control with poisoned materials applied as a covering to the onion leaves.
Leaf hoppers of Idaho: A systematic study and collection of species.
Mineola scitulella: Life history studies and control experiments.
San Jose scale: Control in southern Idaho by use of oil sprays.
Wireworms: Experiments in control. (In cooperation with the Bureau of Entomology, United States Department of Agriculture.)

Forestry

Experimental tree planting.
Relative durability of Idaho woods.
Studies of farm woodlands.
Agricultural possibilities of logged-off lands.
Grazing studies.
Farm windbreaks.

Home Economics

Food expenditures of farm families.
A study of the methods of vegetable storage now in use.
A study of the conditions determining successful storage of potatoes.
The effect of storage upon the Vitamin C content of the Russet Burbank potato of Idaho.

Horticulture

Potato production experiments.
Experiments in the control of western yellow tomato blight by breeding and selection. (In cooperation with Plant Pathology.)
Varietal study and cultural tests in producing head lettuce.
Experiments with the various sprays for the control of the leaf roller. (In cooperation with Agricultural Chemistry.)
Pruning investigations.
Orchard fertilization tests. (In cooperation with Agronomy.)
The testing of new spray materials.
Variety testing of fruit trees, small fruits, and vegetables.
A study of bulb culture in Idaho.
Factors determining storage of Idaho prunes.
Apple breeding.

Plant Pathology

Comparison of various treating agents for grain smut control.
Potato seed treatment investigations.
Study of western tomato blight.
A study of mosaic and dry root rot of beans.
Virus diseases of potatoes.
A study of sclerotium disease of wheat.
Clover mildew investigations.
Study of stripe rust of grains and grasses. (In cooperation with the office of Cereal Investigations, United States Department of Agriculture.)

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 Leghorns.
The value of certain vegetable protein feeds supplementing sour skimmilk in a ration for laying hens.
The correlation of factors of production and egg characteristics in the Single Comb White Leghorns.
The comparative value of certain feeds as supplements to peameal for laying hens.
The relation of humidity to hatchability of hens' eggs.
The relation of certain constituents of sour skimmilk to egg production.
The comparative cost of producing baby chicks with different types of incubators.

Aberdeen Substation

(In cooperation with United States Department of Agriculture.)

Small grain investigations: (a) Varietal experiments with wheat, oats, barley; (b) cereal breeding and selection in nursery.

Investigation in field and garden peas and beans: (a) Varietal experiments; (b) the 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.

Potato investigations: (a) Varietal experiments; (b) tuber-unit potato improvement.

Study of trees with respect to environment.

Duty of water for selected crops.

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

Sod fertility investigations: (a) To determine effect of surphur on yield of alfalfa; (b) crop rotations, designed to maintain soil fertility and crop yields.

Pure seed distribution: (a) Increase the distribution of pure seed of various crops which have been improved.

Caldwell Substation

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

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

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.

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 lands; (c) variety test of cereals for the production of hay; (d) rate of planting oats.

Fallow and cultural tests with wheat.

Forage and miscellaneous crop investigations: (a) To determine the best variety 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.

Rotation experiments, primarily to discover the value of sweet clover in soil improvement.

Rotation experiments with peas and wheat.

Field and garden pea investigations: (a) To determine the varieties best adapted to dry lands.

Saudpoint 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) oat varieties for peat soils; (d) rate and date of planting field peas.

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; (c) comparison of eye and stem and upon yield of potatoes; (f) comparison of vorious root crops for forage and seed.

Sheep management: (a) Cost of production.

Forage crop investigations: (a) Alfalfa and red clover and production; (b) legume variety test; (c) cultural experiments with alfalfa; (d) vetch variety tests; (e) grass variety test for hay and seed; (f) annual grains and legumess for hay; (g) legume combinations; (h) nurse crop trials.

Silage crop investigations: (a) Rate and date of planting sunflowers; (b) variety test of corn; (c) comparison of silage crops.

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 culti- packing 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; (g) fertility problem on peat as relating to grain production.

PROGRESS OF INVESTIGATIONAL WORK

Detailed reports of the various departments and branch stations are prepared each year by heads of departments and substation superintendents. Brief abstracts of these reports will be found in succeeding pages.

Agricultural Chemistry

The cooperative field studies on the reclamation of alkali lands have been extended and marked progress has been made in the use of special cultural practices and chemical treatments for lands having proper drainage facilities. Winter sowing of unscarified sweet clover seed and the use of surface covering of well-rotted manure as a seed bed show some promise of general application on alkali lands. The presence of a highly deflocculated stratum of soil has been observed, which produces a perched water table, near the surface, in no way connected with the normal water table some distance below. This presents a serious problem in alkali reclamation. Laboratory studies show a rapid reduction of soluble salts in saline soils, while in alkaline soils the decrease is small, with a tendency to occur in the normal carbonate fraction.

The study of chemical aids to reclamation and the work on the tolerance of beans for alkali soils are almost completed, while the study of the tolerance of different soils for high salf concentration is being continued.

Laboratory studies on the nature and treatment of "slick spots" have been extended to include field studies of these soils in place in both virgin and cultivated soils at the Caldwell substation.

Practical field methods developed cooperatively for the treatment of lime-induced chlorosis by iron sulphate indicate the possibility of economical control. A report on the studies of the cause of low productivity in recently cleared soils has been completed and submitted to the publishers.

Work on the effect of Canadian field peas on the skeleton of swine in cooperation with the department of animal husbandry is ready to be compiled, as is the work on the cumarin content of sweet clover and its effect on dairy products, in cooperation with dairy husbandry.

Preliminary work on the blood as an index to health and plane of nutrition is being carried out in cooperation with the department of bacteriology and poultry husbandry.

Numerous analyses of apples have been made in this laboratory in connection with the control of spray residues. A comparison has also been made of the hydrochloric acid wash with that of the mixture of sodium carbonate and sodium chloride in removing arsenic, and a study of their effect on the storage quality of the apples. One year's data have been collected as to the time of picking and storage quality of prunes. This work is in cooperation with the department of horticulture.

In connection with the various projects the development and improvement of analytical methods are often found necessary. Two papers have been published on this phase referring to the indirect method of determining potassium and sodium, and the use of equivalent parts per million in repressing soil and water analyses. Refinements have also been made in the determination of cumarin, and in an improved hydrogen ion electrode for soils.

Agricultural Economics

The economic phases of the enterprise situations and reginal farming situations that have been given special consideration include the following:

1. The production and marketing of Idaho farm products. This is a survey of the production trends, and of present and potential markets for Idaho farm products. It is intended to point out the possibilities for profitable adjustments in the types and practices of farming and to emphasize the factors, physical and economic, upon which profitable production depends.

2. The consumption and distribution of farm products in home markets; the consumptive requirements outside the state. and the extent to which Idaho producers are meeting them. For home markets this involves a survey of the consumption of farm products by regions in Idaho to determine to what extent producers are meeting the present consumptive requiremnts as to quality, quantity, and seasonal supply, to determine if cognizance has been taken of the future consumptive needs, if preparations are being made to meet such needs, and if improvements in distribution could be effected. For outside markets it involves a study of the western

as well as the eastern markets into which the surplus farm products of Idaho are moving; to determine to what extent Idaho producers are recognizing the varied market possibilities and the opportunities for their further utilization.

3. Survey of competing producing areas. This study involves of producing conditions in areas outside the state which compete with Idaho products, with a view to determining the extent to which such competition is becoming more or less keen than formerly.

4. A determination of high-profit combinations of farm enterprises. This involves a study of the individual farm business organizations in specific farming regions of the state, to determine the proper combinations and proportions of enterprise and the proper methods and practices as far as available data and resources permit.

The need for local surveys of specific farming regions in Idaho became apparent early in the progress of the economic investigations. With such wide variations in physical conditions prevailing thruout the state, the broad generalizations arising out of the various studies of markets and producing conditions are of little value unless more concrete application of the economic facts of the local areas can be made. Local area surveys, therefore, were initiated thruout the state, some of which embody part of the regular research program, while others have been undertaken by county agents who are interested in studying the economic conditions in their respective counties. For the past few months efforts have been concentrated on an economic survey of the Boise Valley which was started over a year ago. In an investigation of this sort it first is necessary to know something of the area, its characteristic climate, geography and soil, its history and agricultural development, and the physical and economic factors influencing development. With these facts to serve as a background, the next step is to trace out the history of crop and livestock production, involving also an analysis of the reasons for the shifts discovered. A further step is to study the present-day systems of farming in the area. This is made in order to gain a clearer understanding of the inter-relationships of enterprises on the farm and also to secure a cross-section of the farm business of the previous years. Then finally an attempt is made to determine what the prospects are with respect to different

enterprise combinations, working out suggestive reorganizations for present organization in the light of all that previous study has shown.

A study is being pushed forward at the present time. The results of the investigation will appear in publication form in the near future.

Agricultural Engineering

The project dealing with reclamation after drainage was continued in cooperation with the departments of agricultural chemistry and agronomy and the division of agricultural engineering of the United States Department of Agriculture. At Banida a study of the depth to water in July, 1927, shows that the drainage system has been effective in lowering the water table. Continued progress is evident in the reclamation of the experimental plots and of the district as a whole. At Caldwell the older plots show continued improvement. Repeated leaching with sweet clover on the native sod still seem to be a very effective method of reclamation. A well was dug and a pump installed in an attempt to lower the ground water in one part of the district. No definite results were secured this season.

Studies on the rate of infiltration of water into soil have been conducted in tanks filled with Palouse silt loam. The rate of infiltration decreases with the volume weight of the soil. Tanks of different sizes filled to the same volume weight settled at different rates. The amount of settlement varied directly with the diameter of the cans. A flume had been set up with equipment for adjusting the slope for a study of the velocity of flow of thin sheets of water over soil. Measuring devices for determining the quantity of water have been installed and carefully calbrated. The depth will be measured by a series of hook gages.

Data were secured of the size and shape, sugar content and yield of sugar beets irrigated at various times. An attempt is being made to correlate these factors.

The second progress report of the Idaho Committee on the Relation of Electricity to Agriculture was issued in mimeographed form in June. Data were included on the electrification of the Caldwell substation, on the cost of electric energy to the farmers under the mutual companies on the Minidoka project, on the use of 10-

horse power motor in silo-filling, and on the relative cost of hatching eggs by means of oil heated and electrically heated brooders.

About $4,000 worth of loaned equipment has been installed on the Caldwell Substation for study and demonstration of the use of electricity in the household and on the farm.

A field study of the cost of operation of combines during the 1927 harvest season has been made. Four horse-drawn and five tractor-drawn outfits were studied. Two of the four farmers using horses have since purchased tractors. One did so during the harvest season.

A project on the methods, equipment, organization and cost of seed bed preparation has been outlined and arrangements made for carrying it on at Caldwell. Manufacturers have agreed to loan a tractor and other equipment for this work.

Agronomy

For the third successive season satisfactory yields of alfalfa seed have been obtained at Moscow. Such yields can only be secured when thin stands—not more than one plant per square foot—and the first growth are utilized. Rate and date of seeding tests with both Grimm and common alfalfa show that early seeding without a nurse crop at the rate of 10 pounds of seed per acre are necessary for satisfactory stands. In the cutover sections, 200 pounds of gypsum per acre are essential for maximum yields of alfalfa. At Moscow, however, over a two-year period using 11 strains of alfalfa, gypsum has given no increase.

Extensive strain tests of sweet clover, red clover and alfala are being carried on. Pasture studies of grasses and legumes have been commenced at Moscow, Caldwell and Aberdeen. Twenty-five different grass and legume species are included in these trials.

A number of the newly introduced garden varieties of peas again demonstrated their ability to yield as well as the leading field sorts. Tom Thumb, Early Washington, Allans' Canner and Sunrise produced the best yields. Bluebell, White Canada and Early Britain are the high-yielding field varieties over a period of years.

Nine years' results with winter wheat varieties show Mosida, Triplet, Jenkin and Ridit to be outstanding from the point of yield. Fall-seeded Federation is high yielding, but not very winter hardy.

This variety came thru the winter satisfactorily at Moscow but winter-killed at all other points where it was seeded in northern Idaho. A cross between Fortyfold and Federation is showing considerable promise. This variety is high yielding and does not shatter as badly as Fortyfold. Mosida and Fortyfold have been high yielding varieties at Winchester. Federation, Red Bobs and Jenkin are the high yielding spring varieties. Markton oats again outyielded all other varieties. Trebi barley for spring planting and Winter Club for fall seeding are the outstanding varieties. The latter yielded at the rate of 139.6 bushels per acre in 1927.

The annual soil survey conducted in Idaho in cooperation with the Bureau of Soils was carried on in Jerome County. The field work was completed this season.

Studies of chlorosis on apple and prune trees in the Twin Falls section have shown that the application of 5 pounds of iron sulphate to each tree produces the most satisfactory results. This is best applied by removing the soil so as to form a basin around the tree. The iron sulphate is applied to this basin and put into solution by the addition of water.

As previously recommended, the addition of two tons of lime per acre appears to be the most promising treatment yet found for the reclamation of the overflow lands along the Coeur d'Alene River.

Rotations as Moscow have shown barnyard manure to be especially effective in maintaining wheat yields. The addition of sodium nitrate has failed to give increased yields.

The weed eradication program was greatly extended in 1927. Extensive cooperative trials with farmers have been carried on under the supervision of the department of agronomy thru the cooperation of the extension agronomist. While definite recommendations cannot be made until the spring of 1928, K. M. G., a commercial product, has apparently given promising results upon Canada thistle, Russian knapweed and bindweed.

The Idaho grain laboratory established last season by the department of Agronomy has furnished grades for a large number of growers and dealers. A number of certificates have been issued upon carload lots. For the most part, grades have been determined upon samples submitted and applied to lots of grain being sold or held for sale by farmers.

Animal Husbandry

Steer feeding investigations were continued at the Caldwell substation with four objects in view: (1) to compare long, chopped and ground alfalfa hay when fed in conjunction with barley; (2) to compare wheat and pea hay with alfalfa hay; (3) to determine the value of corn silage and (4) to compare two-year-old steers with yearlings. The lot receiving long alfalfa hay and barley made larger net returns than the lots receiving chopped or ground hay and barley. The latter lots made larger gains on less feed. Seven hundred and seventy-one pounds silage replaced 302 pounds alfalfa hay and 19 pounds barley. The gains were slightly larger, as was the cost. The selling price and dressing percentage were lower for the silage fed lot. The yearling steers made larger gains on considerably less feed and at lower cost. They sold for more money even tho they did not have quite the dressing percentage that the two-year-olds had. The net returns were larger for the yearlings. The demand on the Portland market was for lightweight cattle.

Lamb feeding investigations were conducted at the Aberdeen substation to determine the value of alfalfa screenings, cull beans and cottonseed cake with the check ration of alfalfa hay and barley. Again alfalfa screenings showed that they could profitably replace a portion of the barley in a ration for fattening lambs. Cull beans can profitably replace a limited amount of barley in a ration for fattening lambs. The cull beans are not palatable so should be used in a limited way. The cottonseed cake increased the gains and lowered the feed requirements. All lots sold for the same price on the Chicago market.

The growth of wool studies in cooperation with the United States Department of Agriculture is making progress. These studies are being made with Rambouillets, Lincolns and Suffolks.

A ration composed of 6 parts wheat (rolled) and 1 part Canadian field peas (cracked) produced for 42 days beginning February 13 a daily gain of 1.83 pounds when fed to purebred Duroc Jersey shoats with an initial weight of 150 pounds. The grain requirement for each 100 pounds of gain was 442 pounds. The average dressing percentage was 79.5.

In a 94-day feeding trial beginning January 7 eight purebred

Duroc Jersey shoats with an average of 85 pounds, fed a ration of 3 parts Canadian field peas and 7 parts of barley, both ground. made gains of 1.08 pounds per day requiring 472 pounds of grain for each 100 pounds of gain. A similar lot covering the same period, fed about one-quarter pound cut alfalfa hay in addition to the above ration, made average daily gains of 1.2 pounds and required 437.5 pounds of grain for each 100 pounds of gain.

In two different swine herds in the state the tendency has developed in one strain in each herd to farrow pigs with Hernia Cerebri (Meningosele) composed of cerebral membranes protruding from an anomolous opening in the cranium where the walls of the skull have failed to close. In one herd approximately twelve percent of the pigs have been farrowed with this trouble. In the other herd the percentage of malformed pigs farrowed is somewhat larger. The percentage overcoming the trouble is very small in both herds. Records are available for four generations, and pigs which overcome the trouble are now studied experimentally with a view of making genetic analysis of the anomaly.

Whorls in the hair along the backline of purebred swine are discriminated against by all the swine breed associations, some of them even disqualifying from registration on this basis. The heritage of this character has been studied for a number of years in systematic matings and progress is being made in determining its genetic behavior.

In some strains of Duroc Jersey swine there is a slight tendency to farrow pigs with white markings, which are ordinarily confined to the extremities, particularly to the legs below the knees and hocks. The behavior of this tendency has been studied in a number of appropriate matings for some time and the effort to gather sufficient data for a satisfactory analysis of this character is in progress.

Bacteriology

The work of the department other than teaching is devoted to several lines of work: Research on various projects; the preparation of cultures for legumes; routine water analyses; routine analyses of chicken blood for agglutinating antibodies against bacillary white diarrhoea; routine analyses of cows' blood for agglutinating antibodies against infectious abortion; routine analyses of

miscellaneous specimens submitted by physicians and others thruout the state, and routine autopsies on birds.

A shorter and more efficient method of isolating the legume root nodule bacteria thru the use of various bacteriostatic dyes has been worked out. It was discovered that various tri-phenyl-methane dyes have a selective action in eliminating B. radiobactor, which is a very common contaminant of legume cultures.

Dyes have been found useful in the isolation of study of the nitrifying bacteria. With the use of certain concentrations of such dyes as malachite green, rosanaline hydrochloride and thionine, all contaminating forms were eliminated except one which could be readily distinguished by its different appearance.

Studies on the coniferous timber soils were continued. Two soils were studied for their ammonifying and nitrifying power. One of these is a virgin forest soil and the other a similar soil which has been under cultivation for the past 15 years; good crops are being produced on this at the present time. Both soils were tested without any further treatment and also with applications of calcium carbonate, rotted manure, fresh manure, sodium nitrate, ammonium sulphate, or mixtures of these. No toxic effect on the ammonifying power of the soil was noted in the virgin soil while a distinct toxic effect was noted in the nitrifying power of the virgin soil. This was not mitigated by any of the additions of salts or manures.

The comparative efficiency of the agglutination and the intradermal tests in diagnosing adult bacillary white diarrhoea infection is being studied intensively but the work has not progresed to the stage where definite results can be announced.

Means of inhibiting the non-specific precipitations which occur in biologic tests when using fowl sera are being studied. Thus far it can be said that adding acid to the serum followed by incubation and centrifugalization has not been successful. Chemically modifying the sera in other ways has been efficient in inhibiting the "cloudy" reactions but has introduced other undesirable results such as impairment of the specificity of the tests. The study is being continued.

Dairy Husbandry

In the calf-feeding experiments one group of calves was fed on powdered buttermilk as a substitute for skimmilk. They received

in addition alfalfa hay and grain. The calves drank the buttermilk dissolved in warm water readily and showed very little digestive disorder. They appeared thrifty and the group exceeded Eckle's standard for growth in both weight and height. The cost of raising the calves to six months of age was $23.76. The results indicate this feed to be a satisfactory substitute for skimmilk.

Another group of calves was raised on alfalfa and skimmilk with no grain, while still another group was raised on alfalfa hay, skimmilk and barley. Both groups averaged above Eckle's standard in growth altho the calves varied somewhat. The group receiving grain made the greater growth but the growth per unit was more expensive. The cost of raising to six months of age was $28.90 per calf for the group receiving grain and $17.92 for the group without grain. This work will be continued with more calves but the data seems to indicate the possibility of raising calves without grain in the irrigated alfalfa areas.

Three groups of dairy heifers were fed as follows: Group I—pea straw, corn silage and barley; Group II—alfalfa hay, apple pomace, barley; and Group III—alfalfa hay, corn silage and barley. All the groups averaged above Eckle's standard for normal weight and height at the beginning of the feeding period. All the groups made a greater average gain while on the experimental feed than the normal of Eckle's standard. In relative gain the groups ranked II, III and I. The heifers all appeared thrifty but the group getting apple pomace appeared in very slightly better condition than Group III, while Group I getting pea straw was not as fat or sleek of hair. The average feed cost per 30-day period for Group I was $3.26; Group II was $3.10; and Group III cost $4.36. Group II was cheaper than Group III because the apple pomace cost one-third as much as silage. Group I had a low cost because pea straw was almost one-half the cost of alfalfa hay.

Three other groups were wintered as follows: Group I on alfalfa hay, Group II on alfalfa hay plus barley and Group III on alfalfa hay plus corn silage. Group II made the greatest gain in weight with Group III ranking next and then Group I. Group II made the greatest gain in height with Group I and III practically the same. The cost per month for feed was $9.66 for Group I, $14.72 for Group II and $10.98 for Group III. Altho Group III received silage the amount fed was too limited.

In a study of pasture management for dairy cows the results indicate little value in cultivation. The addition of manure is practically equal to additional water and proper irrigation plus manure gave best results.

The experimental work in manufacturing consisted of an investigation of the best methods of manufacture of cheddar cheese from pasteurized milk. Several kinds of starters were used. The results showed better quality of cheese was obtained from pasteurized milk but the kind of starter used greatly influenced the flavor.

Some work also was done on the influence of feeding apple pomace on the flavor of dairy products. This is still in progress but the results show that apple pomace flavor is found in the products unless the pomace is fed after milking.

A ne wservice work started this year is the checking for accuracy all Babcock glassware used in the state. All glassware found accurate is branded S. G. I. (Standard Glassware Idaho). Since July 1, 1927, 17,256 pieces of glassware have been tested for accuracy in the laboratory at Moscow.

Entomology

A beet leaf hopper survey was continued, in cooperation with the Bureau of Entomology, United States Department of Agriculture, in an endeavor to secure quantitative information thruout the season of the populations of typical breeding areas. Areas were chosen in southern and southwestern Idaho and examined at two-week intervals to determine the prevalence of *Eutetix tenellus* and its relative abundance on different host plants. Information also was obtained of the occurrence of leaf hoppers in isolated communities, not typical breeding areas, to determine whether injury in such localities in some seasons is due to dispersal from breeding areas or to differences in populations in favorable and unfavorable years. Work toward the development of sugar beets resistant to curly-top was continued and experiments on the ecology of the curly-top disease of beans was begun.

Codling moth life history studies will be completed and the data published this spring. Activity of the codling moth was much delayed and the injury less severe than in 1926. Best control was obtained this year by the use of 3 pounds of lead arsenate to 100 gallons water. Nicotine in combination with soap was much less effective

than in combination with ½ percent oil emulsion. The highest percentage of sting-free fruit was obtained by the nicotine-oil combination.

The Colorado potato beetle was found to be established in two fields in southwestern Idaho and in Lemhi county. Eradication was undertaken in cooperation with the State Department of Agriculture but the success of the undertaking will be uncertain until after another season.

Mineola scitulella, an insect causing severe injury to prunes in a small area in southern Idaho, was under observation and life history studies were continued. No method of combating it is yet known.

Oil spray experiments were continued and, as far as possible, work was conducted in accordance with an outline agreed upon by cooperators in the Western Oil Spray Cooperative Project. Oils alone and in various combinations were tested for codling moth control. Emulsions were prepared from different types of oils and of emulsifiers and used at different strengths. The season's work indicated that no injury was caused to fruit or foliage by repeated applications of highly refined oils and that as good control was obtained by oils of high viscosity and low concentration as by oils of lower viscosity and high concentrations. The best controls with oils alone were slightly less than with lead arsenate alone and there were many instances of low degrees of control with high grades of oil. On the average a soap-cresol emulsifier gave slightly better control than a calcium caseinate emulsifier. The smaller amounts of calcium caseinate produced more toxic oil emulsions than the larger amounts. Lead arsenate sprays alone produced a greater percentage of sound fruit than when one or two cover sprays of lead arsenate were followed by two or three cover sprays of oil.

Oils of higher unsulphonated residue and lower viscosity were more toxic to fruit tree leaf roller eggs, within certain limits, than oils of lower unsulphonated residue and higher viscosity. Sprays of 7 percent actual oil killed an average of 99.37 percent of the eggs; those of 4 percent oil killed 95.80 percent of the eggs. On the average, calcium caseinate produced a more toxic emulsion than soap-cresol in all proportions tried and decreasing the amount of caseinate in emulsifying a certain amount of oil increased its killing properties. It appears from this year's experiments that practical control of the

fruit tree leaf roller may be obtained by the use of 4 percent oil thoroly applied.

Oil sprays for control of blister mites on apples were much less effective than lime sulfur but in many cases a very high degree of control was obtained. Nearly 100 percent control was the average on all plots where a combination of oil and lime sulfur was used.

Results of dormant oil sprays for San Jose scale agree with those of the past three seasons. Three percent actual oil was as effective as 4 percent on heavily encrusted trees where application was thoroly made. From this year's experiments it appears that 4 percent oil with emulsification will give commercial control of San Jose scale, leaf blister mite and fruit tree leaf roller where all three insects are to be combated on the same tree in southern Idaho.

Efforts were continued to develop a contact insecticide or a coverage spray containing poison that would protect onion plants from severe thrips attacks. A survey was also made of thrips infestations and host plants near onion fields.

Wireworms continue to cause heavy annual loss. Pre-baiting and soil fumigation in rows with calcium cyanide in a 3-acre field did not prove very effective.

Farm Forestry

In briefly reviewing the data secured from the preliminary study during the summer of 1927 to determine the influence of windbreaks on the growth and yield of farm and orchard crops in the Twin Falls irrigated tract of southern Idaho, it is evident that a windbreak has both a detrimental and beneficial effect on the crops. In the *zone of competition,* in which the crops are competing with the trees of the windbreak for light, moisture, and nourishment, a loss in certain field and orchard crops results. This area seems to be of a width on both sides of the windbreak row at least equal to the height of the trees. Since all of the windbreaks found in this vicinity are growing alongside a road, any loss is felt only on one side of the windbreak.

In the *zone of windbreak protection,* the crops are benefited thru decreased wind movement and consequently less evaporation from the growing plants and soil, more even soil and air temperatures and higher relative humidity, and increased yields are secured. In the case of a severe wind at the time the field crops are ready to harvest, the windbreaks are of special benefit, since they prevent the dried

crop from being scattered and the seed shaken out. This protected area extends from the zone of competition to a distance out from the windbreak equal to about 20 times the height of the trees forming the windbreak. It cannot be stated at this time that the increased yield alone always compensates for the loss in the zone of competition. Further study with different crops and various windbreaks is necessary.

Where alfalfa, clover, or other forage crops are planted in the zone of competition, considerably less loss in crop production results than if beans, potatoes, etc., are planted. It is also evident that if the windbreaks are taken care of properly, an additional revenue of forest products can be secured from them without injuring their efficiency. Since the prevailing winds in Twin Falls County are from the west during the growing season, only north and south windbreaks have any great influence on crop production. An east and west row of trees cannot be expected to exert much protective influence except to livestock and to field crops in the case of an early fall frost, but is valuable aesthetically as a roadside planting, and also for the revenue it might produce in the way of forest products.

Home Economics

Research in home economics has been started on the problems involved in the home storage of vegetables. An attempt has been made to determine what vegetables enter the winter dietaries of the people of Idaho and what the storage practices are. No attempt has been made to collect data for statistical treatment but rather to reveal diverse conditions that may be of value in later experimental studies.

Questionnaires were sent to a list of housewives in the state and to student groups on the campus. A summary of the replies received would place potatoes easily first in the quantities used by both these classes. Carrots and cabbage are listed second. Onions seem to be very generally used but are given a comparatively low rank as to quantity. It appears that the faculty families as well as the student groups depend largely upon cabbage as the leafy vegetable of the winter diet. These figures would seem to bear out the statement of Hess that, "The civilized world is dependent for its quota of anti-scorbutic food stuff largely upon the potato." Unless the cabbage is eaten raw and in relatively large amounts, or citrus fruits generally used, it would seem desirable to increase the consumption of canned

tomatoes especially by the student groups to better fortify the winter diet in vitamin C.

The equipment for the animal laboratory for studies of vitamin C is being assembled and will be ready for experimental work about April 15.

Data assembled in connection with the study of the food requirements of the farm family are being assembled and will be published in bulletin form soon.

Horticulture

The various horticultural activities have included apple breeding and orchard fertilization; orchard pruning; fertilizer tests with spinach, onions, cabbage and tomatoes; potato and tomato experiments; prune storage investigations; bulb work; and variety tests of various kinds.

Considerable progress has been made in the apple breeding project. This year 4,000 seedlings have fruited and have been studied and described in detail. Data accumulated over a period of years have been compiled and will be published soon as a station bulletin. The important results which have been obtained in leaf roller control will also be presented in bulletin form in the near future.

The past season's records in the orchard fertilizer experiments at Dalton Gardens seem to corroborate results obtained heretofore, namely, that under clean culture conditions, fertilizer applications produce relatively little difference in the average terminal growth.

Two varieties of cabbage, Early Jersey Wakefield and Copenhagen Market, did not respond to fertilizer treatments during the past season. Seventy different varieties and strains of tomatoes were tested this year, the yield varying from 34,025 pounds to 5,172 pounds per acre.

Results of the past season's prune storage investigations at Boise show that under the conditions of the experiment the pressure resistance of the fruit is the most reliable index of the proper picking time for successful storage. There was also a fairly close correlation between skin color and stage of maturity. Both the hydrometer and acidity tests are subject to variation from so many sources as to be unreliable and impracticable. In general the fruit from the earliest pickings held up the longest in storage but did not attain a good quality, while the mid-season pickings usually attained very good

quality but at the sacrifice of long storage life. From a commercial standpoint the very heavy cullage due to shrivelling seems to be the greatest obstacle to successful storage. The prune storage studies also brought out the fact that there is a very definite correlation between weather conditions and the rate of ripening of the fruit in the orchard. Percentage of sunshine proved to be the most important single factor.

Plant Pathology

Further tests of various methods of seed treatment for stinking smut control have again shown copper carbonate to be the most satisfactory material from the standpoint of both economy and efficiency. This chemical, however, has not been satisfactory for oat smut control. The concentrated formalin spray treatment, 1 part formalin to 10 parts water, has proved most satisfactory.

The hot formalin treatment, 1 pint of formalin to 15 gallons of water at a temperature of 125° F. for 4 minutes, has again this year given the most satisfactory results in the control of both rhizoctonia and scab of potatoes. Presprinkling potatoes with water 48 hours before treating and keeping them moist for that period, has materially increased the efficiency of practically all treatments tested for rhizoctonia control.

Extensive tests of various organic mercury dusts and dips have shown them to be less efficient and more expensive for seed treatment of either grain or potatoes than the methods mentioned above.

All lots of certified bean seed were again tested in the greenhouse during the winter months. The information thus secured regarding the amount of mosaic infection in these seed lots has been exceedingly valuable. From greenhouse tests and from field observations it has been found that the symptoms of bean mosaic are much more pronounced and more easily seen at higher temperatures. Curling of the leaves is often absent and mottling less distinct at low temperatures. Selection and breeding for resistance to this disease in both field and garden varieties is under way. Observations in Twin Falls County have shown that the bean mosaic occurs in larger amounts, and spreads much more rapidly, in the central portions of the bean producing area where bean fields are close together, than in regions on the border of the tract and adjacent to the sage brush, where the fields are more isolated and vegetation in general is more sparse.

Bacterial wilt and crown rot of alfalfa appeared in several irrigated sections of southern Idaho during the past summer. Many older stands have been practically destroyed. Systematic investigations of the effect of various methods of culture upon the spread of the disease and selection for resistance to the disease are being undertaken.

Dusting, 10-15 pounds of sulphur per acre two or three times during the season, effectively controlled clover mildew in the Boise Valley.

In the study of the germination of spores of several cereal rusts, urediniospores of stripe rust (*Puccinia glumarium*) proved to be less resistant to drying than urediniospores of leaf rust of wheat (P. triticina) or timothy rust (*P. graminis phlei-pratensis*). Teliospores of *Puccinia glumarum tritici* germinated readily when collected in the field in August and continued to germinate until the following spring.

Poultry Husbandry

Sour skimmilk proved of little more value for egg production than sweet skimmilk when fed in unlimited quantities. Sweet skimmilk apparently had a tendency to cause digestive disorders. Results of one year's work, however, do not justify a definite conclusion. Neither lactose alone nor lactose combined with milk salts gave the results secured by the use of either sweet or sour skimmilk.

Birds receiving lawn clippings and permitted the use of an outdoor run the year around gave a higher percentage of production and a greater profit over feed cost than birds confined and fed cod liver oils, irradiated wheat or lawn clippings. Birds fed cod liver oil mixed with mash and held six months before feeding produced larger eggs, but only slightly higher percentage production than birds receiving no vitamin feeds. Irradiating wheat for one hour at a distance of one foot caused a mortality of over 50 percent from what was evidently a nutritional disease.

Vegetable proteins as supplements to sour skimmilk seem entirely unnecessary from the standpoint of production and profit. Both alfalfa meal and peameal, however, tended to make larger eggs, while the use of beanmeal resulted in smaller eggs.

Characteristics of 18,821 eggs were observed during the year

1926-27. Improvements in egg texture, shape, color and weight were secured by selection and breeding.

Aberdeen Substation

The year 1927 was one of the best ever experienced at the Aberdeen Substation. Irrigation water was plentiful, an extensive building program was completed and a large number of projects was successfully carried thru the year.

Extensive cereal nurseries were again grown in cooperation with the Office of Cereal Crops and Diseases, United States Department of Agriculture. These nurseries included 1700 barley varieties, 450 oat varieties and 300 varieties of wheat.

The certified seed potato tests representing over 600 growers of certified seed, were continued again this year. Much valuable information is secured each year from these plots and of the 500 or more people who visited the substation this year, the large majority were primarily interested in these potato test plots.

A clover nursery was started this year including 3,000 individual plants. These plants will be watched for variation in growth, yield of seed and resistance to mildew.

In the variety tests, Idamine, Victory and Markton were the highest yielding oats, Trebi and Beldi the highest yielding barleys, and Solo, Carleton and Paragon outyielded all field peas tested.

Five hundred lambs were fed on the Aberdeen Substation this year. A brief statement of the results of the lamb feeding experiments will be found under Animal Husbandry.

Caldwell Substation

The farmstead at the Caldwell Substation has been greatly improved during the last year by the building of a large granary equipped with an elevator, the construction of a new poultry house and by much needed fencing.

The experiments with farm use of electricity have been continued. Equipment secured during the year for this work include: milking machines, dairy sterilizer, chore motor, feed grinder, dairy and household refrigerators, and laundry equipment.

Twenty-one yearlings and 40 two-year-old steers and 250 lambs

are being fed on the Caldwell Station this year. A more detailed report of this work is given under Animal Husbandry.

The study of pasture management and pasture grasses is yielding some very valuable information for the use of dairymen in irrigated section of southern Idaho.

A field day was held at the substation July 15 with an attendance of over one hundred.

High Altitude Substation (Felt)

In the variety test this year Kanred and Kharkof were the highest yielding winter wheats while Ridit and C. I. No. 3055 yielded very well. Jenkin and Bluestem were the highest yielding spring wheats. Jenkin, however, seldom matures before being frosted. Trebi has been the best yielding barley and Victory and Idamine the best yielding oats. McAdoo, Wellwood and Carleton have been the highest yielding pea varieties.

Thirty-two pounds to the acre has been found to be the best rate of seeding for Victory oats on dry farms in the Upper Snake River Valley.

Sweet clover is proving a desirable legume for use on dry farms. The yield of spring wheat has been increased an average of 2.5 bushels per acre by the use of sweet clover.

An experiment was started this year to determine the best date and best spacing for planting potatoes. Potato seed treatment tests this year showed the hot formalin superior to Semesan Bel and Dip-dust for the control of scab.

Sandpoint Substation

The completion of five years' work with dates of seeding winter wheat shows that August seeding averaged 29.8 bushels, September seeding 23.6 bushels and October seeding 16.4 bushels per acre.

Mosida, Triplet and Turkey Red were the highest yielding winter wheat varieties, while Supreme, Red Bobs and Marquis made the highest yields of the spring wheats. Victory, Markton and Abundance were the best yielding oat varieties while Han River, Colsess and Charlotteton led among the spring barleys.

Potatoes planted June 1 produced better yields than those planted earlier or later than that date. Seed potatoes treated by the hot

formalin method yielded 13,145 pounds, those treated with the corrosive sublimate 11,935 pounds, those treated with cold formalin 11,100 pounds and those with no treatment 8,360 pounds per acre.

Rye and vetch continue to be the highest yielding annual hay crops. Tall meadow oat and slender wheat grasses were high yielders this year. Cultivation of alfalfa in the spring gave a slight increase in yield over that not cultivated. Rolling both spring and fall seeded wheat produced an increase in yield.

The annual field day was held June 25 with about 500 visitors present.

FINANCIAL STATEMENT

University of Idaho Agricultural Experiment Station in account with Federal Appropriations

DR.		HATCH	ADAMS	PURNELL
To Balance appropriations for 1925-1926		None	None	None
Received from Treasurer of United States for year ending June 30, 1927		$15,000.00	$15,000.00	$30,000.00
CR.	**ABSTRACT**			
By Salaries	1	11,496.23	12,334.31	17,330.29
By Labor	2	1,823.62	1,678.66	2,090.48
By Stationery & Office Supplies	3	10.93	7.00	111.57
By Scientific Supplies	4	199.77	619.48	358.77
By Feeding Stuffs	5	752.55	47.50	
By Sundry Supplies	6	244.68	100.40	280.43
By Fertilizer	7	6.00		115.20
By Communication Service	8		1.10	36.52
By Travel Expense	9	420.56	175.23	5,483.74
By Transportation of Things	10			261.38
By Publications	11			2,561.87
By Heat, Light, Water and Power	12			43.52
By Furniture, Furnishings, etc	13			454.10
By Library	14			24.09
By Scientific Equipment	15	5.58	34.50	630.23
By Livestock	16			
By Tools, Machinery and Appliances	17	38.83	1.82	217.81
By Buildings and Land	18			
By Contingent Expense	19			
Total		$15,000.00	$15,000.00	$30,000.00

LOCAL STATION FUND STATEMENT

Balance January 1, 1927	$ 194.38	
Receipts January 1, 1927-December 31, 1927	2,765.15	$2,959.53
Disbursements January 1, 1927-December 31, 1927		2,968.33
Balance December 31, 1927		$ 8.80

RECEIPTS BY DEPARTMENTS

Interest on Deposits	$ 269.12
Agronomy	94.38
Horticulture	821.40
Plant Pathology	69.50
Poultry Department	974.97
Refunds	35.78
Profit on Purnell Lamb Feeding	500.00
	$2,765.15

DISBURSEMENTS BY DEPARTMENTS
Local Station Fund, January 1 to December 31, 1927

	Adm.	Ag. Chem.	Ag. Engr.	Ag. Econ.	Agron.	An. Hus.	Bact.	Dairy	Home Econ.	Hort.	Plant Path.	Poultry	Forestry	Total
Help	$ 5.00				$165.55		$ 94.00		$ 1.20	$368.45	$ 5.95	$552.35		$1,192.50
Travel Expense	22.81				57.20	$221.36				108.92	89.50	34.03	$120.35	654.17
Freight and Express					2.92							8.75		11.67
Printing & Advertising	13.66			$15.07										28.73
Stationery & Office Supplies	3.55								20.50	10.00		0.88		34.93
Laboratory Supplies		$273.08	$22.40		24.43		31.18	$28.58		10.04	35.60	14.90	2.61	442.82
Feeding Stuffs										10.24		27.50		37.74
Repair to Equipment											Membership	10.00		10.00
Equipment							30.97					524.80		555.77
Total	$45.02	$273.08	$22.40	$15.07	$250.10	$221.36	$156.15	$28.58	$21.70	$507.65	$131.05	$1,173.21	$122.96	$2,968.33

EXPENDITURES BY DEPARTMENTS
From State Appropriations, January 1 to December 31, 1927

	Adm.	Ag. Chem.	Ag. Engr.	Ag. Econ.	Agron.	Bact.	Dairy	Entom.	Hort.	Plant Path.	Poultry	Soil	Forestry	Total
Salary		$150.00	$43.75		$1,140.00	$600.00	$ 333.35	$4,179.36	$400.49		$160.00			$ 7,006.95
Help	$15.00	27.35			297.40	35.60		299.54	134.80		63.52	$379.48		1,252.69
Travel					17.50	64.39		629.86	51.15			312.84	$105.21	1,180.95
Telephone & Telegraph						7.16		59.33						66.49
Postage								35.46						35.46
Freight & Express	2.44	0.24			8.65	60.01		39.74	4.00	$ 6.16	21.33		15.02	157.59
Light & Power						3.15		34.11						37.26
Printing & Advertising	433.04	27.21			9.07	6.88	177.30	278.55	7.50		50.92			990.47
Laboratory Supplies		38.32			94.48	248.94		421.34	16.23	5.50	201.35			1,026.16
Office Supplies				$33.25				127.99						161.24
Feeding Stuffs							780.00				390.54			1,170.54
Equipment					509.60	6.44		958.55			55.75			1,530.34
Fixed Charges						11.05		0.60						11.65
Repairs to Equipment								14.65						14.65
Total	$450.48	$243.12	$43.75	$33.25	$2,076.70	$1,043.62	$1,290.65	$7,079.08	$614.17	$11.66	$943.41	$692.32	$120.23	$14.642.44

EXPENDITURES—SUBSTATIONS
January 1 to December 31, 1927

	Aberdeen	Caldwell	High Altitude	Sandpoint	Total
Salaries	$ 2,700.00	$ 1,800.00	$1,500.00	$2,075.00	$ 8,075.00
Labor	2,337.50	4,913.30	827.40	2,049.95	10,128.15
Expense & Supplies	5,232.81	5,290.26	722.93	2,043.42	13,289.42
Equipment	2,587.73	2,564.31	204.00	117.15	5,473.19
Total	$12,858.04	$14,567.87	$3,254.33	$6,285.52	$36,965.76