Bulletin No. 251

Wartime Agricultural Research

Fiftieth Annual Report of the Idaho Agricultural Experiment Station. For the Year Ending December 31, 1942

Idaho's effort to meet the need for herb and drug crops. General view of test plots for these crops at the Parma Branch Station.

UNIVERSITY OF IDAHO
Agricultural Experiment Station
MAY 1943

Published by the University of Idaho, Moscow, Idaho

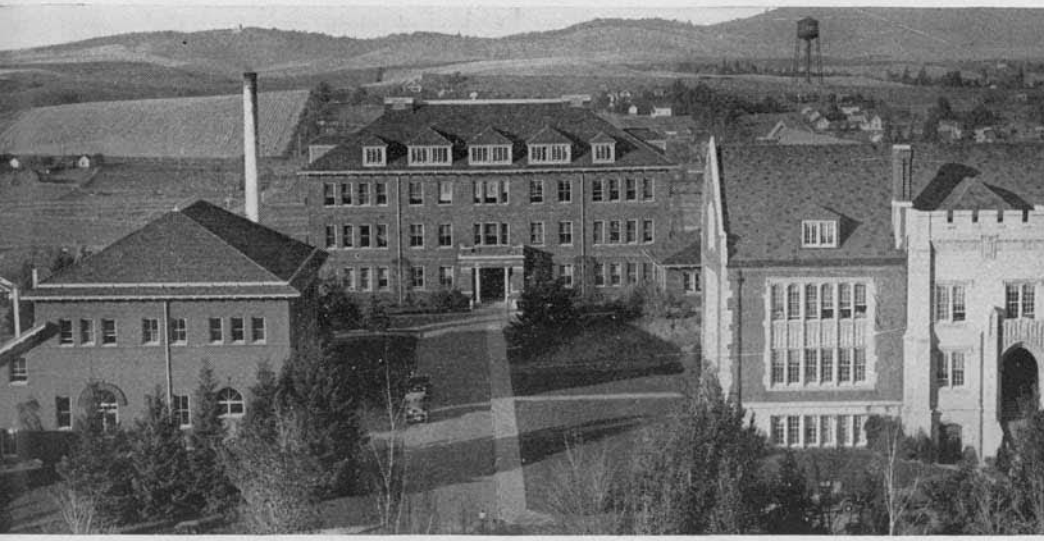
The old University campus. (See page 4 for airview of today's campus.)

Idaho Station's Semi-Centennial

E. J. Iddings, *Director*

THIS annual report of the Idaho Agricultural Experiment Station marks the semi-centennial of the Station's organized program of agricultural research. From the small beginnings of 50 years ago, when the work of the Experiment Station was not well known and frequently misunderstood, this research organization of the University of Idaho College of Agriculture has grown in the complexity of its work and in its stature as a constructive force in the State's agricultural development.

These years, since the first report was issued, have witnessed fundamental changes and remarkable progress in the State's agriculture. The livestock industry has been extended from its former status, largely limited to the range, to a combination range and farm enterprise representing a substantial contribution each year to the State's new wealth and marked by higher standards of produc-



Morrill Hall (center) headquarters of the College of Agriculture.

tion and more efficient marketing. Numerous crops, such as potatoes, beans, dry edible peas, sugar beets, vegetable crop seeds, and others, almost unknown on the farms of the Western states when the Station started, have become standard sources of Idaho's agricultural wealth.

The farmers of the State through the years have indicated increasing confidence in and dependence upon the work of the Station. It, therefore, has been a contributing factor to the attainment of high yields and high quality in plant and animal production, in the protection of farm enterprises from destructive pests and diseases, and in the development through these 50 years of an agricultural industry which supports approximately two-thirds of our population and which, both in times of peace and in times of war, contributes substantially to the food production of the nation.

The Idaho Agricultural Experiment Station has had an important share in these years of Idaho's remarkable agricultural achievement.

Wartime Agricultural Research

C. W. HUNGERFORD, *Vice Director*

Introduction

THE responsibilities and tasks of the Idaho Agricultural Experiment Station have been increased many fold by changing conditions brought about by the war. The methods of production, processing, and handling of foods and food products have undergone rapid and revolutionary changes during the last two years. The 12 departments of the Experiment Station have revamped their programs in order to conform to these changing conditions and to help farmers meet wartime needs of Idaho agriculture. Research in the various fields of agriculture is of value not only to agricultural producers alone; it affects countless consumers who are depending upon us for food.

The investigations of the Experiment Station are carried on under individual projects for each line of research undertaken. There are at present about 150 of these research projects. The several departments began over a year ago to scrutinize their lists of projects and eliminate, for the time being at least, those having little or no place in the wartime agricultural experiment station program. They then proceeded to modify the remaining projects to bring them in line with wartime needs. Many new projects have been initiated to assist farmers to solve problems which have developed because of the war.

That progress has been made is shown by the fact that 36 projects have been dropped from the list of projects supported by Adams, Purnell, and Bankhead-Jones funds and 30 new projects have been initiated since July 1, 1941. We believe that our revised program will be one which will contribute more fully toward the progress of the war and assist in carrying on necessary agricultural practices.

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

A few of the newer lines of investigation include nutrition and vitamin studies of Idaho potatoes and field peas; investigation of the effect of frozen storage and cooking upon certain vitamins in pork and lamb; methods of preservation of the carotene content of alfalfa and other forages; management of irrigated pastures; economic study of the use of small tractors; factors influencing the market value of real estate in certain Idaho counties. Other newer studies include control of swine ery-

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The air view reproduced on the opposite page shows the University Farm in relation to the University Campus.

sipelas, swine brucellosis, and urinary calculi in sheep; control of the bacterial ring rot of potatoes and of the storage rot of carrots; investigation of problems related to growing of vegetable seeds in Idaho; tests of various specialty crops, such as certain herbs, condiment plants, and rubber-producing plants in various parts of the State; investigations of radiant energy drying in agricultural processes; and a study of the design and function of certain mechanical equipment on Idaho farms.

Cooperation with various federal, state, and private agencies has been extended materially during recent months. About 30 different lines of cooperation are now in force. The most recent one is in cooperation with the Bureau of Plant Industry of the U. S. Department of Agriculture at the Parma Branch Station in studies dealing with vegetable seed production.

During the summer of 1942, cooperative experiments were conducted at the branch stations at Aberdeen and Caldwell by representatives of the Western Regional Research Laboratory at Albany, California, to test the practicability of air drying cull potatoes and to investigate the utilization of the dried product as material for the manufacture of starch and alcohol. At Aberdeen, using cull Netted Gem potatoes from the 1941 crop, it was possible to air dry these culls satisfactorily at a cost of approximately $2.00 per wet ton of potatoes, not counting bags, transportation, or storage charges.

At Caldwell, cull potatoes of the 1942 crop were used and the tests were conducted during August and September. Drying was not satisfactory in any of the trials except those using forced air circulation. Otherwise the results of the tests conducted at Aberdeen and Caldwell did not differ materially.

The dried product has not been found to be entirely satisfactory for feed for livestock. Details of feeding trials are given under the Caldwell Branch Station report. When the cut potatoes were treated with sodium sulphite before drying, starch can be produced which is only slightly discolored and which has a paste viscosity as good as starch made from raw potatoes.

In brief, the Experiment Station is endeavoring in every way to speed up the translation of science into practice, to assemble this information as rapidly as possible, and in cooperation with the Agricultural Extension Service make this information available to the farmers of the State.

Following are brief reports of progress made during the year in the 12 departments of the Agricultural Experiment Station at Moscow, and the five Branch Stations at Aberdeen, Caldwell, Sandpoint, Tetonia, and Parma. Reports of many of these investigations already have been published. Others will be reported upon during the coming months. Keep "tuned in" to your Idaho Agricultural Experiment Station for latest research findings.

Crops, Crop Breeding, and Soils

Climatic Conditions Generally Favorable

THE crop year of 1941-42 (September 1 - August 31) was generally favorable to all crops of the Palouse area even though precipitation was 1.81 inches below the 50-year normal of 21.75 inches. Rainfall during the fall months was high; it was low during the winter and early spring months but again slightly above normal during the critical months of May, June, and July. The temperatures were close to normal with the exception of January, which was 3.2 degrees below the normal. Fortunately, May and June had temperatures of 2.5 and 3.4 degrees below normal. This condition, together with the higher than normal rainfall for these months, largely accounted for the good yields of cereals, grasses, peas, and flax for the season. *(K. H. W. Klages.)*

Superior Field Corn Hybrids Tested

Commercial corn hybrids were tested over a wide area in southern Idaho. Thirty of the common hybrids sold to Idaho farmers were placed in one or more of the 12 yield trials in 12 counties. The results indicate that many of these hybrids are rather late for Idaho conditions. The moisture content of many of the corn hybrids tested was too high at harvest time for the economical utilization of the crop. Many of the hybrids tested produced higher yields than open-pollinated varieties. Since the quality of the crop produced is closely correlated with the degree of maturity at harvest, late maturing hybrids should not be selected for planting.

Hybrids ranging from early to medium-late have been developed at the Caldwell Branch Station. Seed stocks of the inbred lines utilized in the development of superior hybrids are being increased for the production of commercial field corn single crosses. Ten medium-early and ten medium-late double crosses were made in 1942 on the basis of predicted yields and maturities from the 1941 single cross results. These will be tested next year in comparison with the best single crosses, commercial double crosses, and several adapted open-pollinated varieties. Most of the corn breeding work is carried on at the Caldwell Branch Station.

A new project on breeding for earworm resistance in sweet corn was started this year in cooperation with the Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture. Twenty of the most resistant sweet corn lines available in the United States were collected, studied for resistance to earworm damage, and adaptation to Idaho conditions. The best lines of these were perpetuated for yearly selection and the development of improved strains. *(H. K. Schultz, M. G. Forsyth, K. H. W. Klages.)*

Cereal Trials Include Promising New Crosses

The higher yielding varieties of winter wheat this year were Elgin, Brevon, Rex, Mosida, and several Mosida hybrids. Yields of the winter wheat varieties were significantly higher than those of the spring wheats tested. While a late stem rust epiphytotic resulted in only slight damage to the winter wheats, varieties of spring wheat showing from 30 to 85 per cent of stem rust were reduced materially in yields. High yield-

ing varieties of spring wheat were Marquis, Idaed, Onas, Baart, and Federation.

Three white spring wheats, Idaed, Federation, and Australian Selection 735, were crossed with Premier, a hard red spring wheat carrying the stem rust resistance of Hope and H-44. A total of 53 F_2 progenies of 25 to 150 plants each were grown in the field under a severe stem rust epiphytotic. Stem rust resistant segregates with desirable agronomic characteristics were selected and are being grown in the greenhouse to speed up the increase of homozygous types. Idaed, a white spring wheat, was distributed by the Department of Agronomy in 1938. It is giving generally satisfactory results. While the variety is not resistant to rust, it frequently escapes severe stem rust damage if planted early in the season. The development of a variety with the yielding capacity and agronomic characteristics of Idaed plus stem rust resistance is highly desirable.

In the case of oats, two Markton x Victory crosses, together with Victory, gave outstanding yields. Certain (Victory x Richland) Bannock crosses are showing up well.

Advanced generation crosses of Vaughn x Atlas barley were compared for yield. Some of these barley crosses appear promising. *(H. K. Schultz.)*

Pea Varieties Selected For Genetic Purity and Hybrids Studied

In order to study the degree of uniformity within varieties and to isolate pure lines, 104 varieties of peas were grown with individual plant spacings of 4 x 4 feet. This spacing of the plants and frequent applications of rotenone dust for pea weevil control helped to insure against cross pollination. Several superior plants were selected from each variety on the basis of plant and seed characteristics. This season's work gave evidence of the necessity of isolation and selection before more detailed studies, such as the selection of true breeding strains, can be inaugurated.

About 120 early and advanced generation pea crosses were studied in detail with regard to their agronomic characteristics and for homozygosity. These crosses involve parents of both smooth and wrinkled types.

Several strains of Austrian winter peas breeding true for seed coat and cotyledon color were selected. *(H. K. Schultz.)*

Flax Produces High Yields

Flax planted early in the season on land relatively free from weeds has produced high yields. The average yield of the 32 seed flax varieties and one fiber flax in the flax nursery test in 1942 was 25.6 bushels per acre. These same varieties gave an average yield of 27.2 bushels per acre in the 1941 nursery. A 5-acre increase field of Bison flax yielded 20.0 bushels per acre in 1942. These yields are higher than can be expected under normal conditions. The seasons of 1941 and 1942 were exceptionally favorable to flax. Nevertheless, the yields reported indicate that satisfactory yields of flax can be produced in Idaho if proper attention is given to the selection of land, seedbed preparations, and if the crop is planted early in the season. A high level of fertility is desirable and above all the land selected must be free from weeds. Flax is poorly adapted to compete with weeds; furthermore, green weed growths at harvest interfere with the combining of the crop. *(K. W. Klages.)*

Comparative Values of Various Phosphate Carriers Determined

Several new kinds of phosphate fertilizers have been developed in recent years. Since crop production in many of the irrigated areas of Idaho can be increased materially by the use of soluble types of phosphate fertilizers, some of these newer forms were studied in the greenhouse to provide an indication of their adaptability under field conditions.

The soil used in these tests was obtained from a field near Aberdeen, Idaho. This soil contained 8.6 per cent of lime, was alkaline in reaction with a pH of 8.2, and was relatively low in phosphorus.

The soil used in these greenhouse tests was placed in 12-quart containers and 15 Trebi barley plants were grown in each. The various phosphate fertilizers were added at a rate to supply the same amounts of available phosphate (P_2O_5) as was supplied by the addition of 200 pounds per acre of treble superphosphate. The fertilizers were applied in layers 3 inches below the surface of the soil. Only one application was made during the course of the experiment. Care was taken not to disturb the soil below a depth of 1½ inches in the preparation of the seedbed for the planting of the first crop and the three subsequent (residual) crops. The barley was grown to maturity, yields were obtained, and the phosphate in the harvested crop was determined. The results are summarized in Table 1.

Table 1.—Greenhouse investigation of the initial and residual influence of phosphate fertilizers on barley yields and on the percentage recovery by the plants of the available P_2O_5 supplied by the fertilizers.

Phosphate Carrier	Equivalent rate per A. applied lbs.	1st crop after adding phosphate		Total of three residual crops		Total of all crops grown	
		Yield index Check= 100	Recovery of available P_2O_5 added in phosphate fertilizer per cent	Yield index Check= 100	Recovery of available P_2O_5 added in phosphate fertilizer per cent	Yield index Check= 100	Recovery of available P_2O_5 added in phosphate fertilizer per cent
Check (untreated)		100		100		100	
Treble superphosphate	200	141	36.6	114	35.4	123	72.0
Triple superphosphate	179	143	31.2	122	30.5	129	61.7
Potassium calcium metaphosphate	161	141	42.2	123	41.0	129	83.2
Potassium metaphosphate	152	148	39.8	124	43.0	132	82.8
Calcium metaphosphate	144	133	20.7	118	27.6	124	48.3
Fused phosphate	459	133	17.1	122	26.5	126	43.6
Rock phosphate	6433	106	1.5	93	0.7	98	2.2

The results obtained indicate that yields alone do not provide the most reliable index of the amounts of phosphate that the plants are able to obtain from the fertilizers applied. This is illustrated by the fact that for all the crops grown, fused phosphate shows a slightly higher yield index than treble superphosphate. However, the latter was able to supply approximately 40 per cent more phosphate to the plants. This is important in relation to mineral nutrition.

The first crop removed approximately one-half of the phosphate that the plants were able to take up during the entire period of the test. Obviously, however, the residual effects are of considerable importance in relation to soil management practices.

Potassium calcium metaphosphate, potassium metaphosphate, treble superphosphate, and triple superphosphate were the most satisfactory forms for applications to high lime soils. However, since the first two of these supply potassium in addition to phosphate, they are higher in price per unit of phosphate supplied than is the case with the use of treble and triple superphosphate. Most of the irrigated soils of Idaho are at present well supplied with potassium. It is, therefore, not desirable to incur the additional expense of supplying this element. Calcium metaphosphate and fused phosphate are not as satisfactory as the more soluble forms mentioned above. Rock phosphate is entirely unsatisfactory, both from the standpoint of yields obtained and amounts of phosphate recovered by plants.

These summary results are in agreement with other greenhouse tests in which tomatoes were used as indicator plants, and with field tests with alfalfa conducted at the Aberdeen Branch Experiment Station. *(G. O. Baker.)*

Farm-Produced Materials Increase Yields

Crop yields were increased materially by the utilization of such farm-produced materials as barnyard manure and green manures. Applications of barnyard manures result not only in immediate yield responses, but long time rotation studies indicate gradual accumulative effects influencing the yields and qualities of crops produced. In two comparable crop rotation systems consisting of winter wheat, oats, and peas, with and without the application of 15 tons of manure every third year, applications of manure resulted in increases of 19 bushels of wheat and 57 bushels of oats per acre in 1942.

The value of sweet clover as a green manure crop was well illustrated in 1942. Two spring wheat plots on which sweet clover was plowed under in 1941 averaged 70 bushels per acre. The first crop of winter wheat after the plowing under of sweet clover yielded 62 bushels, while the second crop yielded 55 bushels per acre. *(G. O. Baker, J. G. Cady.)*

Fruit and Vegetable Crops

New War Crops Are Tested

BEFORE the outbreak of the war the drug and condiment trade of the United States relied almost wholly on foreign countries for raw products. A very few of these, such as seeds of dill, coriander, and fennel, still are being received in limited quantities from India; but a host of others, including sage, anise, paprika, thyme, caraway, digitalis, and belladonna, that formerly were imported from Europe and Asia no longer are available from these sources. In order to assure a wartime supply of these plants, some of which are critically important in the medical care of our military and civilian populations, it has become necessary to develop domestic sources of supply.

With the support of a special fund set up by the Idaho State Chamber of Commerce, and through the cooperation of the Idaho Farm Chemurgic Council, a total of 32 such crops, mostly new to Idaho agriculture, were tested in plots at the Parma Branch Experiment Station in 1942. Some-

what smaller numbers were grown at Moscow and Twin Falls, and at the Branch Experiment Stations at Aberdeen, Tetonia, and Sandpoint. Studies were conducted to determine the best time to plant each of these crops, the best spacing of the plants, the most efficient harvesting methods, and the yields that may be expected under Idaho conditions.

Most promising of the crops tested this year were sage, anise, caraway, coriander, and fennel. In at least some parts of the State high yields and good quality were obtained in each of these. How profitable these crops might be in the next year or two it is impossible to forecast at this time, as prices in recent months have fluctuated widely. Several small commercial plantings of sage observed in the State in 1942 were highly productive and yielded a product of exceptionally good quality. *(Rex Blodgett, D. F. Franklin, and Leif Verner.)*

Onion Floral Development and Seed Production Studied

Factors favoring floral initiation and subsequent development of the seed stalk were given special attention during the winter of 1941-42. Greenhouse experiments were set up in order to study the effect of storage temperature, length of storage, and light upon the behavior of onion bulbs at three different greenhouse temperatures. From examination of growing bulbs sampled at intervals throughout the winter, the course of floral initiation could be followed in all of the treatments used. Bulbs from two different storages were planted at three different dates at Parma. Samples were taken from these plots and examined for flower primordia.

The winter of 1941-42 at Parma was the most severe since the onion trials were started. As a result, conclusive data could not be obtained. The important points brought out from these field experiments were: (1) Varieties Ebenezer and White Portugal were much more satisfactory from the standpoint of survival than were either Sweet Spanish or White Sweet Spanish. (2) Early planting (Sept. 15) is notably better than late planting (Nov. 15). October 15 also is better than November 15 as a planting date for seed onion bulbs. Early planting is especially advantageous in the Spanish varieties. (3) Regardless of planting date, most primordia were initiated during February and early March. Primordia were initiated in the four varieties in this order: (1) White Portugal, (2) White Sweet Spanish, (3) Sweet Spanish, and (4) Ebenezer. *(George W. Woodbury.)*

Carrot and Turnip Seed Production in Northern Idaho Investigated

Relatively mild winters, fall and early spring moisture, and a dry period of harvest are factors which go toward successful production of vegetable seed. This applies especially to biennial crops such as carrots and turnips. These produce seed only during the second year of growth.

During the 1941-42 season preliminary tests were made with turnips and carrots in an effort to establish certain practices regarding culture of these crops.

Turnips were planted at Moscow on four different dates throughout the fall: August 20, September 8, September 20, and October 15. Each planting was replicated four times. These were drilled in rows 3 feet apart. With sufficient moisture germination took place at once in all

plots. The early-planted plots, therefore, made more growth and were better established by cold weather.

None of the plants from the October planting survived the winter. On the plots planted September 20, the stand was notably low. The first two plantings—August 20 and September 8—produced satisfactory crops. The first plantings had a slightly larger average yield than the second, although the difference was not significant. Only two of the plots from the September 20 planting were harvested, and the yield was low. Yield data for the first two plantings are shown below.

Table 2.—Yield of turnip seed in pounds per acre from plantings made August 20 and September 8.

Date planted	Replicates					
	1	2	3	4	M	S. E. M.
August 20	925	1643	1675	2050	1573	± 235
September 8	1756	1375	1050	1225	1351	± 150

The general recommendations which might come through an analysis of this single year's data are: (1) Plantings of turnip for seed should be made as soon as sufficient moisture is present to insure successful germination, and (2) Plantings made much later than September 15 are not likely to succeed unless followed by exceptionally good growing conditions throughout the fall.

General recommendations cannot be made to cover production of seed from all of the root crops. Carrots, for example, require more time for development of a root satisfactory for seed production. Furthermore, there is always some likelihood that many of these roots will not survive the winter if left in the field.

Carrot seeds were planted at Moscow during the early part of August 1941. Three varieties, Danvers, Chantenay, and Nantes, were used. Rows were 18 inches apart. Toward the close of the growing season every other row was removed, leaving in the field rows 36 inches apart. Seed from all three varieties was harvested in August 1942. No yield records were taken. It may be said that the crop was not satisfactory in comparison with a crop taken from irrigated land where most of our carrot seed is produced. This is not necessarily a fair comparison. Less labor is involved in caring for the crop under dry land conditions. Less expensive land is used for seed production. If yields from 500 to 1,000 pounds per acre are profitable on irrigated land, dry land crops might show a profit if from 300 to 600 pounds could be produced. One year's results do not conclusively show that this is possible, but with increasing demand for larger acreages of seed crops commonly grown in the irrigated sections of the state, production of a part of the necessary vegetable seed may need exploitation elsewhere. *(George W. Woodbury.)*

Apple Tree Training Improved

One of the main purposes an apple grower has in mind in training a young tree is to avoid the development of framework branches that form narrow angles with the trunk. The experienced grower knows that such a union is weak. In orchards with many branches of this type serious damage to trees may be expected in years of heavy crops, or as a result of heavy snows or severe wind storms.

Recent experiments at the Idaho Agricultural Experiment Station have shown that crotch angles in apple trees are determined largely by the action of a plant hormone, a complex chemical substance that is produced in the growing shoots of the tree and is capable of directing the growth and behavior of other shoots lower down on the trunk. When a synthetic chemical substitute for this hormone is applied in the form of a paste over the stub of a young whip after it has been headed back, and before growth starts, only wide branch angles are formed as the young tree grows. This method has been used experimentally on many varieties of apple with marked success, but it cannot as yet be recommended as a commercial practice because the results vary according to the vigor of the young tree. The growth of trees that have been weakened considerably by transplanting sometimes is stunted seriously by the hormone paste treatment.

Making use of the principles demonstrated by these investigations, it has been possible to so modify past methods of training trees that a much higher proportion of wide crotch angles may now be obtained.

Three methods that have proved highly satisfactory at the Idaho Agricultural Experiment Station are as follows:

1. Double heading back. The most common method of starting young apple trees has been to head back at a height of 30 to 36 inches at planting time. This results in development of narrow angles by the first three or four branches below the point of heading, and a bad compound crotch is formed. In the new method the tree is first given a preliminary heading back to a height 4 to 6 inches above the height ultimately desired. When the uppermost shoots have attained a length of 4 to 6 inches the tree again is headed back, this time to a point just above the lowest branch with a narrow angle, usually the third or fourth branch from the top. This branch continues the upward growth of the tree, serving as a central leader. All branches below it have been subjected to the hormone influence of branches above long enough to have formed more or less permanent, wide angles. Thus, at the second heading back we eliminate the compound crotch normally formed by the upper three or four branches, reduce the tree to the desired height, and leave a single upright leader with all lower branches wide angled. Subsequent training consists simply of selection and thinning out of framework branches.

2. Deshooting. In this method the tree is headed back to a height of 3 to 5 feet, or approximately three-fourths of its original height. Nothing further is done until the majority of shoots have reached a length of about 3 inches. By that time most of the shoots have been under the influence of hormones from shoots above for a long enough time to have formed wide angles. Selecting vigorous, broad-angled shoots that are well distributed on the trunk, and a terminal shoot to continue upward growth, all others then are removed with a sharp knife. The resulting tree usually has an excellent framework, with well spaced, strong branches not crowded on the trunk.

3. Cutting back to a single bud. Not infrequently, newly transplanted whips make such poor growth the first year that not enough vigorous shoots are produced to train the tree satisfactorily by either of the methods outlined above. In such a case the tree may be cut back to a single live bud above the graft union. Usually a vigorous growth is made from

this bud. All lateral shoots will develop wide angles under the influence of the hormone formed by the actively growing terminal portion of the tree. As these shoots appear, those most desirable for framework branches are selected and all others are removed as soon as possible, preferably before they exceed 1 inch in length. When handled in this manner trees that made a poor start after transplanting are definitely superior in form and vigor to similar trees handled by conventional methods.

All three of the methods outlined above take advantage of the natural hormones of the tree to insure the development of wide crotch angles. Methods 1 and 2 are applicable only to unbranched trees, or whips. Method 3 may be used for either branched or unbranched trees. *(Leif Verner.)*

Beef Cattle, Horses, Sheep, and Swine

Beet By-product Rations Need Phosphorus Supplement

TWO year trials show that yearling steers, fed a daily ration of beet molasses (3.5 lb.), wet beet pulp (40 lb.), and unlimited amounts of alfalfa hay (14 lb.) become deficient in phosphorus. This deficiency may be corrected effectively and economically by feeding 1/10 of a pound of steamed bonemeal per steer daily, or by giving them free access to steamed bonemeal. The steers fed the bonemeal gained 1/3 pound more per day, and required about 15 per cent less feed per pound of gain.

It is of special interest to note that this year's experiment has confirmed our previous studies showing that a yearling steer should receive a phosphorus supplement such as steamed bonemeal when the ration is made up principally of beet molasses and wet beet pulp.

Cattle that are being fattened on grain, either as one-half or all of the concentrate mixture do not need a phosphorus supplement. All grains and by-products of grains are rich in phosphorus; therefore cattle receive ample phosphorus from these sources.

In an attempt to obtain information on the effect of feeding large amounts of wet beet pulp (80 lb. daily) and a limited amount of alfalfa hay (5 lb. daily), along with beet molasses (4 lb. daily), experiments were conducted in which bonemeal was added to the diet at the rate of 1/10 pound per steer daily. Even though the phosphorus intake was adequate, the gains of the steers were slow (1.38 lb. daily) and they failed to fatten. This ration apparently supplied ample phosphorus, but the steers failed to fatten normally because of a lack of protein. It is suggested that when yearling steers are fed on large quantities of wet beet pulp a protein supplement such as cottonseed meal should be added to the ration at the rate of 1 pound per steer daily. *(W. M. Beeson, C. W. Hickman, D. W. Bolin, R. F. Johnson, and E. F. Rinehart.)*

Possible Causes of Urinary Calculi Eliminated

An intensive study for 2 years on the possible causes of urinary calculi, popularly known as "water belly," in male sheep, has permitted the following conclusions:

Statements about these urinary substances are largely speculative at this time, because little experimental evidence can be given concerning

Pen of steers in feeding tests at Caldwell Branch Station.

their behavior. However, data at hand indicate that large amounts of silica in urine produced a saturation with resulting calculi formation in the kidneys. The amount of magnesium probably exerts a strong influence in the determination of the silica solubility limits.

Experimental diets high in linseed and cottonseed meal, calcium, magnesium, or calcium and phosphorus, fed to wether lambs, with and without an adequate source of vitamin A, did not lead to the formation of urinary calculi within 150 to 160 days. Elemental sulphur or added silica did not lead to any observable effects whatever.

Vitamin A deficiency was eliminated as having any effect on the formation of urinary calculi under conditions observed in this study. Feeding large amounts of wheat bran was found to lead to the formation of urinary calculi.

Individual variation in the absorption and excretion of dietary mineral elements was found to be worthy of important consideration in the etiology of urinary calculi formation.

The occurrence of an apparently rare siliceous type of calculi observed in this study was attributed to a hyperexcretory state in which urinary magnesium plays an important role in establishing the urinary silica solubility limitations. *(W. M. Beeson, J. W. Pence, G. C. Holm, D. W. Bolin, and C. W. Hickman.)*

How to Feed Michels' Grass Seed

Farmers may utilize Michels' grass seed satisfactorily in hog rations by feeding it in a mixture with one-half wheat or barley. In addition to the grain mixture the hogs' diet should be balanced with free access to meat meal, 5 per cent ground alfalfa, 1 per cent oyster shell or limestone, and ¼ per cent salt.

Michels' grass seed, when fed alone, is extremely unpalatable for hogs and as a result the gains are slow, the hogs are unthrifty, and fail to fatten.

Hogs on Michels' grass seed consumed only 3.98 pounds per head daily as compared to a daily intake of 6.39 pounds of feed for the hogs on wheat.

Hogs fed Michels' grass seed consumed 5 per cent more meat meal than those fed on wheat or barley. This amounted to a total of 20 more pounds of protein supplement per 100 pounds of gain, and thus increased the cost of gain 80 cents per hundredweight. Michels' grass seed contained more protein than wheat or barley but the hogs probably consumed more of the supplement because of the unpalatability of the Michels' grass seed.

Michels' grass seed is not as good a feed as Rosen rye in palatability, economy, or rapidity of gains.

The mixing of Michels' grass seed with equal parts of wheat or barley definitely increases its palatability and the hogs grow faster and make more economical gains. Hogs fed on a balanced ration with Michels' grass seed as the sole grain gained only 0.91 pound daily, while hogs fed the same diet with half of the Michels' grass seed replaced with barley or wheat made an average daily gain of 1.31 and 1.36 pounds respectively.

Although Michels' grass seed is equally as good on the basis of chemical analysis as wheat or barley, the feeding results definitely show that feed analyses alone cannot be accepted as criteria for the relative food value of different feeds. *(W. M. Beeson and C. W. Hickman.)*

Pays to Balance Hog Rations With Meat Meal

Hogs cannot secure adequate amounts of protein from ground alfalfa hay to balance a ration of wheat, barley and minerals. Hogs were self-fed equal parts of rolled barley and wheat mixed with 1.0 per cent flour-fine oyster shell and 0.25 per cent salt and in another compartment they had free access to good quality ground alfalfa hay. To show the advantage of giving hogs an animal protein supplement another pen of hogs was fed the same ration as above, excepting they were allowed to eat meat meal at will.

The differences between these two lots were striking. The hogs with meat meal gained three times more rapidly than the hogs without meat meal, and required 100 pounds less feed to produce 100 pounds of pork. At the end of 112 days the pigs with meat meal weighed 200 pounds and those without meat meal only weighed 95 pounds. The pigs without meat meal were thin, emaciated, and lacked decidedly in thriftiness and bloom.

Ground alfalfa cannot be relied on to meet the protein requirements of hogs. The difference in gains between the two lots of hogs was so great that it cost $1.50 more for every 100 pounds of pork produced for the hogs not fed meat meal. That is entirely on the basis of feed requirement without considering the fact that it would require three times as long a feeding period to market the hogs receiving no meat meal—provided they did not die in the meantime.

Other animal proteins may be substituted for meat meal, such as fish meal, skimmilk, buttermilk, or whey. Pasture will compensate for part of the protein deficiencies in grains and reduce by one-half the amount of animal protein required. An excellent protein and vitamin supplement for hogs is meat meal, 50 lb., linseed, cottonseed, soybean or pea meal, 25 lb., and ground alfalfa, 25 lb. *(W. M. Beeson and C. W. Hickman.)*

Lactation in Ewes Lowers Blood Phosphorus

That lactation has a definite effect on the blood phosphorus levels of range ewes has been brought out by a 4-year study on a group of ewes managed under typical range conditions at the Western Sheep Breeding Laboratory, Dubois, Idaho. Ewes wintered on dry range feed or low phosphorus alfalfa (0.15 per cent or less phosphorus) should be given free access to a mineral mixture of equal parts of steamed bonemeal and salt.

Blood samples were collected at lambing time when about half of the ewes had lambed. Blood phosphorus levels were definitely higher for ewes that had not lambed (4.53 milligrams per 100 milliliter) than for ewes that already had lambed (4.06 milligrams). Ewes which recently had dropped single lambs had an average blood phosphorus content of 4.38 milligrams as compared with 3.60 milligrams for ewes which recently had dropped twin lambs. Dry ewes had an average blood phosphorus content of 5.84 milligrams which was much higher than for both ewes which had lambed or were going to lamb.

Blood samples taken in the middle of June toward the end of grazing on the spring range were obtained after lambing and shearing had been completed. At this time ewes suckling two lambs had an average blood phosphorus content of 5.22 milligrams, ewes suckling one lamb, 5.58 milligrams, and dry ewes 5.81 milligrams.

These data suggest that ewes draw heavily on their body stores of phosphorus during lactation somewhat in proportion to the amount of milk produced.

During periods of high phosphorus requirement, the body stores are much more available for use than the feed phosphorus. Therefore, it is important to supply feeds containing ample phosphorus during the dry period and forepart of pregnancy so that the body stores may be replenished for periods of heavy phosphorus demand, e.g. latter part of gestation and lactation. Give the ewes free access to steamed bonemeal mixed with an equal amount of salt. *(W. M. Beeson, D. W. Bolin, and C. W. Hickman, cooperative with the Western Sheep Breeding Laboratory, Dubois, Idaho.)*

Swine Progeny Testing

A summary of 3 years' data collected from the University Poland China herd indicates that a swine breeding program based on progeny testing results in increased production of pork by improving the management as well as by aiding in the concentration of desirable genetic factors. Of an increase in rate of gain from 1.12 to 1.25 pounds per day approximately one-third can be attributed to improved heredity and might be called a permanent gain while two-thirds of the increase will be maintained only on the present management level.

The results of the third year of testing show a further decrease of 5 per cent in amount of feed required per 100-pound gain, a further increase in rate of gain, number and weight of pigs farrowed.

A comparison of rate of progress and intensity of selection for number of pigs farrowed, weight of litter at weaning time, and rate of daily gain

gives estimates of heritability of these characters of 0.23, 0.21 and 0.29 respectively—estimates in close agreement with those made for similar factors by others workers. *(M. L. Buchanan and W. M. Beeson.)*

Swine Brucellosis Disease Studied

Blood reaction studies were continued in the investigation on swine brucellosis in a breeding herd of 108 animals. Four new animals became reactors and nine developed suspicious reactions. Eight animals that were either suspects or reactors became negative. Forty-two pigs born in the fall of 1941 were tested during the year; three developed positive reactions after 8 months. Eighty-four individuals of the 1942 spring pig crop were studied; four became reactors and three of these were reactors at weaning time. These three pigs were of a litter of three, their dam was negative at the time she entered the farrowing pen but was positive 30 days later. These findings indicate that sows farrowing and nursing during the acute stages of swine brucellosis can transmit the infection to their offspring. Litters farrowed from reactor sows went through parturition and the suckling period without developing reaction titres.

A negative boar was allowed to breed reactor sows and a positive blood reaction developed in this boar within 2 months. Three negative gilts were bred to each of two boars that were negative at the time of breeding but had reacted previously. None of the gilts developed positive reactions. One of the boars appeared to be sterile although no clinical manifestations of swine brucellosis were observed.

Vaccination studies are now being conducted to determine the immune response to Brucella abortus strain 19. *(G. C. Holm, W. B. Ardrey, and W. M. Beeson.)*

Dairy Production and Manufacturing

Value of Proved Sire Program Well Established

A VERY interesting and informative story for dairy cattle breeders is revealed in a study of the continuous use of proved sires in the Holstein-Friesian and Jersey herds owned by the University of Idaho. Perhaps the best indication of the very fundamental value of the use of proved sires is shown in a study of the production and type records of the representatives of these two breeds. The high level of production and type attained by these herds is apparent in the recognition given by the respective breed associations. The American Jersey Cattle Club awarded the sixth consecutive Constructive Breeder's Registry certificate to the Jersey herd and the Holstein-Friesian Association of America awarded the fourth consecutive Progressive Breeder's Registry certificate to the Holstein herd. The Jersey herd was the first in the United States to qualify for six consecutive certificates and the Holstein herd was likewise the first to qualify for four consecutive years for the Progressive Breeder's Registry. In addition, the University of Idaho dairy herd is the only college herd in the United States where cattle representing both breeds have qualified for these high awards. Since qualification for these certificates is based on combined achievement in production, type, number of animals bred by the owner, and the observance of a satisfactory disease control program, it is very apparent that the high standards of the herd

Dairy Science Building, new home of the Department of Dairy Husbandry.

have been attained chiefly as the result of the continuous use of proved sires. Proved sires have been used continuously for 25 years in the Holstein-Friesian herd and 10 years in the Jersey herd.

During 1942 the average herd production, including dry cows, of the combined Holstein-Friesian and Jersey herds, consisting of 48 cows, was 445 pounds of butterfat. The Holstein herd, composed of 25 head, averaged 493 pounds of fat and the Jersey herd of 23 cows averaged 400 pounds of fat. Each herd had an average type rating of slightly higher than "Good Plus." *(D. L. Fourt and F. C. Fountaine.)*

Incidence of Mastitis Minimized

As a result of research work and long experience definite practices have been developed and adopted in the management of the University of Idaho dairy herd. These practices, which have given exceedingly satisfactory results in controlling mastitis, are:

1. Making regular laboratory tests every 2 months on composite samples of milk from each cow, in order to locate infected cows. Suspicious cows between routine tests are checked by examining milk, by laboratory methods, from individual quarters.

2. Eliminating infected cows from the herd when production is reduced because of mastitis, old age, or other causes, and replacing them with non-infected heifers.

3. Segregating the infected and non-infected cows.

4. Milking the non-infected cows first and the most severely infected last.

5. Adding an extra head and teat cup assembly to the milking machine equipment, thereby making it possible to immerse each set of teat cups in a chlorine solution (100 parts per million of available chlorine) for 2 minutes between milking each cow. The teat cups first are dipped in warm water before immersing in the chlorine solution.

6. Application of short wave diathermy to the udder for 1 hour daily as soon as possible after a cow is reported to have a hard, swollen, or congested udder. Diathermy usually relieves the congestion before the udder or quarter becomes infected.

These practices were adopted in the spring of 1940 when the milking herd consisted of 56 head. In approximately 2½ years after adopting the practices outlined, the number of cows having mastitis, as shown by laboratory tests (a leucocyte count of 500,000 or more per milliliter of milk and the presence of long chain streptococci in incubated samples of milk) was reduced approximately 50 per cent.

Work was continued on the study to control mastitis with various types of chemicals. One of the most successful used during the past year was Gramicidin. Fifteen cases were treated in various stages of lactation, including dry cows. Of the 15 individuals treated, 11, or 73.3 per cent, were freed of the infection and 4, or 26.7 per cent, showed no improvement. The best results were secured when cows were treated during the dry period. Several of the cows which became negative after treatment, later became re-infected and four cows failed to return to normal production in the lactation period during which they were treated. Preliminary trials with homogenized sulfanilamide give every evidence of very satisfactory results. *(D. L. Fourt, F. C. Fountaine, G. C. Holm, and V. A. Cherrington.)*

Co-operative Dairy Stud Bull Associations Operating Efficiently

Good bull service at a low cost now is being provided to dairymen in Idaho by the Idaho Dairy Stud Bull Service Plan. There are, at present, 28 Co-operative Dairy Stud Bull Associations operating in the state. These associations are using 180 bulls representing the leading breeds of dairy cattle. In two of the leading dairy counties, almost 20 per cent of all of the cows in the county are being serviced by this type of association. A study of 9581 services made in Co-operative Dairy Stud Bull Associations showed that:

(1) The average production (on a mature basis) of the dams of all bulls was 506 pounds of butterfat; (2) The average number of bulls per association was 5.6; (3) The average number of services per bull in a year was 176.4; (4) There was an average of 75.4 per cent conceptions for the first service, and 1.39 services per conception; (5) An average of 6.96 miles was traveled per service; (6) The average cost per conception was $3.43; (7) Heifers had a slightly higher breeding efficiency than older cows; and (8) There was no evidence of the spread of any disease where

recommended sanitary precautions had been followed. *(G. C. Anderson and D. L. Fourt.)*

Vitamin A Content of Milk Increased by Feeding Shark-Liver Oil

Twelve cows, 6 Holstein-Friesian and 6 Jerseys, were fed shark-liver oil during a period of 3 months. The daily feeding of shark-liver oil in quantities sufficient to yield 1,400,000 international units of Vitamin A increased the Vitamin A content of the milk of the Holstein-Friesian cows approximately 280 per cent and the milk of the Jersey cows approximately 306 per cent. The feeding of shark-liver oil had a suppressing effect on the carotene content of the milk of both breeds. Following the feeding of shark-liver oil, there was a 22 per cent reduction in Beta carotene in the Holstein milk and a 33 per cent reduction in the amount of Beta carotene in the Jersey milk. The shark-liver oil increased the total Vitamin A potency (Vitamin A plus Beta carotene) of the Holstein milk by 231 per cent and of the Jersey milk by 217 per cent. The feeding of shark-liver oil caused an immediate increase of the Vitamin A of the blood, but this increase was only temporary. At the end of the experimental period the cows receiving shark-liver oil had a lower Vitamin A content of the blood than those on the control diet. The shark-liver oil caused no measurable difference in the ascorbic acid content of the blood of the experimental cows. No significant influence was exerted by the shark-liver oil feeding on either the milk or fat production of the Holstein-Friesian and Jersey cows. *(F. C. Fountaine and D. W. Bolin.)*

Nitrogen Distribution in Cheddar Cheese Studied

Chemical and organoleptic determinations were made on cheddar cheese manufactured from milk which was homogenized, and homogenized and then pasteurized. The principal portion of the study was on the distribution of the various nitrogen fractions in the cheese. Results obtained indicated that homogenization did not materially influence the distribution of soluble nitrogen in the various fractions of the cheese serum. Pasteurization of the milk, however, resulted in a slower rate of distribution of the soluble nitrogen in the various fractions of the cheese serum. On the basis of organoleptic determinations it was very apparent that, by the methods of manufacture used, cheese made from homogenized milk was inferior in quality to that made from unhomogenized milk. *(H. C. Hansen and R. S. Snyder.)*

Commercial Fertilizers Revive Pastures for Dairy Cattle

For four successive years commercial fertilizers have been applied to old pastures originally seeded as mixed grass pastures. Treble superphosphate, triple phosphate, ammonium sulphate, and potassium chloride, alone and in combination, were applied annually at the rate of 100 pounds per acre. The pastures were grazed in rotation by milking cows and some heifers. Results were based upon milk and butterfat production and body weights. The carrying capacity of all pastures was materially increased especially the first 2 years. Ammonium sulphate in combination with the other fertilizers gave the most response. *(R. F. Johnson, D. R. Theophilus, and G. O. Baker.)*

Poultry

Disease Resistance Difficult to Maintain from the Standpoint of Inheritance

LAYING flock mortality has continued to increase in the Station Leghorn flock during the past year from the low point of 3.5 per cent during 1939-40. Total losses during the pullet laying year (11 months) for 906 birds housed October 1, 1942, amounted to 27.4 per cent of which 2.7 per cent was due to cannibalism.

As was the case in former years of high mortality, the paralysis-leukosis complex was the single disease responsible for the major portion of the losses. This disease resulted in a loss of 12.4 per cent of the original number of birds housed and 45 per cent of the total laying flock mortality.

The neural type (leg and wing paralysis) predominated during the growing period; of the 39 cases of leukosis from June 1 to September 30, 32 cases were of the neural type, 4 ocular, and 3 visceral. On the other hand the visceral form, particularly the liver type, was responsible for 76.6 per cent of the leukosis occurring during the first laying year.

Family differences continue to be exhibited, particularly in the leukosis mortality. The progeny of three males, (Y243, Y244, and Y245) illustrate families with good livability. The leukosis mortality occurring in the daughters of these males during the first laying year was 6.0, 4.6, and 6.5 per cent respectively. In contrast, the progeny of two other males, Y241 and Y242, who were full brothers, is cited to illustrate families with high leukosis mortality. During the same period the leukosis mortality in the progeny of these males amounted to 25.0 and 15.5 per cent respectively. Data acquired during the past year have emphasized the fact that the excessive mortality of the progeny of certain hens within the mating is sometimes responsible for the apparent high leukosis mortality of the sire heading that particular mating. For example, 22 per cent of the progeny of one sire (Y251) died of leukosis during the first laying year; however, 82 per cent of this mortality occurred in the progeny of only two hens mated to Y251. In the past much emphasis has been placed upon the male in a selective breeding program; this is a sound practice but the pedigree breeder will need to observe specific families within the matings.

The records accumulated on this project over a period of several years indicate that insofar as leukosis mortality is concerned resistance is not maintained after the virulence of infection reaches a low ebb and a resulting low mortality prevails for a period of several years. A fact of practical importance to the pedigree breeder is that although rapid progress may be made in reducing mortality by a selective breeding program based on progeny testing it is likely to be difficult to maintain a low level of mortality once it has been reached and periodic upturns in the cycle of mortality may be expected.

Genetically, disease resistance appears to be complex and extremely difficult to establish in any degree of homozygosity. Other factors such as management, environment, the presence or absence of such parasitic disturbances as coccidiosis or worm infestations are complicating predisposing factors. *(C. E. Lampman and Glenn C. Holm.)*

Alfalfa and Irradiated Animal Sterols a Satisfactory Combination for Vitamins A and D

Previous work at this Station has shown that 200 micrograms of carotene per bird daily, supplied by alfalfa, provided adequate protection when the alfalfa was added to a basal deficient ration daily. Higher levels did not result in a consistent increase in egg production or hatchability nor was the higher level effective in reducing laying flock mortality. Due to the unstable nature of both carotene and vitamin A, additional amounts (often several times the above figure) need to be incorporated in the mash.

It was the purpose of this experiment to check the previous work with trials conducted on a more practical or commercial basis. Following such a practice the rations were mixed approximately every 2 weeks. Dehydrated alfalfa again was used to supply the carotene and an irradiated animal sterol concentrate (Delsterol) as a source of vitamin D.

Table 3.—Summary of results for 11-month period October 1, 1941—September 1, 1942.

Lot Pens	1 6A&8A	2 6B&8B	3 7A&9A	4 7B&9B
Variable	Micrograms of carotene per bird daily 1000	500	200	400D, 2000A fish oil 0.25%
Av. per cent dehydrated alfalfa	3.4	1.7	0.7	
Approximate I. U. of vitamin A per bird daily	1,666	833	333	600
Approximate I. U. of vitamin A per pound of feed	6,300	3,150	1,260	2,250
Per cent production—11 months	54.8	54.1	53.7	53.2
Per cent production—1st 7 months	56.4	56.5	61.0	55.0
Per cent production—last 2 months	37.55	31.35	20.0	33.6
Per cent fertile hatch in March	90.0	82.5	86.7	
Income over feed cost per bird	$2.33	2.31	2.37	2.36
Per cent birds observed with colds in July	32.0	48.0	65.0	44.0
Per cent mortality	24.0	36.0	15.0	25.7

Three duplicate lots of 33 Leghorn pullets each were placed on a basal white-grain ration with sufficient alfalfa of known carotene content added to supply approximately 1,000, 500, and 200 micrograms of carotene per bird daily for the respective lots. Sufficient Delsterol was added to supply 100 A O A C chick units of vitamin D per 100 grams of ration. A fourth lot in duplicate received a fish oil concentrate (400 D, 3000 A per gram) added at the rate of 0.25 per cent of the ration.

A summary of the results is presented in Table 3. No direct correlation appeared to exist between the alfalfa intake and the average egg production, hatchability of fertile eggs, or mortality. The intermediate level of alfalfa had the highest mortality and the lowest hatchability. Colds developed during June and were quite prevalent through July, as is indicated in the table. It is of interest to note that the high intake of alfalfa did not prevent the birds from contracting colds although a lower percentage of the birds were affected. The high mortality in the pens on the 500 microgram level was due principally to leukosis.

The combination of alfalfa and Delsterol proved to be a satisfactory source of vitamins A and D. The results this time on the 200 microgram level indicate that this amount was not sufficient when the mash was mixed twice a month. Inasmuch as high temperatures hasten the destruction of carotene, it is logical to assume that during the late spring and summer months the actual intake of carotene was considerably less

than the amount originally incorporated in the mash. In commercial practice it is necessary to allow for both variation in the quality of alfalfa and for deterioration after mixing. Poultrymen and feed mixers should operate on a basis of using freshly mixed feeds. A greater margin should be allowed for deterioration during hot weather. *(C. E. Lampman and D. W. Bolin.)*

Carotene in Alfalfa Readily Utilized by the Young Chick

Chicks hatched from hens on the above project also were placed on various levels of carotene intake with alfalfa as the source. The results on liver storage of vitamin A demonstrated that the chick was able to utilize carotene efficiently during the first week on feed. A more detailed report is given in the section under Agricultural Chemistry. The results of this project also have been prepared for publication. *(D. W. Bolin and C. E. Lampman.)*

Irradiated Animal Sterol Concentrate a Satisfactory Vitamin D Supplement for Laying Rations

This trial was started October 1, 1941, with two duplicate lots of 70 White Leghorn pullets and was continued for a period of 11 months. The basal mash was the regular University of Idaho formula No. 2 which contains 7 per cent dehydrated alfalfa meal and 10 per cent yellow corn as sources of the vitamin A factor.

An activated animal sterol vitamin D concentrate, sold under the trade name of Delsterol and containing 2000 units of vitamin D per gram, supplemented the mash in one set of duplicates. A fish oil concentrate, having a potency of 400 units of vitamin D and 2000 units of vitamin A per gram was the supplement in the other duplicate. Each supplement was added in sufficient quantity to provide 200 A O A C units of vitamin D per 100 grams of mash or approximately 90 units per 100 grams of total feed intake on the basis that mash comprised about 45 per cent and a white-grain mixture about 55 per cent of the total feed.

Egg production, mortality, average shell thickness, and returns over feed cost were quite similar for all the groups. The groups receiving the fish oil concentrate averaged 3 per cent higher egg production for the period. Considering the other variables beyond control, this is not considered significant. These birds gave a return over feed cost of $3.11 per bird for the period compared to $2.98 for those receiving the irradiated animal sterol concentrate. The results warrant recommending the use of the activated animal sterol concentrate when it is available as a cheaper source of vitamin D. It should be kept in mind, however, that this product contains no vitamin A and when used as a source of D, alfalfa of good quality and in sufficient quantity will need to be incorporated as the source of carotene. *(C. E. Lampman and L. R. Berg.)*

Utilization of Calcium Not Influenced by Varying the Levels of Phosphorus

In previous investigations by the leader of this project the utilization of calcium at varying levels had been studied with the phosphorus

maintained at a constant level (0.7) of the diet. Laying hens which had received rations containing 0.5 and 1.0 per cent calcium withdrew as much as 50 per cent of their skeletal calcium for shell formation. Similar birds receiving 2.0 and 3.0 per cent calcium increased their skeletal calcium as much as 25 per cent over a period of 30 days.

The present study was made to determine the effect of varying levels of phosphorus on the calcium balance and on egg shell thickness when low- and high-calcium diets were fed to laying hens. In the first phase of the experiment balance data were obtained on two lots of 4 birds each, each lot receiving a ration containing 0.7 per cent calcium. The ration for lot 1 contained 0.35 per cent phosphorus and for lot 2, 0.7 per cent phosphorus, which was about the desired level. The birds were kept in laying batteries which had been provided with equipment to facilitate balance trials. The birds were fed an all-mash ration in pelleted form. Balance data were obtained every 3 days for a period of 36 days. The results obtained showed that during an experimental period of 36 days those birds receiving 0.35 per cent phosphorus withdrew an average of 45.9 per cent of their skeletal calcium for shell formation. The birds receiving 0.7 per cent phosphorus withdrew 44.4 per cent of their skeletal calcium. In each case the range was between 39 to 50 per cent withdrawal.

The average shell thickness in the case of the birds receiving the low phosphorus ration decreased from a maximum thickness of 13.4 to 8.8 thousands of an inch and for those birds receiving 0.7 per cent phosphorus the shell thickness decreased from a maximum of 13.2 to 9.3 thousandths of an inch.

These results indicate that when a ration containing a marginal level (0.7 per cent) calcium is fed to laying pullets the ability of the birds to utilize calcium is not influenced by the presence of 0.35 or 0.70 per cent phosphorus. *(L. R. Berg, D. W. Bolin, and C. E. Lampman.)*

Utilization of Calcium in Oyster Shell Not Influenced by Size of Particle

As a preliminary step in a contemplated program of mineral investigations it was deemed advisable to determine if size of particle of the calcium supplement would be an influencing factor in the utilization of calcium by laying hens.

Three lots of 13 birds each were placed on experiment October 1. The birds were housed in a laying battery and were fed an all-mash ration with sufficient oyster shell added to provide approximately 1.6 per cent calcium. Coarse hen-size oyster shell was used in lot 1, chick-size particles in lot 2, and oyster shell flour in lot 3. Monthly observations on egg production, body weight, and shell thickness were made for the first 7 months after which the project was terminated due to resignation of personnel. The results obtained during this period indicated that calcium from oyster shell was utilized with the same efficiency when fed as hen-sized, chick-sized, or as flour. *(L. R. Berg and C. E. Lampman.)*

Agricultural Engineering

Machinery Development Meets War Demands

THE harvesting of the increased production of field peas in Idaho would be impossible without the research work that has been done on adapting the combine by means of cutter bars and reels.

The development of pea dusting equipment and the plans for farm-made units based on laboratory and field studies have resulted in the construction of machines which have been in operation in the field from 3 to 5 years. This equipment includes horse-drawn and tractor-mounted units with cable and caster wheel supported booms covering widths from 20 to 72 feet. Dust is distributed by engine-operated blowers producing a low static air pressure in 3 to 2½ inch steel tubes, discharging through 3/8 to 5/16 inch holes on 3 inch centers.

To meet war conditions, duster blowers have been built from salvaged automobile parts using the engine fan and bearings, and the brake drums for fan housings. Plans for a small capacity 20-foot pea duster using automobile salvage parts for the blower unit are available for distribution.

Management and equipment designed to help meet the farm labor shortage has included the bulk handling of crops to save labor, and the combining or elimination of operations to save time and crops. The bulk handling equipment and practices developed by Oscar W. Johnson have been reported in Experiment Station Circular No. 86, "Bulk Handling of Potatoes." Man-hour requirements for the bulk handling of potatoes as compared with bag handling show a saving of from one-third to one-half of the field labor requirements for picking up the potatoes in the field and placing them in the cellar. Where bags are used, three men are required to load the field trucks or wagons while the bulking method requires but one man to handle the bulk carts at the cellar. Bulk handling of potatoes is better adapted to the employment of children and women in the field than bag handling.

Field studies of machinery and equipment required for potato production have resulted in the preparation of plans for shop and farm-made seed cutting devices, cultivators, trailer-pickers, bulking carts, sorting tables, pilers, conveyors, washers, and grading and sizing devices.

The Department of Agricultural Engineering has cooperated with the potato starch industry and the potato dehydration industry on technical and production problems. Copies of plans for equipment developed in the field and in the laboratory have been made available for distribution.

Records of the operation of buckrakes for four different methods of stacking hay show the lowest labor requirement of 57 man-minutes per ton. Plans for buckrakes, stackers, and slides have been listed in a mimeograph on labor-saving devices.

The 1942 plantings of sheared beet seed in Idaho gave favorable yields, and the mechanical thinners, and topping and loading equipment are contributing to a saving in the field operation and labor requirement for this crop. *(Hobart Beresford.)*

Household-Type Radiant Energy Drier Developed

The fundamental data obtained in previous studies on drying beans and seeds were used in the design of a small household-type fruit and vegetable drier. Plans for the construction and operating characteristics of this unit were published in Rural Electrification Extension Leaflet Number 30, June 1, 1942. *(Norman B. Akesson and Hobart Beresford.)*

Farm Building Requirements for War Production

Blackout requirements for farm buildings were studied in cooperation with the Departments of Dairy Husbandry and Poultry Husbandry. Plans were prepared for the application of rigid panels and waterproof paper for window and ventilator openings. Ventilation systems for poultry houses adapted to blackout conditions have been adapted to Idaho requirements.

The maintenance of farm buildings and the blackout and ventilation requirements have been reported in Defense Circulars No. 33, "If You Have to Blackout" and No. 13, "First Aid to Farm Buildings." *(Hobart Beresford, Walter R. Friberg, C. E. Lampman, and D. L. Fourt.)*

Rural Electrification

Of 43,663 farms in the state of Idaho, a total of 32,231, or 74 per cent, have electric service. The private power companies serve 25,587 of the farms, the nine Rural Electrification Administration Cooperative Associations serve 5,019, and the Minidoka Project 1,625 farms.

Land Conservation and Irrigation Studies Varied

Results of potato irrigation studies at Aberdeen showed no significant variation in total yield or yields of U. S. No. 1's under early, normal, and late dates of application of the first irrigation of the season. Extremes of light and heavy total application of irrigation water reduced yield, but over a wide range the total amount of water applied had little effect on the yield or quality.

A summary of 4 years' comparison of cold well water versus warm canal water showed an increase of 3 per cent in total yield and 6 per cent in yield of U. S. No. 1 potatoes in favor of the cold well water. The rate of absorption of the canal water was more rapid than the well water.

In the cooperative hydrologic studies with the Soil Conservation Service a simple and satisfactory method of measuring absorption and retention of water by soils was developed where the water was from simulated rainfall and the soil column contained in cylinders. The cylinders are suspended from calibrated springs and a scale reading at any time gives the amount of water retained at that time.

A study of seasonal use of water on irrigated farms shows a marked tendency toward an increase in acreage of late water crops such as potatoes, sugar beets, clover seed, and irrigated pasture. *(Hobart Beresford, Mark R. Kulp, Herbert Riesbol, J. C. Marr, William Watson, John L. Toevs, and James E. Kraus.)*

Electrical Pumping for Irrigation

Irrigation pumping continues to use a large percentage of the electri-

cal power in Idaho. A total of 656 plants representing a connected load of 34,383 horsepower used 72,579,806 kilowatt hours for the year. This figure does not include the small motors of less than 5 horsepower used for irrigation pumping and metered as farm power. *(Hobart Beresford, Mark R. Kulp, and J. C. Marr.)*

Agricultural Chemistry

Carotene in Dehydrated Alfalfa Readily Utilized by Young Chicks

PREVIOUS investigations have shown that dehydrated alfalfa is a good source of carotene, precusor of vitamin A. This investigation was undertaken to determine whether the carotene in dehydrated alfalfa is utilized readily by the young chick. Day old chicks from hens on different levels of carotene were put on a basal ration, low in vitamin A, and basal rations containing different levels of carotene for a period of 3 weeks. Dehydrated alfalfa was used as the sole source of carotene in all rations. At the beginning and during the progress of the experiment, chicks from each ration were killed and their livers analyzed for vitamin A.

Day-old chicks fed rations containing different amounts of carotene for 3 weeks show the following trends in liver storage of vitamin A: In case of those chicks receiving 25 to 125 micrograms of carotene per 100 grams of ration, approximately all of the initial liver storage of vitamin A was lost; those receiving 250 to 500 micrograms exhibited no marked gain or loss; and those receiving 750 to 2250 micrograms showed a marked increase over the initial storage of vitamin A. The greater the amount of carotene the hen received in her ration, the greater was the rate of loss of vitamin A from the livers.

These feeding experiments suggest that the vitamin A requirements for chicks at the age of 3 to 5 weeks are relatively higher than the minimum requirements previously recommended. Other research workers and work at this Station have shown that chicks were able to make good growth and were free from gross vitamin A deficiency symptoms on 100 microgram levels of carotene per 100 grams of ration. In this experiment, livers were rapidly depleted of their vitamin A on this ration, and the data suggest that liver storage values should be a better criterion than growth response in determining the adequacy of the ration with respect to vitamin A requirements of young chicks.

Sufficient carotene or vitamin A in starting rations to prevent a depletion of liver stores and to permit reasonable storage may be relatively more important than reinforcing the breeders' ration to the extent commonly thought necessary.

The fact that a chick can utilize at an early age the carotene, as supplied by dehydrated alfalfa, should emphasize the importance of supplying a liberal amount of a good quality product in the starter rations.

In view of the present shortage of fish oils of high vitamin A potency because of wartime conditions, this information presents a timely contribution to the war effort. A ration containing 5 per cent good quality dehy-

drated alfalfa, averaging 15 milligrams of carotene per 100 grams as a sole source of vitamin A, would be sufficient to meet the vitamin A requirements. Alfalfa is also a good source of riboflavin, other vitamins, and pigments. The riboflavin requirements of the young chick are relatively high. Pigments are needed for pigmentation of the skin and shanks, thus giving the chick a healthier appearance. Increased amounts of pigment improve the market quality of broilers. The use of liberal quantities of alfalfa in the starter ration should be practical and economical. *(D. W. Bolin and C. E. Lampman.)*

Laboratory Test for Available Phosphorus Valuable

Since many of the soils of Idaho are becoming deficient in available phosphorus, a real need has arisen for a dependable method of determining the amount of available phosphorus in soil. In most cases the available phosphorus content of the soil must be known in order to make sound fertilizer recommendations.

The carbonic acid-soluble phosphorus was extracted from a large number of soil samples of known phosphate response. The phosphorus thus extracted was correlated with the increase in yield due to phosphate applications. This correlation showed that soils containing 25 pounds or more of carbonic acid-soluble phosphoric acid per acre gave no response to phosphate fertilization. Soils containing 8 pounds or less per acre gave a large increase in yield when fertilizer was applied. Those containing 9 to 15 pounds per acre gave a moderate increase in yield, while those containing 16 to 24 pounds per acre gave only a small increase in yield. *(L. E. Ensminger.)*

Clay Influences Rate of Decomposition of Soil Organic Matter

Previous work has shown that organic matter is bound chemically by soil clays. The degree of reaction taking place between soil organic matter and soil clays was found to depend on the amount and nature of the clay present. Experiments were set up to determine the effect of clay binding on the rate of decomposition of organic matter. The organic materials studied were gelatin, albumen, hemoglobin, and alfalfa leaf meal.

The results show that clays with a high base exchange capacity are very effective in reducing the rate of decomposition of organic materials. In many cases the addition of clay reduced the rate of decomposition as much as 50 per cent as measured by the quantity of carbon dioxide produced by microbial activity. These data indicate that it would be possible to build up and maintain a higher level of organc matter in a clay soil than in a sandy soil. Clay soils need to be maintained at a high level of organic matter in order to keep the soil in a good physical condition. *(L. E. Ensminger.)*

Agricultural Bacteriology

Pullorum Disease Studied

IN cooperation with several hatcheries throughout the State a new whole blood antigen produced and supplied by the Bureau of Animal Industry of the U. S. Department of Agriculture for detecting pullorum

disease in turkeys was tested on a large number of birds. All tests were run in triplicate using one loopful of blood with the B. A. I. turkey antigen. To serve as a check on the B. A. I. antigen, simultaneous tests were made using a standard whole blood antigen which had been developed for detecting pullorum disease in chickens. The standard antigen was used both with one and two loopfuls of blood. The turkey antigen was found to be greatly superior to the chicken antigen using either one or two loopfuls of blood. The turkey antigen gave comparable results to the standard tube test when the spot plate received a minimum of rocking. A number of birds which showed negative reactions to the tube test gave positive or suspect reactions when the turkey antigen was rocked continuously during the test.

Eighty consignments of baby chicks from different points in the State were examined bacteriologically for pullorum disease. The disease organism *(Salmonella pullorum)* was isolated from the chicks in 43 of these consignments. Other conditions found were coccidiosis, navel ill, slipped tendon, and pneumonia.

Paralysis-Leukosis Complex in Chickens Common

A survey of autopsy findings on adult chickens submitted for diagnosis shows that next to coccidiosis birds most commonly are affected with one or more of the types of disease belonging to the paralysis-leukosis complex. A preliminary investigation is under way to study the immunological and serological nature of this malady with a view to developing a method for its early detection. *(W. B. Ardrey.)*

Etiology of Infectious Bovine Mastitis

Extensive studies have been made concerning the physiological and cultural conditions which induce radical pleomorphic changes in *S. agalactiae*. The antigenic relationship of a variant of *S. agalactiae* to bovine mastitis infection has been reported previously. *(V. A. Cherrington.)*

Alfalfa Studies Continued

Bacterial antagonisms are common in nature. Du Bos demonstrated that if a particular disease-destroying organism is introduced into a soil in large numbers that a soil population of microorganisms develops which is capable of destroying these bacteria. Studies now are under way to determine to what extent this principle may explain the condition known as "alfalfa sick soils." Since nodules are continually being sloughed off and the nodule bacterial thus are liberated into the soil, it seems probable that an antagonistic population may be built up which will destroy the root nodule bacteria and thus interfere with their beneficial action.

Many cultures of soil microorganisms have been isolated from soils growing old and young stands of alfalfa and from virgin soil with the view of finding organisms which were antagonistic to alfalfa bacteria. Most of these cultures were actinomyces. Some cultures seemed to stimulate the growth of alfalfa bacteria (Rhizobia) on artificial media, while others had no apparent effect, and still others stopped the growth completely.

Detailed studies have been made concerning the effect of inhibitory organisms upon the nature of growth of Rhizobia. Two species of acti-

nomyces caused the Rhizobia to produce excessive gum and pleomorphic abnormalities characterized by vacuolated cells and x and y forms. *(W. V. Halversen and T. C. Cordon.)*

Animal Diseases Diagnosed

The laboratory has continued its practice of making its facilities available to livestock producers throughout the State. Bacteriological, serological, and pathological diagnostic tests have been conducted on consignments sent in for examination.

Farm Economics

Tractor Depreciation and Capacity Listed for Irrigated Farms

THE life of general purpose, tricycle, and 4-wheel type tractors, varying from a drawbar H.P. of 9.74 to 22.64, ranged from 11 to 13 years on irrigated farms in the Upper Snake River Area. Annual depreciation in terms of the purchase price was about 7.5 per cent when junk value was taken into account. The following table (Table 4) gives the record of the average capacities of a number of tractors on certain common farm operations. The initials (D.B.H.P. hours per acre) appearing in the table stand for one drawbar horse power for one hour. For example a 15 H. P. tractor will develop 15 D.B.H.P. hours per hour. Lower H.P. tractors usually use slightly more D.B.H.P. per acre on heavy pulling operations but less on light pulling operations unless larger width or capacity machines were drawn for these lighter operations by the higher H.P. tractors.

Table 4.—Average rates of work for tractor operations.

Operation	No. of cases	Width of impl.	D.B.H.P. rating of tractor	Acres per day		Total hours per day	D.B.H.P. hours per A.	Acres per 10-hour day	Acres covered during season
				Calc.	Reported				
Plowing sod or alfalfa (moldboard plow)	35	16"	12.42	4.9	4.1	10.0	22.4	4.1	20.6
Plowing row cropland or stubble (moldboard plow)	30	16"	12.70	5.2	5.0	9.8	18.0	5.1	31.6
Discing	14	7'	15.03	26.6	21.4	9.3	5.4	23.0	60.1
Planting potatoes	31	2 row	15.75	15.2	9.5	8.5	7.7	11.2	39.9
Digging potatoes	60	1 row	15.12	4.6	3.5	5.8	17.4	6.0	32.0

(Paul A. Eke and Bureau of Agri. Econ. U.S.D.A.)

Farm Organization Stone Area, Oneida County, Described

Capital investments averaged close to $5,000 per farm. The farmer's equity comprised 83 per cent of the total investments. The typical farms ranged in size from 40 to 200 acres, averaging 108 acres in size for the 17 studied. Approximately 80 per cent of total acreage was in crop land. Alfalfa was the chief crop grown and dairy cattle the main kind of livestock raised. Livestock production was only of average quality. Average operator's labor earnings varied by size groups. All operators averaged $804 in earnings for the year under consideration. The better farms excelled in several different factors that usually are associated with higher earnings such as above-average yields, more livestock, more crop acres per man and per horse, etc. *(Leo Fenske.)*

Costs Producing Vegetable and Oil Seeds Obtained

Records of the costs of the various field operations and other costs were obtained from seed growers for seeds harvested in the fall of 1941. Two main areas were surveyed—one in southern Idaho and one in northern Idaho. The area in southern Idaho was made up mainly of the Wilder, Melba, and Nampa vicinities. In northern Idaho the major crop studied was rape seed—generally in the wheat-growing area, but most concentrated near Craigmont in Lewis County.

It is difficult to determine the probable costs (to an average grower) of producing the seeds found in southern Idaho for various reasons. Many of the minor seed crops have been grown only a short time. There is great variation in practices and yields. Although probabilities admittedly have not been adequately determined, the data point out some possibilities. It should be borne in mind that costs shown in Table 5 are based on only 35 cents per hour for labor. Labor costs are now (1942) much higher and still are rising. Other costs have risen but not so much as labor costs.

Table 5.—Costs (not including the cost of management) per acre of producing five major seed crops in southern Idaho in 1941.

Seed Crop	Number of fields	Labor costs	Total costs (excluding management)
Carrot	17	$27.80	$ 85.24
Hybrid sweet corn	33	34.35	68.58
Onion	31	44.44	136.65
Head lettuce	22	32.68	69.04
Baby lima bean	20	17.16	55.56

The principal seed crop studied in northern Idaho was rape. Fifteen fields totaling 815 acres were embraced. On the average there were 82.47 horsepower hours used in producing an acre of rape seed. The operators of 815 acres estimated that they would have received 28,997 bushels of wheat had the land been in wheat rather than rape. The total rape seed production was 1,006,453 or 36.31 pounds of rape seed per bushel of wheat. Farmers reported production requirements of rape seed and wheat to be fairly comparable, and if hazards are not too different the price of wheat would have to have been $1.09 per bushel to do as well as rape seed. *(Norman Nybroten and Leo J. Fenske.)*

Volume of Butterfat Produced in Northern Idaho

The volume of butterfat marketed in all forms from 10 counties of northern Idaho during the years 1937 to 1941 inclusive averaged very close to 3,000,000 pounds. From 1930 to 1935 cow numbers increased about one-fourth, but from 1935 to 1940 a decline of about one-tenth occurred. Judging by the total amount of butterfat handled by creameries and cream stations a considerable increase in cows milked must have occurred in 1941 over 1940. Some of the increase was due to a cool wet spring and early summer which made pastures above normal. Boundary County showed the greatest percentage increase in butterfat production in 1941 over 1940. This increase was 25 per cent. Latah County was next with 23 per cent and Kootenai County was third with a 15 per cent increase. *(Paul A. Eke.)*

Mortgaged and Mortgage-free Farms in Kootenai County Compared

Generally farmers in Kootenai County acquired more land either by going into debt or by renting additional land. Farms free of mortgage (Census of 1940) averaged only 109.9 acres per farm while the mortgaged farms averaged 179.4 acres per farm. Full-owned farms averaged only 100 acres while part-owned (owner rents additional land) averaged 379.6 acres.

Table 6.—Value of real estate and owner's equity on part-owned, full-owned, mortgaged, and mortgage-free farms, Kootenai County, Idaho, 1940[1]

Status of ownership of farms	Mortgaged and mortgage-free		Mortgaged farms		Mortgage-free farms	
	Total value	Owner's equity	Total value	Owner's equity	Total value	Owner's equity
Part-owned and full-owned	$3905	$2511	$4928	$2758	$3027	$2301
Full-owned	3098	2323	3575	2450	2228	2228
Part-owned	8465	3578	9891	3884	5713	2987

(1) These data were calculated from 1,130 of the 1,411 farms shown by the U. S. Census to be operated by owners and part owners.

Owners' equities in farm real estate definitely depend upon whether the farmers had rented additional land or borrowed to buy additional land. Figures show that the rather popular idea that the smaller farms, because a smaller percentage of them are mortgaged, are more successful is not correct. Owners' equities on mortgaged farms averaged $2,758 while on mortgage-free farms they averaged $2,301. Farmers who both mortgaged and rented additional land averaged the largest owner equities in real estate ($3,884) and also averaged the largest farms (414.7 acres). Land values per acre were approximately the same on the mortgaged and mortgage-free farms. *(Norman Nybroten and Paul A. Eke.)*

Interest Rates in Mortgages on Palouse Land Have Decreased

Although the war has brought about some increase in land values there is not enough good land on the market to determine a definite trend. The increase in the acreage of land sold is a result of heavy sales of cut-over lands. Indications are that this class has increased very little over the stable values that existed between 1936 and 1940. An abnormally large proportion of the buyers are active farmers. A great majority of the purchases are made for the purpose of increasing the size of present ownership units. In Lewis County the operating units are increasing faster than the ownership units. Operators have been increasing the farms more through renting rather than buying additional land.

Between 1930 and 1941 the average interest rates in mortgages fell from about 6.74 per cent to about 5.22 per cent in 1,035 mortgages held by local banks and individuals. Generally the larger farms were mortgaged for less per acre than were the smaller farms, indicating that some farmers have more land because they had more available funds, rather than having bought more because they were able to borrow more funds. Generally the larger mortgages and those of longer duration showed lower interest rates. *(Norman Nybroten and Ronald Bird.)*

Insects

Rotenone Substitutes Sought for Pea Weevil Control

INVESTIGATIONS on the pea weevil and its control were continued in cooperation with the Bureau of Entomology and Plant Quarantine, Agricultural Research Administration, U. S. Department of Agriculture. Because of the threatened shortage of rotenone due to the war, the objective of the project was shifted early in 1941 from further work on the perfection of control measures involving the use of rotenone dust to the development of measures of extending available supplies of these materials and also to the discovery of a suitable substitute. A total of 49 materials, ranging from new compounds recently developed to old insecticides incorporated into new mixtures, were tested during the winter of 1941-42. The only materials that showed much promise were those containing the pyrethrins. A mixture containing 0.15 per cent of pyrethrins killed 64 per cent of the weevils treated in laboratory tests. Another mixture made up of 1 per cent of 2.4 dinitro-o-cyclohexylphenol and 0.2 per cent of pyrethrins killed 95.1 per cent of the weevils.

Field tests conducted during the summer of 1942 with dust mixtures containing pyrethrins showed results similar to those obtained in the laboratory. In eight fields treated with mixtures containing 0.1 per cent of pyrethrins, weevil populations were reduced on an average 52.1 per cent. The average reduction in eight similar fields that were treated with rotenone dusts was 96.8 per cent. The mixture containing 1 per cent of 2.4 dinitro-o-cyclohexylphenol and 0.2 per cent of pyrethrins, which showed up well in the laboratory, failed to give satisfactory reduction in weevil populations when applied in the field.

Since the proper time of applying dusts for weevil control closely is associated with the conservation of insecticides, studies on the relation of weevil populations to infestations were emphasized. During the season an average of one weevil for each 25 sweeps of a collecting net 15 inches in diameter indicated an infestation of 8 per cent, whereas the average was 3 per cent in 1940 and 5.6 per cent in 1941.

In addition to these projects, experimental work was continued on the factors influencing the emergence of weevils from hibernation, the causes responsible for the presence of "pinhole" weevils (small pea weevil larvae that die soon after entering the pea, leaving small holes in the seed), and the relation of the time of planting to the amount of damage caused by the weevil.

In spite of the large increase in pea acreage, the weevil situation in the State was good. In the northern part of the State, where the largest crop on record was harvested, the average infestation was 2.55 per cent, the lowest ever recorded in this section. *(T. A. Brindley, F. G. Hinman, and W. E. Shull.)*

Rotational and Cultural Control of Wireworms

Studies to determine the possibility of controlling wireworms through the application of rotational and cultural practices have been continued near Parma, Idaho, in cooperation with the Bureau of Entomology and

Plant Quarantine, U. S. Department of Agriculture. A 7-year crop rotation consisting of alfalfa 4 years, followed by potatoes 1 year, sugar beets or corn 1 year, and wheat 1 year, is under study and has shown definite results in reducing wireworm numbers to the point where potatoes following alfalfa received only slight damage as a result of wireworm injury.

All the field plots where alfalfa had been grown for 4 years contained one or less wireworm per square foot. These small populations will cause only slight damage to potatoes. The lowest populations were obtained in alfalfa plots that were allowed to become dry during the season previous to potatoes. This long rotation with the included practice of plowing about August first after wheat or early potatoes to kill the pupal stage seems to offer the most encouraging prospect for wireworm control.

The field laboratory of the Bureau of Entomology and Plant Quarantine was moved from Parma to Twin Falls in order to make a closer study of wireworms in the Twin Falls-Burley areas as well as at Idaho Falls. The result of preliminary studies at Twin Falls shows that the optimum time for plowing to kill the pupal stage of wireworms is about the first week of August, the same as for the Boise Valley.

Crude naphthalene tested on a small scale this season gave good control of wireworms on the soils in the Kimberly district. Naphthalene, if obtained at a reasonable cost, could be used for controlling wireworms on heavily infested areas by applying it at the rate of 500 pounds per acre in two doses—one half broadcast, before plowing, and the other half broadcast on the surface and disked in after plowing. The investigation on wireworms in Idaho will be continued in an effort to find the best cultural practices for their control in the various districts where wireworms are serious. *(H. F. Shirck, M. C. Lane, and W. E. Shull.)*

New Materials Show Promise for Onion Thrips Control

The importance of the onion thrips, *Thrips tabaci* Lind., in Idaho has increased locally with the introduction of onion seed production and onion dehydration into the state. These two industries necessitate the growth of onion varieties that are extremely susceptible to onion thrips damage. Control measures used at the present time are quite expensive and not as satisfactory as is desirable.

Laboratory experiments with a large number of insecticides revealed that only two gave promise of controlling thrips. These were tartar emetic, used as a spray in combination with brown sugar or sugar beet molasses, and Code 2 dust, a proprietary insecticide.

Field trials with these two materials were carried out on onion fields in Canyon and Owyhee counties in cooperation with onion growers. Tartar emetic sprays were prepared in the proportion of 2 pounds of tartar emetic and 1 gallon of sugar beet molasses to 100 gallons of water, and applied at a rate slightly over 100 gallons per acre. On experimental plots, one and two applications of the tartar emetic molasses spray increased the yields by 44 and 32 bags per acre, respectively. Thrips per plant on these plots averaged from 90 to 117 after the last dusting and spraying, as compared to 315 per plant on the untreated plots. Plots sprayed three times with tartar emetic gave no better yields than those sprayed once or twice. Three applications of 20 per cent "Code 2" dust increased the

yields 37 bags per acre over untreated plots, while 10 per cent "Code 2" dust did not give satisfactory control.

Results indicate that two applications of either the tartar emetic spray or the "Code 2" dust are economically advisable. The first application should be made when thrips injury first becomes noticeable, but not serious. This is ordinarily during the first half of July. The second treatment should follow after an interval of not more than 7 days. The cost of the tartar emetic-molasses spray is approximately $3.50 per acre per application, including materials, labor and machinery. The exact cost of "Code 2" dust is estimated not to greatly exceed that of tartar emetic.

Attempts to control thrips on onion seed fields were unsuccessful because of difficulties in getting machinery through the fields after the flower heads had opened. *(R. A. Fisher, H. C. Manis, and W. E. Shull.)*

Potato Tuber Worms Not Found in Idaho

Because of a demand for information on the distribution of the potato tuber worm from various potato producing states, the U. S. Department of Agriculture, Bureau of Entomology and Plant Quarantine, in cooperation with State Agricultural Experiment Stations and State Departments of Agriculture conducted a survey of several states, including Idaho, to determine the presence of the insects. The survey shows that there are no potato tuber worms in Idaho. *(W. E. Shull, J. R. Douglass, and T. A. Brindley.)*

Plant Diseases

Better Bean Selections Developed

CURLY top and common bean mosiac, two of the most damaging bean diseases in Idaho, continue to make serious inroads into the bean yields of the State on varieties where resistant strains have not been developed. Work is being continued and progress has been made this year in breeding curly top and common bean mosiac resistance into important bean varieties. Bean trial grounds were established again in the bean growing areas of southern Idaho. One of these was located near Buhl and one near Twin Falls.

The Buhl site was chosen because of its proximity to the desert breeding grounds of the beet leafhopper, the insect responsible for the transmission of the virus causing curly top. Normally the infestation of curly top is as severe in this area as anywhere in the State. The progeny of 1600 single plant selections of garden and field bean hybrids were tested in the plot the past season. Observations were made and notes taken on habit of growth, length and shape of pod, and seed yield, as well as on the reaction of the plants to curly top and common bean mosaic.

The Twin Falls plot is maintained to test those selections which are not curly top resistant, but which are being selected for resistance to common bean mosaic. Some 200 hybrid single plant selections of garden beans were grown and observed for resistance to this disease.

Dry shell or field beans tested include many selections of the Great Northern, Red Mexican, Red Kidney, Michellite, Pinto, and California Pink hybrids. The most promising new field bean hybrid is of the Pinto type. A large number of desirable Pinto bean hybrids have been saved for

Bean improvement plots at Buhl.

further tests preparatory to releasing the best selection to Idaho growers. These selections are progeny of a Pinto x Red Mexican U. I. 34 cross. The original Pinto parent is very susceptible to both curly top and common bean mosaic, whereas the Red Mexican parent is resistant to both diseases. The selections saved for further trial combine the early maturity and plant and seed type of the Pinto parent with the resistant qualities of the Red Mexican. Preliminary trials seem to indicate that the hybrid Pintos are superior in yielding ability to other Pinto strains. This bean will be of greatest value in those areas which are often severely damaged by curly top and which also have a relatively short frost free growing season.

Many of the important garden or snap bean varieties have also been crossed with selections resistant to curly top and common bean mosaic. Some of the more promising garden hybrids include Refugee type wax, Kentucky Wonder Green Pod, Sure Crop Wax, and Refugee type green pod.

This project is conducted in cooperation with the State Leafhopper Administration, the Bureau of Entomology and Plant Quarantine, and the Bureau of Plant Industry of the U. S. Department of Agriculture. *(Leslie L. Dean and W. J. Virgin.)*

Fruit Diseases Cause Serious Losses

Peach leaf curl, a fungus disease, is now commonly found in orchards of southwestern Idaho. This disease has been known for many years in northern Idaho but until 1940 had never been reported in the southern part of the State. Leaf curl is characterized by greatly swollen, distorted, reddish-colored leaves that appear in the early part of the season and fall as soon as hot weather comes on. Serious defoliation, retardation of

growth and reduction of the vigor of affected trees result from attacks by the leaf curl fungus.

Tests have shown that peach leaf curl can readily be controlled by an application of either Bordeaux mixture or lime sulphur if it is applied any time before the buds swell in the spring. Timely application of materials used for Coryneum blight control will prevent infection by leaf curl.

A potentially serious virus disease of cherry called rasp leaf has been shown to be present in the State. Symptoms appear as numerous leafy outgrowths on the underside of the deformed leaves. Diseased trees are stunted in growth.

Studies on peach, cherry, and prune diseases have progressed sufficiently to permit calling attention to the seriousness of some of the virus diseases and perpetuated troubles common on these hosts. More and more attention and care in selecting propagating wood for future orchard trees is essential to insure disease free stock to growers. Likewise growers should realize that it is very poor practice to leave virus infected trees where spread to healthy trees may occur. This is especially true in connection with the Western X disease of peaches.

The studies on varietal reaction to virus diseases in the brambles, and to fire blight resistance among pear varieties were continued. Another method to supplement budding tests for studying abnormalities in prune, peach, and cherry trees has been started this year by testing for seed transmission. *(E. C. Blodgett.)*

Miscellaneous Vegetable Disease Research Continued

Material progress was made during the year in the study of the near wilt disease of peas and in the development of hybrids resistant to this disease. Promising material has been developed for further tests during the coming year.

From field tests at Buhl, Idaho, in 1941, three tomato plants were selected which survived the severe curly top disease conditions and which were fairly good type. These were crosses of hybrids of *Lycopersicon chiliênse* and Marglobe on the variety Bison. Seed from these plants and other hybrid material was tested again this year with promising results. The work will be continued.

The study of conditions causing rots of carrot roots in storage and methods for controlling these losses has resulted in evidence that pit storage is ordinarily superior to cellar storage as the temperature does not fluctuate so much and uniformly low temperatures can be maintained. Where roots were thoroughly cooled before covering with straw and soil in the pit, damage from rots was held to a minimum. Cellar storage has some advantages if the temperature can be controlled satisfactorily. *(W. J. Virgin.)*

Bacterial Ring Rot of Potatoes Studied

It has been shown that contaminated potato planters are capable of spreading the ring rot organism, and that the picker type of planter is more responsible in this respect than the assist feed type. Results of tests at the Aberdeen Branch Station seem to indicate that this relationship is

particularly true when single drop seed is used in comparison with cut seed. The explanation of this condition lies in the fact that in planting single drop seed with a picker type planter, the vascular system of each single drop seed piece will be contacted by the pickers, which is not necessarily true in every case when a cut seed is jabbed with the pickers.

B. K., a commercial product, when used in a water solution of 8 parts per thousand as a disinfectant of the cutting knife significantly reduced the spread of infection of the ring rot organism. Likewise, when New Improved Semesan Bel was used in combination with Intramine Y. (a commercial wetting agent) as a cut seed disinfectant, the amount of infection in the subsequent crop was significantly reduced.

Contaminated bags have been shown to be capable of spreading the ring rot organism. This condition can be remedied by boiling the sacks in water for 5 minutes. *(J. M. Raeder.)*

Resistance of Potato Seedlings to Virus Infection

A total of 488 seedlings were grown and their reactions to infection with various viruses were observed. One hundred forty-five were discarded because of virus infection. Of the remaining 343, 12 have been grown for 9 years, 16 for 8 years, 3 for 6 years and 135 for 5 years and have shown no evidence of virus infection. The most promising of these will be tested for adaptability to Idaho conditions. *(J. M. Raeder.)*

Studies With Fusarium Wilt of Potatoes

Of 140 single spore isolates made, 55 were tested for pathogenicity in the green house. Because of symptoms produced, 5 of the 55 were tentatively classified as *oxysporum* type and 2 as *cumartii* type. Final identification of the organisms was made by Dr. W. C. Snyder of the University of California. One of the *oxysporum* isolates will be increased, in mass culture in sufficient amount to infest a plot on the Aberdeen Branch Station, where further tests will be made under field conditions. *(J. M. Raeder and J. E. Kraus.)*

Nutrition

Conservation of the Nutritive Value of Foods Important

AS a result of the increased emphasis placed upon adequate diets for the civilian population as well as for the armed forces, many questions arise concerning the nutritive value of foods as eaten. Most of the available data on nutritional values are those for foods as grown or as purchased in the markets with only limited information about what changes in these values take place while the foods are handled in the home and prepared for the table.

The Agricultural Experiment Stations undertook to answer cooperatively some of these questions for the most important nutritive factors contributed by the more commonly used foods. After local, regional and national conferences each station selected for study the factors for which equipment was available for the foods of greatest importance in that state. Each station took the responsibility of coordinating the studies on one product. Idaho is the "key state" for potatoes and is

investigating the effect on ascorbic acid and thiamin of the various ways of preparing the Russet Burbank variety for the table. This laboratory is also cooperating with other states in a study of the effect of cooking on the vitamins in lamb, especially after freezing.

The investigation on the conservation of the nutritive value of these products has not progressed far enough to make a definite report at this time. *(Ella Woods.)*

Alaska Peas as Food

Meat, milk, and eggs are important in the diet, in part at least, because of the high biological value of their proteins. Because of the war the civilian use of these products will be limited and other sources of protein such as beans and peas will necessarily be more generally used. In Idaho and the Pacific Northwest the field pea, which is rich in nitrogen, is easily available and the biological value of the protein of the Alaska variety has been under investigation here for the past few years.

The study was continued this year with further growth tests in young rats and nitrogen balance experiments with adult rats. One of the interesting and important facts brought to light by the work this year was the very excellent growth obtained when the dietary protein was provided by feeding dried peas supplemented with egg. Even on the low level of protein used in these experiments growth was obtained which is comparable to that made by rats in another series of tests on a diet containing 18 per cent casein and which is at least five times greater than that obtained when peas were the only source of protein.

In order then to insure a supply of good quality protein in the diet when peas are the chief source, it would seem advisable to combine egg with peas either in the same recipe or in separate dishes to be served at the same meal. The study of the biological value of pea protein is being continued. *(W. M. Beeson, Ella Woods, and Donald W. Bolin.)*

Peas Good Source of Thiamin and Riboflavin

Insofar as other foods may be used to spare meat, it becomes desirable to know how much of each of the vitamins usually supplied in meat can be furnished by them. In order to answer this question for the Alaska pea, a new project was undertaken this year to determine the thiamin, the riboflavin and the niacin present and the effect of cooking the peas on each of these vitamins.

This work has not progressed far enough to give a complete answer for all these factors but it may be said that peas are an excellent source of thiamin and a good source of riboflavin when raw and that a large part of each is retained during cooking. These studies so far relate to the whole pea, not to the split pea of commerce. *(Ella Woods, Donald W. Bolin, and W. V. Halversen.)*

Ascorbic Acid Status Study Reported

Twenty-six more men volunteered to have blood tests for ascorbic acid made this year. Suitable tests from 21 were obtained and the results added to data already accumulated. This study is a continua-

tion of a project which is cooperative with the experiment stations in Oregon, Washington, Montana, and Utah. The Idaho data have been combined with those from the other stations in a joint report to be published in the Journal of Nutrition.

This cooperative investigation has revealed the fact that the college men of the Pacific Northwest have on the average lower values for blood plasma ascorbic acid than the college women. A high percentage of the Idaho men had low values which is interpreted to mean that they do not eat enough of the foods rich in this factor. Whether this is due entirely to poor choice of food or in part to losses of ascorbic acid in the preparation of the food for the table cannot be reported without further research. *(Ella Woods.)*

Aberdeen Branch Station

JOHN L. TOEVS, *Superintendent*

THE research program at the Aberdeen Branch Station was more extensive than ever before. Cooperation continued with the Office of Cereal Crops and Diseases and the Soil Conservation Service of the U. S. Department of Agriculture. Cooperation was established this year with the Western Regional Research Laboratory at Albany, California, in a potato drying experiment. While the drying of sliced potatoes in racks exposed to free air movement out of doors did not give promise of being practicable, it did produce some valuable information in the field of dehydration.

Judicious Potato Fertilization Recommended

Fertilizer tests indicate that extensive use of commercial fertilizers is not necessary. Results indicate that good farming practices, such as proper rotations, maintaining a phosphate level for maximum legume growth, utilization of barnyard fertilizers, along with good cultural practices are, under ordinary conditions, sufficient for the production of a satisfactory potato crop. When potatoes are grown on soil of low fertility or on second or third year potato ground, applications of nitrogen or preferably a nitrogen and phosphate combination are desirable.

Newer Sugar Beets Tested

In recent years continued efforts have been concentrated on perfecting the new selections of curly top resistant sugar beets as to yield, sugar content, freedom from bolters, etc. The Branch Station has cooperated with the office of Sugar Plant Investigations of the U. S. Department of Agriculture and the Utah-Idaho Sugar Company in testing the newer selections. Numbers 7 and 22 are the two outstanding selections, both as to yield and per cent sugar. *(J. L. Toevs.)*

Segmented Sugar Beet Seed May Save Labor

Single drop segmented seed and lighter rates of seeding of regular seed save labor. The testing of single drop segmented seed was set up in conjunction with regular seeding and thinning operations and with

seed treatments with such substances as Seed Aid and Staymone highly recommended to increase yields.

Table 7.—Comparison of single drop segmented seedings thinned with long handle hoe with regular seeding and thinning, with and without seed treatments.

Type of Seed	Method of thinning	Av. stand per 120 ft. plants	Per cent doubles	Yield per acre tons
Single drop segmented	Long handle hoe	89	10.1	16.70
Regular—untreated	Standard thinning	110	3.0	18.85
Regular—treated with Staymone	Standard thinning	111	3.3	18.25
Regular—treated with Seed Aid	Standard thinning	111	2.7	18.15

The data indicate no benefit was derived from treating seed with the so-called growth promoting substances; on the other hand, differences in yield are not great enough to indicate any harm from the treatments. The yield of the single drop segmented seed was approximately 2 tons below the check or regular seeding, thinned with the short handle hoe and doubles removed by hand. Under present labor conditions the lower yield from segmented seed is probably commensurate with labor saved. However, special plates for seeding segmented seed may not be obtainable under present conditions. It is believed that similar results could be obtained by reducing the present recommended seeding rate by 50 per cent. The tendency in recent years has been towards heavier rates of seeding sugar beets, which has resulted in retarding speed in thinning operations. An experiment was set up to compare different rates of seeding, then thin these beets without removing the doubles. This is the operation that makes beet thinning burdensome.

Many sugar beet yields were seriously reduced in 1942 by late thinning. With the use of the long handle hoe considerable more help could have been enlisted in the beet fields. With the lighter rates of seeding and the use of the long handle hoe, yields are only 10 per cent less than when beets are thinned under optimum conditions by the standard methods.

Table 8.—Comparison of different methods of thinning various rates of seeding of sugar beets.

Rate of seed per acre pounds	Type of hoe used	Stand per 120 ft. plants	Per cent doubles	Yield per acre tons
11	Short handle hoe	110	12.7	20.5
12	Short handle hoe	105	14.3	21.3
20	Short handle hoe	106	29.2	17.7
11	Long handle hoe	85	18.8	20.4
12	Long handle hoe	96	27.1	19.1
20	Long handle hoe	99	35.4	18.6
20	Short hand hoe and doubles removed by hand	116	3.0	22.9

(J. L. Toevs.)

Some Specialty Crops Appear Well Adapted

Anise, Caraway, Coriander, Fennels, Chicory, Digitalis, Dill, Horehound, Sweet marjorum, Sage, Clary sage, and Summer savory were grown at the Branch Station for the first time. The early seedings, April 17, of Anise produced from 1116 to 1800 pounds of seed per acre; Coriander from 642 to 1356 pounds per acre; and Fennels from 1332 to 1602

pounds per acre. Yields from seedings May 18 dropped to less than half for each crop. The late seeding of Fennels did not mature satisfactorily and no yield data were obtained.

Yield of leaves and flowering parts used for flavoring and perfumes varied considerably. Some of the perennial types developed very slowly and yields will not be obtainable until the second year. Sweet marjorum, Summer savory, and Horehound made the following acre yields (less than 12 per cent moisture): Horehound, total 7830 pounds, leaves 4035 pounds; Sweet marjorum, total 2100, leaves 1440 pounds; Summer savory, total 6570, leaves 2145 pounds. *(J. L. Toevs and Lief Verner.)*

Cereal Research Continued

The cereal program in cooperation with the Office of Cereal Crops and Diseases U. S. Department of Agriculture was of about the same scale as for the past few years. More space was devoted to increasing desirable hybrids populations and selections and less to genetic studies.

Tests of cereals indicate some progress toward improving strength of straw in both oats and barley as well as disease resistance. Earlier maturation or shorter straw do not appear to be inhibiting factors from the standpoint of obtaining high yield. There is a close association between plant vigor and yield but early selections and short oats produced desirable yields in 1942 when compared with standard commercial varieties. *(Harlan Stevens.)*

Flax Varieties Compared

Bolley Golden selections C.I. Nos. 976 and 977 both outyielded Bison flax again in 1942. The percentage oil of these is equal to Bison and the iodine number (drying factor) of C.I. No. 976 is decidedly better than Bison and that of C.I. No. 977 equal to Bison. C.I. No. 976 does not have the wilt resistance of Bison but produces a much better yield on irrigated land in southeastern Idaho. C.I. No. 977 has wilt resistance but does not yield equal to C.I. No. 976.

Table 9.—Yield in bushels per acre and quality comparisons of two new flax selections with Bison.

Variety	C.I. No.	1939	1940	1941	1942	Ave.
Bison	389	41.6	31.8	35.5	29.1	34.5
Bolley Golden sel.	976	46.7	37.1	37.1	39.0	40.2
Bolley Golden sel.	977	43.2	37.6	37.6	36.8	39.0
	Oil content	Iodine number	Wilt res.	Wilt res.	Height	
Bison	medium'	medium	good	poor	good	
C.I. No. 976	medium	good	poor	good	good	
C.I. No. 977	medium	medium	good	good	good	

(J. L. Toevs and Harlan Stevens.)

Sorghum Varieties Grown

A few of the earliest maturing forage sorghums and several grain sorghums with desirable forage qualities were grown in 1942. Only one grain sorghum reached near maturity but the grain yield was too low to be of economic importance in this area. Of the forage sorghums, Free-

mont or Dakota Amber gave best total tonnage, being equal to that of early corn varieties. *(J. L. Toevs and Harlan Stevens.)*

Corn Hybrids Tested

Three open-pollinated varieties and 13 hybrid corns were tested. Wisconsin hybrid Nos. 235 and 240 produced grain more mature than Minnesota No. 13. Minhybrid Nos. 702 and 800, and Wisconsin hybrid Nos. 255 and 275 were equal to or slightly more mature than Minnesota No. 13. Idahybrid No. 330 was slightly later than Minnesota No. 13 and Wisconsin Golden Glow and Idaho Yellow Dent were too late maturing for this area. Forage yields, of Idahybrid No. 330, Minnesota No. 13, and Minhybrid No. 702 were nearly alike and the highest in the test. All of the earliest maturing hybrids were somewhat lower in total plant weight. *(J. L. Toevs.)*

Season Too Short for Most Soybeans

The results obtained in 1942 compared favorably with those obtained in 1933. Ten of the earlier maturing varieties were tested each year. Five of the varieties tested were the same for each year. Wisconsin Black matured satisfactorily both years, yielding 22½ bushels in 1933 and 19 bushels in 1942. Padoga matured fairly well in 1942 but the yield was considerably less than Wisconsin Black. None of the other varieties tested matured sufficiently for harvest. Compared to yields of other crops in this area, the varieties of soybeans that mature here cannot compete unless the price differential was greatly in favor of soybeans. *(J. L. Toevs and K. H. Klages.)*

Chopped Alfalfa Hay Less Palatable Than Long Hay for Spring Lambs

This experiment was set up to determine the relative value of chopped first cutting alfalfa hay, long first cutting, and long third cutting alfalfa hay. All other feeds for the three lots for both ewes and lambs were the same. The ewes in all lots received long alfalfa hay, oats, cull potatoes, and red clover chaff. Lambs in each lot were fed all the oats that they would consume. Lambs receiving long first cutting made an average daily gain of 0.614 pound; lambs receiving chopped first cutting made an average daily gain of 0.581 pound; and lambs receiving long third cutting made the highest gain, 0.655 pound daily.

These results appear comparable with observations in the past. While some farmers and sheepmen have made similar observations, and have discontinued feeding chopped hay to lambs, the tendency by many has been to assume that chopped hay is desirable for all types of feeding.

The finish and appearance of the lambs was in the same order as the rate of gain. Lambs receiving good leafy third cutting ranked first; lambs receiving good quality first cutting long, ranked a close second; but the lambs receiving chopped hay, lacked decidedly in quality and appearance. *(J. L. Toevs and C. W. Hickman.)*

Aberdeen Branch Station Potato Research

J. L. Toevs, *Superintendent*
J. E. Kraus, *in charge potato research*

Fertilizers Effect on Fusarium Wilt Damage to Potatoes

CONSIDERABLE evidence has been accumulated that the disease known as fusarium wilt or "blight" of potatoes in southern Idaho may be partially controlled by supplying available nitrogen to the plants early in the growing season. Results in the greenhouse in 1941-42, and in the field at St. Anthony in the summer of 1942 further indicated that such a relationship exists. On soils that showed severe fusarium wilt in 1941, the application of commercial nitrogen fertilizer or barnyard manure delayed the appearance of the disease and increased yields of potatoes.

Under the present emergency conditions, it will be increasingly difficult for growers to obtain commercial fertilizers, yet it is also highly important to maintain maximum yields. Much can be done to alleviate fusarium wilt damage in Idaho potato fields by plowing under a green manure crop, either in the fall or in the spring, or by applying a liberal amount of barnyard manure. These practices along with a proper rotation system and the avoidance of planting potatoes more than 2 years in succession (preferably not over 1 year) on the same land, will usually control fusarium wilt to a point where it will not cause much loss in yield. *(J. E. Kraus, J. M. Raeder, and J. L. Toevs.)*

Various Factors Influence Jelly-End Rot Occurrence

Two experiments were conducted to determine the relationship between soil fertility, soil moisture at different stage of growth, stem number per hill, and the occurrence of jelly-end rot.

Results obtained indicate very definitely that low soil moisture during the month of August increases the amount of jelly-end rot. Plots with such conditions produced as much as 10 to 13 per cent of the disease as compared to 1 to 3 per cent from plots receiving normal irrigations. There was some indication that plots of low fertility in addition to low moisture had more jelly-end rot than high fertility plots with low soil moisture, but it seems probable from moisture determinations that the high fertility plots were actually higher in soil moisture. This might have been due to the higher water holding capacity of the fertilized plots, or to location in the field where irrigation was heavier.

A study was made of the relationship between the number of stems per hill, soil moisture, and occurrence of jelly-end rot. About 6 per cent of the total yield of plots given low water and containing one stem per hill had jelly-end rot, whereas plots given low water but having an average of 4.3 stems per hill showed only about 2 per cent. Plots given high water treatment but containing plants having one stem per hill showed as much or more jelly-end rot than those having many stems but low water, whereas those containing plants with many stems and given high water had practically none. A summary of the data is shown in Table 10.

Table 10.—Effect of stem number and soil moisture on yield, second growth, and jelly-end rot. (High fertility soil, plowed out of alfalfa, 1942.)

Water treatment	No. stems per hill	Yield in sacks per acre			Percentage			Total % jelly-end rot
		U. S. No. 1	U. S. No. 2	Sec. growth U. S. No. 2	U. S. No. 1	U. S. No. 2	Second gr. U. S. No. 2	
Low water	1.0	313	151	44	49	31	43	5.7
	4.3	380	232	9	67	17	14	2.2
High water	1.0	342	162	96	48	36	77	2.4
	4.6	452	342	20	76	10	47	0.5

These results indicate that the occurrence of jelly-end rot, may be influenced by either soil moisture, or stem number, or a combination of both, and they also indicate that it may be caused partially by unbalance nutrition of the plant. It is possible also that jelly-end rot may be caused by a combination of these factors with the action of a disease organism. *(J. E. Kraus and J. M. Raeder.)*

Several Factors Influence Second Growth of Potatoes

Several experiments were conducted in 1942 in an attempt to determine the causes of second growth in Idaho Russet potatoes and cultural practices affecting its formation. Included were studies of spacings, size of seed piece, irrigation, and number of stems per hill.

Several important indications are apparent from the results. Soil moisture itself may have but little to do with the incidence of second growth, and variations in soil moisture do not necessarily result in more second growth. More was obtained on high water than on low water plots. Close planting in the low and narrow rows had a tendency to reduce the amount of second growth. The use of large seed pieces for planting, resulting in a higher number of stems per hill, reduced the percentage of second growth tubers. Under high fertility conditions, there seems to be a definite relationship between the size of tops, number of tubers, and second growth. It appears that a high top-tuber ratio is likely to markedly increase the amount of second growth. The first few weeks of tuber formation seems to be the critical period as far as initiation of second growth is concerned. The evidence indicates that but little second growth takes place after the tubers have reached a size of 3 to 4 inches. It is probable that soil temperature may have considerable influence on second growth, and this may be indirectly affected by irrigation practice and by depth of planting and ridging. That the available nitrogen present at various stages of growth may be an important factor in the production of second growth, is indicated by the fact that plants grown without nitrogen produced small perfectly shaped tubers, but when nitrogen was added to such plants, typical second growth was initiated. *(J. E. Kraus and J. L. Toevs.)*

Seed Handling Related to Seed Piece Decay

As in former years, the 1942 results indicate that exposure of cut seed pieces to high temperature with accompanying low relative humidity, may result in rapid decay immediately after planting. Potatoes should be cut in the storage cellar and left there until they are taken to the field for planting. In this way the chances of drying out are less, and better stands and yields are likely to be obtained.

A Mimeo-Leaflet (No. 70) entitled "How to Obtain Better Stands of Potatoes in Idaho" was published in April 1942, and distributed to interested growers. By following the suggestions in this publication, growers will in most instances have good stands of potatoes and markedly reduce the possibility of obtaining low yields. *(J. E. Kraus.)*

Test plots of certified seed on Aberdeen Branch Station.

Seed Stock Tests Valuable

In previous tests there were some indications that certain stocks of Idaho Russet potatoes had superior yielding ability while others were inferior. From results of replicated trials of 10 of these stocks, and one each from Montana and Minnesota, it seems apparent that there is but little basis for classifying them as high or low yielding. Similarly, there was no observable difference in shape or quality of the various lots. From these results it may be stated that as far as is known at the present time, there are no important inheritable differences between seed stocks of the Russet potato in Idaho, and any differences that may be observed are caused by variations in conditions under which they are grown or by variations in the amount of disease which they contain. *(J. E. Kraus and E. W. Whitman.)*

Size of Potato Seed Piece Important

Four plantings were made in 1942 to determine the relationship of size of seed piece, soil fertility, date of planting, and spacing on yield and grade of Idaho Russet potatoes.

In general, as the size of seed piece increased, the total yield and yield of U. S. No. 1 tubers increased. However, there was considerable difference in yield between seed pieces of the same size, depending upon the size of the original tuber used in cutting. In general, the larger the tuber used to obtain a given size seed piece, the lower the yield.

On high fertility soil there was no difference in the average yield between early and late plantings with the same spacings. However, the U. S. No. 1 tubers from the late planting averaged about 25 per cent smaller in size than similar tubers from the early planting. The results also check with previous observations that a higher percentage of second growth or knobby tubers was produced by the early planting than by the late planting, and also a higher percentage with wide than with close spacing of plants in the row. The net effect of early planting and wide spacing was to increase the yield of U. S. No. 2's at the expense of the yield of U. S. No. 1's.

Wider spacing of plants served to increase the average size of U. S. No. 1 tubers produced, but also increased the number of rough or second growth tubers.

In general, these results indicate that for highest yields and best grades, large seed pieces should be used; on soil of high fertility they should be planted not more than 12 inches apart; the soil should be high in fertility, and it should contain enough organic matter to allow good water absorption and retention. *(J. E. Kraus and J. L. Toevs.)*

Various Spacings of Potato Plants Tested

Seed pieces were planted 8, 12, 16, and 20 inches apart in rows 32, 36, and 40 inches apart on soil that was high in fertility and also on soil that was comparatively low in fertility.

On soil of high fertility for all row spacings, plants spaced 8 inches apart produced the highest total yield but there was only a small increase in yield of U. S. No. 1 tubers over the 12-inch spacing. In most instances, spacings of 16 and 20 inches were too wide for maximum yields of total or U. S. No. 1 tubers. The percentage of U. S. No. 1's was smaller with a 20-inch spacing than with closer spacings. There was little if any difference in yield between the 32- and 36-inch row spacings, but they both yielded more than the 40-inch row spacing.

On soil of low fertility for all row spacings, plants spaced 8 inches apart produced the highest total yield and also slightly higher yields of U. S. No. 1's. However, there was not as great a difference between the extremes of spacings in yields as was the case on soil of high fertility. Here again, there was not much difference in the yields per acre on plants planted in 32- or 36-inch rows, but they were both higher than the 40-inch rows. In general the differences between spacings seem to be somewhat equalized by the fact that the soil was of lower fertility and the plants at the closer spacings did not reach maximum production. *(J. E. Kraus and J. L. Toevs.)*

New Potato Varieties Tested

A new seedling from the Colorado Potato Station, C. S. 3412, was tested at Aberdeen in 1942, and preliminary observations indicate that it may have possibilities as a substitute for the variety Bliss Triumph. It is very smooth, not quite as bright red as the Triumph, slightly russeted, has shallow eyes, and does not seem to be subject to cracking when handled, a serious defect of the Bliss Triumph. Seed of this seedling has been saved for further trial. *(J. E. Kraus.)*

Hormones Evidently Not Beneficial

Several different treatments of hormones or growth promoting substances were used for treating potato seed pieces and tested to determine their effect on stand and yield in the field. In no case was there any beneficial response and in several cases seed pieces were severely injured and the stand of plants as well as yields were reduced. There is no basis whatsoever for recommending the use of these materials in potato production in Idaho at the present time. *(J. E. Kraus.)*

Seed Stock Improvement Continued

In the winter of 1941-42, 450 Bliss Triumph and about 5,000 Russet tubers were indexed for virus disease. Approximately 50 per cent of the Triumphs and 25 per cent of the Russets were discarded as diseased or doubtful. The remainder of the tubers were planted in tuber units at the Tetonia High Altitude Branch Station. Because of an early frost and severe drought conditions, very small yields were obtained of the Russets. Approximately 1,500 of the Triumphs were again brought to Aberdeen for indexing. The remainder of them and all of the Russets will be planted next year for seed increase and observation. This seed should then be available for foundation seed stock for certified growers. Indexing of new stock of Russets is being continued in order that a continual supply of stock as foundation seed will be available. *(J. E. Kraus and E. W. Whitman.)*

Over-Irrigating of Potatoes Harmful

The potato irrigation experiment indicates that conservation of water could be effected under many conditions without sacrificing yield or quality and in some cases yield and quality could be improved by a more limited or rational use of irrigation water. With the demand for increased production of row crops such as potatoes, it becomes highly essential that irrigation water be used more efficiently. Over-irrigation frequently occurs on flat land having insufficient slope for water to move freely. This condition is seriously aggravated by the presence of large numbers of earthworms. In fact in many instances earthworms are the main reason for over-irrigation, and heavy losses have resulted from so-called "water rot." The potato grower must be on the alert and exercise sound judgment when such conditions arise.

A preliminary study of the so-called water rot of potatoes in the field indicates that it starts as a physiological breakdown of the tuber due primarily to lack of aeration, and that subsequent decay takes place by the action of soft rot organisms. It occurs especially in low spots in fields where irrigation water does not drain off, or it may occur in almost entire fields where the soil is heavy and compact, and drainage is poor. A possible solution indicated is that of incorporating more organic matter in the soil and giving lighter irrigations at more frequent intervals. *(J. E. Kraus and J. L. Toevs.)*

Potato Storage Investigated

Tubers of Idaho Russet grown in different rotation systems, on different fertilizer plots, and some that were sprayed to test methods of hastening maturity, were stored to test their keeping quality. The results

indicate that such cultural treatments have but little if anything to do with the amount of shrinkage or decay in storage.

There was considerable difference in the keeping quality of potatoes kept in controlled refrigeration rooms at different temperatures. Tubers kept at 50° F. for a period of 2 months at high relative humidity showed considerable rot similar to the water rot found in the field. Tubers kept at 32° and 40° F. in rooms with high relative humidity kept exceptionally well and the amount of rot occurring was negligible. It is probable that different results would be obtained on potatoes stored at lower humidities but at the same temperatures. However, the results indicate that a combination of high temperatures and very high humidity is not conducive to best keeping quality. *(J. E. Kraus.)*

Fertilizer Treatment, Tuber Injury, and Keeping Quality Related

It has been the opinion of some growers and dealers in the State that potatoes grown in soils of varying fertility levels may differ considerably in keeping quality. Of particular interest has been the possible effect of the extent of decay in storage of injured tubers from plots of varying fertility.

One year's results of storage experiments indicate that the commercial fertilizer applied to potatoes in the field does not affect the amount of decay near an injury. However, the amount of decay or depth at the point of injury varied considerably with the storage temperature. Storage of tubers at 32° F. from the time they were harvested resulted in more decay around an injury than those stored at 40° F. However, those stored at 40° F. continuously or at 50° F. for 2 months and then at 40° F. decayed more around the injury than those stored in the cellar. It is possible that the high humidity in the cold storage rooms may have played an important part in the extent of decay.

The results indicate, however, the advisability of handling potatoes as carefully as possible in the harvesting and storing operations. Considerable losses of early harvested potatoes in southern Idaho in storage and in transit in 1942 could in most cases be traced to the fact that they were stored in warehouses that were poorly aerated, and in which the temperatures were comparatively high with accompanying low relative humidity. Under such conditions the formation of cork or protective tissue over an injury is retarded, allowing entrance of rot organisms and rapid decay. *(J. E. Kraus.)*

Caldwell Branch Station

R. F. JOHNSON, *Superintendent*

Feeds for Fattening Lambs Compared

THE lamb feeding trials consisted of fattening 82-pound western feeder lambs in groups of 90 lambs for a period of 80 days, using a basal standard ration of chopped alfalfa hay and whole barley, and comparing the value of dried molasses beet pulp, wet beet pulp, discard beet molasses and air-dried cull potatoes as supplements.

Oregon feeder lambs weighing 67.7 pounds per head were contracted on October 10 and pastured 43 days on third crop alfalfa left standing in the field, fourth crop alfalfa, ditch banks and grain stubble. The average daily gains were 0.27 pound per day, which did not include a death loss of 1.7 per cent.

Dried Molasses Beet Pulp Equal to Barley for Lambs

The dried molasses beet pulp was fed as 50 per cent of the grain ration at the rate of 0.62 pound per day for each lamb. It was very palatable and stimulated the gains to a slight degree. On the basis of the feed cost of gains, the dried beet pulp was almost equal, pound for pound, to whole barley.

Wet Beet Pulp Excellent for Lambs

The wet beet pulp had a dry matter content ranging from 10 to 14 per cent and was fed at the rate of 3.0 pounds per lamb daily. In addition each lamb consumed 1.25 pounds of whole barley, but the amount of hay consumed was decreased 0.4 pound per head daily or 20 per cent. The daily gains were the same as were produced by dried beet pulp. From the standpoint of the feed replacement, 965 pounds of pulp replaced 230 pounds of alfalfa hay or, in other words, 4.2 pounds of wet beet pulp replaced 1.0 pound of alfalfa hay.

Feed Limited Amount of Molasses to Lambs

Undiluted discard beet molasses was fed on the alfalfa hay at a rate to replace half of the barley fed. This amount of molasses proved to be too large as severe scouring was induced and therefore the amount of molasses was reduced to approximately one-third of the concentrate mixture. For the length of the feeding period 0.71 pound of barley and 0.37 pound of molasses were fed daily to each lamb, making a total of 1.08 pounds, which was 0.18 pound per day less than was fed to the control pen. A significant increase of 0.5 pound of hay consumed by this lot was made, which may have been due to feeding molasses on the alfalfa or caused by the fact that these lambs consumed less concentrates. While the average daily gains of the lambs fed molasses and barley were slightly less than the gains made by lambs fed barley, the feed cost of the gains indicate that limited quantities of molasses may be used satisfactorily in lamb fattening rations.

Dried Cull Potatoes Unpalatable for Lambs

Air-dried cull potatoes proved to be unsuitable as a supplement to barley and alfalfa for fattening lambs. The potatoes used were from two sources, eastern Idaho where stored potatoes had been dried whole, and local early potatoes that had been sliced and dried on racks. The only difference noted in the potatoes used was that the lambs consumed the locally dried potatoes better, although none of them were palatable. Because of the unpalatability of the potatoes and because of the poor daily gains that were made the proportion of potatoes was changed from one-half to one-third of the concentrate ration. The lambs consumed daily 0.81 pound of barley, 0.45 pound of dried potatoes and 1.89 pounds of alfalfa hay per day, the latter being limited in order to force the consump-

tion of the potatoes. The net result of this method of feeding was poorer average daily gains and lack of finish when the lambs were marketed.

Rations for Wintering Ewe Lambs Compared

Western whiteface medium wooled ewe lambs weighing 67 pounds to be kept for breeding purposes were divided into four lots of 50 ewes each and wintered for 111 days on (1) alfalfa hay, silage and barley, (2) alfalfa hay and barley, (3) alfalfa hay and oats, and (4) alfalfa hay and cull beans. The roughage was fed ad libitum, the corn silage at the rate of 1 pound per head daily and the concentrate at the rate of 0.45 pound per ewe each day. The gains made were all near 0.15 pound per head daily indicating sufficient gain for normal growth. With alfalfa hay figured at $11.00 per ton; barley and oats $1.35 per hundred; and cull beans $1.00 per hundred the cost of wintering a ewe lamb per month ranged for the various lots as follows: (1) $0.59, (2) $0.58, (3) $0.51, (4) $0.43, the average being 52 cents per head per month.

Succulent Feeds Valuable in Steer Feeding

The results of an experiment to determine the comparative feeding value of corn silage, beet top silage and wet beet pulp as a succulent supplement to a ration of chopped alfalfa hay and ground barley when fed to 490-pound Angus calves for 263 days were similar to three previously conducted experiments using the same feeds. Due to a shortage of wet beet pulp, dried molasses beet pulp was substituted for it during approximately the last half of the experiment. The results for one year indicated that dried beet pulp did not have the same value as wet beet pulp as a medium to maintain the thrift of the animals on full feed for a long period. The corn silage fed steers outgained the beet top silage fed steers 0.13 pound per day and the pulp fed steers 0.12 pound per day, although the daily gains for the period when wet pulp was fed was decidedly in favor of the pulp fed steers. With chopped alfalfa hay valued at $11.00 per ton, ground barley at $1.45 per hundred, corn and beet top silage at $5.00 per ton and wet pulp at $2.00 per ton, the feed cost of 100 pounds of gain ranged as follows: Corn silage lot $10.03; beet top silage lot $10.69 and wet beet pulp lot $11.27. In spite of precautions taken to eliminate dirt from the beet top silage, evidence of it could be detected in the bottom of the mangers after beet top silage feeding. Excessive amounts of dirt in beet top silage is often a source of trouble to the cattle, causing digestive disturbance, poor gains, and frequently resulting in prolonged sickness.

The steers were fed in open lots without shade until August 6. The steers gained as rapidly during the summer months as during the winter and spring, in spite of the aggravation at times by small flies. When slaughtered this group of steers dressed 60.8 per cent and yielded 31 prime and 6 choice carcasses.

A Profitable Way to Fatten Calves

Thirty-nine Angus steer calves weighing 357 pounds per head were secured October 30 and allowed to run in the fields until January 28. During the first month supplementary feed was not given but during the last 2 months all the silage they would consume and a limited allowance

of alfalfa hay were fed. The calves maintained their weight during the 3-month period.

Angus stocker calves weighing 323 pounds were wintered for 83 days on a ration of 12 pounds of chopped alfalfa hay and 3.7 pounds of ground barley and made 2.18 pounds gain per day. Similar calves weighing 388 pounds fed 12 pounds of hay and 3.8 pounds of barley made 1.93 pounds of gain daily. Another group of 388-pound calves were fed chopped alfalfa hay only. These gained 1.65 pounds per day and though they did not exhibit any indications of unthriftiness, their hair coats appeared longer and rougher.

During the summer the above steers were pastured on irrigated bluegrass and mixed grass pasture. One-half of the steers from each lot were fed 4.4 pounds of ground barley during the last 72 days of the 158-day pasturing period. For the entire period the grain fed steers made 17.7 pounds or 7.5 per cent more gain than the steers receiving grass only. In the test for this year the increased gains from feeding grain were insufficient to pay for the barley fed.

The steers made an average daily gain of 1.58 pounds while on pasture. The carrying capacity of the 25.6 acres of pasture averaged 1.35 animals per acre for the season. The steers pastured weighed 527 pounds at the beginning of the pasturing period and 777 pounds at the close of the season. Excluding the cost of the grain fed, each acre of pasture produced 361 pounds of beef having a value of $32.59 when the beef was figured at 10 cents per pound. On an alfalfa hay replacement basis at $10.00 per ton the pasture was worth $27.60 per acre.

Farm Woodlot Produces Many Posts

The harvest of an 11-year old planting of Black Locust wood lot began in the fall of 1942. All trees were cut regardless of size. Five hundred and fifty trees were cut from approximately ½ acre, yielding 1,256 seven-foot posts with top diameters varying from 2 to 5 inches and other material suitable for fire wood. During the 11-year growing period certain practices were observed in regard to cultivation, irrigation, trimming and general management of the grove. The trees were cultivated the first year to keep down weeds. During the second year the tree rows were well-ridged and no further cultivation was given.

After the first year the trees were irrigated once each month. The last irrigation of the season was applied about August 15. This was done so that the new growth would have sufficient time to harden to avoid frost injury during winter months. All the lower branches were trimmed off each spring. Cattle were grazed in the grove at regular intervals during the last few years, although it may have been advantageous to allow stock to graze after the trees are but a few years of age. Stock are fond of the locust leaves and help to keep lower growth retarded and at the same time pasture off the early June grass which may become a serious fire hazard later in the year if it is allowed to mature.

High Altitude Branch Experiment Station

W. A. Moss, *Superintendent*

Crop Year Low in Summer Precipitation

THE total amount of moisture received during the crop year (September 1 to August 31) was 2.10 inches above normal. July and August were dry, with only 0.60 and 0.18 inches as compared to the normal precipitation of 1.04 and 1.17 inches for these months. This type of moisture distribution was unfavorable to spring sown cereals, grass seed production, and potatoes. *(W. A. Moss.)*

Potato Improvement Work Under Way

The Station is cooperating with the Aberdeen Branch Station in potato improvement. Tubers of Netted Gems were indexed in the greenhouse at Aberdeen last winter. More than an acre of these indexed potatoes was grown on the Station on a tuber-unit basis this year. The summer drought interfered with this project. Nevertheless, enough tubers were produced so that the selection of disease-free stock can be continued next year. *(W. A. Moss and James Kraus.)*

Area Well Adapted to Grass Seed Production

Two years of yield data are now available on the seed producing capabilities of new species of grasses. The yields of the better ones are presented in Table 11. Even with the dry conditions during July and August, good yields were obtained from these species. However, certain of the grasses tested were adversely affected by the summer drought. Mountain Brome *(Bromus marginatus)* yielded 819 pounds of seed per acre in 1941; in 1942, the second year of seed production, Mountain Brome yielded only 74 pounds per acre. Orchard grass *(Dactylis glomerata)* dropped from 160 to 20 pounds per acre. The earliness of Big Bluegrass *(Poa ampla)* enabled this grass to escape the effects of the drought. It was the only grass included in the test that yielded more seed in 1942 than in 1941. The grass tests are carried on in cooperation with the Department of Agronomy and the Regional Nursery Division of the Soil Conservation Service of the U. S. Department of Agriculture. *(W. A. Moss, R. H. Stark, and K. H. Klages.)*

Table 11.—Two year results of seed yields of the more productive grasses tested at the High Altitude Branch Station.

Grasses	Acc. No.	Yields in pounds per acre		
		1941	1942	Average
Slender wheat	P-41	930	395	662
Sheep fescue	P-2517	598	293	445
Erect brome	P-2336	633	171	402
Big bluegrass	P-2716	393	405	399
Crested wheat	Comm.	557	207	382
Canada wild rye	P-2633	520	210	365
Bluebunch wheat	P-739	396	260	328
Smooth brome	Comm.	544	111	327
Chewings fescue	Comm.	259	103	181

Utilization of Straw Related to Type of Plowing

Three year average yields of winter wheat grown on a wheat fallow sequence of cropping in relation to type of plowing and method of utili-

zation of the straw produced by the previous crop are now available. The highest yields were obtained in all cases when the straw was burned, regardless of the method of soil preparation used. Nevertheless, while burning the straw resulted in relatively small yield increases, the yields obtained show that stubble and straw can be utilized to advantage without reductions in yield with the proper type of plowing preparatory to the establishment of the fallow. In areas subject to wind and/or water erosion, the utilized straw will serve to cut down soil and water losses. In addition, the utilization of the straw can be expected to have favorable effects on the physical properties of the soil. This alone offers sufficient reason for leaving the straw rather than destroying it by burning. It is evident from the yield data so far obtained that the economic utilization of the straw is definitely associated with methods of soil preparation.

In dry areas, it is advantageous to prepare the soil so that most of the straw will be left at or near the surface, or, in other words, stubble mulch farming is practiced. This type of soil preparation can be produced by the use of the lister bottom plow or by the modified moldboard plow. The use of the lister bottom plow gave favorable yield responses and at the same time enabled the utilization of the straw left from the previous crop. With the use of the lister bottom plow the yield of the wheat was 27.9 bushels per acre when the straw was left on the surface, as compared to 29.8 bushels when it was burned prior to plowing. The corresponding yields when the straw and stubble were utilized and destroyed by burning and the use of the common moldboard plow were 27.6 and 28.8 bushels per acre. With the use of the one-way disk (Wheatland plow) the yields were 25.0 and 28.2 bushels per acre, without and with burning. It is interesting to note that the employment of the lister bottom plow enabled the utilization of the straw and resulted in practically the same yield as when the straw was burned and the one-way disk was used. The yields reported here were obtained with spring preparations of the soil for the fallow. These tests are carried on cooperatively with the Department of Agronomy and the Research Section of the Soil Conservation Service of the U. S. Department of Agriculture. *(W. A. Moss and Hugh McKay.)*

Active Organic Matter Increases Wheat Yields and Quality

The average yields of 1941 and 1942 indicate that the growing of winter wheat following alfalfa and alfalfa-grass mixtures increases both yields and quality. Wheat after fallow yielded 27.6 bushels; wheat after alfalfa, 31.0 bushels; wheat after alfalfa-grass mixed, 31.8 bushels; and wheat after crested wheat yielded 27.0 bushels per acre. This represents an increase of 4.2 and 3.4 bushels per acre for the wheat following the alfalfa-grass mixture and straight alfalfa. Wheat after alfalfa had a protein content of 17.45 per cent as contrasted to 15.10 per cent for the crop after fallow. Wheat following wheat had only 11.81 per cent protein. *(W. A. Moss, K. H. Klages, and Donald Bolin.)*

Sandpoint Branch Experiment Station

RALPH KNIGHT, *Superintendent*

Use of Fertilizers on Potatoes Is Sound Practice

WITH the local demand for potatoes stimulated by an influx of defense workers and personnel of the armed forces, growers may well consider the use of commercial fertilizers to increase their potato yields and profits. Table 12 gives the increases obtained for the past 2 years through the application of several of the most effective fertilizers. The general fertility level of the soil on which the plots were established in 1941 was somewhat low; it was relatively high in 1942. Climatic conditions, however, were far more favorable in the former year.

Old Cereal Varieties Replaced or Supplemented by New

Good progress has been made during the past 2 years in the selection of improved cereal varieties. Elgin winter wheat is replacing Mosida on land where the latter is likely to lodge, and Marida oats appeared likely to replace Markton as rapidly as seed becomes available. Both were released from the Sandpoint Branch Station during the biennium. The next contribution will be Premier wheat, a hard red spring variety that will be available for distribution to farmers after the 1943 harvest to replace Bluestem. Its advantages are higher yield, earlier maturity, very high resistance to rust, and apparently a lower moisture and fertility requirement. Plot yields of Premier for 1941 and 1942 were 29.7 bushels and 51.0 bushels per acre, respectively, as compared with 15.0 bushels and 34.1 bushels for Bluestem. *(Ralph Knight.)*

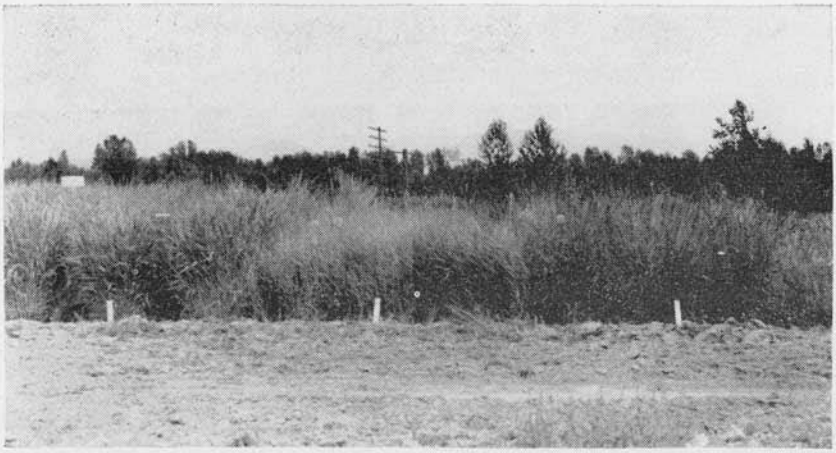
Table 12.—Effect on potato yields of several fertilizers, 1941-42.

Fertilizer and rate applied	Yield in cwt. per acre	
	1941	1942
Treble super phosphate—150 lb.	98.8	66.8
Ammonium sulphate—100; T. s. phosphate—150	94.6	59.7
Muriate of potash—100; T. s. phosphate—150	109.9	58.8
Amm. sul.—100; mur. of potash—100; t. s. p. 150	106.5	107.5
Manure—15 tons	.....	105.3
Average 10 check plots	75.7	46.6

(Ralph Knight and G. O. Baker.)

Additional Data on Grass Seedings Compiled

Compliance with the government request for more livestock on farms may call for an increase in the acreage of summer pasture. Information obtained from the reseeding projects, conducted cooperatively by the Sandpoint Branch Station and the Soil Conservation Service, U. S. Department of Agriculture, should be of value to farmers in this area who plan such an increase, since in many instances new pasture seedings would necessarily be made on burned-over brush or timber land. A list of grasses adapted for this purpose, selected after 3 years of observation from three locations in northern Idaho, is presented in Table 13. The top-ranking grasses for stand and forage production are listed under Group 1; second choice species under Group 2.



Grasses grown on Sandpoint Branch Station.

Table 13.—Grasses best adapted to seeding burned-over land in northern Idaho.

Spirit Lake Clean burn—drouthy soil		Kendrick Clean burn—favorable site		Tomer Butte Light burn—considerable brush	
Group 1	Group 2	Group 1	Group 2	Group 1	Group 2
Intermediate wheat grass	Crested wheat	Timothy	Tall oat	Reed canary	Intermediate wheat grass
Red top	Smooth brome	Red top	Intermediate wheat grass	Smooth brome	Red top
Orchard grass	Beardless wheat grass	Reed canary	Pubescent wheat grass	Blue wild rye	Timothy
Big bluegrass	Timothy	Smooth brome	Blue wild rye	Tall oat	Sweet clover

(Ralph Knight.)

Sinox Weed Spray Proves Effective in Preliminary Trials

Lack of equipment and material at the proper time prevented the undertaking of the rather extensive weed-control program that had been planned. Some preliminary work was done, however, in the grass nursery that was seeded this spring. The most troublesome weeds present were lambs quarter, shepherds purse, wild buckwheat, cud weed (Gnaphalium palustre), and knotweed. A spray made up of 1 gallon Sinox, 48 gallons water, and 24 pounds ammonium sulphate was applied to the rows of the 1-acre field with a pressure spray pump in mid-July. Excellent control resulted except for the knotweed. Owing to the characteristics of the plant, it was not expected that knotweed would be killed. The effect upon the various grasses appeared to depend chiefly upon the stage of development, rather than upon the leaf surface exposed to the spray. The rapid-developing grasses such as the bromes, wild rye grasses, some of the broad-leaved fescues, and orchard grass were affected only very temporarily or not at all. The most severe injury was sustained by the fine-leaved fescues which, as a group, are very slow developing. *(Ralph Knight.)*

Specialty Crops Are Tested

Included in the list of specialty crops tested this year were anise,

coriander, caraway, fennel, dill, winter and summer savory, marjoram, celery, thyme, horehound, and chicory. Where sufficient seed was available, two dates of planting were employed. In general, results were not especially encouraging, although no conclusion should be drawn after a single season which was, in some respects, very unfavorable. It is likely, also, that the perennials will make higher production after the first year. Carrots, the only vegetable tested for seed production, yielded 660 lb. recleaned seed per acre from roots over-wintered in storage. A plot of the Russian dandelion was seeded this fall, and another planting will be made in the spring of 1943. *(Ralph Knight and Leif Verner.)*

Active Experiment Station Projects

Agricultural Chemistry

Ag. Chem. P-2	A Study of Certain Types of Chlorosis as Found in Idaho on Trees, Shrubs, and Herbaceous Plants. (In Cooperation with Plant Pathology and Agronomy.)
Ag. Chem. P-5	A Study of the Availability of Plant Nutrients and the Response to Fertilizers of Idaho Soils. (In cooperation with Bacteriology and Agronomy.)
Ag. Chem. P-7	The Utilization of Wastes from Idaho Farm Products. (In cooperation with Agricultural Engineering and Bacteriology.)
Ag. Chem. P-8	The Preservation of the Carotene Content in Alfalfa and Other Forages. (In cooperation with Poultry Husbandry.)
Ag. Chem. A-2	The Relation of the Yield and Protein Content of Wheat to Nitrogen Content of the Soil Under Several Systems of Cropping. (In cooperation with Agronomy.)
Ag. Chem. A-9	Influence of Irrigation Practice Upon Physical and Chemical Properties of Soil with Particular Reference to Salinity. (In cooperation with Agronomy.)
Ag. Chem. H-11	The Feeding Value of Distillers By-Products. (In cooperation with Animal Husbandry, Poultry Husbandry, and Home Economics.)
Ag. Chem. S-64	Studies on Starch.

Agricultural Economics

Ag. Econ. P-30A	A Study of the Factors Influencing the Market Value of Real Estate in Latah, Nez Perce, and Lewis Counties.
Ag. Econ. P-70	Management Costs and Carrying Capacities of Irrigated Farm Pastures in Southern Idaho.
Ag. Econ. P-71	Economic Study of the Use of Recently Developed Small-Size Tractors and Supplementary Equipment on Irrigated Farms in Idaho. (In cooperation with the Bureau of Agricultural Economics, U.S.D.A.)
Ag. Econ. P-73	Comparative Study of Butterfat Prices in Northern Idaho.
Ag. Econ. P-74	Productive Costs and Marketing of Grass, Garden, and Field Seeds in Idaho.
Ag. Econ. P-75	Profitableness of Diversification in the Idaho Palouse Wheat Area.
Ag. Econ. P-77	Area Analysis of the Environs of the Farragut Naval Station in Kootenai County.

Agricultural Engineering

Ag. Engr. P-32	A Study of Methods, Equipment, Crew Organization and Cost of Harvesting and Stacking Hay in Southern Idaho.
Ag. Engr. P-33	A Study of the Adaptation of the Combine to the Harvesting of Field Peas and Beans.

Ag. Engr. P-34	The Preparation and Maintenance of Farm Lands for Irrigation as Affected by the Use of Farm Machinery.
Ag. Engr. P-35	Effect of Movement and Distribution of Irrigation Water on Field Crops. (In cooperation with Agronomy.)
Ag. Engr. P-36	Canal Linings.
Ag. Engr. P-37	A Study of the Cost, Effectiveness, and Methods of Pumping for Drainage and Supplemental Irrigation.
Ag. Engr. P-41	Potato Production Structures and Equipment. a. Structural and functional design of potato storages under Idaho conditions. b. The design and function of mechanical equipment in the handling, sorting, grading, washing, sizing, packaging, and shipping of potatoes. c. Field power and machinery for the mechanization of potato production (planting, cultivating, harvesting, transport).
Ag. Engr. P-42	Farm Refrigeration Requirements.
Ag. Engr. P-44	Improvement of Concrete and Cement Products Used on Farms.
Ag. Engr. P-45	Radiant Energy Drying in Agricultural Processes. (In cooperation with Horticulture.)

Agronomy

Agron. P-46	Forage Crops Seed Production.
Agron. B-J 2	The Control of Noxious Weeds, Particularly European Bindweed *(Convolvulus arvensis)*.
Agron. H-8	Breeding of Silage Crops.
Agron. H-9	Cereal Breeding.
Agron. H-10	Changes in the Physical Properties of Soils Under Different Management Practices.
Agron. H-12	Flax Investigations.
Agron. S-25	Clover and Alfalfa Breeding.
Agron. S-26	Improvement of Grasses.
Agron. S-27	Pea Breeding and Morphological Studies.
Agron. S-28	Sweet and Field Corn Investigations.
Agron. S-29	Varietal and Genetic Studies of Field Beans.
Agron. S-30	Crop Rotation Studies.
Agron. S-31	Fertilizer and Soil Amendment Studies.
Agron. S-47	Resistance of Peas to Weevil Damage.
Agron. S-48	Resistance of Earworm Damage in Corn. (In cooperation with Department of Agronomy and Bureau of Entomology and Plant Quarantine, U.S.D.A.)
Agron. S-49	Specialty Crops.
Agron. S-60	Relationship of Minor Elements to Crop Production. a. Boron Investigations. (In cooperation with Agricultural Chemistry and Plant Pathology.)
Agron. S-61	Salinity Investigations: The Influence of Irrigated Agriculture Upon the Physical and Chemical Properties of Well Drained Soils. (In cooperation with Agricultural Chemistry and Agricultural Engineering.)

Animal Husbandry

A. H. P-51	Steer Feeding Investigations. The Influence of Phosphorus in Rations for Fattening Cattle. (In cooperation with Agricultural Chemistry.)
A. H. P-55	The Biological Value of the Protein of Field Peas and the Effect of Heat Treatment on Pea Protein. (In cooperation with Agricultural Chemistry and Home Economics.)
A. H. P-57	Swine Progeny Testing and Improvement.

A. H. B-J 10	A Study of the Epidemiology, Pathology, and Control of Swine Brucellosis. (In cooperation with Bacteriology.)
A. H. B-J 11	The Phosphorus Requirement for Ewes for Reproduction and Lactation. (In cooperation with Agricultural Chemistry.)
A. H.B-J 12	Effect of Frozen Storage and Subsequent Cooking Thiamin, Riboflavin, and Niacin Content of Lamb and Pork Loin. (In cooperation with Agricultural Chemistry and Home Economics.)
A. H. S-1	Lamb Feeding Investigations: To Determine the Value of Wet Beet Pulp, Beet Top Silage and Corn Silage.
A. H. S-2	Steer Feeding Investigations: To Determine the Value of Wet Beet Pulp, Beet Top Silage, and Corn Silage.
A. H. S-3	Wintering Calves that are to be Grazed (Irrigated pasture) Following Season and Fattened for Early Winter Market.
A. H. S-4	Feeding and Management of Ewes, and Creep Feeding of Lambs for Early Lamb Production.

Bacteriology

Bact. P-132	Bacteriological and Immunological Studies on Poultry. (In cooperation with Animal Husbandry and Poultry Husbandry.)
Bact. A-7	An Investigation of the Etiology of Infectious Bovine Mastitis. (In cooperation with Animal Husbandry and Dairy Husbandry.)
Bact. B-J 6	Bacteriological Factors Affecting the Growth of the Alfalfa Plant.

Dairy Husbandry

D. H. P-81	Influence of the Kind of Crop Used and the System of Management and Value of Pastures for Dairy Cattle. (In cooperation with Animal Husbandry and Agronomy.)
D. H. P-82	A Study of the Use of Phenylmercuric Nitrate and other Chemicals in the Treatment of Mastitis in Cattle. (In cooperation with Bacteriology and Animal Husbandry.)
D. H. P-85	Artificial Insemination of Dairy Cattle. (In cooperation with Animal Husbandry.)
D. H. P-86	The Deficiencies of Alfalfa Hay as a Sole Diet for Herbivora.
D. H. H-1	Continuous Use of Proved Sires to Breed Dairy Cattle that Will be Pure in Their Inheritance for High Milk and Butterfat Producing Capacities.
D. H. H-2	Study of Breeding Efficiency in Dairy Herds.
D. H. H-3	A Study of Solids-not-fat Content of Milk of the University of Idaho Jersey and Holstein Herds.
D. H. S-10	Official Testing for Advanced Registry of Register of Merit in the State of Idaho.
D. H. S-11	Investigation in the Use of Dairy Sires from Ancestors of Known Production with Co-operative Bull Associations and Dairy Bull Studs.
D. H. S-12	Vitamin A and Carotene Content of Idaho Butter. (In cooperation with Agricultural Chemistry and Bureau of Dairying, U.S.D.A.)
D. H. S-32	Improvement of Milk Supply for Idaho Creameries and Cheese Factories.
D. H. S-33	The Influence of Homogenization of Milk or Cream on the Ripening of Cheddar Cheese.
D. H. S-34	A Comparison of Suggested Methods of Determining the Fat Content of Whey.
D. H. S-40	The Differential Cell Count as a Means of Diagnosing Anitaminosis A in Dairy Calves.
D. H. S-43	A Comparison of the Titratable Acidity and pH of Weighed and Measured Samples of Cream.
D. H. S-44	Potato Silage for Dairy Cattle.

D. H. S-45	The Milk and Fat Production and Physiological Responses of Lactating Holstein-Friesian and Jersey Cows to Shark-liver Oil in the Diet.
D. H. S-46	A Study of Idaho Co-operative Dairy Stud Bull Service Plan.
D. H. S-62	Sterilizing Methods for Teat Cups.
D. H. S-63	Sulfonic Soaps as Cleaners for Dairy Utensils.

Entomology

Ent. P-92	Experiments in Control of Wireworms on Irrigated Land and Study of Economic Species. (In cooperation with Bureau of Entomology and Plant Quarantine, U.S.D.A.)
Ent. P-93	Pea Weevil: Ecological Study and Investigation in Control. (In cooperation with Bureau of Entomology and Plant Quarantine, U.S.D.A.)
Ent. P-94	Studies in Insect Physiology and Toxicology.
Ent. P-94a	Studies of the Effect of Various Insecticides in Insect Physiology.
Ent. P-94b	Control of Various Garden, Field, Fruit, and Ornamental Crop Insects by Insecticides, Commonly Accepted as Standards in Comparison with Newly Developed Insecticides.
Ent. P-94c	Studies of Various Insecticides in the Control of Hemipterous Insects. 1. Moisture and Insect Relationships in Alfalfa Production. (In cooperation with Agronomy.)

Home Economics

H. Ec. P-103	The Ascorbic Acid Metabolism of College Students.
H. Ec. P-104	The Alaska Field Pea as a Source of Thiamin, Riboflavin and Nicotinic Acid. (In cooperation with Bacteriology and Agricultural Chemistry.)

Horticulture

Hort. P-111	Factors Influencing Crotch Angles in Young Fruit Trees.
Hort. P-114	Vegetable Seed Production in Idaho.
Hort. P-114a	Selection of Roots and Bulbs as a Means of Bringing About Uniformity in Varieties of Carrots, Onions, and Other Biennial Crops.
Hort. P-114b	Size and Spacing of Carrot Stecklings as Factors Influencing Seed Yield.
Hort. P-114c	Developing High Seed-yielding Strains of Carrots and Onions.
Hort. P-114d	Factors Affecting Blasting of Seed in Onions and Carrots.
Hort. B-J 9	Potato Quality Studies.
Hort. A-1	Apple Breeding.
Hort. A-8	Factors Influencing the Cracking of Sweet Cherries.
Hort. H-4	Potato Production Problems.
Hort. H-5	Variety Testing of Fruits.
Hort. S-15	Orchard Fertilization and Cover Crops.
Hort. S-16	Horticultural By-Products. (In cooperation with Bureau of Plant Industry, U.S.D.A.)
Hort. S-38	Onion Seed Production.
Hort. S-65	Handling Sweet Spanish Onion Bulbs for Seed Production.
Hort. S-66	Fertilization of Vegetable Seed Crops.
Hort. S-67	Time and Frequency of Irrigation as Affecting Seed Production in Carrots and Onions.

Plant Pathology

Pl. Path. P-121	Bean Disease Investigations in Idaho.
Pl. Path. P-123	Investigation of Pea Diseases in Idaho.

Pl. Path. P-125	Control of Storage Diseases of Carrots.
Pl. Path. P-126	Cause and Control of Jelly-End Rot of Potatoes.
Pl. Path A-11	An Investigation of Fusarium Wilts and Tuber Rots in Idaho.
Pl. Path. B-J 1	Certain Diseases of Stone Fruits.
Pl. Path. B-J 7	Bacterial Ring Rot of Potatoes.
Pl. Path. H-6	Investigation of Fire Blight of Pears.
Pl. Path. H-7	Boron Deficiency Studies. (In cooperation with Agronomy and Agricultural Chemistry.)
Pl. Path. H-13	Virus Diseases of Potatoes.
Pl. Path. S-17	Gooseberry Mildew Control.
Pl. Path. S-18	Plant Disease Survey.
Pl. Path S-19	Curly-top of Tomatoes.
Pl. Path. S-20	Diseases of Ornamentals.
Pl. Path. S-37	Bramble Diseases.

Poultry Husbandry

P. H. P-134	Protein Supplements in Wartime Poultry Rations. (In cooperation with Agricultural Chemistry.)
P. H. S-22	Study of Laying Flock Mortality. (In cooperation with Animal Husbandry.)
P. H. S-24d	The Influence of Carotene Intake on the Storage of Vitamin A and Pigments in the Liver of the Chick. (In cooperation with Agricultural Chemistry.)
P. H. S-52	Riboflavin Supplements for Poultry Rations.
P. H. S-53	The Efficiency of Simplified Mashes for Home Mixes.
P. H. S-54	Improved Ventilation of Poultry Houses to Facilitate Blackout Procedure. (In cooperation with Agricultural Engineering.)

NOTE: The letters used with numbers in identifying projects refer to funds used as follows:

P—Purnell
A—Adams
H—Hatch
B-J—Bankhead-Jones
S—State and Local Funds

Changes in Staff

Resignations

Leo M. Christensen, Agricultural Chemist, August 31, 1942.
L. E. Ensminger, Assistant Chemist, October 31, 1942.
Leo M. Fenske, Assistant Economist, August 31, 1942.
W. R. Friberg, Assistant Agricultural Engineer, June 16, 1942. On leave.
Elmer N. Humphrey, Assistant Agricultural Engineer, August 19, 1942.
Everett Van Slyke, Assistant Agronomist, June 30, 1942.
D. E. Brady, Assistant Animal Husbandman.
V. A. Cherrington, Assistant Bacteriologist, September 15, 1942.
T. C. Cordon, Assistant Bacteriologist, November 26, 1942.
H. C. Manis, Assistant Entomologist, September 31, 1942. On leave.
C. Y. Arnold, Assistant Horticulturist, June 15, 1942.
Carl F. Dietz, Assistant Horticulturist, October 1, 1941.
W. J. Virgin, Associate Plant Pathologist, September 31, 1942.
L. R. Berg, Assistant Poultry Husbandman, June 10, 1942.
Irving J. Mork, Assistant Poultry Husbandman, November 31, 1942.

Appointments

Olof Stamberg, Agricultural Chemist, February 1, 1943.
De Lance Franklin, Assistant Horticulturist, June 10, 1942.
V. B. Fielder, Assistant Economist, October 18, 1942.
Kenneth Frost, Associate Agricultural Engineer, January 1, 1943.
M. L. Buchanan, Assistant Animal Husbandman, August 16, 1942.
Glenn KenKnight, Associate Plant Pathologist, November 1, 1942.
G. W. Woodbury, Assistant Horticulturist, June 16, 1942. Return from leave of absence.
J. G. Cady, Assistant Agronomist, July 1, 1942.
J. A. Callenbach, Assistant Entomologist, August 1, 1942.
C. F. Peterson, Assistant Poultry Husbandman, February 1, 1943.
Irving J. Mork, Assistant Poultry Husbandman, August 1, 1942.

Publications

THE results of investigations by the Station staff are published as bulletins, research bulletins, circulars, and mimeo-leaflets by the University and as research papers by various scientific journals. The list of publications for 1941-1942 follows:

Bulletins

240. Phosphorus Requirement for Growing and Fattening Beef Steers.
241. The Production of Ethyl Alcohol From Cull Potatoes and Other Farm Crops.
242. Mineola Moth or Destructive Prune Worm.
243. Organization and Efficiency of Dry-Land Wheat Farms in Southeastern Idaho.
244. 49th Annual Report-Highlights in Agricultural Research.
245. Climate of the Palouse Area as Indicated by Fifty Years of Climatological Data for the University Farms.
246. Diseases of Small Fruits.
247. Onion Seed Production in Idaho.
248. Land Values, Mortgages, Rents and Wheat Yields on Northern Idaho Wheat Lands.
249. Growing Strawberries in Idaho.
250. Crops and Cultural Practices on Former Apple Orchard Land.

Circulars

83. Phosphorus Requirement for Fattening Steers.
84. The Idared Apple.
85. Potato Research at Aberdeen Branch Station.
86. Bulk Handling of Potatoes.

Defense Circulars

1. Food For Freedom.
2. Build Your Meals Around Idaho Defense Foods.
3. Eggs and Poultry.
4. Protect Farm Machinery.
5. Conserve Irrigation Water.
6. Control Garden Crop Diseases.
7. Growing a War Garden.
8. Seed Production of Grasses and Clovers.
9. Soil Management in Food Production.
10. Field Crop Varieties.
11. Commercial Fertilizers.
12. Beef Cattle and Sheep.
13. First Aid to Farm Buildings.
14. Farm Machinery Repair.
15. Producing Quality Milk and Cream.
16. Your Soil Needs Defending Too!
17. Producing More Pork.
18. Wartime Farm Management.
19. Managing the Dairy Herd.
20. Feeding Dairy Cattle.
21. Irrigated Dairy Pastures.
22. Hotbeds and Coldframes.
23. Select Vegetable Varieties Carefully.
24. Feeding For More Pork.
25. Efficient Poultry Feeding.
26. Meat Preservation with Freezer Lockers.
27. Freezing Preservation of Fruits and Vegetables.
28. Farm Fire Protection.
29. Farm Fire Protection.

30. Farm Fire Fighting Equipment.
31. Storage of Vegetables.
32. Preservation of Fruits and Vegetables by Drying.
33. If You Have to Blackout.
34. Mobilizing Idaho Forage Resources.

War Circulars

1. Care and Operation of Milking Machines.
2. Ring Rot of Potatoes.
3. Protein Supplements for Hogs.
4. Fertilizers Help Reach War Crop Goals.
5. Control Cattle Grubs!
6. Pea Weevil Control.
7. Field Pea Production.
8. Wartime Hay Baling.
9. Costs and Returns of Irrigated Pastures.
10. Feeding Hogs During the War Emergency.
11. Herb Crops for Idaho.
12. Meat on the Home Front.
13. 1943 Wartime Fertilizer Recommendations for Idaho.
14. Commercial Corn Hybrids.
15. Check List of Practices for Dairymen.
16. Carrot Seed Production.
17. Prospects in Growing Vegetable Seeds in Southern Idaho in 1943.
18. Fusarium Wilt of Potatoes.

Mimeo-Leaflets

48. Recent Settlement on Cut-Over Lands of Northern Idaho.
49. Potato Insect Control.
50. Mechanical Protection of Tomatoes from Leafhoppers.
51. Cultural Control of Legume Bugs in Seed Alfalfa.
52. Squash Bug Control.
53. House Fly Control.
54. Control of the Corn Earworm.
55. Maggots in Radishes.
56. Orchard Spray Recommendations for Idaho—1941.
57. Food Sanitation.
58. Root-Knot Nematodes in Potatoes.
59. Earwigs.
60. Making Potato Silage.
61. Ant Control.
62. Onion Thrips
63. Freezing of Meats, Fruits and Vegetables for Locker Storage.
64. Increased Production of Dairy Products is Needed Now for National Defense.
65. Increasing Dairy Production to Meet Defense Needs.
66. Cattle Grub Control.
67. Measure Your Daily Diet by the Nutrition Yardstick.
68. Orchard Spray Recommendations for Idaho—1942.
69. Rust Mite Control.
70. Obtaining Better Stands of Seed Potatoes.
71. Alfalfa Weavil Control.
72. Insecticides and Their Uses.
73. Control of Carrot Root Rots by Storing at Proper Temperatures.
74. Trench Silos.
75. Costs and Carrying Capacities of Irrigated Farm Pastures in Southern Idaho.
76. Onion Thrips Control.
77. Commercial Hybrid Corn Yield Trials in Idaho.
78. Orchard Spray Recommendations for Idaho—1943.
79. The Aster Yellows Disease of Truck Crops in Idaho.
216. 1942 Commercial Hybrid Corn Yields in Idaho.
217. Potato Research—1942 Report of Progress.

Research Papers

190. A Report on Inheritance of Resistance in Beans to the Curly Top Virus.
191. Effective Methods of Inoculating Seed Barley With Covered Smut *(Ustilago hordei)*.
192. The Azotobacter Plaque Test as Applied to the Determination of Phosphate Deficicency in Idaho Soils.
193. The Danger of Hydrochloric Acid Gas Poisoning When Testing Salt-Treated Cream.
194. Nutritional Requirements of the Albino Rat I.
195. Hybridization and Genetics in *Ustilago hordei* Race 6 and *U. nigra* Races 4 and 6.
196. A Buff Colored Smut of Barley.
197. Chronic Swine Erysipelas.
198. Variations in Chemical Composition of Arrowleaf Balsamroot.
199. Wheat Yields and Land Values.
200. The Production of N-Butanol and Acetone from Cull Potatoes.
201. Production of Ethanol From Corn.
202. Duration of Receptiveness of Corn Silks.
203. Auxanometer for Continuous Recording of Potato Tuber Growth.
204. Killing Potato Vines to Induce Periderm Maturity.
205. Biology and Control of the Intermountain Potato Leafhopper—*Empoasca filaments* DeLong.
206. Insecticidal Control of Legume Bugs (*Hemiptera, Miridae*) in Seed Alfalfa.
207. Urinary Calculi in Sheep.
208. Michels' Grass Seed as a Feed for Hogs.
209. Homogenization of Milk for Cheddar Cheese. I. The Influence of Homogenization of Raw and Pasteurized Milk on the Ripening of Cheddar Cheese.
210. Homogenization of Milk for Cheddar Cheese. II. The Influence of Standardizing Raw and Pasteurized Skim Milk with Homogenized Raw or Pasteurized Cream for Cheddar Cheese.
211. Homogenization of Milk for Cheddar Cheese. III. The Influence of Washing the Curd on the Quality of the Cheese Made from Raw and Raw Homogenized Milk.
212. Homogenization of Milk for Cheddar Cheese. IV. The Influence of Washing the Curd on the Cheese Made from Pasteurized and Pasteurized Homogenized Milk.
213. Field Peas as a Source of Protein for Growth.
214. Effect of Freezing Rate on Quality of Broiled Steaks.
215. A Biological Method for Determining the Relative Boron Content of Soils.

Experiment Station Staff

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Bacteriology

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*V. A. Cherrington, Ph.D., *Associate*
W. B. Ardrey, Ph.D., *Assistant*

*On one year leave of absence.

Dairy Husbandry

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Plant Pathology

C. W. Hungerford, Ph.D., *Plant Pathologist*
J. M. Raeder, M.S., *Associate*
E. C. Blodgett, Ph.D., *Associate*
Glenn KenKnight, Ph.D., *Associate*
Leslie Dean, B.S. (Agr.), *Assistant Leafhopper Administration*

Poultry Husbandry

C. E. Lampman, B.S. (Agr.), *Poultry Husbandman*
Charles Petersen, B.S. (Agr.), *Assistant*

Branch Experiment Stations

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R. F. Johnson, B.S. (Agr.), *Superintendent, Caldwell Branch Station*
W. A. Moss, B.S. (Agr.), *Superintendent, High Altitude Branch Station*
R. E. Knight, B.S. (Agr.), *Superintendent, Sandpoint Branch Station*

HOME STATION DISBURSEMENTS

Detail of Expenditures of State Appropriations[1] and Income Funds
Idaho Agricultural Experiment Station
January 1, through December 31, 1942

	Salaries	*Help*	*Expense and Supplies*	*Capital Outlay*	*Total*
Administration	$ .00	$ 217.10	$ 247.13	$ .00	$ 464.23
Agr. Chemistry	.00	.00	43.00	203.25	246.25
Agr. Economics	.00	207.70	265.36	.00	473.06
Agr. Engineering	.00	.00	138.58	.00	138.58
Agronomy	.00	1,943.80	930.38	.00	2,874.18
Animal Husbandry	.00	239.62	409.76	50.00	699.38
Bacteriology	.00	.00	16.11	.00	16.11
Dairy Husbandry	.00	683.86	1,816.94	141.40	2,642.20
Entomology	.00	84.00	408.93	48.25	541.18
Home Economics	.00	.00	26.18	129.25	155.43
Horticulture	.00	905.51	493.87	745.67	2,145.05
Plant Pathology	.00	.00	166.91	.00	166.91
Poultry Husbandry	202.26	713.79	3,820.10	67.00	4,803.15
Soil Survey	170.84	.00	173.22	431.25	775.31
TOTAL	$ 373.10	$ 4,995.38	$ 8,956.47	$ 1,816.07	$16,141.02

1 Includes general appropriation and institutional funds.

BRANCH STATION DISBURSEMENTS

January 1, through December 31, 1942

	Salaries	*Help*	*Expense and Supplies*	*Capital Outlay*	*Total*
Aberdeen	$ 2,963.95	$ 5,620.62	$ 4,139.31	$ 6,600.39	$19,324.27
Aberdeen Potato Research	4,349.98	1,825.70	1,119.83	566.23	7,861.74
Caldwell	3,739.52	3,817.40	6,319.47(a)	676.18	14,552.57
High Altitude	1,800.00	552.71	1,361.80	502.28	4,216.79
Sandpoint	3,180.00	709.55	1,305.24	.00	5,194.79
TOTAL	$16,033.45	$12,525.98	$14,245.65	$ 8,345.08	$51,150.16

(a) Does not include transfer of $3,000 to revolving fund.

FINANCIAL STATEMENT

Detail of Expenditures of Federal Appropriations
Idaho Agricultural Experiment Station
July 1, 1941 to June 30, 1942

	Hatch	*Adams*	*Purnell*	*Bankhead-Jones*
Personal services	$ 9,969.35	$13,598.35	$50,507.65	$10,325.09
Supplies and materials	1,075.16	1,016.34	3,772.70	1,690.09
Communication service	1,361.88	.00	147.87	2.60
Travel expense	1,374.57	55.31	2,780.64	881.89
Transportation of things	12.03	10.51	251.52	25.60
Printing and duplicating or illustrating publications	1,074.69	.00	.00	23.50
Heat, light, water, and power (services) and fuel	.00	.00	50.39	11.79
Contingent expenses	.00	4.00	.90	2.60
Equipment	132.32	297.49	2,291.76	1,009.18
Land (purchase and rent)	.00	.00	100.00	240.00
Structures and nonstructural improvements	.00	18.00	96.57	7.50
Balance unexpended June 30, 1942	.00	.00	.00	.00
TOTAL	$15,000.00	$15,000.00	$60,000.00	$14,219.84