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# Agricultural Research In Idaho

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UNIVERSITY OF IDAHO

AGRICULTURAL EXPERIMENT STATION

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# INTRODUCTION

C. W. HUNGERFORD, *Vice Director*

THE research program of the Idaho Agricultural Experiment Station was considerably affected by the war. During the past year the Station has made an effort to return to its normal volume and quality of activities and to adjust the program to meet the needs of post-war agriculture.

The investigations of the Experiment Station are carried on under individual projects for each line of research undertaken. There are now 150 of these projects in the 12 Station departments.

Much of the Main Station farm of 800 acres, adjoining the University campus at Moscow, is devoted to the uses of the various departments in the Agricultural Experiment Station. The administration of the Station also is located on the University campus.

The work of the Station covers the State. Five branch stations, at Aberdeen, Caldwell, Tetonia, Sandpoint, and Parma, investigate problems peculiar to the area surrounding each branch station. Field trials are conducted wherever it seems advisable to cooperate locally with farmers.

Established in 1906 the oldest branch station is the one at Caldwell. It consists of 320 acres of irrigated land with adequate facilities for conducting research dealing with livestock feeding, emphasizing especially the use of Idaho agricultural products and by-products for feeding steers and lambs. Considerable research work dealing with soils and crops is also conducted on this branch station. The branch station at Aberdeen was established in 1911 and consists of 160 acres of irrigated land devoted to research dealing with crops grown on irrigated farms in southern Idaho. Two large potato cellars, a greenhouse, office buildings, and other facilities for conducting research with crops are located at this branch station. The Tetonia Branch Station, established in 1919, consists of 100 acres of land with adequate facilities for conducting research dealing with problems of argiculture in the high altitude non-irrigated area. The Sandpoint Branch Station was established in 1912 and consists of about 100 acres of land used in conducting investigations related to agriculture in the cut-over areas of northern Idaho. The most recent branch station is the one located at Parma. Established in 1935, it consists of 34 acres of land where fruit and vegetable research is emphasized.

In addition to the five Branch Stations, temporary facilities for conducting field research have been utilized on rented land at various locations in the State. For example, at Twin Falls, research dealing with diseases and insect control has been carried on for

years in cooperation with the federal laboratory of the United States Department of Agriculture.

Cooperation with various federal bureaus has been extended. More effective cooperation with federal agencies, with other experiment stations and with industry has been planned in anticipation of the funds to be made available under the Flannagan-Hope Act.

The following reports have been chosen to give an over-all picture of agricultural research in the State. They are not complete and include only a representative number of the entire research projects conducted by the Station.

# HOME STATION

## Animal Husbandry and Veterinary Science

### The Phosphorus Requirements of Range Ewes for Reproduction and Lactation

THREE lots of range ewes were fed as follows: Lot I, molasses dried beet pulp, alfalfa hay, bean straw and salt; Lot II, the same as Lot I except for the addition of 1.5 percent of bonemeal to the beet pulp; Lot III, alfalfa hay and salt. After lambing, the ewes in Lot I and II received an additional pound of molasses dried beet pulp and those in Lot III received a pound of barley per head daily. The ration fed Lot I was to have been deficient in phosphorus. However, it was not low in phosphorus because the bean straw had an unusually high phosphorus content. (Steps have been taken to remedy this situation during the 1946-47 season.) There were no appreciable differences between Lots I and II in percentage lamb crop nor in the lamb weights at birth or at the end of the dry-feeding period. The only difference of any consequence among the three lots was the larger lamb crop in Lot III. The percentages of lambs raised to the end of the dry-feeding period were 114.6, 114.9, and 126.9, respectively for Lots I, II and III. (*C. W. Hodgson, R. F. Johnson, A. C. Wiese, E F. Rinehart and C. W. Hickman*).

### Phosphorus Supplements for Fattening Steers

Six lots of yearling steers were used. The phosphorus-deficient basal ration was composed of alfalfa hay, beet molasses, wet beet pulp and salt. It contained 0.12 percent phosphorus. Steamed bonemeal and defluorinated superphosphate were each force fed and fed free choice both alone and mixed with salt. The results showed that both supplements were satisfactory when force fed. When fed free choice, however, the superphosphate was scarcely touched. Bonemeal was considerably more palatable than the superphosphate but not eaten in quite large enough quantities to provide an adequate intake of phosphorus as indicated by the blood-phosphorus levels and by the daily gains in weight. Bonemeal was eaten more readily when mixed with salt than when fed alone. The steers ate very little superphosphate when it was fed free choice, even when mixed with salt. (*C. W. Hodgson, R. F. Johnson, A. C. Wiese, E. F. Rinehart anl C. W. Hickman*).

### Swine Progeny Testing

This completed the sixth year of improving the University's Poland China herd by selecting sows and boars for breeding stock which produce heavy, large and desirable litters. Four pigs were selected this year from each of 14 litters. The project was revised

in regard to management and feeding practices. At this writing no data are available on this year's results. (*W. P. Lehrer, Jr.*)

### Purebred vs. Crossbred Swine

Three lots of weanling pigs, one lot containing Durocs, another Hampshires, and the third lot Hampshire-Duroc crossbreds, were kept in comparable dry lots and fed similar rations until they reached market weight. No significant differences were observed among the three groups from the standpoint of feed utilization and average daily gains. (*W. P. Lehrer, Jr.*)

### Cull Peas for Fattening Hogs in Dry Lot

The work reported here is a brief summary of that published in Idaho Agricultural Experiment Station Circular No. 107.

A ration of peas and wheat was more efficient when mixed together than when self-fed separately free choice. Hogs on a wheat-pea-alfalfa grain mixture containing 35 percent peas made faster gains and required less feed per 100 pounds of gain than those on a mixture containing only 20 percent peas. Meat meal was considerably more efficient than ground peas as a protein supplement for the grain mixture containing only 20 percent peas. It was only slightly more efficient in supplementing the grain mixture containing 35 percent peas. (*W. P. Lehrer, Jr. and C. W. Hodgson*).

### Bovine Mastitis Still Controlled

Infectious mastitis was last observed in the University of Idaho dairy herd early in 1944. Since that time only cases of non-infectuous mastitis such as that produced in injury, chilling and pre-milking congestion have been observed. During 1945, eight cases of this type were observed, and, during 1946, six cases have been found. During this period routine laboratory tests have been run on all animals without detecting a carrier or infected animal. (*G. C. Holm, D. L. Fourt, and H. C. Hansen*).

### Swine Brucellosis Field Studies

As a follow-up on the controlled exposure studies of swine brucellosis five herds have been under observation. During 1946, a total of 291 gilts and boars were vaccinated between 110 and 130 days of age. In one of the herds, infected boars have been purposely retained and used in order to study the protective power of vaccination. No cases of abortion have been observed and in routine blood testing all gilts and boars have been negative at the time of vaccination and the majority of them have cleared up in time to breed for gilt litters. Sows and gilts are being watched to see if the resistance decreases after they have been vaccinated for some period of time. (*G. C. Holm, W. B. Ardrey*).

# Dairy Production and Manufacturing

## Continuous Use of Proved Sires Maintained Standards of Type and Production in Dairy Herds

THE average production per cow of the combined Holstein-Friesian and Jersey herds, consisting of 32 cows, was 12,154 pounds of milk and 474.5 pounds of butterfat. All cows were milked twice daily.

The Holstein herd of 18 cows averaged 15,392 pounds of milk and 502.9 pounds of butterfat. The Jersey herd of 14 cows averaged 7,900 pounds of milk and 435 pounds of butterfat.

The average type classification of the combined herds was "good plus."

The Holstein herd has a 10-year average of 498 pounds of butterfat and the Jersey herd 422 pounds of butterfat.

The American Jersey Cattle Club has awarded eight Constructive Breeders Registry Certificates to the Jersey herd, and the Holstein herd has received for the eighth year the Progressive Breeders Registry Certificate from the Holstein-Friesian Association of America. These are the highest honors awarded by the national breed associations. According to available information, only two other herds in the United States of each breed have been awarded as many certificates by the respective breed associations as has the Idaho Agricultural Experiment Station herds.

These high standards of both production and type are due to a large extent to the continued use of proved sires in both the Holstein and Jersey herds (*D. L. Fourt and F. C. Fountaine*).

## Continuous Use of Thyroprotein Gives Varied Results

Three Holstein and three Jersey cows were fed thyroprotein continuously from the 61st day after freshening throughout the remainder of the lactation. The thyroprotein was fed in the amount of 1.5 grams for each 100 lbs. of body weight of the cow. The daily amount was fed by mixing it with the evening allowance of grain mixture.

The effect of this drug on milk and butterfat production varied between the breeds and among cows within each breed. Of the six cows fed thyroprotein, milk production was increased in only two Holsteins. Butterfat test was increased in the third Holstein, but the increase was only temporary. Thyroprotein did not increase production of Jersey cows. In fact, with one of the Jerseys it was possible to maintain lactation for only 8½ months. Because of the limited number of cows used it cannot be stated definitely that the differences are due to breeds. Such differences might be individual differences between cows.

Within the breeds there was a variation of response to thyroprotein. In one cow an immediate increase of about 20 percent in milk production was observed. This cow maintained her high production throughout the lactation. In the other Holstein cows a definite but temporary increase in production followed the feeding of thyroprotein.

It was necessary to increase the amount of grain fed to Holstein cows receiving thyroprotein. One cow required 22 lbs. of grain daily to maintain her weight. This was more than the amount necessary to support her production under normal conditions. Jersey cows fed thyroprotein gained weight and became fat and patchy on their regular grain rations.

Thyroprotein caused an increase from 10 to 25 percent in the pulse rate of both Holstein and Jersey cows. The respiration rate of thyroprotein fed cows increased in hot weather, but this effect was not apparent in cool weather.

One Jersey cow became extremely nervous after the drug had been fed a few months. Her nervousness was particularly exhibited at milking time.

With one exception, cows fed thyroprotein came in heat regularly and conceived normally.

**Dehydrated Alfalfa Improves Standard Calf Meal Mixtures**

Twelve Holstein bull calves from 3 to 10 days old were purchased from farmers in southern Idaho and transported by truck to Moscow. The calves were equally divided according to weight and assigned to experimental groups.

All calves were fed 8 lbs. of whole milk daily for the first week; 7 lbs. daily for the second week; the daily amount being reduced by 1 lb. each week, so that no milk was fed after the 8th week of the experiment. Each calf was allowed free choice of good quality alfalfa hay and free choice of the calf meal assigned to its group.

The following is the composition of the calf meal fed to each group.

| Group I | Group II |
|---|---|
| 25 lb. ground barley | 25 lb. ground barley |
| 30 lb. ground oats | 35 lb. ground oats |
| 6 lb. wheat bran | 12 lb. wheat bran |
| 10 lb. dehydrated alfalfa | 12 lb. linseed oil meal |
| 13 lb. linseed oil meal | 13 lb. dried buttermilk |
| 13 lb. dried buttermilk | 1 lb. steamed bonemeal |
| 1 lb. steamed bonemeal | 1 lb. finely ground limestone |
| 1 lb. iodized salt | 1 lb. iodized salt |

The calf meal fed Group II is a standard dry calf meal, widely recommended for calf feeding. The meal fed calves in Group I was similar in composition, except that 10 lb. of dehydrated alfalfa

and 1 lb. of linseed oil meal replaced 5 lb. of ground oats and 6 lb. of bran of the standard calf meal.

Each calf in Group I gained more than its pair mate in Group II. During the 63 days of the trial, calves in Group I made an average gain of 104 lb. while those of Group II gained 83.5 lb. This difference of gain of 20.5 lb. in favor of Group I is almost 25 percent. Statistical analysis showed the difference in gain to be significant. Calves in Group I were more efficient in gains since they required 1.976 lb. of T.D.N. per lb. gain, while those in Group II needed 2.255 lb. T.D.N. per lb. gain. It should be noted that the gain of calves in Group II is normal for the breed.

Further studies are in progress. (*F. C. Fountaine, A. C. Wiese and G. C. Holm*).

### Ultra Violet Ray Lamps Sterilizes Milk Cans

A Westinghouse sterlizer designed to kill bacteria and sterilize milk cans, which operates on 110 volts and has a power rating of 30 watts, when applied approximately 6 inches from the surfaces of a milk can, was effective in killing 98 percent of the bacteria when applied for 180 seconds, 96 percent when applied for 90 seconds, 80 percent when applied for 60 seconds, and 50 percent when applied for 30 seconds. (*H. C. Hansen and J. W. Martin*).

## Poultry Husbandry

### Rendering Plant Meat Meal Again Proves an Efficient Protein Supplement in Laying Rations

EXPERIMENTS here reported constitute the fourth series of trials dealing with protein supplements in laying rations. The series reported last year demonstrated that whole carcass meat meal, available from local rendering plants, was satisfactory as the sole protein supplement for egg production. The experiments were conducted to obtain further information as to the necessity or advantage of supplementing the rendering plant meat meal with fish meal and soybean oil meal, separately or in combination. Four lots of 65 White Leghorn pullets in duplicate were given the various combinations of supplementary protein indicated in Table 1 for Groups 1 through 4. The percent of total supplementary protein supplied by each concentrate is indicated in the table.

The results are briefly summarized in the tabulated data for Groups 1 through 4. The rendering plant meat meal produced near maximum results in terms of numbers of eggs produced. The addition of fish meal resulted in no significant increase in numbers of eggs but did produce a slight increase in egg size, confirming previous work, and resulted in a slight reduction in the amount of feed

required per dozen eggs and a slight increase in income over feed cost per bird. Under the conditions of this experiment, soybean oil meal used to supply a third of the supplementary protein resulted in a slight decrease in average egg production and no significant difference in egg size. When both fish meal and soybean oil meal supplemented the meat meal, the increase in egg size was the most significant result.

The differences between all four groups were slight, in some cases less than differences between duplicates on the same ration. It is concluded, therefore, that the use of fish meal and soybean oil meal to supplement the rendering plant meat meal in laying rations for the production of market eggs should be influenced by the availability and price of the products. (*C. E. Lampman and C. F. Petersen*).

### Pea Protein Limits Size as Well as Number of Eggs

Last year it was reported that packing plant meat meal was not as effective as fish meal, dried milk, or rendering plant meat meal in supplementing the protein of Alaska peas in laying rations. To determine the extent to which pea protein constitutes a limiting factor for size as well as numbers of eggs, an experiment was conducted in which ground Alaska pea meal was used to supply 4 percent protein in an all-mash ration for each of two duplicate pens and was supplemented with 1, 2, and 3 percent protein from packing plant meat meal in three other duplicate groups.

The results are briefly summarized in Table 1 for pens 5 to 8. Pea protein alone proved very inefficient for egg production, resulting in an average of only 144.4 eggs per bird for the 10-month period which averaged only 22.84 ounces per dozen. The protein of packing plant meat meal proved effective in increasing both the number and size of eggs. Referring to Table 1, it is noted that the highest level of meat meal protein was necessary to produce standard size eggs. In other words, with increasing amounts of meat meal protein, size of egg continued to be improved after the numbers of eggs remained stationary. (*C. E. Lampman and C. F. Petersen*).

### High Levels of Riboflavin Required for Hens in Batteries

The riboflavin content of eggs as influenced by the level in the ration and the actual riboflavin requirements of hens confined in laying batteries for egg production and hatchability were investigated durng the past year.

Six groups of 8 White Leghorn pullets each were confined to individual wire-bottom laying cages and, after a preliminary period of 3 weeks, were distributed on six different levels of riboflavin varying from 127 to 1000 micrograms of riboflavin per 100 grams of feed.

The level of 127 micrograms was not adequate for maintenance

**Table 1—The comparative efficiency of various combinations of supplementary protein concentrates in laying rations. 10-month period—Oct. 1, 1945 through July 31, 1946**

**Groups 1-4 R.P. meat meal with and without other supplements; groups 5-8 peas alone and with increasing amounts of P.P. meat meal**

| Protein concentrate | percent of supplementary protein | | | | lb. protein/100 lb. mash | | | |
|---|---|---|---|---|---|---|---|---|
| .....Group No. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Meat meal (RP)..... | 33.00 | 66.00 | 66.00 | 100.00 | | | | |
| Meat meal (PP) ..... | | | | | 0.00 | 1.00 | 2.00 | 3.00 |
| Fish meal ..... | 33.00 | 33.00 | | | | | | |
| Soybean oil meal..... | 33.00 | | 33.00 | | | | | |
| Ground cull peas ..... | | | | | 4.00 | 4.00 | 4.00 | 4.00 |
| % Protein in mash.... | 20 | 20 | 20 | 20 | 14 | 15 | 16 | 17 |
| Av. % egg prod..... | 67.29 | 67.03 | 64.60 | 66.63 | 46.50 | 51.96 | 58.09 | 57.03 |
| Eggs per bird (hen-day basis) .....204.60 | | 203.80 | 196.40 | 202.50 | 141.40 | 158.00 | 176.60 | 173.40 |
| Lb. feed/doz. eggs..... | 5.08 | 5.01 | 5.21 | 5.12 | 6.65 | 6.16 | 5.69 | 5.77 |
| Av. feed cost (cents per doz. eggs)..... | 15.20 | 14.81 | 15.41 | 15.36 | 22.67 | 21.01 | 19.26 | 20.00 |
| Inc. over F.C./bird | | | | | | | | |
| based on No. eggs .... | 4.39 | 4.44 | 4.17 | 4.31 | 2.24 | 2.70 | 3.21 | 3.12 |
| based on egg size..... | 4.87 | 4.92 | 4.65 | 4.80 | 1.84 | 2.32 | 2.87 | 3.14 |
| Av. body wt. (lb.)..... | 4.61 | 4.60 | 4.48 | 4.61 | 4.18 | 4.30 | 4.27 | 4.36 |
| Av. egg weight (ounces per doz.).... | 25.03 | 24.75 | 24.49 | 24.36 | 22.84 | 23.12 | 23.07 | 24.08 |
| Percent mortality ..... | 10.00 | 13.08 | 4.62 | 10.77 | 15.00 | 16.67 | 28.33 | 18.33 |
| Percent mortality less leukosis ..... | 4.62 | 9.23 | 2.31 | 6.92 | 10.00 | 10.00 | 13.33 | 10.00 |

Groups 1-4—Laying mash was supplemented with grain at the rate of approximately 50 percent each.

Grous 5-8—Received an all mash ration.

(RP) Rendering plant product—(PP) packing plant product.

of body weight or egg production, the latter dropped rapidly from 64 percent at the beginning of the period to a complete cessation of laying after 4 weeks; the second level of 250 micrograms appeared adequate for maximum egg production under these conditions. Maximum transfer of riboflavin to the eggs did not occur until 500 micrograms or more per 100 grams was provided in the ration. At this level the eggs averaged 5.36 micrograms of riboflavin per gram of fresh egg. The greatest efficiency in the utilization and transfer of riboflavin to the egg was on the level of 3.62 micrograms per 100 grams of feed.

The level of 250 micrograms per 100 grams, previously recommended for birds in open pens on litter, was definitely inadequate for sattisfactory hatchability under these conditions and 360 micro-

grams appeared to be marginal. Five hundred micrograms proved adequate for maximum hatchability of eggs and for the prevention of embryonic defects associated with riboflavin deficiency. This level also afforded a maximum of high quality chicks at hatching and sufficient body storage in chicks to permit good growth when placed on adequate rations.

These levels were much higher than those previously quoted as being necessary for hens in open pens on litter. Inasmuch as it is now known that under those conditions the hens have access to riboflavin made available by bacterial synthesis in the droppings, it is believed that these levels obtained with birds in batteries constitute more nearly the requirments of actual riboflavin intake for the various functions enumerated. (*C. F. Petersen, C. E. Lampman, and O. E. Stamberg*).

### Large Eggs Have Lower Hatchability

Information accumulated during the past several years of pedigree hatching has shown that large eggs do not hatch as well as smaller eggs. The summarized data on 3,082 eggs for the 1946 hatching season demonstrate a definite trend in this respect. The tabulated data which follows show a marked reduction in hatchability of eggs weighing more than 28 ounces per dozen as compared to those under this weight.

| Av. weight—oz. per doz. | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 |
|---|---|---|---|---|---|---|---|---|
| Percent hatchability of fertile eggs | 82.9 | 73.5 | 76.7 | 72.3 | 66.7 | 63.4 | 64.7 | 34.1 |

(*C. F. Peterson and C. E. Lampman*).

## Agronomy

### New Varieties of Cereals and Grasses Distributed

THE objective of the various crop improvement projects under way on the University Farm is the development and introduction of varieties adapted to Idaho conditions. New varieties are released to farmers of the State after their yielding capacities and special characteristics have been determined. The Department cooperates with the Idaho Crop Improvement Association to increase the availability of seed of new varieties in the shortest possible time. Seed released from the Experiment Station is designated as foundation stock. Members of the Crop Improvement Association will in turn increase these seeds and make them available for general distribution as certified seed.

The varieties of new crops released from the Experiment Station this year are *Gem* barley, *Elgin* winter wheat, *Manchar* smooth

brome grass, *Bromar* mountain brome grass, *Intermediate* wheat grass and *Beardless Bluebunch* wheat grass.

*Gem* barley originated from a cross between *Atlas* and *Vaughn* made in 1927 by V. H. Florell at Davis, California, in connection with the cooperative breeding activities between the California Agricultural Experiment Station and the United States Department of Agriculture. When Mr. Florell was transferred he continued selecting from the progeny of the cross. The testing of the various selections was continued after Mr. Florell left Moscow until selection No. 35 was finally selected for increase in 1945. A total of 38,000 pounds of foundation stock seed of *Gem* were distributed this year.

*Gem* is a six-rowed semi-smooth awned, white-seeded, spring, feed barley with rather short heads of medium density. *Gem* is expected to replace *Trebi*, both in the dry-land and in the irrigated portions of the state. When compared to *Trebi*, the new variety is 4 days earlier in maturity, has about the same height, but has a somewhat stronger straw than *Trebi*. The fact that the beards of *Gem* are semi-smooth makes the straw more desirable for feeders than that of the decidedly rough and long bearded *Trebi*. *Gem* has outyielded *Trebi* by 19 percent over a 10-year period on the University Farm.

*Elgin* is a short, stiff strawed, soft white, winter, club wheat, resulting from a cross between *Goldcoin* and *Hybrid 128*. This cross was made at the Sherman Branch Experiment Station, Oregon. The favorable features of *Elgin* are high yielding ability, the good quality of wheat produced, and resistance to lodging and shattering. *Elgin* is the highest yielding variety tested in recent years both at Moscow and at the Sandpoint Branch Station. A total of 17,000 pounds of *Elgin* were distributed in the fall of 1946 for the production of certified seed.

*Manchar* is an improved variety of smooth brome grass especially adapted for growth with alfalfa for alfalfa-grass hay production and as a pasture grass. It has outyielded commercial smooth brome in comparative tests on the University Farm. Over a 3-year period of comparison it produced .35 tons of hay and 93 pounds of seed more per acre per year than commercial smooth brome. Foundation seed of this grass was distributed in 1945 and 1946.

*Bromar* mountain brome is especially adapted to seeding with sweet clover for pasture and soil improvement purposes in the northern part of the state. It is resistant to smut.

*Intermediate* wheat grass is a late maturing grass adapted for seeding with alfalfa for hay production and as a late season pasture grass.

*Beardless Bluebunch* wheat grass is adapted to dry ranges. It is intermediate in maturity, reaching the pasturing stage later in the season than Crested wheat grass. Early pasturing should be avoided where this grass is used in reseeding range lands. (*K. H. Klages*).

## Fertilization of Legumes Has Both Direct and Indirect Effect

Previous tests reported have shown the favorable effects of applications of fertilizers containing sulfur to alfalfa from the standpoint of increased yields and quality of hay produced. Table 2 gives the average annual yields of an alfalfa fertility test extending over a period of 7 years and the yields of winter wheat following the plowing up of the alfalfa. The indicated fertilizer treatments were given to the plots while they were in alfalfa. No fertilizers were added prior to the seeding of wheat. The increases in the wheat yields obtained resulted from treatment applied while the land was in alfalfa. It is interesting to note that the highest wheat yields were obtained on those plots which had previously produced high alfalfa yields, that is on the plots to which sulfur was applied in one form or another while they were in alfalfa. The increased wheat yields can therefore be accounted for by the more vigorous

**Table 2.—Effects of fertilizer additions on the yields of alfalfa and the winter wheat crop following 7-years of alfalfa.**

| Fertilizer applied to alfalfa for 7 years | Alfalfa | | Winter wheat following alfalfa, no fertilizer applied. | |
|---|---|---|---|---|
| Rate given in pounds per acre per year | Ave. yield ton per acre | Increase over checks tons per acre | Yields bu. per acre | Increase over checks bu. per acre |
| 1. Check—No fertilizer applied to alfalfa. | 2.55 | | 44.7 | |
| 2. Treble superphosphate 40 pounds. | 2.97 | 0.42 | 41.1 | –3.7 |
| 3. Gypsum 100 pounds | 4.08 | 1.53 | 58.8 | +14.1 |
| 4. Gypsum 100 pounds, Treble superphosphate 40 pounds. | 4.44 | 1.89 | 61.0 | +16.3 |
| 5. Gypsum 100 pounds. Sulphate of potash 50 pounds. | 4.67 | 2.12 | 58.1 | +13.4 |
| 6. Gypsum 100 pounds Treble superphosphate 40 pounds, Sulfate of potash 50 pounds. | 4.09 | 1.54 | 61.3 | +16.6 |
| 7. Sulfur 18 pounds | 3.83 | 1.28 | 68.5 | +23.8 |
| 8. Sodium nitrate 125 pounds. | 2.61 | 0.06 | 51.9 | + 7.0 |
| 9. Ammonium sulfate 100 pounds. | 4.11 | 1.56 | 68.0 | +23.3 |

(*G. O. Baker*).

growth of the alfalfa plants on the plots where the existing sulfur deficiencies were corrected.

The value of sulfur-containing compounds added to alfalfa in the above experiment can be stated on the basis of increased income resulting from this practice. When the yields of alfalfa for the 7-year period and the yields of wheat for 1 year are evaluated at the rate of $10.00 per ton for the hay, and $1.00 per bushel for the wheat, it is found that the returns above the fertilizer costs for the various treatments containing sulfur ranged from $11.33 to $18.21 per year. For the 8-year period these increases amounted to from $90.62 to $145.72 per acre.

## 2,4-D of Value As a Selective Herbicide and in Preventing Seed Production in Perennial Weeds

Low concentrations of 2,4-D have given good results in the control of some annual and winter-annual weeds in cereal crops. Rates as low as 0.3 and 0.6 pounds per acre on the pure acid basis gave good control of crowfoot (*Ranunculus arvensis*) infestations in winter wheat. In some instances wheat yields were increased as much as 10 bushels per acre as a result of spray applications.

Many tests of the effectiveness of 2,4-D on perennial weeds have been made under both irrigated and dry-land conditions. The results have been variable. However, the different perennial species treated can be classified into 3 groups on the basis of average recovery recorded the spring following treatment. These groups are given in Table 3.

While most of the serious perennial noxious weeds occur in the most resistant group, that is in group showing the highest percent-

**Table 3.—Grouping of perennial weeds on the basis of sprlng recovery following treatment with 2,4-D the previous season.**

| 0-10 percent | 11-20 percent | 21-100 percent |
|---|---|---|
| Plantain | Yarrow | Hedge bindweed |
| Stinging nettle | Perennial ragweed | Field bindweed |
| Dandelion | Perennial sow thistle | Common tansy |
| | Perennial mugwort | Klammath weed |
| | Tall white top | Blue flowering lettuce |
| | | White top (Cardaria spp.) |
| | | Canada thistle |
| | | Wild snapdragon |
| | | Leafy spurge |
| | | Dogbane |
| | | Horsetail |
| | | Russian knapweed |
| | | Perennial groundcherry |

age of recovery, 2,4-D may be used on these weeds for preventing seed production, and as general control measures. The material cannot be recommended as a strict eradication measure for these weeds.

Many annual weeds can be successfully controlled with 2,4-D. Table 4 groups the species tested according to the quantity of pure 2,4-D acid equivalent per acre required to give control. The weeds listed in the most susceptible group can be readily controlled without serious damage to growing cereal crops.

**Table 4.—Amount of 2,4-D acid required per acre for control when weeds are small.**

| 0.5 to 1.0 lb. | 1.5 to 3.0 lb. | Not successfully controlled |
|---|---|---|
| Tumbling mustard | Shepherds purse | Gromwell |
| False flax | Cow cockle | Common chickweed |
| Prickly lettuce | Star thistle | Mouse ear chickweed |
| Fanweed | | Dog fennel |
| Crowfoot | | |
| Cocklebur | | |
| Common mustards | | |
| Treacle mustard | | |
| Tansy mustard | | |
| Russian thistle | | |

*(C. I. Seely, L. C. Erickson.)*

# Horticulture

## Improved Onion Varieties Sought for Idaho

IDAHO is an important producer of both fresh and dehydrated onions. There is need for improvement in varieties for both purposes. To assist in developing or introducing better or more productive kinds, 32 varieties, strains, and hybrids were grown in yield trials at Parma in 1946. Eleven of these were of the Sweet Spanish type, all of which have good yields of 3-inch or larger bulbs. The tests indicated that there may be significant differences in the yielding abilities of different strains of Yellow Sweet Spanish. Bulbs of some of these strains are being selfed for use in a breeding program to obtain improved varieties of Sweet Spanish or to obtain inbreds for producing hybrids. Three white varieties, two of which were obtained from Colorado and one from Utah, showed considerable promise for use in dehydrating. None of these is available for commercial use at the present time, but they will be tested further, and the seed stock will be increased if desirable.

An inbreeding program was begun with several varieties of onions in 1945 and 1946 to determine if selection for high soluble

solids content could be correlated with keeping quality in storage or with a higher yield of dehydrated product. Plants are being grown of the first inbred generation from several bulbs for these tests. The bulbs used for the tests were selected on the basis of soluble solid content as measured by the refractometer.

Trials in 1946 indicated that fertilizer applications to bulb onions have but little if any effect on the final solids content of the bulbs. (*James E. Kraus and D. F. Franklin*).

### Oil Sprays Promising in Onion Weed Control

Herbicidal sprays for weeding of commercial onions have not been widely accepted in Idaho, because the materials used would not eliminate the grasses which constitute a high percentage of the weed population affecting row crops. Stove oil sprays which have been used extensively in eliminating grasses as well as broad-leaved weeds from commercial carrot fields have not been used on onions because they kill the onion plants as well as the weeds.

Since onion seed germinates slowly it often happens that weed plants emerge considerably ahead of the onions. When such weeds are left until the onions are large enough to be "rowed out," they have usually grown such extensive root systems that their removal by hand without injury to the delicate onion seedlings is difficult and expensive.

It now appears probable that stove oil may have possibilities of reducing the weeding costs of onions, *provided it is used before the onion plants emerge above ground.* To determine whether oil sprays used on the onion beds prior to the emergence of the onion seedlings would provide a cheap, efficient, and non-injurious method of dealing with such situations, an experiment was set up at the Parma Branch Station in which different plots of onions infested with a high population of weeds were sprayed with stove oil. Application was at the rate of approximately 50 gallons per acre. The several treatments were as follows: (1) Stove oil applied just after the seed had sprouted; (2) Stove oil applied just prior to the emergence of the "knee" of the onion seedling; and (3) Hand-weeded check plots which were not sprayed.

Results of this experiment are encouraging but not conslusive enough to recommend this type of treatment for commercial use as yet. The sprays killed all weeds that had emerged at the time of treatment and there was very little injury to the onions, although stand of plants was reduced slightly. The spray treatments eliminated the cost of one hand weeding. (*D. F. Franklin*).

### Fall Planting of Carrot Stecklings Not Yet Recommended

Contrary to the indications of early experiments with fall vs. spring planting of carrot roots at the Parma Branch Station, this year's work indicates that the method is not reliable enough to be

recommended, even when modifications suggested by earlier investigations are employed.

In this year's experiment the following treatments were used: (a) Roots planted in the fall in the same fashion as that generally used by the industry for spring planted roots; (b) Roots fall planted in orthodox fashion as in "a", but subsequently covered by a 4-inch ridge of soil by means of a disc hiller, and the ridge maintained throughout the growing season; (c) Roots fall-planted as in "b", but ridge of soil planked off as early as possible the following spring, and (d) Spring planted checks.

With all three methods used on fall-planted roots the results in seed-yield were very unsatisfactory. Yield of seed from spring-planted roots was almost 10 times as great as in any of the fall planted lots. There was a heavy mortality among the roots planted in the fall and only an insignificant loss in the spring planted roots.

These results show that until more effective modifications of fall planting have been developed, carrot roots should be planted only in the spring. (*D. F. Franklin*).

**Production of Vegetable and Flower Seeds in Palouse Area**

The vegetable and flower seed industry is always interested in new areas where high-quality seeds can be grown with minimum cost and with the least amount of loss from diseases. The Palouse area of northern Idaho seems to hold promise for the production of a few such crops. Trials of various vegetables and flowers for seed were conducted at Moscow in 1946. Most of the crops were planted in 5-row plots, 25 to 50 feet in length. In most instances the row spacing was 3 feet.

Low yields were obtained with most of the vegetables. These low yields can, in some instances at least, be attributed to the wide row spacings and to seeding too late. Head lettuce will probably not mature seed here unless it can be seeded as a fall crop. Only 51.7 pounds of leaf lettuce were produced per acre, mainly because only a small percentage of the seeds ripened. It is believed that this vegetable could be grown successfully if seeded earlier and planted at a closer spacing.

Radish produced only 163 pounds of seed per acre with the wide row spacing used. Profitable yields could probably be obtained with a solid seeding as for seed peas.

Yields of 400 to 600 pounds per acre have been obtained with White Portugal onions in this area when grown by the seed-to-seed method. Tests are being conducted to determine if other varieties are hardy enough to be grown by this method. Several hundred yellow Sweet Spanish bulbs are being planted in 1947 and results obtained should definitely indicate the yields that might be expected by this method of seed production in the area.

Lilliput zinnias yielded as high as 325 pounds of seed per acre

on nonirrigated land at Moscow in 1946. If such a yield can be consistently obtained, there are excellent possibilities of growing them here commercially. The curly top disease is not serious in this area, a condition which makes the zinnia a hazardous seed crop in southern Idaho. (*James E. Kraus*).

## Agricultural Engineering

### New Methods and Materials for Farm Structures

THE shortage of building materials, their high price and low quality has prompted research in new materials. One material of promise is sawdust, which used as an aggregate results in a concrete of light weight and insulative value. Previous experiments have indicated that the cost is high because of the large amount of cement required. By replacing part of the cement with diatomite and clay, this research made possible a concrete of light weight, high insulative and fire-resistant properties, and low in cost.

One hundred twenty-six combinations of these materials were made. Tests for compressive strength were made, at 7 and 28 days, and tests for absorption density, tensile strength, and fire resistance were also made. Selected combinations were tested as beams, wall and floor slabs, wallboard and plaster.

Weather data which influences building design and farmstead arrangement were compiled, and charts and maps made. New plans and ideas of design and new methods of construction were collected from many sources. (*W. R. Friberg*).

### Farm Refrigeration Requirements

In connection with the investigation of farm refrigeration requirements, it was found that about one half of the 40,000 lockers available in Idaho are used by farmers.

As the use of farm freezers increases, more of the farm-grown fruits and vegetables will be frozen on the farm. The 25 to 50 cubic foot capacity farm freezer would be satisfactory for most Idaho farms. Some preference is shown for the 75 to 100 cubic foot combination types, and the 200 to 300 cubic foot walk-in freezer. The combination of the farm freezer and a cold room will be popular on Idaho farms. Many variations in design are possible and low operating costs can be obtained by the proper location and the use of adequate insulation.

One of the most popular and economical farm freezer cabinets is the lift-top type ranging in size from 10 to 30 cubic feet and operated with a ¼ to ⅓ horsepower compressor. The operating costs are low, averaging about 600 kilowatts per year based on the record

of a 20 cubic foot ⅓ horsepower experimental unit which has been in operation for the past ten years.

As a result of field studies, plans have been developed for providing 60 cubic feet of frozen storage space at approximately the cost and with the same materials formerly required for a 30 cubic foot frozen storage space in the conventional walk-in cooler. The plan is designed to use fill or rigid board insulation and requires the equivalent of 6 inches of cork board.

There are over 8,000 frozen food locker plants in operation in this country at present. It is estimated that new locker plant construction will continue at a rate of at least 1,200 new plants per year. About 90 percent will be constructed to serve suburban and rural areas. (*Hobart Beresford and J. W. Martin*).

### Irrigation for Northern Idaho

Natural moisture for crop production in northern Idaho is ordinarily exhausted early in July and this climatic feature limits the crop yields and restricts the crops which may be produced. The return from the average farm unit in several of the communities requires additional income from other sources. Supplemental water profitably applied in July and August would benefit this dryland condition.

The Sandpoint Branch Experiment Station, characteristic of much of the northern Idaho farm land, is being studied to determine the feasibility for irrigation. The necessary engineering investigations have been made and the analysis shows sprinkling to be the most desirable method for applying water. The soil characteristics indicate that the intensity of water-application will have to be low. The costs of electrical power and the pumping head at the station are relatively high. (*Max C. Jensen*).

### Mechanization of Sugar Beet Production

The fall of 1946 saw the first attempt at big scale mechanical harvesting of sugar beets in Idaho. The scale of operations were retarded by unavailability of machines. It can be stated that the sugar beet harvester is an accepted piece of machinery. Reports from those who were fortunate enough to obtain machines show: Low cost of operation (about ⅓ of that of hand methods) ; minimum losses due to unharvested marketable beet tissue (the loss under most conditions is no greater than from average hand topping) ; and an acceptable job of topping.

A study of the cost of harvesting and loading sugar beets yielding an average of 15.5 tons per acre by various methods gave the following results: (1) harvesting and loading with machines, $.97 per ton; (2) harvesting with machine and loading by hand, $1.10 per ton; (3) harvesting by hand and loading with machine, $1.67 per ton; and (4) harvesting by hand and loading by hand, $1.80 per ton.

A detailed study was made of the cost of harvesting 34.5 acres of sugar beets by hand methods and machine methods. The result was a total saving of $538.55 in favor of the machine harvester and mechanical loader. (*J. W. Martin*).

### Irrigation Pumping Unit Efficiences Determined

There are approximately 800 electrical pumping units of above 5 horsepower in Idaho. These units consume approximately 75,000,000 kilowatt hours annually at a cost of about $675,000.00. A small increase in average pumping unit efficiency would be a large annual saving.

Laboratory tests were made on a series of irrigation pumps manufactured in Idaho to obtain performance characteristics various speeds and operating heads. Maximum efficiencies ranged from 55 percent to 60 percent. Each pump had a definite limited range of speed and head to obtain operation efficiencies above 50 percent. Efficiencies dropped rapidly with speed and head fluctuations beyond these limits.

From the study it was evident that the following points should be observed for any irrigation pump installation:

1. Analyze, control, and determine the friction losses for the proposed pump installation.
2. Study the factory determined efficiency curves for various pump makes in the size for the job.
3. Select a pumping unit properly engineered for specific job.
4. Select a motor designed for the job load and one which will operate the pump within its efficient speed range.

(*Max C. Jensen, Hobart Beresford*)

## Bacteriology

WORK in bacteriology at the Idaho Agricultural Experiment Station consists of research and service. The research has dealt with problems affecting Idaho soils and Idaho's livestock industry. Service work has consisted of pathological examinations of poultry specimens submitted by Idaho farmers to determine the cause of disease.

### Effect of 2,4-D on Soil Nitrogen-Fixing Bacteria Analyzed

The Department of Bacteriology, with the cooperation of the Department of Agronomy and Agricultural Chemistry, is studying the effect of 2,4-D on the nitrogen-fixing soil bacteria. This herbicide has received a good deal of publicity and has come into general use before experiment stations could check all aspects of its application. The effect of this chemical on the nitrogen-fixing legume bacteria is important because of the common practice of including

a legume in a crop rotation as a means of building up soil nitrogen. Any compound added to the soil that would inhibit the bacteria that work in symbiosis with the legumes to fix atmospheric nitrogen would cancel out the value of legumes as a soil builder in a rotation.

In laboratory studies it has been found that concentrations of 2,4-D above 0.3 percent have a decided inhibitory effect on the legume bacteria. Also the ammonium salt appears to be much more toxic than the sodium salt.

A greenhouse study of the effects of 2,4-D on nodulation of peas, beans, alfalfa and red clover is in progress. This work should shed some light on the advisability of using 2,4-D on legume crops. (*R. E. Carlyle, G. O. Baker, R. S. Snyder*).

### Antibodies in Bovine Brucellosis Vaccination

In bovine brucellosis vaccination the agglutination test is of little or no value in determining the immunity of an animal, in that the agglutination titers usually become negative in a relatively short period of time. It is believed that the concentration of bactericidal substances in the blood (substances which destroy bacteria) may be a better indication of the amount of immunity which an animal possesses toward brucellosis. Work is now in progress to develop a reliable test for demonstrating the presence and the concentration of these bactericidal substances.

A total of 51 heifer calves have been vaccinated with *Brucella abortus* vaccine obtained from several different biological supply houses. Four hundred and twenty-six agglutination tests and 424 bactericidal tests have been run on the sera of these animals to determine the immunity-producing power of these vaccines and to show the relative value of these two tests in demonstrating this immunity. It has been shown that bactericidal substances may be detected in appreciable quantities long after the agglutination test is negative. (*W. B. Ardrey, Guy Anderson, G. C. Holm*).

### Udder Infection Studies Continued

The microorganism most commonly associated with chronic bovine mastitis is *S. agalactiae*. Numerous methods have been developed for the detection of this type of infection in dairy cows. Most tests, however, deal with the examination of milk and are of no value when the animals are not lactating. The development of a suitable blood test would, therefore, greatly simplify the problem of identifying cows infected with *S. agalactiae*.

Previous work at this station has shown that specific agglutinins could not be demonstrated in the blood of infected animals when *S. agalactiae* itself was used as an antigen. However, direct microscopic examination of milk from infected udders sometimes show a considerable number of large rod-shaped organisms in addition to many chains of *S. agalactiae*. These rod-shaped forms do not develop on culture media causing speculation as to their significance.

One explanation is that they are dead variants of *S. agalactiae* and may possess antigenic properties.

Somewhat similar variants of *S. agalactiae* have been produced in the laboratory and factors affecting the formation of variants are being studied. When stable cultures have been obtained the antigenic properties of these organisms will be investigated. (*V. A. Cherrington and G. C. Holm*).

## Agricultural Chemistry

### Analysis of Some Potato Products

THERE is considerable interest in the use of dehydrated cull potatoes or dried potato pulp, from starch or syrup manufacturing plants, as an animal feed. The analysis of these potato products showed that the protein content was low, but that the nitrogen-free extract content was high. Tests are now in progress to determine the value of these potato products as supplements to other feedstuffs. (*A. C. Wiese*).

### Vitamins for the Dairy Calf

Work is in progress on the study of the vitamin requirements of the dairy calf during its first three months of life. The study is being made with the cooperation of the Department of Dairy Husbandry. (*A. C. Wiese and F. C. Fountaine*).

### A New Nutritional Factor for Poultry

In cooperation with the Department of Poultry Husbandry work is in progress in an attempt to isolate a new nutritional factor for poultry. This factor, present in marine and animal products, is required for maximum chick growth and egg hatchability. (*A. C. Wiese, Charlie F. Petersen, and C. E. Lampman*).

### Additions of Nitrogen to Straw Residues Maintains Organic Matter Levels

The use of straw residues has been advocated as a method of erosion control. Such additions result in the withdrawal of available nitrogen from the soil in order to convert the straw into humus. This competition causes lower yields in the succeeding crop. Nitrogen, when added to wheat straw at the rate of 12 pounds of nitrogen (usually as ammonium sulfate) to every 1000 pounds of straw, has resulted in higher yields of wheat and has maintained the organic matter level in the soil over a period of several years. (*R. S. Snyder and G. O. Baker*).

the index for an individual year because the numbers of transfers were inadequate, but the general level shown is reliable.

**Table 5.—Trend indexes of rural land prices in Bonner, Idaho and Twin Falls counties.**

| Year | Bonner County Number of transfers | Bonner County Index* | Idaho County Number of transfers | Idaho County Index* | Twin Falls County Number of transfers | Twin Falls County Index* |
|---|---|---|---|---|---|---|
| 1936 | 29 | 86 | 48 | 88 | 92 | 91 |
| 1937 | 22 | 136 | 40 | 110 | 74 | 98 |
| 1938 | 23 | 112 | 20 | 109 | 58 | 102 |
| 1939 | 24 | 97 | 51 | 94 | 54 | 109 |
| 1940 | 22 | 89 | 35 | 99 | 64 | 100 |
| 1941 | 23 | 116 | 46 | 109 | 109 | 108 |
| 1942 | 55 | 133 | 50 | 122 | 148 | 117 |
| 1943 | 74 | 141 | 84 | 120 | 198 | 143 |
| 1944 | 88 | 159 | 95 | 161 | 191 | 168 |
| 1945 | 68 | 175 | 63 | 201 | 195 | 178 |
| 1946 | | | 91 | 209 | 113 | 200 |

*Based on 1936 to 1940 inclusive equal to 100. The last year shown for each County is subject to future revision because all the transfers had not been recorded at the time of the study.

It is of interest to note that the three areas represented—Bonner, cut-over; Idaho, grain-pea; Twin Falls, irrigated, beans, beets, potatoes and general—showed much the same trends. All the areas appeared due for a slump in land prices at the beginning of the war.

In Twin Falls county, there was an inverse correlation between the price index and the quality of land on the market. For example, the average per-acre assessed values of irrigated land sold during the last 5 years were $51.08 in 1942 and $42.29, $41.94, $41.28 and $40.36 respectively in the following years. This was at a time of price rises. An index based only on the price per acre of land transferred would not show the full extent of price rises. In order to do this, it is necessary to classify the land. Assessed valuations were used for this.

There seems to be a common belief in the irrigated areas of Idaho that buyers of land disregard unpaid water construction debts which are liens against the land. Data from Canyon county refute this and show further that this has an undue influence on the price of land. Indications are that land prices are, generally, discounted to the full extent of the debt. On the Bureau of Reclamation projects where there are no interest charges as such, this is illogical. Although these results seem quite conclusive, they are derived from a limited area and for a short period of time. Further investigations are anticipated. (*Norman Nybroten*).

### Migrant Farm Labor Surveyed

A survey of the movement, earnings, attitudes and general status of migratory farm labor located in the Caldwell and Twin Falls area were made in October 1946. Ninety-two schedules embracing 491 persons were taken. In several of the interviews, more than one family was covered by the replies. In these cases, the group covered was either several individuals or families working as a crew or a group traveling together.

These workers came from 22 states. About one-sixth from Arizona with one-half of them having come from Arizona, Arkansas, Oklahoma and California. There are two rather fixed patterns of migration. In one of these, the people come from the general area of the Ozark Mountains. These are mainly families coming out for the whole summer season and going back in the fall. The other pattern is one between Arizona, California and Idaho. A larger proportion of these are single men working and traveling in crews. Most of them follow certain crops—notably carrots and lettuce.

Most of the workers indicated that they needed more reliable information on crops, wages and housing before entering an area. Many of them migrate without any advance information, others rely on hearsay, while a few have established what they deem reliable sources of information. Those following certain crops had better sources of information. Nearly all paid their own travel and few had advance job arrangements. (*Norman Nybroten, Roland C. Bevan, Royale K. Pierson*).

## Plant Pathology

### Ring Rot Investigations Continued

IT was again shown, as in previous years, that when a seed lot of potatoes contains but a trace of ring rot, the build up of disease in the subsequent crop is such that a grower should not take a chance in planting questionable seed. The rapidity and degree in which the disease occurs in the crop is shown in Table No. 6.

Boiling water and Therapogen, in either a 10 or 15 percent solution, were equally efficient in preventing the spread of ring rot bacteria when applied to a rotating disc cutting knife. Therapogen is a commercial product containing thymol. When the check showed 94 percent disease, boiling water and 10 percent Therapogen applied to the rotating cutting knife reduced the amount of disease to 4 percent. (*J. M. Raeder*).

### Winter Killing of Wheat is Studied

In some non-irrigated districts of the upper Snake River Valley, it has become impossible to grow winter wheat successfully be-

**Table No. 6.—Data showing rates of increase in subsequent crop when seed contains 1, 2, 3, 5, 7, 9, and 10 percent infected seed.**

| Percent diseased tubers in seed | Percent disease in crop |
|---|---|
| 1 | 24 |
| 2 | 18 |
| 3 | 38 |
| 5 | 44 |
| 7 | 50 |
| 9 | 55 |
| 10 | 90 |

cause of the occurrence of what the growers call "winter-killing." Observations disclose the fact that the trouble is not a mechanical killing of the grain by low temperatures, but that at least two pathogenic organisms might be involved. Observations likewise indicate that the two organisms are most active under deep accumulations of snow which has fallen on unfrozen ground.

In preliminary investigations attempts have been made to isolate the organisms involved, study the effects of previous cropping and cultural practices upon the occurrence of the trouble, and make selections for resistance of those plants surviving in exposures where the stand has been so reduced that reseeding was necessary. (*J. M. Raeder*).

### Tomato Improvement Attempted

Ninteen hundred and forty-six was a year of low incident of curly top in southern Idaho and the build up in the plots was relatively late, which did not favor complete elimination of the susceptible plants. Curly top eliminated on the average 88 percent of the commercial tomatoes.

One hundred and sixteen selections of inter-specific crosses of tomatoes and progeny of 131 new crosses were exposed to curly top at Buhl, Idaho. About 12,000 plants in all were planted at Buhl. Of the 116 lines, 45 had less than 50 percent curly top and 12 lines had less than 25 percent of the plants showing curly top. It is significant to note that the progeny with the lowest curly top in 1945 also had the least curly top in 1946. Of the 12 selections with less than 25 percent curly top, 8 were from this line and of the 45 selections having less than 50 percent 23 were also from the line that survived best in 1945. Twenty three of the 27 lines had less than 20 percent curly top.

Since the low natural incidence of curly top in the breeding plots appeared to be the main limiting factor to the success of the breed-

ing work, much of the research time is being spent in a study of methods of completely eliminating the surviving susceptible plants. (*R. D. Watson*).

### Control of Bacterial Blight of Carrots

In 1945 a cooperative control program for carrot blight was undertaken by certain seed companies and the Station in which nearly all the carrot seed planted was treated in hot water at 128° F. for 11-12 minutes. Other practices were followed when possible, such as: growing the stecklings on land new to carrots and isolated from the seed fields, planting roots for the seed crop on land that had not been in carrots for 3 years. In order to evaluate the control measures the carrot fields were examined for blight during the summer.

For a good evaluation, untreated fields should have been planted but this was impractical. Of the 26 fields examined, half had no blight and 11 others had blight present only on occasional flowering heads. The other two fields had 15 and 60 percent of heads infeted. Both of these fields were planted on old carrot ground.

The blight reduced yield and germination of the seed when compared with other fields in the area.

**Table 7.—Effect of bacterial blight on seed germination and yield.**

| Field No. | Percent of heads infected with bacterial blight | Germination | Yield per acre |
|---|---|---|---|
| | (percent) | (percent) | (pounds) |
| 1 | 60 | 69 | 490 |
| 2 | none | 92 | 970 |
| 3 | none | 88 | 930 |
| 4 | none | 85 | 880 |

(*R. W. Watson*).

### Pea Root Rot a Major Disease in Idaho

Peas grown in Idaho are reduced in yield of seed and quality of canning product by root rots. As shown by a disease survey conducted during the summer of 1946, these diseases are common in a large percentage of the fields of the State and in many fields the losses were nearly complete. Pea root rots caused more loss in 1946 to the pea industry in Idaho than did all other diseases of peas. Research into the nature and control of these root rot diseases is being undertaken. (*R. W. Watson.*).

### Bean Improvement Continues to Pay Dividends

Bean improvement plots were again established in the Buhl area where the curly top disease of beans may be expected to be as se-

vere as anywhere in the bean-producing areas of southern Idaho. The plot was bordered with overwintered curly top infected sugar beet crops in an effort to increase the amount of curly top disease in the beans. Susceptible Bountiful, Great Northern U.I. 123 and Idaho Refugee bean varieties were planted at regular intervals throughout the plot to determine the amount of natural curly top infection. Unfortunately, the population of the leafhoppers responsible for spread of the virus causing curly top was one of the lowest known and very little success in eliminating susceptible selections was had. This year Great Northern U.I. 123 averaged 2 percent curly top infected plants, Idaho Refugee 10 percent, and Bountiful 58 percent.

The bean improvement work has also been concerned with obtaining resistance to the virus disease of common bean mosaic in combination with the curly top resistance. Common mosaic is probably the most universal of all diseases of beans. Lately, it has been proven that there is a different strain of the mosaic virus or another mosaic disease which produces symptoms so identical to common bean mosaic that as yet it has been impossible to distinguish between the two on symptoms alone. Fortunately, bean varieties having complete resistance to both mosaic diseases have been used as parent material in crosses several years past and curly top resistant Great Northern strains almost ready for release have been found to have resistance to both mosaic diseases as well. This material was grown in a replicated yield trial in 1946 and will be grown again in 1947. One-year data indicates that two of the resistant Great Northerns will yield nearly the same as Great Northerns U.I. 123 and U.I. 15. (*Leslie L. Dean*).

## Entomology

### Automatic Spraying of Sheep for Tick Control

EXPERIMENTS conducted during 1945 proved that spraying sheep with a DDT water-suspension spray for sheep tick and wood tick control was both practical and economical. Results obtained in 1946 show that even better control can be obtained by spraying the underlines as well as the sides and back of the sheep. In order to speed up the procedure and to make the method more appealing to owners of large range bands, an automatic spray boom was devised. The boom is fitted with 10 nozzles.

A spray containing 8 pounds of 50-percent wettable DDT powder and 100 gallons of water is applied at a pressure of 500 pounds while the sheep pass through the boom. Sheep can be treated at the rate of 60 per minute using this method. The control obtained in field use has been very good. Range ewes came through the winter and entered the lambing sheds in excellent condition and wool from sprayed sheep brought top prices on the market. (*H .C. Manis, W. E. Shull and G. C. Holm*).

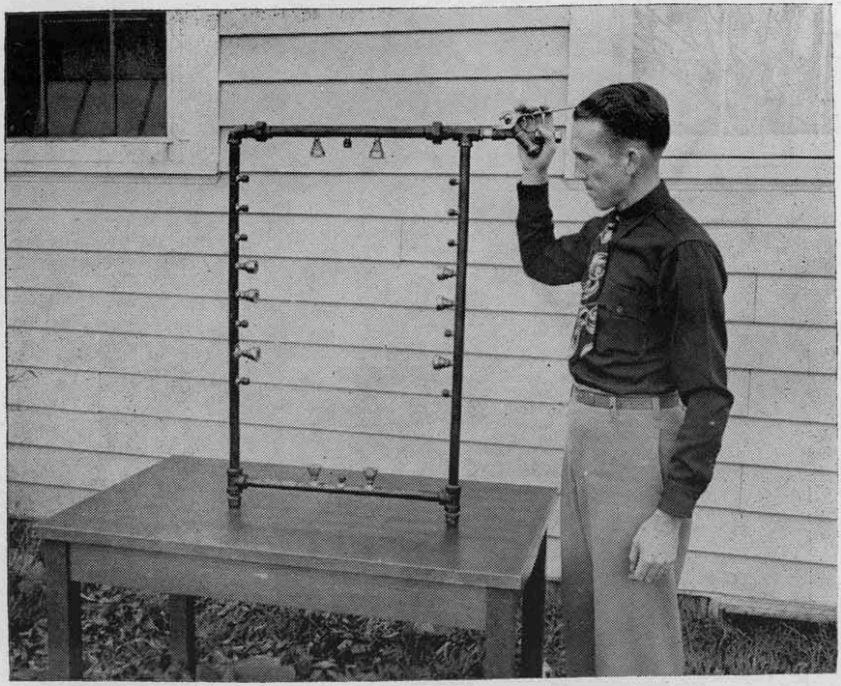

Figure 1.—Spray boom developed for treating large range bands. Nozzles arranged for best spray pattern.

## Insect Control by Aircraft Increased

The application of insecticides by aircraft for the control of insects on vegetable and forage crops has increased in importance in Idaho during the last two years. Field studies were made of this method in the control of legume bugs and alfalfa weevil on alfalfa grown for hay and seed, pea weevil on seed and canning peas, onion thrips on seed onions, and Colorado potato beetle on potatoes. The results of these studies show that very good control of these insects can be obtained by this method of application. The chief advantage of aircraft applications are decreased mechanical damage to crops, faster coverage, and the application of insecticides to such crops as seed onions where the use of ground equipment is impractical. (*H. C. Manis and W. E. Shull*).

## Onion Thrips Controlled

Extensive experiments to obtain further information on onion thrips control were conducted in 1946 at Twin Falls in cooperation with the Bureau of Entomology and Plant Quarantine, U. S. Dedepartment of Agriculture. Tests were conducted with a number of new insecticides and 14 formulations of DDT in an effort to find

the most satisfactory dust or spray formulation for use in controlling thrips under Idaho conditions. Of the materials tested, benzene hexachloride, DDT, tartar emetic and chlordane showed the most promise. These tests also showed that thrips can be successfully controlled on extremely susceptible varieties like Southport Yellow Globe. Marked differences can be seen in the photograph between the untreated and treated plots.

Figure 2.—Center foreground untreated plot. Plot on right treated four times with tartar emetic and plot on left treated four times with DDT emulsoin.

A combination spray of nicotine sulphate and DDT gave an average increase in yield of bulbs of 15,100 pounds per acre over the untreated plots. Gains from using a benzene hexachloride spray averaged 11,200 pounds and a DDT emulsion spray gave an increase of 9,700 pounds. The season's peak population of thrips occurred on July 8 when the infestation averaged 61 thrips per plant.

Field tests of the past two years have shown that practical control of onion thrips on seed onions can be obtained by the application of a 10-percent DDT dust applied at the rate of 25-30 pounds per acre. Two or three applications have resulted in a 25-percent average increase in seed yields. (*J. H. Douglass, F. H. Shirck and H. C. Manis*).

## Control of Clover Seed Caterpillar Promising

The clover seed caterpillar was first observed as a pest of alsike clover in 1929. Since that date it was not serious enough to attract attention until the summer of 1945 when it destroyed an estimated 50 percent of the alsike clover seed fields of Clearwater and Idaho

counties. In the spring of 1946, preliminary control work was started shortly after the adult moths commenced to emerge. Field tests were made using 5 percent DDT, benzene hexachloride containing 1 percent gamma isomer, and 5 percent di(methoxyphenyl) trichloroethane. Dust applications were made on May 8 using the above three insecticides each at the rate of 20 pounds per acre. Perfect control of the adult moths was obtained within 24 hours. Very little control of the larvae was obtained even at the end of 10 days. Because of their habit of feeding almost entirely inside the leaf and flower buds, the larvae apparently did not contact the insecticides sufficiently to cause death. Indications are that control measures will have to be directed at control of the adults before egg laying occurs. (*H. C. Manis and W. E. Shull*).

### Alfalfa Seed Yields Increased by Control of Legume Bugs

Tremendous interest has been aroused among alfalfa seed growers by the results obtained in field tests in the control of legume bugs on seed alfalfa during the last two years. Very promising results were obtained using 5 percent DDT dust applied at the rate of 25-30 pounds per acre. Field tests in the Springfield area, where only one application was made, resulted in seed yield increases of 2-5 bushels per acre. In Jerome county, where three applications were made, seed yields were increased from 2 bushels to 11 bushels per acre. (*H. C. Manis and W. E. Shull*).

### Effectiveness of DDT for Controlling Pea Weevil Confirmed

Investigations on the control of pea weevil were continued in cooperation with the Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture. As a result of these studies, it was established that a 5 percent DDT dust applied at 15 to 20 pounds per acre was equal or superior to dust mixtures containing 0.75 to 1.0 percent of rotenone applied at the same rate. DDT was found to be effective over a period of 4 days and killed pea weevil nearly as rapidly as did rotenone.

Data show that pinhole weevil injury, caused by pea weevil larvae that die soon after penetrating the seed coat, was induced by the rapid maturing and hardening of weevil-infested pea seed. This condition is favored by swathing the pea vines before the pea seeds completely harden. Pea weevil infestations in dry seed peas in Idaho averaged 3.9 percent during 1946, a decrease of 1.1 percent from the 1945 infestation. (*Tom Brindley, F. G. Hinman, R. Schopp, and H. C. Manis*).

# Human Nutrition

### Studies on the Value of Pea Protein are Continued

RESEARCH at the Idaho experiment station has shown that dry peas must be supplemented with methionine when they are used as the only source of protein for growth. In practical nutrition all the amino acids needed to meet protein requirement come from food combination. Therefore, studies using diets adequate in all other respects have been carried on for some time with combinations of cooked peas and other foods such as eggs, milk, the meats and cereal germs, as the source of amino acids, including methionine.

Both wheat germ and corn germ contain protein of high nutritive value and when either is fed as the only source of amino acids permits good growth. If peas are combined with an equal amount of either cereal germ the quality of the mixed protein permits growth which is greatly improved over that from pea protein alone and not greatly altered from that with the germs alone.

The effect of smaller portions of germ supplements for peas have been studied this year. When the proportion of the germ products was one to three parts of peas, the rate of growth was tripled and the efficiency doubled over that of peas alone. Even when the supplement was reduced to one part to seven of peas, growth and protein efficiency was at least doubled. On this lower level of supplementation, there appeared to be a difference between the values of the two germ products studied. The animals receiving the corn germ supplement showed some signs of failure in general well-being, while those receiving the wheat germ were all in good condition at the end of the test period.

Studies are in progress on the value of potatoes as a supplement for pea protein. (*Ella Woods and W. P. Lehrer, Jr*).

### Availability of Some Nutrients in Split Peas Investigated

An investigation of the availability of the thiamine, the iron and the calcium of raw split peas has been carried out. It was found that the thiamine in split peas was utilized for the cure of the nerve symptoms in thiamine deficient rats. Raw split peas promoted hemoglobin formation in rats made anemic by an iron deficient diet and they supplied calcium for bone formation when added to a low-calcium diet. (*Ella Woods and Winifred Bessey*).

### Availability of Protein of Dry Beans Studied

Previous study has shown that the protein of raw beans is not available to rats for tissue building because of their failure to digest it. Work is continuing on a study of this anti-digestion probproblem in the belief that it may have a bearing on the difficulty of digestion of cooked beans in human dietaries often reported. (*Ella Woods*).

# CALDWELL BRANCH STATION

R. F. JOHNSON, *Superintendent*

## Various Rations Tested for Fattening Lambs

TWO comparable lots of white-face feeder lambs with an average initial weight of 72 pounds, were fed the following fattening rations for 133 days: Lot I, 1.1 lb. whole barley and alfalfa hay free choice; Lot II, same as Lot I plus 0.1 lb. cottonseed cake. The average daily gains were .304 and .307 lb. per head daily, respectively for the lambs in Lots 1 and II. The corresponding feed costs per 100 lb. grain were $18.99 and $19.63, which are slightly in favor of the lot not receiving the cottonseed cake supplement. Feed costs were as follows: Chopped alfalfa hay, $23.50 per ton; whole barley $2.50 per cwt.; and cottonseed cake, $3.15 per cwt. The lambs in Lot II sheared 7.43 lb. of wool, which was only a little more than that obtained from those in Lot I. Chemical analysis of the feeds indicated that the ration of alfalfa hay and barley was adequate from the standpoint of protein and phosphorus. There was no advantage from supplementing the alfalfa-barley ration with cottonseed cake.

In a third lot of lambs, 50 percent of the barley was replaced with an equal amount of molasses dried beet pulp. The lambs on alfalfa and barley required 739 lb. of alfalfa and 389 lb. of barley for 100 lb. of gain. Those receiving molasses dried beet pulp as 50 percent of the concentrate made less efficient use of their feed requiring 836 lb. of alfalfa hay and 418 lb. total concentrates per 100 lb. gain. The lambs on alfalfa and barley made an average daily gain of .304 lb. as compared with .288 lb. for the lambs receiving molasses dried beet pulp and barley. The substitution of the beet pulp for half of the barley resulted in a slight increase in consumption of alfalfa hay. These results are in accordance with previous experiments which showed that molasses dried beet pulp was more valuable as a part of the fattening ration when it represented less than 50 percent of the concentrate portion of the ration. (*R. F. Johnson, E. F. Rinehart and C. W. Hickman*).

## Wintering, Pasturing and Finishing Steers

Three comparable lots of Hereford weaner steer calves averaging 500 lb. each, were wintered, pastured and then finished out to 1150 lb. the following winter. All lots were pastured and finished under uniform conditions, but the wintering rations differed as follows: Lot I, chopped alfalfa hay; Lot II, chopped alfalfa hay plus 3.5 lb. of ground oats; Lot III chapped alfalfa hay plus 3.5 lb. ground barley.

The steers were on wintering rations for 124 days and gained

an average of 1.15, 1.60, and 1.66 lb. per head daily in Lots I, II, and III, respectively. The average daily consumption of hay per head was 18.5 lb. in Lot I and somewhat less in Lots II and III. The steers were on irrigated pasture for166 days. Those which had been wintered on hay alone gained an average of 1.56 lb. per head daily on pasture, which was about .29 lb. more than those which had been wintered on hay and grain. The steers which had been wintered on hay alone never quite overcame the disadvantage in weight incurred during the wintering period. At the end of the pasture season this lot averaged 17 lb. lighter than those wintered on hay and oats and 7 lb. less than those whose wintered on hay and barley.

All steers were finished in dry lot on a ration averaging 12.42 lb. chopped alfalfa hay, 9.09 lb. ground barley and 12.59 lb. corn silage. It required 120 days to bring the steers up to 1150 lb. live weight. The average daily gain was 2.18 lb.

Valuing chopped hay at $23.50 per ton, ground barley or oats at $2.65 per cwt., and pasture at 10 cents per head per day, the average of all costs per 100 lb. gain were as follows: Wintering, $17.95; pasturing, $7.37; and finishing, $20.88. (*R. F. Johnson, E. F. Rinehart and C. W. Hickman*).

# ABERDEEN BRANCH STATION

RALPH KNIGHT, *Superintendent*

THE Aberdeen Branch Experiment Station was established as a part irrigated and part dryland station in 1911. At that time the station was composed of 80 acres of land. A total of 167 acres are under state ownership at the present time. The change from a part dryland to an entirely irrigated station was made in 1920 and 1921.

An extensive research program on potatoes has been in progress since 1941. This was made possible by the Idaho State Legislature appropriation. Another special appropriation to the Idaho Crop Pest Control and Research Commission provides for research work on root knot and potato rot nematodes in the potato areas with headquarters at this station.

The Aberdeen Branch Station operates as a branch of the University of Idaho Experiment Station and cooperative work is conducted with the United States Department of Agriculture. The first cooperative agreement was made with the Bureau of Plant Industry at the time the station was founded. The work of the Bureau of Plant Industry is with the Office of Cereal Crops and Diseases and consists principally of breeding, developing, and testing of wheat, oats, and barley.

A cooperative agreement with the Nursery Division of the Soil Conservation Service was signed in 1938. Experimental and observational work with grass and legume forage crops essential to the soil and moisture conservation are conducted under this project. This program fits in favorably with the State Experiment Station work to improve irrigated pastures in Idaho.

In a less formal way, this Branch Station cooperates with the Office of Forage Crops and Diseases.

Irrigation water for the station is obtained from the Aberdeen-Springfield Canal Company, but this supply is supplemented by a well on the station. The well is 222 feet deep, equipped with a 7½ horse power motor and turbine pump that supplies 80 miner's inches of water.

### Certified Seed Stocks Distributed

The Aberdeen Branch Station again took an active part in the program designed to supply growers with clean seed of the leading cereal varieties. Approximately 615 bushels of certified Lemhi wheat, 360 bushels of certified Velon barley, and 300 bushels of certified Overland oats were distributed to farmers and seed concerns for planting in 1946.

In addition, 5400 pounds of Pinto beans, Selection 78, were produced for seed stock. The early maturity of this selection is very valuable in helping to reduce the hazard of damage from an early frost. Its resistance to the old forms of mosaic is an added asset.

Cooperation with other stations in increasing desirable crop varieties for their use is being maintained. This station grew approximately two acres of the Commando peas for the Wisconsin Agricultural Experiment Station; and will harvest several acres of Emerson red clover seed for the Idaho Agricultural Experiment Station. (*R. E. Knight*).

### World Barley Collection Grown at Aberdeen

A collection of barley varieties, selections, and strains, totalling some 4360 in number and presumed to be the largest collection of this type in the world, was grown at the Aberdeen Branch Station this year. While many of the varieties, as such, are of no commercial importance, certain characteristics and qualities which they possess may make some of them of inestimable value in breeding desirable varieties. Under favorable storage conditions, a high percentage of the seeds will remain viable for a number of years; consequently, growing the collection every 5 or 6 years will maintain the seed stocks. (*Harland Stevens and R. E. Knight*).

### Reseeding Trials on Abandoned Dryland

Information relative to the reseeding trials on abandoned dryland was published in Bulletin No. 267 in March, 1946 in coopera-

tion with the Soil Conservation Service, USDA. The conclusions reported in that publication were further substantiated by the 1946 results. Current season data point out the following:

1. Seeding on summerfallow produced higher yields than seedling on duckfooted or unprepared seedbeds even in the seventh season after weeding.
2. Differences in yields as influenced by drill type or unprepared seedbeds are no longer evident in the seventh season.
3. Yields of new or immature stands of grass are influenced more by weather conditions than are the yields of older, well-established stands.

(*R. H. Stark and R. E. Knight*)

### Grass Seed Production

The Soil Conservation Service is increasing seed stocks of beardless wheat grass, mountain brome grass, big blue grass, steambank wheat grass, intermediate wheat grass, sheep fescue, Russian rye grass, Canada rye grass, and Indian rice grass. The Idaho Experiment Station is distributing a part of the seed of the first three as foundation seed stock. Seed of the other species is used for further field trials.

Weeds are an important factor in producing grass seed under irrigation. There is a marked variation among the various grass species in their ability to compete with weeds. Indian rice gives the least competition, while Russian rye grass is high competitive. (*R. H. Stark and R. E. Knight*).

## Potato Rot Nematode

L. W. BOYLE, *In Charge*

### The Potato Rot Nematode, a New Problem

SINCE its discovery near Aberdeen in 1943, the potato rot nematode has been a problem of much concern to the potato growers. This pest is already known to cause serious loss of potato crops in other parts of the world and since the 15 farms near Aberdeen are the only known locations of infestation in the United States, quarantines that deny a market to Idaho potatotoes, have been suggested as an insurance against spread of the pest. To control the spread of infestation and avoid quarantine, a comprehensive program of research and regulatory measures has been carried cooperatively by the Idaho Crop Pest Control and Research Commission; the State Agricultural Experiment Station; the State Department of Agriculture and the U. S. Department of Agriculture, Bureau of Plant Industry, Soils and Agricultural Engineering.

## Preliminary Tests of Control by Soil Fumigants Give Promising Results

The results of tests with soil fumigants to control the potato rot nematode are very encouraging. These data are summarized in Table 8. It will be noted that no infestation was found where W10 was used in large amounts.

**Table 8.—Summarized data from soil fumigation tests for control of potato rot nematode.**

| Soil Fumigant | Rate per-acre | Date applied | Total tubers | Infested tubers | Nemic rating Total | Nemic rating Average |
|---|---|---|---|---|---|---|
| None | | | 21,118 | 857 | 2073 | 2.41 |
| W10 | 20 gal | 10/31/45 | 9,224 | 1 | 1 | — |
| W10 | 20 gal | 10/31/45 | | | | |
| | 50 gal | 4/15/46 | 10,018 | 0 | 0 | 0 |
| W10 | 50 gal | 4/15/46 | 10,085 | 0 | 0 | 0 |
| DD | 50 gal | 4/15/46 | 10,273 | 424 | 872 | 2.05 |
| Mixture 4 parts DD 1 part EDB | 50 gal | 4/15/46 | 4,478 | 3 | 5 | 1.66 |

W10 Dow Chemical Company (Ethylene dibromide)
DD Shell Chemical Company (Dichloroprylene dichloropropane)
EDB Ethylene dibromide

The comparison between W10 and DD is of special interest. According to reports of other research workers, this is the reverse relation to that found in effort to control root knot on potatoes and sugar beet nematode. Compounds containing ethylene dibromide appear far more effective in control of the potato rot nematode.

It is hoped that the control obtained as in these tests will be lasting and repeated applications of large amounts of fumigant will not be required. Several years are yet necessary to test the practical phases of this method for control.

## Tests of Varietal Resistance and of Control by Rotation Continued

Plantings were made to compare the relative resistance of 14 different varieties of potatoes to infestation by the potato rot nematode and to compare the relative effect of fallow and respective crops on the severity of infestation in subsequent potato crops. Data from the current year are considered of no significance in answer to these questions, since the incidence of infestation was very low in the susceptible Russet Burbank variety used to check these plots. Plantings of this variety in 1946 yielded 0.36 percent

infested tubers as compared to 8.48 percent infested tubers in 1945. The severity of infestation on an average tuber was also greater in the 1945 as compared to the 1946 crop.

### No Evidence That Nematode Persists Through Reservoir

Water from the irrigated area about Aberdeen drains into the American Falls Reservoir and over the American Falls dam to more remote areas. Gerald Thorne, Nematologist, Bureau of Plant Industry, Soils and Agricultural Engineering, U.S.D.A. has filtered large samples of water passing over the dam. It is significant that no terrestrial species of nematode have been found in the water passing the dam.

### Survey of the Crop at Harvest and in Storage to Locate Infestations

Intensive survey was made of the Townships 5 and 6, north and south from Aberdeen respectively. Four workers were given special instruction for the job. Working with Harvey Ransom of the Idaho State Department of Agriculture, they made 1407 observations of the crop as it was being dug. Every field was visited frequently. In cases where fields were near to previous recorded centers of infestation, two to four visits were made each day to observe the crop as it was being dug.

In addition to the harvest survey, cellar inspections, and observations of sorting operations have been made by Harvey Ransom through the shipping season. Between the close of harvest and December 31, fifty-two such observations were recorded.

No evidence was found to indicate that the infestation of the potato rot nematode has spread beyond the limits of the area defined by surveys of previous years. During the current season, evidence was found to indicate that overflow from waste ditches carrying water from infested fields, not only is an effective means of transfer of the nematode, but creates a very favorable condition for development of the pest while these spots are standing in forage.

### Regulation and Handling of Infested Crops to Prevent Spread of Pest

Considerable work was accomplished to complete the cellar at Aberdeen and fit it to handle the infested potatoes. The faults in the roof were corrected and a waterproof material added. Bins were constructed for storage. Drainage from the washing equipment was installed. Minor changes were made in the electric and plumbing installations to gain more efficient operation of the equipment.

Potato rot nematode was found in five lots of potatoes from the Aberdeen area in 1946. These five lots will total about 14 carloads.

except for one shipment of about 23.5 tons to a dehydration plant in September, these potatoes were stored at the State cellar built to separate such crops from public storage. Farm Security Administration loans were allowed on the infested lots and they were diverted to feed. Restrictions were made on the place and manner of feeding and handling of the animals to insure against spread of the pest.

## Potato Research

L. W. NIELSEN, *In Charge*

### Delayed Early Irrigations a Factor in the Production of "Bottle-Neck" Tubers

IN two experiments during 1946, water was withheld from rapidly growing plants when tubers were forming and enlarging. It was not applied until the plants turned dark green in color. Subsequent irrigations were made at 7 to 10 day intervals for the remainder of the growing season. In each experiment the artificial drought during early tuber growth significantly increased the yield of "bottle-neck" tubers and reduced the yield of U.S. Number 1 tubers. Withholding one or two early irrigations did not reduce total yield.

An examination of Station records revealed that similar experiments were conducted in 1929, 1930, 1941, and 1944. In all cases those potatoes receiving the first irrigation after tubers started forming produced fewer U.S. Number 1 potatoes; however, the total yield was equal to that of potatoes receiving water prior to tuber formation. In the 1944 experiment, yield of "bottle-neck" tubers was recorded and the longer the first irrigation was withheld (July 31) the greater was the yield of "bottle-neck" tubers. Evidence gained thus far seems to warrant advising potato growers to supply adequate moisture when tubers start forming and to maintain adequate moisture during early tuber growth.

### *Verticillium albo atrum* Caused Much of the Early Dying in 1946

The growing season of 1946 was generally warm, and early dying of potato vines was found July 15 in the vicinity of Aberdeen. Many affected fields were completely dead by the last of August. In contrast, the early growing season of 1945 was cooler than normal. Early dying was first observed August 14 and vines in a relatively few fields were dead before killing frost.

Plants representing all stages of disease development were collect from affected fields in southern and eastern Idaho Isolations were made from the underground stems of 270 plants. *Verticillium albo atrum* grew from 168, or 62 percent, of those plants. *V. albo atrum* grew from a smaller proportion of plants in advanced stages of disease. Numerous and sundry fungi were also recovered.

In 1941, J. E. Kraus of this Station, selected tubers from late maturing, large-vine plants from commercial plantings of the Russet Burbank variety. They were selected for resistance to *Verticillium* wilt (Fusorium wilt). In 1946, three experimental plantings of these selections and some varieties were made at Caldwell, Aberdeen, and Shelley on wilt-infested land. In each case a portion of a field being planted to commercial table stock acreage was used. In all cases, plants from regular Russet Burbank stock were completely dead by time of harvest or killing frost.

Total yields of the selections and varieties at the three locations were not significantly different, even though regular Russet Burbank stock died several weeks prior to harvest or frost. Selections 1 to 4, inclusive, yielded fewer U.S. Number 1 grade tubers at Caldwell and Aberdeen than regular Russet Burbank stock. The heavy cull-out of the Russet selections was due to malformed tubers. The round-white sorts Sebago, Menominee, and Seedling 47105, yielded more tubers of Number 1 grade than any of the Russet Burbank stock. The failure of the varieties and selections to produce a greater total yield, might be explained by the irrigation practices employed. As the regular Russet stock surrounding the experimental plantings died, the growers stopped irrigating. Consequently, the apparently resistant selections and varieties had insufficient water for late growth.

### Withholding Late Summer Irrigations Will Control Pink Rot (Water Rot) of Potato Tubers

Pink Rot of potato tubers caused by *Phytophthora erythroseptica* Pethyb. is frequently found at harvest and in storage in Idaho, and is known locally as water rot. The pathogen appears to be widely distributed in potato soils and to cause disease in soils having high water absorption, and holding capacity associated with soil organic matter.

To test the effect of late irrigations on the development of pink rot, potatoes were grown on new alfalfa land and irrigated at 7 to 10 day intervals. Various plots were irrigated for the last time August 7, 17, 26, and September 13. Plots receiving all irrigations had 2.2 percent of the tubers affected with pink rot. Those receiving the last irrigation August 26 or earlier had only a trace of rot. There was no difference in yield of Number 1's or total yield when the last irrigation was made August 17 or later.

### Fusarium Seedpiece Decay is Widely Distributed in Idaho

The *Fusarium* sp. that caused most of the seedpiece decay in Idaho during 1945 and 1946 was identified by Dr. Otto A. Reinking, New York Agricultural Experiment Station, Geneva, New York as *Fusarium coeruleum* (Lib.) Sacc. This pathogen has been isolated in approximately 80 to 90 percent of the cases where positive identification could be made, and causes a common storage

rot. Infected stored tubers probably produce much of the seedpiece inoculum. A second *Fusarium* sp. has been isolated from 5 to 10 percent of infected seedpieces. Its cultural characters and pathological reaction closely resemble those of *Fusarium sambucinum* Fuck. f6 Wr.

Surveys of southern and eastern Idaho during spring and early summer of 1946 showed that this disease is distributed throughout the major potato growing sections. During one survey through eastern Idaho, 354 seedpieces were dug and examined. On the basis of macroscopic examination, 271 of these had *Fusarium* decay. Isolations were made of 257 seedpieces in all stages of decay, and *Fusarium coeruleum* grew from tissue plantings of 151 of them.

The planting season and early summer of 1946 were very favorable for rapid emergence and early plant growth, and the effects of *Fusarium* seedpiece decay were not so pronounced on the crop. However, it was again demonstrated that the disease reduced the number of hills, plant vigor, and yield. Blackleg was more prevalent in plants growing from sets affected with *Fusarium* decay.

Several tuber and seedpiece treatments were tested for controlling the disease. Mercury compounds were most promising. Semesan Bel used as a seedpiece dip was superior to muratic acid-corrosive sublimate mixture. This latter dip controlled the disease, but adversely affected stand, plant vigor, and yield in a number of cases.

# SANDPOINT BRANCH STATION

RALPH SAMSON, *Superintendent*

### Low Summer Rainfall Hurts Crops

IN spite of a year with above normal precipitation, crops suffered from lack of moisture during July and August. The average annual precipitation at this station is 28.87 inches whereas this past year 34.38 inches fell. During July and August a total of 0.83 hundreds of an inch was recorded, without any appreciable rainfall from June 29 till August 26. As a result of this prolonged dry period, yields of spring grain, potatoes and second cuttings of alfalfa were lowered. This lack of moisture during these two months is a common occurrence in this locality and the value of supplemental irrigation can be appreciated. (*Ralph Samson*).

### Purification of Cereal Varieties Continued

In an attempt to make available to the farmers of this community a source of clean seed, a system of cereal purification is being

continued. The seed from 5 acres of Elgin winter wheat was sold for planting this fall. A supply of Hannchen barley and Premier spring wheat is available for distribution. (*Ralph Samson*).

### Establishing Sweet Clover with Small Grain Companion Crops

To establish a soil-improving crop of sweet clover and obtain a grain crop at the same time has not been satisfactory in this locality. For this reason alternate-row seedings of small grains and sweet clover are being tried. A preliminary seeding of Hannchen barley and sweet clover made this year, gives good promise of success. An excellent stand of sweet clover was obtained. The barley was seeded at the rate of 45 pounds per acre and produced approximately three-fourths of a full stand. The barley yielded 31 bushels per acre. This practice will be continued for further trial using other spring grains as well as barley. (*Ralph Samson*).

### Alternate-Row Seeding of Alfalfa and Grass Attracts Great Interest

The seeding of alternate rows of alfalfa and grass established in the spring of 1945 in cooperation with the Nursery unit of the Soil Conservation Service has attracted much attention. Farmers of the community are thinking more in terms of permanent pastures and burnt-over seedings than brush pasture and naturally want to know more about grass varieties and adaptation. (*Ralph Samson*).

### Fertilizer Trials Featured

In as much as forage crops are of primary importance in this locality, any economical increase in hay production by application of fertilizers is of value. The yields of alfalfa hay obtained this year from a second-year stand clearly indicate material increases can be expected from several different fertilizers. An application of borax, gypsum and treble super phosphate, at a rate of 20-200-150 pounds per acre respectively, produced 4.2 tons of dry hay per acre. The check plots averaged 2.78 tons. The next highest yielders of the treated plots were sodium nitrate plus treble super phosphate at 125-150 pounds per acre, yielding 3.79 tons; manure at 10 tons per acre, yielding 3.75 tons; and borax at 20 pounds, yielding 3.70 tons.

Grain continued to show favorable responses to fertilizers. Twelve fertilized plots averaged 49.2 bushels of Hannchen barley per acre as compared to an average of 40.4 bushels for untreated plots. Manure returned the highest yield with 62.6 bushels; followed by sodium nitrate, treble super phosphate combination with 57.5 bushels; sodium nitrate, muriate of potash with 55.5 bushels; and ammonium sulphate alone with 54.6 bushels. During the dry periods of July and August, the barley showed a pronounced burning on all the plots treated with commercial nitrogen fertilizers.

This burning was not as evident on the manure plot. (*Ralph Samson*).

# HIGH ALTITUDE BRANCH STATION

W. A. Moss, *Superintendent*

### The 1946 Season Average for Cereals But Unfavorable for Alfalfa and Potatoes

THE total rainfall recorded in 1946 amounted to 11.82 inches. Even with precipitation 1.26 inches below the 28-year average, all cereal yields were average. Freezing temperatures in May and low rainfall in June and August resulted in poor yields of alfalfa and potatoes. The five-year average yields of outstanding varieties of alfalfa in tons of hay per acre are Meeker Baltic 2.62, Hardigan 2.60, Ladak 2.50, Hardistan 2.37, and Ranger 2.30. The corresponding yields for these varieties for 1946 were 1.27, 1.28, 1.20, 1.19 and 1.15 tons of hay per acre. (*W. A. Moss*).

### Winter Killing of Wheat Influenced by Many Factors

Winter killing has been an important consideration in the production of winter wheat in the area represented by the High Altitude Branch Station. Some of the factors entering into this important problem are: the variety selected, date of seeding, and the sequence of cropping.

The Turkey types of wheat have shown the highest degree of hardiness. The Wasatch variety has shown itself to be winter hardy and in addition has demonstrated its resistance to the ordinary bunt and dwarf bunt. Both of these smuts are common to the eastern Idaho winter wheat producing areas. Wasatch was again among the highest yielding varieties of winter wheat tested in the 1945-46 season.

Winter wheat seeded in August and early September has generally suffered more from winter injury than wheat seeded after the middle of September.

Observations indicate that winter wheat grown in rotations including either alfalfa or sweet clover is damaged less in winter than wheat grown in a wheat-fallow system. (*W. A. Moss*).

### Moisture Condition Should Determine the Amounts of Sweet Clover to Be Utilized As Green Manure

Sweet clover and sweet clover-grass mixtures were allowed to grow to three different heights in 1945 and the materials produced either removed from the field or utilized for green manure pur-

poses. The plowing was accomplished in two ways, with an ordinary moldboard plow which turns under practically all of the material, and with a modified moldboard plow which leaves most of the plant matter on or near the surface of the soil. Table 9 gives the yields of winter wheat obtained in 1946 on the plots treated in the designated manners.

The fact that 1945, the year in which the sweet clover was produced and utilized, was a high moisture year, 18.52 inches, must be considered in the interpretation of the results given in Table 9. The moisture conditions during the fallow year have an influence on yield for the succeednig crop year. Nevertheless, it is evident from the tabulated data that the winter wheat yields decreased significantly in all instances where the sweet clover and sweet clover-grass mixtures were allowed to develop beyond the 20-22 inch height. An excessive growth of the legume crop removes too much moisture from the soil and the yields of the following winter wheat crops are reduced.

The results given in Table 9 do not show differences in the yields obtained with the two methods of plowing; that is, it made no difference as to whether the crop residues were plowed under or left on the surface of the soil. Likewise, no significant differences were obtained where the sweet clover or sweet clover-grass mixture was removed from the soil or where is was utilized as green manure. Straight sweet clover gave as good results as the sweet clover-grass mixtures in this particular test. Yield data obtained over a period of years show that any soil improvements resulting from the use of sweet clover have been more enduring where the crop was utilized than where it was removed. In former tests the use of sweet clover-grass mixtures has resulted in somewhat higher wheat yields than were obtained from the use of straight sweet clover. (*W. A. Moss and Hugh McKay*).

**Table 9.—Yields of winter wheat following sweet clover and sweet clover-grass mixtures with the crop either removed or utilized for green manure at designated heights and the use of two methods of plowing.**

| | Height of crop in inches in 1945 | Yields in bushels per acre | | | | |
|---|---|---|---|---|---|---|
| | | Sweet Clover | | Sweet clover-grass | | |
| | | Crop removed | Crop utilized | Crop removed | Crop utilized | Av. |
| Moldboard | 12-14 | 29.6 | 29.4 | 28.0 | 29.7 | 29.2 |
| | 20-22 | 28.7 | 29.2 | 28.6 | 27.5 | 28.0 |
| | 34-63 | 24.6 | 27.3 | 23.6 | 27.9 | 25.8 |
| | Average | 27.6 | 28.6 | 26.7 | 28.4 | 27.8 |
| Modified | 12-14 | 30.5 | 28.4 | 29.7 | 28.1 | 29.2 |
| | 20-22 | 26.4 | 30.4 | 28.4 | 31.9 | 29.3 |
| | 34-36 | 24.1 | 21.8 | 24.4 | 22.8 | 23.3 |
| | Average | 27.0 | 26.9 | 27.5 | 27.6 | 27.3 |

**Cereal Varieties Tested and Released**

More Wasatch winter wheat was released this year. Idaed and Lemhi have been high yielding varieties of spring wheat. Both of these are soft white wheats. Komar ,a hard red spring wheat, is especially suitable for reseeding of winter wheat fields in the spring.

Seed from an increase field of Gem barley was released to farmers. This new variety outyielded Trebi, the old standard variety, by 6.6 bushels per acre.

The new Overland variety of oats developed at the Aberdeen Branch Station was increased and seed released to farmers. This variety has produced the same average yield as Bannock, 60.4 bushels per acre over a 3-year period. The short stiff straw of the Overland variety makes it a good oat on lands of high fertility where the taller Bannock is likely to lodge. Overland makes a good oat for combine harvesting. (*W. A. Moss*).

# UNIVERSITY OF IDAHO

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C. F. PARROTT, State Soil Scientist, Soil Conservation Service

**Animal Husbandry**

C. W. HICKMAN, M.S.(Agr.), Head of Dept., and Animal Husbandman
G. C. HOLM, D.V.M., Veterinarian
C. W. HODGSON, Ph.D., Assistant Animal Husbandman
W. P. LEHRER, JR., M.S.(Agr.), Assistant Animal Husbandman

**Bacteriology**

V. A. CHERRINGTON, Ph.D., Head of Dept., and Bacteriologist
W. B. ARDREY, Ph.D., Associate Bacteriologist
R. E. CARLYLE, Ph.D., Assistant Bacteriologist
GUY R. ANDERSON, M.S., Assistant Bacteriologist

**Dairy Husbandry**

D. L. FOURT, M.S., Head of Dept. and Dairy Husbandman
F. C. FOUNTAINE, Ph.D., Associate Dairy Husbandman
JAMES C. BOYD, M.S., Associate Dairy Husbandman
H. C. HANSEN, Ph.D., Assistant Dairy Husbandman

**Entomology**

H. C. MANIS, Ph.D., Head of Dept., and Entomologist
T. A. BRINDLEY, Ph.D., Entomologist, cooperating USDA
F. G. HINMAN, M.S., Associate Entomologist, cooperating USDA
RALPH SCHOPP, M.S., Assistant Entomologist, cooperating USDA

**Home Economics**

ELLA WOODS, Ph.D., Home Economist

**Horticulture**

LEIF VERNER, Ph.D., Head of Dept., and Horticulturist
JAMES E. KRAUS, Ph.D., Associate Horticulturist
LOWELL NEILSEN, Ph.D., Associate Horticulturist, Aberdeen, Idaho
LLOYD COWDEN, B.S., Associate Horticulturist, Special Research Fund
D. F. FRANKLIN, B.S., Assistant Horticulturist and Superintendent, Parma, Idaho.

**Plant Pathology**

C. W. HUNGERFORD, Ph.D., Head of Dept., and Plant Pathologist
J. M. RAEDER, M.S.(Agr.), Associate Plant Pathologist
R. D. WATSON, Ph.D., Associaite Plant Pathologist
LESLIE L. DEAN, M.S.(Agr.), Plant Pathologist in cooperation with Idaho State Pest Control Commission

**Poultry**

C. E. LAMPMAN, B.S., Head of Dept., and Poultry Husbandman
C. F. PETERSEN, M.S.(Agr.), Assistant Poultryman

**Branch Experiment Stations**

R. E. KNIGHT, B.S.(Agr.), Superintendend, Aberdeen Branch Station
L. W. BOYLE, Ph.D., Plant Pathologist, Nematode Control, Plant Pest Research and Control Commission, Aberdeen
ROY JENSEN, B.S.(Agr., Agronomist, Soil Conservation Service, Aberdeen
RUSSELL STARK, M.S.(Agr.), Manager, Aberdeen Nursery Unit, Soil Conservation Service
HARLAND STEVENS, Ph.D., Agronomist, USDA, Bureau of Plant Industry, Aberdeen
R. F. JOHNSON, B.S.(Agr.), Superintendent, Caldwell Branch Station
W. A. MOSS, B.S.(Agr.), Superintendent, High Altitude Branch Station, Tetonia
HUGH McKAY, M.S.(Agr.), Agronomist, Soil Conservation Service, Tetonia
RALPH SAMSON, B.S.(Agr.), Superintendent, Sandpoint Branch Station

# Publications

THE results of investigations by the Station staff are published as bulletins, research bulletins, circulars, and mimeo-leaflets by the University and as research papers by various scientific journals. The list of publications for 1946-47 follows:

## Bulletins

268 Fifty-third Annual Report

## Circulars

111 March of Mechanization of Sugar Beet Production in Idaho—*Hobart Beresford*

112 How to Reseed Abandoned Land for Pasture and Range in Southern Idaho—*R. H. Stark, J. L. Toevs and A. L. Hafenrichter*

## Mimeo-Leaflets

101 Suggestions to Idaho Farmers about the 1946 Income Taxes—*V. D. Kennedy*

102 Trend of Rural Land Prices in Bonner County, Idaho—*Norman Nybroten*

103 Suggestions for Preparing and Shipping Diseased Specimens of Plants—*J. M. Raeder*

104 Earwing Control—*H. Manis*

105 Idaho Suggestions for Use of DDT in Insect Control—*H. Manis*

106 Weed Control in Grains with 2,4-D and Other Selective Sprays—*L. C. Erickson and C. I. Seely*

107 Soils of Idaho—*H. E. Dregne*

## Research Papers

253 The Influence of Temperature on the Curing of Cheddar Cheese—*H. C. Hansen*

254 Rapid Digestion Method for Determination of Calcium—*Olof Stamberg*

255 Composition, Including Thiamin and Riboflavin, of Edible Dry Legumes—*Olof Stamberg and W. P. Lehrer, Jr.*

256 Riboflavin Content of Poultry Feed—*Olof Stamberg, Charlie F. Petersen and C. E. Lampman*

257 Riboflavin Content of Chicken Meats as Effected by Level of Intake—*Olof Stamberg, Charlie F. Petersen, and C. E. Lampman*

258 Effect of Riboflavin Intake on Egg Production and Riboflavin Content of Eggs—*Charlie F. Petersen, C. E. Lampman and Olof Stamberg*

259 Effect of Riboflavin Intake on Hatchability of Eggs from Battery Confined Hens—*Charlie F. Petersen, C. E. Lampman and Olof Stamberg*

260 The Photolysis of Riboflavin in Poultry Feed—*Olof Stamberg and Charlie F. Petersen*

261 Transmission of Peach Wart by Graft Inoculations with Affected Fruit Tissue—*Earle Blodgett*

262 Rusty Spot of Peach—*Earle Blodgett*

263 New Species of the Genus Triozoida (Psyllidae: Homoptera)—*Leonard D. Tuthill*

264 Effect of Alkali Salts on Shape and Appearance of Russet Burbank Potatoes—*Earle Blodgett*

265 The Value of Meat and Peas, Alone or in Combination, as a Source of Protein for Growth—*W. P. Lehrer, Jr., Ella Woods and W. M. Beeson*

266 Peas, Supplemented with Wheat Germ or Corn Germ, as a Source of Protein for Growth—*W. M. Beeson, W. P. Lehrer, Jr., and Ella Woods*

267 Fasiation in Russet Burbank Potatoes—*Earle Blodgett and L. W. Nielsen*

268 Some Effects of Ammonium and Sodium 2,4 Dichlorophenoxyacetatis on Legumes and the *"Rhizobium Bacteria"*—*R. E. Carlyle and John Thorpe*

## HOME STATION DISBURSEMENTS

Detail of Expenditures of State Appropriations[1] and Income Funds
Idaho Agricultural Experiment Station
January 1, 1946 through December 31, 1946

| | Salaries | Help | Expenses and Supplies | Capital Outlay | Total |
|---|---|---|---|---|---|
| Administration | $ .00 | $ 62.40 | $ 238.10 | $ .00 | $ 300.50 |
| Agr. Chemistry | .00 | .00 | 10.85 | .00 | 10.85 |
| Agr. Economics | .00 | .00 | 39.65 | .00 | 39.65 |
| Agr. Engineering | 370.00 | 132.65 | 165.65 | .00 | 668.30 |
| Agronomy | .00 | 2,439.59 | 912.24 | .00 | 3,351.83 |
| Animal Husbandry | 351.52 | 145.00 | 125.05 | .00 | 621.57 |
| Bacteriology | 150.00 | 72.50 | .00 | 120.00 | 342.50 |
| Dairy Husbandry | 358.34 | 108.60 | 2,215.70 | 72.50 | 2,755.14 |
| Entomology | .00 | .00 | 6.50 | .00 | 6.50 |
| Home Economics | .00 | .00 | .00 | .00 | .00 |
| Horticulture | .00 | 2,109.52 | 387.56 | 3,411.86 | 5,908.94 |
| Plant Pathology | .00 | 64.80 | 99.28 | .00 | 164.08 |
| Poultry Husbandry | 431.24 | 806.69 | 1,769.71 | 8.50 | 3,016.14 |
| Soil Survey | 225.00 | 447.20 | 235.67 | .00 | 907.87 |
| Total | $1,886.10 | $6,388.95 | $6,205.96 | $3,612.86 | $18,093.87 |

[1] Includes General Appropriation and Institutional Funds.

## BRANCH STATION DISBURSEMENTS

January 1, 1946 through December 31, 1946

| | Salaries | Irregular Help | Expenses and Supplies | Capital Outlay | Total |
|---|---|---|---|---|---|
| Aberdeen | $ 3,241.69 | $14,338.41 | $ 4,788.66 | $4,557.67 | $26,926.43 |
| Aberdeen Potato Research | 4,486.56 | 1,459.75 | 1,342.04 | 299.76 | 7,588.11 |
| Caldwell | 5,070.42 | 5,703.93 | 6,814.13 | 1,581.85 | 19,170.33 |
| High Altitude | 2,000.04 | 1,033.44 | 1,376.43 | 578.67 | 4,988.58 |
| Sandpoint | 3,875.00 | 608.80 | 741.63 | 1,304.83 | 6,530.26 |
| Total | $18,673.71 | $23,144.33 | $15,062.89 | $8,322.78 | $65,203.71 |

## FINANCIAL STATEMENT

Detail of Expenditures of Federal Appropriations
Idaho Agricultural Experiment Station
July 1, 1945 to June 30, 1946

| | Hatch | Adams | Purnell | Bankhead Jones |
|---|---|---|---|---|
| Personal Services | $ 8,623.93 | $12,197.31 | $51,227.38 | $ 9,950.54 |
| Supplies and Materials | 829.54 | 1,003.94 | 3,991.82 | 3,407.93 |
| Communication Service | 151.91 | 18.90 | 94.23 | 14.87 |
| Travel Expense | 1,722.69 | 420.03 | 2,092.62 | 689.75 |
| Transportation of Things | 12.34 | 12.28 | 78.47 | 4.90 |
| Printing and Duplication or Illustrating Publications | 1,113.85 | .00 | .00 | 236.91 |
| Heat, Light, Water and Power (Services) and Fuel | .00 | 31.50 | 90.88 | 7.30 |
| Repairs | 101.18 | 428.99 | 773.85 | 47.54 |
| Equipment | 2,444.56 | 497.05 | 1,650.75 | 1,045.10 |
| Structures and Nonstructural Improvements | .00 | 390.00 | .00 | .00 |
| Balance Unexpended June 30, 1946 | .00 | .00 | .00 | .00 |
| Total | $15,000.00 | $15,000.00 | $60,000.00 | $15,404.84 |