

UNIVERSITY OF IDAHO
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UNIVERSITY OF IDAHO

Agricultural Experiment Station

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To the President, University of Idaho:

While still far from perfect in its own organization, it is a pleasure to record that the Experiment Station has reached a very satisfactory position among other units of the State University for the conduct of work for which it was created, namely, research and experimentation in the broad field of agriculture.

THE YEAR IN REVIEW

On the campus and to a limited extent in the field Experiment Station work is accomplished thru the same departmental organization which prevails in the College of Agriculture. Nine departments have given more or less time to distinct lines of investigation during the past year; all have made contributions that in one way or another will materially advance the agricultural interests of the state. Off the campus the work of the Station is conducted for the most part on branch or sub-station farms under the immediate supervision of technically trained resident superintendents, each one chosen because of a peculiar fitness for the initiation and development of work it has been thought best to undertake on the farm to which he has been assigned. The Station is supporting independently at the present time two sub-stations; it shares equally with the Federal Department of Agriculture in the support of two more, and has an interest in yet another because of a lease made to the Federal Department of Agriculture and because of the equipment it has provided for work in the shape of buildings.

Practically all work of the Station is now organized on the "project" basis. A "project" is simply a statement of a definitely outlined course of procedure the investigator intends to pursue in attempting to gain certain kinds of information by experimentation or research. Experiments are planned and carried thru to determine the applicability of well established scientific facts to farm practice in this state. The research projects aim at the discovery of heretofore unrecognized fundamental principles which underlie agriculture in its manifold relations. Research seeks for new information. Experimentation aims to determine the applicability of that information to farm practice. It was research of the most searching character which resulted in the discovery of nitrogen-gathering bacteria and their association with the roots of legume plants. It was experimentation of the most patient kind that made possible the routine work the bacteriologist now goes thru in preparing culture for the artificial inoculation of legumes without which those crops are far from satisfactory in many sections of the state. It was tireless research which traced out the life history of the plant we call wheat smut and determined its parasitic character. It was experi-

mentation equally as tireless which gave to the wheat grower the means of killing the countless numbers of smut spores on his wheat seed before sowing it. Again, thru research the real cause of many common plant and animal diseases have been established and thru experimentation means of controlling them have been placed in the hands of farmers and stockmen. Research and experimentation will have a great deal to do with making the farmers and stockmen more nearly masters of the situation than they are now not only in the growing but in the marketing of farm crops and livestock. The relations of soils and climate to plant life are still very imperfectly known. We have barely touched upon the feeding problems which confront the stockmen of the state and efforts to solve our marketing problems are still of the crudest kind.

The live projects of the Station organization may best be introduced at this time, together with comments on progress made during the past year by those who are responsible for them.

DEPARTMENT OF ANIMAL HUSBANDRY

E. J. IDDINGS and C. W. HICKMAN, Reporting

Projects: (1) A study of leading breeds of sheep with special reference to production factors. (2) The use of silage other than corn in the feeding of beef cattle and sheep. (3) Experiments with field peas in pork production. (4) Experiments with forage crops for swine. (5) Experiments in lamb feeding.

Sheep Breeds and Management

During the past year work in sheep breeding and management was conducted as in former years. Comparisons were made of the Southdown, Shropshire, Hampshire, Cotswold, and Rambouillet breeds with respect to the average weight of the ewe, weight of fleece, economy of maintenance, weight of lambs at birth, lambing percentage, and daily gain of lambs for the first three months after birth. At present there are available records as follows: On weight of fleece, five years; on weight of ewes, three years; on economy of maintenance, three years; on weight of lambs at birth, three years; on lambing percentage, five years; on daily gain of lambs, three years. It is interesting to note at this time the relative economy of maintenance of the Southdowns and Rambouillets, the prolificacy of Hampshire ewes and size of their lambs at birth, and the relatively rapid gains of the Hampshire lambs. In addition to the work of preceding years, there were obtained this year the milk yield of the ewes of different breeds and data on its composition, for, as stated above, there appears to be pronounced differences between lambs of different breeds in rate of growth. It was thought that there might exist definite relations between the quantity and composition of milk and the daily growth of the lamb. Samples of the milk secured were analysed for casein, albumen, ash, fat, and total solids. A study of tabulated results on the milk yield of the ewes of different breeds and its composition thus far fails to give an adequate

explanation for differences in the growth of lambs noted. W. H. Booth and O. W. Johnson, seniors in Animal Husbandry, secured all data for the year on maintenance, weights and growth, and milk yield. G. C. Turnbow, a senior student in Dairying, under the direction of R. E. Neidig of the Department of Agricultural Chemistry, made the milk analyses. This feature of the work will be continued during the winter and spring of 1917. An additional breed, the Lincoln, will be introduced into the work for the first time. As soon as possible measurement work will be started to determine rates of growth of the lambs of the various breeds. In connection with the flock-maintenance features of the work, a test will be made during the coming year of peas and oat silage. A summarized statement of results secured up to the present time from this line of investigation appears in Table I.

Table I—Comparative Breed-Management Work
Annual records on 35 to 40 ewes of five well-known breeds.

BREED	Wt. fleece 5 yrs.	Rank based on economy of maintenance		Birth wt. of lamb 3 yr. aver.	Lambing per cent aver. 3 yrs.	Daily gain lambs for 3 mo. aver. 3 yrs.	Aver. daily milk yield in lbs. 2 ewes 1 yr.	Butter fat per cent 2 ewes 1 yr.	Total sol- ids per cent 2 ewes 1 yr.
		'14-15	'15-16						
Rambouillet	14.1	1	2	8.3	147	0.45	2.32	8.82	14.66
Hampshire	7.8	3	4	9.4	173	0.61	2.38	6.64	11.98
Shropshire	11.2	5	3	8.2	154	0.49	1.65	9.02	14.86
Southdown	7.3	2	1	7.1	116	0.39	1.22	8.60	14.61
Cotswold	15.1	4	5	*7.0	142	*0.45	2.46	8.62	14.98

* Cotswold lambs have been crossbred.

Production and Feeding of Silage

The investigation of silage crops conducted with the active assistance of the Departments of Agricultural Chemistry, Dairying and Farm Crops has been continued. During the summer two concrete silos, ten by twenty feet, were increased in height to thirty feet and an additional one, ten by thirty-five feet, was erected at one end of the beef cattle barn. Another silo (the Potlatch), eight by twenty feet, was also secured for use in sheep feeding thru a most favorable arrangement with the Potlatch Lumber Company. During the summer of 1915 silage was made from a mixture of peas and oats and a mixture of vetch and wheat grown especially for the purpose. It was used with satisfactory results during the winter of 1916 in maintaining the University herd of sixty beef cattle. Silage from both mixtures was eaten readily by cattle of all ages but that from the peas and oats appeared to be more palatable and kept with less waste from decomposition. Silage of both kinds was transported to the dairy barn to be used in comparison with corn silage in milk production. It was found in each case that after the effect of abrupt feeding was overcome peas and oats or wheat and vetch silage could replace, pound for pound, that made from corn in the production of a given milk flow. In all cases samples were provided the Department of Chemistry for analytical work.

During the 1916 crop season four silage crops were grown, viz., peas and oats, nine acres; vetch and wheat, one acre; wheat, three

acres; peas and wheat, three acres. The yields varied from 7.10 to 9.76 tons per acre. The lightest yield was from the three acres of wheat, the heaviest was from the three acres of peas and wheat. The crops were more finely cut than heretofore for storage in the silos, and in filling the silos water was liberally added thru the blower. Recently two of the silos, one containing peas and oats and the other peas and wheat, were opened. Below a top layer of from six to ten inches practically no spoiled material has been found. Both mixtures have kept well and are being readily eaten by livestock. That made from peas and wheat, however, is lighter in color and of a milder odor. At the present time the breeding ewes of the University flock are consuming from three to three and one-half pounds per head daily of the silage made from peas and oats.

Future plans in silage-crop investigations contemplate the growing of a wider variety of crops, continued cooperation with Agricultural Chemistry in securing records of composition and fermentation changes of silage from various mixtures, continued cooperation with the Department of Dairying in feeding experiments and feeding experiments with ewes, lambs and beef cattle.

Field Peas and Pork Production

That the "hogging-off" of field peas is a practical and economical method of harvesting the crop and feeding the hogs has again been shown by experiments conducted during the summer of 1916.

A field of Canada field peas consisting of 3.88 acres was divided into four lots of the size indicated as follows: Lot 1, .82 acres; lot 2, .84 acres; lot 3, .70 acres; lot 4, 1.52 acres. Lot 1 was pastured for 28 days by 14 spring pigs averaging at the start 88.6 pounds. The pigs made a total gain of 453.5 pounds or an average daily gain of 1.16 pounds. Lot 2 was pastured for 21 days by 26 spring pigs averaging at the start 81.7 pounds. These pigs made a total gain of 790 pounds or an average daily gain of 1.45 pounds. Lot 3 was pastured for 21 days by 16 late fall pigs averaging in weight 125 pounds. They made a total gain of 442 pounds or an average daily gain of 1.32 pounds. Lot 4 was pastured for 35 days by 18 fall pigs averaging at the start 160 pounds in weight. This drove made a total gain of 685 pounds or an average daily gain of 1.09 pounds. The pigs in lot 2 were fed, in addition to the peas, rolled barley at the rate of two pounds per 100 pounds live weight or a total of 1162 pounds. The barley cost \$30 per ton. The value of the amount fed was deducted in determining returns per acre from the peas. The summarized results are indicated in Table II.

Table II—Summarizing Results of 1916 Hogging-Off Work

LOT	Area in acres	No. of pigs per lot	No. of days on test	Initial live wt. Aug. 16 lbs.	Final weight lbs.	Gain in lbs.	Average daily gain lbs.	Gain per acre	Value of Pork	
									per acre hogs 8c	per acre hogs 9c
1	0.82	14	28	1246.5	1700.0	453.5	1.16	553	\$44.24	\$49.77
2	0.84	26	21	2123.5	2913.5	790.0	1.45	940	54.44	63.84
3	0.70	16	21	2010.0	2452.0	442.0	1.32	631	50.48	56.79
4	1.52	18	35	2875.0	3560.0	685.0	1.09	450	36.00	40.50

From gains made in lots 1 and 2, it is apparent that the pigs in lot 2 made the greater average daily gain by .29 pounds and the greater total gain by 336.5 pounds. This gain should be credited to the 1162 pounds of barley fed. With hogs at 8 cents, the barley had a feeding value of \$2.31 per hundred weight. Lot 4 consisted of a mixture of peas and wheat sown at the rate of 80 pounds of Blue Prussian field peas and 20 pounds of Palouse Bluestem wheat per acre. The wheat failed to show up strongly in the mixture. It constituted not over five per cent of the total feed in the lot. The returns from this lot averaged less per acre than those from the other lots.

It should be remembered that the hogs did the harvesting, thus reducing the labor of harvesting and feeding, and it should be pointed out that the work left the land in excellent condition for succeeding crops.

Other Pig-Feeding Experiments

During the winter of 1915-16 sixty pigs were divided into six lots of ten each and were fed on a basal ration of barley supplemented with various nitrogenous feeding stuffs. The work was done by C. F. Johnson and P. A. Wenger, senior students in Animal Husbandry, under the direction of Professor C. W. Hickman. The results secured indicated a relatively high feeding value for chopped alfalfa. Tankage protein produced relatively cheap and largest gains.

Proposed New Work

The lamb- and sheep-feeding work of the department to date has been published in Bulletins No. 77 and No. 89. Bulletin No. 89 issued in June, 1916, reports feeding tests with 513 lambs and 220 old ewes at the Caldwell Sub-Station and of 27 lambs at Moscow.

Plans for the work of investigation in Animal Husbandry contemplate the continuance of lamb-feeding work at Caldwell and the initiation at the earliest possible date of work in commercial steer feeding at the same place. Both lamb- and steer-feeding work should be done with sufficient numbers that buying, selling, and transportation may be taken care of on a carload lot basis. Considerable lamb-feeding equipment is already at hand, but, since the plans for future work provide for the feeding of cut and ground roughage and the use of silage, some additional equipment will be needed. A large number of steers that make excellent feeders are turned off annually from the

farms and ranges of Idaho. An increasingly large number of these steers will be finished within the state by the use of native-grown grains and hay and such other feeds as silage, sugar-beet molasses, sugar-beet pulp, and feeds of a similar nature. This beef-cattle industry is a prominent one and of such great importance in the state's agriculture that experimental work by representatives of the Idaho Station will no doubt be of direct and marked value to those interested in beef-cattle breeding and feeding. Equipment for steer feeding, such as open sheds and feed bunks, should be considered in the estimates for the biennium. For the initial outlay for well organized lamb- and sheep-feeding projects from \$1000 to \$1500 will be required. In addition there will be required from \$6000 to \$9000 for the purchase of livestock and feeding stuffs. The sum invested in livestock and feeding stuffs of course should be returned as soon as the experiment is completed and the livestock sold. If the work is properly organized and equipped, it will prove to be practically self-supporting.

Proposed Publications

There is a marked tendency in Idaho at the present time to start the development of small farm flocks. Many who are starting such flocks desire information and advice on breeds, selection of the ram and ewes, and on feeding and management under farm conditions. A manuscript covering this field under the title "The Farm Flock in Idaho" has been submitted for publication. It is proposed also to publish a report of the work of the department to date in production of swine, a popular informational bulletin on swine husbandry, a survey of beef-cattle production in the state, a bulletin containing practical hints for horse breeders and one or more informational bulletins or circulars containing plans and suggestions for providing shelter for livestock under Idaho conditions. The last named publication will probably be a cooperative effort of the Departments of Animal Husbandry and Agricultural Engineering.

The beef-cattle industry in the state is entering upon a stage of development that merits the attention of the University of Idaho. A field survey of the industry by a qualified representative of the Department of Animal Husbandry and the results of that survey combined in bulletin form with informational material in regard to the more important factors of modern beef-cattle feeding and management will be productive of good returns for the University and will be appreciated by those engaged in or interested in the production of beef cattle.

Three men are now employed in the department, one of whom devotes part of his time to administration of the Agricultural College. In order that the work of investigation in the department may receive greater, more continuous, and detailed attention, it is recommended that an additional man be provided whose whole time can be given to Experiment Station work.

DEPARTMENT OF BACTERIOLOGY

J. J. PUTNAM, Reporting

Projects: (1) Bacteriological studies of north Idaho soils (Adams).
(2) Commercial preparation of cultures for the inoculation of legumes with nitrogen-gathering bacteria.

Studies of North Idaho Soils

Enough work has been done with the timber soils of north Idaho to warrant the statement that in their development particular attention must be given to processes which render organic nitrogen available. Particular attention has been given during the year to two types of soils which are the subject of a great deal of comment from farmers who own them or know of their peculiarities. These two are not strictly timber types but to a certain extent they are similar to them. The research work of the department has been confined during the year to nitrification and ammonification studies on these two types. Eventually the work will be broadened to take in other characteristic types of timber soils. The immediate objective points at this time are (1) the determination of influences which operate upon the biological agents that may be concerned in the production of available soil nitrogen; (2) the determination of the extent to which bacteriological deficiencies may account for low fertility in certain soil types and for differences between types and productive capacity; (3) the determination of practical methods of shifting the bacteriological equilibrium in the direction desired and of increasing the physiological efficiency of beneficial groups.

The nature of the organic matter which occurs in the timber soils of north Idaho suggested a study of the effect of varying percentages of sawdust on processes of nitrification, ammonification, and nitrogen fixation. It appears from the results of nitrification experiments, both with ammonium sulphate and blood as the source of nitrogen, that the presence of one per cent of calcium carbonate greatly increases the activity of the nitrifying organisms. The presence of five per cent of sawdust greatly lessens the activity of the nitrifying organisms even when calcium carbonate is present.

With blood as a source of nitrogen the presence of sawdust greatly lessens the activity of the ammonifying organisms. When $2\frac{1}{2}$ per cent of sawdust was used, 36.72 per cent of the nitrogen was transformed into ammonia. When the amount of sawdust was increased to 5 per cent, only 27.84 per cent of the nitrogen was transformed to ammonia. Experiments of this nature of course will have to be conducted for a much longer period to enable the making of any practical application.

Cultures for Inoculating Legumes

It has been the policy of the department for some time to provide the farmers of the state at nominal cost with dependable cultures for

the inoculation of legumes with nitrogen-gathering bacteria. During the last year the department furnished material for the inoculation of seed sufficient for planting 6536 acres as follows: Alfalfa, 2095; red clover, 1770; Canada field peas, 1152; beans, 969; alsike clover, 285; garden peas, 109; sweet clover, 100; white clover, 28; vetch, 24; sweet peas, 4. The total output for the preceding year was sufficient for the planting of 3139 acres. Comparison of the price charged for this service with that asked by manufacturing firms leads to the conclusion that the department saved this year to the farmers who purchased inoculating culture from it somewhere in the neighborhood of \$6000.

When consideration is taken of the fact that a large portion of the northern part of the state is yet to be developed and that the accumulation of available nitrogen thru the activities of the legume bacteria for years to come will play an important part in the development of these lands, the work involved in the manufacture and distribution of inoculating material should be recognized as an important function of the department. The proper management of the work will necessitate the services in the department of another well qualified man. He should devote some four or five months of the year to the manufacture and distribution of cultures and the remainder of the year to investigations pertinent to the general subject of legume inoculation.

DEPARTMENT OF BOTANY

M. A. WILLIS, Plant Pathologist, Reporting

Projects: (1) A study of apple rosette (Adams). (2) A study of the striped rust of wheat (Adams). (3) Control of powdery mildew of apples. (4) Control of rhizoctonia of potatoes. (5) Noxious weeds and methods of control.

During the past year the plant pathologist has been working upon two Adams Fund projects. Two projects supported with Hatch funds have also been carried in cooperation with the Department of Horticulture. The results of the year's work may be briefly described as follows:

Adams Fund Projects

Apple rosette: The most important part of the work done upon apple rosette consisted of a close and systematic study of the University and neighboring orchards. This survey brought out the fact that the name "apple rosette" is being applied to at least four maladies. More intensive work upon each is being planned for 1917.

Striped rust of wheat: The object of the work on striped rust of wheat is to determine the manner in which the causal organism, *Puccinia glumarum*, is able to survive the winters under climatic conditions which obtain in Idaho. A survey of plants in the vicinity of Moscow shows that this rust infests *Hordeum jubatum*, *Bromus margin-*

atus, *Agropyron cristatum*, emmer, and wheat. During the latter part of November both uredospores and teleutospores were plentiful upon *Hordeum jubatum*. Attempts have been made to connect the aecidiospore stages of certain rusts with the striped rust of wheat but without success.

Hatch Fund Projects

Control of powdery mildew of apples: In this experiment several fungicidal sprays were tested. Applications were made at the times usually recommended for apple scab and codling moth. As the results were not conclusive, these sprays will be tried again in 1917 under slightly different conditions.

Control of rhizoctonia of potatoes: In this experiment an effort was made to get the comparative value of seed selection and seed disinfection. Rhizoctonia-free seed treated with corrosive sublimate gave a rhizoctonia-free crop. From this we infer that the land upon which the potatoes were planted was practically free from this disease. When rhizoctonia-infected tubers were used, those which were treated either with formaldehyde or corrosive sublimate gave very much better results than those which were not treated. Corrosive sublimate was more effective than formaldehyde. Selection of apparently clean seed tubers without treatment gave better returns than infected seed with treatment. This experiment will be duplicated in 1917.

DEPARTMENT OF CHEMISTRY

C. L. VON ENDE, R. E. NEIDIG, C. W. COLVER
and H. P. FISHBURN, Reporting

Projects: (1) Factors involved in the ripening of fruits, particularly apples (Adams). (2) Factors concerned in the elaboration of protein in the wheat kernel (Adams). (3) Silage investigations, (a) The relation of the kind and quantity of acids formed in silage made from different crops, (b) An investigation of protein changes in silage made from corn and leguminous crops. (4) The ash constituents of irrigated and non-irrigated apples. (5) A study of the milk of different breeds of sheep. (6) Rare elements in feeding stuffs.

Apple Storage

Fundamental to the question involved in the apple-storage work is the biochemistry of the apple. In order to bring light into this phase of the work, an attempt is being made to correlate chemical and physico-chemical studies. On the basis of the experience accumulated during the past two years the following outline of procedure has been formulated.

Material: Three varieties of apples, Jonathan, Wagener, and Rome Beauty, from the University orchard furnished the material for

experimentation. The apples were harvested by the Department of Horticulture from one selected tree of each variety. A box of each variety for the actual tests was sorted for uniformity of size and color. Reserve material of similar quality was also selected. All material is kept unwrapped in boxes set on racks which allow free circulation of air.

Storage: All material, experimental and reserve, was stored for about four weeks at cellar temperature (10 degrees Centigrade). It was then divided, one-half being continued at cellar temperature and one-half being placed in cold storage at zero degrees Centigrade. The temperature 10 degrees Centigrade is maintained by means of an electric heater and an oscillating fan in the basement of the mill building. During the warmer months ice will have to be employed. This basement space is suitably insulated by heavy stone and brick walls, air-spaced, board and paper ceiling, and refrigerator door. The temperature, 0 degrees Centigrade, is maintained with brine coils in a room in the Dairy Department by means of an ammonia refrigerating machine.

Experimental tests: These are made about once a month, beginning with the fruit on the tree; each sample being a composite of five individual apples. Thus in each run all tests are made on identical material. Storage samples are taken from both cellar and cold-storage room. At intervals a limited quantity of cold-storage and cellar material is to be placed in a thermostat at a room temperature (20 degrees Centigrade), testing being made at the beginning and end of this room-temperature period.

Preparation of the sample: Five apples are selected from different parts of the tree or from different portions of the box, weighed, cored, and sliced. Of the sliced material fifteen to twenty grams are taken for total solids and one gram for enzymes; the remainder is run thru a meat grinder. A fifty-gram sample of the ground material is taken for sugar, a fifty-gram sample for starch, and the remainder is reweighed and expressed for juice, the volume of which is measured. This juice is used for the following physical and chemical tests. Chemical: Starch, sugar, total solids, alkalimetric acidity (approximate), enzymes. Physical: Osmotic pressure, acidity (exact) by titration and conductance curves, electrical conductance at temperature of ice bath, and hydrogen ion concentration at temperature of ice bath. It is expected that the coming year's experimental results will furnish some interesting and serviceable data. It is to be noted that the temperatures are being controlled more definitely than formerly, that the experimental material has been more circumspectly chosen, that the method of sampling is more representative and that the chemical and physical determinations have been extended in number and improved in method.

Wheat Investigations

The Adams Fund project entitled, "A Study of the Factors Which Influence the Protein Content of Wheat" was thoroly reviewed in the

last annual report. It is a project which will require a number of years to finish. A part of the work on this project during the past year has been a continuation of the several lines of investigation previously outlined. Additional data have been secured on the formation and movement of soil nitrates under irrigation and on the effects of various amounts of irrigation water and of cultivation and fertilization upon the protein content of the grain. Additional data have also been secured on the performance record of wheats transferred from middle-western to northwestern conditions. The work which had for its object the determination of the relative value for milling purposes of dry-farmed and irrigated wheats has been completed and published as Bulletin No. 88.

During the year elaborate plans for determining the effect of crop rotation upon protein content were formulated and work undertaken. Work of this nature seems to be necessary in view of the fact that in the literature reporting investigations of the protein content of wheat, two sets of factors—soil and climate—have been advanced as being responsible for the wide variation of this important constituent in any variety of wheat when grown under various environments. There are equally strong statements that soil—type, richness in this or that constituent, and physical condition—or that climate, humidity, variation and distribution of sunlight, differences in temperature, and length of the growing and ripening periods—has the most pronounced effect upon the elaboration and formation of the wheat proteins.

Some investigators hold that climatic differences play a more important part in influencing the composition of wheat than soil but have suggested that possibly the climatic features bring about changes in the soil conditions which in turn react upon the wheat crop. Some of our own results, especially those obtained with irrigated wheats grown on the Gooding Sub-Station, seem to indicate that possibly some soil factors have not received as much attention as they deserve. It seems not improbable that the ultimate amount of protein stored in wheat kernels can be decidedly influenced by the stock of readily available soil nitrogen. It is believed that the system of rotations planned and now under way will eventually throw light upon this question.

The rotations are to be practiced on the central station at Moscow. Two spring varieties, Palouse Bluestem and Marquis, and two winter varieties, Forty Fold and Red Russian, will be the varieties used in the rotations. Each variety will be grown each year in three series of rotations in which field peas (Series 1), alfalfa (Series 2), and clover (Series 3) are the legumes and in a fourth series (Series 4) where small grains only come into rotation. (Plate I illustrates the plan of rotation for one variety). Twenty-five plats, each 1-100 of an acre in area, constitute a series. The wheat in each series for any one year will be grown on five plats extending in one or two rows diagonally across the series. In the first three series the second crop will be grown one year after a legume, the third crop after two and the fourth and each succeeding crop after three years of a legume. At the

Series III											
1916 1917 1918 1919 1920	Wheat "Bluestem" Beers Clover Clover	2	1916 1917 1918 1919 1920	Clover Clover Wheat Beers Clover	3	1916 1917 1918 1919 1920	Clover Clover Wheat Beers Beers	4	1916 1917 1918 1919 1920	Beers Clover Clover Wheat Wheat	5
1916 1917 1918 1919 1920	Beers Clover Clover Wheat	6	1916 1917 1918 1919 1920	Wheat Beers Clover Clover	7	1916 1917 1918 1919 1920	Clover Wheat Beers Clover Clover	8	1916 1917 1918 1919 1920	Clover Wheat Wheat Beers Clover	10
1916 1917 1918 1919 1920	Clover Wheat Wheat Wheat Beers	11	1916 1917 1918 1919 1920	Beers Clover Clover Wheat	12	1916 1917 1918 1919 1920	Wheat Beers Clover Clover Wheat	13	1916 1917 1918 1919 1920	Clover Wheat Wheat Beers Clover	15
1916 1917 1918 1919 1920	Clover Wheat Beers Clover	16	1916 1917 1918 1919 1920	Clover Clover Wheat Beers	17	1916 1917 1918 1919 1920	Beers Clover Wheat Wheat Wheat	18	1916 1917 1918 1919 1920	Wheat Wheat Clover Clover Clover	20
1916 1917 1918 1919 1920	Clover Wheat Beers Clover Clover	21	1916 1917 1918 1919 1920	Clover Wheat Wheat Beers Clover	22	1916 1917 1918 1919 1920	Clover Wheat Wheat Beers Wheat	23	1916 1917 1918 1919 1920	Beers Clover Clover Wheat Wheat	25
Series IV											
1916 1917 1918 1919 1920	Wheat "Bluestem" Oats Beers Barley Beers	1	1916 1917 1918 1919 1920	Beers Wheat Oats Barley Beers	2	1916 1917 1918 1919 1920	Barley Wheat Oats Wheat Beers	3	1916 1917 1918 1919 1920	Beers Barley Beers Barley Wheat Oats	5
1916 1917 1918 1919 1920	Oats Beers Barley Beers Wheat	6	1916 1917 1918 1919 1920	Wheat Oats Barley Beers Beers	7	1916 1917 1918 1919 1920	Beers Wheat Oats Beers Barley	8	1916 1917 1918 1919 1920	Beers Barley Wheat Oats Beers	10
1916 1917 1918 1919 1920	Beers Barley Wheat Wheat Oats	11	1916 1917 1918 1919 1920	Oats Beers Barley Wheat Wheat	12	1916 1917 1918 1919 1920	Oats Beers Beers Barley Beers	13	1916 1917 1918 1919 1920	Beers Wheat Oats Oats Beers Barley	15
1916 1917 1918 1919 1920	Barley Beers Wheat Oats Beers	16	1916 1917 1918 1919 1920	Beers Barley Wheat Wheat Oats	17	1916 1917 1918 1919 1920	Beers Beers Barley Beers Beers	18	1916 1917 1918 1919 1920	Wheat Wheat Oats Oats Barley	20
1916 1917 1918 1919 1920	Beers Wheat Oats Barley	21	1916 1917 1918 1919 1920	Beers Wheat Oats Beers	22	1916 1917 1918 1919 1920	Beers Beers Wheat Oats Oats	23	1916 1917 1918 1919 1920	Oats Beers Oats Barley Wheat	25

PLATE I.—Plan of rotation in testing influence of crop rotation on protein content of wheat.

end of the first five years every foot of land devoted to any one series will have grown a crop of wheat.

The study of the wheats grown on these plats will include complete chemical analyses of the wheat from each plat, the grinding of a composite sample representing each series into flour, and analyses and baking tests of the resulting flour. An attempt will be made to correlate available soil nitrogen with the protein content of the grain. Soil samples for nitrate determination will be taken from fallowed portions of the legume and wheat plats during the growing seasons.

Owing to the contour of the land upon which these plats have been laid out, a part of them have a northeast slope exposure, part a southwest slope exposure, part a north slope exposure and part a southeast slope exposure. Undoubtedly some variations in the soil and air temperatures prevail on these different slopes. To determine to what extent they prevail, complete records during the growing season will be kept of soil and air temperatures on the different slopes. The data so secured may be of service later should differences in the production of soil nitrates develop.

It will take five or six years to determine the possibility of increasing the protein content of wheat by a system of rotations in which the legumes are prominent.

Fruit and Plant-Ash Investigations

Investigations dealing with the composition of the inorganic (ash) portions of fruits, fruit stems and tree prunings have paralleled the study of the organic composition of irrigated and non-irrigated fruits undertaken by the Department of Agricultural Chemistry several years ago.* The publication of this data has been somewhat delayed owing to the seemingly conflicting results which have been obtained. During the past year analyses have been made of the ash of eight irrigated and seven non-irrigated varieties of apples. The data are being tabulated and should be available for publication during the coming year.

Silage Investigations

A problem of great importance to this state and to the Pacific northwest is forage crops for silage purposes. The chemistry of corn silage has been quite thoroly worked out. Corn, however, cannot be considered the staple silage crop for all portions of the Pacific northwest for climatic conditions in certain sections operate against it. It is necessary to find suitable crops to substitute for corn in the silo. At this station mixtures of oats and peas, wheat and peas, wheat and vetch and wheat alone have been siloed with success. In the belief that the chemistry of silage other than corn should be thoroly investigated, work has been planned, which involves (a) a study of the relation of the kind and quantity of acids developed in silage made from forage crops and mixtures; and (b) a study of protein changes in silage made from forage crops. Information secured from this line of investigation will

* Reported in Idaho Experiment Station Bulletin No. 73.

help in placing relative values on corn and other kinds of silage. During the past year particular attention has been given to a study of the acids developed in silage made from various crop mixtures. For convenience in siloing comparatively small quantities of material, several silos of approximately one ton each were erected. No. 1 was filled with oats, No. 2 with field peas. No. 3 was filled with a mixture (on the dry basis) of $12\frac{1}{2}$ per cent oats and $87\frac{1}{2}$ per cent field peas; No. 4 with a mixture of 25 per cent oats and 75 per cent field peas; No. 5 with a mixture of 50 per cent oats and 50 per cent field peas. No. 6 was filled with straight clover; No. 7 with a mixture of 75 per cent clover and 25 per cent wheat straw; No. 8 with a mixture of 50 per cent clover and 50 per cent wheat straw. No. 9 was filled with straight alfalfa; No. 10 with a mixture of 75 per cent alfalfa and 25 per cent wheat straw; No. 11 with a mixture of 50 per cent alfalfa and 50 per cent wheat straw.

After sufficient time had elapsed to insure thoro curing, silage was withdrawn from each thru openings made by borings into the sides of the silos. The samples were examined for their content of volatile and fixed acids. A research bulletin or technical paper will be based upon the results of the investigation. During the coming winter preliminary work will be undertaken to determine the palatability of the different silage mixtures and their relative value in milk production. From this preliminary work a definite project will be formulated for another year's work. The work on the hydrolytic products of the proteins will be undertaken just as soon as time permits. The silage investigations now under way constitute the beginning of work in feeds and animal nutrition at this station.

The Milk of Sheep

A chemical study of the milk from different breeds of ewes has been carried on during the past year with the aid of a senior student in the Department of Dairying. This work is one phase of a combined project carried in cooperation with the Department of Animal Husbandry. The results of the past year are preliminary in nature. The work will be somewhat elaborated for the coming year. From the work with milk it is not improbable that some basic reason for differences so frequently noted by the Department of Animal Husbandry in lamb growth may be secured.

Rare Elements in the Ash of Feeding Stuffs

Up to this time preliminary work only has been accomplished on methods of determining the rarer elements in the ash of plant materials.

DEPARTMENT OF DAIRY HUSBANDRY

E. V. ELLINGTON, Reporting

Projects: (1) Dairy-herd management. (2) Experiments to find a basal ration for the most economical feeding of dairy cattle under northwestern conditions.

Dairy-Herd Management

During the year work was continued in dairy-herd management. A considerable portion of the time was spent with the milking machine installed by the Sharples Company for use on the College herd. Data were compiled to show the economy of milk production and the effect on the health of the herd. Attention is being given to the control of the bacterial content of the milk.

It is observed that there was no decrease in production during the first eight months in the lactation period of the individual cows as compared with similar preceding lactation periods of the same cows. It was also observed that with the same amount of labor necessary to handle the University herd when milking by hand the herd could be milked three times a day with a resulting average increase in milk flow of 22 per cent. This procedure is probably not practical for the farmer who is milking cows as a side line but for the man who devotes his entire time to dairying and who is supplying milk for city markets or cheese factories, this is an important factor in the management of the dairy herd. The effect of the mechanical milker on hard-milking cows is worthy of note. Very frequently cows that are capable of high production are not given the attention they deserve because of difficulty experienced in drawing the milk. It has been noted in the case of one pure-bred Holstein cow in the University herd, Philidea Young DeKol, that with the mechanical milker in 1916 during eight months 11,795 pounds of milk containing 360 pounds of butter fat were produced. In 1915 during a similar period with hand milking 8001.5 pounds of milk with a fat content of 274 pounds were produced and during 1914 for a similar period with hand milking 8500 pounds of milk with a fat content of 336 pounds were produced. Machine milking with this class of cattle seems to increase the length of the lactation period as the average hand milker has a tendency to "dry up" the cow that he finds difficult to milk.

Close inspection was given each individual animal by the Department of Veterinary Medicine to determine the effect of mechanical milking on the udders. Thus far no ill effects have been noted.

Special precautions were taken to keep the machine in perfect repair at all times. The results obtained so far, however, do not warrant an unqualified endorsement of the mechanical milker. The observations should extend over two consecutive lactation periods.

The Basal Ration

That portion of the Department's work which has sought to establish a basal ration for northwestern conditions is practically completed. The results secured are being compiled for publication in a bulletin to be entitled "Dairy Farm Management." It has been found that the following ration can be adapted to the high-producing cow or to the low-producing cow and, moreover, may be adapted to animals of different weights: Alfalfa hay, one part; corn silage, 4 parts; grain (consisting of barley 4 parts, bran 2 parts, linseed oil meal 1 part), one

part. To show how closely this ration conforms to the standards established by Armsby, the following data should be noted:

900-lb. Cow, Giving 20 lbs. Milk, Testing 4 per cent

	Digestible protein	Energy value (therms)
For maintenance.....	.46	5.70
To produce 20 lbs. milk.....	1.00	6.00
	1.46	11.70
Hay 7 lbs., silage 28 lbs., and grain 7 lbs. gives	1.45	11.98

900-lb. Cow, Giving 40 lbs. Milk, Testing 4 per cent

	Digestible protein	Energy value (therms)
For maintenance and milk production.....	2.46	17.70
Hay 10 lbs., silage 40 lbs., grain 10 lbs., gives	2.48	17.98

1500-lb. Cow, Giving 20 lbs. Milk, Testing 4 per cent

	Digestible protein	Energy value (therms)
For maintenance and milk production.....	1.65	13.90
Hay 8 lbs., silage 32 lbs., grain 8 lbs., gives.....	1.89	13.69

1500-lb. Cow, Giving 40 lbs. Milk, Testing 4 per cent

	Digestible protein	Energy value (therms)
For maintenance and milk production.....	2.65	19.90
Hay 11 lbs., silage 44 lbs., grain 11 lbs., gives	2.60	18.84

These rations correspond very closely to the rough rule that is used by many dairymen, feed one pound of grain daily for every pound of butter fat that the animal produces weekly.

Other Work

The project in factory management has been completed insofar as the first section is concerned. Idaho Bulletin No. 90 entitled "Creamery Records" is now available for distribution.

The department has assisted in a number of scoring contests for the improvement of Idaho creamery butter in order to assist in standardizing the product shipped from the state. Practically all the creameries of Idaho have participated in these contests. Official supervision has also been given to the testing of seven Holstein herds and one Jersey herd for advanced registration in the breed associations.

DEPARTMENT OF FARM CROPS

G. S. RAY and C. M. EKLOF, Reporting

Projects. (1) Variety tests of small grains. (2) Forage crops. (3) Winter-barley culture. (4) Variety tests and culture of field peas. (5) Corn; variety tests and cultural methods. (6) Root crops. (7) Nursery work.

Experimental work in the department for the year was largely a continuation of 1915 projects. The scope of a few projects was broadened and additions were made in some instances. One line of investigation, that of potatoes, was transferred from the Department of Farm Crops to the Department of Horticulture.

Variety Tests of Small Grains

Twenty-one varieties of winter wheat, ten of spring wheat, three of winter oats, fifteen of spring oats, five of winter barley, fourteen of spring barley, three of winter rye, one of spring rye, and in addition winter and spring emmer were grown for comparative yields. With the idea in view of obtaining those cereals best adapted to our conditions, new varieties are added to the tests from year to year. Any variety showing itself exceptionally poor for three consecutive years is dropped.

Red Russian still remains our highest yielding winter variety with a yield of 59.7 bushels per acre for 1916 and an average of 46.3 bushels per acre for the six years, 1911 to 1916 inclusive. Turkey Red, Little Club, and Forty Fold also rank high. Weakness of straw is an objectionable feature of the Turkey Red variety.

Spring wheats in order of yield in bushels per acre ranked as follows:

Jenkins' Club.....	72.0 bu.	Early Baart.....	59.2 bu.
Defiance	63.4 bu.	Marquis	53.1 bu.
Palouse Bluestem.....	60.8 bu.		

The four-year average for white winter barley is 67.1 bushels. Tennessee Winter and Wisconsin 519 showed a high percentage of winter-killing but yielded 47.9 and 30.4 bushels respectively. Hannchen, White Smyrna, Beldi C. I. 190, and Swan Neck were our best spring barleys ranking in the order named.

All of the fall-sown winter oats winter-killed. Spring oats gave exceptionally high yields, as follows:

Colorado 37.....	168.7 bu.	Big Four.....	146.0 bu.
Danish Giant.....	159.3 bu.	Silvermine	143.7 bu.
White Russian.....	147.6 bu.		

Swedish Select, Banner and Abundance oats also yielded well.

Invincible rye, Petkuser rye and Russian rye yielded 58.9, 54.9 and 39.3 bushels respectively. They are winter varieties.

Forage Crops

The grasses, alfalfa, clovers, and various mixtures seeded in 1915 were continued and comparative yields of hay secured. In addition

several new mixtures were added. At least two more years of testing are necessary before reliable data on the plats can be obtained.

Mixtures of field peas and oats grown for hay have produced good yields. Rates of sowing and tonnage secured are indicated below.

Peas 70 pounds per acre	Oats 32.....	4.2 tons
Peas 80 pounds per acre	Oats 32.....	4.5 tons
Peas 90 pounds per acre	Oats 48.....	4.3 tons
Peas 90 pounds per acre	Oats 32.....	4.6 tons

The growing season of 1916 was too cool for Sudan grass. It made practically no growth until August.

Of the twenty-five varieties of soy beans planted in 1916 none matured seed.

Different kinds of sorghums such as kafir and milo have been planted each year but rarely do they make much growth. Millets thrive better than the sorghums but seem to be unworthy of recommendation.

Field Peas

This project covers two distinct lines of work,—variety testing and a comparison of different cultural methods.

Twelve varieties, ten of them field peas and two of them garden peas, were grown under similar conditions as to time, rate, and depth of planting. According to yield the varieties rank as follows:

	Bu. per acre		Bu. per acre
Amraoti	53.3	Bangalia	42.8
Solo	49.0	Kaiser	41.6
Blue Bell.....	47.5	White Colorado.....	30.6
Blue Prussian.....	44.1	Alaska	27.6
White Canada.....	44.0	Amer. Wonder (garden pea).....	22.5
White Marrowfat.....	43.3	Gradus (garden pea).....	17.6

The Blue Prussian and Bangalia varieties again gave very satisfactory yields. One feature of the Bangalia which makes them quite desirable is their early maturity. Altho they do not equal the Blue Prussian in yield they mature from seven to ten days earlier.

The Blue Bell pea resembles the Blue Prussian very closely. Little difference can be noted in the manner of growth, time of blooming and ripening, and color and size of seed.

Solo peas proved very satisfactory. This was the first time they were ever grown on the station farm. Further testing is necessary before they can be recommended for general planting.

The American Wonder, a garden pea, altho early in maturity, makes a poor vine growth, does not hold the weeds in check and gives a small yield. The Gradus is even poorer than the American Wonder. It produces long and spindling vines which bear very few leaves.

The very marked increase in the acreage of field peas grown in

north Idaho the past two seasons and the problems naturally arising in the growth of this crop suggested the cultural tests now in progress.

For our cultural work ninety pounds per acre were seeded unless otherwise stated. The depth of seeding was from two to two and one-half inches for the shallow seeding and from five and one-half to six inches for the deep. Ordinary seedings were made at a depth of from three and one-half to four inches. The plats in single and double rows were given two cultivations. Not much difference is to be noted between the results secured from different depths of early planting. One reason for this is perhaps the very favorable season which we had in 1916. Had the season been dryer and warmer, results from 1915 would lead us to conclude that an early deep seeding was preferable to an early shallow one. Early seedings were made on April 8; medium late seedings, April 17, and late seedings, April 29.

The highest yield of all cultural methods both in 1915 and 1916 has been secured from seed sown broadcast on the surface of the ground and then plowed under to a depth of three and one-half to four inches. But until further trials of this method are made with different rates of seeding and different depths of plowing, this procedure will not be recommended.

	Yields in bu. per acre
Single rows, 18 inches apart, 60 pounds per acre.....	58.6
Single rows, 24 inches apart, 60 pounds per acre.....	57.4
Double rows, 18 inches apart, 75 pounds per acre.....	48.6
Double rows, 30 inches apart, 75 pounds per acre.....	53.9
65 pounds per acre.....	52.3
75 pounds per acre.....	55.7
90 pounds per acre.....	58.7
120 pounds per acre.....	59.3
Early shallow seeding.....	54.6
Early seeding	52.0
Early deep seeding.....	54.4
Medium late shallow seeding.....	53.1
Medium late deep seeding.....	46.5
Late seeding	46.9
Broadcast seeding, plowed under.....	70.5

Corn

Minnesota 13, Idaho White Dent, Northwestern Dent and Rustler's White Dent were planted for grain production. Minnesota 13, the earliest of the four, was the only variety to mature seed.

Idaho White Dent when cut in the glazed stage for silage gave 15.8 tons per acre. Silage production from Rustler's White Dent with different methods of planting resulted as follows:

Drilled, 12 pounds per acre.....	14.4 tons
4 stalks per hill.....	14.6 "
3 stalks per hill.....	11.3 "
Rows 30 inches apart, hills 3 feet 8 inches apart.....	16.1 "

Root Crops

Mangels, rutabagas, and carrots have been tested for two years producing from eight to twenty tons of roots per acre. In addition to securing yields, selections of mature roots for seed production have been started.

Nursery Work

In the nursery new varieties of grains have been tested beside our standard varieties. Extensive notes are taken thruout the growing season. Seed from the better sorts is planted for increase the following year and as soon as enough seed is secured the grain is put into our regular variety-testing plats. Pure line selections of white winter barley have been carried in the nursery for three years and are ready for plat testing. Selection has been made for stiffness of straw, good length of straw and yield.

DEPARTMENT OF FORESTRY

C. H. SHATTUCK, Reporting.

Projects: (1) Clearing of logged-off lands. (2) Forest by-products. (3) Experimental tree planting. (4) Surveys in the interest of range improvement.

The Department of Forestry has just issued Circular No. 4 entitled, "Forest and Shade Trees and Basket Willows Recommended for Planting in Idaho," which gives a list of thirty species of tested shade and forest trees which have been grown in the forestry arboretum at Moscow for from five to eight years and which are known to do well over the greater part of the state. These trees are recommended for planting for ornament, shade, woodlot, windbreak, and reforestation purposes. About 120,000 trees are ready for distribution this year at approximately the cost of growing. The department has devoted almost the entire time of one man to this work during the past year and is testing out a great many species other than those listed in this bulletin. As fast as definite information is obtained the trees will either be included in the list to be recommended for use in the state or rejected if not found satisfactory.

The department is also issuing at this time a sixty-page bulletin (Methods of Clearing Logged-off Land) covering its experiments and studies on land clearing for the past five years, in which the various methods of removing stumps are discussed and results and conclusions given. The bulletin includes the results of experiments and actual operations in removing stumps with powder of various kinds, with fire, with stump pullers, and with donkey and traction engines, to-

gether with costs, conclusions, and recommendations. This will be known as Bulletin No. 91 of the Experiment Station. Considerable time has been devoted to this work during the past year. The data in connection with Plat No. 3, in which Vulcan stumping powder has been thoroly tried out, has all been collected and compiled, together with the information and conclusions relative to donkey and traction engines, as well as much more information gathered concerning the pasturage method which continues to lead all the others under certain conditions. A number of lecture tours have been made by members of the forestry staff; addresses have been delivered to farmers and to Chambers of Commerce and other bodies on this important subject. The department will also take a prominent part in organizing and conducting a "Land Clearing Special" the first train of its kind to be operated in the Northwest, which will cover western Montana, northern Idaho and eastern Washington during the months of April and May. This will be a demonstration train in which all methods of clearing land known to be suitable for conditions in the Northwest will be given a thoro trial. At the same time, data, photographs, and general information will be secured relative to the merits, advantages and disadvantages of each of these methods, which will probably be published by the department in a later bulletin on this subject.

Cooperative experiments in the utilization of by-products from stumps of Yellow pine and other species has been under way for several years between this department and the Bureau of Chemistry of the United States Department of Agriculture. These experiments are now finished and the results are being compiled at Washington. They will appear in bulletin form from the Department of Agriculture. This work is the first of its kind to be done in the Northwest and will be a distinct contribution to the land clearing problem as well as to that of the closer utilization of the products of our forests.

The department also has in process of preparation a large bulletin on tree growing in Idaho which will give the results of eight years of experimental work, observations and conclusions on approximately 200 species of shade and forest trees, as well as the results of a tree survey of the state including both native and introduced species. This bulletin will be entitled "Tree Growing in Idaho" and should be ready for the public about the first of June. Cooperative arrangements have been in operation for some years past with the Office of Foreign Seed and Plant Introduction, whereby trees secured by our agricultural explorers in foreign lands are sent to us by the Department of Agriculture at Washington, D. C., for experimental growth and tests in the forestry aboretum at Moscow. Something like twenty-five new species have been received during the past year and a number of others are promised for the coming spring.

The department has also during the past two summers had a member of its staff cooperating with the Forest Service in grazing studies in the southern part of the state. This work has been of an

investigative nature embodying the careful consideration of the present condition of the range and the plants it contains, the best methods of improving the range by means of eradication of poisonous plants, rotation and deferred grazing, water development, and proper distribution and handling of stock. The importance of investigations of this kind is well shown in the fact that the Caribou National Forest of this state has, by means of grazing studies and carrying-capacity work conducted by its officers and men from the University of Idaho, been able to increase the number of stock grazing within its borders approximately 20 per cent during the past five years. It is well known that similar work will not only conserve and improve the forage on the National forests in Idaho, but will also increase the carrying capacity to a very considerable degree.

DEPARTMENT OF HORTICULTURE

C. C. VINCENT, W. C. EDMUNDSON, G. J. DOWNING
and E. P. TAYLOR, Reporting.

Projects: (1) Apple breeding (Adams). (2) Fruit by-products investigations. (3) Summer versus winter pruning experiments. (4) Orchard irrigation. (5) Orchard survey work. (6) Small fruits experiment. (7) Testing spray materials for the control of San Jose scale. (8) Oyster shell scale. (9) Spraying for codling moth. (10) Commercial onion culture. (1) Variety tests of vegetables.

The projects enumerated above were under way at the time the last annual report was made. During the past year four new projects have been started, 14 and 15 in cooperation with the Division of Plant Pathology.

New Experimental Work

Strawberry variety tests: One hundred plants each of the following varieties were planted in the spring of 1916: Steven's Late Champion, Jessie, Climax, Dorman, Sharpless, New York, Bederwood, Dr. Burrill, Kellogg's Premier, Cardinal. Additional varieties will be planted in the spring of 1917.

Apple variety tests: The following varieties of apples were planted in the spring of 1916: Red Siberian, Yellow Siberian, Martha, Whitney No. 20, Hyslop Crab, Yellow Transparent, Red Astrachan, Early Harvest, Jeffries, Wealthy, Red June, Maiden Blush, Gravenstein, Duchess of Oldenburg, Winter Banana, Alexander, York Imperial, King, McIntosh Red, Delicious, Newtown Pippin, Spitzenburg, Stayman Winesap, Winesap, Baldwin, Rhode Island Greening, Rambo, Red Rome, Artley, Yellow Bellflower, Blue Pearmain, Black Ben Davis, Gano, Arkansas Black, Sierra Beauty.

Potatoes: Work under this project will have to do with variety tests, seed selection, seed treatment, and the tuber unit method of potato improvement. With the harvesting and taking of data of this year's crop, one year's work on the project will have been completed.

Spraying for apple powdery mildew: The object of the work undertaken under this project is the determination of the efficiency of different spray materials for the control of powdery mildew.

Investigations Completed

Data on the following projects will be submitted for publication in bulletins or in other form within a short time: Commercial onion culture; preliminary report on pruning experiments; orchard irrigation; and the orchard survey of Canyon county.

Spraying for Codling Moth

Since the results of this piece of experimental work are not likely to be published elsewhere within the near future, data secured up to this time may very properly be included in this report. The work was undertaken three years ago to determine the relative efficiency of one, two, and three applications of arsenate of lead and for the purpose of comparing the efficiency in the control of the codling moth of two well known and widely advertised brands of powdered arsenate of lead, Corona and Sherwin-Williams. Probably from seventy-five to seventy-eight per cent of the insect injury to the orchards in the state of Idaho is caused by this insect.* It is very important, therefore, that orchardists be kept informed of the most efficient methods for its control.

Plan of experimental work: For this experiment one of the Station orchards was divided into seven plats. Plat No. 1 was the check plat. It was not sprayed for codling moth during the three years. Plat No. 2 was given one application of Corona arsenate of lead each year. It was applied when from eighty to ninety per cent of the petals had fallen. Plat No. 3 was given two applications of Corona; the first at the same time that plat No. 2 was sprayed; the second three weeks after the application of the first spray. Plat No. 4 was sprayed three times each year. The first application was made when from eighty to ninety per cent of the petals had fallen, the second three weeks later, and the third about the first week in August. The last application was made to control the second brood of worms. Plats No. 5, No. 6 and No. 7 were given the same number of treatments as plats No. 2, No. 3, and No. 4 respectively but Sherwin-Williams arsenate of lead was substituted for Corona. Thruout the experiments one pound of the powdered arsenate of lead was used to each fifty gallons of water. The spray was applied at two hundred pounds pressure. The results of the experiment are recorded in the following tables:

* For a complete description of the codling moth and its life history, see Idaho Experiment Station Bulletin No. 87.

Table I—Results of Spraying for Codling Moth, 1914

Applications	Brand	No. good	No. wormy	Per cent good	Per cent wormy	Total
Check		1889	218	89.66	10.34	2107
One	Corona S. W.	4332	57	98.71	1.29	4389
		2551	48	98.16	1.84	2599
Two	Corona S. W.	9490	35	99.63	0.37	9525
		5444	25	99.55	0.45	5469
Three	Corona S. W.	6704	31	99.54	0.46	6735
		2489	13	99.49	0.51	2502

Table II—Results of Spraying for Codling Moth, 1915

Applications	Brand	No. good	No. wormy	Per cent good	Per cent wormy	Total
Check		2296	2273	50.30	49.70	4569
One	Corona S. W.	10265	898	91.95	8.05	11163
		1579	640	71.12	28.88	2219
Two	Corona S. W.	10951	961	91.94	8.06	11812
		2465	755	76.56	23.44	3220
Three	Corona S. W.	8304	439	94.98	5.02	8743
		3069	352	89.77	10.23	3421

Table III—Results of Spraying for Codling Moth, 1916

Applications	Brand	No. good	No. wormy	Per cent good	Per cent wormy	Total
Check		4850	813	85.65	14.35	5663
One	Corona S. W.	5525	521	91.39	8.61	6046
		9767	317	96.86	3.14	10084
Two	Corona S. W.	7786	282	96.52	3.48	8068
		8708	209	97.96	2.34	8917
Three	Corona S. W.	11312	135	98.83	1.17	11447
		8266	105	98.76	1.24	8371

Recommendations: The Corona gave slightly better results but we believe that either material properly applied will give satisfaction. The first or calyx spray should be applied when from eighty to ninety per cent of the petals have fallen or work should begin in time to complete the first spray before the calyx lobes have closed. Two hundred pounds pressure should be maintained on the machine to drive the spray into the calyx cups. It may not be possible to apply this spray to all varieties at the same time.

The second spray should be applied about three weeks after the

first. A close observation should reveal codling-moth eggs at this time. It may be necessary to spray again in two or three weeks if the apples are not thoroly coated with spray material or if the orchard is a seriously infested one. To determine the time for the application of a third spray the trees should be banded about the middle of June. The spray should be given twenty days after the first larvæ come down under the bands. Trap or breeding cages may also be employed to determine the exact time for the application of the third spray. It should be applied when the first moths appear. The number of applications will depend on the infestation the previous year, the variety of the fruit, the infestation in neighboring orchards, effectiveness of early sprays, and seasonal conditions. The early calyx spray, however, is the most important. If this and other early brood sprays are neglected or improperly applied when the worms are bad no amount of spraying late in the season will save the crop. There may be exceptional cases in certain sections where it will not pay to make more than one application.

Publications

The department has published the following bulletins during the year:

Bulletin No. 85, The Use of Lime Sulphur as a Summer Spray for Apple Scab (Vincent). This bulletin summarizes the results of spraying experiments for the control of apple scab over a three-year period. The results secured indicate that three applications of lime-sulphur, summer strength, applied (1) when the buds show pink, (2) when the petals fall, (3) three weeks later, will give practically clean fruit. This bulletin also discusses the introduction of apple scab into the state, presents a map showing infected districts, and discusses the economic importance of scab and the cost of spraying.

Bulletin No. 87, Insect Pests of the Orchards and Gardens of Idaho and Their Control (Edmundson). This bulletin conveys practical information to those interested in the production of fruits and vegetables. It is divided into three parts, (1) Insect Pests of the Orchard, (2) Insects of the Garden and (3) Spray Materials. Of the orchard pests such insects as San Jose scale, oyster-shell bark louse, scurfy scale, cottony maple scab, codling moth, caterpillar, pear, and cherry slug, red spider, and aphids are described and remedies given. Remedies are also given for such garden pests as the Colorado potato beetle, potato-flea beetle, cabbage worms, cabbage aphid, tomato worms, pea weevil, onion thrip, raspberry cane-maggot.

Circular No. 1, Spraying Calendar (Taylor and Willis). This circular gives in condensed form formulas and recommendations for the preparation of spray materials, and shows when to spray and what to spray for.

Extension and Other Work in Horticulture

The Department of Horticulture has devoted a portion of its time and energy to various kinds of extension work in cooperation with the

Agricultural Extension Department. During the year members of the department made thirty-six talks at movable schools and farmers' institutes, judged at thirteen state and county fairs, and prepared educational exhibits for the Latah County Fair and the National Apple Show. Papers dealing with experimental work in horticulture at the University were presented during the year as follows. "Apple Breeding," by Vincent, before the American Association for the Advancement of Science at Berkely, California; "By-Products Investigations" by Vincent, before the State Horticultural Society at Twin Falls; "The Amount of Water needed to Perfect the Crop of Fruit and to Prepare the Buds for the Succeeding Season," by Downing and Taylor, before the fifth annual convention of Operating Engineers at Boise; "Vegetable Gardening," by Vincent, before the Inland Empire Teachers' Association at Spokane; "The Effect of Irrigation on the Development of Fruit Spurs and Fruit Buds," by Downing, at the ninth annual Apple Show at Spokane; "What We Have Learned About the Efficiency of the Different Spray Materials for the Control of San Jose scale," by Edmundson, at the ninth National Apple Show at Spokane.

Departmental Needs

The proper development of this department is seriously hampered at the present time by the lack of a packing and storage building. As the department is maintaining a good sized commercial apple orchard, a pear and plum orchard, a variety apple orchard, over twelve thousand apple seedlings, and approximately thirty acres for gardening purposes, the present facilities for handling the crops are entirely inadequate. A new packing and storage building is badly needed. One room in that building should be provided where all horticultural products that are to be sold can be properly graded and packed. Cold-storage rooms are needed so that the seedling trees, commercial varieties of apples, potatoes and vegetables can be properly stored temporarily and until studied or sold. The building should be sufficiently large to accommodate our spraying equipment, orchard tools, and garden tools.

DEPARTMENT OF POULTRY HUSBANDRY

PREN MOORE, Reporting

Projects: (1) Flock management. (2) Feeding experiment to determine the relative efficiency of vegetable and animal protein for egg production.

Feeding Experiment

The relative value of vegetable and animal protein in the ration of laying hens is a subject that is the cause of much discussion among poultrymen. Some experimental work has been done but the question is still an open one. As a means of securing further information, the following experiment was planned and started November 1st, 1915. Four pens of twenty-five fowls each were fed with the following rations:

Pen IV

Grain	Mash
10 parts peas	3 parts bran
14 parts wheat	3 parts shorts
6 parts corn	1 part corn meal
	1 part wheat meal
	1 part pea meal
	6 parts oil meal
	1 per cent charcoal

Nutritive ratio 1:4.2

Pen V

6 parts corn	2 parts bran
10 parts wheat	1 part shorts
	1 part corn meal
	1 part wheat meal
	3 parts beef scrap
	1 per cent charcoal

Nutritive ratio 1:4.2

Pen VI

1 part peas	1 part bran
5 parts corn	1 part shorts
10 parts wheat	1 part corn meal
	1 part wheat meal
	1 part pea meal
	3 parts oil meal
	1 per cent charcoal

Nutritive ratio 1:5.5

Pen VII

6 parts corn	2 parts bran
10 parts wheat	2½ parts shorts
	1 part corn meal
	1 part wheat meal
	1½ parts beef scrap
	1 per cent charcoal

Nutritive ratio 1:5.5

The grain was fed in deep litter at the rate of eight quarts a day per one hundred hens and the mash in open hoppers. The rations were supplemented with green food, grit, shell, and bone. In the calculation of nutritive ratios, Idaho analytical data on wheat, bran, and shorts have been used. All other analytical data and digestion coefficients have been taken from Henry's Feeds and Feeding. The fowls were all trap-nested and the number and weight of each were recorded. Moreover the fowls were weighed at the beginning of the experiment, on May 1st, and again on October 31st, 1916, and individual weights recorded.

Results of first year's work: Pen No. 5 produced 55.8 per cent more eggs than pen No. 4, 51.1 per cent more eggs than pen No. 6, and 35.2 per cent more eggs than pen No. 7.

Table of Weights of Eggs

Pen	Per cent under 2 oz.	Per cent 2 oz.	Per cent over 2 oz.
IV	46.5 plus	52.7 plus	0.8 minus
V	15.2 plus	72.7 minus	12.0 plus
VI	41.9 minus	56.3 minus	1.8 plus
VII	17.5 plus	79.7 minus	2.9 minus

The condition of health and gain in flesh show about the same percentage as that of egg production and weights of eggs. This experiment is planned to extend over a period of at least three years. The results of the first year's work have led to the addition of another flock. The difference in production between pens 4 and 6, and pens 5 and 7 indicates that animal protein is essential for heavy egg production. In the ration of pen No. 5 the beef scrap constitutes 37½ per cent of the mash; in that of pen No. 7 it constitutes 18¾ per cent of the mash. The fact that pen No. 5 produced 35.2 per cent more eggs than pen No. 7 suggested the advisability of increasing the pens by one whose mash would contain an intermediate percentage of beef scrap. The ration of the new pen, No. 8, is indicated below. Its mash contains 28 per cent of beef scrap.

Pen VIII

Mash	Grain
6 parts corn	2 parts bran
10 parts wheat	1¾ parts shorts
	1 part corn meal
	1 part wheat meal
	2¼ parts beef scrap
	1 per cent charcoal

Nutritive ratio 1:4.8

The fowls used in this experiment are White Leghorn pullets.

DEPARTMENT OF SOIL TECHNOLOGY

P. P. PETERSON and G. W. GRAVES, Reporting

Projects: (1) Rotation systems for Palouse soils. (2) Fertilizer requirements for Palouse soils. (3) Rotation experiments on timber soils. (4) Soil survey of Latah county. (5) Reconnaissance survey of the soils of the upper Snake river valley. (6) Experiments to determine the duty of water for common field crops under different conditions of climate (Adams). (7) Soil colloids (Adams).

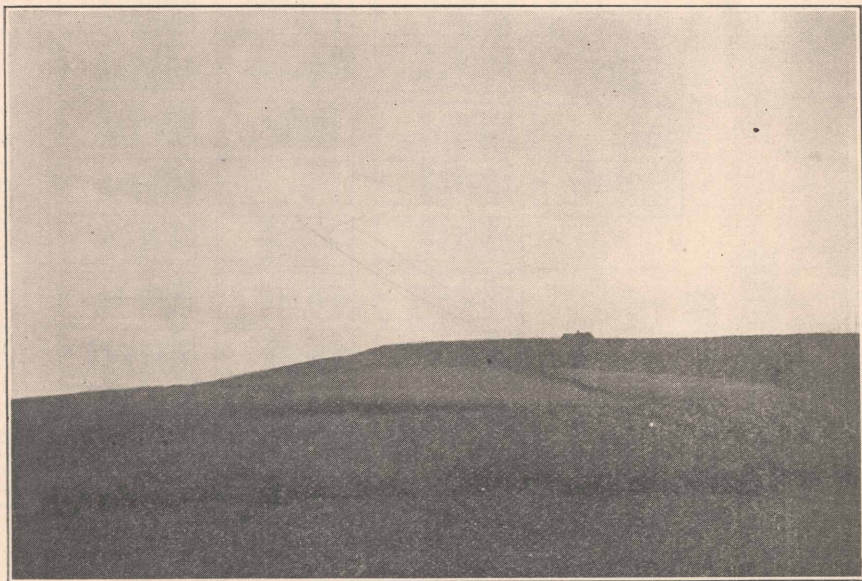
Rotation and Fertilizer Experiments

These experiments were started for determining the best system of crop rotations upon the predominating type of soil found in the Palouse area of Idaho, the Palouse silt loam, and also for determining more definitely the needs of this soil in the way of plant food elements. The first year after the land was divided into plats, wheat was grown exclusively. The year 1915 was the first in which

a diversity of crops was used. Obviously no data with regard to the value of rotations could be obtained in that year. However, the data indicated the deficiency of nitrogenous plant food. Nitrate of soda gave an apparent increase in the yield of wheat. Muriate of potash and acid phosphate apparently gave no increase. These data are somewhat questionable as the squirrels so damaged the crop as to make comparisons in yield almost valueless.

The work is now developing so that we are obtaining data of great value to the farmers of the Palouse area. We find this year, as we did last, that the yield of grains on the Palouse silt loam can be greatly increased by increasing the soil's content of available nitrogen. We find also that wheat does well after a potato crop or a field-pea crop. Plate II shows the area of the plats and the kinds of rotations being tried out.

The systems of rotations being used in the rotation and fertilizer experiment are as follows: (1) Wheat, oats, and peas; (2) Wheat, oats, and fallow; (3) Wheat, oats, and corn; (4) Wheat, oats, and potatoes; (5) Wheat, wheat, and wheat; (6) Wheat, timothy and clover two years, oats and corn; (7) Wheat, winter barley, potatoes, and oats; (8) Wheat, winter barley, oats, and corn. The experiment has not been conducted long enough to justify the drawing of any very definite conclusions with regard to the rotations but this much can be said at this time, viz. wheat does very well after potatoes, corn, or peas.



Potatoes on Palouse silt loam, 1916. Yield 217.7 bu. per acre. Wheat does well after potatoes.

Table I—Yields of Wheat in 1916 as Affected by the Preceding Crop
(Bu. Per Acre)

Crop	1915	Wheat	Oats	Corn	Peas	Fallow	Potatoes
"	1916	"	Wheat	Wheat	Wheat	Wheat	Wheat
Yield	1916	29.8	25.3	48.4	51.2	63.1	76.1

Facts of considerable value in regard to the fertilizer needs of the Palouse silt loam have also been ascertained. An experiment with fertilizer in rotation No. 4 has been conducted. The experiment is so arranged that each year the plats in this rotation which have a crop of wheat get two hundred pounds of nitrate of soda, one hundred pounds of muriate of potash, and one hundred pounds of acid phosphate alone and in various combinations. Plats carrying the same rotation are run alongside these as checks. Tables II and III give the data secured thus far from the fertilizer tests.

Table II—Effect of Fertilizer added in 1915 on Yield of Oats, 1916

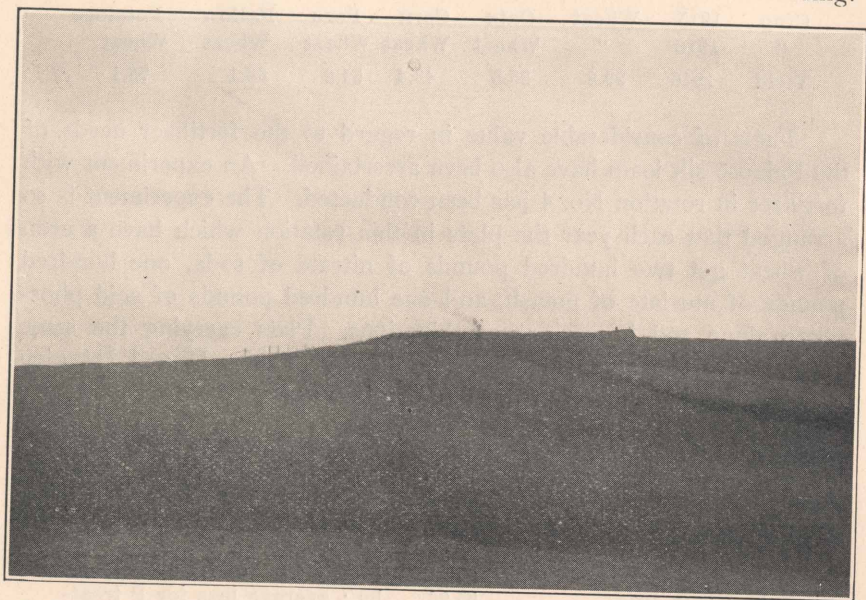
Plat treatment	Yield in bu. per acre	Remarks
A 6 None	64.53	Average increase for N treatment, 19.8 bu.; average increase for K treatment, 2.5 bu.; average loss for P treatment, 2.4 bu.
A 5 N in 1915	75.53	
B 9 K in 1915	63.53	
D 7 KN in 1915	95.96	
C 4 P in 1915	60.30	
B 8 PN in 1915	83.90	
C 6 PKN in 1915	73.56	
C 5 PK in 1915	61.52	

Table III—Effect of Fertilizer on Yield of Wheat in 1916

Plat treatment	Yield in bu. per acre	Per cent of smut.	Remarks
E 2 None	76.1	10.6	Owing to the varying percentages of smut, conclusion drawn from these figures can mean but very little.
E 1 N 1916	70.0	31.0	
D 3 K 1916	75.2	30.0	
C 11 KN 1916	64.7	34.6	
E 3 P 1916	67.1	11.6	
D 4 PN 1916	53.1	32.7	
D 5 PKN 1916	53.2	50.0	
D 6 PK 1916	47.2	49.0	

Table II gives very conclusive evidence that nitrogen is the element of plant food most likely to become the limiting factor in plant growth. Potassium and phosphorus-treated plats show 2.5 bushels per acre above and below the check respectively; this figure may, therefore, be considered as about the limit of experimental error. The conclusion justified is that additions of these two elements have practically no effect on crop yield. With nitrogen, however, the case is different. There was an average increase in yield per acre from nitrogen fertilization of 19.8 bushels per acre. The consistency of the

data for the several plats indicates that we may safely conclude that nitrogen is the element of soil fertility which needs most husbanding.



A 96 bu. yield of oats on the Palouse silt loam one year after fertilization with sodium nitrate at the rate of 200 lbs. per acre.

Rotation and Soil Correction Experiment at Sandpoint

The rotation and soil-correction experiment at Sandpoint has also been continued. During the past year funds have been so limited and consequently facilities for harvesting so inadequate that the data which we have can not be considered quantitative. From the qualitative point of view the results are not sufficiently pronounced to mean anything. It is sincerely hoped that during the next year better machinery for harvesting the crops can be obtained so the experiment may become quantitative. The most notable result to report in connection with this experiment is the yield of clover and timothy hay, the second year after planting. Plat 7A which was given one ton of limestone in 1915 and was planted in the spring of that year yielded three and one-fourth tons of hay in 1916. While on other soil this yield would not be considered very remarkable, on this soil it is to be so considered, for the average yield of peas on six plats this year was only five and one-half bushels per acre; and the average yield of oats on six plats was eleven and three-tenths bushels per acre. With an application of limestone, clover can be made to give very satisfactory results.

Duty of Water

The plan of this experiment has been revised and enlarged. The

work is now being conducted at Moscow, Gooding, and Idaho Falls. Its objects is three-fold: (1) To secure the moisture equivalent of various crop plants under the atmospheric and soil conditions which prevail at the three places; (2) To determine the variation of the moisture equivalents caused by planting at different months of the year; (3) To determine variations in moisture equivalents caused by different soil moisture contents.

The potometers that were used in previous years have been discarded for larger ones having a better shape. Those now in use are thirty-six inches in depth and eighteen inches in diameter and have a plain bottom. The feeding cans used on the old ones have been abandoned as they were easily jammed loose from the potometer with resultant leakage of water.

There are fifteen potometers located at each place. It is planned to add five more to each place next season. The potometers are prepared for use by burying them so that their tops are very nearly flush with the soil surface. About twenty pounds of coarse sand or gravel are then placed in the bottom of each. It covers the horizontal part of an L-shaped feeding pipe that is perforated on the lower side with holes of about three-sixteenths of an inch in diameter. The vertical part of the pipe extends up to the surface of the soil near one side of the potometer. Into the L-shaped pipe water is fed in such a manner as to keep the level of the water table constant. This is done by means of an aspirator bottle placed near the potometer on the surface of the soil. The aspirator bottle forms the reservoir which holds the feeding water. The water is conducted from the bottle to a point very near the bottom of the pipe thru a glass tube in the side orifice of the bottle. From the neck of the bottle a glass tube extends to about four inches from the bottom of the pipe. This allows the water to feed until the level shuts off the air in the upper part of the tube. As the level sinks by the capillary action of the soil, water is again allowed to flow.

Evaporation is prevented almost totally by placing a sheet of empire cloth over the soil and covering it with about two inches of coarse sand or fine gravel. The seeds are planted thru slits cut in the cloth. The young plantlets grow thru the slits. The coarse sand or fine gravel acts as a mulch over the slits and edges of the cover. To avoid the influence of any electrical current set up by the zinc or galvanized iron cans and the soil solution, the cans have been enameled with two coats of Bakelite. The potometers run as checks were not enameled. It is planned to plant only one kind of crop in any one year. This year peas were used and were planted at three different periods. The first crop was planted near the first of April, the second near the first of May and the third near the first of June. Three potometers were planted at each period. Two out of each five potometers were kept as checks. At the present time the results of the experiments at Gooding have not been compiled. The results for the Moscow experiment are reserved for future publication.

At each place hygrothermograph records were made for the grow-

ing periods insofar as that was possible. No graphs were obtained before July. Livingstone porous cup atmometers also were used at the places of experimentation. They were secured too late for use previous to July.

Results for the summer of 1916 at Moscow indicate that crops planted in June have a much higher moisture equivalent than those planted in April or May. The results at Idaho Falls are quite different; crops planted in April or June have a much higher moisture equivalent than those planted in May.

Soil Colloids

The work under this project has now been conducted for three years. Its object is the discovery of correlations between the colloidal content of certain soils and striking physical phenomena. In the vicinity of Tertiary Lake, Idaho, are found spots of soil which are referred to by the farmers as "slick spots." The soil settled so tightly together that it will not take up moisture sufficient to support a growing crop for more than a day or so. After a fall of rain these spots look slick, which fact accounts for this designation "slick spots." Again there are areas in the glaciated section of north Idaho that are described as "ashy." The soil particles have no adhesive properties. An investigation of the colloids of these two types of soils is almost completed. The department will publish the data secured in the form of a magazine article or technical bulletin.

THE ABERDEEN SUB-STATION

L. C. AICHER, Superintendent, Reporting

Projects, Dry Farming: (1) Crop rotations. (2) Cultural tests. (3) Small grain variety tests. (4) Legume seed production. Irrigation: (1) Variety tests of small grains. (2) Variety tests of field peas. (3) Alfalfa and clover seed production. (4) Potato culture and variety tests. (5) Sugar-beet seed production. (6) Miscellaneous crop tests. (7) Extension service.

The 1916 work at the Aberdeen Station was very largely a continuation of the work outlined in 1913. A few additions and new features to better bring out the results of previous work were added.

The season was abnormal. Late spring and summer frosts coupled with an unusually cool spring and summer retarded growth on both the irrigated and dry land. The dry lands, however, suffered most from adverse climatic conditions. From a study of the climatological data submitted it will be noted that the precipitation from January 1 to August 31 was 7.70 inches. Of this amount 6.75 inches fell before the first of June. The normal June and July rainfall is 2.43 inches. This year only .55 inches were received during those two months and that amount fell in three different showers. Winter-wheat prospects on the dry farms until June 1 were very good. The crop yielded an average of a little over ten bushels per acre.

The irrigated farm fared very well. Irrigation water was plenti-

ful. The seed crop suffered most from the abnormal climatic conditions as frost injured more or less of the seed on two different occasions.

Dry-Farm Work

The general conduct of the dry farm was the same as that of previous years. The work may be treated under three heads, rotations, cultural experiments, and cropping experiments.

Rotations: The rotations have been continued along lines similar to those outlined in 1913. The results of a few of the rotations this year are very encouraging. Peas following wheat and fallow yielded a good crop of pea hay. Potatoes following fallow which had previously been green-manured with a crop of sweet clover gave one of the highest yields secured. This fall for the first time winter wheat has been planted on alfalfa land with a crop plowed under. Various other cropping tests will be conducted on this piece of land to determine the effect of growing alfalfa on dry land a few years and the final turning under of a crop for the production of small grains.

Cultural tests: The effects of the abnormal season can be traced thru the various cultural tests. A marked change was noticed in the *time-of-planting* experiment. This year the later plantings yielded proportionately more than the medium early plantings which in previous years have given the best results. This is no doubt due to the fact that the early seedings were made in dry ground. Following the September 20 rains there was a rise in temperature and as a result the late seedings, with the exception of that of October 15, emerged in splendid condition. The September 15 and October 1 plantings yielded best. October 15 plantings as usual, practically speaking, proved a failure. The same thing has happened for the past four seasons and still there is a tendency among farmers to keep on planting at this late date. This *time-of-planting* test, however, will eventually bear fruit for on Farmers' Day this year the striking difference between late and early planting was brought to the attention of those who visited the station, and, as a result, a large acreage of wheat was planted from three to four weeks earlier than usual.

The *depth-of-planting* tests show clearly that deep seeding is not to be recommended. Two and one-half inch planting in moist soil and one-inch planting in dry ground gave the highest returns per acre. It is advisable to plant in moist ground but where a large acreage is to be planted this is not always possible. When the ground becomes dry the shallow seeding is to be recommended.

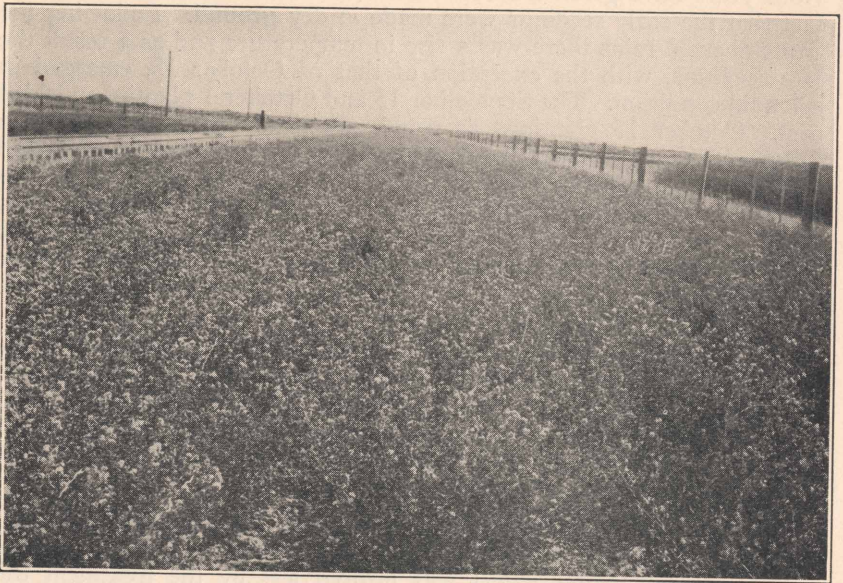
The *rate-of-planting* tests indicate that the three-peck-per-acre rate will prove most profitable year in and year out.

Harrowed winter wheat was injured less by the treatment this year than at any time since the experiment was begun. This probably results from the fact that the soil was packed hard on account of the severity of the winter and the great amount of snow fall. The wheat really needed aeration and that was accomplished by the harrowing. None of the harrowed cropped plats blew badly this year.

In the *time* and *depth-of-plowing* tests, it has been clearly proven that early spring plowing for fallow is one essential in successful dry-farming operations. Fall plowing is also satisfactory. With the exception of the shallow-plowed plats results are practically the same in the *depth-of-plowing* experiments. Deep plowing does not give higher yields than a normal six- or seven-inch plowing. The one great essential is the securing of a good firm seed bed.

Results from the *time-of-harvesting* experiments were the same as those obtained last year. With Turkey wheat there is very little loss from shattering if the harvesting period is extended for a period of thirty days or more after ripening. There is, however, because of shrinkage, a direct loss from the practice of cutting wheat before the kernels are fairly well ripened.

Cropping experiments: The various winter and spring cereal variety tests make up the larger part of the cropping experiments. The winter wheats were planted in triplicate but the spring grains, for want of sufficient land, were planted in duplicate only. There are great differences in the soils of the station. Replication of plats is absolutely necessary to insure reliable data on variety performance. Results of variety tests on winter wheat emphasize the fact that the wheat of the Turkey group is the best for the dry lands. The better spring-wheat



Grimm alfalfa on railroad right-of-way, Aberdeen Sub-Station, 1916. Yield of seed one bu. per acre.

varieties are Early Baart and Fretes. The best oats are Sixty-Day and Kherson and the best barleys are White Smyrna and Mariout.

Very satisfactory results were obtained this year from potatoes planted on dry land. The bottom land returned good yields of well formed tubers. The Early Ohio, Early Rose, and Pearl have again proved that they are well adapted to dry-land conditions.

Results obtained with alfalfa, sweet clover, and peas indicate that these crops may well be given greater attention on the dry lands of the state. Certain sections more favored for one reason or another can grow them with every assurance of success. On the dry-land section of the railroad right-of-way alfalfa produced seed at the rate of



Field peas on the dry farm, Aberdeen Sub-Station, 1916. Yield 10 bu. per acre.

one bushel per acre. Sweet clover sown for seed production gave satisfactory returns. More seed and seed of better quality would have been obtained had the rows been spaced not less than twenty-one inches apart. Peas yielded a little over ten bushels per acre, returns that are very satisfactory in view of the fact that the wheat yield this year was only ten bushels per acre.

Flax was again grown but the results obtained from this crop do not warrant its being recommended for the dry lands of the state. Sudan grass was also grown. From results secured we must conclude that this crop, too, is not generally adapted to the dry lands of this state.

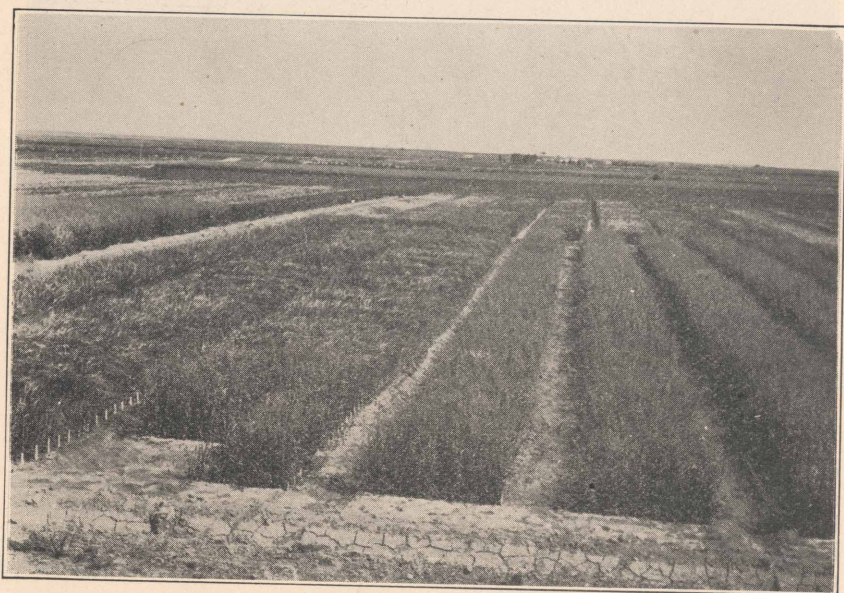
Experiments on Irrigated Land

Results this year from irrigation experiments were very satisfactory. Splendid yields were obtained from field peas, potatoes and white clover. A new feature of the irrigation work was the introduction of sugar-beet seed production and the growing of "stecklings" or mother beets. Five individual plants were brought to maturity. A

great difference was noted in the quality of seed produced and in yielding capacity.

Irrigated cereals: The irrigated cereal work is a continuation of the varietal testing and improvement work which was commenced when the station was first established. The barleys and oats were planted in duplicate. From the results of variety tests the following varieties of spring grain can safely be recommended for this section of the state: Spring wheat—Dicklow, Defiance and Washington Bluestem; Oats—Swedish Select and White Bonanza; Barley—Beldi, Sandrel, Trebi, and Hanna.

In addition to the regular plat work with cereals, nursery work embracing over two thousand varieties and strains in six-foot rows was maintained. This work is done in cooperation with the Office of Cereal Investigations of the United States Department of Agriculture. Men



Nursery work and tests of small-grain varieties under irrigation, Aberdeen Sub-Station, 1916.

of that office who have charge of wheat and oat investigations assisted in harvesting and taking notes on the various wheat and oat varieties. The barley work was handled entirely by the station force but a barley technologist spent forty-five days in taking technical notes on the growth of the different varieties. The Trebi has proven itself to be a very satisfactory variety. This year a large quantity of it was grown for distribution among farmers.

Field peas: Thirty-four varieties of field and garden peas planted

in duplicate plats were grown this year. For the first time the Blue Prussian variety in point of yield took first rank, a fact which may be explained, in part at least, by the introduction of new seed direct from the Office of Forage Crops of the United States Department of Agriculture. Several new varieties were added to the list already under test on the farm. The Kaiser still stands as one of the best. From Seed of this variety distributed the preceding year, one grower in the neighborhood secured a yield of fifty-five bushels per acre on a field of eight acres. The field-pea business has been given great encouragement because of a contract secured with a bureau of the Federal Government to furnish it with peas of the Kaiser, Carleton, and Chang varieties. Next year the acreage of field peas in this vicinity will be more than doubled.

Sugar and canning peas: This year six of the most prominent varieties of sugar peas were obtained from a large Idaho seed firm and were grown to secure data on their yielding capacity in comparison with that of field peas. Altho they did better than during any previous year they fell considerably short of producing as much per acre as the field peas. From these tests it would seem that where a good variety of field peas can be secured, sugar peas are not to be generally recommended even for "hogging-off" purposes.

Alfalfa and clover seed: The year has not been a normal one for seed production because of the late spring and mid-summer frosts; nevertheless results from this year's work in clover- and alfalfa-seed production are very encouraging. White clover on the station yielded at the rate of eight bushels, alsike at the rate of five and one-half bushels, and red clover at the rate of six and one-half bushels per acre. The alfalfa seed yielded but four bushels per acre, but, being of the Grimm variety and worth thirty-five cents per pound, the acre income was practically the same as that from the white clover. The area of Grimm alfalfa and of the various clovers for seed production is being increased rapidly in this section. At this writing we have over twelve thousand dollars worth of Grimm alfalfa seed stored in the cleaning room and machine shed for cleaning and sale. This year three carloads of Grimm alfalfa seed will be shipped out of Aberdeen and vicinity. The price obtained will be thirty-five cents per pound, f. o. b. loading station. The quality of seed grown in this section of the state is rapidly becoming favorably known. More calls have been received this year than ever before for assistance along the lines of clover- and alfalfa-seed production.

Potato cultural and variety work: The results from the potato experiments this year are most interesting. In general they correspond with those secured last year but the yields per acre were considerably greater. A yield of five hundred and twenty bushels per acre was obtained on one plat planted with the stem ends only of three-ounce seed cut in half. The Station supplied many farmers this year with some very good Idaho Rural seed stock and they have been so well pleased with it that a great demand for seed potatoes has arisen among both irrigation and dry-land farmers. A large and carefully constructed

potato storage cellar makes possible the selling of seed of the highest quality. The temperature maintained in this cellar (33 degrees F.) is a preventive of tuber-rot disease and insures seed of the highest vitality. The practice at this station is to cut the stem end of every seed tuber to ascertain the presence of disease. If a discoloration is found the tubers are rejected. Tubers showing any outward sign of skin disease are given no consideration whatever in seed selection. A great deal of reliable information on potato production is now available for publication.

The better yielding types of early potatoes are Early Rose, Early Ohio, and Irish Cobler. Of the later types those yielding most are Idaho Rural, Pearl, and Netted Gem. The Pearl is more susceptible to disease than either of the other two varieties.

The tuber unit work was greatly enlarged this year. Approximately sixteen hundred individual hills were planted and harvested. The work is costly for each hill must be handled separately in the matter of counting, weighing, and discarding of tubers. Satisfactory returns for the money spent in this line of investigation may possibly come by securing high yielding strains of potatoes of the different varieties.

Sugar beets: Work with this crop has been concentrated in seed production and the growing of "stechlings." The selection of mother beets for this year's seed crop was made last year from the crop grown in the regular manner. The work in sugar-beet production up to this time has been of a preliminary nature. The seed for next year's mother beets is of a special variety obtained by the United States Department of Agriculture from Germany. A much larger acreage of sugar beets for seed production will be planted next year. The acreage devoted to the production of sugar-beet seed in this section of the state this year was eight hundred; next year it will be over two thousand.

Miscellaneous crops: Corn was again grown for silage. Late planting was made necessary because of the lateness of the spring. The crop was injured by frosts during the growing season on two different dates and an early frost killed it before the grain was out of the milk stage, nevertheless a fair amount of feed was secured. Vetch was grown for seed on a small area and a fairly satisfactory yield was secured.

Local Extension Service

Farmers' Day: Three hundred and fifty farmers from southeastern Idaho this year took advantage of the opportunity afforded on Farmers' Day to inspect the work that is going on and to inform themselves with reference to results already secured from experimental work. The visitors were shown over the farm and had explained to them the experimental work in detail. Special interest was manifested in the clover- and alfalfa-seed production work, pea variety tests, the potato work on irrigated land, alfalfa sown in rows for the production of seed, and in the Turkey winter wheat sown in rows on the dry land. Interest in the sowing of wheat in rows is due to the fact that wheat thus

planted can be cultivated for the destruction of weeds. Tumbling mustard is so thick on many of the dry farms that serious losses have been incurred. This row-culture method which on the station has given about the same yield per acre as that secured from the ordinary system of planting may be the solution of the weed problem.

Seed cleaning: A new and modern seed-cleaning outfit has been installed on the station to clean up various seed crops now being produced in this section of the state. This equipment is not only a great convenience to the farmers of the section but enables rapidity of operation in the thoro cleaning of the various seed crops produced on the station farm. The Station last year with a small hand-operated mill fanned up two carloads of seed. This year three carloads of seed will be cleaned for shipment. In addition a great deal of wheat, barley, and oats will be cleaned for seeding purposes. The influence of the station has been greatly increased thru the operation of this cleaning plant. Many farmers who came to have seed cleaned also came for specific information on this or that subject. Others who never would have come to the farm directly for information have brought seed to be cleaned and while at work on it have become greatly interested in the work of the station after being made acquainted with the purpose for which it was established. A charge for cleaning is made sufficient to pay for all labor involved and fair interest on the money invested. Every effort is made to give farmers who come to the station to have seed cleaned thoro reliable information relative to the seed-growing business.

Thru the efforts of the station superintendent last year, local farmers secured a contract to supply the DeKalb County, Illinois, Soil Improvement Association with a carload of alfalfa seed. The contract was made with the signed understanding that all seed purchased was to be cleaned over the experiment station mill and was to be inspected and passed upon by the station superintendent. Warehouse storage receipts were issued for all seed inspected and passed and the farmers took them to the bank and cashed them at face value. As a direct result of this contract farmers received the highest price ever paid for common alfalfa seed in this section. The purchasers, too, appear to be well satisfied for this year they have returned for more seed. The contract again specifies that all seed purchased must first be cleaned and inspected at the experiment station. Seed for filling this contract is now being cleaned.

Thru the efforts of the station superintendent local farmers were also enabled in January of this year to secure a contract from a bureau of the Federal Government to supply it with thirty thousand pounds of Kaiser peas at three and one-half cents per pound, and with fifteen thousand pounds of Chang peas and one thousand pounds of Carleton peas at \$2.50 per bushel. The peas were to be grown under the general direction of the station superintendent by local farmers designated by him and are to be cleaned by the station farm mill and inspected and passed by the superintendent before shipment. Officials to whom sam-

ples of this year's crop have been sent have already expressed themselves as being well pleased with the results.

A movement inaugurated by the State Leader of County Agents in Minnesota to supply Grimm alfalfa seed to the farmers of that state is now under way. A similar movement by the Agronomy Department of the University of Wisconsin has also been made, but owing to its lateness, may not have much influence on this year's sale of seeds. Movements of this kind are capable of opening up a large and profitable seed business between farmers of Idaho and those of other states.

An effort has been made to organize the local seed growers into a seed-growers' association in order that the benefits of cooperative effort might be realized both from the standpoint of production and marketing. The initial steps were taken five months ago but thus far no businesslike organization has been effected. It is hoped that further efforts in this direction will prove to be more effective.

Publications

A bulletin has been written for the Office of Cereal Investigations entitled "Growing Grain on Southern Idaho Dry Farms." This bulletin is now available as Farmers' Bulletin No. 769 and may be obtained free of charge by addressing a request to the Experiment Station.

Bulletins on alfalfa- and clover-seed production in southern Idaho are in process of preparation. They will deal with clover- and alfalfa-seed production on both irrigated and dry land. A technical paper dealing with certain phases of potato growing has been prepared for the Journal of the American Society of Agronomy. Eventually manuscripts dealing with field-pea production and the growing of cereals under irrigation will be submitted for publication in bulletin or circular form.

Plans For the Future

Practically all the experiments now under way will be continued. The work with sugar beets will be enlarged, for the sugar-beet industry is a growing one in this section of the state. Efforts will be made thru experimental work to encourage the seed-growing business, for this section appears to be especially adapted to seed production. As time and space permit other seed crops as blue grass and orchard grass will be introduced and tried out. From one-fifth of an acre one hundred and fourteen pounds of onion seed have just been cleaned for market. One dollar per pound has already been offered for it.

THE CALDWELL SUB-STATION

O. D. CENTER and C. B. HAMPSON, Reporting.

Projects: (1) Land clearing and leveling. (2) Variety testing of small grains. (3) Pork production from alfalfa pasture. (4) Pork production from field peas, peas and wheat, and corn. (5) Dairy herd management. (6) Farm crops. (7) Improvements.

The necessity of making the Caldwell farm produce sufficient

revenue to be self-sustaining has forced comprehensive plans for experimental work into the background. In the conduct of the general farm work, however, feeding and other data that are well worth while have been secured.

New Work

The working plans for 1916 called for the clearing, leveling and seeding of the NE $\frac{1}{4}$ of section 9. This tract lies across the road to the west from the farm house and barn and field 4 of the older part of the farm. It can be watered from the Forest lateral and is intended for experimental work in the growing of small grains, clovers and alfalfas. By extraordinary effort it was possible to clear ten acres only of this tract. Of this ten acres, two and one-half were leveled, plowed and given over to variety tests of oats, wheat and barley. Plantings were made too late to secure the best results but the yields are comparable thruout with the exception of those reported for Swedish Select oats and Horn barley grown on the outside plats where they were particularly exposed to the depredations of jack rabbits. The results secured from variety tests on this piece of land are tabulated below.

Oats

	Yield per acre in bushels.
Swedish Select	9.5
Golden Rain	22.3
Colorado No. 37	21.8
Pedigree No. 1	25.6
Big Four	23.3

Barley

Horn	5.4
Bohemian	11.8
Holland	14.1
H. S. P.	15.0
Select	17.0

Wheat

Marquis	9.2
Bluestem	9.2
Defiance	6.7
Sonora	6.6
Fife	7.7
Dicklow	10.3

In this connection it is interesting to note that Swedish Select oats and California Feed barley grown across the road to the east in fields 10 and 11 produced 62.8 and 50 bushels per acre, respectively. This goes to emphasize two things, first, the necessity of soil improvement by the growth of alfalfa or other leguminous crop in preparation for the satisfactory testing out of varieties and, second, the necessity of early spring sowing. With adequate support for experimental work, this forty acre tract can be gotten into shape for splendid

work with the small grains and such other crops as should be grown in an experimental way on a farm of this kind. Additional clearings on both quarters will be made as rapidly as time and funds permit.

Live Stock Feeding and Management

The work with livestock follows very closely that undertaken and carried thru in 1915.

Pork production: Fields numbered 1 and 2 on the accompanying blueprint of the farm were given over as in 1915 to pork production from alfalfa pasture and from various crops sown for "hogging off" purposes. On May 18 three sows and nineteen pigs with a total weight of 1525 pounds were placed on one acre of alfalfa pasture. On June 5 three sows and fourteen pigs weighing 1047 pounds were added to the drove which then consisted of six sows weighing 1517 pounds and thirty-three pigs weighing 1055 pigs. This drove was insufficient in numbers to keep the alfalfa pasture down. On June 27, 588 pounds of cured alfalfa hay were taken from this acre pasture. After this cutting for hay the hogs kept the alfalfa pastured rather closely. They were fed twenty-five pounds of barley and one hundred and forty pounds of skim-milk daily and had access constantly to running water. On August 11 the thirty-three pigs weighed 2266 pounds and recorded, therefore, a gain of 1211 pounds. They were then turned into the first acre of peas. While on the peas they were fed eleven pounds of barley (soaked) daily. On August 30 the first acre of peas had been cleared. Weights taken on that date showed a gain of 155 pounds only. On September 11 the second acre of peas was cleared and the pigs were again weighed. They showed a total gain of 429 pounds. The third acre, peas and wheat mixture, was by far the best acre of the three in the "hogging off" series. The stand of both grains was superior to either acre of peas alone and the combination seemed to be particularly relished by the pigs. They had cleared this acre on September 28 and on that date showed a gain of 447 pounds.

The thirty-three pigs were then allowed free range of fields 1 and 2 which gave them opportunity to glean any peas not yet secured on the three pea fields, to secure any horse beans that might have escaped the blight, to root and harvest a possible half ton of half-sugar beets in the beet field and to hog down one-half acre of Gehu corn. Thru some misunderstanding on the part of the farm foreman, the pigs were not weighed when they had completed the harvesting of the corn. The results of this work, therefore, except as indicative of certain things, were rendered incomplete. On October 12 two of the best gilts were selected from the herd for brood sows. One of the barrows had become ruptured so that it was advisable to butcher him and a second barrow had been broken down in the back by the old sows. On November 24 nineteen of the older pigs were sold for \$8.25 per hundred. On January 19 four more were sold for \$9.00 per hundred.

The remaining six are now in the feed yard. All of this work with hogs is summarized in the statement below.

Number of animals in drove, sows.....	6
Number of animals in drove, pigs.....	33
Weight of pigs placed on pasture May 18.....	745 lbs.
Weight of pigs placed on pasture June 5.....	310 lbs.
Weight of sows when placed on alfalfa pasture.....	1520 lbs.
Days on pasture, 19 pigs	86
Days on pasture, 14 pigs	68
Pigs fed while on pasture	
Barley 1055 lbs.	\$ 21.00
Milk 2540 lbs.	5.08
Gain of pigs on pasture.....	1211 lbs.
Value of pork produced at 8c.....	\$ 96.88
Hay cut from pasture, 588 lbs.....	2.65
Gross value produced from pasture.....	99.53
Net value from pasture.....	73.45

The sows were not weighed at the close of the pasture period, and as the feed account does not include anything fed them, the pasture should be given the additional credit of maintaining the six sows.

Weight of 33 pigs when turned into peas.....	2266 lbs.
On first acre peas (Early garden peas).....	19 days
Weight of 33 pigs when acre cleaned.....	2421 lbs.
Gain on first acre peas.....	155 lbs.
Fed while on acre peas, 209 lbs. barley.....	\$ 3.80
380 lbs. milk.....	.76
Gross value of pork while on peas at 8c.....	12.40
Net value of pork from acre peas.....	7.84
On second acre peas (Blue Prussia peas).....	13 days
Weight of 33 pigs when acre cleaned.....	2850 lbs.
Gain on second acre peas.....	429 lbs.
Fed while on acre peas, 146 lbs. barley.....	\$ 2.90
260 lbs. milk.....	.52
Gross value of pork at 8c from second acre peas.....	34.32
Net value of pork at 8c from second acre of peas.....	30.90
On acre peas and wheat.....	17 days
Weight of 33 pigs when acre cleared.....	3297 lbs.
Gain on acre peas-wheat.....	447 lbs.
Fed while on acre peas-wheat, 190 lbs. barley.....	\$ 3.80
340 lbs. milk.....	.78
Gross value pork at 8c from third acre.....	35.76
Net value pork from peas and wheat.....	31.18
19 pigs sold Nov. 24 at \$8.25.....	265.64
4 pigs sold Jan. 19 at 9.00.....	52.20

The two gilts selected are due to farrow in February. Two barrows were injured and died and the six remaining shotes are in the feeding yard. The sows on pasture were bred to farrow fall litters. One sow failed to become pregnant, one lost all her litter farrowed, and the remaining four raised twenty-five pigs now on the farm.

The dairy herd: It was necessary to divide field 5 this year in order to provide pasture sufficient for the increased herd. Fields 5, 8 and 7 were in pasture this year and used in rotation in the order mentioned.

Pasture results: On April 1, thirty-one days earlier than in 1915, there were twenty-one head from the herd in the orchard-grass, alsike, alfalfa, blue-grass, pasture of field 5. As in 1915 it was planned to use each of the three pasture fields about ten days. It was found, however, that this plan could not be followed since ten days sufficed to pasture the grass more closely than was thought desirable or safe. Then, too, field 5 lying so near the barn and corrals was found very advantageous for use as night pasture. The average number of days in the rotations was six for field 5 when used for night pasture and eight for fields 7 and 8. The twenty-one animals placed on pasture were weighed March 30, their aggregate weight being 20,095 pounds. They were again weighed October 2 at the close of the pasture season at which time their aggregate weight was 21,895 pounds, an increase of 1800 pounds, and this after the loss of one heifer weighing 900 pounds. The pasture also supported two yearling steers and five calves thruout the greater part of the grazing season.

Herd results: It has been the plan to have not less than ten cows in full milk all of the time. During one month only (July) did the number fall to ten. With the strippers, cows in full lactation and those just freshening, there has been an average of slightly above eleven cows in milk thruout the year. The largest number in full milk in any month (December) was thirteen.

There has been a total of nineteen live calves born during the year. Of these two died within two days after birth. One broke into the alfalfa and died of bloat and another died from unknown causes when about three weeks old. There has been one case of abortion at seven months in the herd. Of the fifteen live calves, seven grade heifers and one pure-bred bull are still in the herd. Seven calves were sold for veal. The lightest calf born weighed 61 pounds at birth. The heaviest (the pure-bred bull calf) weighed 101½ pounds. All were started on whole milk. By the time they were two weeks old the amount of whole milk in their feed had been gradually decreased until separator milk with linseed-meal supplement had taken the place of the whole-milk ration. In one instance it was thought advisable to put two calves on one of the heifers and in a second case to place three calves on one of the cows whose udder had become injured while in the stable. It will be necessary to fatten and sell this cow for beef since the injury received has failed to yield to treatment.

Two animals in the herd developed a peculiar enlarged condition of the glands at the angle of the jaw during the year. Only one of these became serious and this swelling extended to the entire face and head. The local veterinarian called in the case said it was not Actinomycosis. He was allowed to treat these animals and the difficulty yielded to treatment; the animal most seriously affected, however, took nearly three months to recover.

During the year the herd has produced a total of 88,849.7 pounds of milk with a general average test of 3.6 per cent butter fat. The price received for the butter fat has varied from twenty-four to thirty-seven cents per pound.; it averaged twenty-eight and three-fourths

cents per pound. There have been sold to the Hazelwood Company 8,665.5 pounds of cream or 2,565.9 pounds of butter fat, for a total of \$724.05. Butter amounting in value to \$56.67 was used on the farm and sweet cream amounting to \$53.35 has been sold to a local confectioner. Data resulting from the management of the herd for the year have been summarized as follows:

Total number now in herd (no calves).....	22	
Died or sold	2	
Increase since last report	7	
Number of calves dropped.....	19	
Number of calves raised.....	8	
Number of calves died at birth.....	2	
Number of calves died later.....	2	
Number of calves sold.....	7	
Cases abortion at seven months.....	1	
Number in herd, all ages.....	30	
Herd placed on pasture (21 head).....	April 1	
Number of days on pasture.....	184	
Weight of 21 head, on pasture April 1.....	20095	lbs.
Weight of 20 head, off pasture Oct 2.....	21895	lbs.
Gain while on pasture.....	1800	lbs.
Greatest gain, any individual.....	395	lbs.
Number of animals losing weight on pasture.....	4	
Total aggregate number of pounds loss.....	70	
Value of increase in weight herd at 6c.....	\$ 103.80	
Number of pounds milk produced in year.....	88849.7	
Number of pounds butter fat (approx.).....	2845	
Butter fat sold to creamery.....	2565.9	lbs.
Cream sold to confectioner.....	\$ 53.35	
Total value cream and butter fat sold.....	777.40	
Value separator milk at 20c per 100.....	177.70	
Value calves sold	96.68	
Sterile heifer sold	47.00	
Two calf hides sold.....	4.90	
Value calves raised	200.00	
Money value produced by herd during year.....	1407.48	
Approximate value of herd exclusive of the above.....	1980.00	

The herd at present includes fourteen grade Holstein cows from two to four years old, one pure-bred cow three years old, one pure-bred bull three years old, three grade heifers that will drop their first calves early in 1917, two grade Holstein steers (long yearlings), one pure-bred yearling heifer, and eight calves including one pure-bred bull, all under one year, a total of thirty head. There are now for sale one cow, two steers and one pure-bred bull calf two and one-half months old. The weeding out of the least profitable animals in the herd should be given immediate attention since we have arrived at a point where our available pastures will be taxed unless the herd is reduced in numbers.

General Farm Crops

Reference to the accompanying blueprint in connection with this discussion will make plain the portion of the farm given over to the production of general farm crops. As already indicated, fields 1 and 2 were given over to the work with hogs. The attempt to produce half-sugar beets in field 1 was practically a failure. Altho the field was

placed in a most excellent condition for growing the beets, the stand secured was irregular and thin. A part of the field was reseeded and that portion of the field made somewhat the better appearance. When the beets were approximately one-third grown they seemed to stand still in their growth and neither cultivation nor irrigation could revive them. No disease could be discovered but the plants died rapidly. The total amount that finally matured was so small that they were not gathered. The hogs were allowed the run of the field and in this way they were harvested. Fields 3, 4, 6 and 14 produced approximately one hundred tons of alfalfa hay. Field 9 produced sixty tons of cured silage, field 10 four hundred bushels of California Feed barley of excellent quality and field 11 four hundred and forty bushels of Swedish Select oats of superior quality. Fields 12 and 13 are in the extreme southeast corner of the west quarter section and lie above the Forest lateral. These fields were cultivated thruout the season and were in splendid condition for sowing in the fall to Turkey Red wheat. A delayed shipment of seed and the early freezing of the ground prevented the sowing. These fields may be sown to spring wheat in 1917.

Improvements

Several improvements have been made on the farm during the year.

1. Conditions became so bad early in the year that it was impossible to use longer the dilapidated structure set aside for use as a horse barn. A new horse barn has been erected on the shed plan in such manner that it may later form a shed lean-to, sixteen by forty-eight feet, to a large barn.

2. A root cellar sixteen by twenty-four by six feet was excavated. Owing to the failure of the root crop this cellar has not yet been put into use.

3. The failure of the root crop made necessary some other provision for succulent feed for the dairy herd. A fourteen by thirty-four foot red-wood stave silo was erected to receive the seven acres of corn grown in field 9. This silo of course can be used in experimental work with silage and is the first of several which should be erected to provide silage in sufficient amounts for feeding experiments both with the dairy herd and with other livestock.

4. Approximately one hundred and sixty rods of new fencing were built to enclose field 5.

With the exception of the silo, the above improvements are all completely paid for.

Recommendations and Suggestions

For the enlargement and conduct of experimental work and for the economical management of the farm, certain changes and improvements are absolutely necessary.

1. Field 10 on the east quarter should be leveled and seeded for pasture as planned in 1915 and the remainder of the forty-acre tract on the west quarter intended for experimental work with small grains,

field peas and other crops should also be cleared, leveled and put into condition for the conduct of experimental work. Additional land should also be cleared, fenced and gotten under cultivation as soon as possible not only to provide greater support for the farm but also to permit of a wider diversification and definite crop rotation, two very important factors of development.

2. The dwelling house should be painted and the interior re-kalsomined thruout, porches and windows provided with new screens, the bathroom equipped, and the water system completed. A septic tank should be installed to care for all house and milk-house sewage.

3. The milk house should be receiled thruout and a partition built to separate the engine and pump room from the milk room and separator. A sink with hot-water connections for the house is a necessity as are also screens for the doors and windows.

4. The horse and cow barn should be painted. The cow barn shows distinctly serious damage from checking of the siding due to one year of weathering.

5. The machine shed should be enlarged, repaired and painted.

6. The wagon scales must be reset and readjusted.

7. Hog houses, either colony or individual, should be provided. We are forced at the present time to use the horse barn for farrowing pens.

8. A calf shed and enlarged corral should be provided.

9. A paddock securely fenced should be provided for the herd bull. At present he is deprived of needful exercise since we have no suitable place in which he can be turned loose.

10. The fencing on the farm except that built during the past biennium is in need of repair. This will require several hundred posts, a few rolls of barb wire, and a roll or more of woven wire.

Altho this enumeration of desirable and necessary improvements appears formidable, it includes only those for which there is a crying and immediate need if we render the service and occupy the place that an experimental and demonstrational farm could and should occupy in this community.

THE GOODING SUB-STATION

JOHN S. WELCH, Superintendent, Reporting

Projects. (1) Duty-of-water experiments with potatoes, small grains and alfalfa. (2) Size-of-stream and depth-of-application experiments. (3) Time-of-irrigation experiments. (4) Variety tests of small grains and field peas. (5) Whole versus cut seed in potato growing. (6) Management of pastures under irrigation. (7) Pork production in "hogging-off" experiments. (8) Local extension service.

The work of the Gooding station during 1916 has been conducted under the same general conditions and along lines similar to those of

preceding years. The work of the station, broadly speaking, may be classified under one of two divisions, irrigation investigations and general crop tests.

Irrigation Investigations

All of the *duty-of-water* experiments with the exception of one dealing with spring wheat have been discontinued. The one with spring wheat is conducted in cooperation with the Department of Chemistry; it includes a study of the effect of varying amounts of irrigation water upon the protein content of the wheat kernel and upon the production and movement of nitric nitrogen in the soil. It is interesting to note that a much higher duty of water is secured now than was possible several years ago when the tests were conducted on raw sage brush soil.

The experiments upon the *size of stream* and *depth of application* that were started in 1915 have been enlarged to include wheat, oats, barley and alfalfa. From the results of these tests it seems that farmers could with advantage use larger streams of water than are now available for most of them. On most irrigation projects the water is supplied to each farm by the continual flow of a small stream. This stream usually amounts to one cubic foot per second for eighty acres of land. Many irrigation farmers are operating on forty acres and have therefore only one-half cubic foot per second. It requires the entire time of one man to distribute this small stream over the land and then the work is not properly done. If the irrigator were supplied with a much larger stream the work could be done in a fraction of the time and with less water and better crop yields. There is nothing that will increase the duty of water and the efficiency of irrigation practice so much as the adoption of a sensible system of rotation to replace the system of continuous flow now in force.

In the experiments on the *time of irrigating spring wheat*, a slight change was made in the detail of the plans. The growing period of the wheat plant has been divided into three stages. During each stage of growth one irrigation and all possible combinations of irrigations have been made. The work is now much simpler and the results secured are more applicable to field practice.

The experiments on the *time of irrigating potatoes* were conducted in the same manner as were those of previous years. The results substantiate the conclusions reached from the earlier experiments. The irrigation of potatoes should begin when the tubers begin to form.

Experiments on the *irrigation of alfalfa for seed production* were continued. They indicate that light, frequent irrigations rather than heavy irrigations at greater intervals should be made use of.

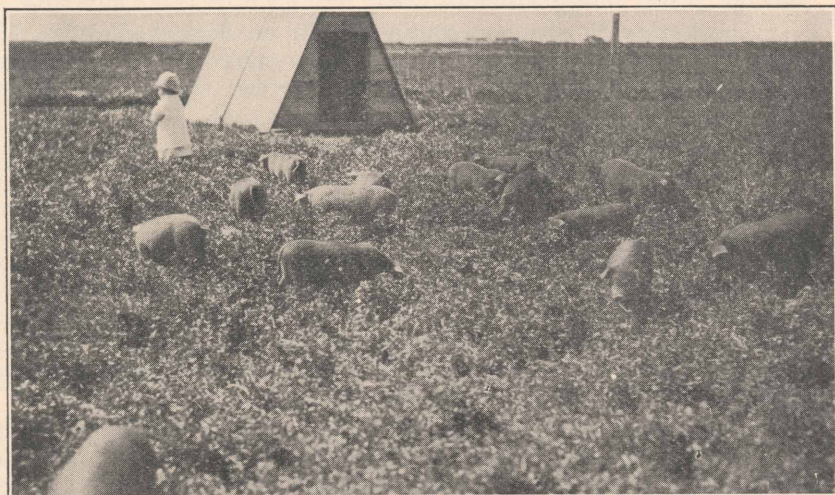
During the year work was started which has for its object the determination of the relative advantages of the *flooding* and *corrugation* methods in the irrigation of wheat and barley.

General Crop Tests

Under this heading is included all work in which some phase of irrigation practice is not the prime object of study.

Varietal tests have been conducted as heretofore with barley, oats, wheat, clovers, grasses, field peas, beans, potatoes and stock beets.

The work on *grass pastures* has been continued. The grazing test with dairy cows was conducted in a very satisfactory manner with the same animals used in 1915. Four steers were used in the grazing test with beef cattle. They gained 731 pounds on the one acre of grass during the pasture season. A herd of pure-bred Hampshire ewes and lambs was secured for the sheep-grazing test. Thirty-two head were maintained nicely on two acres and made a total gain in weight of 907 pounds. The experiment with pigs on alfalfa pasture was conducted



Pigs in alfalfa pasture, Gooding Sub-Station, 1916.

with young pigs raised on the station farm. The following is a summarized statement of procedure and results:

Size of pasture, one-half acre.

Number of pigs, 21.

Total time on pasture, 131 days.

Grain fed while on pasture, 3284 pounds.

Skim milk fed while on pasture, 1878 pounds.

Gain in weight, 1362 pounds.

Grain fed per cwt. of pork gained, 241 pounds.

Value of pork at \$8 per cwt., \$108.96.

Value of grain fed at \$1.75 per cwt., \$57.47.

Value of milk fed at 20 cents per cwt., \$3.75.

Net returns from alfalfa alone, \$47.74.

Net return per acre from alfalfa alone, \$95.48.

In the "hogging-off" work, three crops were utilized; field peas, field peas and wheat, and horse beans. The horse beans were unavoidably planted later than usual and did not produce as heavily as they

are capable of doing. The essential features of the work are tabulated below:

CROPS	Area of plats in acres.	Number of pigs turned in.	Days grazed	Initial weight lbs.	Weight when taken out. lbs.	Gain in weight lbs.	Gain in weight per acre. lbs.	Value of crops per acre, pork \$8.00 cwt.
Peas .....	.238	5	27	367	485	118	496	\$39.68
Peas and wheat	.230	5	39	323	453	130	565	45.20
Horse beans ..	.216	5	20	357	442	85	394	31.52

This has been the third year in the work with *whole and cut seed* in potato growing. This year's results check with those of the two previous years. The planting of whole seed potatoes is not advisable.

The work with corn was continued with no change of plans. No ripe ears were secured because of very unfavorable climatic conditions.

A very satisfactory home vegetable garden was grown. In it there were forty-two varieties of common vegetables. The testing of varieties has proved very popular with irrigation farmers in this section.

Following the custom of previous years some land this year has been devoted to the increase of the best varieties of small grains and field peas. The grain will be sold to farmers in various parts of the state. From seed distributed in previous years, instances could be cited of an increase in production over that from varieties formerly grown of one hundred per cent. In the spring of 1916, 3095 pounds of pure seed were distributed. Distribution of seed from thoroly tested varieties is one of the most effective ways of making practical application of some of the work conducted on the station farm.

Cooperative work with the Office of Irrigation Investigations of the United States Department of Agriculture will come to a close at the end of this year because of the merging of that office with another in the Department of Agriculture and resultant changes in policy. A summary has already been made of the work of the station since its establishment and this is being prepared for publication in bulletin form under the titles "Irrigation Investigations in Southern Idaho," "Experiments with Cereal Crops Under Irrigation," "Experiments with Legume Crops Under Irrigation," "The Management of Irrigated Pastures" and "The Vegetable Garden on the Irrigated Farm." The first mentioned will probably be published by the Federal Department of Agriculture. The last four will be published as State Experiment Station bulletins. The work with whole and cut seed potatoes is being summarized and prepared for publication in the Journal of the American Society of Agronomy.

The Station receives a vast amount of correspondence relative to various phases of irrigation farming from farmers on the irrigated lands of the state. Many requests come from local farmers for help in solving local farm problems. Many requests come also from the Extension Department of the University for the presentation of Experiment Station work at farmers' institutes and movable schools and for the

time of the superintendent in judging at county and district fairs. Insofar as compliance with these requests does not interfere with the primary work of the station it is given.

JEROME SUB-STATION *

G. W. DEWEY, Superintendent, Reporting

Projects: (1) Irrigation experiments. (2) Green vs. ungreened seed. (3) Foreign vs. home-grown seed. (4) Mature vs. unmaturing seed. (5) Cut vs. whole seed. (6) Testing of varieties. (7) Production of new varieties. (8) Selection studies. (9) Investigation of diseases.

Broadly speaking, the work of the Jerome station for the past year may be classed under irrigation investigations, cultural investigations and potato-disease investigations. There was an abundant supply of irrigating water but continued low temperatures in the early part of the season seem to have prevented a heavy set of tubers, particularly in the case of the Netteed Gem variety. The seed used in the 1916 plantings exhibited low vitality, a condition that is traceable to the extremely high temperature and water shortage of the preceding season. An indirect result of planting seed low in vitality was the rather extensive development of a disease closely resembling curly dwarf.

Irrigation Investigations

The irrigation work was carried on with the Idaho Rural and Netteed Gem varieties and concerned itself entirely with problems connected with time of irrigation. The following subdivisions of the work indicate more specifically its trend: (1) Irrigating soil before planting. (2) Irrigating-up newly planted tubers. (3) Checking early growth. (4) Frequent irrigations. (5) Infrequent irrigations. (6) Irrigating in accordance with local practice. Results thus far do not permit of specific recommendations.

Cultural Investigations

All cultural investigations are duplicated by the use of two varieties and triplicated by plantings in three sections of the field, a procedure that gives six separate sets of data for each experiment.

Greened vs. ungreened seed: In the seed-greening investigations, Idaho Rurals and Netteed Gems were employed. The potatoes were greened during the month of May but the greening was unsatisfactory because of the cool cloudy weather which prevailed during that period.

* The Jerome Sub-Station is owned by the State and was equipped by the State for experimental and research work with potatoes and root crops. At present it is being operated under a lease by the Bureau of Plant Industry of the Federal Department of Agriculture. Detailed reports of the station work are furnished that Bureau by the superintendent and his co-workers. This report indicates the more important lines of investigation that have been taken up and something of the progress that is being made in them. The superintendent gives freely of his time to local extension work and will gladly answer all inquiries made of him with reference to the potato-growing industry.

The greened Idaho Rural seed produced 41.1 bushels per acre (17.9%) more than the ungreened. The yield of the greened Netted Gems was 19 bushels per acre (10.8%) over the ungreened.

Foreign vs. home-grown seed: An exchange of seed of the Idaho Rural and Netted Gem varieties was made with the Greeley, Colorado, station last spring for the purpose of comparing the vitality of home-grown with that of foreign-grown seed. The seed secured from the Greeley station was produced from seed grown at the Jerome station in 1914. The results of the year's work bear out the observation that the low vitality of home-grown seed was due, in part at least, to the hot, dry weather of 1915. The Idaho Rural seed secured at Greeley produced more than the home-grown seed of the same variety by 25.6 bushels per acre, or 6 per cent. Seed grown at Greeley of the Netted Gem variety produced more than home-grown seed of the same variety by 18 bushels per acre, or 17.1 per cent.

Mature vs. unmaturred seed: Preparations for this work were made in 1915. Idaho Rural and Peoples potatoes were planted on May 1 for the purpose of securing matured seed. They were planted on July 1 to secure unmaturred seed. Seed from both plantings was stored under similar conditions in shallow flats.

Plants from the unmaturred seed developed curly dwarf to the extent of 4.8 per cent and plants from the matured seed developed that disease to the extent of 37.6 per cent. Idaho Rurals grown from unmaturred seed were far less affected with curly dwarf than any other lot of Idaho Rurals grown at the station. The heaviest yield of Idaho Rurals was secured from the unmaturred seed. It amounted to four hundred and fifty-five bushels per acre and was greater than the yield from matured seed by 59.7 bushels or 16.7 per cent. The gain in yield from unmaturred seed of the Peoples variety over the yield from matured seed was 88.7 bushels per acre, or 29.5 per cent.

Cut vs. whole seed: The Idaho Rural and Netted Gem are the varieties used in this experiment. The work this year involved the production of three hundred hills for each unit of the two varieties. No definite conclusions are possible from the work up to this time. The manner of conducting it is indicated below.

- 6 oz., 5 oz., and 4 oz., whole, planted 18 in. in the row.
- 6 oz., whole, halved and quartered 16 in. in the row.
- 5 oz., whole, halved and quartered 16 in. in the row.
- 4 oz., whole, halved and quartered 16 in. in the row.
- 3 oz., whole, halved and quartered 16 in. in the row.
- 2 oz., whole and halved 16 in. in the row.
- 1 oz., whole 16 in. in the row.
- 10 oz., tubers cut to 2 oz. pieces 16 in. in the row.

Testing of varieties: One hundred varieties introduced from South America were grown at this station during the 1916 season. Only two deserve further consideration. Nearly fifty other varieties were tested but none of them compare favorably with the well-known Idaho Rural and Netted Gem. Of the early varieties, White Bloss, Early Ohio, and Irish Cobler easily take first place.

Breeding work: Nearly thirty seedlings, the result of breeding work, were grown at the station this year. Three of them only are particularly promising.

Selection studies comprising hill selection and tuber unit selection are being made on a fairly extensive scale. During the coming season all experiments of the past season will be repeated. Some seed will be fall-greened. In addition to the experiments of the past year, numerous strains of the Netted Gem and Idaho Rural varieties will be tested for the purpose of finding particularly high-yielding ones.

Potato Disease Investigations

The station is equipped with laboratory facilities suitable for pathological investigations. During the past year a well trained pathologist has given his whole attention to research and experimental work with potato diseases. Results of his work appear in detail in Nos. 9, 15 and 21 of Vol. VI, Journal of Agricultural Research, under the titles: A Western Field Rot of the Irish Potato Caused by *Fusarium radicola*; Experiments with Clean Seed Potatoes on New Lands in Southern Idaho; Control of the Powdery Dry-rot of Potatoes Caused by *Fusarium trichothecioides*.

THE SANDPOINT SUB-STATION

F. H. LAFRENTZ, Superintendent, Reporting

Projects: (1) General improvements. (2) Land clearing. (3) Crop production. (4) Dairy-herd improvement. (5) Pork production from forage crops. (6) Local extension.

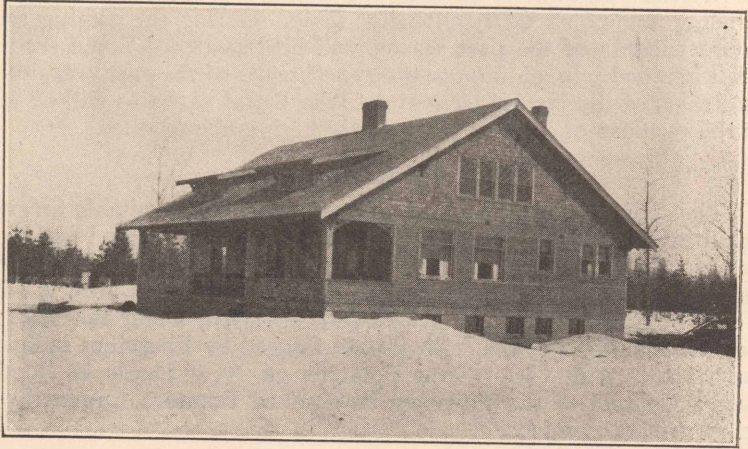
The Sandpoint station consists of approximately one hundred and seventy acres of which not over one hundred acres are suitable for experimental work with farm crops. The balance of the tract is very rough and broken and is suitable for pasturage only. When taken in charge it was in typical "cut- and burned-over" condition. The first work involved the erection of farm buildings and the planning of a system of farming that will as specifically as possible serve the interests of those who are developing the cut- and burned-over lands of north Idaho.

Permanent Improvements

Farm buildings: Subscription by public-spirited citizens and business firms made possible on the station the erection of a very serviceable set of farm buildings. The house and barn were completed and made ready for occupancy early in the year.

The house is of the bungalow type, forty-four by forty-six feet, and so arranged that it can be equipped with modern conveniences that are possible in farm homes. Features worthy of special note are; a basement thirty by thirty feet which provides space for laundry work, a furnace-room, and a room for the storage of vegetables, an especially well-lighted kitchen, pantry and dining-room, fireplace in the living-

room, a large bathroom, a boxed-in front porch, a screened-in back porch, and an outside toilet and lavatory.



The farm house, Sandpoint Sub-Station.

The barn is thirty by sixty feet with a sixteen foot lean-to on the east side. It is covered with a Gambrel type of roof. At present it shelters twelve cows and six horses. With slight readjustments additional stanchion space can be secured and storage provided for approximately forty tons of hay.

The barn and house were built for practical purposes. Already they are serving to a certain extent as models in house and barn construction on neighboring farms. The costs of construction are itemized below:

	House.	Barn.
Lumber	\$ 711.50	\$ 521.40
Labor and millwork.....	1545.00	488.50
Cement	122.10	48.00
Shingles	32.00	92.00
Gravel	49.75	25.50
Hardware	98.00	90.00
Plumbing	132.00	
Electric fixtures.....	43.00	
Tiling	19.25	
Linoleum	32.00	
Screens	10.00	
Plans and specifications.....	35.00	
Painting and painting material.....	100.00	45.00
Total.....	\$2929.60	\$1310.40

Other improvements of the year that are worthy of note are the remodeling of an abandoned dynamite magazine for use as a chicken house and the building of two hundred rods of fence, sixty of which are hog-tight.

Land clearing: Land clearing is of necessity an important feature of the yearly program of work on this farm. A strip of land two and three-quarters acres in extent bordering the Spokane International right-of-way was cleared this year. Accurate data were kept on the cost of the several operations involved. The strip being a part of an area that was cut-over twenty-two years ago, had to be cleared of the old stumps, logs, and a fifteen to eighteen-year growth of white pine and tamarack. The logs and stumps being in an advanced stage of decay, the work was relatively easy. The method of clearing involved, (1) cutting the small trees and undergrowth and piling them with old logs for burning, (2) pulling of small stumps with team, block and tackle, and piling for burning, (3) dynamiting of large stumps, (4) piling for burning dynamited stumps and other loose material and leveling preparatory for plowing, (5) plowing. The cost of the work reduced to an acre basis was as follows:

Cleaning off rubbish and small growth.....	\$ 22.00
Dynamiting	17.00
Cleaning up and leveling.....	12.00
Plowing	8.00
	<hr/>
Total.....	\$ 59.00

In figuring these costs an allowance of \$2.50 and \$5.00 per day of ten hours was made for man and for man-and-team labor respectively. It will cost somewhat more to clear land having the same amount and character of growth if it has been logged-off within the last ten years.

It may be well to mention in this connection for the benefit of others who are clearing cut and burned over lands that:

Time and money will be saved if, instead of cracking only and pulling, the whole stump is blown out.

Dynamite works to the best advantage when the soil is wet; the stumps lift more easily since the water in the soil acts as an air-tight seal.

The load should be placed in one body beneath the center of the stump. When the ground is wet and cold the charge should be shot as soon after loading as possible. The use of a quick, high-percentage dynamite is advisable in gravelly soil and for stumps which have tap-roots. The use of a slower and lower-percentage dynamite is advisable when shooting above hard pan and stumps with spreading roots.

Crop Production

In this work attention at present is confined almost entirely to the production of those crops that are of primary importance to the dairy industry. A fairly good line has been secured on varieties of clover, field peas, and root crops that adapt themselves readily to the soils and climatic conditions of this section of the state. Definite plans have been formulated for the conduct of experimental work in the production of field peas, small grains, and root crops, but the work is being held in abeyance while a ten-acre tract is being made ready for it by

the growth of clover and the turning under of green and barnyard manure.

A "rotation and soil corrective" experiment is being conducted in cooperation with the Department of Soil Technology but no conclusive data have yet been obtained. Three strains of Turkey Red wheat have been grown for the Department of Agricultural Chemistry.

Introduction and Work With Live Stock

Dairy-herd improvement: The beginnings of a dairy herd were placed on the farm in the fall of the preceding year in the form of four pure-bred and four grade Holstein heifers and a pure-bred Holstein bull. There was an abundance of pasture for the herd during the spring and summer months but a few tons of hay may have to be purchased to put it thru the winter. The herd is already giving a good account of itself, as is shown by the monthly cream and milk checks. Particular attention will be given to the gradual building up of a high-production herd by breeding and the elimination of the low-producing animals. It is the aim to keep before the farmers of this section the proper type of dairy animal. Eventually the herd can be used for definite feeding experiments with native-grown forage crops and at all times its indirect value in soil improvement will be emphasized thru the use of liberal quantities of barnyard manure in the growth of forage, small grains and root crops.

Other livestock work: Some pigs were purchased for "hogging off" work and as soon as possible foundation stock of one or two breeds will be secured.

It is the intention also to secure in the near future foundation stock for at least two breeds of sheep. High production on soils of the cut-and-burned-over sections will come as an indirect result of dairying and other livestock work.

Pork production from field peas: Three or four varieties of field peas were sown in rows on raw land prepared in a fairly satisfactory manner by cultivation among the stumps. One and one-fourth acres of these peas were fenced off early in September. On September 25 four pigs weighing 596 pounds were turned in. On October 25, thirty days later, the four weighed 820 pounds. In the thirty days there had been a gain in live weight of 224. At nine cents per pound for pork, the value of the one and one-fourth acres of field peas was \$20.16.* This kind of work will be given considerable prominence in succeeding years.

Local Extension Work

Some field peas and vetch seed grown on the station farm and seeds of various kinds secured from the Bureau of Plant Industry have been distributed among local farmers. Climatological data have been furnished the Weather Bureau office at Boise, the Forestry office at Missoula, Montana, and the local papers. The superintendent has presented the work of the station at one movable school and at two farmers meetings and has judged at three local fairs. Many people

* From this should be deducted \$2.40 as the value of 1200 pounds of skim-milk fed while the pigs were working at the peas.

new to the country and looking for locations have availed themselves of information which has been secured from experience on the farm. During the summer months as many as six different calls have been made at the farm in a single day. All visitors are given courteous attention. All questions, whether asked in person or by letter, are given prompt consideration.

The diversity of climatic conditions under which farming operations are conducted in this state is one substantial reason for the establishment of sub-stations. The superintendents of those stations are cooperative observers in the United States Weather Bureau Service. Their detailed daily reports are filed with the State Section Director for publication monthly. The monthly record sheets may be obtained upon application to the State Section Director, Weather Bureau Service, Boise. It appears not inappropriate, however, to insert here such summaries of climatological data as will quickly give to readers of this report fairly definite ideas relative to the climatological conditions under which the several sub-stations are operating.

Mean monthly temperatures (in degrees F.), monthly, yearly, average monthly, and average yearly precipitation (in inches), Moscow Station.*
1907-1916 inclusive.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1907—													
Temp.					56.2	59.8	67.4	63.1	54.2	47.9		33.4	
Precip. ....					.81	2.58	1.58	1.44	.98	.78			2.90
1908—													
Temp.	30.6	32.4	35.4	45.7	48.6	56.1	70.0	66.8	59.1	46.8	40.4		
Precip.	1.37	1.77	2.76	1.30	2.00	1.07	.13	.95	.93	1.97	.85	1.41	16.56
1909—													
Temp.				42.8	51.8		63.6	67.6	60.2	49.7	41.6	26.6	
Precip.	4.11	3.19	1.02	2.05	1.62		3.65		1.54	1.70	5.77	1.48	25.94
1910—													
Temp.	26.6	25.0		51.2	55.8	57.6	67.0	63.6	56.4	49.4	38.0	34.0	
Precip.	2.58	3.50		1.77	1.92				.56	2.21	4.11	1.87	18.52
1911—													
Temp.	28.7	27.2	21.3	45.6	49.2	60.8	68.0	64.4	55.2	47.0	35.6	29.8	
Precip. ....	.98	1.08	.37	.08	2.17	.80	.10	.76	.86	1.01	1.59	1.16	10.96
1912—													
Temp.	30.5	33.6	34.1	44.8	52.5	61.5	62.4	62.4	54.1	43.5	38.2	31.0	
Pprecip.	2.16	3.50	1.17	1.77	3.23	.75	.46	2.00	1.76	2.01	2.60	2.69	24.10
1913—													
Temp.	23.3	21.2	33.0	46.0	54.8	57.4	63.8	66.7	57.5	44.0	38.3	30.6	
Precip.	9.63	1.51	4.42	1.43	1.90	3.20	.19	.86	.91	2.36	3.20	1.03	30.64
1914—													
Temp.	34.2	30.2	40.8	47.6	56.0	57.2	69.0	67.1	56.1	49.5	40.2	23.5	
Precip.	2.51	1.95	.76	1.76	2.00	1.36	.70		2.04	2.04	1.76	1.25	18.13
1915—													
Temp.	25.5	36.6	44.0	49.0	52.0	56.1	65.8	71.5	55.8	49.4	34.2	29.3	
Precip.	1.36	1.32	1.53	2.07	4.08	.40	.78	.08	.31	1.66	3.22	2.13	18.94
1916—													
Temp.	15.2	32.6	40.4	45.3	48.1	57.4	61.6	65.6	57.2	45.5	32.9	23.4	
Precip.	2.19	2.03	4.88	1.01	1.36	2.20	1.12	1.17	.64	.30	2.64	1.90	21.44
Aver. Precip.	2.99	2.21	2.11	1.47	2.11	1.37	.87	.73	1.06	1.60	2.75	1.78	20.58

Length of growing season 1916, 132 days. Average length of growing season, 1907-1916, incl. 167 days.

Precipitation (in inches) Aberdeen Sub-Station
1912-1916 inclusive.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1912	1.75	0.02		0.30	1.45	0.34	1.41	2.40	0.36	2.90	0.56	0.13	11.83
1913	0.39	0.03	0.71	0.12	2.08	2.33	1.56	0.17	0.54	0.05	1.29	1.22	10.10
1914	0.72	0.10	0.00	0.63	0.51	2.59	0.47	0.00	1.08	1.26	0.00	0.30	7.66
1915	0.54	0.44	0.34	0.56	2.31	0.52	0.54	1.13	1.62	0.05	0.70	0.54	8.29
1916	1.04	1.76	2.15	0.38	1.37	0.08	0.47	0.40		1.71	0.43	1.14	10.93
Aver. Mo.	0.88	0.47	0.58	0.39	1.54	1.17	0.89	0.82	0.72	1.19	0.59	0.44	
Mean													9.76
Precipitation during growing period 1916 (June 11-Sept. 10), 0.87.													

Average monthly maximum and minimum temperatures (in degrees F.)
Aberdeen Sub-Station, 1912-1916 inclusive.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1912 Max.						79.1	82.6	80.4	67.9	57.6	47.9	39.8
1912 Min.						48.4	49.0	46.5	35.0	29.5	24.8	10.0
1913 Max.	31.6	36.3	45.2	62.6	71.0	76.6	79.1	37.7	73.7	58.9	44.3	28.3
1913 Min.	9.7	9.9	23.7	29.0	37.7	45.7	48.5	50.1	34.6	29.1	25.5	7.8
1914 Max.	32.7	31.7	51.7	57.3	66.4	73.2	88.0	88.0	74.8	62.3	52.9	30.0
1914 Min.	13.0	12.7	25.5	33.4	39.2	43.2	51.0	46.8	35.6	34.3	17.6	3.5
1915 Max.	30.6	44.1	55.8	68.0	65.0	75.1	84.8	91.6	72.7	67.2	45.2	34.0
1915 Min.	8.0	24.0	25.6	33.9	37.9	38.8	45.8	47.6	37.7	31.0	23.2	18.1
1916 Max.	28.0	35.2	50.5	62.0	65.0	76.6	88.8	85.5	77.0	58.3	41.5	29.3
1916 Min.	6.9	14.3	26.9	31.5	31.8	39.5	49.4	45.0	37.1	29.1	12.0	11.3
Mean Max	30.7	36.8	50.8	62.4	66.8	76.0	84.6	85.6	73.2	60.8	46.3	30.2
Mean Min.	9.4	15.2	25.3	31.7	36.6	43.1	48.7	47.1	35.6	30.6	21.6	10.1

Length of growing season, 1916 (June 11-Sept. 10), 91 days. Average length of growing season, 96 days. Average date of last killing frost, June 3. Average date of first killing frost, Sept. 11. Hottest day 1916, July 12, 97 degrees. Coldest day, Dec. 30, -23 degrees.

Average total evaporation from a free water surface, April to September, incl., 38.1 inches.

Precipitation (in inches) Gooding Sub-Station
1910-1916 inclusive.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1910	0.71	1.06	0.14	0.77	0.32	0.08	0.24	0.00	0.44	0.45	1.72	1.50	7.43
1911	3.21	0.43	0.47	1.13	1.77	1.06	0.00	0.00	0.00	1.10	2.15	0.09	11.41
1912	2.00	1.24	1.06	0.96	1.33	0.67	0.33	0.00	0.18	2.16	0.88	0.68	11.49
1913	0.63	0.05	0.55	0.47	0.15	0.91	0.73	0.08	0.05	0.94	2.36	1.64	8.55
1914	1.18	0.15	0.06	1.02	0.44	0.43	0.22	0.00	1.09	1.74	0.02	0.26	6.61
1915	0.58	1.62	0.23	0.75	1.91	0.33	1.01	0.10	1.04	0.00	1.04	0.93	9.54
1916	1.68	1.28	0.78	0.49	0.70	0.15	0.71	1.15	0.00	0.70	0.98	0.75	9.37
Aver. Mo.	1.43	0.83	0.47	0.80	0.95	0.52	0.46	0.19	0.40	1.01	1.31	0.83	
Mean Annual													9.20
Precipitation during growing season (April 1-Aug. 31), 7 year average, 2.91.													

*Average monthly maximum and minimum temperature (in degrees F.)
Gooding Sub-Station, 1910-1916 inclusive.*

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	year-ly
1910 Max.	30.0	34.7	61.2	71.0	75.0	85.0	93.5	88.0	79.0	68.0	49.5	40.0	49.5
1910 Min.	14.0	15.9	32.2	35.5	40.0	45.6	55.0	46.5	39.8	34.0	29.4	25.0	
1910 Mean	22.0	25.3	46.7	53.2	57.5	65.3	74.2	67.2	59.4	51.0	39.5	32.5	
1911 Max.	37.0	30.8	54.4	59.3	68.0	76.0	89.9	90.0	74.0	62.0	43.8	37.2	45.8
1911 Min.	17.7	15.6	27.7	30.0	38.0	44.0	51.0	43.8	39.0	30.0	22.3	17.1	
1911 Mean	27.4	23.2	41.1	44.7	53.0	60.0	70.5	66.9	56.5	46.0	33.1	27.1	
1912 Max.	34.5	40.9	49.5	60.2	69.8	88.0	85.3	85.7	71.9	57.8	50.1	36.5	47.3
1912 Min.	17.6	23.9	29.8	32.5	38.0	47.3	49.1	48.1	35.9	32.6	27.8	12.5	
1912 Mean	26.0	32.4	39.7	46.4	53.9	67.9	67.2	66.9	53.9	45.2	38.9	24.5	
1913 Max.	30.9	35.0	47.1	66.1	75.4	78.4	84.5	90.0	80.1	60.8	50.5	33.4	46.2
1913 Min.	8.3	10.8	25.1	32.2	40.6	47.5	50.9	45.9	42.1	30.6	30.5	13.7	
1913 Mean	19.6	22.9	36.1	49.2	58.0	62.9	67.7	68.0	61.1	45.7	40.5	23.4	
1914 Max.	35.7	37.3	54.0	63.8	76.5	77.9	91.6	88.7	75.8	64.5	55.1	33.5	47.7
1914 Min.	20.6	19.7	27.4	31.6	39.7	44.3	53.4	47.9	38.9	37.1	22.7	7.3	
1914 Mean	28.1	28.5	40.7	47.7	58.2	61.1	72.5	68.3	57.3	50.8	38.9	20.4	
1915 Max.	34.0	45.1	59.3	69.4	67.2	77.5	87.3	95.9	74.1	69.6	46.3	37.4	48.3
1915 Min.	10.1	27.6	26.2	35.3	38.7	40.9	48.9	54.0	38.6	32.3	23.9	19.0	
1915 Mean	22.1	36.4	42.7	52.4	53.0	59.2	68.1	74.9	56.2	50.9	35.1	28.2	
1916 Max.	30.0	38.2	51.9	65.3	67.0	78.2	89.2	88.0	78.5	61.9	46.4	34.3	45.6
1916 Min.	9.5	18.9	27.2	32.1	34.0	41.1	51.3	46.2	40.7	29.8	19.2	14.7	
1916 Mean	19.8	28.6	39.6	48.7	50.5	59.6	70.2	67.1	59.6	45.8	32.8	24.5	
Monthly Mean ...	23.6	28.2	40.9	48.9	54.9	62.3	70.1	68.5	58.4	47.9	36.9	25.8	

Average yearly mean 47.2

Average length of frost free period, 113 days. Average number of clear days, 195.
Average number partly clear days, 95. Average number of cloudy days, 75.

Average weekly evaporation from free water surface, April to September, inclusive,
1.53 inches. Average total evaporation for same period, 39.2 inches.

*Average maximum and minimum temperatures (in degrees F.) and
precipitation (in inches) Jerome Sub-Station
Dec. 1915 to Nov. 1916, inclusive.*

	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Total
Max.	37.7	31.7	41.0	53.8	63.7	67.1	77.0	87.0	85.7	78.0	62.0	45.2	9.26
Min.	21.7	13.7	24.3	31.0	35.2	36.8	43.9	52.8	50.7	41.5	33.2	19.4	
Mean	29.7	22.7	32.6	42.4	49.4	52.0	60.4	69.9	68.2	59.8	47.6	32.3	
Precip.	1.40	.98	2.20	1.65	.51	.67	.01	.40			1.17	.87	

*Precipitation (in inches) Sandpoint Sub-Station
1915 and 1916.*

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1915	0.81	2.26	0.79	2.10	3.70	1.26	1.80	0.25	1.69	.95	4.31	4.77	24.69
1916	3.81	2.16	4.36	1.85	1.50	2.98	1.57	1.81	1.85	0.59	3.49	2.16	28.13

*Average monthly maximum and minimum temperatures (in degrees F.)
Sandpoint Sub-Station, 1915 and 1916.**

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1915 Max.	32.7	41.6	54.3	65.1	64.6	73.0	78.1	88.5	69.5	59.9	40.5	34.5
1915 Min.	26.5	28.5	30.8	37.0	43.1	42.6	49.7	51.2	41.6	37.2	28.8	22.2
1915 Mean	26.6	35.0	42.6	51.0	53.8	57.5	63.9	69.8	55.6	48.6	34.6	28.4
1916 Max.	22.1	36.5	44.6	56.9	60.4	72.3	78.1	79.1	67.9	55.8	39.8	29.2
1916 Min.	7.5	21.4	28.6	32.9	36.4	41.9	46.6	43.5	31.8	25.1	22.1	10.4
1916 Mean	14.8	29.0	36.6	44.9	48.4	57.1	62.4	61.3	53.0	40.5	31.0	19.8

* Instruments transferred from town to the station farm July 1, 1916.

LOOKING FORWARD

Having thus presented in outline the work of the Experiment Station organization and something of progress made on project work during recent months, it is in order to inquire whether all is being done that might be to serve in the best possible manner the various farming interests of the state which demand investigations of various kinds upon which to base a more intelligent and orderly conduct of business. In making suggestions and recommendations for readjustments here and there and for entering upon new lines of investigation, I am not unmindful of the fact that if they are adopted provision for putting them into effect must come from funds appropriated by the State. If there is any justification needed for a slight increase in the total amount heretofore appropriated by the State for the support of Experiment Station work, it may be found in the fact that the Experiment Station is expected by the people of the State to be a leader in the further development of the state's agricultural resources. The situation at the central station will be dealt with first.

At the Central Station

The work at the central station has been almost entirely supported with Federal funds. The Hatch fund, amounting to fifteen thousand dollars a year, has been used in the support of purely laboratory projects and those having to do with the herds, orchards, gardens, and farm crops on the University farm adjacent to the University campus. During the past two years it has been impossible to budget any of this fund to the creamery division of the Dairy Department, to Bacteriology, to Farm Engineering, or to Veterinary Science, in all of which departments there is a constant and heavy demand for information which can be secured only thru well planned and carefully executed experiments. The portion of the Hatch fund assigned to the Department of Farm Crops is entirely inadequate for the work expected of that department. I am, therefore, making the recommendation that the work of our Department of Farm Crops be concentrated as soon as possible on fifty or sixty acres on the east side of the University farm and that this portion of the farm be placed upon precisely the same basis with reference to financial support as each one of our sub-stations. With our Department of Farm Crops adequately taken care of in that way, thoro and effective experimentation in butter and cheese making can be undertaken by the Dairy Department with a portion of the Hatch funds.

The research work of the Department of Bacteriology has been supported with a portion of the Adams fund. Aside from its research the department has been doing a very valuable piece of work in the making and distribution of cultures for the inoculation of legumes with nitrogen-gathering bacteria. During the spring and early summer months of the present year, sufficient culture for the inoculation of over six thousand acres was sent out. This was double the amount sent out during the same period of the preceding year. The work has grown to such an extent that it seriously interferes with the research

work of the department. A plan has been submitted under which this work is to be thoroly reorganized and made entirely self-supporting but, in view of the fact that there is abundant room for experimentation in legume inoculation, it would seem that some provision should be made for further work in that direction. The commercial end of the work, even tho it is made self-supporting, should be incidental to investigational work in legume inoculation and not an end in itself. Indeed it would seem that this view is the only one that can justify commercial work on the part of the Station in spite of the fact that commercial firms charge for legume-inoculating cultures from ten to fifteen times as much as it costs our Department of Bacteriology to manufacture and distribute them. The commercial end of the work can be taken care of by the department at a cost to the farmer of twenty-five cents or less per acre. An addition of three or four hundred dollars per year to the income of the department from this source would enable the employment of an additional man who could give his entire time to the manufacture and distribution of legume-inoculating cultures and to much needed experimentation in legume inoculation.

It would seem that the most effective work the Department of Farm Engineering can do at the present time from the standpoint of the Experiment Station organization is to publish carefully worked out plans for the construction of minor farm buildings such as houses for poultry, sheep, and hogs, and for the installation of farm-house conveniences such as running water and sewage-disposal tanks. The expense involved would not be great and would affect the publication funds only, but, as will appear later, adequate provision has not been made for the printing of Experiment Station publications. With as little loss of time as possible, the Department of Farm Engineering should take up work in drainage and irrigation.

For Experiment Station work in the Department of Veterinary Science, no recommendations can be made until a lighter teaching schedule can be arranged for the head of that department.

Some three or more years ago cooperative work with the Bureau of Soils of the United States Department of Agriculture was undertaken by our Department of Soil Technology. The survey of Latah County was completed in 1915. No further cooperative work has been undertaken because funds have not been available for the purpose. I wish to point out, however, that exceedingly valuable work can be accomplished thru carefully conducted surveys if they are followed with comprehensive experiments by the Soils Department on the several soil types that occur in the areas surveyed. Fortunately for the Latah County survey, our Soils Department has been able to use a portion of its Hatch funds for the conduct of rotation and fertilizer experiments on the predominating type of Latah County soil. A report covering the completed survey and the experimental data thus far secured is in course of preparation. Survey work ought to be encouraged and rapidly developed and there is no more effective way to bring the results of experimental work in soil improvement directly

home to the farmers interested than by conducting it on well chosen farms lying within the areas surveyed. The Bureau of Soils of the Federal Department of Agriculture stands ready to put into this work at least dollar for dollar advanced for it by the State.

A year ago the Experiment Station organization had very inadequate entomological service. Inroads made by insect pests made the situation a distressing one. It became so acute during the early summer months of the present year that the services of one well trained in economic entomology seemed absolutely necessary to save the clover-seed crop and to take steps against the steadily advancing alfalfa weevil. A field entomologist was finally put to work by the Division of Agricultural Extension. His field expenses were paid from the pure-seed fund. He discovers that the perfect control of the clover aphid calls for further research into its life history. This insect is only one that must be studied. The chalcid fly of the red clover is another. The weevil which infests the field pea and may in time threaten the rapidly developing field-pea industry in northern Idaho is still another. A laboratory for the study of dangerous insect pests and methods for their control is one of the pressing needs of our present organization. The Hatch fund can not possibly take care of the situation.

The Department of Forestry for several years has been conducting experiments on the clearing of logged-off lands. There is a steady increase noted in the demand for reliable data on land-clearing operations. The publication of the Department's work on land clearing will relieve the situation. The Forestry Department as organized at present, if properly supported, can also perform a valuable service to the sheep and cattle men of the state who make use of the forest reserves and public ranges in the summer pasturage of flocks and herds thru carefully conducted surveys on forest reserves and ranges and the prompt publication of its findings with reference to the kind and abundance of the native vegetation.

On the Sub-Stations

The work on the several sub-stations was never in a more satisfactory condition than at the present time. The work is organized as at the central station on the project basis and is producing results. Adjustments here and there, however, are absolutely necessary to meet the increasing demands made upon us by rapidly developing dry-farming and irrigation interests. The superintendent of the Aberdeen station conducts work in the interests of both dry and irrigation farmers. He has repeatedly pointed out the fact that this arrangement for several reasons is not entirely satisfactory to either group. From the standpoint of careful experimentation alone, there is good reason for urging the wide separation of tracts of land devoted to the investigation of dry-land problems and those which have to do with irrigation. He points out the fact that he is operating on the great Snake river plains where the rainfall averages not over ten inches per year. While the results of his experiments are applicable to extensive areas

of similar lands, it is perfectly evident that they are not strictly applicable to other extensive areas that are more fortunately located with reference to rainfall. It is quite possible that the Aberdeen station can take care of the required work in dry farming for the immediate future but eventually a comprehensive plan must be worked out under which all the dry-farming interests of the state can be effectively taken care of. A tentative proposal is that the Aberdeen station shall eventually be operated only as a high-altitude irrigation station and that a much larger tract of land should be provided for dry-land investigations. The main dry-land station should be located in a region of greater rainfall. The superintendent of that station in addition to planning the work of the main station should assist in the planning and supervision of experimental work on smaller stations established here and there on the Snake river plains or in higher altitudes as occasion requires. It is realized that this is an ambitious plan, but it is the only one that will adequately take care of dry-farming interests at a relatively low cost. The initial move toward putting this plan into effect is the passage by the coming Legislature of a resolution calling upon the State Land Board for the segregation of at least one-quarter section of state-owned land in a suitable location for the conduct on the part of the State Experiment Station of dry-land investigations.

Our cooperative agreement with the Office of Irrigation Investigations for the conduct of work at the Gooding Experiment Station expires with this year. In view of the fact that our lease on that farm gives us but two more crop years in which to operate and that the Caldwell farm has been given to the University organization for the conduct of experimental work in irrigation farming, it is planned to allow the lease on the Gooding farm to lapse with this year and to transfer all irrigation investigations at once to the Caldwell station. This plan calls for the placing in charge of the work at Caldwell a thoroly trained and capable resident superintendent.

With adjustments indicated above should come the establishment of one other sub-station, one that can be made to serve farming interests at high altitudes in regions of ample rainfall. It is suggested that a sub-station might well be established in the vicinity of Grangeville or Nezperce.

Special Service

Technical advice and assistance are frequently asked of Experiment Station men. Sometimes they can and do render the service asked for without serious interference with their project work. Just as frequently, however, they cannot. A trip of several days' duration or an acknowledgment of inability to render the service asked for are the two alternatives. Traveling expenses on other than project work obviously cannot be allowed on Federal funds. The creation of a small emergency fund which will be called into use only when crop pests become rampant and plant and animal diseases and soil troubles become acute will be repaid many times over in effectiveness of service to the agricultural interests of the state.

Publication and Distribution of Bulletins

Another matter has to do with getting the results of Experiment Station work into the hands of those who can use and really want them. There is an enormous waste incurred in the practice of sending publications broadcast to the mailing list. We have adopted the plan of sending out publications only in response to direct requests for them. The mailing list, however, which now numbers over ten thousand, is kept informed by means of the semi-monthly Agricultural News-Letter and special announcement circulars of available publications. Definite plans for increasing the number of names on the mailing list and making more effective the bulletin service of the Station are being put into effect as rapidly as funds permit.

During the past biennium ten regular bulletins, one poster bulletin and three circulars have been issued, a total of 109,100 copies and 1,811,500 pages, at a total cost of \$1344.00. Federal and local station funds have borne this expense to the extent of \$570.75. A special publication fund placed at our disposal last year by the State Board of Education has borne the remainder.

Mention should be made in this connection of an understanding which was reached during the year with the Washington State Experiment Station whereby an interchange of publications is made possible to the mutual advantage of the farming interests of both states at a minimum cost. Previous to publication manuscripts of the bulletin or circular about to be printed are submitted by one organization to the other. If the publication is one which promises to be of interest to farmers of both states, arrangements are made for running an extra edition to be delivered to the neighboring institution. During this biennium we have purchased from the Washington Experiment Station three publications totaling 4000 copies and 47,500 pages. We have sold to that organization during the same period four publications totaling 4300 copies and 53,000 pages. Similar arrangements might well be made with other neighboring institutions. There are on file for publication in bulletin or circular form at the present time no less than twelve or fifteen manuscripts. Every mail brings inquiries which could be answered definitely and completely by one or more of these proposed publications. They ought to be gotten into print at the earliest possible opportunity.

An unusual interest in the work of the Experiment Station on the part of farmers has been shown in various ways during the past year. Farmers' and Housekeepers' Week in January was well attended. In June local farmers and their families to the number of five or six hundred assembled at the University to be shown the work going on in field, orchard, garden, pasture, feed-lot and laboratories. A few weeks later, led by their county agent, some forty or fifty farmers drove from Lewis County to see the work done in grain growing on the Station farm and to learn more about the nature of smut and practical means for its control. Still later in the season several hun-

dred threshermen and grain growers assembled to witness the demonstration of an apparatus for putting out fires which usually follow smut explosions in threshing machines. The apparatus in question was perfected in the Office of Public Roads and Rural Engineering of the Federal Department of Agriculture but our own Department of Farm Engineering cooperated with representatives of that office the year before in securing data which were used in designing it. On the Aberdeen Sub-Station an unusually large number of farmers gathered this year to see the experimental work in the production of grains and forage crops under dry-land and irrigation conditions. Insofar as opportunity offers, encouragement will be given to these summer gatherings at the central station and at each one of the sub-stations.

In conclusion, it is not out of place to remark that in spite of certain defects here and there, our Experiment Station organization is stronger now than ever before. The very fact that there is urgent request for additional funds for the conduct of Experiment Station work indicates that the men engaged in it are keenly alive to the situation. Two men at the present time are giving their entire time to Experiment Station work. In the near future we will have three and possibly four doing likewise, a circumstance which bodes well for thoro investigation. College and Station activities must be carried on thru the same departmental organization, but in justice to Experiment Station work and to the men themselves, participation by any one, except he be the head of a department, in more than two lines of agricultural activity should be discouraged. The thoro and effective work which the Extension force is doing in this state means that there must be additional concentration of effort on the part of another group equally as well organized for the thoro testing of theories and the production of new information thru research. A man may well do College and Station work, College and Extension work, or Station and Extension work, but participation in all three divisions of agricultural activity creates that diversity of interests for which some of our departments have been adversely criticised.

Finally, it is well to note the progress other stations are making in the investigation of marketing problems and the help they are giving farmers in the solution of those problems. Our next advance should be in a direction that proves our recognition of the importance of the marketing end of the farming business and should show our intent to attack the problems connected with it in a comprehensive and thoro manner.

Respectfully submitted,

J. S. JONES, Director.

Financial Statement
University of Idaho Agricultural Experiment Station
in account with
The United States Appropriations.

Dr.	Hatch Fund. None	Adams Fund. None
To balance from appropriations for 1914-15.....	None	None
Receipts from the Treasurer of the United States, as per appropriations for fiscal year ended June 30, 1916, under acts of Congress approved March 2, 1887 (Hatch Fund), and March 16, 1906 (Adams Fund).....	\$15,000.00	\$15,000.00
Cr.	Abstract.	
By salaries.....	1 \$10,047.63	\$ 8,581.15
Labor	2 2,454.77	2,133.29
Publications	3 255.30	.....
Postage and stationery.....	4 196.83	54.14
Freight and express.....	5 52.83	319.79
Heat, light, water, power.....	6 143.28	117.96
Chemicals and laboratory supplies.....	7 211.39	459.46
Seeds, plants, and sundry supplies.....	8 297.97	325.42
Fertilizers	9 1.88	.....
Feeding stuffs	10 699.41	39.00
Library	11	47.27
Tools, machinery, and appliances.....	12 128.57	907.40
Furniture and fixtures.....	13	50.48
Scientific apparatus and specimens.....	14 53.21	1,028.41
Livestock	15 .....	.....
Traveling expenses.....	16 163.93	892.31
Contingent expenses.....	17 22.00	.....
Buildings and land.....	18 271.00	43.92
Total.....	\$15,000.00	\$15,000.00

Financial Statement—Local Station Funds
 July 1, 1915 to June 30, 1916.

Receipts:

Interest on deposits.....	\$ 272.46
Department of Animal Husbandry, sale of livestock.....	300.00
Department of Bacteriology, sale of legume inoculating cultures....	498.29
Department of Chemistry, sale of flour.....	52.38
Department of Farm Crops, sale of seeds.....	63.79
Department of Horticulture, sale of produce.....	512.57
Department of Poultry Husbandry, sale of eggs.....	3.50
Total.....	\$1702.99

Disbursements:

	Ad- min.	An. Husb.	Bact.	Chem.	Farm Crops	Hort.	Soil Tech.	Totals
Books, post., pub. stat.	\$ 52.32			\$ 28.10	\$ 11.61	\$ 10.00		\$ 102.03
Feeds		\$150.00				27.48		177.48
Freight and ex.	1.03	2.97	\$ 1.30	1.36	8.59	29.65		44.90
Heat and power.						6.80		6.80
Labor	14.40		162.70	6.60	117.31	106.18	\$ 26.25	433.44
Supplies and equipment....	.60	23.70	224.76	13.10	50.54	289.32		602.02
Tools and machinery.....		30.00			13.00	21.90		64.90
Traveling exps.. ..						97.82		97.82
Total.....	\$ 68.35	\$206.67	\$388.76	\$ 49.16	\$201.05	\$589.15	\$ 26.25	\$1529.39

Financial Statement—Sub-Stations' Receipts and Expenditures

Dec. 1, 1914 to Dec. 31, 1916.

Receipts:	Aberdeen	Caldwell	Gooding	Sandpoint	Jerome
Balance on hand Dec. 1, 1914..	\$ 111.87	\$ 832.55	\$ 308.42	\$ 306.76	O.D. \$ 9.39
Old appropriation, purchase of live stock.....		2000.00			
Building funds (donations)...				2764.17	
Local station receipts, from sale of livestock, hay, surplus grain, potatoes, seed cleaning, pasture, milk and cream	1603.07	3267.51	1721.14	411.22	504.86
State appropriations.....	5000.00	2000.00	4000.00	4800.00	
	<u>\$6714.94</u>	<u>\$8100.06</u>	<u>\$6029.56</u>	<u>\$7668.63</u>	<u>\$ 514.25</u>
Disbursements:					
Salaries	\$1759.20	\$3102.50	\$2313.36	\$2620.23	
Sundry labor.....	719.71	1389.58	1046.15	465.71	\$ 57.24
Stationery and office supplies.	11.23	30.24	43.08	13.60	
Freight and express.....	107.01	166.14	1.35	122.02	
Chemical and laboratory supplies	7.75				
Bulletins and publications.....	4.80		100.71		
Sundry supplies	823.24	602.59	389.63	627.82	29.37
Traveling expense	117.26	167.39	335.80	138.95	
Heat and power.....	153.54	30.75		5.94	
Telephone and telegraph.....	65.72	31.55	90.13	30.18	
Insurance	52.43	23.62	32.55	46.20	75.50
Feeding stuffs.....	227.27	5.05	45.40	327.01	
Legal fees	25.00				
Water			161.45	27.16	
Repairs			102.86		
Postage			9.00	9.60	
Rentals				52.50	
Tools, implements and machinery	707.79	76.15	87.25	142.83	
Scientific apparatus	20.00				
Furniture and fixtures.....	34.90		3.00	33.69	
Livestock	225.00	1400.00	205.00	300.75	
Other equipment	11.76	45.20	53.75	44.28	
Buildings and betterment.....	552.04	816.25		3077.15	
Total	<u>\$5625.65</u>	<u>\$7887.01</u>	<u>\$5020.47</u>	<u>\$8085.62</u>	<u>\$ 162.11</u>