Bulletin No. 220

Science Aids Idaho Farmers

The Annual Report

of the Agricultural Experiment Station
for the Year Ending December 31, 1935

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R. E. KNIGHT, B.S. (AGR.)	*Superintendent, Sandpoint Substation*

* On leave of absence
** In cooperation with the U.S.D.A.

Introduction

THE Idaho Agricultural Experiment Station was established in 1892. The Station is, therefore, entering upon its forty-fifth year of successful organized research in the field of agriculture. Although funds are still inadequate to meet pressing needs, at no time in its history has the Station been so well organized for supplying scientific information pertaining to Idaho agriculture. It is also evident that at no time in its history has there been a greater demand and a greater need for this information than in these years of social and economic uncertainty.

The activities of the Idaho Agricultural Experiment Station cover the State. Through the branch stations and through the temporary cooperation of various departments of the Station with the farmers through the county agricultural agents in various parts of the State, problems of Idaho agriculture are investigated in a comprehensive manner.

The four substation farms are strategically located in different parts of the State in order to serve the interests and investigate the problems of specific areas. At Aberdeen is located an irrigated farm, established in 1911, of 113½ acres, 37½ of which were added to the farm during the last year. At Caldwell the farm, established in 1906 and containing 320 acres, is devoted largely to problems connected with the feeding of livestock, to dairy cattle management, and to the adapting of crop practices to soil conditions in that area. The High Altitude Substation Farm near Tetonia was established in 1919. There are 180 acres of land in this farm and the work carried on deals primarily with the adaptation of crops to the non-irrigated areas of this high altitude region. Problems connected with agriculture in the cut-over areas of northern Idaho are considered at the Sandpoint Substation Farm of 170 acres which was established in 1912.

Two field stations have been operated for a number of years, an entomological field station at Parma and a plant disease field station at Twin Falls. Sixteen acres of irrigated land were purchased last summer near Parma to be used in studies pertaining to the development of better methods of control of fruit insects, for the testing of varieties of fruits and vegetables, and for the study of problems related to vegetable seed production. An additional tract of land containing 133 acres was added to the home station farm at Moscow. This land is adjacent to the present farm and will furnish much needed land for dairy pasture and for the growing of feed for the University herds.

Additional emphasis is being placed during recent years upon broad, general policies and upon regional problems affecting the agricultural industry. Research pertaining to specific problems of soil, crops, and livestock should not be neglected, but these broader relations of distribution, farm taxes, and farm adjustments are demanding the attention of the farm population as never before.

The Federal funds received by the Idaho Agricultural Experiment Station for agricultural research have been augmented this year by the addition of a little more than $3,300.00 from the Bankhead-Jones fund. The provisions under which this fund is administered lay emphasis upon research into laws and principles underlying basic problems of agriculture in its broadest aspects. The major portion of these funds will be used

during the coming year for the continuation of a study of agricultural adjustment.

Changes in Staff

There were a number of changes in the staff of the Experiment Station during the year.

Resignations:

F. W. Atkeson, Head of the Dairy Husbandry Department, resigned April 1, 1935, to accept a position as head of the department of dairy husbandry at Kansas State College, Manhattan, Kansas.

H. W. Hulbert, Agronomist, resigned January 1, 1936, to accept a position with Mark Means Seed Company, Lewiston, Idaho.

Roscoe E. Bell, Soil Technologist, resigned September 1, 1935, to accept a position with the Federal Resettlement Administration, Northwest division, Portland, Oregon.

J. H. Christ, Superintendent of the Sandpoint Substation Farm, resigned May 16, 1935, to accept a position with the United States Soil Erosion Service, Colorado Springs, Colorado.

T. R. Warren, Assistant Dairy Husbandman, resigned September 1, 1935, to accept a position as western representative of the American Jersey Cattle Club, Portland, Oregon.

G. S. Schilling, Associate Bacteriologist, resigned April 1, 1935.

Ruth Remsberg, Assistant Plant Pathologist, resigned July 1, 1935, to accept a fellowship for graduate study at Cornell University.

T. R. Ashlee, Florist, resigned September 1, 1935.

Promotions:

D. R. Theophilus was promoted from Associate Dairy Husbandman to Head of the Dairy Husbandry Department July 1, 1935.

D. L. Fourt was promoted from Extension Dairy Specialist, to Associate Dairy Husbandman July 1, 1935.

W. E. Shull was promoted from Assistant Entomologist to Associate Entomologist November 1, 1935.

R. F. Johnson was promoted from Assistant Animal Husbandman to Superintendent of the Caldwell Substation Farm April 1, 1935.

Appointments:

K. H. Klages was appointed Head of the Agronomy Department February 1, 1936.

G. O. Baker was appointed Soil Technologist October 1, 1935.

Earle Blodgett was appointed Associate Plant Pathologist October 10, 1935.

Glen L. Dunlap was appointed Assistant Bacteriologist September 1, 1935.

W. M. Beeson was appointed Assistant Animal Husbandman February 1, 1936.

G. W. Woodbury was appointed Associate Horticulturist September 1, 1935.

A. O. Shaw was appointed Assistant Dairy Husbandman September 1, 1935.

Carl Tjerandsen was appointed Assistant Economist February 1, 1935. and resigned June 16, 1935.

R. E. Knight was appointed Superintendent of the Sandpoint Substation Farm June 1, 1935.

Alexander Joss was appointed Instructor and Research Assistant in the Department of Agricultural Economics September 9, 1935.

M. J. Buschlen was appointed Field Superintendent, Department of Agronomy, September 1, 1935.

J. B. Rogers was appointed Instructor in Agricultural Engineering April 15, 1935, and resigned November 1, 1935.

A. L. Schade was appointed Assistant in Plant Pathology September 1, 1935.

Leave of Absence:

Hobart Beresford, Head of the Agricultural Engineering Department, was granted leave of absence in order to accept an appointment with the Rural Housing Section of the Federal Housing Administration, April 16, 1935, to September 1, 1935.

J. M. Raeder, Associate Plant Pathologist, was granted leave of absence in order to take graduate work at Iowa State College, October 1, 1935, to June 16, 1936.

L. R. Tucker, Assistant Horticulturist, was granted leave of absence in order to take advanced work at the University of Minnesota, February 1, 1936, to April 1, 1936.

Harold Vogel, Assistant Economist, was granted leave of absence in order to continue work as Idaho Land Planning Consultant for the National Resources Board, February 1, 1935, to June 16, 1936.

C. O. Youngstrom, Associate Agricultural Economist, was granted leave of absence in order to assume charge of county agricultural program planning in Idaho from December 10, 1935, to June 9, 1936.

The Agricultural Experiment Station is ready at all times, within the limit of the funds available to assist in solving the problems of Idaho agriculture. In order to meet urgent requests for much needed investigation and research, it is very necessary that funds for the home station, as well as for the several branch stations, be at least partially restored to the amounts appropriated before drastic cuts were made in these appropriations.

Publications

THE results of investigations by the Station staff are published as bulletins and circulars by the University and as research papers by various scientific journals. The list of publications for 1935 follows:

Bulletins:

210 *Index numbers of Idaho farm prices.*
211 *A varietal study of the susceptibility of sweet cherries to cracking.*
212 *Effect of various phases in the manufacture of casein by the natural sour method on its physical and chemical properties.*
213 *Pea meal as a feed for dairy cows.*
214 *Sweet clover silage as a feed for dairy cows.*
215 *Sunflower silage for milk production.*
216 *Potatoes as a feed for dairy cows.*
217 *Science aids Idaho farmers.* Annual report of the Experiment Station for the year ending December 31, 1934.
218 *Soybean production in Idaho.*

219 *The vitamin C content of the Russet Burbank potato of Idaho.*

Circulars:

61 *Operation and care of the cream separator.*
74 *Dry applications of chlorates.*

Research Papers:

116 *The effect of acetic acid vapor treatment on the blood cell count in the cockroach Blatta Orientalis.* Robert C. Fisher. Ann. Ent. Soc. Amer. 28: 146-153. 1935.

127 *The inheritance of resistance to common bean mosaic in field and garden beans.* W. H. Pierce. Phytopath. 25 : 875-883. Sept. 1935.

130 *Hydrogen ion concentration of creamery waters and their relationship to washing butter.* N. S. Golding. Jour. Dairy Sci., Vol. XVIII, No. 6, pp. 359-371. June 1935.

132 *Inheritance of wry tail in Jersey cattle.* F. W. Atkeson and T. R. Warren. Jour. of Heredity, Vol. 26, No. 8, pp. 331-334. Aug. 1935.

133 *Portable elevator as a labor saving device on the dairy farm.* F. W. Atkeson and Hobart Beresford. Jour. Agr. Engr., Vol. 16, No. 4 pp. 149-150. April 1935.

136 *Vitamin A content of pasture plants.* II. *Timothy (Phleum pratense* L.) *and red top (Agrostis alba* L.) *under pasture conditions and fed green.* Ella Woods, F. W. Atkeson, Harry Wellhausen, and R. F. Johnson. Jour. of Dairy Sci., Vol. XVIII, No. 8, pp. 547-556. Aug. 1935.

137 *Vitamin A content of pasture plants.* III. *Alfalfa (Medicago sativa* L.) *and smooth brome (Bromus inermis* Leyss) *under pasture conditions and fed green.* Ella Woods, F. W. Atkeson, Alfred O. Shaw, I. W. Slater, and R. F. Johnson. Jour. of Dairy Sci., Vol. XVIII, No. 9, pp. 573-578. Sept. 1935.

138 *Vitamin A content of pasture plants.* IV. *White blossom sweet clover (Melilotus alba* Desvx.), *orchard grass (Dactylis glomerata* L.), *and meadow fescue (Festuca elaitor* L.) *under pasturage conditions and fed green.* Ella Woods, F. W. Atkeson, I. W. Slater, C. D. Arndt, and R. F. Johnson. Jour. of Dairy Sci., Vol. XVIII, No. 10, pp. 639-645. Oct. 1935.

141 *The Idaho caliper for measuring inequalities of the jaws of sheep.* J. E. Nordby. The National Woolgrower, Vol. 25, No. 5. May 1935.

Agricultural Chemistry

H. P. MAGNUSON *in charge*

SINCE chemistry deals with the composition of all agricultural products, as well as the proper balance of essential constituents required for their production, most of the projects are cooperative with other departments. Specific cooperation is usually apparent in each case.

Phosphorus Deficiency is General

A subject of great importance to the citizens of Idaho is the lack of sufficient available phosphorus in the soils of a large portion of the State. A survey of the distribution and extent of this deficiency has now been completed for most of the State. In areas where there is insufficient available phosphorus to produce maximum crops, the composition of the alfalfa is also adversely affected. Where the addition of phosphatic fertilizers produces appreciable increase in yields, it also increases the phosphorus content of the alfalfa. A definite, though less pronounced influence, is likewise seen in an increase in the protein content in the alfalfa from phosphate-fertilized fields. Both of these items of composition are important when the alfalfa is used to feed the animals on the farm. This effect on the composition of alfalfa is found to persist for two years after fertilizing the land. In the third year the composition of the alfalfa is often maintained less satisfactorily than is the yield.

In connection with the preservation of blood samples, sodium fluoride has been used. This system is satisfactory in most cases. When too long time is taken in transit, the blood sometimes hemolizes, thus affecting the phosphorus reading. Studies are under way to develop methods of shipping the samples that will be more satisfactory.

An extensive survey was carried out in cooperation with the Bureau of Animal Industry, United States Department of Agriculture, on the phosphorus level of animals from various parts of the State. The phosphorus content of their blood was used as an index. Considerable variation was found in most herds, with many animals showing a low phosphorus level. Several hundred analyses were run in the spring and are now being repeated. The spring samples show definite effect of the rations on the phosphorus levels. Beet pulp tends to produce low-phosphorus diseases if fed in too large quantity. A surprising number of animals were found to be low in blood phosphorus at the end of the pasture season. A second check on these same animals is planned in the spring, before the animals are again put on pasture, to find the influence of the winter ration on the phosphorus levels.

Iron Reduces Chlorosis

Chlorosis is a general name for a group of diseases, indicating the lack of green color in the leaves. In Idaho the chief cause of this "yellowing" of the leaves is deficiency in iron, apparently produced by the high lime content of the soil. A number of apple trees were treated for chlorosis by means of injection of various chemicals into the trunk, just below the ground surface. Iron salts regularly produced an improvement in color, growth, and fruit production. Iron citrate, phosphate, and tartrate were about of equal value. Zinc alone had no effect on this type of chlorosis, but when added to iron citrate in the proportion of one part zinc sulphate

to six parts iron citrate, it seemed to add slightly to the thrift of the plant. Treatments were all made during the winter when the tree was dormant. Trees will be watched to see how long one application remains effective.

Pasture Studies Produce Results

Further studies have been made on pasture grasses under grazing conditions. Carotene was determined on these grasses and found to vary considerably. Mostly the carotene content corresponds with former biological assays, except in Kentucky blue grass, which is high in carotene but low in vitamin A potency. There also seems to be direct correlation between the carotene content and the protein content of the grasses. This point is receiving more study.

Fig. 1.—Root system of chlorotic apple tree. The maximum portion of the root system is within 14 inches of the surface.

It has been found that the stability of carotene is very low under normal farm method of handling. For this reason rapid drying methods have been developed to put out a high vitamin A product. Carotene determinations are being made regularly on the stock supply of vitagreens used as the chief source of vitamin A in feeding poultry. Part of the vitagreens are kept in cold storage and part in the feed shed under normal conditions, to compare the stability of the vitamin A potency.

Slick Spot Studies Continued

Slick spot soils found in certain sections in southern Idaho have been further examined in the field and in the laboratory. Percolation pots, treated with very large quantities of gypsum, showed very satisfactory removal of sodium by leaching. Leaching alone showed very small sodium losses, as well as no improvement in physical condition. Crops also showed response to gypsum applications. The chief value of the gypsum seems to be the replacement of sodium by calcium in the complex, which in time improves the structure of the soil.

Miscellaneous

The work on effect of crop rotation on yield and nitrogen content of wheat and fertility of the soil has been continued with similar results as

in past years. Washing apples with silicate and acid solutions is still the best cleaning method that has been developed. The addition of compatable deturgents to each of these slightly increases the efficiency. Brushes added to the washing machine adds to the efficiency, but the mechanical features still give some trouble.

The method of determining phosphorus availability developed here some time ago has been successfully used to analyze miscellaneous samples of soil sent in by farmers, and seems to give results that are quite adequate as a basis for fertilizer applications. These samples have also given added information on soils from new areas in the State. Most such samples have been found to be adequate in potash, but quite low in nitrogen, as is characteristic of desert soils.

Agricultural Economics

P. A. EKE *in charge*

Land Classification Map Completed

FROM December 1, 1934, to February 1, 1935, all available research workers of the department were engaged in collecting data for making land classification maps for 22 of the State's 44 counties. About $20,000 was spent for F.E.R.A. labor, and about 20 students were employed on a part-time basis to compile statistics in this study. An additional $20,000 will be needed to complete this work if relief labor is used. Ownership and tax delinquency maps have been completed for 15 counties and partially constructed for 4 others. Several copies of these maps have been distributed to public officials and other interested persons. Maps showing assessed values of holdings, assessor's classification of the land, location of farm houses and their vacancy or occupancy, and the location of rural relief cases may be constructed from data now available. All ownerships have been classified as to tenure and type of owner, whether individual, corporate, or credit institution. The history of tax delinquency back to 1928 has been shown on the maps which are now available. An accurate map of school districts for each of 20 counties also can be made. Much of the above data and a great deal more are available in tabular form. Three publications upon wheat yields, tax delinquencies, and ownership classifications are now planned, and data are being assembled for this purpose. In making these studies the department has worked in cooperation with the Idaho State Planning Board, the United States Forest Service, the Rural Resettlement Administration, and the Farm Credit Administration.

Sources of Public Revenue Studied

A mimeographed pamphlet on "The Sources and Uses of State and County Revenues in Idaho", which will be the first publication giving a picture of the total county revenues of all kinds, will soon be available for distribution. This pamphlet will cover analyses of all State revenues and expenditures for the years 1931-1932, as these were the only figures available when the pamphlet was written. Eight sample counties have been analyzed as to complete revenue and expenditures for the years 1931, 1932, and 1933. General property taxes also were analyzed as to major uses for the years 1924, 1929, and 1933.

TABLE I
Monthly Farm Prices of Butterfat, Idaho, 1910-1934
(Cents per pound)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1910	32	32	30	28	26	25	26	28	30	30	30	31
1911	32	30	26	23	21	21	22	23	23	26	28	30
1912	30	28	28	28	26	23	23	23	26	28	29	30
1913	30	29	27	27	26	21	22	26	28	30	30	30
1914	30	28	25	23	21	21	20	21	23	28	28	28
1915	28	23	21	21	21	19	19	21	23	26	26	28
1916	28	27	26	26	25	23	22	23	26	29	32	35
1917	32	32	35	36	36	34	34	37	44	44	46	47
1918	46	44	44	42	39	37	39	44	48	56	59	58
1919	57	51	48	52	53	49	49	53	55	62	64	67
1920	66	60	60	62	60	57	56	57	66	62	55	47
1921	44	41	40	38	28	26	29	36	36	42	41	36
1922	26	32	31	28	27	30	34	34	34	38	41	42
1923	44	42	42	42	39	40	38	40	45	43	45	46
1924	49	46	44	39	38	35	34	36	39	38	36	36
1925	39	39	40	40	39	41	42	47	48	52	54	51
1926	48	44	44	42	42	40	40	39	42	44	43	45
1927	47	46	40	42	41	39	40	40	44	46	46	46
1928	48	46	45	43	41	41	43	45	49	51	50	49
1929	47	47	46	44	44	44	44	44	46	48	47	46
1930	38	35	35	37	36	30	30	32	37	37	35	31
1931	23	23	26	21	20	19	19	23	27	28	28	28
1932	22	19	17	14	15	13	12	16	16	18	18	22
1933	16	14	14	14	19	19	21	19	19	16	18	16
1934	14	21	21	17	17	19	19	23	25	27	29	33

1910 to August 1920, Estimated, see "Source Data," appendix.
September, 1920-1925, United States Department of Agriculture Statistical Bulletin No. 17.
1926-1934, Monthly issues, Crops and Markets, United States Department of Agriculture.

TABLE II
Monthly Farm Prices of Wheat, Idaho, 1910-1934
(Cents per bushel)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1910	92	96	94	90	90	92	86	81	81	76	74	70
1911	68	67	66	68	71	72	71	66	64	66	66	66
1912	66	70	73	78	86	84	78	72	66	64	64	64
1913	64	68	70	73	72	72	72	69	65	64	62	64
1914	64	66	68	70	72	72	72	72	72	72	80	92
1915	103	116	114	106	108	98	86	82	78	78	80	82
1916	88	88	82	80	82	80	80	97	116	126	140	138
1917	142	148	150	180	222	220	191	188	190	183	182	184
1918	182	180	187	195	196	198	206	203	196	192	192	192
1919	191	194	197	200	200	204	206	200	202	209	208	210
1920	222	230	238	240	240	244	239	216	200	186	147	130
1921	133	134	124	100	94	100	91	79	82	80	72	74
1922	76	89	104	106	102	92	84	76	77	84	88	94
1923	97	98	101	102	105	105	88	75	78	81	81	77
1924	80	80	77	75	80	82	100	107	110	128	130	140
1925	163	174	179	138	151	151	141	132	133	120	124	136
1926	137	139	127	123	119	109	110	110	101	105	108	109
1927	109	112	109	106	116	124	123	108	103	102	96	102
1928	107	108	115	121	138	122	112	90	88	99	93	96
1929	94	100	98	93	85	82	93	102	99	101	93	98
1930	97	92	88	89	83	86	68	67	58	55	52	49
1931	44	42	44	42	41	36	32	30	33	34	51	47
1932	48	46	46	45	45	40	35	33	32	27	26	26
1933	25	23	25	34	44	44	61	59	54	48	54	50
1934	53	55	55	51	57	58	60	71	73	72	70	72

1910-1925 United States Department of Agriculture Statistical Bulletin No. 17.
1926-1934 Monthly issues, Crops and Markets, United States Department of Agriculture.

The index numbers of Idaho farm products were published June, 1935, in the form of Bulletin No. 210. Tables I and II and Figure 2 are samples of these data. The history of prices is always of interest and frequently of much value in planning farm production for future years. These index numbers will be kept up-to-date in the *Idaho Agricultural Situation.*

Regional Agricultural Adjustments Recommended

Beginning in May 1935, the research resources of the department were put to work in directing a cooperative study by five departments of the Experiment Station. This study was entitled "Regional Agricultural Adjustment Research", and was directed nationally by the Bureau of Agricultural Economics and the Agricultural Adjustment Administration. The Idaho report was completed September 15, 1935. The scope of this work has been to plan cropping systems which will result in soil conser-

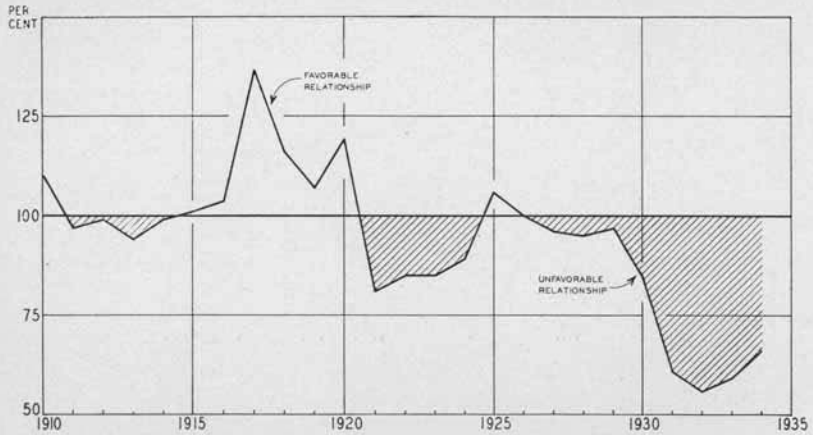

Fig. 2.—Ratio of prices paid by farmers for commodities bought to farm prices received by Idaho farmers for products sold 1910-1934 (1910-1914=100). During the war period prices were favorable to the farmer, but in recent years the relationship has been unfavorable.

vation under the peculiar conditions existing in each county. Estimated production of the crops to be grown and the numbers of livestock to be raised under the adjusted program have been made. These figures were summarized for the State and sent to the United States Department of Agriculture where national totals were made available. To match these estimates, county agricultural adjustment conferences will be held, where farm committees will treat the same problem and arrive at similar figures. Both sets of figures will be used in guiding a federal soil conservation program. This research project will be continued during the coming year and will be financed by moneys from the Bankhead-Jones Fund.

Wheat yield and acreage figures were tabulated from the more than 13,000 wheat compliance forms for 1935. Acreages of other crops were taken for the same year from the same source. For sample counties, acreages of wheat and other crops were tabulated for the year 1933. These figures, especially for 1935, are of current interest to farmers and business men. They have not been released but are available upon request.

Although the regular research work of the department has been somewhat hampered by the fact that these more pressing problems have demanded attention, this work has been correlated as much as possible with the emergency program which has recently taken first place.

Agricultural Engineering

HOBART BERESFORD *in charge*

Irrigation, Drainage, and Land Development Problems Studied

STUDIES were made of the drainage effect of wells used for pumping for drainage and supplemental irrigation. It was found that some wells have not been pumped on account of the lack of drainage effect in the immediate vicinity, while others were pumped intermittently. A combination of open gravity drains and pumped wells seems more desirable than either system used exclusively. Areas were found where wells were effective within a few feet of open drains which afforded no relief. In other cases flowing wells and open drains gave more relief than pumping alone. The geologic and soil conditions determine the drainage effect of pumped wells.

Studies on the irrigation of potatoes are to be resumed along lines that will have a broader application, including practical methods of determining when irrigation is necessary. Preliminary studies have been made on the irrigation of hemp.

The development of spring and shallow well water supplies for rural homes was studied on a Palouse farm by means of test borings observed through the summer. The previous well had been located on low ground and the study showed that equally productive and much more sanitary wells could be located at a higher elevation over a large area.

New Types of Farm Machinery Tested

During the 1935 harvest season a field trial was made of a recently developed small-size high speed "all-crop" combine to determine its adapt-

Fig. 3.—"All-crop" combine harvesting wheat during test trial under direction of the Agricultural Engineering Department.

ability to the direct combining of peas under Idaho conditions. The machine has a 5-foot cutter-bar and cylinder of the same width, making it narrow enough to handle easily in small fields, and is capable under favorable conditions of traveling at field speeds of from 4 to 5 miles per hour. In tests made by the Department of Agricultural Engineering, 66 acres of wheat and 33 acres of field peas were combined with satisfactory operation on slopes up to 15 per cent, and with only slight loss of grain on slopes up to 30 per cent. Peas yielding 23.3 bushels per acre were harvested at the rate of one acre per hour. In wheat yielding 31.2 bushels per acre, 1.3 acres per hour were combined. Owing to the narrow 5-foot width of cut, peas were picked up cleaner than is possible with the wider cutterbars on the larger machines. The tests revealed that with the new machine threshing injury bears a direct relation to the cylinder speed. At 475 r.p.m. the crackage in peas was 1.09 per cent, at 575 r.p.m. it was 1.56 per cent, and at 650 r.p.m. it was 3.6 per cent. Operation costs, including combine and tractor, fuel, lubricants, labor, and repairs, gave a total of $1.36 per acre for peas and $1.09 per acre for wheat, as compared to $1.63 per acre for peas and $2.33 per acre for wheat for the larger combine operating under similar conditions. The possible saving in operating cost for the small machine over the conventional 12-foot size is $0.52 per acre in wheat and $1.23 per acre in peas. With this new development it is possible for the operator of the smaller grain farm to lower harvesting costs to the level of the costs of the large scale farming operations.

Cooperating with the Bureaus of Agricultural Engineering and Entomology, United States Department of Agriculture, a field trial was made of a new aid to clean plowing in the border crop method of pea weevil control. The special attachments were furnished through the courtesy of the Bureau of Agricultural Engineering, the attachments having been developed by them and for which they have obtained a public service patent. The attachment has a concave disk which cuts and aids in turning under the edge of the furrow slice nearest the unplowed land just ahead of the moldboard of the plow. The disk is mounted so that it is free to move about the vertical standard and to resume a position parallel to the direction of the motion of the plow. This mounting permits the disk to swing sideways and up when striking obstructions, thus reducing the possible injury to the blade. This type of coulter rolling ahead of the plow starts the cutting of the furrow slice and lays the top of the material over near the furrow edge so that it will be more thoroughly covered. The attachments were effective in aiding the coverage of a heavy growth of field pea vines when plowing at depths of from 8 to 9 inches.

Methods of Utilization of Waste and Surplus Farm Products Investigation

A survey of waste and surplus agricultural products readily available in Idaho has shown that potatoes afford the greatest constant supply of surplus raw materials suited to industrial processing and utilization. Studies have been made of the problems entailed in the production of alcohol from potatoes. It has been found desirable to use a supplementary yeast food in connection with successful potato fermentation. The

supplementary material used is low in cost, is an agricultural by-product, and is a desirable addition to the yeast tissue and fermentation residue in view of its possible use for feeding livestock. The problem of employing thick mashes has been studied from the standpoint of reducing distillation costs and of producing a residue of suitable thickness for feeding purposes. The use of thick mashes has increased the difficulties encountered in the saccharification of potato starch, and various mechanical treatments are being studied in an attempt to develop the correct thick mash procedure. Four typical varieties of yeast have been made available through the courtesy of the Chemical Foundation, and are now being studied relative to their suitability for potato mashes. It is apparent that the utilization of all by-products of fermentation, including dry ice, which is meeting with increasing favor for refrigeration in transportation, and the complete utilization of suitable stock feeds must necessarily play an important part in lowering the cost of alcohol production where it is intended for the motor fuel market.

Power and Labor Utilization in Idaho Creameries Considered

A study to determine the cost of steam, electricity, and labor in representative Idaho creameries was made in cooperation with the Department of Dairy Husbandry during the summer months of 1935. A complete report of this work is to be published in bulletin form and shows that the management of steam, electrical and man-power, is an important factor in lowering the processing costs. The study shows that it is possible to stagger creamery operations throughout the 24-hour period, and by so doing, decrease the electrical power bill. A piece of electrical equipment known as a peak limiting device proved to be a valuable aid in holding the power demands within predetermined limits. The electrical energy consumption per 1,000 pounds of milk and cream received and processed by the creameries averaged 10.38 kilowatt-hours. Can washers were found to use large amounts of steam, the straight-away type using more steam and electrical power than the rotary type. For drying skimmed milk and buttermilk 1.42 pounds of steam were used per pound of liquid milk dried, and it required twice as much electrical power to operate the dryer rolls for the skimmed milk as it did for the buttermilk. The power required for churning varied with the barrel diameter for churns of the same capacity, the smaller diameter churn using the least power. Power studies on churning showed that more power was required to churn cream fresh that day than cream held over from the previous day.

Dairy Barn Ventilation Studied Cooperatively

In cooperation with the Department of Dairy Husbandry a study has been made of the electrically operated ventilating system located in the main dairy barn on the University of Idaho farm. Recent tests of this system have shown that the fans have a tendency to collect dust and dirt on the leading edge of the blades and that a considerable accumulation of material may reduce their capacity as much as 40 per cent. The two exhaust fans in the main barn and two similar fans in the milking wing have sufficient capacity to completely change the air in the barn about every 10 minutes. The chief advantages of an electrically operated ventilating system in the dairy barn and milk house are found in the removal of steam caused by the washing of cans and sterilizing of dairy

utensils, making it possible to dry the floor quickly after washing in the milking wing, and the reduction in the accumulation of frost or sweating on the walls and ceilings of the stable during adverse weather conditions.

The period during which the fans are used extends from about the middle of October to the middle of April. Using a rate of $0.03 per kilowatt-hour, the average operating cost for the fans in the milking wing is $1.05 per month, and for the main stable $0.97 per month. The use of the fan in the milk room is spread throughout the year; however, the greatest use comes during the winter months.

Rural Electrification Investigation Continued

In cooperation with several departments of the Agricultural Experiment Station and with the Idaho Committee on the Relation of Electricity to Agriculture, the progress of rural electrification in the State of Idaho has been surveyed and several research problems studied. As of January 1, 1935, data obtained from the major private power companies and the mutually owned farm lines gave a total of 14,633 farms served by 3,217.55 miles of rural lines. In addition to the farm customers, it was revealed that there is a considerable number of other rural customers estimated to be approximately 3,639 in number. This gives a total of 18,272 rural customers receiving central station electric service in Idaho. On the basis of farm customers only and the 1935 census data which gave 45,113 total farms, Idaho now has 32.43 per cent of her farms electrified. Studies made of the use of electricity by various kinds of farms revealed that the fully electrified dairy specialty farm averages about 10,000 kilowatt-hours a year. This is twice as much as the stock ranch, general farm, or crop specialty farm uses. The animal specialty farm, poultry farm, and fruit specialty farm each use about three-fourths as much as the dairy farm. A comparison of the average yearly use of electrical energy on farms served by public utilities and by mutually owned farm lines showed that from 25 per cent to 50 per cent more kilowatt-hours were used on the farms served by the power companies.

In cooperation with the Department of Poultry Husbandry a study has been made of the use of supplementary electric heat in poultry laying houses. With the circulation type electric heater the heat was made available immediately when the room temperature dropped below 35 degrees Fahrenheit by the automatic thermostat control. The circulation type electric heater used in this test was designed and built by the department, and consists of two 440-watt heating elements connected in parallel across a 110-volt line giving a total of 880 watts. Circulation of air through the heating units is obtained by a standard type of 8-inch ventilating fan. The operation of the heater was automatically controlled by a brooder thermostat equipped with a low temperature wafer. The heater was used in a 20x20-foot pen of a well-constructed and insulated laying house. With a minimum outside temperature of -19 degrees Fahrenheit, the temperature recorded in the electrically heated pen did not go below 34 degrees Fahrenheit. In the pens heated by the underground coal-fired furnace the temperature at 6:00 a.m. was 20 degrees Fahrenheit and the maximum temperature reached was 30 degrees Fahrenheit at 6:00 p.m. Forty-four kilowatt-hours were used during the three-day cold period by the circulation type air heater, which at $0.03 per kilowatt-hour repre-

sents a cost of $1.32. Three hundred pounds of coal were used in the underground furnace during the same period, which at $12.00 per ton represents a fuel cost of $1.80. The chief advantages of the circulation type electric heater for poultry laying houses are that the heating is automatically available and that the operating costs are less than for the coal-fired furnace. Standby supplementary heat from the circulation type, electrically operated, thermostatically controlled heaters can also be used to advantage for frost protection and in storage rooms and cellars wherever there is danger of damage from low temperatures.

In cooperation with the Idaho Committee on the Relation of Electricity to Agriculture, an electric fence installation has been made at the Caldwell Substation in the bull pen at the dairy barn. This installation has reduced fence damage and appears to be an important application of electric fence controllers to farm fencing problems. A state-wide survey has been conducted to obtain information on the success and operating characteristics of the various electric fence controllers. This survey has shown that the maximum operating cost of this device was $0.15 per month. When suitable electric controllers are used, the operators have reported no injury to livestock or people. However, some radio interference has been encountered, especially on the short wave lengths. Electric fence controllers are being used on temporary fences for rotating pastures, for fencing ditch banks, for pasturing, and for the regular farm fencing requirements. Two cases were reported where injuries had occurred from the direct connection of the electric service to the farm fencing. In no case should the use of electricity on fences be attempted without a suitable controller to interrupt the circuit and regulate the voltage and current within safe limits. There appears to be no danger from the use of the battery operated controller where there is no electrical connection between the battery and the electric power service.

Agronomy

H. W. HULBERT *in charge**

PRECIPITATION totaling 20.48 inches fell from September 1, 1934, to August 31, 1934, a deficiency of 1.23 inches from the 40-year normal of 21.71 inches. Rainfall during May, June, and July was only 1.32 inches compared to 3.98 inches for the 40-year average. This scanty distribution during the actual growing period seriously affected the yield of all small grains. However, early varieties of peas, such as Alaska, seeded on fall-plowed, well-prepared seed-beds produced yields higher than in any other year since 1926.

Cereal Investigations Reveal Most Valuable Varieties

Cereal varieties were below normal in yield but high in test weight and quality of grain produced. Fall seeded wheat varieties outyielded those spring seeded by nearly 37 per cent. However, fall sown Winter Club barley yielded less than a bushel more than the same variety spring planted.

Mosida, Golden, and Turkey were high yielding in the plot trials of 18 winter wheat varieties. Rex, a new white bunt-resistant type, ranked 10th and yielded 7 bushels per acre less than Mosida. Ridit and Albit

*Resigned Dec. 31, 1935.

ranked 17th and 18th respectively. Seventy-six varieties were included in the nursery trials. Strains of Turkey produced the highest yields.

Mosida F_2 segregants, progenies from crosses between Mosida and the following varieties: Fortyfold, Federation, White Odessa, Ridit, and Hybrid 128, showed exceptional promise. All are high yielding, averaging 7 bushels better than the highest yielding varieties in the nursery

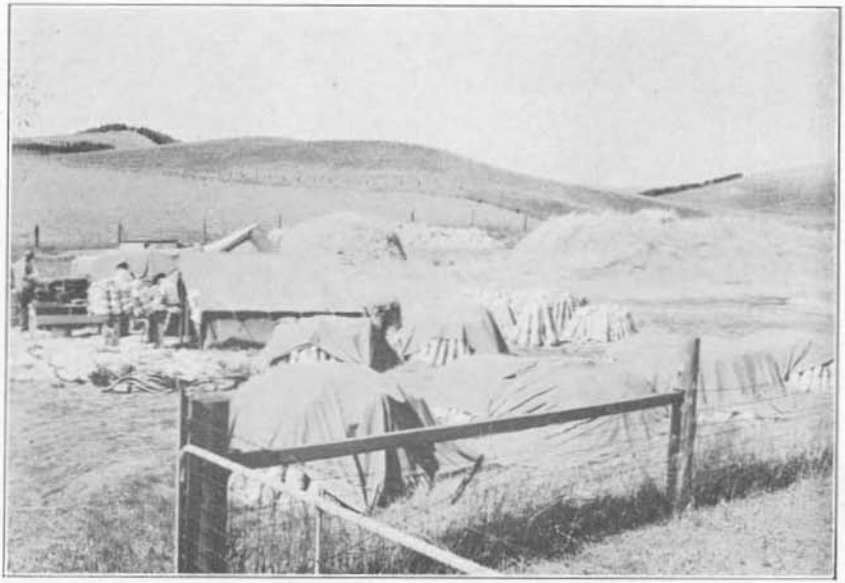

Fig. 4.—Threshing the crop breeding nursery.

trials. Many of these selections show high bunt resistance, stiff straw, mid-height, early maturity, and have soft-white kernels.

Jenkin was the outstanding spring wheat variety in plot trials. Baart and Federation ranked 6th and 8th, respectively, of the 13 varieties tested. In the nursery some of the newer Federation crosses outyielded the 59 strains tested. In addition, some of these crosses showed considerable promise as to stiffness of straw, early maturity, and quality of kernel.

Markton and Victory were the leading oat varieties in the plot trials. Idamine was 4th, yielding 14 bushels per acre less than Markton. Laurel, a hulless variety, produced only about half as many pounds of grain per acre as Markton. In the nursery, crosses of Markton x Victory, Markton x Idamine, and Markton x Swedish Select outyielded Markton, used as a check.

Winter Club was the outstanding barley variety from both fall and spring seeding. Trebi, the high yielding variety over a period of years, ranked 4th. Colsess, a hooded type, yielded only a little more than half as much as Winter Club. This is the best hooded variety tested at the Idaho Station during the past 15 years.

Forage Crop Breeding Shows Promise

Sweet clover, alfalfa, red clover, Ladino clover, peas, grasses, sunflow-

ers, and corn are the principal crops under investigation. Corn and alfalfa breeding work is carried on both at Moscow and at several locations in southern Idaho.

A pink-flowered, brown-seeded Ladino clover, two weeks earlier and more winter hardy than the original strain, has been developed. Sufficient seed was produced this season so that forage trials can be started.

Fig. 5.—Alfalfa breeding nursery showing method used in compelling plants to self-fertilize.

Its general distribution will depend upon its value compared with the original strain, as shown in these tests.

Breeding studies pertaining to the improvement of white-blossom sweet clover and the production of a yellow-blossom, purple-seeded type have been continued. Several interesting and valuable types have appeared among the white-blossom selections. One type sets all of its seed within a 10-day period. One has fine leafy stems, and another branched root systems.

The yellow-blossomed, purple-seeded types are still segregating for seed and plant characters. It is expected that a yellow-flowered, purple-seeded type with an alfalfa-like crown can be developed.

The strain of slender wheat grass selected in 1929 from a species native to the Pacific Northwest was tested for forage and seed production. It outyielded the commonly grown slender wheat grass in both of these respects.

A large number of crosses were made on Alaska and Idabell peas in an attempt to produce a more uniform, deeper-green pigment in the pea seed. Other crosses with yellow-seeded varieties were made to secure a more uniform yellow-seeded strain. Such strains, if developed, would be valuable for commercial usage.

Tests to study the quality and yield of 46 sweet corn strains were started this year near Troy. The quality of the corn for canning and market garden purposes was very high. In years when normal spring weather and moisture conditions prevail, many sweet corn varieties can be grown in the bean-growing area for seed purposes with profit to the farmer. The breeding work with dent corn started last year in southern Idaho was continued. Plots are located near Boise, Caldwell, Emmett, Payette, and Jerome.

Turkestan Alfalfa Yields Well

Eight strains of Turkestan alfalfa furnished by H. L. Westover, United States Department of Agriculture, have been tested for a three-year period. The four high yielding strains averaged 3.34 tons per acre and the four low yielding strains 2.90 tons per acre. Idaho Grimm, used as a check, produced 3.22 tons per acre. This would indicate that the better strains of Turkestan yield at least as well as Grimm under Moscow conditions.

Pea Variety Tests Extensive

Since 1918 more than 650 strains and varieties of field and garden peas have been tested in plot and nursery trials. Tall Gray Sugar, Everbearing, and Hawley's Improved were the high yielding varieties in 1935. An 11-year average shows S.P.I. 19709, Tall Gray Sugar, and Tom Thumb to be the high yielding sorts. S.P.I. 19709 is a green-seeded Alaska type probably suited for commercial use. Tom Thumb is a white-seeded dwarf type, and Tall Gray Sugar is one of the edible pod group.

Alcross, an improved Alaska type, ranked 9th and Idabell 10th. Perfection and Alaska, two important commercial varieties, yield about 20 per cent less than S.P.I. 19709.

Perfections cultivated in 18-inch single rows outyielded drilled seedings by 364 pounds per acre. The size and quality of the seed produced in rows was superior to that from plots.

Chick peas in plots yielded 1320 pounds per acre, which was 775 pounds less than the average yield of seven Alaska strains.

Alfalfa Improves Pea Yields

Comparative yields were obtained on peas in alternate wheat-pea rotation and in an alfalfa-wheat-pea rotation. Ten strains of Alaska in the alfalfa rotation outyielded those in the wheat-pea rotation 481 pounds, or 28 per cent. In addition, the plants in the alfalfa rotation were 3 inches taller. American Wonder was 5 inches taller and yielded 456 pounds, or 25 per cent, more when grown in the alfalfa rotation. Perfections yielded 234 pounds, or 20 per cent, more in the legume rotation. Sweet clover in the rotation should produce similar results.

Soil Survey

A soil survey of Bingham County in cooperation with the United States Department of Agriculture has progressed satisfactorily.

Animal Husbandry

C. W. Hickman *in charge*

ACTIVE projects in animal husbandry consist of studies of Idaho-grown feeds, including various by-products, for fattening steers and lambs for market; the influence of phosphorus in rations for fattening

steers and lambs; experiments to increase the value of sweet clover pasture; experiments with various feed rations for growing and fattening swine; animal breeding studies having to do with variations and abnormalities affecting sheep and swine; and animal disease investigations; mastitis, Bang abortion disease, foul sheath, Oestrus Ovus, and fowl paralysis. Further discussion of animal diseases will be found under divisions concerned, i.e., Bacteriology, Dairy Husbandry, and Poultry Husbandry.

Fig. 6.—University Shorthorn herd on sweet clover pasture.

The major portion of the investigations of rations for fattening steers and lambs is carried on at the Caldwell and Aberdeen Substations. Further discussion of lamb and steer feeding will be found in the section of this report devoted to the Caldwell and Aberdeen Substations.

Lamb Feeding Investigations: Phosphorus Gives Negative Results in Rations for Fattening Lambs

Caldwell Substation. Three hundred fifty lambs, averaging 57 pounds, were fed 130 days. One lot was fed alfalfa hay; another lot was fed alfalfa hay, barley, and dried beet pulp; and a third lot was fed alfalfa hay, barley, and dried beet pulp at one-half the allowance of concentrates given the second lot.

The above lots were fed in duplicate with the phosphorus supplement, mono-calcium phosphate, added at the rate of .1 ounce per head daily. The addition of the phosphorus supplement to the above rations had no beneficial effect; in fact, it was somewhat depressing. The addition of the phosphate supplement lowered the rate of gain and increased the feed requirements. Blood samples were taken for phosphorus and cal-

cium determination. The blood phosphorus showed no significant change during the progress of the experiment on either of the above rations.

Aberdeen Substation. Two hundred fifty lambs, averaging 70 pounds, were fed 84 days. One lot was fed alfalfa hay; another lot was fed alfalfa hay, pressed beet pulp, and barley; and a third lot was fed alfalfa hay, pressed beet pulp, and barley at one-half the allowance of the barley given the second lot. The above lots were fed in duplicate with the phosphorus supplement, mono-calcium phosphate, added at the rate of .1 ounce per head daily.

The addition of the phosphate supplement lowered the rate of gain and increased the feed requirements in all lots except those receiving alfalfa hay alone. Blood samples were taken for calcium and phosphorus determination. The blood phosphorus showed no significant change during the progress of the experiment on either of the above rations.

Steer Feeding Investigations: Phosphorus Negative in Steer Fattening Rations

Forty-eight yearling steers, averaging 750 pounds, were fed 137 days. One lot was fed alfalfa hay; another lot was fed alfalfa hay, barley, and dried beet pulp; and a third lot was fed alfalfa hay, barley, and dried beet pulp at one-half the allowance of concentrates given the second lot. The above lots were fed in duplicate with the phosphorus supplement, mono-calcium phosphate, added at the rate of .05 pound per head daily.

The addition of the phosphate supplement lowered the rate of gain and increased the feed requirements. Blood samples were taken for phosphorus and calcium determination. The blood phosphorus showed no significant change during the progress of the experiment on either of the above rations.

Radiological Studies Reveal Bone Inequalities in Foot Development in Swine

The practical aspect of this problem concerns a defect which manifests itself in the form of a lack of balance in the main claws in swine. Very often the difference is adequate to result in very little support from the inside toe, particularly in the rear feet, thus distorting the alignment of the rear legs.

As a result of radiological examinations of a number of affected feet, and a detailed study of the various bones after all other tissues were removed, it has been determined that there is a very definite difference in the length and diameter of the bones in the inside and outside toes. The dewclaws are similarly involved; however, inequalities in these are not of so much consequence. It appears that the magnitude of the inequalities can be influenced by selective matings. The inheritance of the defect is being studied.

Overshot and Undershot Jaws in Sheep Studied Further

A discussion of new developments in this study will soon appear in the 1935 *Proceedings of the American Society of Animal Production* as Experiment Station Paper 147. An improvised caliper for measuring inequalities in the jaws has been developed in this department and discussed in *The National Wool Grower,* Vol. XXV, No. 5, 1935.

Inverted Nipples in Swine Inherited

A number of matings are under way with a view of getting more detailed information relative to the type of inheritance that is involved in this defect. The information available at this time points definitely to the defect as a problem in inheritance.

Reports on foul sheath in bucks, mastitis in cattle, paratyphoid of turkeys, and fowl paralysis are to be found in the departments of Bacteriology, Dairy Husbandry, and Poultry Husbandry sections.

Grubs in the Head of Sheep (Oestrus Ovis) Develop Rapidly in Warm Weather

Grub in the head of sheep is caused by the maggot or grub of the sheep gad fly (*Oestrus ovis*). This maggot is responsible for most of the nasal discharge seen in sheep (*See* 1934 *Annual Report*).

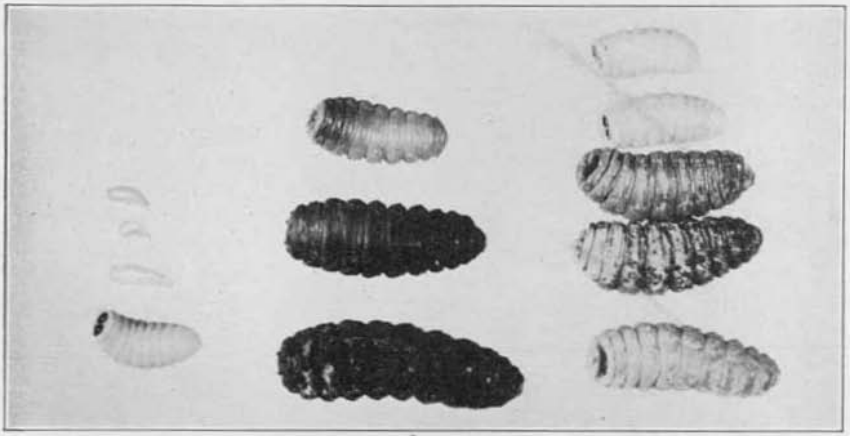

Fig. 7.—Larvae of *Oestrus ovis* taken from the heads of lambs, 25, 33, and 37 days after infestation with minute larvae (1½-2 mm. long). Only one larvae was mature and naturally dark in color (bottom larva in center row). All infestations on May 3.

For many years research workers and sheep men have been of the opinion that the small maggots (larvae) deposited in the nostrils of the sheep by the fly required eight or ten months for development before they were discharged. Recently the finding of full-grown grubs in the heads of spring lambs at three months of age by Federal Bureau of Animal Industry workers indicates that the life cycle of this fly may be shorter than was formerly supposed. During the past few years it has been found at this Station that minute larvae (1½-2 mm. in length) remain in the nasal passage without growing during the winter months (September 2 to March 3) and that only those larvae that had migrated back into the sinuses developed during the winter (*See* 1934 *Annual Report*). During the past year this Station has shown that minute larvae (1½-2 mm.) in the head of sheep can become full grown in a period of 33 days during warm weather (May 3 to June 6). See Figure No. 7. External temperature, then, would appear to be the controlling factor in the rate of development of larvae of the sheep gad fly.

On the basis of this new information it would seem logical to direct

attention toward the destruction of the minute larvae as found in the nasal passage during the winter season. If this could be done, there would be no gad flies to harass the sheep and, consequently, no larvae (grubs in the head) the following winter.

Bacteriology

W. V. HALVERSEN *in charge*

EFFECTIVE scientific research generally requires cooperation of specialists in several fields. Pasteur once remarked, "It is characteristic of science and Progress that they continually open new fields to our vision." The research work in bacteriology has dealt with problems which perplex the agricultural interests of Idaho. The subject matter presented in this report necessarily will be paralleled by reports from co-workers in other departments.

Poultrymen Learn Tests for Pullorum Disease Control

Increased interest by poultrymen in problems of pullorum disease control has resulted in the conducting of schools to inform poultry raisers of facts concerning the various field and laboratory tests to detect carriers of pullorum disease and the sanitation program that accompanies such an eradication plan. The Extension Poultryman, Poultry Husbandry Department, and Bacteriology Department have cooperated in carrying out this program.

The development of the rapid whole blood method has led hatcherymen to adopt a program of home testing with the result that commercial antigens from many sources are being used by unskilled workmen as a basis for detecting pullorum-infested birds. Hatcherymen desire some recognition for their home testing and are requesting schooling in the method of applying this test and also recognition of their chicks on the basis of this test.

On the basis of tests conducted at other laboratories and on the limited number tested at this laboratory it appears evident that official recognition should not be given to the whole blood test unless tests have been conducted by an approved laboratory, employing standard methods which have been found effective.

Two flocks have been tested with the purpose of comparing the whole blood test with the tube agglutination test. The work is not completed and definite conclusions cannot be made.

Foul Sheath in Rams Cured by Copper Sulphate

Foul sheath or sheath necrosis is a disease of sheep affecting the sheath near its external opening, and is quite prevalent in Idaho.

The Station Veterinarian and the Department of Bacteriology have been working cooperatively on various phases of this project. Foul sheath is characterized by a black scab which covers the portion of the sheath affected. Under the scab is found necrotic or dead tissue. The size of the lesions varies with the extensiveness of the disease. In some cases the lesions are so extensive that it is impossible for the animal affected to be used for breeding purposes.

In order to better understand the disease, cultural, bio-chemical and

morphological studies have been made on organisms found in characteristic lesions. Removal of the scab from the affected sheath and the repeated application of powdered copper sulphate seemed to be an effective method of treatment.

Udder Infections

No cure for mastitis. For several years the departments of Bacteriology, Dairy Husbandry, and Animal Husbandry have been working cooperatively on various phases of this project. It has been found that many types of microorganisms are capable of causing this disease, but the most commonly encountered organisms are streptococci. These bacteria are usually found in large numbers in milk coming from cows suffering with mastitis. Occasionally, however, cases of mastitis occur in which it is difficult, if not impossible, to demonstrate the causative organism. In such cases other methods must be employed to indicate diseased udders.

Many tests have been tried with the hope of developing a method that would readily detect milk coming from cows suffering with mastitis. Of all the tests studied the leucocyte count and the catalase content of milk seemed to be the most reliable. Milk from infected udders almost invariably contained more than 100,000 leucocytes per cubic centimeter when examined by the direct microscope method. Milk from normal udders usually contained less than 50,000 and seldom more than 100,000 leucocytes per cubic centimeter. The catalase content of milk from infected udders was nearly always sufficient to produce at least 2.5 cubic centimeters of gas from 15 cubic centimeters of milk and 5 cubic centimeters of hydrogen peroxide. These tests, together with bacterial counts, have been used extensively in periodic examinations of milk to isolate infected animals.

Many treatments for mastitis have been tried but none have been entirely successful in eliminating the causative organism from the udders of infected animals.

The University dairy herd is kept under constant observation in order to detect acute cases of mastitis. Periodically, all cows are examined to detect subclinical or chronic mastitis. This information is used as a basis for a program of isolation as means of controlling its spread in the dairy herd.

Paratyphoid in Turkeys Transmitted Through Eggs

A severe outbreak of paratyphoid in turkey poults has been studied by the Station Veterinarian and a member of the Bacteriology staff.

A *Salmonella aertrycke* type organism was found to be responsible for an outbreak of paratyphoid in young turkeys that resulted in a loss of more than 11,000 poults out of 12,000 hatched on one farm in Idaho. The poults appeared to be weak at hatching time and died rapidly during the following 10 days. The onset of the disease was very rapid and the only symptoms were weakness and an occasional diarrhia. No outstanding diagnostic lesions were present, but the *Salmonella aertrycke* type organisms were isolated readily from the liver, spleen, and heart blood of affected birds. When 30 dead-in-the-shell poults were cultured, the same organism was isolated in three cases.

One-third of the hens from the breeding flock reacted when tested by the agglutination test with antigen made from the *Salmonella aertrycke* type organism.

The data accumulated indicate that the initial infection was present in the ovaries of the breeding hens; that the organisms were transmitted to the yolks of fertile eggs; and that the infection was present in the poults at the time of hatching.

Miscellaneous Projects Studied

Artificial inoculation of legumes is a common practice in certain sections of Idaho. In northern Idaho peas are commonly inoculated when sown on land which has been continuously cropped to grain, and alfalfa and sweet clover are also inoculated when planted on recently reclaimed soil or land which has been used for continuous grain crops. During 1935 sufficient inoculation medium was prepared and distributed to inoculate 10,000 acres of legumes.

Thermophilic spoilage bacteria in sugar. Current literature has shown that sugar may contain heat resistant bacteria which may cause spoilage in canned foods. After an extensive study of this subject, bacteriologists working under direction of the National Canners Association drew up standards which would minimize danger of infection from sugars. Since sugar represents a potential source of spoilage bacteria which in turn may result in a great deal of spoilage in home canned foods, it was decided to test samples of sugar from the various sugar factories in Idaho. Thirteen samples were collected and tested—all samples came within the limits allowed by the National Canners Association.

Miscellaneous Projects

Miscellaneous services have included the analyzing of many samples of blood, water, milk, and food, and various specimens sent to the laboratory by citizens and doctors of northern Idaho.

Health service in secondary schools of Idaho was studied through a comprehensive questionnaire which was mailed to all high schools. Replies were received from 37 high schools with an enrollment of 14,000 pupils, which is about 75 per cent of the total State high school enrollment. A few of the salient facts are as follows: (1) of the schools reporting, 70 per cent had no health examinations; (2) no schools required health examinations for admittance to the teaching staff; (3) 20 per cent reported that medical supervision was available to their athletic teams at all times, while 10 per cent indicated only partial medical supervision; (4) there was great need for sanitary plumbing; (5) only 15 per cent of the schools have a required course in hygiene; (6) 60 per cent serve hot lunches to students for varying periods of time during the winter; (7) there has been little attention paid to the hygiene teacher's preparation in biological science and health work. It is recommended that, in order to overcome the present conditions of unequal opportunities between counties and even between schools within the same county, the State Board of Education and the State Department of Health agree on a set of minimum health standards and practices and cooperate in their application.

Dairy Husbandry

D. R. THEOPHILUS *in charge*

Continuous Use of Proved Sires Maintains High Production

PRODUCTION in the dairy herd during the last five years has been maintained on the average above 500 pounds of butterfat per cow, based on cows in milk. During 1935 the average production of the herd was 13,304 pounds of milk and 509 pounds of butterfat. The Holstein herd averaged 549 pounds of butterfat and the Jersey herd 448 pounds.

The project dealing with continuous use of proved sires, in cooperation with the Bureau of Dairy Industry, United States Department of Agriculture, has been in progress for 13 years in the Holstein herd. Ten proved sires have been used, eight being proved by dam-daughter comparisons in the University herd, one is in the process of being proved, and one has daughters in the herd which have not freshened. Each of the last six bulls have consistently increased production when the daughters' records were compared with the records of their respective dams. The production of all daughters of these six bulls, adjusted to mature age equivalent, Class B, is 21,248 pounds of milk and 670.8 pounds of butterfat. The last eight bulls used have bull indexes of more than 800 pounds of butterfat, computed on the basis of four-time milking. Further proof of the value of the continuous use of proved sires are Belle Korndyke Piebe 1135233 and Idaho Walker Notion 136315, Idaho's highest producing

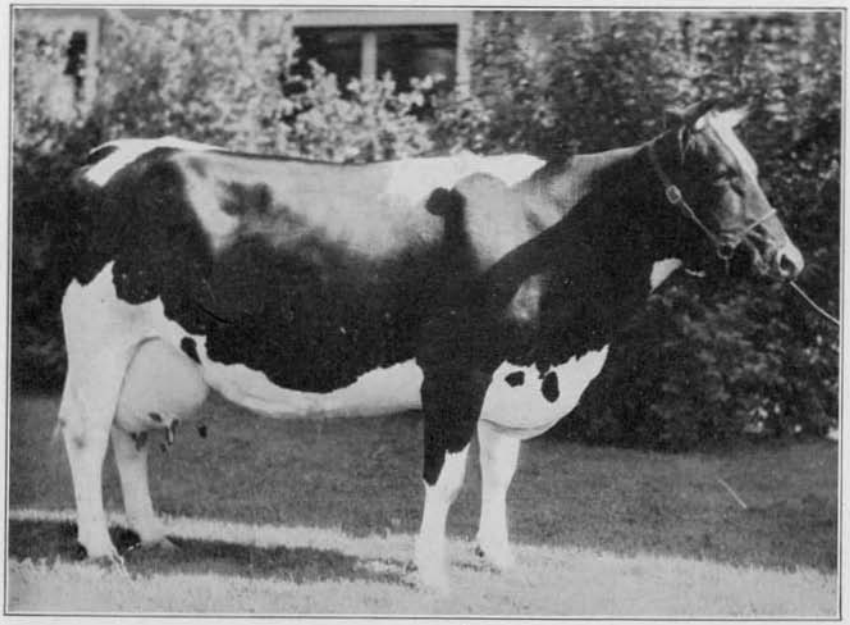

Fig. 8.—Idaho Walker Notion 1361315; 32,428 pounds of milk and 1,059.6 pounds of fat in 365 days; Idaho record, all breeds and all ages. Breeder and owner—University of Idaho.

aged cow and senior four-year old respectively, over all breeds and ages for milk and for butterfat, and for combined milk and butterfat. These cows were bred and developed by the University of Idaho. Belle Korndyke Piebe 1135233 produced 32,108 pounds of milk and 1,027.9 pounds of butterfat in a year, starting test at 7 years and 6 months; and Idaho Walker Notion 136315 produced 32,428 pounds of milk and 1,059.6 pounds of butterfat, starting test at 4 years and 11 months. These cows are descended from four consecutive generations of proved sires, each proved in his ability to transmit high production to his daughter.

Breeding Efficiency of Vital Importance to Dairymen

Breeding efficiency in the dairy herd is a measure of the breeding health of the herd based on a definite standard, usually a living calf each year from each cow in the herd. A study was made of the records of 45 dairy-herd-improvement-association herds in Idaho. Breeding efficiency was calculated by taking an inventory of pregnancy at the beginning and end of the year on 712 cows. Data obtained from the field by this method are subject to some error and probably show a higher percentage of breeding efficiency than actually exists in the herds, as only records representing cows on test two or more consecutive years could be used. Records of all cows that aborted or were sold, and sterile heifers were eliminated as the necessary data were not available.

Data showed the breeding efficiency of 712 cows ranged from 0 to 119 per cent with an average of 89 per cent; 49 per cent of the cows had more than 100 per cent breeding efficiency, and on the average dropped a calf every 11 months; 51 per cent had less than 100 per cent breeding efficiency, and on the average dropped a calf every 15½ months. Low breeding efficiency one year resulted in low production the following, and high breeding efficiency resulted in high production the following year.

It appears from the study that farmers cannot expect to secure 100 per cent breeding efficiency in their herds unless they breed the cows soon after calving to offset delayed conception. The question of early breeding is undoubtedly a debatable one. The results indicate that the problem of low breeding efficiency facing dairymen should be called to their attention as strongly as the factors affecting feeding and management.

Eckles Height and Weight Standard Apparently Inapplicable to Idaho Dairy Cattle

Observations on the growth of Holstein and Jersey females in the University of Idaho herd up to 30 months of age since 1921 have been summarized. When compared with the Eckles standard for weight, the Idaho Holstein females varied between 101 and 105 per cent at the different age class intervals. In body weight the Holstein females were considerably larger than that suggested by Eckles as standard for their age. Varying from 101 to 103 per cent of standard for the early age groups, the succeeding age groups showed a gain increasing to 143 per cent of standard at 17 weeks of age, following which less phenomenal gains were observed.

Data obtained on Jersey female heights indicated that up to 10 months of age the individuals averaged between 95 and 97 per cent of standard, while the older groups ranged between 97 and 99 per cent of standard.

In body weight Idaho Jersey females appeared to be lighter than standard, being as low as 84 per cent of standard at one month of age. However, the data showed that after 10 months of age the heifers were approximately 110 per cent of standard body weight.

During recent years the type of Jersey maintained in the herd tended toward "Island type." These individuals, being smaller, prohibited large average body gains. Unquestionably this factor played its part in reducing the average gains made, especially in the lower age class intervals.

Extremely High Producing Holstein Cows Efficient Users of Feed

A study of one year's feed consumption of six Holstein cows averaging 27,915 pounds of milk and 889.85 pounds of butterfat, showed that the digestible nutrients consumed per 100 pounds of milk and per pound of butterfat were much higher than those established by the Morrison feeding standard. The cows consumed on an average 35 per cent more digestible nutrients per 100 pounds of milk, 26 per cent more digestible crude protein, and 29 per cent more total digestible nutrients per pound of butterfat than required according to the Morrison feeding standard.

When compared with feed records of 12 southern Idaho dairy-herd-improvement-association herds, there was no marked difference shown between the extremely high producing Holstein cows and the cows in the dairy-herd-improvement-association herds in consumption of digestible nutrients per 100 pounds of milk and per pound of fat. No apparent relationship was found between the plane of production and consumption of digestible nutrients per 100 pounds of milk and per pound of fat.

Marked Variations in the Solids-not-fat Content of Individual Cows Within the Holstein and Jersey Breeds

The laws of most states and many city ordinances require an 8.5 per cent solids-not-fat content of milk. A progress report covering four months included a study of 103 samples of Holstein milk representing 33 cows, and 63 samples of Jersey milk representing 23 cows which showed a weighted average of 8.48 per cent of solids-not-fat for the Holstein milk and 8.99 per cent of solids-not-fat for the Jersey milk. The solids-not-fat content of the Holstein milk varied from 7.75 to 9.81 per cent, and the Jersey milk varied between 8.19 to 9.47 per cent. For the period of the study 47.5 per cent of the Holstein samples and 15.8 per cent of the Jersey samples were below the standard of 8.5 per cent solids-not-fat.

Capacity and Cost of a Ventilating System for Dairy Barns Determined

A study of the ventilating system installed in the University of Idaho dairy barn is in progress. Data secured to date show that the air is changed every 10 minutes in the main barn and every 6.7 minutes in the milking barn. For a six months period, extending from October 15 to April 15, the cost was $0.97 per month in the main barn and $1.05 per month in the milking barn at the rate of $0.03 per kilowatt-hour. It was also noted that the direction and velocity of the wind affected the capacity of the fans and the efficiency of the ventilating system. An accumulation of dust and dirt on the leading edge of the fan blades decreased the capacity by as much as 41 per cent, indicating the necessity

of clean fan blades for efficient ventilation. This project was conducted in cooperation with the Department of Agricultural Engineering.

Distribution and Costs of Steam, Electrical Power, and Labor in Representative Idaho Creameries Determined

Data secured in the study of the distribution and costs of steam, electrical power, and labor in representative Idaho creameries established many interesting facts. Among the most salient facts were: atmospheric roller driers consumed 65 to 80 per cent of the total steam generated in the plant; boiler efficiency of the boilers was approximately 75 per cent; 1.4 pounds of steam were required for drying 1 pound of liquid milk; 8.8 pounds of steam were required to pasteurize 100 pounds of cream; the load on the motor of churns ranged from overload to a point where the motor acted as an induction generator; churns having a small barrel diameter required less power for operation than churns of the same capacity but having a larger barrel diameter; more power was required to churn fresh cream than aged cream; 100 per cent more power was required to drive the rolls on atmospheric roller driers when drying skim milk than when drying buttermilk; straight-away can washers required more steam and power per 100 cans washed than rotary washers; operations in the plant must be staggered throughout the day in order to raise the electrical load factor and thus decrease power cost; a peak limiting device was very efficient in lowering electrical power costs; creamery equipment should be motored for the type of service for which it is to be used; steam, electricity, and labor averaged respectively 28.35, 13.45, and 58.20 per cent of the total energy cost of manufacturing butter; steam, electricity, and labor averaged respectively 78.55, 9.15, and 12.30 per cent of the total energy cost of manufacturing milk powder; labor represented 70.9 per cent of the total energy cost of manufacturing ice cream. This project was conducted in cooperation with the Department of Agricultural Engineering.

Thorough Washing and Sterilizing of the Separator, An Important Procedure in Producing Cream of Good Quality

The bacterial content of cream from unwashed separators was extremely high when compared with the bacterial content of cream from properly washed and sterilized separators, although the unwashed separators were thoroughly flushed with water after each separation and again thoroughly flushed before the succeeding separation. The average bacterial content of 14 lots of cream from properly washed and sterilized separators was 72,578; from separators unwashed for 12 hours, 349,000; from separators unwashed for 36 hours or 1½ days, 4,371,000; from separators unwashed for 60 hours or 2½ days, 33,563,000; and from separators unwashed for 84 hours or 3½ days, 60,730,000. When unwashed and unsterilized separators were used the bacterial contamination of the cream was sufficiently high to cause rapid deterioration after separation regardless of the care taken in cooling and storing. The rapidity of deterioration, as indicated by the flavor and odor scores of the cream, was in direct relationship with the period of time the separator was left unwashed and unsterilized. The loss of fat in the skim milk was higher when unwashed and unsterilized separators were used.

Amount of Extraneous Matter in Cream Influences Extraneous Matter in Butter

Butter containing extraneous matter is subject to seizure by the Federal Food and Drug Administration. A detailed study of all the cream going into 23 churnings of commercial butter definitely showed a direct relationship between the amount of extraneous matter in the cream and the amount of extraneous matter in the finished butter. The study indicates the great need for the careful examination of cream for extraneous matter if the resulting butter from the cream is not to contain excessive quantities of extraneous matter even though ordinary precautions of straining and filtering the cream are followed in the creamery.

Service Work

A total of 1440 cows were officially tested for production during the year, or an average of about twelve 10-cow herds. The supervisors spent a total of 207 days conducting these tests.

The calibration laboratory received 7446 pieces of glassware to be checked for accuracy and etched "S.G.I." (Standard Glassware Idaho).

Nine hundred ninety-two analyses of dairy products were made. These products were divided as follows: 484 samples of milk tested for fat, 9 samples of butter and 5 samples of cheese for complete analysis, 9 samples of butter and 5 samples of cheese for flavor score, 479 samples of milk for bacterial count and complete score, and 1 sample of butter for yeast and mold count.

Entomology

CLAUDE WAKELAND *in charge*

Northern Idaho Free From Alfalfa Weevil

WITH funds provided through the State Department of Agriculture, all counties in northern Idaho were surveyed for the presence of the alfalfa weevil and were found to be free from the pest.

Beet Leafhopper Controls Investigated

Two strains of sugar beet seed from selections started in 1925 show resistance to curly top. These yielded at the rate of 11.9 and 11.1 tons of beets per acre while the yield of U.S. No. 1 was 13.3 tons and that of commercial seed was 5.0 tons.

Biological Control of Fruit Insects Studied

In cooperation with the Bureau of Entomology and Plant Quarantine and with the Ohio Agricultural Experiment Station, a study of insect parasites of the codling moth, San Jose scale, and woolly aphid was started. Populations of *Ascogaster carpocapsae* Viereck, *Trichogramma minutum* Riley, *Prospaltella perniciosi* Tower, and *Alphelinus mali* Haldeman were introduced into a 5-acre apple orchard at Parma, purchased in 1935, by the Idaho Agricultural Experiment Station. Usual orchard practices will be followed, but insecticides will not be applied. A native parasite of San Jose scale, *Aphytis mytilaspidis* (Le Baron) increased rapidly in the absence of insecticides, and it was determined definitely that *A. carpocapsae* and *T. minutum* had become established.

Cherry Fruit Fly Eradication Unsuccessful

Cooperative with the county commissioners of Latah County and with the State Department of Agriculture, an attempt has been made to eradicate the cherry fruit fly during the last two years. The county was surveyed this year to ascertain the effectiveness of the attempt. Twenty-eight per cent of the 567 orchards examined had been sprayed during the year. The sprayed orchards represented most of the larger commercial plantings, however, since 77 per cent of all the trees in the county were sprayed. Seven per cent of the trees inspected were found to be infested. The insect appears to be limited in distribution to the higher ridges and benches, which have been infested for many years, the lower valleys remaining uninfested. The major portion of the cherries produced in the county could be marketed free from quarantine restrictions if quarantines were placed on a topographical rather than on a county-line basis. More power spray machines and more thorough application are necessary, without thought of residue consequences, if eradication eventually is accomplished.

Cube-Kaolin Dust Effective Against Several Insects

Preliminary tests were made with a cubé-kaolin dust mixture containing .02 per cent rotenone. This mixture, applied in the center and over the top of ant hills, killed most of the colony, and a second application two weeks later usually served to exterminate the colony. Occasional light dustings of the mixture around shrubbery or ornamentals or at places where the insects entered the buildings effectively controlled ants. The dust readily killed nymphs of the squash bugs but squash vines soon were reinfested. One thorough dusting of Virginia creeper killed most of the nymphs and adults of the grape leafhopper and a second dusting 10 days later produced complete control. Two dustings of the mixture, 10 days apart, controlled the grape leafhopper on grapes.

Grasshopper Threat Reduced

The 1935 survey indicated that no severe outbreaks of grasshoppers will occur during the 1936 growing season. Populations are normal in all counties except Bear Lake, where the population is slightly above normal. Federal bait stored in previously infested counties is sufficient to bait all areas where the grasshoppers may cause damage in 1936 and should be used to control incipient infestations to prevent populations from reaching outbreak proportions in succeeding years.

European Earwig Parasite Introduced

Two hundred fifty-five adults of the European earwig parasite *Digonichaeta setipennis* Fall., supplied by the Bureau of Entomology and Plant Quarantine, were liberated in Moscow, Idaho. Whether the species has been successful in colonizing is not yet known.

Insect Physiology Studies Reveal Effects of Poisons

The project, designed to study various phases of normal and pathological physiology of insects, continued. Work, to-date, has dealt with a method of inhibiting coagulation in the blood removed from the insect's body and a study of the total blood cell counts. A technique for inhibiting coagulation of blood by treating live insects with vapors of fatty acids has been developed. All fatty acids used succeeded and all

other chemicals used failed in inhibiting coagulation. The technique developed was employed further to study the total blood cell counts of normal insects and those treated to prevent coagulation. The total blood cell counts per cubic millimeter was approximately doubled when coagulation was inhibited. The total number of cells was greatly reduced in the blood of insects that had succumbed to arsenical poisoning and then only one of the various types of cells remained in the blood stream.

Ladybeetles Studied as Predators for the Pea Aphid

An ecological study of ladybeetles in northern Idaho indicated that they overwinter in locations that have been similarly used in former years. They move around in these locations during mild winters. Beetles which remain unprotected during the night have the greatest mortality. Hibernants which are active succumb much more quickly than those which are inactive. Migration from winter quarters takes place after the maximum daily temperature in the spring exceeds 65° F. and proceeds rapidly thereafter. Ladybeetles were stored throughout the winter at a temperature of 32° F. with little mortality. The beetles may be collected and liberated in the spring at less cost than to collect them in the autumn and store them during the winter. Ladybeetles liberated in the field in early spring remained there until the temperature raised but then soon migrated. They were shipped by common express to distant points economically and with small mortality.

Fig. 9.—Ladybeetles overwintering at the base of a small shrub.

Onion Thrips Injury Less on Certain Varieties

Certain strains of Sweet Spanish onions harbored a smaller population of thrips than other commercial strains studied. Damage from thrips was much less on these strains than on red globes, danvers, and certain other sweet Spanish strains in the test plots.

Favorable Hibernation Important to Pea Weevil

Pea weevil investigations have continued in cooperation with the Bureau of Entomology and Plant Quarantine. Only 29.07 per cent of the adults dug from beneath the bark of ponderosa pine were alive following a

minimum temperature of -19° F. and all weevils in hibernation cages in unprotected places were killed. The minimum temperature at which weevils survived any place in the state was -13° F. Nearly all the weevils stored at 32° F. survived the winter.

Salt floatation at times removes practically all weevil-damaged seeds but on some occasions a large percentage of infested seeds fail to float. Buoyancy of infested seeds, with consequent more effective removal, increases as the size of the weevils in the peas increases.

Due to a late, cold spring, peas in border trap experiments matured at too nearly the same time as commercial fields to hold the weevils from migration long enough to make the border traps as effective as in former years. Encouraging results in protecting peas from weevil damage were obtained by dusting garden peas with derris-tobacco dust. The pea weevil parasite *Triaspis thoracicus* Curtis was liberated at Moscow from the European Parasite Laboratory, Heyeres, France.

Several Spray Combinations Tested in Codling Moth Control

Codling moth spray experiments were primarily field tests of various types of spreaders in combination with lead arsenate. Check plots were sprayed with lead arsenate, 3 pounds in 100 gallons of water and rated on control on the basis of 100 per cent. Spreader plots were as follows: lead arsenate 3-100 and collodial spreader ¼ pound in all sprays plus oil, 0.75 per cent, in the first, second, third, and fourth cover sprays, and 0.50 per cent in the fifth, sixth, and seventh cover sprays—rating 121.5; calcium arsenate 3-100 plus hydrated lime 3-100—rating 97.7; lead arsenate 3-100 plus tar soap ¼ pound—rating 105.5; lead arsenate 3-100 plus tar soap ¼ pound plus kerosene 2 quarts (emulsion)—rating 117.5; lead arsenate 3-100 plus collodial spreader ¼ pound—rating 108.9. Consistent with the results of spray deposit experiments of last year, lead arsenate combined with the spreaders used produced a higher degree of control than when used alone. Calcium arsenate with lime was less effective than lead arsenate alone or in combination with spreaders.

One and one-half per cent of summer-oil used in combination with the first three codling moth cover sprays caused an average injury to Jonathan apples of 45.9 per cent. Thus, injury was reduced to 31.3 per cent when 1 per cent alphanaphthylamine was added to the combination. Foliage injury from this amount of oil was noticeable but unimportant.

Lead arsenate, when used alone, produced a spot-type coverage. Lead arsenate plus colloidal spreader produced a spot-type coverage but the spots were smaller than with lead arsenate alone. Lead arsenate plus colloidal spreader and oil, lead arsenate plus tar soap, lead arsenate plus kerosene emulsion, all produced a film-type coverage. The most uniform coverage, especially on the leaves, was obtained by lead arsenate and tar soap. Calcium arsenate and lime produced a heavy, spot-type coverage which was fluffy when dry and rubbed off easily.

Summer Sprays Control European Elm Scale

Summer-type oil emulsion, 1.35 per cent oil in water, killed 96.3 per cent of the newly hatched young of the European elm scale. The same strength of oil in combination with 20-pound pyrethrum extract, ¾ pint in 100 gallons of dilute spray, killed 98.4 per cent and in combination with 40

per cent nicotine sulphate, ¾ pint to 100 gallons of dilute spray, killed 97.9 per cent of the young insects. Considering economy and relative effectiveness, summer oil alone is more practical to use for control of European elm scale nymphs than in combination with nicotine sulphate or with pyrethrum.

Wireworms Increase in Red Clover or Sweet Clover Fields

The Idaho Agricultural Experiment Station has continued its cooperative relationship with the Bureau of Entomology and Plant Quarantine in wireworm investigations. Plot studies in Idaho have indicated that the growing of yellow sweet clover may be associated with marked increases in wireworm infestations. Rapid build-up of wireworm populations in red clover soil apparently is not due to any special attractiveness which that crop has for ovipositing beetles. Field observations indicate that wireworm populations may reach a low point of one per square foot, or less, even when no intentional control is applied. Factors governing the cycle of infestations are not understood fully.

Allowing a four-year-old stand of alfalfa to go unirrigated for the season resulted in a 60 per cent decrease in the wireworm population in the soil. Fallow soil areas under cage conditions, apparently attracted more egg-laying females than soil areas in which crops were growing.

Eight acres of land were kept flooded with water for eight days, resulting in a 56 per cent decrease in the wireworm population. During that time the average temperature of the upper six-inch layer of soil was 72.4° F. Delaying the date of planting potatoes did not result in sufficient reduction in wireworm damage to compensate for the decreased yield occasioned by late planting.

Home Economics

ELLA WOODS *in charge*

Vitamin Investigations Continued

DURING 1935 research in the Home Economics Department again has been in the field of nutrition.

Animals used for experiments were reared in the laboratory colonies. The rat colony produced 250 young rats. Most of these have been used in vitamin tests although some have been returned to maintain breeding stock, and others have been chloroformed because of lack of space for larger numbers in the experimental groups. The guinea pig colony produced 62 young animals for vitamin C tests and for colony maintenance.

The vitamin investigations concerned vitamin G in the Netted Gem potato, vitamin C in Italian prunes, and a study of vitamin E in pea germ meal in cooperation with the Department of Dairy Husbandry.

Vitamin G Value of Foods Studied

Further refinements in a basal diet for the study of vitamin G were made and a report of the work was given before the Division of Biological Chemistry of the American Chemical Society, San Francisco, last August.

Studies on the vitamin G value of foods have given somewhat unsatis-

factory results because the negative control animals failed to show consistently characteristic signs of deficiency. The basal diet of extracted casein, butter fat, cod liver oil, salt mixture, and cornstarch with vitamin B supplied by individual doses of an 80 per cent alcohol extract of rice polish on cornstarch resulted in greatly retarded but continuous growth over long periods for most animals. Dermatitis appeared in some animals but not all, and some developed a soft moleskin-like coat of fur. Coprophagy seemed the probable cause of these inconsistencies but attempts to harness the animals were not successful. Recently some tests have been made using a diet in which half of the commercial cornstarch was replaced by commercial sucrose. The animals ate the diet well and dermatitis developed in all the nine negative control animals so far used. The average time for the appearance was 55 days. Longevity records were kept for five animals and the average survival period for these was 114 days. Growth continued until about three weeks before death. Small doses of mature field peas seemed to delay the onset of the dermatitis and larger doses produced the soft-moleskin-like coat seen frequently in vitamin G studies. Small amounts of baked potato supplement this basal diet, causing increased growth but failing to cure dermatitis once it is established. This project is still active but should be completed before the end of another year.

Vitamin C in Prunes Valuable

This is the second year of the study of the vitamin C content of Italian prunes. Again fresh prunes show antiscorbutic value when fed to guinea pigs, as do prunes kept for 3 or 4 days in the household refrigerator. This year prunes were put in frozen storage the same day as picked. These will be tested later for antiscorbutic properties.

Titrations for ascorbic acid (vitamin C) in prunes have been undertaken but thus far no satisfactory method for treating the coloring matter has been found. This interferes with the titration method for this fruit.

Horticulture

LEIF VERNER *in charge*

New Horticulture Field Station at Parma

FOR the past several years the Experiment Station activities of the Department of Horticulture have been directed more and more toward the solution of problems of the horticultural industry of the more southerly parts of the State, especially in the counties of Payette, Canyon, Ada, and Gem. In these counties are located the most extensive commercial plantings of tree fruits, small fruits, and vegetables. In recent years it has been the practice to send a man from the Experiment Station into this region for several months of the growing and harvesting seasons to carry on various experimental projects having to do largely with fruit crops. The demands for such work, however, increased to a point where it seemed desirable that a horticulturist be stationed permanently in southern Idaho to carry on experiments with both fruits and vegetables. Accordingly, Mr. L. R. Tucker of the Department of Horticulture was transferred to southern Idaho on the first of July 1935,with headquarters at Parma. To further facilitate the horticultural research program in

the south, an 11-acre tract of irrigated land was purchased one mile north of Parma, which will be used for experimental work with fruits and vegetables. These new provisions should give considerable impetus to the efforts of the Experiment Station to meet the needs of the extensive horticultural industries of the southern part of our State.

Promising New Apple Varieties Produced

During the past year major emphasis in the apple breeding project has been placed on the improvement of growing conditions in the seedling orchards, and on preparations for more extensive testing of promising seedlings. Little attention has been given genetic phases of the study, which have been dealt with rather fully in past years.

Due to crowding of the trees and consequent moisture and nutritional deficiencies many of the seedlings have become unfruitful, and such fruit as has been produced has been of inferior size and quality. To alleviate this condition some 1500 trees of no promise were removed in the winter of 1933-1934, and an additional 150 were removed during the winter of 1934-1935. To further improve moisture conditions and fertility, a 6-inch mulch of straw and stable manure was applied to the soil of these orchards before spring growth began.

In spite of an exceptionally dry growing season, the seedling apples of the 1935 crop were much larger and of better color than they have been for many years, probably due to the combined effects of tree thinning and mulching. From three to six trees each of the most promising 100 seedlings have been propagated and are now growing in the department's nursery preparatory to transplanting in trial plots in commercial fruit districts of the State. Several new seedlings of promise have been found among those fruiting this year, of which there were well over 2000.

Fertilizers Fail to Benefit Idaho Apple Orchards

Applications of N, P, K, NP, NK, and NPK to bearing apple trees in several orchards of southern Idaho, as in past years, showed no significant results from any of the treatments, individual tree yields varying so widely that plot differences, although sometimes rather great, could not be attributed to the fertilizers used. As there is some reason to suppose that some of these fertilizer elements, especially the P and K, were not being carried deeply enough into the soil to materially benefit fruit trees, the fertilizers were applied in some cases this year by means of forcing them, under pressure in solution form, to depths of approximately 18 inches into the soil around the trees.

Applications of sulphate of ammonia to two bearing prune orchards in southern Idaho have shown benefit from this fertilizer in the nature of increased tree growth and increased production over a period of years.

Preliminary experiments at Lewiston indicate that calcium cyanamid may be harmful as a fertilizer for sweet cherry trees, having caused, in one orchard, marked defoliation following each irrigation subsequent to the fertilizer application.

Potatoes May Benefit From Straw Mulch in Palouse Areas

Deficient soil moisture is unquestionably a major factor in the low yields of potatoes in the Palouse area as compared with yields in irrigated parts of the State. An experiment to determine the value of a straw

mulch in maintaining a higher soil moisture content was begun this year, but the soil was already so dry at planting time that a very poor stand of plants resulted, and the experiment was given up until next year. Straw is available in abundance in the Palouse country as a waste product from wheat production, and might be made to serve a useful purpose in potato culture.

Many New Fruit Varieties Under Test

The recently enacted plant patent laws, whereby it has been made possible for nurseries, plant breeders and others to secure patents and sole propagating rights for promising new varieties of plants, have greatly stimulated the development and introduction of new varieties of fruits and ornamentals. Some of these new introductions, all of which are advertised widely and in glowing terms, have real merit, while many others are inferior to our old, established varieties, and, therefore, not worthy of general distribution. To determine the relative merits of such of these new introductions as may be of value under Idaho conditions is a function of the Experiment Station, and has greatly increased the scope and importance of the variety testing project of the department of horticulture.

Agreements for cooperative testing of new varieties of tree fruits and small fruits have been entered into with four growers at Lewiston and with three in southern Idaho. New kinds of fruits distributed among these growers in 1935 include five new varieties of cherries, five new varieties of peaches, two new varieties of nectarines, three new varieties of grapes, and one new variety of cultivated elderberry. Duplicate plantings of all of these were made in the fruit testing plots at Moscow. The 11 acres of orchard land acquired at Parma will also serve for testing many of these new fruits and probably for some new flower varieties.

To secure still further information on the adaptabilities and merits of new varieties in different parts of the State, a cooperative fruit testing plan was inaugurated during the past summer. Under this plan, detailed information is solicited from growers in all parts of the State relative to their results with any new varieties that they may have tested. As far as possible such reports are gathered in the field by a member of the department who personally examines the new plants and their fruits. This plan is making immediately available, at little cost, a great deal of information that would require several years to secure if all of these plants were to be grown in our own plots.

Some of the recently introduced fruits that already have been established as very promising under Idaho conditions are the Rockhill, Dorsett and Red Heart strawberries, the Newburgh red raspberry, the Riland apricot, Sweet Delicious and Orleans apples, and the Hale Haven peach.

Cherry Cracking May Bring New Varieties

Experiment Station Bulletin No. 211 reports the results of the past four years' work on the cherry cracking project. Of particular significance in this recent work was a study of varietal differences in susceptibility to cracking, in which the varieties studied were grouped in the following order, from the least susceptible to the most susceptible: Eagle, Waterhouse, Oregon, Republican, Lambert, Napoleon, Tartarian, and

Bing. The cracking indices of these varieties ranged from 29 in the case of Eagle to 298 in the case of Bing, a difference of ten fold between the least and the most susceptible. This indicates great possibilities for developing increased resistance to cracking in our better cherry varieties through breeding.

During the current year major emphasis in this project has been placed on a further study of varietal resistance to cracking. Of a number of seedlings tested in June and July, one was found to be virtually immune to cracking, while others were much less susceptible to this injury than are Bing, Lambert, and Napoleon, the leading varieties of Idaho cherry districts. While none of these seedlings has a high enough quality to be promising for cultivation, several of them are very promising as parents

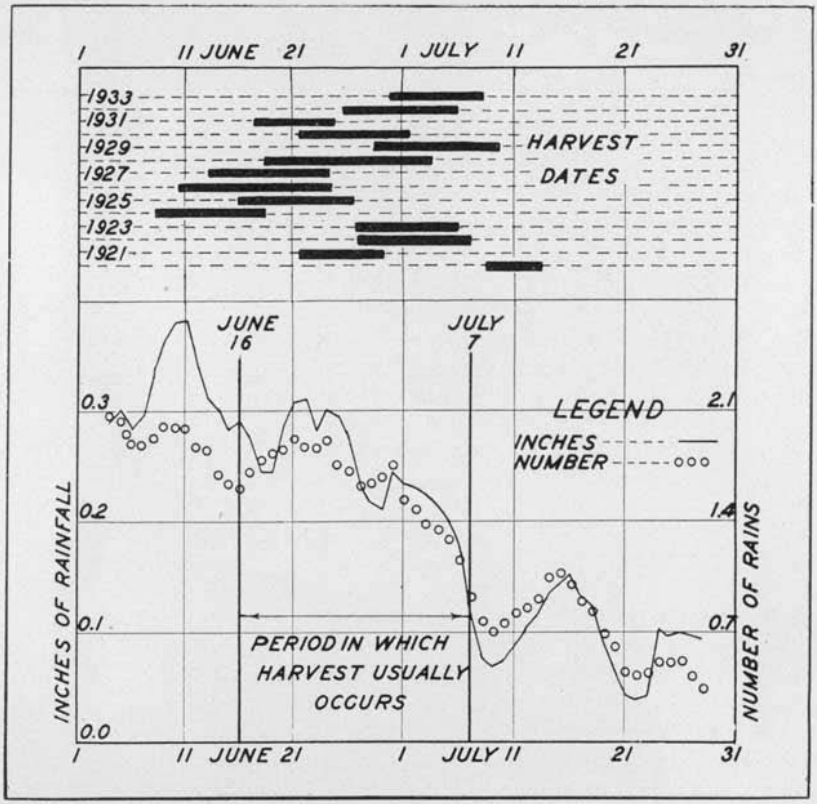

Fig. 10.—Relation of the harvesting period of sweet cherries at Lewiston to the period of heavy rainfall that causes ripe fruit to crack. In seasons of late harvest the crop escapes these heavy rains. Late maturing varieties would do the same.

for use in further breeding work. One hundred fifty seedlings of Bing, Lambert, and Napoleon crossed with Black Republican and Black Tartarian were started in the greenhouse in the winter and later transplanted to the nursery. Trees of two new varieties of sweet cherries developed in New York (the Emperor Francis, which resembles Napol-

con, and the Giant, which resembles Bing), were planted at Moscow and at Lewiston for trial.

Samples of fruit tissue from many varieties and from several seedlings of sweet cherries were collected during the summer and are now being prepared for sectioning to study possible relationships between structural characteristics and cracking. Continued physiological studies on the nature of cracking have shown that varieties resistant to this injury owe their resistance in part to a lower rate of permeability of their skins and to a greater capacity of their skins for expanding without rupture.

Surplus and Cull Fruits Into Juice Concentrates

An effort is being made to help solve the problem of surplus and cull fruits in Idaho by means of experiments designed to work out improved methods of producing high quality fruit juice concentrates at low cost. The method used is essentially that developed by the United States Department of Agriculture and described in their 1914 Yearbook. In this method the fresh fruit juice is frozen at temperatures of about zero degree Fahrenheit. The portion that freezes consists largely of water, and the juice, which remains free, becomes greatly concentrated as a result of the removal of this water to form ice. The ice is then ground and the mixture of juice and ice is placed in a centrifuge where the concentrated juice is whirled free and the ice remains behind. This method has the advantage of preserving the fresh fruit flavor that is always lost in concentration of fruit juices by cooking.

The principal improvement made in this method in the past years is in the development of a specially constructed container in which, when the juice is frozen, it can be centrifuged directly without the necessity of grinding the ice. This eliminates a rather expensive step in the old method, and it is hoped it will make the cost of concentration by freezing more nearly comparable to the costs of other methods in use at the present time.

Plant Pathology

C. W. HUNGERFORD *in charge*

Disease Resistant Bean Strains Developed

THE development of varieties of beans resistant to mosaic, curly top, and root rot has been the object of the intensive bean breeding and selection program of the Department of Plant Pathology. Satisfactory mosaic-resistant strains have been developed, and previous reports have described these fully. Table III gives the comparative resistance to common mosaic, yellow mosaic, and curly top, as well as the yield per acre for several of the better selections from the Great Northern bean.

A severe epidemic of curly top in the Twin Falls section in 1935 was responsible for heavy crop losses on contract seedbeans and somewhat lighter losses on Great Northerns. The mosaic-resistant University Selection No. 81 was the most curly top-resistant Great Northern selection grown on the Twin Falls trial plots. Individual crop losses with this selection were heavy in some instances, however, indicating the need of a Great Northern strain completely resistant to curly top. A few white seeded segregants from a Red Mexican-Great Northern cross made in

1929 and grown in 1935 at Buhl, Idaho, under a heavy beet leafhopper infestation, showed a high degree of resistance to curly top. Further trials are planned for 1936.

TABLE III
Plot Yields of Great Northern Strains (1/40 Acre Plots)
Twin Falls, 1935.

Strain	*Common Mosaic*	*Yellow Mosaic*	*Curly top*		*Yield per Acre*
			June 28	July 16	
	Per cent	Per cent	Per cent	Per cent	Bushels
UI 59	0	1	4	12	38.3
UI 81	0	2	1	2	38.1
UI 88	0	3	6	26	5.0
UI 123	0	2	1	5	42.6
Ellsworth	0	5	6	13	30.3
Common	85	Undet.	3	9	22.5

A new small, white bean developed from a Great Northern-Robust cross has been developed on the Moscow station in competition with the regular Robust variety. The new strain matured one week earlier than Robust and, in addition, out-yielded Robust. Growers' demonstration trials in cooperation with the Latah county agent are planned for 1936.

Curly Top of Vegetables and Flowers Important

Curly top was unusually prevalent this year. Losses were severe on tomatoes, cucumbers, squashes, pumpkins, peppers, as well as upon zinnias and a number of other flowering plants. Tomato plantings at Buhl, Idaho, consisting of 250 plants representing six selections, were almost completely eliminated. Only one plant survived the severe epidemic. This plant was a pear tomato, Pomadora variety. Another planting at Parma was completely eliminated except for one plant. This plant was one of a selection of the John Baer variety. Curly top at Moscow was not severe enough to show any significant differences in susceptibility and resistance of the various selections.

Fig. 11.—(Left) Stringless Refugee Green bean plants susceptible to mosaic. (Right) Idaho Refugee variety resistant to mosaic. Note heavy set of pods.

Pea Diseases Investigated

More intensive, as well as more extensive, growing of field and garden peas has led to the serious development of diseases which formerly have been considered of minor importance. Root rots caused by several fungus organisms are being studied, and information regarding their distribution, nature, and the resistance of pea varieties to these organisms has been gathered.

Mosaic (virus) was not found prevalent on peas in the Upper Snake River Valley nor in the Palouse area in 1935. Severe infections of mosaic, however, were found in the McCall-Cascade green pod pea area on the Alderman, Dwarf Alderman, and Laxton's Progress varieties. Infections varied from slight in some fields to as high as 75 per cent in others. The most severe infections were found to border red clover or alsike fields, or were bordered by ditches or fence rows harboring these clovers. A rather high percentage of the clover plants were found to be affected with mosaic. Greenhouse tests have shown that the mosaic occurring on the peas in this section was caused by the same virus as that causing the mosaic on red clover and alsike. It seems probable that red clover and alsike clover are important overwintering hosts of the pea mosaic virus common in the Cascade-McCall area.

Studies on the differentiation of the various viruses affecting legumes have been under way during the past year. A report of these studies was published in the January 1936 number of the Journal of Agricultural Research.

Growers Again Cooperate in Potato Virus Studies

For the purpose of providing potato growers with disease-free tubers for seed plots, the department indexed a total of 1373 tubers, representing 28 separate samples. Of the 1373 tubers indexed, 947, or 69 per cent, were found to be healthy and were, therefore, returned to the respective growers for seed plots.

An experiment designed to study the effect of the isolation of varieties, as against growing all varieties in close proximity, on the disease content of the tubers was carried on this year. Five varieties were grown in this connection and a total of 824 tubers were indexed. The healthy tubers were grown in tuber units in isolated locations during the 1935 season.

The mosaic-resistant Katahdin and Chippewa varieties are being tested in several localities and are apparently adapted to some sections. A total of 130 seedlings from the Katahdin variety have been propagated and studied in order to secure, if possible, a mosaic-resistant variety better adapted to Idaho conditions. Some of these seedlings are very promising.

Miscellaneous Investigations Continued

Potato seed treatment tests indicated that the germination of tubers treated with Semesan Bel was not impaired. Better stands were obtained in 1935 with Semesan Bel than with hot formalin or with no treatment. Previous results indicate, however, that formalin is much more effective in the control of rhizoctonia.

In **grain seed treatment** tests, improved Ceresan gave only slightly higher yields than treatments with copper carbonate or formalin. In the

control of the stinking smut on wheat, copper carbonate was the most effective.

Losses from **alfalfa wilt** have not been so severe during the last two years. It is evident that wilt is most destructive following severe winter injury. A number of alfalfa varieties and selections are being tested for resistance on the Substation Farm at Caldwell. As fast as new varieties and selections are developed, these will be secured and added to those being tested.

A widespread disease of alfalfa called "black stem", caused by *Phoma medicaginis*, has been carefully studied during the past two years. A preliminary report has been submitted for publication. The perfect stage of the fungus was found to be *Pleospora rehmiana*. The knowledge of the complete life cycle of the organism causing "black stem" of alfalfa will assist materially in formulating measures for controlling the disease.

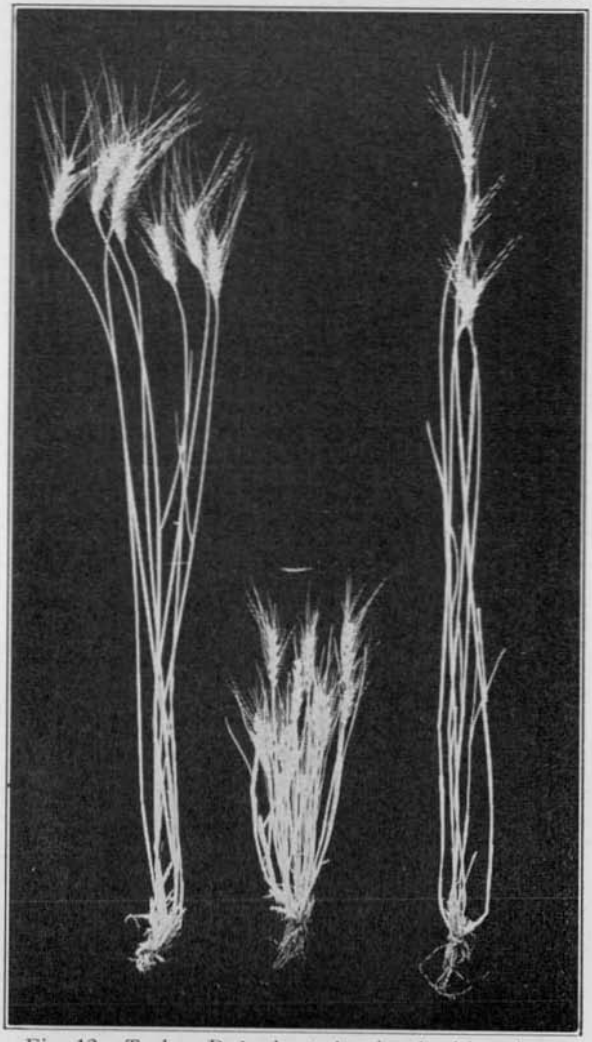

Fig. 12.—Turkey Red wheat showing healthy plant at the left, plant infected with short smut in the center, and plant infected with tall smut at the right.

Smut Investigations Produce Results

In cooperation with the Division of Cereal Crops and Disease United States Department of Agriculture, a thorough smut survey was made in 1935 throughout the dry land wheat growing sections of southeastern Idaho. The survey revealed the heaviest smut infection experienced since 1928, when a similar infection was observed. The amount of smut ranged from 10.15 per cent on the Rexburg bench to 60-75 per cent in the Malad Valley. The so-called "short smut",

The winter wheat nurseries, consisting of 14 bunt resistant and susceptible varieties, failed to reveal any one variety that was entirely resistant to both the "tall" and "short smut". The variety Relief was found to be almost immune to the "short smut" and resistant to many races of the "tall smut"; consequently, it was recommended over any other variety in the dry land wheat growing section of southeastern Idaho.

which is different from the ordinary smut in that it stunts the plant, was found to be much more prevalent than in past years and appeared quite generally over the entire dry land wheat growing area.

The winter wheat nurseries, consisting of 14 bunt resistant and susceptible varieties failed to reveal any one variety that was entirely resistant to the "short smut", but was not entirely resistant to the "tall smut"; however, it is recommended over any other variety in the dry land wheat growing section of southeastern Idaho.

Stripe Rust Investigations

The study of stripe rust has been continued in cooperation with the Division of Cereal Crops and Diseases, United States Department of Agriculture. The climatic conditions during 1935 were not at all conducive to infection and spread of stripe rust. High temperatures early in June and throughout July, with very little rainfall after May 1, brought about a condition of extremely low relative humidity and drouth which persisted throughout the summer and into late fall.

Barley plants infected with stripe rust were found to be much less resistant to cold temperatures than those free of infection. Plants showing 100 per cent infection were entirely killed at a temperature of 21° F. Plants showing 10 per cent, exhibited only a partial killing, while the non-inoculated plants showed no visible signs of damage when exposed to the above temperature.

Poultry Husbandry

C. E. LAMPMAN *in charge*

DURING the past year experimental work of this department has been concentrated in the fields of poultry nutrition and disease control. Projects have been conducted in cooperation with Agricultural Chemistry, Bacteriology, and Veterinary Science.

Laying Hens Have High Requirements for Vitamin A

Adequate vitamin A supplements for rations which consist chiefly of the small grains (deficient in this vitamin) continue to be one of the major problems in poultry nutrition. Investigations on this phase of nutrition were initiated several years ago with growing chicks and have been continued during the past two years with laying hens. The results to date demonstrate that laying hens have greater requirements for this vitamin than do growing chicks.

In the past it has been common to think of vitamin A requirements in terms of preventing nutritional roup, a swollen eye condition similar to, and oftentimes a predisposing factor to, contagious roup. Results of the past two years indicate that hens may reach an advanced stage of malnutrition due to vitamin A deficiency, in some cases death resulting, without the swollen eye lesions occurring. These recent investigations demonstrate the importance of vitamin A for the purpose of maintaining the normal health and resistance to colds and specific infection. A check group of birds receiving a white grain ration (wheat, oats, and barley) with no vitamin A supplements added were all dead by 8 months, the mortality occurring chiefly after the fifth month. Very few of these

birds developed the swollen eye condition, although a few cases of watery eyes were observed. The typical lesions, which developed extensively in all of these birds, consisted of small abscesses, commonly called "pustules", on the lining of the esophagus.

Ground peas at 25 per cent of the mash, used as the sole source of vitamin A in one group, and dehydrated alfalfa at 5 per cent of the mash as the sole source in another group, proved markedly inadequate. All the birds in both groups exhibited typical throat lesions and eventually died. Dehydrated alfalfa at 10 per cent of the mash as the sole source did not completely protect the birds, inasmuch as preliminary throat lesions occurred in a few birds of this group. When the mash contained a variety of feeds, furnishing a combined source of vitamin A, such as alfalfa, cod liver oil, yellow corn, and peas, complete protection was afforded even though the scratch mixture consisted entirely of white grains.

Experimental results to date demonstrate that dehydrated alfalfa and cod liver oil, because of their relatively high potency, should be considered the chief vitamin A supplements in poultry rations. Other feeds, such as yellow corn, peas, and fresh growing green feed, should be used to the extent that they are available. Dehydrated alfalfa is recognized as being especially valuable as a vitamin A supplement, and improved methods of manufacture have made it possible to produce a product of high potency as indicated by its carotene content. Recent investigations, however, at this and other experiment stations, have demonstrated that some of the potency is lost in storage. Work is now in progress to obtain more information on this particular problem.

Rations Containing Peas Require Animal Protein Supplements

Additional results obtained on this project during the past year confirmed those reported a year ago; namely, that ground peas need to be supplemented with animal protein to meet the requirements of laying hens. Ground peas were used at 30 per cent of the mash in combination with three different levels of animal protein supplements. In pen 1, 6 per cent of dried milk was added; in pens 2 and 3, dried milk, meat scrap, and fish meal were added at 5, 3, 3, and 5, 6, 6, per cent, respectively. The results of the two years' work have demonstrated that with the increase in animal protein an increase is also obtained in egg production, size of eggs, hatchability, and average body weight of birds. The pullets receiving the higher levels of animal protein supplements produced eggs which averaged approximately 2 ounces per dozen more than those laid by pullets receiving the low level.

When ground peas comprised 20 per cent of the mash mixture, practically as good results were secured by using animal protein supplements in the mash as when liquid milk was used as a source of protein.

Confined Rearing Compares Favorably with Range

Results secured during the past two years demonstrate that birds reared under satisfactory conditions of confinement compare favorably with birds reared on range. There were no significant differences in egg production, mortality, age at first egg, average weight of bird, or in average egg weight of the two groups during the first laying year. The average weight of the birds reared on range was approximately one-tenth of a pound greater than that of those reared in confinement, and the mortality

was approximately 2 per cent less. During the first trial the average age at first egg of the birds grown in confinement was two days earlier than for those reared on range, whereas in the second trial the range-reared birds matured five days earlier than those grown in confinement, which is contrary to previous results and popular belief.

It should be emphasized, however, that the confined group was reared under favorable conditions. They were confined to a brooder house which was equipped with a wire-bottomed sunyard in front. Approximately 3 square feet of floor space was allowed per pullet in the brooder house, with an equal area in the sunyard. The groups were fed the same mash and scratch grain ration and the confined group were fed freshly cut alfalfa daily. All feed was given in the sunyard during the summer growing period. The confined birds exhibited the typical uneven plumage development characteristic of birds raised in confinement. Although cannibalism usually constitutes a major problem in commercial practices, this difficulty was not encountered in these trials.

Flocks Establish Resistance to Fowl Paralysis

In a continuation of the study of fowl paralysis, 351 day-old chicks were secured in the spring of 1934 from another paralysis-free flock, divided into three lots, and placed with an equal number of chicks from the affected station flock at hatching and at 4 and 8 weeks of age respectively. These chicks were managed in exactly the same manner as during the previous year. The project set-up and data on seasonal distribution of lesions, as well as prevalence of symptoms and lesions, is given in Experiment Station Bulletin No. 217, *Annual Report for* 1934.

The accompanying table gives the summary and comparison of the results obtained during two consecutive years, the observations extending through the first laying year. The mortality from paralysis in the pullets from a non-affected flock when reared with chicks from a paralysis-affected flock was practically the same for both years, being 43.3 cent and 41.6 per cent, respectively.

TABLE IV

Percentage comparison of fowl paralysis in progeny from an affected flock vs. clean flock; in hen-pullets vs. pullet-pullets from an affected flock; and in range-reared vs. confinement-reared birds.

	Affected Flock	*Clean Flock*	*Hen-Pullets*	*Pullet-Pullets*	*Range Reared*	*Confined-reared*
Series I 1933-1934	31.1	43.3	27.4	34.7	37.3	37.1
Series II 1934-1935	19.9	41.6	17.0	24.6	30.8	30.8

In comparison, the paralysis mortality dropped materially in the pullets from the infected flock from 31.1 the first year to 19.9 per cent in the second year. Of further interest is the fact that there have been still fewer cases of paralysis during the summer and fall of 1935, only 3.45 per cent of the pullets having developed the disease by December 1. This marked decrease in the number of cases of paralysis indicates that a resistance or immunity to the disease is being developed. During both years there is shown a decided difference in mortality in favor of pullets from hen breeding stock over pullets from pullet breeding stock. Ap-

proximately one-third more birds died from paralysis in the pullet-pullets. Neither trial showed either range or confined rearing to be superior over the other as far as the development of paralysis is concerned.

The third year's study of paralysis is in progress, in which chicks from a flock that has apparently recovered from paralysis were placed with chicks from the Station affected flock. Approximately 1 per cent of these pullets have died of paralysis up to eight months of age. This is considerably lower than the mortality for the station pullets and indicates a high resistance to paralysis in the stock introduced.

In the spring of 1934 a few hens from the affected flock which showed contraction or irregularity of one or both pupils were mated to a male which showed contractions of both pupils. From this mating 31 pullets were secured, of which number, 14, or 45.2 per cent, had died from paralysis by the end of the first laying year. Inasmuch as only 19.9 per cent of the general stock from the affected flock developed the disease, this data would indicate that the offspring of birds affected with paralysis are highly susceptible to the disease.

In the light of present knowledge of paralysis three suggestions seem worthwhile for its control: First, prevent the introduction of the disease into paralysis-free flocks by guarding against the introduction of hatching eggs, baby chicks, or breeding stock from flocks that have been affected with paralysis; second, when the disease is present in a flock, chicks should be obtained from a flock that has recovered from paralysis; third, if the disease shows up in a breeding flock, it can be most rapidly eliminated by using old hens and old cock birds as breeders and by the use of families that show decided resistance to the disease.

Paratyphoid, a New Disease of Turkeys

A paratyphoid infection was found to be responsible for the loss of practically all of 12,000 poults hatched on one farm in Idaho in the spring of 1935. Work on this disease was conducted with the cooperation of the Bacteriology Department and the Station Veterinarian.

Affected broods started dying on the third or fourth day, with the greatest mortality being over by the tenth day. Eighty per cent of each brood was dead by this time. In well-cared-for broods very little trouble was experienced after this time. However, poults may continue to die until they are half grown if not brooded properly. About the only symptoms shown were weakness and occasional diarrhea. Poults become sick, gradually become weaker, and die within a period of three or four hours. Birds that have died of the disease up to 10 days of age practically always have pneumonia. They also have mottled, light-colored livers and a smooth cheesy plug in the ceca.

Paratyphoid was found to be caused by a *Salmonella aertrycke* type organism. This organism was regularly isolated from the liver, spleen, yolk sac, and heart of poults dead of the disease. The organism was recovered from 10 per cent of the 30 dead-in-shell-poults. An attempt is being made to determine if the organism gains access to the eggs from infected hens.

About one-third of 26 breeding hens reacted positively when tested with antigen made from the organism obtained from the poults. Ovarian

lesions were found in some of these hens, but the organism responsible for the disease has as yet not been isolated from such hens.

Attempts to prevent the extensive losses caused by the disease were not encouraging. Fumigation of the incubator (standard formalin treatment), isolation of poults in clean quarters, and the use of antiseptics in the water did not eliminate losses from paratyphoid infection.

The use of a battery brooder did reduce the mortality from about 90 per cent in regularly brooded poults to 44 per cent. The good brooding practices followed with the battery brooder were thought responsible for the reduced mortality obtained.

Further study is being conducted to determine the extent of the disease in the State and to work out means of prevention and control.

Pure Seed

H. L. SPENCE *in charge*

THE Idaho Pure Seed Law provides for its enforcement by the Director of Experiment Stations who is authorized to appoint a State Seed Commissioner, with offices at Boise, to take charge of the work. The State Seed Laboratory, located in Boise, is maintained to issue certificates of purity and germination to both farmers and seedsmen. Under the present policy the Extension Agronomist has direct charge of the enforcement of the Pure Seed Law and supervision of the State Seed Laboratory. Seed enforcement work is very closely correlated with the seed improvement program in Extension Agronomy and makes it possible to maintain a closer relationship between the seed dealer and seed grower. Through the State Seed Law it is also possible to establish recognized standards for the production of high quality seed in Idaho by requesting the source of seed for planting within the State. The seed law is enforced largely in an educational manner.

The State Seed Laboratory is under the competent direction of Miss Jessie C. Ayres, State Seed Analyst. Through her efforts the laboratory has built up a strong reputation for accuracy and efficiency among seedsmen and growers. The Idaho Seed Laboratory is on the accredited list of the Association of Official Seed Analysts of North America. Mr. Emery Chaffee who has been employed by the department for the past three years assists Miss Ayres with the analytical work during the fall and winter months. During the summer, Mr. Chaffee helps with the inspection of seed houses and certified crops.

The services of the State Seed Laboratory, in issuing certificates of purity and germination on seed stocks, act as a guide to farmers in both the buying and selling of these commodities. With definite information on the quality of his seed, the farmer is better able to intelligently select his seed for planting or to sell the crop of seed which he has produced. The records of seed tests made at the laboratory offer a medium for the extension agronomist to determine different needs of educational work along seed production lines. The State Seed Laboratory also offers the service to farmers of identifying weeds and other plants and seeds. Mounts containing all the noxious and common troublesome weed seeds are prepared and may be obtained from the Seed Laboratory at cost.

All samples of seeds which are received at the State Seed Laboratory are analyzed and a certificate of purity issued which shows all foreign crop seeds and weed seeds found as well as other impurities. The Idaho State Seed Law prohibits the sale in Idaho for seeding purposes, any seed which has a purity less than 95 per cent and seed which contains over one noxious weed seed in ten thousand crop seeds. All lots of seed not coming within the requirements of the seed law are condemned for sale and cannot be sold within the State for seeding purposes. As the majority of Idaho seedsmen not only sell seed locally but buy and ship large quantities east, they have given splendid cooperation in preventing impure seed from being sold in the State as they well realize the danger which would arise from infesting seed-producing fields with noxious weeds.

During the past year seed house inspections have found few inferior lots being offered for sale. Demand for good seed was much greater than it has been for several years, and seedsmen found farmers generally reluctant to purchase low grade seed stocks. Very few lots were condemned during the past year because of low quality. During the seed house inspections samples of questionable lots are drawn and analyzed by the Seed Analyst. A report on these inspections is prepared and distributed in order to guide farmers in purchasing their seed stocks.

An attempt was made during the Legislature this year to have the State Seed Law amended to take care of several recognized weaknesses. However, the bills prepared were defeated.

The total number of samples analyzed at the seed laboratory during the past year was approximately 25 per cent under a year ago. This is primarily due to a smaller seed crop of alfalfa and clover being produced this year. Samples received from farmers, however, showed an increase which would indicate their care in selecting seed to be planted. A statistical report of the seed laboratory follows:

Comparison of grand totals of seed tested by State Seed Laboratory, Boise, Idaho.

	1932-33	1933-34	1934-35
Alfalfa	1,460	2,446	1,614
Red Clover	263	450	331
Miscellaneous	206	449	197
Germination Tests	463	479	645
Moisture Tests	73	56	77

Aberdeen Substation

JOHN TOEVS *in charge*

Sugar Beet Improvement Continues

SIX strains and varieties of sugar beets were used in the variety tests. Three of the better-yielding foreign or commercial varieties, Braune, Dippe, and Schreiber, were compared with selections US 1 and 600, both developed at the Sugar Beet Breeding Station at Twin Falls, and selection Accession 34, a reselection from US 1 made by the Utah-Idaho Sugar Company.

Curly top began to appear by the last of June in the foreign varieties and by the last of July these varieties showed practically 100 per cent infection, as compared to 45 per cent infection in 600 and 55 per cent in

US I and Accession 34.

Selection 600 had only a trace of seed-producing plants commonly known as bolters, whereas US 1 had 2.2 per cent bolters, and Accession 34 had 1.4 per cent. Both top growth and the beet proper were very uni-

Fig. 13.—View of Plots on Aberdeen Substation Farm.

form in selection 600 as compared with the beets in the other two selections. Yields were as follow:

Dippe	8.42 tons per acre
Braune	8.58 tons per acre
Schreiber	8.69 tons per acre
US 1	17.64 tons per acre
Accession 34	17.66 tons per acre
600	19.92 tons per acre

Raw Rock Phosphate No Good

In order to further substantiate data that raw rock phosphate does not become available to plants under soil conditions as they exist in southern Idaho, a very finely ground raw rock (Ruhm) from Tennessee was used in fertilizer trials on one-year-old alfalfa. This was applied at the rate of 800 to 1000 pounds per acre. On one side of each plot receiving Ruhm, one plot was left for a check and received no treatment, and on the other side the plot received an application of 200 pounds of treble-superphosphate. The plots receiving Ruhm gave no increase in hay yields over the check plots, whereas the treble-superphosphate gave an increase of 20 per cent on one set of plots and 39 per cent on the other.

Allowing Red Clover Plant to Suffer Depresses Yield

A three-year clover irrigation experiment was completed this year. Of the nine different sets of treatments, such as light and heavy applications, different frequencies of irrigation, and time of last irrigation, the four treatments calling for plants to suffer sometime during their growth period gave the lowest yields and ranked 6th, 7th, 8th, and 9th. Each year the clover was clipped between the first and sixth of June, and the second

crop was used for seed production. The experiment did show that the last irrigation can be made when the clover is from one-half to three-fourths in bloom without decreasing the yield. However, when water is plentiful, an irrigation about two weeks before harvest would seem advisable from the standpoint of aftermath and lessening the amount of shattering at harvest.

Lamb Feeding

The addition of mono-calcium phosphate to rations for fattening lambs again gave depressing effect upon average daily gains and finish of lambs. Similar effects were noted the previous year under similar conditions.

TABLE V
Results of Aberdeen Lamb Feeding Experiments
Nov. 30, 1934, to Feb. 22, 1935
84 days

	LOT I 60 Lambs Alfalfa Hay ½ lb. Barley Beet Pulp	LOT II 60 Lambs Alfalfa Hay ½ lb. Barley Beet Pulp M.C.Phosphate	LOT III 60 Lambs Alfalfa Hay 1 lb. Barley Beet Pulp	LOT IV 60 Lambs Alfalfa Hay 1 lb. Barley Beet Pulp M.C.Phosphate	LOT V 5 Lambs Alfalfa Hay	LOT VI 4 Lambs Alfalfa Hay M.C.Phosphate 72 days
Av. initial weight, lbs.	69.34	68.74	69.67	69.72	73.00	67.50
Av. final weight, lbs.	89.29	88.00	94.45	94.30	83.60	77.25
Av. gain, lbs.	19.95	19.26	24.78	24.58	10.60	9.75
Av. daily gain, lbs.	.237	.229	.295	.292	.126	.135
Av. home weight (full) lbs.	89.29	88.00	94.45	94.30	83.60	77.25
Av. market weight, lbs.	85.02	83.75	90.00	89.33	79.00	72.50
Av. shrinkage, lbs.	4.27	4.25	4.45	4.97	4.60	4.75
Av. shrinkage, per cent	4.8%	4.8%	4.7%	5.3%	5.5%	6.1%
Av. daily ration						
Alfalfa hay, lbs.	2.12	2.02	1.75	1.62	4.00	3.47
Beet pulp, lbs.	2.46	2.60	2.62	2.62		
Barley, lbs.	.51	.52	.97	.97		
Salt, lbs.	.019	.019	.019	.019	.029	.019
Mineral, oz.		.09		.098		.111
Per cent waste hay	8.81%	11.11%	12.72%	13.41%	17.58%	20.50%
Feed for 100 lbs. gain						
Alfalfa hay, lbs.	892.	883.	593.	557.	3160.	2564.
Beet pulp, lbs.	1037.	1085.	888.	895.		
Barley, lbs.	216.	223.	327.	330.		
Salt, lbs.	7.9	8.1	6.5	6.5	22.6	14.4
Mineral, oz.		39.6		33.4		82.1
Feed cost per 100 lbs. gain	$7.73	$7.88	$7.47	$7.40	$15.97	$13.08
Selling price per cwt.	$7.00	$7.25	$8.00	$7.75	$6.50	$6.50

TABLE VI
Results of Aberdeen Lamb Feeding Experiments
Nov. 30, 1934, to Feb. 22, 1935
84 days

	LOT I	LOT II	LOT III	LOT IV	LOT V	LOT VI*
Initial cost of Lamb	$3.61	$3.57	$3.62	$3.63	$3.80	$3.51
Cost of feed per Lamb	1.54	1.52	1.86	1.82	1.70	1.27
Total cost	$5.15	$5.09	$5.48	$5.45	$5.50	$4.78
Home cost per cwt.	$6.02	$6.03	$6.04	$6.02	$6.85	$6.45
Home value per cwt. 4% shrink	$6.58	6.32	7.08	6.79	5.54	5.50
Home value per lamb	$5.64	5.34	6.42	6.15	4.45	4.08
Profit or Loss	.49	.25	.94	.70	—1.05	.70

*72 days

Feed Prices F.O.B. Aberdeen:
Alfalfa Hay ..... $10.00 per ton
Pressed Pulp ..... 1.20 per ton
Barley ..... 1.20 per cwt.
Salt ..... .75 per cwt.
M.C. Phosphate ..... 3.00 per cwt.

Blood analyses taken at regular intervals from some lambs revealed no conclusive information, and apparently all rations contained a sufficient amount of phosphate without the addition of mono-calcium phosphate. This year's experiment again emphasized the importance of grain for fattening livestock.

Cooperative Work with the U. S. Department of Agriculture was continued as in the past. Mr. Harland Stevens, Assistant Agronomist of the Department, stationed at Aberdeen, was in direct charge of the cereal breeding program at the Aberdeen Substation. The following workers from the Office of Cereal Crops and Diseases, Washington, D. C., spent from two weeks to better than two months at Aberdeen making studies and selections of their materials grown on the farm: Dr. H. V. Harlan and Miss Mary Martini with barley; Mr. T. R. Stanton and Mr. F. A. Coffman with oats; and Mr. B. B. Bayles with wheat.

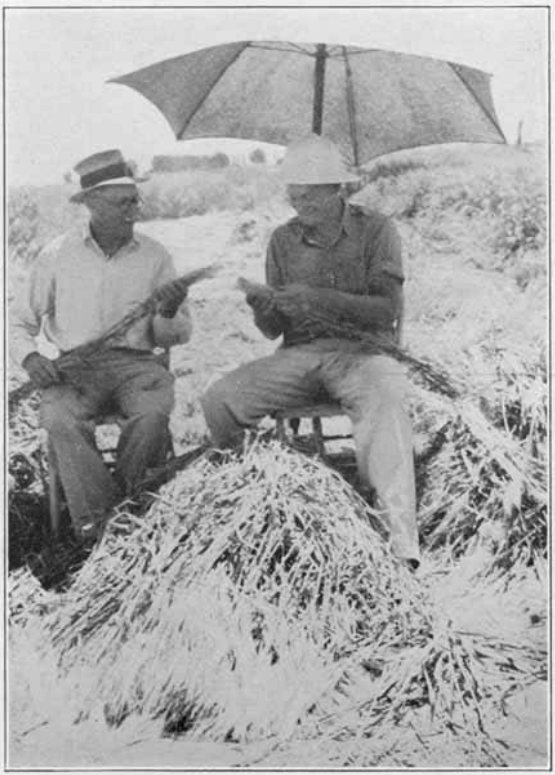

Fig. 14.—Dr. H. V. Harlan, Barley Specialist, and son Jack making selections.

Barley. The barley nursery consisted of a little over 4600 rows, of which 2400, 15-foot rows were space planted to material from 378 crosses, which had been grown individually and in bulk for the past six years. Slightly over 6000 selections were made from this group for future testing of their commercial value as new barleys in the United States.

Two hundred fifty barley varieties and strains were tested in slightly over 1000 rod rows for yield and other characteristics, and approximately 200 rows were devoted to genetic studies.

Oats. Nearly 3000 rows were planted in the oat nursery, from which yield tests were made of 195 varieties and strains in 1200 rod rows. Eight hundred fifty rows were planted to rust-resistant oats from the Middle West for the study of smut resistance, and 700 rows of oats were grown for classification and identification, of which 500 were samples from lots of seed purchased by the seeds stock committee.

Wheat. The wheat nursery consisted of nearly 2000 rows besides the

dry-land wheat nursery at Rockland. One hundred eighty-seven varieties were tested in rod rows, some in three and other in five replications. The Bayles uniform wheat nursery consisted of 405 rod rows.

New Grains That Show Promise

Two barleys of rather recent introduction from Afghanistan gave promise of being well adapted to heavy rich soils under irrigation. Trebi barley, although a good yielding variety, has a tendency to lodge easily where soil fertility is high. These new barleys are Afghanistan C. I. 4166 and Afghanistan C. I. 4156-2.

Fig. 15.—Afghanistan barley standing erect while other barleys badly lodged. Aberdeen Substation Farm.

Another barley which shows considerable promise is Ezond (Selection Ab. 324645) developed at the Aberdeen Substation. This barley has a smooth awn, yields equal to Trebi, and seems to have a somewhat stiffer straw. These three barleys will be tested this next year in one or two different localities before releasing one and perhaps two for distribution. The following table gives the comparison of yields for 1935:*

Afghanistan C. I. 4166	138.8 bu.
Afghanistan C. I. 4156-2	130.7 bu.
Ezond (Ab. 324645)	120.8 bu.
Trebi C. I. 936	118.4 bu.

Several new oat crosses continue to show promise and will be tested by a few county agents along with the barleys and one or two of the better wheats. The new oats are all Markton x Victory crosses. They all carry the smut-resistant quality of the Markton parent and more or less of the grain color of the Victory. These have been tested in the plots for the past three years and the yields are as follows:

Markton x Victory C.I. 2965	134.1
Markton x Victory C.I. 2592	132.8
Markton x Victory C.I. 2952	131.2

*This is the first year that the two Afghanistan barleys were grown in plots.

Markton	C.I. 2053	.....129.8
Victory	C.I. 2020	.....128.2

The wheat cross that at present is the most promising is a cross between Federation and Dicklow. It yields about the same as its parents, has the stiff straw of Federation, the light chaff of Dicklow, and indications are that it will have the milling qualities of Dicklow.

Caldwell Substation

R. F. JOHNSON *in charge*

Emphasis Placed Upon Feeding Experiments

Livestock feeding experiments have dealt with fattening range lambs and steers, with emphasis placed on the proper use of home-grown feeds for animals of various ages and mineral requirements. Other projects, including soil studies, corn variety testing, testing of various methods of wood preservation, and testing of alfalfa varieties for resistance to bacterial wilt, have been reported by various other departments in this report.

Lamb Feeding

TABLE VII
A comparison of results secured from feeding light and heavy silage

Daily Ration*	Av. Daily Gain	Feed for 100 lbs. Gain		
		Hay	Barley	Silage
69 Lambs				
Ch. Alfalfa 1.38 lbs..... Barley .98 lbs..... Corn Silage .88 lbs.....	.285	489	348	313
70 Lambs				
Ch. Alfalfa 1.12 lbs..... Barley .97 lbs..... Corn Silage 1.75 lbs.....	.276	398	345	621

Corn silage, as a feed for fattening lambs, produces the largest and most economical gains when fed at the rate of approximately one pound per head per day.

*Salt was fed ad libitum in both the lamb and steer feeding experiments.

TABLE VIII
A comparison of results of feeding lambs with and without mineral supplements

Daily Ration	Av. Daily Gain	Feed for 100 lbs. Gain		
		Hay	Barley	Pulp
69 Lambs				
Ch. Alfalfa 1.35 lbs..... Barley .66 lbs..... Pulp .66 lbs..... M. Cal. Phos. .008 lbs.....	.318	433	211	211
70 Lambs				
Ch. Alfalfa 1.40 lbs..... Barley .66 lbs..... Pulp .66 lbs.....	.326	430	201	201

Mono-calcium phosphate, sprinkled on the morning feed of dried beet pulp and barley, did not increase the rate of daily gain or save any feed in producing 100 pounds of gain, when fed to 57 pound feeder lambs.

TABLE IX
Results from feeding average and "Peewee" lambs.

Daily Ration		Initial Weight	Av. Daily Gain	Feed for 100 lbs. Gain		
				Hay	Barley	Silage
70 Lambs						
Ch. Alfalfa	1.12 lbs.					
Barley	.97 lbs.	57.5	.276	398	345	621
Silage	1.75 lbs.					
201 Lambs						
Ch. Alfalfa	.83 lbs.					
Barley	.80 lbs.	44.7	.258	322	313	569
Silage	1.46 lbs.					

The light-weight lambs made normal gains and required less feed to produce 100 pounds of gain than the larger lambs. They were induced to consume a relatively large amount of silage by feeding a limited amount of chopped alfalfa in the morning and all the corn silage they would consume in the evening. Other data indicates that the light-weight lambs may have gained as rapidly as the larger lambs, had the corn silage been limited rather than the chopped alfalfa hay.

Steer Feeding

TABLE X
A comparison of results secured from feeding light and heavy silage

Daily Ration		Av. Daily Gain	Feed for 100 lbs. Gain		
			Hay	Barley	Silage
9 Steers					
Ch. Alfalfa	14.2 lbs.....				
Barley	8.4 lbs.....	2.16	657	388	381
Silage	8.2 lbs.....				
9 Steers					
Ch. Alfalfa	10.9 lbs.....				
Barley	8.4 lbs.....	2.03	536	413	811
Silage	16.5 lbs.....				

Corn silage, fed at the rate of about 8 pounds per day with chopped alfalfa hay and ground barley, to 740-pound steers, produced slightly larger and more economical gains than when fed at the rate of 16 pounds per day.

TABLE XI
A comparison of results of feeding steers with and without mineral

Daily Ration		Av. Daily Gain	Feed for 100 lbs. gain		
			Hay	Barley	Silage
8 Steers					
Ch. Alfalfa	11.5 lbs.....				
Gr. Barley	5.7 lbs.....	1.83	630	311	311
Pulp	5.7 lbs.....				
M. Cal. Phos.	.052 lbs.....				
8 Steers					
Ch. Alfalfa	11.5 lbs.....				
Gr. Barley	5.7 lbs.....	1.85	623	308	308
Pu'p	5.7 lbs.....				

The use of a supplemental mineral in the form of mono-calcium phosphate or bone meal for fattening lambs or steers for periods of not exceeding 200 days, apparently, has not been beneficial from the standpoint

of increasing average daily gains, decreasing the feed requirements for 100 pounds of gain, or improving the finish when fed with feeds grown on the Caldwell Substation Farm.

TABLE XIII
Results secured from feeding yearling steers on pasture.

Lot	I	II	III
Number of Steers	9	10	11
Wintering period—131 days (January 11—May 22, 1935)			
Av. Daily Gain	2.34	1.73	1.97
Av. Daily Ration			
Ch. Alfalfa	15.0	13.5	12.8
Barley	2.6	2.6	2.3
Oats	1.0	1.0	1.0
Corn Silage		4.7	4.7
Cottonseed			.35
Feed Cost per 100 lbs. gain	$5.15	$7.11	$6.54
Pasturing Period—156 days (May 22—October 25, 1935)			
Av. Daily Gain	1.74	1.74	1.75
Av. Daily Ration			
Barley	5.70	5.70	5.70
Oats	1.90	1.90	1.90
Feed Cost per 100 lbs. gain	$8.14	$8.14	$8.14
Finish Period in dry lot—46 days			
Av. Daily Gain	2.37	2.18	2.29
Av. Daily Ration			
Ch. Alfalfa	15.7	15.2	15.2
Gr. Barley	7.8	7.7	7.8
Gr. Oats	2.6	2.5	2.5
Feed Cost per 100 lbs. gain	$6.86	$7.34	$7.00
Summary (3 periods)			
Av. Daily Gain	2.08	1.82	1.88
Feed Cost per 100 lbs. gain	$6.70	$7.53	$7.22

These data on feeding yearling steers indicate that a home-grown ration of barley, oats, and alfalfa hay gives a more rapid and economical gain than rations supplemented with either cottonseed meal or where part of the hay is replaced with corn silage. The feed during the wintering period had no influence on the pasture gains, for all lots made practically the same average daily gain. In the finishing period the lot fed three parts of barley, one part of oats and alfalfa hay made the most satisfactory gains. These data tend to point out that sufficient protein is supplied in a steer-fattening ration by feeding 15 pounds of alfalfa hay daily, and therefore, additional protein makes a poor and expensive substitute for a fattening feed like barley.

Feed costs were figured from the following feed prices: chopped alfalfa, $9.50 per ton; ground barley, $1.35 per hundred; ground oats, $1.35 per hundred; corn silage, $4.00 per ton; cottonseed meal, $2.50 per hundred; and pasture, $15.00 per acre.

The calves used in this experiment weighed 402 pounds each when purchased. At the time they were slaughtered, the dressing percentage was 60.3, and 24 of the carcasses graded choice and five graded good.

The carcasses were criticized for having fat with a slightly yellow color, indicating that the length of the feed lot period was insufficient to remove the "grassy" coloring.

Pastures

A plentiful supply of irrigation water kept the pastures in excellent growing condition from April until the first of October. Yearling steers were pastured for 156 days, the dairy herd for 175 days. Old seedlings of Kentucky blue grass and white clover, when pastured with 635-pound yearling steers that were fed a supplemental feed three parts ground barley and one part of ground oats at the rate of 7.8 pounds per head each day, had a carrying capacity of 1.7 thousand pound animal units per acre. Mixed grass pastures, when grazed with thousand-pound Holstein heifers that received no supplemental feed, and thirteen-hundred-pound milking Holstein cows that received approximately four pounds of ground barley per head per day, had a carrying capacity of 1.25 thousand pound animal units per acre.

Improvements Include New Horse Barn

Improvements during the year include replacement of the old horse stable with a new structure. The new horse barn is a 1½ story frame structure on a concrete foundation, which is 8 inches thick and extends 38 inches above the ground level. The barn, which is 34 x 42 feet, provides double and single stall space for 8 horses and, in addition, has a box stall and a feed storage bin with capacity for about 5 tons of feed. Storage for about 25 tons of hay is provided in the loft and in the north end section of the barn which extends to the floor. The estimated construction cost for the horse barn was $2500. The actual construction cost was $2,145.30, made possible by fortunate purchases of materials and careful supervision of the construction. The cost per square foot of floor area provided in the barn was $1.51, and on the basis of volume the cost was $0.75 per cubic foot.

A 24-foot section was built on the south end of the machine shed providing additional space for the storage of farm machinery and equipment. The estimated cost for this construction was $500.00 and the actual construction cost totaled $432.00. This gives a cost of $0.60 per square foot of added floor area, or $0.0375 per cubic foot of storage space.

High Altitude Substation

W. H. Moss *in charge*

RAINFALL during the growing season, April to July inclusive, was 4.15 inches, which was slightly less than in 1934 when 4.94 inches fell during the same period. Crops, in general, were much better, due principally to the fact that there was less drying wind this year. Killing frosts did not occur until September 27 as compared with the average date of September 1. Potatoes produced a fairly good yield due to the longer frost-free period. Due to dry weather much of the winter wheat planted this fall failed to germinate. This may result in weedy wheat next year, as weed seed had little chance to germinate in dry fallow ground during the summer.

The work of the Substation during the year consisted of the usual

crop rotation tests, including five different rotations: variety tests of winter and spring wheats; tests of commercial fertilizers on wheat and potatoes; grass seed production trials; cultural tests with potatoes; and shade and windbreak studies with trees. A winter wheat nursery was grown in cooperation with the Office of Cereal Crops and Diseases, United States Department of Agriculture.

The dry, windy weather in 1934 resulted in a poor stand of sweet clover in all of the plots. No crop of sweet clover was harvested on any of the plots this year, as Russian thistles choked out what few plants survived from the previous season. This is the first complete failure of sweet clover during the years it has been grown on the Substation farm. Sweet clover grown in the six years' rotation has increased the yield of winter wheat 1.4 bushels per acre over the rotation including only wheat and summer fallow. These results are for a period of eight years on land that has been farmed approximately 20 years.

The crop of winter wheat on the variety plots was almost a complete failure this year on account of weeds which were so thick they could not be removed without destroying the wheat. Although the crops were harvested and the yields recorded as usual, they do not give a fair test of the yielding ability of the various varieties. This is especially true with the Oro variety, which is one of the best varieties grown on the Substation farm. Seed of Oro wheat has been distributed to a few farmers, and 200 acres were harvested this year, yielding approximately 4,000 bushels of seed. The seed was practically all planted during the fall of 1935, and if the average increase of yield of Oro over Turkey Red is secured next year, it will result in approximately 9,200 bushels more wheat for farmers planting the Oro variety. Increase in yield will represent a money value of $8,280 if wheat is worth 90 cents per bushel. This amount would pay the running expenses of the High Altitude Substation for the present biennium. This does not, of course, take into consideration the value of this variety of wheat to farmers in this region in years to come.

Several new varieties in the winter wheat nursery appear to be even more promising than Oro in both yield and smut resistance. The cereal nursery is proving a valuable asset to the substation in keeping the growers informed on the better varieties which are produced by the various experiment stations and the United States Department of Agriculture.

Treble-superphosphate applied to winter wheat at the rate of 50 pounds per acre at planting time resulted in an increase of 2.9 bushels of wheat per acre while an application of 125 pounds per acre increased the yield only 2.1 bushels per acre. In 1934 there was practically no difference in yield between the fertilized and the unfertilized plots. Treble-superphosphate gave no beneficial results when applied to potato land at the rate of 100 pounds per acre. Indeed, the yield on the check plots was 282 bushels more per acre than on the fertilized plots.

Yields of hay on the farm were normal this year. Brome grass planted in 21-inch rows yielded 1,045 pounds more hay per acre than when planted in 7-inch rows. The wider plantings have given much more satisfactory results. There was considerable variation in the yields of the different strains of alfalfa.

TABLE XIV
Yields of alfalfa varieties on the High Altitude substation farm, 1935

	Lbs. Acre	Group Average
Group 1		
Ladak	3393	
Cossack	3386	
Grimm	3212	
Hardigan	3186	
Baltic	3173	3270 lbs.
Group 2		
N. D. Grimm	3106	
Canadian Variegated	3106	
Kansas	3026	
Utah Common	2999	
Idaho Grimm	2969	3041 lbs.
Group 3		
Dakota Common	2873	
Hardistan	2853	
Turkestan	2440	
French	2279	
Argentine	2260	
Arizona Common	1984	2448 lbs.

Table XIV gives the results obtained in pounds per acre for the various alfalfa varieties tested during 1935. The yields have been separated into three groups: Crop No. 1, 3270 pounds per acre; crop No. 2, 3041 pounds per acre; and crop No. 3, 2448 pounds per acre. It will be noted that Ladak gave the highest yield and Arizona Common the lowest of the 16 varieties which were tested. Farmers should plant the hardier, better yielding strains of alfalfa as the first cost of higher price of seed will be offset by the increased yield of hay after the first year.

Among the most pressing needs at the present time for properly operating the High Altitude Substation is a suitable road leading from the highway to the Substation. It is hoped that this road will be completed during the next year.

Sandpoint Substation

RALPH KNIGHT *in charge*

New Extremes Mark Weather Record

THE climatological conditions in the Sandpoint area were somewhat abnormal in several respects. The total precipitation was 23.4 inches, or 5.27 inches below normal. During January 6.9 inches were recorded, this being the second highest amount on record for that month. Nine months showed a rainfall deficiency, several of the fall and summer months being especially dry. The snowfall of 72.5 inches was slightly under normal. Temperatures went to extremes in several instances. A new early date for zero weather was recorded on November 3, when the temperature fell to one degree below zero. The frost-free period was only 73 days, extending from June 3 to August 16. On both these dates a reading of 30 degrees was recorded. The highest temperature of the year was 97 degrees on July 14, while the lowest was -26 degrees on January 20. There were only nine days when the temperature was 90 or above.

Dry Seeding and "Snow Scald" Cut Cereal Stands, but Yields Normal

Yields from the winter wheat varieties were nearly normal in spite of the generally poor stands. The latter condition apparently resulted from the fact that the soil was exceedingly dry when seeding was done and for some time after, and the plants did not become established before cold weather set in. The average estimated stands ranged from 40 per cent in Rosen rye to as high as 87 per cent in some of the wheat varieties. Only in the case of rye was the yield appreciably below normal. Jones Fife and Hybrid 128 were the highest yielding varieties, each making 32.3

Fig. 16.—First cutting alfalfa on Sandpoint Substation Farm.

bushels per acre. Over a period of seven years Mosida ranks first in yield with an average of 35.7 bushels per acre, followed by Triplet with 34.2 bushels. During the two years that it has been grown, Oro 0535 has averaged 36.3 bushels.

All of the nursery varieties showed at least a slight amount of injury from "snow scald." Jenkin was injured the most, the estimated loss being 90 per cent. In the uniform winter nursery, C. I. 11605, C. I. 11606, and C. I. 11607 made the best yields. The first two are crosses of Hybrid 128 x Martin, and the latter is a cross of Hybrid 128 x White Odessa. Of the Jenkin hybrid selections, numbers 9406, 9347, and 0059 made the highest yields. All of these outyielded any of the varieties in the uniform nursery, and two of them are being increased in order to make larger plantings next year.

The spring wheat plats produced yields somewhat above normal, while the nursery yields were in most cases appreciably lower than average. The leading varieties in the plats were Onas, Dicklow, and Federation, and in the nursery Defiance, Federation 15, and Jenkin 42. The leading barleys of the varietal test were Hannchen, Union, and O.A.C. 71, while Beldi, Odessa, and Ottowa 7 were high in the nursery. No heavy infections were obtained in the barley smut nursery, but the data obtained indicate that any of the treatments used are effective in smut control. The bald two-row barley hybrids gave, in general, very poor yields. A series of F-10 hybrids which were tried here for the first time showed little or

no promise on this particular soil type.

Leading varieties in the oat varietal test were Markton, Victory, and Idamine. All of the plats this year produced yields considerably above normal. White Tartar, Banner, and Idamine were the leading varieties in the nursery.

New Potato Varieties Prosper; Fertilizers Fail

The varietal test and fertilizer experiments constituted the work with potatoes this year. All yields were extremely light, due to the early frost and dry weather. No response of any significance was obtained from any of the commercial fertilizers used. An experiment dealing with the residual effect of fertilizers gave negative results, in that two check plats outyielded a series of plats that had been fertilized in 1934. The Chippewa variety outyielded all others by a very substantial amount and, in addition, showed remarkably little disease and excellent frost recovery. These desirable features indicate that this variety is worthy of more intensive study and the seed supply will be increased as rapidly as possible. An increase lot of Idaho Rurals gave a very poor yield and was badly infested with mosaic. The Katahdin variety, which has found considerable favor in some localities, particularly on the drier soils, showed considerable disease resistance but gave rather poor yields.

Gypsum Still Best Alfalfa Fertilizer

Alfalfa yielded exceptionally well this year, slightly over 90 tons being cut from 23 acres in two cuttings. Yields secured from a series of fertilized plats indicate that none of the commercial fertilizers are superior to gypsum for increasing yields in this section. In a series of plats seeded to alfalfa-grass combinations, none of the plats gave any higher yield than alfalfa alone. It is probable that the various grasses will prove more hardy during severe winters, however, and if so, will be of value in that respect.

The introduction nursery contained a large number of grasses and various varieties of alfalfa, vetch, peas, clover, and related crops. Any of the grasses which are adapted to this region produce very abundantly, either for forage or for seed. Some of the grasses which have shown

Fig. 17.—Seed production grasses on the Sandpoint Substation Farm.

special promise for seed production on a commercial scale are orchard grass, tall meadow oat, meadow fescue, chewings fescue, crested wheat, brome grass, and Reed canary grass. Fairly extensive plantings of some of these were made this spring and will be harvested for seed next year.

Financial Statement

DETAIL OF EXPENDITURES OF FEDERAL APPROPRIATIONS
IDAHO AGRICULTURAL EXPERIMENT STATION
July 1, 1934, to June 30, 1935

	Abstract	Hatch	Adams	Purnell
Salaries	1-A	$ 7,605.89	$12,123.50	$31,523.12
Labor	B	3,739.04	962.91	8,954.45
Stationery and office supplies	2-A	270.34	1.00	129.07
Scientific supplies	B	149.21	865.00	2,084.10
Feeding stuffs	C		143.39	4,532.01
Sundry supplies	E	128.09	77.89	318.08
Communication service	5	678.49		172.51
Travel expense	6	330.01	20.90	2,212.23
Transportation of things	7	21.35	85.53	199.57
Publications	8	1,317.89		3,028.37
Heat, light, water, and power	10	95.51	7.22	243.87
Contingent expense	13	24.43	21.12	136.33
Furniture and fixtures	30-A	51.01	14.84	445.47
Library	B			183.14
Scientific equipment	C	155.07	224.65	3,801.05
Tools and machinery	D	433.67	400.64	1,335.75
Livestock	E			81.00
Buildings and land	31		51.41	619.88
TOTAL		$15,000.00	$15,000.00	$60,000.00

SUBSTATION DISBURSEMENTS
January 1 to December 31, 1935

	Aberdeen	Caldwell	High Alt.	Sandpoint	Total
Salaries	$2,522.02	$3,178.70	$1,606.20	$2,811.16	$10,118.08
Help	1,140.95	1,701.80	302.00	662.63	3,807.38
Supplies and equipment	3,824.89	5,889.35	671.16	1,486.26	11,871.66
TOTAL	$7,487.86	$10,769.85	$2,579.36	$4,960.05	$25,797.12

Disbursements by Departments

DETAIL OF EXPENDITURES OF STATE APPROPRIATIONS*
IDAHO AGRICULTURAL EXPERIMENT STATION
Jan. 1 to Dec. 31, 1935—Home Station

	Admin.	Ag. Chem.	Ag. Econ.	Agr. Engr.	Agronomy	Animal Husbandry	Bacteriology	Dairy
Salaries	$	$	$	$	$	$	$ 5.38	$
Help	1.50		13.82				5.25	
Travel			53.40	15.35				
Communication	13.39	3.70	14.35	5.38	3.04	.55	.15	1.78
Freight and miscellaneous		11.49	13.95					
Printing and advertising	7.15		.30	12.00	1.56			
Office supplies	2.40		2.00					
Laboratory supplies		291.70		39.69	3.05		13.80	
Feed stuffs								
Repairs and replacements	18.89	3.63			28.61			33.56
Equipment			38.79		13.52			
Fixed charges		1.24	30.52					
TOTAL	$ 43.33	$ 311.76	$ 167.13	$ 72.42	$ 49.78	$ .55	$ 24.58	$ 35.34

	Entomology	Home Ec.	Horticulture	Legume	Plant Pathology	Poultry	Soil Survey	Total
Salaries	$ 105.00	$	$	$ 543.78	$	$	$	$ 654.16
Help			45.85	226.85		207.90	244.54	745.71
Travel	37.38		85.90		31.71	111.85		335.68
Communication	3.20		.60	25.00	1.67	.30		73.20
Freight and miscellaneous	11.75	.25	1.00	42.13	4.05	1.12	2.25	87.99
Printing and advertising			1.95	1.00	5.00	.60		29.56
Office supplies	3.73		2.92	15.23		.25		26.53
Laboratory supplies	58.55		3.60	223.47	16.10	29.00	116.00	795.05
Feed stuffs		3.84				512.20		516.04
Repairs and replacements	7.60		24.59	37.12	4.72	3.70	130.85	293.27
Equipment	366.55		112.86		59.70	34.38	63.03	688.88
Fixed charges							10.00	41.76
TOTAL	$ 593.85	$ 4.09	$ 279.36	$1,114.58	$ 122.95	$ 901.30	$ 566.81	$4,287.83

*Includes general appropriations and institutional funds.