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Wartime Agricultural Research

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Introduction

C. W. HUNGERFORD, *Vice Director*

AFTER many years of comparative plenty and of developments in agriculture and agricultural science almost beyond belief, we are in the midst of a world war which has upset our general economic structure and brought about additional serious problems for the agricultural industry.

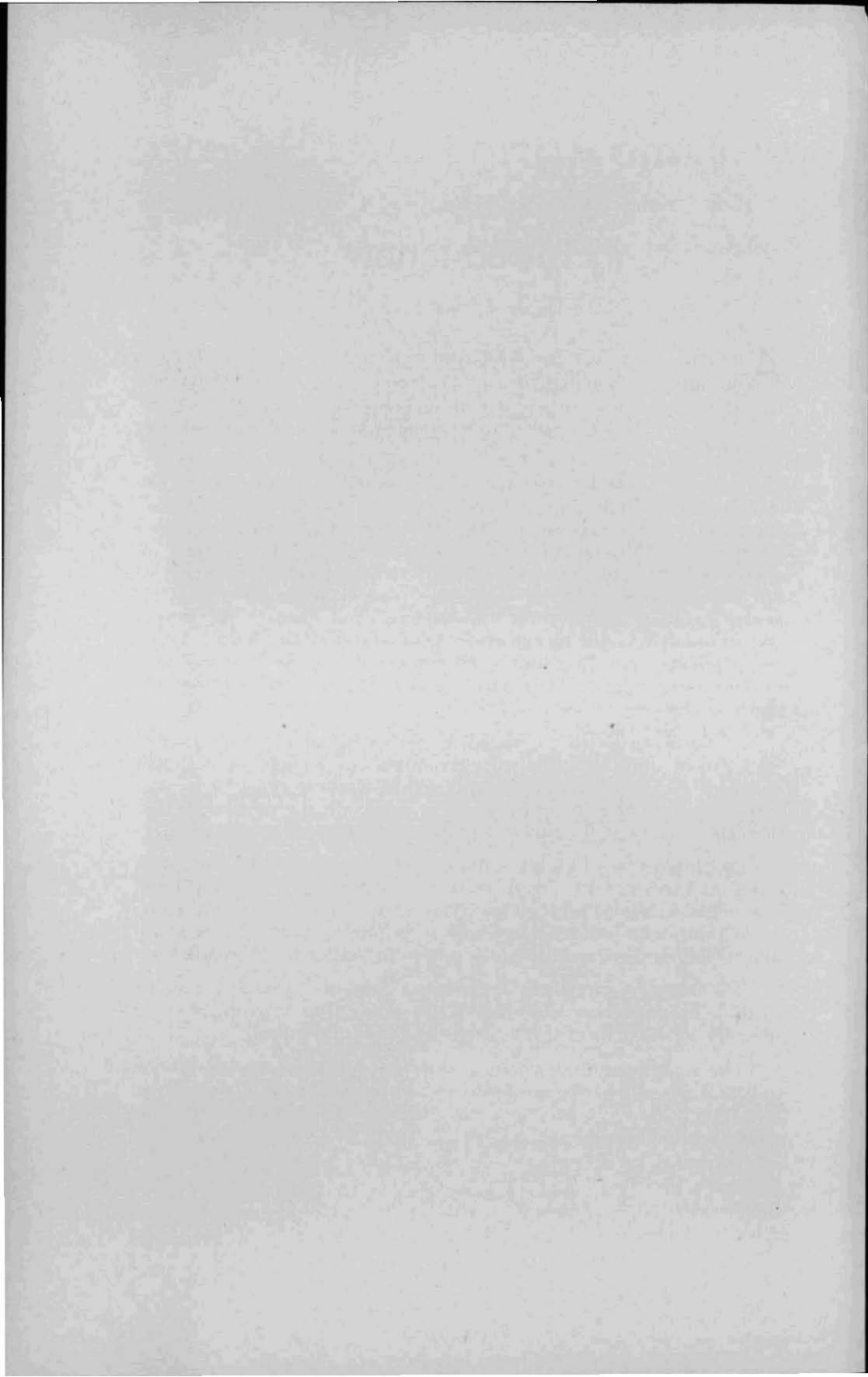
During the last 40 years the population of the United States has increased over 70 percent and yet in this same period the number of farm workers decreased more than 10 percent. This greatly increased production by fewer workers has been due to the development of science and technology in agriculture. It has resulted from better soil management, better crops and livestock through plant and animal breeding, better control of insects, plant diseases and weeds, and from labor-saving machinery. Agricultural science has increased the output per man and improved the quality of the products produced on our farms. These changes are of benefit to both producer and consumer.

It has taken a war to speed up technological development and bring about unity of effort in agricultural production. We should endeavor to apply scientific discoveries in wartime research to post war agricultural needs and also carry over into the postwar period desirable results of the unity of effort made necessary during war.

Developments in science stimulated by the war will be of great value to farmers, but careful research is necessary to apply these new ideas to agricultural uses. Agricultural research must take its place along with industrial research in helping to shape a new world and to help in using available manpower and other facilities wisely.

The Idaho Agricultural Experiment Station is testing a number of these new materials and processes resulting from wartime research in order to adapt them to the needs of Idaho Agriculture.

The reports of the various research departments of the Station follow. These reports are brief and include only those projects in which definite results have been secured which are of potential value to the Idaho farmers.



Wartime Agricultural Research

Beef Cattle, Sheep and Swine and Animal Diseases

Phosphorus Supplements for Steers Compared

DEFLUORINATED rock phosphate prepared at a low temperature (600 degrees centigrade) was found to be unsatisfactory as a phosphorus supplement for steers, because of the low availability of the phosphorus present. A chemical analysis of this product has confirmed our results with steers, indicating that only one-half of the phosphorus present is in the more soluble ortho form.

Six lots of yearling steers were fed as follows for a period of 140 days to compare different sources of phosphorus supplements for fattening steers: Lot I, basal ration (phosphorus deficient) consisting of beet molasses 3.7 lb., alfalfa hay 8.5 lb., and wet beet pulp and salt ad libitum; Lot II, basal ration plus 1/10 pound of bonemeal per steer daily; Lot III, basal ration plus free access to bonemeal; Lot IV, basal ration plus 1/10 pounds of defluorinated rock phosphate per steer daily; Lot V, basal ration plus free access to a mixture of 2 parts of defluorinated rock phosphate and 1 part of salt; and Lot VI, basal ration plus free access to Cudahy's "all-purpose mineral mixture."

It is interesting and significant to report that the steers force fed 1/10 pound of defluorinated phosphate (Lot IV) daily gained only 1.47 pounds per steer daily, while a similar group of steers fed the same amount of bonemeal (Lot II) gained 1.74 pounds per day. The steers in the rock phosphate group showed signs of aphosphorosis as indicated by fence chewing and low blood phosphorus values. Since the phosphorus ingested in the feed was adequate in this lot, it is logical to conclude that defluorinated rock is poorly utilized by the cattle. Steers given free access to a mixture of defluorinated rock phosphate and salt gained 0.94 pound daily, only about half normal, and showed definite signs of phosphorus deficiency. This group of steers exhibited the most depraved appetite of any of the lots. Even though these steers needed a phosphorus supplement, their consumption of defluorinated phosphate was practically nil.

The steers receiving Cudahy's all-purpose mineral mixture (7.0 percent phosphorus) became deficient in phosphorus and gained slowly, only 1.14 pounds daily.

Newer methods are being employed in the processing of rock phosphate which may yield a defluorinated phosphate in a form which is more available to animals. Research is being conducted on the "new process" defluorinated phosphate. (*W. M. Beeson, C. W. Hickman, D. W. Bolin, R. F. Johnson and E. F. Rinehart*).

How Much Phosphorus Does a Ewe Need?

Ewes wintered on alfalfa hay containing 0.16 percent phosphorus lambed and milked normally and gave no indications of a nutritional deficiency either in phosphorus or any other factors. Supplementing the alfalfa hay ration (0.16 percent phosphorus) with steamed bonemeal gave

no beneficial results indicating that a wintering diet containing 0.16 percent phosphorus is adequate for a ewe.

The purpose of this experiment was to study the phosphorus requirement for pregnant ewes. One hundred seventy-five range ewes were bred at random to three purebred Suffolk rams for early shed lambing (February). The ewes were divided into three lots and wintered (started October 25, 1944) on the following rations: Lot I alfalfa hay (0.16 percent phosphorus) and salt; Lot II alfalfa hay (0.16 percent phosphorus), bonemeal and salt; and Lot III alfalfa hay (0.22 percent phosphorus) and salt. After lambing all ewes were fed 1.0 to 1.5 pounds of barley per head daily.

There was no significant difference in the strength or health of lambs from the different lots of ewes and the lambing percentage was respectively 96, 95 and 92 percent. The average birth weights were approximately the same, averaging about 10 pounds per lamb for each lot. On April 4, 1944 the lambs averaged respectively 41, 39 and 42 pounds in the three lots, indicating that the rations for the ewes during the wintering and suckling periods were adequate and that the addition of bonemeal to Lot II did not have any measurable effect on either the ewe or the lamb. At the end of the wintering period the ewe weights were almost identical, ranging from 130 to 133 pounds for averages between the three lots. The average phosphorus intake daily per ewe during the wintering period was, respectively 3.02, 3.69 and 4.02 grams. Since there was no significant differences in the reproductive capacity or milking qualities of the ewes on the various diets, these results point to the fact that a wintering diet containing 0.16 percent phosphorus is adequate for a ewe. (*W. M. Beeson, C. W. Hickman, D. W. Bolin, R. F. Johnson and E. F. Rinehart*).

Cull Peas are an Excellent Hog Feed

Ground cull peas make an excellent protein supplement for fattening hogs in dry lot, if properly balanced with a small amount of meat meal, alfalfa hay and minerals. Here is a formula of a protein-mineral mixture which will balance the grain diet for fattening pigs from weaning to market weight. In one hopper of a self-feeder give the hogs free access to a supplement made up as follows: Meat meal 10 lb., ground cull peas 57 lb., ground alfalfa 25 lb., oyster shell flour 4 lb., steamed bonemeal 2 lb., and salt 2 lb. This mixture will balance any grain such as wheat, barley or corn.

Trials show that pigs are "food wise" enough to balance their rations remarkably well with this program. These pigs made an average daily gain of 1.40 pounds and required 425 pounds of feed to produce 100 pounds of pork. They ate on an average about 1 pound of supplement to 6 pounds of wheat.

Another group of pigs was fed on wheat and a protein-mineral mixture composed of ground peas 67 lb., ground alfalfa 25 lb., oyster shell flour 4 lb., steamed bonemeal 2 lb., and salt 2 lb. Note in particular that no meat meal was fed in this mixture. These hogs gained slowly, only 1.10 pounds daily, were unthrifty, thin and lost considerable hair. This indicates that the protein of peas is not complete, and therefore should be balanced with some animal protein such as meat meal or milk by-products.

Another plan which has given excellent results is to self-feed a mixture of 80 percent wheat and 20 percent peas in one hopper and a protein-mineral mixture consisting of meat meal 50 lb., ground peas 25 lb., ground alfalfa 25 lb., oyster shell 1 lb., and salt 1 lb. in another hopper. This provides a balanced ration whereby hogs can make rapid and efficient gains with a minimum of labor and feed cost.

These studies with hogs corroborate research at this station on feeding peas to rats, showing that peas contain an excellent protein excepting one indispensable amino acid, methionine, which is supplied by milk, egg and meat products. (*W. M. Beeson and C. W. Hickman*).

Selection on Production Records Improves Swine

After 4 years of selection of Poland China hogs on the basis of production records, certain traits seem to be of particular value in improving hogs on a practical basis. Characteristics which show the most promise for improving hogs for both the producer and the consumer are: (1) Number of pigs farrowed, (2) number and weight of pigs at weaning (56 days), (3) days required to reach market weight, (4) feed required to produce a pound of pork, and (5) medium meat type at a weight of 200 to 225 pounds.

Definite progress has been made in improving the type and productivity of the University Poland China herd by selection of breeding sows and boars on production records. Twelve litters of pigs were tested for rate of gain and feed requirement from weaning to market weight. The hogs varied in rate of gain from 1.12 to 1.50 pounds daily and showed a range in feed required per 100 pounds of gain from 352 to 446 pounds. The average feed requirement for all the pigs tested was 392 pounds.

In a free choice method of feeding a protein supplement (meat meal 50 lb., fish meal 25 lb., and linseed meal 25 lb.) to balance a ration of wheat and barley, the hogs consumed on an average 8 pounds of protein supplement to every 100 pounds of grain consumed. These data further substantiate the fact that hogs may be allowed free access to meat meal or any other protein supplement, and they will consume only the amount required to balance their diet. Hogs are "food wise" so let them have free access to protein and minerals to balance their diet.

A moderate degree of inbreeding is being used to intensify desirable factors. (*W. M. Beeson*).

Bovine Mastitis Incidence Low

During the year only five cases of infectious mastitis developed in the University herd. These animals were treated immediately with homogenized sulfanilamide. Two animals required a second series of injections to bring about clinical and bacteriological recovery.

Five animals developed non-infectious mastitis, being treated with homogenized sulfanilamide to keep the udder tissues and secretions bacteriostatic until recovery could take place. Seven cows were treated during the dry period with an aqueous solution of tyrothricin. Only one of these animals developed streptococcal mastitis during the subsequent

lactation. All seven of these animals had harbored *Streptococcus agalactiae* during the previous lactation. Two carrier animals went through their lactations without an acute attack of mastitis. (Glenn C. Holm, D. R. Theophilus and H. C. Hansen).

Swine Brucellosis Vaccination Studies Giving Encouraging Results

Forty-two gilts were vaccinated with *Br. abortus* strain 19 during the year. Blood titre studies gave results similar to those reported last year. (*Idaho Agricultural Experiment Station Bulletin No. 255*).

Two separate series of vaccinated and non-vaccinated gilts were studied during 1944. Each series comprised 6 vaccinated gilts and 3 non-vaccinated controls. The animals in these series were bred to negative boars and as they were safely in pig they were placed in isolation where they were exposed to massive doses of virulent *Br. suis*. All non-vaccinated gilts developed reactions to the blood test in dilutions of 1 to 100 or higher. Only 25 percent of the vaccinated gilts developed reactions as high as 1-50. Thirty-three and one-third percent of the vaccinated gilts aborted. Thirty-three and one-third percent developed an infection of the loin known as spondylitis which is a common lesion of this infection. These same pigs also farrowed pigs that were positive to culture for *Br. suis*. One-third of the control pigs did not abort nor give positive cultures to the infection. Only 1 gilt in a vaccinated group aborted representing approximately 8 percent.

Oral, ophthalmic and vaginal exposures were the methods of challenge employed in the first series. The ophthalmic method proved the most effective method of exposure as judged by symptoms, pathology and serology. Only the ophthalmic challenge was used in the second series. A new group of gilts are undergoing blood titre studies prior to controlled exposure during 1945. Vaccination studies are progressing in a naturally infected herd where non-vaccinated gilts will be maintained as controls. (G. C. Holm, W. B. Ardrey and W. M. Beeson).

Dairy Production and Manufacturing

Proved Sire Program Continued

THE excellent production records and the satisfactory type prevailing in the Holstein-Friesian and Jersey herds of the Idaho Agricultural Experiment Station are results of the long-time use of proved sires. Proved sires have been continuously used for 27 years in the Holstein-Friesian herd and for 12 years in the Jersey herd.

During the Herd Test year of 1944 the average production of the combined Holstein-Friesian and Jersey herds consisting of 36 cows was 11057 pounds of milk and 449 pounds of fat. The Holstein herd of 23 head averaged 492 pounds of fat and the Jersey herd of 14 cows averaged 411 pounds. The herd had an average type classification of approximately "Good Plus".

At the present time 19 of the 27 class production records for Idaho Holsteins are held by cows which have been bred and developed in the

Station herd. The American Jersey Cattle Club for the seventh year awarded the Constructive Breeder's Registry certificate to the Jersey herd. For the fifth year the Holstein-Friesian Association of America awarded the Progressive Breeder's Registry certificate. (*D. R. Theophilus and F. C. Fountaine*).

Influence of Breed, Feed, and Processing on the Riboflavin Content of Milk Determined

In cooperation with the Department of Agricultural Chemistry the riboflavin content of milk produced by two Holstein-Friesian and two Jersey cows was determined over a normal lactation period of approximately 10 months. Samples were taken twice weekly and results showed: (1) Holstein milk contained, on an average, approximately 34 percent less riboflavin than Jersey milk; (2) Holstein cows because of higher milk production produced, on an average, approximately 34 percent more riboflavin per day than the Jersey cows; (3) there was an inverse relation between milk yield per day and the riboflavin content; (4) the riboflavin content of morning, noon, and night milk from the same cows was practically constant although the milk yields varied widely; (5) supplementing a concentrate-dry roughage ration with substantial amounts of sunflower silage increased the riboflavin content of milk 39 percent (within 2 days) and the riboflavin content level was comparatively high for the remaining portion of lactation while the silage was fed; (6) supplementing a concentrate-dry roughage-sunflower silage ration with wheat pasture or sweet clover and wheat pasture caused no significant change in the riboflavin content of milk; (7) stage of lactation, season, pregnancy, and oestrus have no discernible influence on the riboflavin content of milk; (8) colostrum milk contains about three times as much riboflavin as normal milk but loses approximately 30 percent of its riboflavin concentration within 24 hours after parturition of the cow; (9) neither pasteurization, homogenization, or storage for 24 hours at 40° F. in a dark refrigerator decreased the riboflavin content of milk. (*D. R. Theophilus and O. E. Stamberg*).

Ripening Temperatures of Cheddar Cheese Studied

In cooperation with the Department of Agricultural Chemistry cheddar cheese was made from Grade A raw and pasteurized milk. Two 5-pound loaves from each batch were stored at 40°, 50°, and 60° F. for 6 months. One cheese was used for determining flavor, body and texture scores, and moisture content at 6 week intervals for 24 weeks. The second cheese was weighed every 2 weeks for loss in weight during storage. Pasteurization of "A" grade raw milk did not improve the quality of the cheese as judged by flavor, body, and texture scores; nor did it materially lengthen the ripening period.

Ripening at 40° F. did not produce a higher scoring cheese than when ripened at 50° or 60° F. in either pasteurized or raw-milk cheese. There was, however, a correlation between the ripening temperatures and the flavor criticisms. Cheese ripened at 40° F. was most frequently termed flat, slightly bitter, or lacking flavor; cheese ripened at 50° was termed

bitter or high acid; and cheese ripened at 60° F. was criticised as high acid and slightly fruity. The average losses in weight of cheese stored at 40° F. was 4.97 percent; at 50° F., 7.28 percent; and at 60° F., 9.82 percent. (*H. C. Hansen and R. S. Snyder*).

Influence of Washing the Curd on the Ripening of Cheddar Cheese Studied

Studies were made in cooperation with the Department of Agricultural Chemistry on the influence of washing the curd after milling on the time required for ripening. Cheddar cheese was made from split batches of Grade "A" raw and pasteurized milk. The curd from each vat was divided into three portions after milling and treated as follows: one portion was not washed, one portion was washed with 0.5 percent water and one portion was washed with 5.0 percent water (5 pounds H₂O to 100 pounds milk). The cheese was paraffined after drying and stored at 50° F. for curing. The cheese was scored at 2, 4, 7, 10, 14, 18 and 24 weeks for flavor, body, and texture, and chemical analysis. Washing the curd with warm water and allowing it to drain off as rapidly as possible did not materially influence the quality of the cheese as shown by organoleptic tests. The above experiments are being repeated with grade "B" and "C" milk. (*H. C. Hansen and R. S. Snyder*).

Method for Dehydrating Cheese Perfected

In cooperation with the Department of Agricultural Chemistry a simple method of shredding and dehydrating cheddar cheese has been perfected. The cheeses used in these experiments were aged (20 months old) and mild cheddar cheese (4 months old). The aged cheese was dehydrated in 90 minutes and the milk cheddar cheese in 150 minutes. Samples of the above cheese have been held at room temperature for 15 months both in bulk and compressed forms without appreciable loss of their original quality. Blends of the two kinds of cheese have been successfully reprocessed. (*H. C. Hansen and R. S. Snyder*).

Poultry

Quality of Protein Influences Egg Production

THE feeding experiments here reported were conducted for the purpose of securing further information on the relative efficiency of different protein concentrates available in Idaho. Since the beginning of the war emergency period, meat meal produced at several local rendering plants and made largely from whole carcasses, has been generally available throughout the southern part of the State. Neither fish meal nor dried milk was available at the time the experiment was initiated but soybean oil meal was being shipped in from the Middle West.

Some of the major phases of the supplementary protein problem, about which further information was desired, included: (1) a comparison of the two types of meat meals, the rendering plant and packing plant products, with respect to their efficiency for laying hens (chick work pre-

viously reported had demonstrated a higher biological value for the rendering plant product); (2) a comparison of the efficiency of various wartime protein combinations with a more standard type of first-grade mash; (3) a comparison of the efficiency of ground cull peas with soybean oil meal when used in combination with meat meal.

Four lots in duplicate of 70 White Leghorn pullets each, distributed to eliminate the influence of breeding, were used for the different protein combinations listed in the first four groups of Table 1. These laying mashes, which had the following analysis—protein 20 percent, calcium 2.35, and phosphorus 1.15, were fed in combination with a grain mixture at the ratio of approximately equal parts of each. The grain mixture consisted of whole soft white wheat 70, whole oats 15, and rolled barley 15 percent respectively. For groups 5 to 8, four duplicate lots of 33 White Leghorn pullets each were used. They received all-mash diets which analyzed 15.3 percent protein, 1.65 calcium, and 0.84 phosphorus. The proportion of supplementary protein provided by each of the several concentrates is listed in the table for each group.

Table 1.—The comparative efficiency of various proportions of supplementary protein concentrates in laying rations ⁽¹⁾ (October 1, 1943 to August 31, 1944).

Protein Concentrate Group No.	Percent supplementary protein supplied by each concentrate							
	1	2	3	4	5	6	7	8
Meat Meal (RP) ⁽²⁾	Con- trol ⁽⁴⁾				100.00		33.33	33.33
Meat meal (PP) ⁽³⁾		33.33	33.33	16.66		100.00		
Soybean oil meal		66.66	33.33	33.33			66.66	
Ground cull peas			33.33	33.33				66.66
Dried milk				16.66				
Av. % egg prod. in 10 mos.	58.46	53.00	44.86	49.74	57.75	53.89	55.15	52.09
Av. % egg prod. (last 2 mos.)	50.63	43.74	37.27	45.67	49.87	48.72	49.62	40.28
Total eggs (thousands)	24.41	21.77	18.21	20.13	11.28	10.21	10.65	9.99
Av. feed cost (cents per doz. eggs).....	16.66	17.44	19.28	18.52	17.47	17.70	18.37	17.67
Income over feed cost per bird	\$3.31	2.88	2.24	2.56	3.17	2.88	2.87	2.86
Av. cost of mash	3.34	3.20	2.92	3.22	2.95	2.91	2.91	2.73
Av. body weight (lb.)...	4.32	4.26	4.08	4.18	4.23	4.07	4.26	4.18
Av. egg weight (oz. per doz.)	25.00	24.23	23.55	24.21	24.73	24.17	25.13	24.35
Percent mortality	8.57	15.00	17.14	15.00	6.06	12.12	9.09	10.61

⁽¹⁾ In the first 4 groups the laying mash was supplemented with grain at ratio of approximately 50 percent of each; in the last 4 groups an all-mash diet was used.

⁽²⁾ Rendering plant product.

⁽³⁾ Packing plant product.

⁽⁴⁾ Control mash contained the following protein supplements: meat meal (PP) 5 percent, fish meal 3.5 percent, dried milk 3.5 percent, and soybean oil meal 9.5 percent.

The summarized results given in Table 1 constitute an average of the two duplicates on each ration. Inasmuch as there was very close agree-

ment in all the duplicates, the differences are considered as indicating definite relationships.

Reasonably satisfactory egg production was obtained from all lots with the exception of group 3 in which ground peas were used to supply one-third of the supplementary protein in combination with packing plant meat meal and soybean oil meal. Considering that both packing plant meat meal and peas have been found to be deficient in methionine in chick work previously reported, these results are in line with what might be expected. On the basis of total eggs laid, lot 3 produced 25 percent less than the control group, which resulted in a decrease in income over feed cost per bird of \$1.07. However, when ground peas were used in combination with the rendering plant meat meal (group 8) decidedly better results were obtained.

All other combinations of supplementary proteins afforded sufficient egg production to produce profitable income over feed cost. A comparison of the data in the table, however, indicates a definite trend in increased efficiency with better quality proteins such as used in the control mash in group 1, and with rendering plant meat meal supplying 100 percent of the supplementary protein in group 5. The latter group ranked a very close second to the control in egg production, size of egg, and income over feed cost. These two groups also had the lowest mortality.

Packing plant meat meal proved more efficient in promoting egg production than results previously reported on growth response in chicks would indicate. This would suggest that laying hens may utilize this type of protein more efficiently than growing chicks.

The combination of soybean oil meal with either type of meat meal was not efficient as the control ration.

The difference in egg production during the last two months of the period was quite striking, especially in indicating the limitation of the combination of peas and meat meal; the duplicates checked very closely in this respect.

Although the proportion of mash and grain in the first four groups is not indicated in the table, there was a tendency for the birds to consume more mash and less grain when higher levels of soybean oil meal and ground peas were used in the mashes.

Dried milk, introduced to replace half of the meat meal protein, in combination with ground peas (lot 4 compared with lot 3) definitely improved egg production and income per bird over feed cost. (*C. E. Lampman, C. F. Petersen, D. W. Bolin, and O. E. Stamberg.*)

Reasons for Varied Efficiency of Proteins in Chick Rations Studied

Since Alaska peas were found to be deficient in methionine, as indicated by poor growth response in young chicks in work recently reported, further experiments have been conducted to investigate the supplementary value of each of several plant and animal proteins when incorporated with pea meal. Dried milk, casein, and herring fish meal proved to be excellent protein supplements to the pea meal basal. Corn, wheat germ meal, wheat bran, oats, soybean oil meal, dried broccoli, and wheat were fair sources; dehydrated alfalfa and two types of meat meal, rendering plant and pack-

ing plant products, proved to be poor supplements. Methionine added to the pea meal basal plus any of the above supplements resulted in good growth, which indicates that with these rations methionine was the factor largely responsible for the varied efficiency of the proteins in supplementing pea meal.

Other experiments have been in progress in which a cereal basal diet containing corn, wheat, oats, bran, and alfalfa has been used. Normal chick growth was obtained when such a basal was supplemented with sufficient herring fish meal to make the ration contain 14 percent protein; the growth response from the start was equal to or better than that obtained on a regular chick-starter mash in which fish meal, dried milk, and meat meal were incorporated to provide an 18-percent level. Poor growth response was obtained with peas, soybean oil meal, and the two types of meat meal when tested with the cereal basal. The addition of methionine, valine, and tryptophane separately or in combination with these rations did not give normal growth when fed at a sub-optimum protein level.

Further work is in progress to determine what factors are responsible for the efficient growth produced by herring fish meal as compared to other protein concentrates when used with the cereal basal, and why methionine added to protein feeds produce good growth in a pea meal basal but not in a cereal basal. (*C. F. Petersen, D. W. Bolin, C. E. Lampman, and O E Stamberg.*)

Favorable Conditions Promote Low Mortality

Mortality of the Experiment Station flock for the 1943-44 laying year showed a sharp decline over that of the preceding year. Total mortality during the past pullet laying year was 16.1 as compared to 36.5 percent the preceding year. This was due largely to an absence of colds or any serious outbreaks of coccidiosis and a marked decline of the leukosis complex.

Mortality from the leukosis complex was only 3.83 percent of the original number housed; this is 23.7 percent of the total mortality as compared with nearly 50 percent in earlier years. Family difference in susceptibility to this disease continues to be marked. The progeny of one male had a total of 12.2 percent leukosis mortality whereas two males with a total of 139 daughters housed had no leukosis mortality as determined by post-mortem examination. One of these males had 121 daughters on range of which 108 were put in the laying house. None of his progeny died from any cause either on range or in the laying house until they were between 12 and 13 months of age.

The quality of several experimental rations, as measured by egg production, egg size, and body weight, showed a marked effect upon mortality. Those birds on the high quality rations had an average mortality, excluding the leukosis complex, of 6.4 percent while those on the inferior rations had an average mortality of 15 percent. (*C. F. Petersen, C. E. Lampman, and Glenn C. Holm.*)

Field Crops and Soils

Good Crop Yields Despite Low Rainfall

THE 1943-44 crop year (September 1 to August 31) and the 1944 calendar year were exceptionally dry. Recorded precipitation on the University Farm for the crop year was 16.12 inches, 5.57 inches below normal. Precipitation for the calendar year was even lower, 14.13 inches. Only 1911 was drier, 10.98 inches, in the 53-year period for which records are available.

Temperatures for the crop year were above normal during the fall, about normal during the winter, below normal during early spring, fortunately above normal during May, and below normal during the summer months. Temperatures were favorable to the survival of fall sown crops. Conditions favored early seeding of spring crops, and above normal May temperatures resulted in rapid growth. The critical month of June provided more than normal rainfall. This together with the fact that no high temperatures or extreme drying winds were encountered during the summer months enabled crop plants to make full use of the moisture available to them and provides the main reason for the development of an above average crop for the Palouse Area despite the low amounts of moisture received. (*K. H. Klages.*)

Bindweed Reinfestation From Dormant Seed

One of the most frequent causes of failure in the eradication of noxious weeds in areas from which the old plants have been eliminated is reinfestation by viable seed left in the soil. This is particularly the case with bindweed where the amount of dormant seed at maturity is frequently as high as 95 percent.

Sufficient time has now elapsed to give the results of an experiment started in 1937 to determine the rate of disappearance of bindweed seed in the soil. Five hundred bindweed seeds of the 1937 crop were planted in the greenhouse in the fall of that year. Conditions favorable for germination have been maintained since that time. A similar experiment was started in the field on the Genesee weed plots in 1937 with seed occurring naturally in the soil. No seeds were produced on either the field plots or in the greenhouse after the beginning of the study. Figure 1 gives a graphical presentation of seed remaining in the soil at the end of each season for the two tests expressed in percentages of the original numbers. The number of seeds in the soil at the beginning of the field experiment was not determined. For the purpose of this presentation, the number of seeds eliminated during the first year in the field was assumed to be the same as determined in the greenhouse test.

It is evident from Figure 1 that viable seeds of bindweed survive in the soil for a long period of years, thus providing possibilities for the reestablishment of the weed. The rates of survival are remarkably alike for the two sets of data, even though soil, moisture and temperature conditions differed greatly. This indicates that the time factor is of great importance in the germination of bindweed seeds.

General observations indicate that as high as 75 percent of the original seeds in the soil may be unharmed and available for the reinfestations of

areas where established plants are eradicated by chemicals. Continuous cultivation usually requires 3 years to effect eradication; at the end of that time, from 35 to 40 percent of the original seed is still in the soil. Another method of eradicating bindweed is alternating intensive cultivation and cropping. This usually requires 6 years to bring about eradication of the established plants. Even after this length of time, from 10 to 15 percent of the original seed in the soil remains for reinfestation.

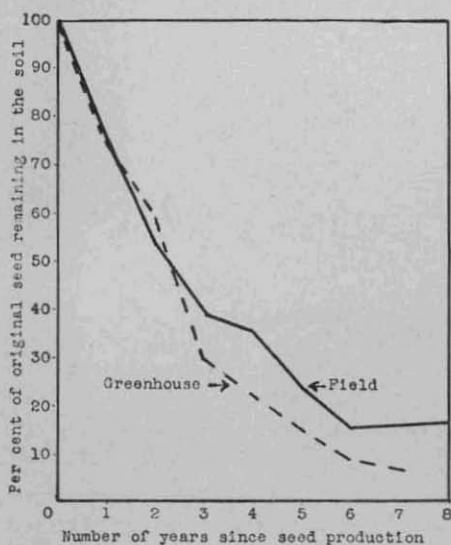


Figure 1.—Rate of disappearance of bindweed seeds from the soil in the field at Genesee and in the greenhouse at Moscow.

The facts brought out above show that seedling control must become a part of any weed eradication program if definite results are to be expected. Seedlings have difficulties in establishing themselves where they are forced to compete with rapidly growing crops such as good stands of winter wheat. They are easily killed by a single cultivation within a month after emergency; however, if the plants are allowed to grow under favorable conditions, they become established as perennials in about 6 weeks. Most of the better crop rotations in general use will, with slight modifications, take care of the seedling problem provided that any surviving plants are spot-treated with chemicals or cultivated whenever they occur. (C. I. Seely and K. H. Klages.)

Idaho Amber, a New Variety of Sorgo Released

The sorgos or sweet sorghums may be grown to advantage to augment forage supplies at low elevations, and in high-temperature areas in south-central and southwestern Idaho, in areas where, or during years when water for irrigation may be low. A new variety, Idaho Amber, sorgo, was released this year. This variety was developed by extensive selection work begun in 1940. Idaho Amber Sorgo has been selected for yield, uniformity, earliness, standing ability, and quality. Quality is evaluated on the basis of leafiness and ability to produce well-filled heads. The stems of Idaho Amber are medium in height, sturdy, resistant to lodging, and leafy. The heads are fairly compact, the seeds are brown in color and large for a sweet sorghum.

The Idaho Amber Sorgo was developed by pedigree selection from a commercial lot of Early Amber. Commercial Early Ambers are characterized by rather tall, slender stems which have a tendency to bend or even to break off at the surface of the soil, thus making it difficult to harvest the crop. This fault has been corrected in the Idaho Amber variety. (K. H. Klages.)

A New Barley Variety Produced by Hybridization

Barley breeding and testing has been one of the major activities of the Idaho cereal breeding program. For the past 8 years, particular attention has been given to a number of promising selections from the cross of Vaughn x Atlas. Over this period of years, the number of selections was reduced from 40 to a single one. This one, unnamed as yet but designated as Idaho 2157 (Vaughn x Atlas Selection No. 35), has made an outstanding yield record in comparison to its parents and to several other commonly grown standard barley varieties.

The comparative performance of Idaho 2157 and 5 other barleys on a yield per acre basis for the period 1937 to 1944 at Moscow is recorded in Table 2. These 6 barleys represent only a small group of the number of varieties tested. The basis of comparison was Trebi, a widely adapted variety known for its high yielding capacity. Idaho 2157 has consistently equalled or outyielded Trebi over the 8-year period. It averaged 22.5 percent higher than Trebi while its two parents, Vaughn and Atlas yielded only 92.8 and 84.7 percent as much as Trebi, respectively.

When compared to Trebi, the new variety is fully 4 days earlier in maturity, is almost identical in plant height, but has a slightly lower test weight. It is a 6-rowed, white-seeded type with a rather short spike of medium density. The awns are semi-smooth, differing from those of Trebi which are decidedly rough and long.

The Idaho 2157 barley will be increased in 1945 to the extent of the Experiment Stations facilities. It will be named and released in the fall of 1946. (*H. K. Schultz*).

Table 2.—Average per acre and comparative yields of barley for Idaho 2157 and five other varieties tested in replicated nursery plots during 1937-1944 at Moscow.

Variety	Bushels per acre by years								Percent of Trebi
	1937	1938	1939	1940	1941	1942	1943	1944	
Trebi	74.8	66.6	51.0	52.3	73.5	67.0	62.2	52.8	100.0
Idaho 2157 (1)	94.0	102.3	90.1	52.5	86.4	73.0	62.3	52.1	122.5
Vaughn	63.2	81.0	54.9	49.1	54.4	57.9	54.4		92.8
Atlas	87.7	64.9	43.2	48.9	49.3	52.2	42.7		86.9
Hannchen	73.3	76.2	49.8	45.4	65.5	50.8	55.2	48.7	93.1
Spartan	68.3	43.2	35.2	47.6	52.5	41.5	40.4	36.9	73.1

(1) Vaughn x Atlas Selection No. 35.

Lime Content of Irrigated Idaho Soils has Increased

In order to have available definite information on the changes in the lime content of certain irrigated soils in southern Idaho, with continued use of these soils, samples of soil were obtained from comparable virgin and cropped areas of Portneuf silt loam. The lime content of these soils at various levels are presented in Table 3.

These preliminary results indicate a pronounced increase in the lime content of the surface soil of the types studied. Since the areas from which the samples were taken were practically level, soil erosion losses did not enter into these determinations. These increases in the lime content

of the upper levels of the soil may be due to lime present in the irrigation water used, or to upward movement from the lower lime layers in these soils incident to the upward movement of soil moisture, or both factors may be active simultaneously. Increases in the lime content of surface soils seem to be related to the development of chlorosis (lack of green color in plants) and certain fertility problems in the soils of southern Idaho. Additional soil samples are being taken throughout the irrigated sections of southern Idaho for further studies. (*G. O. Baker and R. S. Snyder*).

Table 3.—Comparison of the lime content in virgin and cultivated irrigated Portneuf silt loam in southern Idaho.

County	Cropping History	Depth of sample inches	Inorganic carbon expressed as lime, percent	Depth of sample inches	Inorganic carbon expressed as lime, percent	Depth of sample inches	Inorganic carbon expressed as lime, percent
Twin Falls (1)	Virgin soil	0-8	0.2	8-16	5.6	16-24	24.4
	Cultivated 40 years	0-8	4.0	8-16	25.7	16-24	24.0
	Cultivated 17 years	0-8	2.9	8-16	18.7	16-24	27.7
Jerome (1)	Virgin soil	0-8	0.2	8-16	0.0	16-24	19.4
	Cultivated 35 years	0-8	0.9	8-16	9.6	16-24	22.0
	Cultivated 2 years	0-8	0.1	8-16	7.1	16-24	19.6
Bonneville (2)	Virgin	0-6	0.2	6-12	4.0		
	Cultivated	0-6	4.1	6-12	3.8		

(1) Soil samples were taken by soil surveyors of the Soil Conservation Service.

(2) Soil samples were taken by soil surveyors of the Bureau of Plant Industry, United States Department of Agriculture.

Organic Matter Additions Reduce Soil and Water Losses

The effect of organic matter, as supplied by manure, on soil and water losses was studied in co-operation with the Soil Conservation Service over a period of 7 years. These investigations were conducted on the continuous winter wheat plots on Field 1 on the University Farm at Moscow with and without the application of 15 tons of manure per acre every third year. A summary of the data for the period indicated shows that the application of organic matter to Palouse silt loam in the form of manure reduced water losses, measured as runoff, by approximately 50 percent and soil losses by 75 percent. (*G. O. Baker*).

Fruit and Vegetable Crops

Blossom Thinning Sprays Show Promise

HAND thinning of fruit is one of the most expensive operations of the fruit industry. The recent shortage of farm help has made it difficult in many instances to secure the necessary labor for this operation.

Blossom thinning by caustic sprays as a substitute for hand thinning of fruit has shown promise in recent experiments conducted in Idaho. Results secured with peaches, prunes, apricots, and cherries have so far been inconclusive, but with apples satisfactory thinning has been attained in several instances. In a large block of Rome Beauty trees in the vicinity of Emmett, trees sprayed to destroy part of the bloom were more effectively thinned than those thinned by hand following the June drop. Where 1 pint of sodium dinitro cresol (Elgetol 30) was used in 100 gallons of spray the fruit was slightly larger and the yields greater than on hand thinned trees. Where 1½ pints were used per 100 gallons of spray the apples were considerably larger, with a slight reduction in yield over the trees receiving the 1 pint treatment. The cost of the thinning operation was very greatly reduced by use of a blossom spray.

The principle of the blossom thinning spray as applied to apples is to destroy the lateral blossoms of a cluster at a time when most of the central blooms, which open first, have already set fruit and will not be injured. Accurate timing is required in order to affect the most desirable amount of blossom destruction. If the bloom is reasonably heavy and there has been good bee activity so that pollination of the central or "king" blossoms has been assured, the spray should be applied as soon as 90 to 100 percent of the blossoms are open. If weather conditions during the early part of the blossoming period have been unfavorable for bee activity a spray applied at full bloom may thin the crop too heavily. A delay of 1 to 3 days in the application may be necessary under such conditions.

Self-sterile varieties (Delicious, Winesap), trees with a light bloom, and trees of low vigor are more severely thinned by a given concentration of spray than are self-fertile varieties with a heavy bloom and in good vigor. At present there is no way of determining, for all conditions, just when a spray should be applied and what the concentration should be to assure the best results. Until some of these details are worked out, the commercial use of blossom sprays can not safely be recommended. (*Leif Verner and D. F. Franklin*).

Planting Carrot Stecklings Directly Out of Storage Increases Seed Yields

That it is highly desirable to plant carrot roots for seed production immediately following removal from storage is indicated by studies of various root handling methods undertaken at the Parma Branch Station in 1944.

This observation is believed to be important because it is the practice of many producers to remove roots from storage in burlap bags and distribute them along the ends of the field to be planted, there either to await a "curing" process prior to planting, or a convenient planting date.

Instances have been noted where roots were held in the field in this manner as much as 2 weeks after removal from storage, during which time they were exposed to the excessively drying effect of wind and temperature which often attends March and April in the districts where carrot seed is grown.

To test the effect of such treatment on stands and yields, three lots of roots were taken from the storage and planted at varying intervals of time after removal: (a) roots removed 7 days prior to planting, stored in burlap bags in an open shed, (b) roots removed 3 days prior to planting and stored in a like manner, and (c) roots planted directly upon removal from the storage cellar. All roots were planted March 23, 1944.

The effects of these treatments on stands are shown in Table 4.

Table 4.—Percent stands resulting from carrot roots subjected to various time intervals between removal from storage and planting. Parma Station, 1944.

Treatment	Percent stand per plot			Average stand percent
	Replications			
	1	2	3	
Roots 7 days out of storage before planting	44.4	48.1	48.1	46.9
Roots 3 days out of storage before planting	88.8	92.6	85.0	88.1
Roots planted directly out of storage	81.5	77.7	85.0	81.4

The effects of these treatments on yields are represented in Table 5.

Table 5.—Carrot seed yields, pounds per acre, from roots subjected to various time intervals between removal from storage and planting. Parma Station, 1944.

Treatment	Seed yields, lb. per acre			Average yield, lb. per acre
	Replications			
	1	2	3	
Roots 7 days out of storage before planting	477.6	485.8	524.1	495.8
Roots 3 days out of storage before planting	1104.2	778.8	674.1	852.4
Roots planted directly out of storage	798.9	968.8	1066.5	944.7

Although the results presented above indicate that the yields were higher from roots planted immediately than from those planted after the 3-day treatment, it is unlikely that these small differences are significant, especially in view of the fact the stands of plants actually were greater following a 3-day treatment.

The differences in both stands and yields between roots planted directly out of storage and roots subjected to the 7-day treatment, however, are especially worthy of note. Furthermore, it should be pointed out that under some circumstances of weather it could easily happen that the roots would desiccate nearly as much in 3 days as in 7. Planting immediately upon removal from storage is therefore deemed the ideal treatment. (*D. F. Franklin*).

Grape Varieties Show Promise in Idaho

Grapes should be far more generally grown in Idaho, especially for home use. Variety trials conducted since 1937 have revealed the superior qualities of several varieties for both northern and southern conditions in this state. Of 17 varieties tested at Moscow, the most satisfactory have been Alpha and Beta (blue grapes good for juice and jelly but not for eating fresh); Seneca, Ontario, and Portland, which are white varieties suitable primarily for fresh use; and Fredonia, a large, deep blue grape that is adapted to all purposes. Concord, an all-purpose variety, and Niagara and Lucille, dessert varieties, also have attained good yields and high quality at Moscow, but may not ripen fully in years when autumn temperatures are lower than average.

At the Parma Branch Station, in the southern part of the state where grapes are grown under irrigation, 23 varieties have been tested. Of these, Lucille, a deep red table grape, and Sheridan, a blue, all-purpose variety, have been outstanding both in yields and quality. Both are late varieties but ripen readily in that part of Idaho. Of the white varieties, Portland, Niagara, and Golden Muscat have proved excellent. Portland is an early variety, and Niagara a late variety, of the American or "slip-skin" type of grape, while Golden Muscat is a firm-fleshed variety of the European or "California" type of grape. Of the deep blue, general-purpose varieties, Fredonia and Concord also have been highly satisfactory. The variety Champion has been found distinctly inferior both at Moscow and at Parma, as have all of the Munson hybrids tested, including Cloeta, Fern Munson, Edna, Margurite, and Delicatessen.

Many areas in Idaho having a growing season that is shorter and cooler than that at Moscow probably can grow a few of these varieties of grapes successfully. Alpha and Beta are most likely to prove satisfactory in such areas. (*Leif Verner and D. F. Franklin*).

Onion Bulbs Set Upright Produce More Seed

Experiments in 1943 with spring planted onion bulbs at the Parma Branch Station indicated that it is highly economical to set the bulbs upright instead of strewing them at random in the furrow without regard for the positions assumed by the growing points. Similar experiments conducted with bulbs planted in the fall of 1943 for 1944 onion seed production indicate that setting the bulbs upright before covering is just as desirable in the case of fall planted bulbs as with spring planted ones.

In the experiment with fall planting, field run bulbs (varying from 1½ to 3 inches in diameter) of the Brigham Yellow Globe variety were planted October 6, 1943, at equal rates with the following treatments; (a) bulbs set upright in the furrows; (b) bulbs strewed in the furrow without regard for the position of the growing points; and (c) bulbs set upside down in the furrow, representing the extreme that may be expected in the random type of planting. Three replications were provided for each treatment.

Data recorded at harvest time showed not only that average seed yields were 40 percent more where bulbs were set up than where random planting was used, but also that there was an average increase of 25 percent

in the number of seedstalks. In the case of the bulbs planted upside down, virtual crop failure resulted. Statistical analysis reveals these figures to be significant.

These studies indicate that although the setting up operation creates an additional cost of \$25 to \$35 per acre, the increased yields which result will return a substantial profit for the additional investment. (*D. F. Franklin*).

Agricultural Engineering

Labor-Saving Equipment

STUDIES of combinations of machinery and labor for reducing man hours required for harvesting Idaho's crops were continued in 1944. Plans were developed for combination buck rakes and manure loaders. Field operations for haying and for harvesting potatoes and sugar beets with farm-made equipment showed much progress. Tractor and truck-powered mowers, buck rakes, and stackers contributed the most saving of time in haying operations. The combination buck-stacker showed the greatest reduction in labor, while the tractor powered-push-type rake handled the most hay per machine unit with a maximum of 1,000 tons per season. The range of pick-up bailer applications was 600 to 800 tons per season, and the combination buck-stackers handled from 500 to 700 tons of hay per machine unit. Field choppers and yard chopping continue to meet favor with dairy farmers but showed a relatively high investment for the amount of time and labor required. (*Hobart Beresford and Kenneth R. Frost*).

Farm Freezers

Future farm refrigeration requirements will be met by three general types of units as disclosed by a study of the requirements on 2,000 Idaho farms. About one-fourth are interested in frozen storage with a combination walk-in cold storage and freezer compartment in sizes ranging from 75 to 300 cubic feet, with a cost varying from \$400 to \$800 per unit. The remaining three-fourths are about equally divided among the 8 to 12 cubic foot reach-in freezers, the 20 to 30 cubic foot lift-top cabinets, and the reach-in units with 35 to 75 cubic foot capacity.

One percent of the farms reporting now have frozen storage facilities on the farm. About 85 percent of the farmers interested in frozen storage for the future, now use locker plant facilities, available in the 130 plants located throughout the state, and would plan to continue the use of this service which may include butchering, packaging, and use of the quick-freezing unit. The home grown fruits and vegetables will be processed and frozen on the farm. The possibilities of utilizing frozen cooked foods, including pastries, as well as meats and soup stocks are of increasing interest especially during harvest season when a peak load occurs in the farm kitchen as well as in the field. (*Hobart Beresford*).

Sugar Beet Harvesting

About fifty commercial and experimental beet harvesters were operated in Idaho for the 1944 season. Considerable variations in the operating

efficiency of machines of the same type were observed. Lack of trained machine operators and a wide variation in weeds, soil moisture, and crop conditions contributed to the difficulty of mechanized harvesting. The windrow loaders appeared to have reached a state of satisfactory development. Under field conditions good results were obtained with a loader handling the beets for two mechanical harvesters. These loaders have a capacity for handling about a ton of beets per minute which equals the harvesting capacity of 6 to 8 single-row machines. It is impossible to make a satisfactory field application of a loader to more than 2 or 3 harvesters.

Experimental beet harvesters were operated by various manufacturers and by the Agricultural Experiment Station, including a new design for a 2-row rotary disc topper. (*Hobart Beresford and Kenneth R. Frost*).

Irrigation

More effective control of water distribution on the farm has been obtained through the use of siphon tubes and the use of timing devices on head gates for automatic control. Field observations of clock-controlled canvas dams show a reduction in the man hours required to set runs and such control proved especially desirable when rotation of delivery came at night or early morning.

Irrigation pumping plants have been studied for operating characteristics and efficiencies. Laboratory tests were made on pumps ranging from 150 to 3,000 gallons per minute, and operating at heads varying from 5 to 70 feet with power requirement varying from 2 to 40 horsepower. (*Hobart Beresford and Kenneth R. Frost*).

Rural Electrification

In connection with the postwar planning committee and the Agricultural Experiment Station work, data were obtained on the potential needs for rural electrification development in Idaho. Lack of materials and labor for 1944 have resulted in the connection of only the farms which could show essential production possibilities. The potential rural electrification development within the state is about equally divided between the areas served by the government-financed REA lines and the areas under the franchise of the private power companies. It is estimated that of the total farms and rural non-farm establishments not receiving electric service (17,047), one-half will be within the possible reach of central station electric service in the postwar period. The other one-half which represents only 10 percent of the state total will probably not be electrified until a more economical method of distribution is developed. (*Hobart Beresford*).

Potato Harvesting

Motion pictures were used for obtaining records of field operations of equipment and handling of potatoes during harvest. A number of new potato combines were used including 2- and 4-row machines. Methods of removing dirt and vines by means of fingered chains and rubber rolls were found to work satisfactorily on some of the machines. Brushes and air blasts also were used for the removal of dirt and vines.

A single-row potato combine was found to save the labor of 7 to 8 pickers, and the 2-row machine replaced 10 to 12 men. The 4-row combines are adapted to seed potato harvesting but are not suited to operation in the small irrigated fields.

A labor-saving idea for potato harvesting consisted of a platform on a hanging-type bracket for the hauling truck which permitted the loaders to ride in the field and to pick up the sacks without leaving the platform. The plans of labor-saving potato equipment printed for free distribution include the trailer picker, bulk piler, bag piler, power seed cutter, and a hand seed cutter. (*Hobart Beresford*).

Bacteriology

Factors Affecting the Growth of Alfalfa Studied

GREENHOUSE studies designed to determine the factors responsible for reduced yields on so-called "alfalfa sick soils" have been carried out. It is believed by some investigators that these factors in certain instances are biological in nature. For the investigation samples of Portneuf silt loam and Declo loam from old alfalfa fields were selected and collected by Dr. H. W. E. Larson. The influence of sterilization, inoculation, and various fertilizer combinations on the growth and nodulation of alfalfa was studied. For control purposes tomatoes were grown in the same soil treated with various fertilizers.

The results of repeated experiments showed that inoculation of either sterilized or unsterilized soil with known efficient cultures of nodule bacteria did not significantly increase the yield of alfalfa. Likewise the soil did not respond to additions of nitrogen, potassium, or trace elements. The application of phosphorus (500 lbs. 0 - 30 - 0), however, increased the yield on the Declo soil by 50 percent and on the Portneuf soil by nearly 100 percent. Tomato plants showed an 1100 percent increase in growth in the Portneuf soil receiving phosphorus. Even virgin Portneuf soil responded to phosphorus applications. These studies indicate that fertility and not bacteriological factors are responsible for the reduced yields of alfalfa on the soils investigated. It should be pointed out, however, that although inoculation did not increase the growth of alfalfa it did substantially increase the protein content, namely, from 1.3 to 3.5 percent. This fact alone is sufficient justification for inoculating new alfalfa seedings.

A study of the influence of environmental factors on the growth and nodulation of alfalfa showed that periodic drying of the soil considerably decreased growth, retarded nodule formation, and caused some of the nodules already present to die and disintegrate. Frequent clipping had a similar effect upon the nodules. Flooding of the soil at regular intervals increased nodule formation and decreased growth of the young plants slightly, but did not affect the growth of the older plants. Continuous flooding killed the plants completely. (*James P. Martin and W. V. Halversen*).

Microbes and Organic Residues Improve Soil Structure

Organic residues when added to the soil increase aggregation and thereby make the soil more resistant to erosion. The process of microbial decomposition of organic materials is to a great extent responsible for the improvement in structure. Studies designed to determine the influence of various complex organic materials on the aggregation of Declo loam collected near Aberdeen indicated that legume-grass hay tops and legume-grass hay roots are more effective than other organic materials in increasing soil aggregation. Alfalfa, wheat straw, and blood meal are slightly less beneficial. Manure and sawdust are least effective.

Pure cultures of microorganisms were found to vary in their aggregating effect. A *Bacillus subtilis* species isolated from a southern Idaho soil was found to synthesize a polysaccharide which was very effective in bringing about increased aggregation. Polysaccharides were produced from several soil bacteria and were found to be exceedingly active soil-aggregating substances. Inasmuch as a considerable portion of the soil humus is in the form of polysaccharides it is very likely that these substances play an important role in soil aggregation. (*James P. Martin*).

Vaccination in the Control of Avian Leukosis Studied

A vaccine was prepared from the tissues of birds infected with avian leukosis and was used in the vaccination of chicks to determine its immunizing properties. The chicks were divided into groups, some of which received virus and vaccine, some virus only, and some which were left as controls with no treatment. These birds will be carried for a period of 14 months and post mortem, hematological and histo-pathological studies will be made on all birds that die during this period. Those which survive the period will be destroyed and studied. To date there has not been enough mortality from leukosis to draw any significant conclusions as to the possible value of this type of prevention. (*W. B. Ardrey, Glenn C. Holm and C. W. Petersen*).

Agricultural Chemistry

Survey of Vitamin A and Carotene of Idaho Butter Completed

A YEAR'S survey of the vitamin A and carotene content of Idaho butter has been completed. Samples were obtained semi-monthly from six creameries in different regions of the state. The average results showed that the vitamin A and carotene contents were lowest during the months of November to March inclusive. During these months the vitamin A content varied from about 5.5 to 4.9 ug/g and the carotene content from about 6.4 to 3.8 ug/g. In April the vitamin A content began to increase to reach a maximum during July, August, and September, with about 6.4 to 6.7 ug/g. The carotene content increased rapidly during the spring to reach a maximum in June of 9.1 ug/g followed by a decrease to 7.1 ug/g in August when the carotene content again began to increase to reach 8.0 ug/g in October.

The variation in vitamin A content throughout the year was only 1.8 ug/g as compared to a variation in carotene of 5.3 ug/g. (*Olof E. Stamberg, D. W. Bolin, D. R. Theophilus, H. C. Hansen*).

Riboflavin in Milk Destroyed by Light

In cooperation with the Department of Dairy Husbandry, a study has been made on the destruction of riboflavin, or vitamin B₂, by light. Milk should at all times be protected from strong light and particularly direct sunlight. Milk exposed in clear glass quart bottles to sunlight loses as much as 40 percent of riboflavin in 2 hours. Milk similarly exposed in brown glass or paper bottles retains practically all of this vitamin. Several brands of quart paper bottles gave good protection but some variations were observed with different brands.

Temperature of the milk is an important factor and the photolysis of riboflavin is much greater the higher the temperature. The rate of loss is about the same in raw and pasteurized milk, but slightly less in homogenized milk. Milk stored in the dark at 42° F. retained all of its riboflavin for several days. (*Olof E. Stamberg and D. R. Theophilus*).

Rose Hips High in Vitamin C

Wild roses grow abundantly in Idaho and particularly along highways and ditches. The fruits formed after flowering are generally called rose hips. Studies have been made showing that rose hips picked in September and October contain from 900 to 1400 milligrams of vitamin C per 100 grams. Two species of rose hips were studied at different stages of maturity. Purees made from rose hips are high in vitamin C and can be used for jams or to increase the vitamin C content of other fruit juices. Practically all vitamin C was lost by dehydration in a home type dehydrator. Freshly picked rose hips which are immediately packed in mason jars and stored in a cold storage will retain their vitamin C content for many months. (*Olof E. Stamberg*).

Riboflavin and Thiamin in Eggs Investigated

Hens were fed a constant diet for about a month after which eggs from each hen were collected and analyzed for riboflavin and thiamin contents using the eggs raw, fried, poached, boiled and scrambled to determine the loss in cooking. Results thus far obtained indicate about 8 percent loss of riboflavin and about 15 percent loss of thiamin as averages of the four methods of cooking. Variations in loss by the four methods of cooking were not great. (*Olof E. Stamberg and Charlie F. Petersen*).

Studies Made in Ripening of Cheddar Cheese

Chemical studies have been made when cheddar cheese curd is washed after milling on the effect of time required for ripening. Moisture, pH, titratable acidity, protein and various soluble nitrogen fractions were determined after intervals of 2, 4, 7, 10, 14, 18, and 24 weeks of storage. Washing the curd slightly lowered the acidity and increased somewhat the soluble nitrogen fractions of the cheese. Moisture content was not effected. In general, very little differences were observed in all analyses during the

24 weeks of ripening. Studies on this problem are being continued. (*R. S. Snyder and H. C. Hansen*).

Vitamins in Dried Alaska Field Peas Reported

Thiamin, niacin, and riboflavin analyses have been made on raw and cooked Alaska field peas. The approximate content of the raw dried peas was 8 ug/g of thiamin, 30 ug/g of niacin, and 2.3 ug/g of riboflavin. In the processes of soaking and cooking there was about a 15 percent loss in thiamin and riboflavin and only a very slight loss of niacin. (*D. W. Bolin, Ella Woods and Olof E. Stamberg*).

Quality of Crop Improved with Phosphate Fertilizer

The need for heavier rates of application of phosphate fertilizer, particularly on high lime soils of southern Idaho, is becoming more evident each year. Various farming practices have reduced the available phosphorus in the soil to such a point that not only the yield but the quality of the crop is effected.

Continued studies on rates of fertilizer applications to alfalfa plots at the Aberdeen Branch Station show that as high as 350 pounds per acre of treble superphosphate must be added to these soils in a 6-year rotation in order to maintain high quality feed and produce good yields. Larger additions of phosphate did not appreciably improve quality but increased the yields. A fairly high level of available phosphorus was maintained in the soil with the larger applications which had a beneficial effect on succeeding crops in the rotation. Small additions of phosphate fertilizer at regular intervals may be sufficient to maintain the available phosphorus of the soil and produce high-yielding crops of good quality. (*R. S. Snyder, G. O. Baker, J. L. Toevs, and Olof E. Stamberg*).

Idaho Soils Analyzed

Many soil samples have been obtained from various sections in Idaho. In general, analyses were made for pH, nitrogen, available phosphorus and available potassium. Many alkali and high-lime soils were analyzed for total salts, lime content and several other constituents. Arsenic content was determined on a few soils where attempts are being made to farm old orchards. Information on composition of soils from the counties of Idaho is gradually being obtained which will be of value in determining soil management practices for continued high production. This work is being continued. (*R. S. Snyder and Olof E. Stamberg*).

Farm Economics

Hog Production in Palouse Wheat-Pea Area Shows Response to Wartime Demand

RECORDS of the Community Hog pool operating at Moscow show the great rise in hog production in the surrounding territory which began in 1941. The decline from peak numbers in 1942 which started with the spring and fall pig crops for 1943 is also reflected in the num-

bers handled. This pool handled practically all the hogs in an area extending roughly 25 miles in all directions from Moscow. This includes areas surrounding Uniontown, Colton, Pullman and Palouse in Washington and all farming areas in Latah County, Idaho.

The volume of hogs handled is best illustrated by the number of tops and overweights which equaled about 80 percent of the full weight of hogs handled. In 1941 there were 13,744; in 1942, 20,593; in 1943, 19,365; and in 1944, 15,105 in these grades marketed through the pool. The number of sows marketed indicates the prospective increase in hog numbers in 1941 and 1942, but also shows liquidation in 1943 and 1944 due to a lack of optimism respecting future profits in hog raising. The numbers marketed were 577 in 1941, 1324 in 1942, 2276 in 1943 and 1482 in 1944. The peak months for marketing tops and overweights were October and November for spring pigs and March and May for fall pigs. Sows were marketed heavily in October and November in the fall and in the spring during May and June.

When all hogs marketed were graded and total weights tabulated for the period July 9, 1941 until October 18, 1943, it was found that the tonnage marketed of various grades were as follows: tops 70 percent, overweights 8 percent, heavies 4 percent, sows 14 percent and other 4 percent. For the same period it was found that each of about 50 percent of the producers sold 50 or more head of tops, two-fifths of the producers sold head and half of the producers sold from 8 to 49 head of tops. About one-third of all the tops marketed were sold by producers who each sold 50 or more top hogs. This indicates that hog production is not generally on a large scale in this area.

By mapping the location of hog producers, it was found that they were pretty well scattered over the farm areas. There seems to be no correlation due to types of soils or distance from the market. However, producers with small acreages of cropland sold more tops per 100 acres than did those with larger acreages. For example, producers with less than 50 acres of crop land sold 94 tops per 100 acres while operators on 241 to 400 acres sold 19.8 tops per 100 acres. With respect to the size of the hog enterprise, producers with less than 50 acres of crop land averaged 30 top hogs, while operators on 241 to 400 acres of crop land averaged 42. These figures were for the dates July 19, 1942 until October 18, 1943. We conclude that for most hog producers on large acreages hog production has been rather a small side-line even during this wartime period.

Prices secured by producers continued a general upward trend from the beginning of 1941 until November in 1943 when packers' difficulties caused a rather serious, although not a prolonged, slump. Prices during the winter and spring of 1944 remained markedly below ceiling prices. Feed prices, however, continued a steady rise until after harvest of 1944. This feed situation together with a lower future floor price guarantee of \$12.50 per cwt. for tops caused farmers to reduce breedings and production in 1944. Even with some improvement in prices in the fall of 1944 recent figures on farmers' intentions to breed indicates an even smaller hog crop for Idaho in 1945.

Rural Land Market in Grain-Pea Area Analyzed

This study embraces about 2,500 rural real estate transfers and about 600 mortgages. Although emphasis was placed on the activity since the beginning of World War II, some of the information goes back to World War I for comparative purposes.

Price Trends

From 1915 to 1920 there was a steep rise in the price of farm land in this area. In early 1920 the average price of farm land had risen to a peak average of \$123 per crop acre. The abrupt drop in prices of farm products between 1920 and 1921 brought the price of farm land down very sharply. It continued to fall slightly until the great decrease in farm prices in 1929 and 1930. During 1930 to 1935 the market was difficult to determine because voluntary sales of land were few. However, prices were low and erratic. The 5-year period of 1936 to 1940 was a very quiet period, during which the price of farm land was about 70 percent below the 10-year average. Before World War II began land prices had in fact been in a decline because of the fall in wheat and pea prices during the 1920's. During World War II the land prices have again risen and by the end of 1944, about 9 percent above the 1939 level. Most of this rise came in the first half of 1943 and

and Interest Rates Decrease

At the close of 3 years of World War II, over five-and-one-half million dollars worth of rural mortgages securing notes of at least \$1000 were released in Benewah, Latah, Lewis and Nez Perce counties in Idaho. This is the same period less than two-and-one-half million dollars worth of rural mortgages were drawn. This results in a decrease of approximately three million dollars (\$3,200,000) worth of rural mortgages outstanding. Many of the mortgages released were of old standing and called for high interest rates. Mortgage notes over fifty years old and bearing interest up to 15 percent were released. The average rate in the mortgages released was 5.2 percent, while in those drawn it was 4.4 percent. As a result of the decrease in the rural mortgages outstanding and also the decrease in the interest demanded from the farmers annually in this area interest payments based on original principals will decrease about \$189,000.

Public Services and Land Values Related

As a basis for evaluating rural public works programs as well as providing buyers and sellers with more information, an analysis was made of sales of crop land in Lewis County, Idaho, during the years 1941-1943, to determine the effect on land values of schools, roads, electrical transmission, and markets. Land adjoining surfaced roads, school or school bus routes, and electrical transmission lines sold over one-third higher than comparable land not adjoining any of these facilities. The land on surfaced roads less than 3 miles from town sold about one-fourth higher than land on surfaced roads 9 miles or more from town. Of the services that can be extended to rural land, the all-weather road seemed to be most important. On the basis of conditions immediately before the war, the rise

in the value of crop land alone upon becoming served with an all-weather road was sufficient to pay for a crushed-rock road 18 feet wide and 6 inches deep, if there were at least 347 crop acres per section. This is on the basis of parallel roads a mile apart. In areas having 400 acres of cropland the increase was sufficient to provide cross roads at 5-mile intervals in addition to this. (*Norman Nybrotten*).

Assistance Continued to Postwar Programs in Agriculture and Forestry

Cooperation with representatives of various bureaus and agencies of the U. S. Department of Agriculture and interested State Agencies and with the State Extension Service in postwar planning has been continued by the Experiment Station with the Department of Agricultural Economics supplying the chairman for this effort. The main objectives for the year were (1) to publish circulars outlining suggestive programs of action in various segments of agriculture and forestry for the postwar period, and (2) to stand ready to assist in localizing postwar program making.

Published circulars:

1. Postwar Program for IdahoCircular No. 91
2. Range Land Objectives and Problems
in the Postwar Period for IdahoCircular No. 93
3. Predatory Animal Control in the
Postwar ProgramCircular No. 95
4. Idaho Postwar Rural Housing and
Health ProgramCircular No. 96
5. Crop and Pasture Lands in the
Postwar PeriodCircular No. 98
6. Watershed Protection, Recreation, Wild-
life, Range Use on the Forest LandsCircular No. 101
7. Timber Production on the Forest Lands ..Circular No. 99
8. The Farm WoodlandsCircular No. 100

So far local organization for postwar action has not arisen. Increasing and continuing interest has been shown. As a tentative device for assisting local program planning, chairmen of 10 subcommittees of the Idaho Postwar Program committee for Agriculture and Forestry stand ready upon call to give information and guidance. Such requests should be addressed to Paul A. Eke, chairman, Idaho Postwar Program Committee, College of Agriculture, Moscow, Idaho, who will transmit the requests to the appropriate chairman. (*Paul A. Eke*).

Prices of Idaho Farm Products Compiled and Analyzed

Price quotations for many of Idaho's farm products were obtained from government reports and others from dealers within the state. For several products monthly quotations were used while for others only annual prices were compiled or analyzed. The greatest period of time covered was 35 years for some products and only a few years for others.

Over a 35-year period the greatest year-to-year fluctuations have occurred in potato prices. The lowest average price for any year was \$0.26 per cwt. in 1932 and the highest was \$2.37 in 1920. The greatest percent drop in potato prices from one year to the next was 70 percent (\$2.37 to

\$0.64) between 1920 and 1921. Potato prices have fluctuated much more than the prices of the main crops competing for the same land.

The average seasonal variations for the 35-year period of 1910-1944 were computed for 16 major Idaho farm products. Generally the prices for crops vary more during the year than do the prices of livestock and livestock products. The greatest price variations during the year were for eggs and potatoes and the smallest were for wool and chickens. During the war period of 1941-1944, which has been one of public price controls, the seasonal price variations have generally been considerably less than normal. (*Norman Nybrotten*).

Plant Diseases

New Pinto Bean Developed

THE bean improvement program, in cooperation with the federal bureaus of Entomology and Plant Quarantine and Plant Industry, Soils, and Agricultural Engineering and supported by the Idaho State Leafhopper Control Fund, was continued during the past year.

Final tests and selections were made in a number of hybrids between Common Pinto bean and Red Mexican U. I. No. 3. These hybrids are resistant to both mosaic and curly top and three of the most promising have been selected for increase this year and for distribution in 1946. All three selections have good yielding ability, are uniform and of good type, and are as early or earlier than the common pinto beans now grown in Idaho.

Several good mosaic and curly top resistant garden beans have also been produced and will be tested this year in comparison with a number of standard varieties for freezing and canning quality. New varieties of this nature are badly needed as most varieties now grown are susceptible to one or both of these diseases. (*Leslie Deane and J. M. Raeder*).

Spread of Bacterial Ring Rot can be Prevented

When potatoes, containing as low as 1 percent of the tubers infected with the ring rot organism, are used for seed, and no effort made to prevent the spread of the organism, it can be expected that the subsequent crop will contain approximately 50 percent diseased plants. The data in the following table indicate how rapid the spread can be when no preventive measures are taken.

Table 6.—Ring Rot Spread.

Percent of infected tubers in seed	Percent of diseased plants in subsequent crops
1	58.4
3	72.4
5	88.9
7	84.0
9	84.3

It was again shown that sterilization of the cutting knife was the most efficient means of preventing the spread of the ring rot organism. Hot water proved to be the most efficient material to use. When an infected tuber was held against a rotating cutting knife, as the latter passed through the respective disinfecting solutions, hot water kept the amount of infection in the resulting crop down to 3 percent, when as high as 20 percent of the plants were diseased when therapogen solution (1-20) was used, and 32.7 percent when B-K solution 5000 pp.m was used.

Treating seed cut with an unsterilized knife, is of no avail in preventing the spread of the causal organism. When seed containing 3 percent of infected tubers cut with a rotary knife which was continually being disinfected in hot water, and the seed was treated in B-K sol. as it was cut, the spread of the causal organism was entirely prevented, for the resultant crop had but three percent of the plants infected. The check contain 72.4 percent of diseased plants.

The causal organism can withstand freezing temperatures (6°-10° F.) for 24 hours, on a knife blade. Eighty-eight percent of the plants became diseased when disease-free seed was cut with a knife, which had been dipped in mascerated infected potato tissue and exposed to the above temperatures for 24 hours. (*J. M. Raeder*).

Blossom-End Rot of Tomatoes Studied

Six dozen each of Bounty, John Baer, Stokesdale, Pritchard, and Early Chatham tomato plants were grown in the greenhouse on Palouse silt loam with moderate watering to give small, hard plants. Like numbers were grown on similar soil containing one-third well-rotted horse manure to give succulent plants. The plants were set out in the field May 29 (at 10 weeks of age) and were grown without pruning, staking, or irrigation. Because about 15 percent of the plants were killed by curly top and a few affected by double-virus streak, yield per plant was calculated for each picking on a per plant basis including only healthy plants. Since Early Chatham may be spaced closer than the other varieties, it would show up much better if yield were calculated on a per acre basis. Harvesting ended October 13.

There was a tendency for greater incidence of blossom-end rot in plants that were succulent than in hardened plants, but the difference fell short of significance. The incidence of blossom-end rot increased as the soil became steadily drier as the season progressed. In the case of Pritchard, which appeared to be very sensitive to drought, fruits harvested in October were small and hard, and almost free from blossom-end rot. In general, there is a negative correlation between earliness and severity of blossom-end rot. An exception occurred in the case of John Baer which appeared to be more susceptible than Stokesdale. Late varieties, such as Penn Orange, Penn Red, and Ponderosa, tested on a smaller scale, yielded more than 50 percent of fruits with blossom-end rot. (*Glenn KenKnight*).

Table 7.—Effect of hardening tomato plants on incidence of blossom-end rot.

Variety	Blossom-end rot % by weight of fruits			Yield ounces per plant		
	Hardened	Succulent	Av.	Hardened	Succulent	Av.
Early Chatham	1.5	5.0	3.25	132.5	226.5	175.0
Bounty	1.8	5.8	3.80	224.5	221.3	222.9
John Baer	9.1	15.7	12.40	231.5	251.3	241.4
Stokesdale	5.8	7.5	6.65	188.5	192.0	190.3
Pritchard	16.3	14.8	15.55	128.3	143.0	185.6
Difference required for significance at odds of 19 to 1			2.035			56.86

Control of Bacterial Blight of Carrots Possible

Because of the seriousness of bacterial blight in carrot seed production and the fact that the disease organism is seed-borne with most available seed infected, a model hot water seed treater for commercial treatment of the seed has been designed at the University of Idaho. It can be used at a point where a quantity of 20 lb. per hour by one man. The seed is placed in a hot water bath and submerged for 11 or 12 minutes in a hot water bath at 128° F. Extreme agitation of the water is obtained by a propeller or agitator powered by direct connection to a vertical electric motor. The thermoregulator is connected to the agitator. The heater (1000 watt immersion heater) is in a separate chamber which opens into the seed cage with a capacity of about 6 gallons. The seed cage holds a maximum of 5 lb. is recommended. Complete description of the treater with drawings and photographs are available to seedsmen and others who wish to borrow it. At present, while materials for construction of a treater are not available, the model treater may be borrowed from the Experiment Station. It is estimated that about 50 percent of carrot seed for planting in Idaho has been or will be hot water treated in 1945.

Bacterial blight of carrots is also soil-borne and spreads in the field. The following are tentative recommendations for control:

1. Plant only seed treated with hot water at 128° F. for 11 to 12 minutes.
2. Preferably grow stecklings on land new to carrots, but at least on land that has not been in carrots for 4 years. The field should be as far distant as practical from any carrot seed field.
3. Plant roots for the seed crop on land that has not been in carrots for at least 3 years. The field should be as far distant as practical from any other carrot seed field in which these recommendations have not been carried out.

(Earle C. Blodgett and Glenn KenKnight).

Breeding Tomatoes for Curly Top Resistance Continued

About 1600 tomato plants involving 37 selections were grown at Buhl for test of resistance to curly top. Pritchard, Bounty and early

Chatham were employed as controls, and of these 60 percent were killed by the disease. None of the selections was entirely free from curly top. However, 9 selections were highly resistant with less than 20 percent of the plants affected and 23 selections were moderately resistant with 20 to 35 percent affected. Again, single-plant selections were made including several with early, large, smooth fruits.

In some lines there appears to be a linkage between large fruit size and roughness, and small fruit size and smoothness. Some resistant plants produced rough fruits of more than a pound in weight. (*Glenn KenKnight*).

Aster Yellows Overwinters on Weeds

In most carrot and lettuce seed producing areas in southern Idaho the principal over-wintering source of the aster yellows virus appears to be infected carrot roots that are planted as stecklings. However, in the Wilder area there appears to be no relation between incidence of aster yellows in lettuce and location of carrot seed fields. There susceptible weeds are implicated in over-wintering the virus. As yet, only perennial wild asters have been shown to be an important weed source of the over-wintering virus. Obviously other weeds are involved.

Attempts to rogue aster yellows affected carrots from stecklings in storage did not give wholly satisfactory results. Although some roots that harbor the virus exhibit so pronounced symptoms that they cannot be mistaken, many others with bunchy tops were questionable. One lot of bunchy top roots sorted out by seedsmen as suspected of having aster yellows showed only a trace of the disease when planted in the greenhouse. Occasional roots that passed inspection produced yellows-affected plants. Yellows-affected roots gave poor stands when planted in the field.

(*Glenn KenKnight*).

Insects

Vegetable Seed Insect Survey Conducted

A VERY large number of insect pests of vegetable seed crops have been reported from the Pacific coast area of the United States. Because of a possibility of the introduction of some of these pests into Idaho vegetable seed areas, a survey to determine the presence or absence of these pests was started in 1944. The entire vegetable seed producing area was surveyed at four periods during the growing season. Insects present on the plants were collected and prepared for identification. Identifications have not been completed and no lists of insects found on these plants are yet available. No new insect pests were found not already known to be in Idaho vegetable seed fields. The survey will be continued another year. (*W. E. Shull and H. C. Manis*).

Seed Potato Insect Survey Completed

A survey of all seed potato producing areas of the state was made during 1944 with the object of trying to determine what insect vectors of po-

tato diseases were present in the seed potato producing areas of the state. These insects were collected at three periods during the growing season. The insects are now being prepared for identification. No species not known to be previously present in Idaho were found. A list of those found will be prepared when identifications have been made. (W. E. Shull and H. C. Manis).

Flea Beetles in Potatoes

Potatoes which were being dehydrated from the 1943 crop were slightly injured by "worm tracks" causing greater labor in preparing them for dehydration when they were peeled in a chemical bath. Those peeled by abrasive methods were handled without the extra labor. All examination of the cause in the field during 1944 showed that flea beetles were causing the injury. All species of flea beetles found on potatoes have been identified, which has shown that none of the serious pest flea beetles are present in Idaho such as the eastern flea beetle *Epitrix cucumeris* (Har.) and *Epitrix tuberis* Gentner which are causing such serious losses to potatoes in several other states. The heavy population of flea beetles found were chiefly the western potato flea beetle *Epitrix subcrinata* (Lec.) which has been present in Idaho potato fields for many years. (W. E. Shull).

Pea Weevil Investigations Continued

Investigations on the pea weevil and its control were continued in cooperation with the Bureau of Entomology and Plant Quarantine, Agricultural Research Administration, United States Department of Agriculture. Work on the project was directed first, toward finding an alternate control measure which would alleviate the rotenone shortage that developed as a result of the war and which would protect pea plantings over a longer period of time; second, toward finding the factors causing "pinhole" weevil in peas; and third, toward finding the factors influencing the movement of weevils from hibernation.

Field tests with 11 different materials showed that a dust containing 20 percent *Derris malaccensis* applied at 20 pounds and a dust containing 5 percent of DDT applied at 30 pounds per acre gave as effective control on one-tenth-acre plots as a mixture containing 0.75 percent of rotenone applied at 20 pounds per acre.

"Pinhole" weevil, the name given to weevil-infested peas in which the weevil larva dies just after it has penetrated the seed, was studied. Replicated plantings of peas were made on different dates, and these plantings were cut so as to simulate conditions created by swathing, to determine the effect of the planting and harvesting date on this type of injury. No significant effect was found, although the earliest harvested peas in each planting showed the highest percentage of pinhole weevil.

Hibernation-cage studies showed a weevil survival of 66.4 percent. This is the second highest survival recorded during the 6 years the study has been in progress. Emergence this season was featured by five periods of weevil activity which, along with the high survival, accounts for the difficulties in properly timing dust applications during the 1944 season.

Pea weevil infestations in the state were slightly higher in 1944 than they were in 1943. The average for 1,289 graded crops was 2.51 percent. In 1943 the average was 2.17 percent. (*T. A. Brindley, Ralph Schopp, and W. E. Shull*).

Experiments for Control of the Onion Thrips Initiated

Investigations of the onion thrips in cooperation with the Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture, were instituted during the spring of 1944 at the Twin Falls laboratory. Field experiments were conducted against the onion thrips with Code 2 (20 percent Azobenzene in talc), DDT (2,2-bis (parachloropheny 1)-1,1,1-trichloroethane), DN-111 (20 percent of a dicyclohexylamine salt of 2,4-dinitro-6-cyclohexylphenol), nicotine sulfate (40 percent) and tartar emetic. Sprays consisting of tartar emetic, 2 pounds in 100 gallons of water sweetened with honey, and nicotine sulfate, 1 quart in 100 gallons of water sweetened with corn syrup, gave almost identical results as measured in yields. Sprays containing $\frac{1}{2}$ pound of DN-111 or 4 pounds of 10 percent DDT in pyrophyllite in 100 gallons of water showed little, if any, indication of effectiveness. Code 2 applied as a dust at approximately 40 pounds per acre per application was not effective. A 5-percent DDT pyrophyllite dust mixture applied at approximately 31 pounds per acre per application seemed to give definite indications of thrips control, both on a yield basis and as determined by population counts. Differences in yield were not, however, statistically significant over the untreated check plots for any of the materials used. Thrips populations were low early in the season because of unfavorable conditions for reproduction and development in June. The low population affected the control results, as the injury was very light.

Where insect pollinators, such as honeybees, were excluded from onion heads during the blooming period, the yield of onion seed was about 5 times less than where the pollinators had access to the flowers. (*F. H. Shirck, J. R. Douglass, and W. E. Shull*).

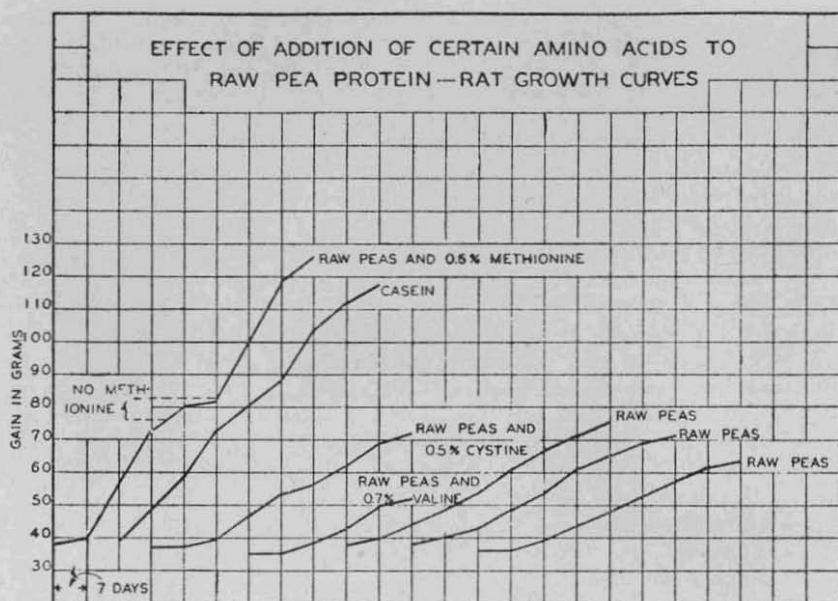
Human Nutrition

Dietary Value of Peas and Beans Demonstrated

BECAUSE war conditions have decreased the available supply of animal protein such as meat, cheese, milk and eggs, an increased interest in and a need for greater use of vegetable proteins has developed.

The edible legume seeds, that is peas, beans, lentils, soybeans and peanuts contain larger amounts of protein than do other vegetable sources. Of these dry peas and beans are important crops in Idaho. For the past several years studies of the nutritive value of the protein of mature Alaska peas have been carried on at this Station and this year a like study of the Great Northern variety of beans was begun. The Idaho selection Great Northern U. I. 12S was used.

The most outstanding result of the study of beans was the inability of young rats to utilize the protein of raw beans. Nitrogen balance experiments showed that part at least of this failure was due to their inability to digest them. When the beans were boiled and dried before feeding, they were fairly well digested but were found to lack the essential amino acid methionine just as Alaska peas do.



When the dietary supply of one of these essential amino acids is limited, growth of the animal is restricted to that permitted by the available supply of that particular one and the addition of another amino acid, although an essential one also, does not improve the rate of growth. This is well illustrated in Figure 2 by growth curves of rats receiving the protein of peas with and without the addition of individual amino acids. Valine is just as essential for the rat as methionine but because peas furnish valine in sufficient quantity for good growth, there is no increased gain due to added valine while there is to added methionine.

The study of dry pea protein was continued this year with special attention being given to split peas and the supplementing effect of egg, cheese and milk. The evidence is very convincing that peas and beans may be used as extenders of the supply of eggs, cheese and milk with resulting good nutrition.

Niacin was the only vitamin studied this year in peas. The Alaska variety was found by a chemical method of analysis to be a fair source of this nutrient with no appreciable loss in boiling them. (*Ella Woods, W. M. Beeson and D. W. Bolin*).

Ascorbic Acid Value of Idaho Potatoes Studied

The research at this Station on the ascorbic acid value of potatoes is a good example of the refinements made in the last few years in methods for studying the contribution which a food may make to the diet.

When the Russet Burbank potato was first studied here for its content of vitamin C the only method available was the biological one which consisted of feeding young guinea pigs weighed amounts of potato every day for a period of several weeks and noting the results in growth and signs of scurvy. Even this relatively crude method made it clear that boiled im-

mature tubers gave at least twice as much protection against scurvy as boiled mature winter stored potatoes.

After vitamin C was identified as ascorbic acid, chemical methods were developed for its determination and one of them commonly called the dye method, was used in this laboratory for the study of potatoes. This method made possible the study of rapid changes in ascorbic acid value such as would occur in cooking and in handling cooked potatoes. In this way it was shown that when potatoes were baked there was very little loss in ascorbic acid if they were analyzed immediately but that if they were kept for some time much or all of it was lost depending upon the time they were held.

In the oxidation of ascorbic acid into its antiscorbutically inactive form there is an intermediate product known as dehydroascorbic acid which is effective as an antiscorbutic but which can not be detected by the dye method.

This year a newer chemical method by which dehydroascorbic acid as well as ascorbic acid can be determined has been adopted here to use with potatoes. By this newer technique it has been shown that the total ascorbic acid in cooked potatoes may vary considerably from that found by the dye method because of the dehydroascorbic acid which may be present. If the potatoes are analyzed immediately after baking, most of the ascorbic acid is present in a reduced form and the two methods will give essentially the same values. If, however, they are held for some time considerable amounts of dehydroascorbic acid may develop and the dye method of analysis will not give the true value. The relative amounts of the two forms of vitamin C depend upon the conditions of time, temperature and hydration at which the potatoes are held after cooking. (*Ella Woods and D. W. Bolin*).

College Meals Analyzed for Ascorbic Acid

During the year a study was made of the ascorbic acid available in food as it was served in five dining halls associated with the University of Idaho. Two were halls where student groups of the armed services were eating and three were dining halls for college women, one of them a cooperative house.

The study lasted two weeks for each hall and included an analysis for ascorbic acid of all foods containing fruits or vegetables served at every meal during the test period. The samples were taken as the food was served.

These portions were taken directly to the laboratory, the serving weighed and an appropriate amount weighed into the extracting solution for analysis. The amount of ascorbic acid supplied by the serving was calculated from the analytical value found.

The results showed that there was a great daily variation in the total amount of ascorbic acid available through one serving of the foods offered. While the daily average over the two-week period studied was well above the amount needed to prevent scurvy, only one of the halls had an average amount as great as the 75 mg. recommended for adult men by the Food and Nutrition Board of the National Research Council. (*Ella Woods and Patricia Keepings*).

Caldwell Branch Station

R. F. JOHNSON, *Superintendent*

Comparison of Phosphorus Supplements for Fattening Steers

THE necessity of feeding phosphorus supplements to fattening animals that are fed rations composed largely of wet beet pulp, molasses or other low phosphorus feeds with a limited amount of fine, bright and leafy alfalfa or grain has been definitely proved in previous experiments. Until the beginning of the war, sterilized steam bone meal was available and provided an easily assimilated, rich source of phosphorus, but it has been difficult to obtain. An experiment was set up with 715-pound yearling white-faced steers to compare the value of deflourinated phosphate, a mined product, and Cudahy's all-purpose mineral mixture with sterilized steam bonemeal, and to determine whether the minerals should be force fed or free choice when the basal ration consisted of a maximum of nine pounds of alfalfa hay, a maximum of four pounds of beet molasses and an unlimited amount of wet beet pulp. The phosphorus content in percent of the feeds used was as follows: beet molasses, 0.02; alfalfa, 0.22; wet beet pulp, 0.007; steamed bonemeal, 14.67; deflourinated phosphate, 12.3; and Cudahy's all-purpose mineral mixture, 7.00. The amount of wet pulp consumed, the rate of daily gain, the amounts of feed that were required to produce 100 pounds of gain, the amount of phosphorus found by chemical analysis to be in the blood and the appearance of the animals were the factors affected by the amount of phosphorus consumed and assimilated from the feed. The rate of daily gain varied from 0.66 pound to 1.74 pounds per day. The blood from all animals tested above 6.0 mg. of phosphorus per 100 ml. of blood at the beginning of the experiment. The steers fed the basal ration, which contained 0.13 percent of phosphorus, consumed 43.4 pounds of wet pulp per day, made an average daily gain of 0.66 pound per day, required 568 pounds of molasses, 1337 pounds of alfalfa and 6591 pounds of wet pulp to make 100 pounds of gain. The phosphorus in the blood decreased from 6.28 mg. at the beginning of the experiment to 3.6 mg. per 100 ml. of blood at the end of the experiment. As the experiment progressed, the appearance of the animals changed, the coats of hair became rougher, the appetites slackened, the movements became listless, and depravity of appetites became manifest by the steers chewing on the fence boards. The phosphorus in the ration was increased to 0.19 percent when one-tenth of a pound of bonemeal was force fed per steer with the basal ration. Force feeding was accomplished by sprinkling the bonemeal on the pulp as it was fed each morning. The average daily gains were increased to 1.74 pounds daily, the feed requirements reduced to 214 pounds of molasses, 489 pounds of alfalfa, 4041 pounds of wet pulp and 5.4 pounds of bonemeal. The phosphorus in the blood was maintained between the 6.41 mg. and 5.25 mg. per 100 ml. of blood. These steers appeared to be thrifty throughout the experiment.

When the steers had free access to bonemeal, they consumed 0.06 pound per day, or 0.04 pound less than the amount considered sufficient for optimum results. With this method of feeding bonemeal, the steers made an average daily gain of 1.33 pounds per day and needed 281 pounds of molasses, 635 pounds of alfalfa, 4807 pounds of wet beet pulp and 4.5

pounds of bonemeal to gain 100 pounds. Though this ration contained 0.18 percent of phosphorus, the blood phosphorus varied from 6.29 mg. to 3.38 mg. per 100 ml. of blood.

The results of this experiment indicate that deflourinated phosphate, force fed, was not equal to steam bonemeal as a phosphorus supplement but that it might be used as a substitute when the latter was unavailable. With the basal ration of molasses, alfalfa and wet beet pulp, it provided 0.18 percent phosphorus, but was not as efficient as bonemeal in the rate of daily gains or economy of gains. The steers fed deflourinated phosphate gained 1.47 pounds per day and required 255 pounds of molasses, 580 pounds of alfalfa, 4805 pounds of wet beet pulp and 5.8 pounds of phosphate to gain 100 pounds. The average level of blood phosphorus varied from 6.29 mg. to 4.36 mg. per 100 ml. of blood.

When the steers were given free access to two parts of deflourinated phosphate and one part of stock salt, they failed to eat any of the mineral and the results were similar to the results obtained in the check lot where the basal ration was fed. The average daily gain was 0.94 pound per day and 397 pounds of molasses, 899 pounds of alfalfa, 6098 pounds of wet beet pulp were required to produce a gain of 100 pounds. The percent of phosphorus was the same as in the basal ration. The phosphorus in the blood decreased during the course of the experiment from 6.29 mg. to 3.43 mg. per 100 ml. of blood, and there were definite signs of depraved appetite and phosphorus deficiency in the appearance of the animals.

The steers fed free access Cudahy's all-purpose mineral consumed 0.05 pound of the mineral per day, which was 0.01 less than the bonemeal consumed by the steers fed free access to bonemeal, and half the amount eaten by the steers in the lot where bonemeal was force fed. The ration with the all-purpose mineral mixture contained 0.14 percent phosphorus, produced 1.14 pounds of gain per day, required 329 pounds of molasses, 766 pounds of alfalfa, 5380 pounds of wet pulp and 4.08 pounds of mineral to make 100 pounds of gain. The blood phosphorus varied from 6.11 mg. to 3.82 mg. of phosphorus per 100 ml. of blood.

It may be concluded from this experiment that deflourinated phosphate and Cudahy's all-purpose mineral mixture do not equal sterilized bonemeal as a phosphorus supplement, and that these minerals are probably more effective when fed in conjunction with other feeds.

Effect of Feeding Bone Meal on the Lambing and Milking Qualities of Ewes

In some sections of Idaho, poor lambing and milking qualities of ewes that are fed on low phosphorus alfalfa hay are attributable to the lack of phosphorus in the diet. Experiments with other classes of livestock have indicated that alfalfa analyzing less than 0.1 percent of phosphorus could in variable degrees, depending upon the age and class of animal, cause a development of a phosphorus deficiency condition. Alfalfa of this quality would be grown on low phosphorus soils and by harvesting methods that would permit bleaching and a loss of leaves or a combination of both. In an experiment with 3-year old ewes fed alfalfa with 0.16 percent phosphorus; 0.16 percent phosphorus supplemented by bone meal and

0.22 percent phosphorus there was no significant difference in the birth weight of the lambs, weaning weight of lambs or milking qualities of the ewes.

Wintering, Pasturing and Finishing Beef Calves on Irrigated Farms

Angus stocker calves weighing 411 pounds were fed on wintering rations from January 28 to April 6 when they were turned out to pasture. The wintering rations were planned to determine the comparative value of chopped hay and long hay when fed with 2.7 pounds of ground barley per head daily, and to determine the extent that barley straw may be used to replace part of the chopped alfalfa hay. The results show that there is a slight but not appreciable increase in the average daily gains when the long hay is fed. The cost of producing 100 pounds of gain was 66 cents per hundred cheaper for the long hay ration. The cost of the gains were \$10.07 per hundred when the base value for ground barley was figured at \$47.00 per ton and long hay was figured at \$17.00 per ton with the charge of \$3.00 per ton added for chopped hay. The percentage of waste hay was 10.8 percent for the long hay as compared with 3.6 percent for chopped hay.

The results indicated that under conditions where alfalfa hay was not plentiful and the time factor was not an important consideration, barley straw could be efficiently used in a wintering ration. Under irrigated farm conditions, where the importance of finishing beef for market in the least time is paramount, the advisability of including straw in a wintering ration is very questionable. The ration of chopped alfalfa hay and barley produced gains of 1.9 pounds per day at a cost of \$10.73 per hundred, while a similar ration containing barley straw made gains of 1.33 pounds per head per day at a cost of \$10.63 per hundred. The value of the straw was figured at \$5.00 per ton. The total daily consumption of roughage was decreased when straw was included in the ration from 12.1 pounds of alfalfa per day to 9.5 pounds of alfalfa and straw, the latter ration being in the proportion of two parts of alfalfa and one part of straw.

When pastured on irrigated mixed grass pastures, these steers averaged 1.46 pounds of gain per head daily for 160 days. The steers wintered with a ration of alfalfa and barley gained 1/10 pound more per day than the steers wintered upon alfalfa and barley. Ten acres of pasture grazed 14 steers and each acre of pasture produced 335 pounds of beef. Feeding ground barley to one half of the steers during the latter part of the summer did not appear to be beneficial from a standpoint of increasing the gains or decreasing the cost. The finishing period consisted of 86 days of grain, silage and chopped hay feeding, during which time they consumed an average of 14.2 pounds of alfalfa hay, 7.5 pounds of ground barley and 9.1 pounds of corn silage per head daily. The rate of gain was 2.0 pounds per day and it required 697 pounds of alfalfa hay, 368 pounds of corn silage, and 446 pounds of barley to produce one hundred pounds of gain, which at current feed prices of \$20.00 per ton for alfalfa, \$7.50 per ton for corn silage and \$45.00 per ton for ground barley amounted to \$18.41 per hundred.

The Value of Dehydrated Beet Tops and Dried Beet Pulp to Replace Grain in a Ration for Fattening Steer Calves

Dehydrated beet tops, as the name implies, was a feed prepared from the dehydrator and ground to the texture of meal. The color of the feed varied from a dark green to a light brown color. In composition the feed contained a high percentage of ash, due to the soil clinging to the leaves and stems when harvested.

When the dehydrated beet tops were used to replace one-half of the grain ration of alfalfa, corn silage and barley for fattening steer calves, the average daily gains were decreased from 1.83 to 1.72 pounds per day and the feed requirements per 100 pounds of gain were increased 128 pounds for alfalfa, 10 pounds for silage and 29 pounds for barley and dried beet tops. However, the difference in feed cost was not as large because the value of the dried beet tops was \$30.00 per ton as compared to ground barley at \$47.00 per ton. The cost of 100 pounds of gain, with alfalfa at \$20.00 per ton and corn silage at \$4.50 per ton was \$16.90 when barley was used at \$16.81 when dried beet tops replaced half of the barley. It was interesting to note that the steers did not consume as much salt with dried beet tops as they consumed with barley or barley and dried beet pulp.

Dehydrated molasses beet pulp, or as the feed is commonly referred to, dried beet pulp, was used in this experiment to take the place of one-half of the barley in a ration of alfalfa, corn silage and barley. It was fed to 480-pound fattening calves, of Angus breeding. The use of the dried pulp did not increase the daily gains, and there was little difference in amount of feed required. Fifty-three pounds of alfalfa and 1.5 pounds each of barley and pulp were saved in producing 100 pounds of gain.

A Comparison of the Value of Dehydrated Beet Tops, and Wet Beet Pulp When Fed with Barley and Alfalfa to Fattening Lamb

Two hundred seventy-one feeder lambs weighing 59 pounds were pastured 59 days on third crop alfalfa and grain stubble, gaining .31 lb. per head daily. In addition, the 271 lambs were fed in the dry lot at night an average daily allowance of 155 pounds of alfalfa and 14 pounds of barley. There was a little loss of only three head or less than 1 percent.

Seventy-five pound feeder lambs fed chopped alfalfa hay and barley for 75 days gained 0.32 pound per day. When dehydrated beet tops were substituted for one-fourth of the grain, the gains were 0.31 pound per day. Some refused material, which appeared to be dirt, was observed from time to time in the feed bunks after the dehydrated beet tops had been fed. Extra care and labor were necessary, especially in wet weather, to keep the bunks in a clean, fresh condition. In other feeding trials, involving the use of beet tops, either as green, dried or ensiled, the presence of variable amounts of dirt has been a factor that has nearly always adversely influenced the feeding value of tops. The most commonly used and satisfactory method of feeding tops to eliminate this source of trouble is to allow the animals to pick up the tops from a dry field.

Wet beet pulp cheapened the cost of the ration and increased the rate of the daily gains when it was included in a ration of chopped alfalfa hay

and barley and fed to 60-pound lambs and compared to 75-pound lambs that were fed straight chopped alfalfa and whole barley. The lambs consumed an average daily ration of 3.97 pounds of wet pulp, 1.34 pounds of alfalfa and 1.08 pounds of whole barley. The non-pulp fed lambs consumed 2.31 pounds of alfalfa and 1.2 pounds of whole barley daily per lamb. An increase in average daily gains of 0.02 pound is significant because the initial weight of pulp fed lambs was 15 pounds less than the non-pulp fed lambs. The main advantage from feeding wet beet pulp is derived from decreasing the feed cost of the gains, which in this case was a decrease from \$15.79 to \$12.74 per hundred pounds, chopped hay was valued at \$20.00 per ton, whole barley at \$45.00 per ton and wet beet pulp at \$2.25.

A Study of Alfalfa Strains

A planting of alfalfa strains in cooperation with the Aberdeen and Tetonia Branch Station has been made in which the comparative adaptation of old varieties as well as some new strains are being studied. The comparative yields and the longevity of the strains are factors being studied.

Field and Sweet Corn Breeding and Testing

In cooperation with the Department of Agronomy, hybrid strains of field and sweet corn are being developed and tested.

Aberdeen Branch Station

JOHN L. TOEVS, *Superintendent*

SINCE the bacterial wilt disease of alfalfa has become prevalent in most of the irrigated sections of Idaho and other states, the so-called winter hardy varieties such as Grimm, Cossack, and Common have become rather short lived. After 2 years of hay production, stands now frequently thin out very rapidly. This early loss of stands is not serious when alfalfa is used in short rotations but where and when longer rotations are practised, the condition becomes quite serious. Then too, many farms have some fields that do not lend themselves to rotations and it is desirable to keep stands as long as possible.

Table 8.—Yields of alfalfa hay in tons per acre for the years 1942 to 1944, inclusive, and averages for the 3-year period.

Variety	1942 tons	1943 tons	1944 tons	Av. 3 years tons
Ranger	8.73	8.51	7.92	8.39
Buffalo	8.34	8.43	8.20	8.32
Orestan	8.36	7.89	7.39	7.88
Kansas Common	8.67	8.12	6.60	7.80
Grimm	9.07	7.68	5.76	7.50
Cossack	8.48	8.36	5.78	7.54
Ladak	7.47	7.22	5.73	6.81

A total of 18 alfalfa varieties or selections was included in the tests but results obtained from only 7 are given in this report. These include

several of the old standard varieties that were of outstanding importance before bacterial wilt became a problem. The remainder are new and improved varieties of which seed is being increased as rapidly as possible.

Differences in yields obtained in 1942 and 1943 from the first 6 varieties were not considered significant; however, in 1944 yields which ranged from 5.76 to 8.20 tons show a difference of 2.44 tons, which is probably significant. Wilt began to appear in the late summer of 1943 in susceptible varieties, such as Grimm, Cossack, and Common, and increased rapidly during 1944. By the end of the 1944 growing season, stands of these wilt-susceptible varieties were reduced to less than 50 percent.

(John L. Toews).

Commercial Fertilizers and Barnyard Manure Increase Potato Yields

In 1943 and 1944 fertilizer tests were conducted with Russet Burbank potatoes on second-year potato land. This land had never received any commercial fertilizer. Results in the table indicate: (1) The value of barnyard manure; (2) A nitrogen-phosphate combination in the ratio of 1-2 to 1-5 is more desirable than nitrogen and phosphate applied separately; and, (3) That no benefit is obtained from potassium in the combination used.

Table 9.—Commercial fertilizers and barnyard manure applied to second year potato land increase potato yields during 1943 and 1944.

Treatment	Pounds of commercial fertilizer per acre		Potato yields in cwt. per acre					
	1943	1944	With manure			Without manure		
			1943	1944	Av.	1943	1944	Av.
Check			300	307	304	254	275	265
6-30-0	417	537	309	354	332	293	281	287
20.6-0-0	293	252	310	314	312	260	276	268
10-21-0	604	725	326	332	329	307	288	298
0-43-0	180	175	287	329	308	290	263	277
10-10-5	433	628	303	314	309	270	283	277
0-20-0		413		318			266	
11-48-0*		272		332			292	
Average all manure versus no manure					316			279

*Applied with cultivator after potatoes emerged.

When these fertilizers are applied to land plowed out of alfalfa or clover and planted to potatoes somewhat similar yield trends are obtained. The increases may or may not be profitable. Increases again favor the nitrogen-phosphate combination. However, in many instances these differences have not been great enough to pay dividends. This is particularly true when a green manure crop is turned under and when phosphate has been applied to the legume crop during the rotation. The benefit of applying phosphate to alfalfa on succeeding potato crops was given in last year's report. (John L. Toews and G. O. Baker).

Heavy Grain Ration for Ewes Proves Uneconomical During Past Two Years

Doubling the grain ration for one lot of ewes did not increase the gain of suckling lambs. The ration for lambs was the same for both lots, for 1943 and 1944, namely, third cutting alfalfa hay and oats, both at full feed. The ewes in both lots received full rations of alfalfa hay, 2 pounds of cull potatoes, and oats were fed at approximately 0.5 pound and 1 pound daily. Lambs from ewes receiving 1 pound of oats made a daily gain of 0.643 pound in 1943 and 0.669 in 1944. Lambs from ewes receiving $\frac{1}{2}$ pound daily made average daily gains of 0.650 and 0.680 pounds for the corresponding years.

Apparently the ration of hay, 2 pounds potatoes, and $\frac{1}{2}$ pound of oats were sufficient for maximum milk production. The hay was all of good quality. The amount of hay fed and consumed was essentially the same for both lots, 6.23 pounds in 1943 and 5.83 for 1944.

A Short Pasture Period for Spring Lambs Results in Poor Gains

During the first 2 or 3 weeks after ewes and lambs are turned out on pasture, daily gains seldom exceed 0.3 to 0.4 pound. It takes about 2 to 3 weeks for the lambs and ewes to become adjusted to the change of feed. If possible the change should be made gradually. Over a longer pasture period the lambs make up considerable gain so that the average daily gain is very satisfactory, particularly when saving in feed costs is taken into consideration.

Lambs that need only 2 or 3 weeks to finish when pasture becomes available had better stay in the feed lot, especially when arrangements are such that ewes can be turned out daily on the pasture. In this way dry feeding of ewes can be discontinued and lamb gains continue without any setback. Daily gains for lambs from May 1 to June 1 in 1940 were as follows: Lambs and ewes on red clover pasture, lambs made a daily gain of 0.369; ewes on pasture, and lambs continuing in feed lot, the gain was 0.568 pound daily; ewes and lambs both continued in feed lot the gain was 0.503 pound daily.

In 1943, one-half of the lambs and ewes were turned on pasture April 28 to June 1. In the other lot the ewes were put out on pasture daily while lambs remained in the feed lot and were fed all hay and grain that they would consume. The lambs in this lot made a daily gain of 0.650 pound as compared to the lot where both ewes and lambs were on pasture of 0.547 pound daily. (*John L. Toevs and C. W. Hickman*).

Cereal Improvement in Idaho

The breeding and distribution of better varieties of oats for Idaho has been in progress for many years at the Aberdeen Branch Station of the Idaho Agricultural Experiment Station and in cooperation with the Division of Cereal Crops and Diseases of the Bureau of Plant Industry, Soils and Agricultural Engineering. Many workers contribute to this improvement program.

Breeding for Improved Standing Ability and Rust Resistant Oat

All of the varieties of commercial importance in Idaho grow rather tall, consequently, often lodge when grown on irrigated land of high

fertility. They are also susceptible to rust. Following the discovery of the crown rust and smut resistance of Victoria, an introduction from South America, many state agricultural experiment stations, including the Idaho Station, cooperated with the U. S. Department of Agriculture in an enlarged oat breeding program, and as a result, new disease-resistant varieties have been developed for many areas. Some of the early breeding work on the Victoria x Richland cross, which has given rise to the Boone, Cedar, Control, Tama, Vicland, and Vikota varieties, already of great economic importance in the North Central States, was conducted at Aberdeen. However, since these varieties are all short and early maturing, they have not proved to be adapted in the Northwest, but are of value as disease and lodging resistant parents. Unnamed sister selections of these varieties were crossed with Bannock and other adapted smut-resistant varieties at Aberdeen. Several disease resistant selections from these crosses have yielded almost as well as Victoria, have white grain of good quality, and a shorter, stiffer straw that resists lodging. It is hoped that a disease resistant variety with high quality grain and short stiff straw, adapted for use as a companion crop in southern Idaho may be developed in the near future.

Climatic Conditions of Idaho Ideal for Oat Production and Breeding

Climatic conditions in certain of the irrigated areas of Idaho are especially favorable to oat production. Because of these conditions, oats develop fully nearly every year. This affords the plant breeder unequaled and uninterrupted opportunities for crossing and critically observing oats in the field. As a result of these very favorable conditions, valuable contributions have been made by the Aberdeen Branch Station to the breeding of new oats not only for Idaho, but also for other regions of the United States.

Barley Program Produces Promising Selections

More than 6000 barley selections, most of which were the result of the large barley breeding program conducted by the late Dr. H. V. Harlan and Miss Mary Martini, have been tested in the yield nurseries and plots during the last 9 years. From this large group 12 selections have been made which will receive special attention during the next few years. These 12 selections yield as much or more than Trebi and Velvon and are definitely less susceptible to lodging than Trebi. These selections will be further tested in plots and regional nurseries throughout the Intermountain States. Out of the group, 3 selections, Ab 36-6127, Ab 36-5652, and Ab 36-6127, are under close observations with the thought of possibly increasing them for distribution in Idaho. (*Harland Stevens and John L. Toews*).

Grass Seed Production

Excellent seed yields have been obtained in the second and third production season through the application of ammonium sulfate on mountain brome grass (*Bromus marginatus*). An application of 350 pounds per acre produced the highest net return in seed yields.

Pasture Plots Under Irrigation

Results obtained in 1944 are similar to those reported for 1943. Tall oatgrass, smooth brome grass, orchard grass, red fescue, and sheep fescue retained excellent stands in pure seedings and in seedings in combination with Ladino clover.

Dryland

Experiments conducted since 1939 have shown that abandoned farm-lands may be seeded to desirable grass species for forage production. The general conclusions made at this time are based upon field observation and data. These conclusions are:

1. A seedbed prepared by summerfallow enables the establishment of a larger number of species than other seedbeds.
2. More uniform stands may be obtained with drills equipped with a positive depth control.
3. Cheatgrass (*Bromus tectorum*) can be eliminated by the use of adapted perennial species thus reducing the hazards of range fires.
4. No significant difference is found in the fifth year from yields of crested wheatgrass, blue bunch wheatgrass, and tall wheatgrass (*Agropyron elongatum*).
5. Bunch type wheatgrasses make more contribution to yields than the sod-forming wheatgrasses.
6. No significant benefit in yield was obtained in the fifth year from seedings containing a mixture of perennial grasses.

(Russell Stark and John L. Toevs).

Sandpoint Branch Station

R. E. KNIGHT, *Superintendent*

Foundation Seed of Russet Burbank Potatoes is Increased

TEN sacks of the foundation seed of the Idaho Russet variety were secured through the Idaho Crop Improvement Association, and planted in tuber units. The fact that only a half dozen units were rogued out during the season speaks well for the efforts that had been made to eliminate all disease. The greater part of 1944 crop will be planted in tuber units for further increase, thus assuring the certified growers of this area a source of clean seed, at least for their seed plots.

Bentonite Shows Promise as Water-Proofing Agent

The procedures followed in testing bentonite for water-proofing potato cellars are outlined in the 1943 report. Results suggest that the most fool-proof method is to mix half of the standard application with soil or very fine sand, either by pre-mixing or raking in, and applying the remainder as a continuous layer. The 2-inch layer of sand or fine gravel that was used on some of the strips appears to be unnecessary except as an aid

in erosion control. The straw and soil beneath the bentonite should be well settled before the material is applied, as uneven settling may result in breaks in the bentonite layer. Faulty or haphazard application is likely to permit leaks which are difficult or impossible to stop by patchwork methods—consequently great care should be exercised to insure uniform distribution.

Erosion has been a rather serious problem. As a means of control, spring wheat and creeping red fescue were seeded on the cellar this fall. It is hoped that the wheat will root sufficiently to hold the soil in place temporarily and then winter kill, leaving the grass as a permanent soil binder.

New Spray Appears Effective in Canada Thistle Control

Preliminary results suggest that a combination of ammonium sulphate and sodium chlorate may be just as effective and, in some respects preferable, to chlorate alone as a weed poison. The two materials cannot be mixed and applied dry, but must be used in solution. Spraying in late May with a solution of $1\frac{1}{2}$ pounds of each in 2 gallons of water per square rod indicated complete control of Canada thistles by November. Another observation will be made in the spring to determine whether or not any re-growth occurs. Reducing the rate to one pound of each per square rod injured the plants to the extent that they may winter-kill.

Ammonium Nitrate Boosts Wheat Yields

In a cooperative project in which several fertilizers were applied to spring wheat, ammonium nitrate was clearly the most effective. Applications of 62 lb. and 123 lb. per acre produced 24.3 bushels and 28.8 bushels of wheat per acre, respectively. Eight check plots averaged 14.3 bushels. Ammonium sulphate at 100 lbs. and 200 lbs. per acre gave yields of 16.6 bushels and 20.0 bushels per acre, respectively. No response was shown on plots fertilized with treble super phosphate or potassium meta phosphate. Ammonium sulphate and the phosphates can usually be relied upon to give substantial yield increases, and would likely have done so this year had it been possible to work them into the soil, or had there been more precipitation during the growing season. In view of the unfavorable season, the increases obtained through using ammonium nitrate were higher than had been anticipated. It is evident that the material is both highly soluble and readily available.

Premier Wheat is Released to Farmers

Approximately 100 bushels of Premier wheat were distributed to farmers throughout the county for seeding last spring. Premier is a bearded, hard red spring variety of excellent quality, and has so far proven immune to rust. It has been one of the highest yielders in normal years, and easily at the top of the list in years of heavy rust infestation.
(*Ralph Knight*).

High Altitude Branch Station

W. A. Moss, *Superintendent*

Average Growing Season

THE moisture relationships for the growing season of 1944 were average for the area. A frost in August caused considerable damage to the potato plots, and resulted in some frost injury to late maturing varieties of spring sown cereals. (*W. A. Moss*).

Cultivation Increases Grass Seed Yields but Not Applications of Nitrogen

Two years results on the fertilization of crested wheat, smooth brome, big bluegrass, and mountain brome grown in solid seedings and in cultivated rows failed to produce significant increases in seed yields. The fertilization consisted of applications of ammonium sulphate at the rate of 50 pounds per acre. The growing of the above grasses in rows 3 feet apart with cultivations at intervals to keep weeds in check resulted in definite increases in seed yields. Thus, crested wheat yielded 286 pounds when grown in solid, uncultivated, plots as compared to 437 pounds when grown in cultivated rows. The comparable yields for smooth brome were 141 and 308, for big bluegrass 262 and 387, and for mountain brome 176 and 192 pounds of seed per acre for the solid and the cultivated row plantings, respectively.

These experiments indicate that moisture rather than the availability of soil nitrates constitutes the main limiting factor in grass seed production in the area represented by the Branch Station. The production of grasses in rows with cultivations during the early part of the season resulted primarily in the conservation of moisture.

(*W. A. Moss and K. H. Klages*).

Alfalfa Test Shows Differences in Yielding Abilities of Varieties

An adaptation and yield trial including 18 varieties or strains of alfalfa was started 4 years ago. Allowing 1 year for the establishment of the plants on these plots, it is now possible to present the yields obtained over a period of 3 crop years. The range in the average yields recorded for these varieties over the 3 years extends from 1.69 to 2.38 tons of hay per acre. The average of the 9 highest yielding varieties is 2.11 tons as compared to 1.82 tons for the 9 low yielding varieties and strains. This shows marked differences in the yielding abilities of the varieties tested. The 5 high yielding varieties together with their 3-year averages in tons per acre were Mecker Baltic 2.38, Hardigan 2.26, Ladak 2.14, Hardistan 2.10, and Turkestan No. 86696, 2.09. It should be mentioned in connection with these alfalfa variety tests that bacterial wilt is as yet not a factor in alfalfa production at the High Altitude Station. The relative performance of the varieties tested would, therefore, be altered considerably in areas where the bacterial wilt disease is present.

The question of growing alfalfa-grass mixtures rather than alfalfa in pure stands should be given consideration. In the soil management plots, higher yields are being obtained on fallow land following the plowing of alfalfa-grass mixtures than following alfalfa alone. Likewise, better

wheat yields followed sweet clover-grass mixtures than sweet clover in pure stands. The inclusion of grass with these legumes counteracts the excessive liberation of soil nitrates which at times leads to an over-stimulation of crops following the plowing up of alfalfa or sweet clover. Such over-stimulation of crop plants results in uneconomical use of water and often to evident burning of the plants prior to maturity in dry areas.

(*W. A. Moss*).

Stubble-Mulch Farming Demands Modifications of Implements and Method of Soil Preparation

Stubble-mulch farming demands that the major portion of the straw of the previous crop be left at the surface of the soil in the course of the preparation of the seedbed. It offers a means of utilizing the stubble and straw to offer protection against soil blowing and washing, helps in adding to the organic residues in the soil, and improves the tilth of the soil. At the same time, if the straw is kept at the surface, crop yields are not decreased as in cases where the straw is mixed with the soil as in ordinary plowing.

One of the best implements for the preparation of trashy fallows is the ordinary moldboard plow with the moldboard removed and replaced by a narrow strip so that the soil will be raised about 4 inches above the plow share. Five-year average winter wheat yields on fallow land with the use of the one-way disk or wheatland plow were 20.9 bushels, where the ordinary moldboard plow was used the yields were 21.4 bushels, when the moldboardless plow was used in preparation of the seedbed, the wheat yielded 22.3 bushels per acre.

Early spring disking previous to plowing has resulted in increased yields. Such disking will enable the producer to delay plowing, serves to kill weeds and volunteer cereal plants. In addition to conserving soil moisture, it also facilitates seeding operations in that the straw is cut up so that it will not interfere with drilling. The cost incurred by the spring disking is compensated in part by the lesser amount of weeding required to keep the fallow clean. Preparation of the fallow by early spring disking and the later use of the moldboardless plow gave 5-year average winter wheat yields of 25.4 bushels per acre. This figure is directly comparable with the yields given in the preceding paragraph.

Heavy stubble and straw may call for the use of special drills such as deep furrow disk drill or drills with wider spacings between the disks to prevent clogging. Shovel type furrow opener drills can also be used to advantage. Where spring grain is grown, the straw does not ordinarily interfere with drilling. By spring, it will be decomposed sufficiently so that it can be cut up readily with a disk. (*Hugh C. McKay, W. A. Moss, and G. O. Baker*).

Publications

THE results of investigations by the Station staff are published as bulletins, research bulletins, circulars, war circulars, and mimeo-leaflets by the University and as research papers by various scientific journals. The list of publications for 1944-45 follows:

Bulletins

- 255 51st Annual Report—Wartime Agricultural Research
- 256 The Results of Stubble—Mulching Investigations
- 257 Diversified Farming in the Palouse Region of Northern Idaho
- 258 Farming Opportunities in Idaho
- 259 Potato Starch Production in Idaho
- 260 Thirty-five Years of Farm Prices to Idaho Farmers
- 261 The Rural Land Market in the Northern Idaho Grain-Pea Area
- 262 Survey of the Diseases of the Carrot Seed Crop in Idaho with Control Recommendations
- 263 Wartime Growth and Decline of Hog Production in the Moscow Area as Representing Conditions in the Northern Idaho Cash-Grain Area.

Circulars

- 90 Treatment for Domestic, Farm, and Industrial Water Supplies
- 91 Introduction to Postwar Program for Idaho Agriculture, Ranges and Forests
- 92 Control of Storage Diseases of Onions
- 93 Range Land Problems in Postwar Period
- 94 Report of Branch Stations
- 95 Predatory Animal Control, Range and Wildlife
- 96 Idaho Postwar Rural Health and Housing Program
- 97 Idaho Amber Sorgo
- 98 Crop and Pasture Lands for the Postwar Period
- 99 Timber Production on the Forest Lands
- 100 The Farm Woodlands
- 101 Postwar Program for Idaho—Watershed Protection, Recreation, Wildlife, Range Use on the Forest Lands
- 102 Vitamin A Potency of Idaho Butter
- 103 Hog Lice Control
- 104 Idaho Employment in Relation to Agriculture.

War Circulars

- 37 Freezing Preservation of Fruits and Vegetables
- 38 Mineral Supplements, Especially Phosphorus
- 39 Control of Vegetable Garden Maggots
- 40 Mechanical Protection of Tomatoes from Leafhoppers
- 41 Bindweed Control
- 42 Control Cattle Grubs
- 43 Vegetables for Health
- 44 Phosphate Fertilization Pays—Influence of Phosphate Fertilizer on the Yield of Alfalfa, Potatoes and Wheat and on the Quality of Alfalfa Hay in a Six-Year Rotation.

Mimeo-Leaflets

- 91 Control of Storage Rots of Squash and Pumpkins—*Glenn KenKnight*
- 92 Diversified Farming in the Palouse Region of Northern Idaho—*V. B. Fielder and Paul A. Eke*
- 93 Orchard Spray Recommendations for Idaho—1945—*W. E. Shull and J. M. Rader.*

Research Papers

- 232 Loss of Riboflavin in Milk Due to Sunlight — *Olof E. Stamberg and D. R. Theophilus*
- 233 The Influence of Breed, Feed, and Processing on the Riboflavin Content of Milk—*D. R. Theophilus and Olof E. Stamberg*
- 234 Photolysis of Riboflavin in Milk—*Olof E. Stamberg and D. R. Theophilus*
- 235 Vitamin C and Carotene in Rose Hips and Products—*Olof E. Stamberg*
- 236 Influence of Certain Factors on Second Growth of Russett Burbank Potatoes—*James E. Kraus*
- 237 Frozen Vitamin Standards—*Olof E. Stamberg and D. W. Bolin*
- 238 The Calcium and Phosphorus Requirements of Breeding Ewes—*W. M. Beeson*
- 239 Riboflavin and Thiamin Loss in Cooking Eggs—*Olof E. Stamberg and Charlie F. Peterson*

HOME STATION DISBURSEMENTS

Detail of Expenditures of State Appropriations (1) and Income Funds
Idaho Agricultural Experiment Station
January 1, 1944 through December 31, 1944

	Salaries	Help	Expense and Supplies	Capital Outlay	Total
Administration	\$100.00	\$ 383.55	\$1,036.95	\$.00	\$1,520.50
Agr. Chemistry .....	.00	126.50	43.56	.00	170.06
Agr. Economics .....	.00	251.75	3.71	.00	255.46
Agr. Engineering .....	.00	282.00	28.04	.00	310.04
Agronomy .....	.00	510.00	236.55	.00	746.55
Animal Husbandry .....	.00	257.75	1,999.15	1,247.80	3,504.70
Bacteriology	308.32	69.75	.00	.00	378.07
Dairy Husbandry .....	.00	.00	16.21	12.33	428.54
Entomology	25.00	982.70	791.97	.00	1,799.67
Home Economics .....	.00	8.13	.00	.00	8.13
Horticulture .....	.00	1,591.11	615.34	20.00	2,226.45
Plant Pathology .....	.00	42.93	32.81	937.09	1,012.83
Poultry Husbandry .....	.00	431.70	2,489.90	9.00	2,930.60
Soil Survey .....	.00	.00	181.54	57.00	238.54
TOTAL	\$433.32	\$4,937.87	\$7,875.73	\$2,283.22	\$15,530.14

(1) Includes General Appropriation and Institutional Funds.

BRANCH STATION DISBURSEMENTS

January 1, 1944 through December 31, 1944

	Salaries	Irregular Help	Expense and Supplies	Capital Outlay	Total
Aberdeen	\$ 3,100.00	\$ 8,969.30	\$ 4,745.75	\$4,413.94	\$21,228.99
Aberdeen Potato Research	2,599.96	2,840.54	991.23	2,022.16	8,453.89
Caldwell	4,590.00	5,300.52	7,905.46	.00	17,795.98
High Altitude	1,900.00	1,001.39	1,652.07	450.00	5,003.46
Sandpoint	3,370.00	708.35	1,549.19	116.83	5,744.37
TOTAL	\$15,559.96	\$18,820.10	\$16,843.70	\$7,002.93	\$58,226.69

FINANCIAL STATEMENT

Detail of Expenditures of Federal Appropriations
Idaho Agricultural Experiment Station
July 1, 1943 to June 30, 1944

	Hatch	Adams	Purnell	Bankhead Jones
Personal Services	\$10,659.70	\$11,388.98	\$47,471.47	\$10,971.63
Supplies and Materials	1,634.47	1,195.25	7,783.87	1,262.45
Communication Service	130.13	6.67	86.21	6.90
Travel Expense	1,085.17	365.23	1,943.80	432.54
Transportation of Things	34.48	20.35	152.83	20.22
Printing and Duplicating or Illustrating Publications	769.95	.00	183.17	11.45
Heat, Light, Water, and Power (services) and Fuel .....	.00	22.81	107.50	40.60
Repairs	173.25	711.76	586.12	164.78
Equipment	512.85	1,082.41	1,465.46	554.51
Land (Purchase and Rent) .....	.00	.00	80.00	240.00
Structures and Nonstructural Improvements .....	.00	206.54	139.57	514.76
Balance Unexpended June 30, 1944 .....	.00	.00	.00	.00
TOTAL	\$15,000.00	\$15,000.00	\$60,000.00	\$14,219.84