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# High Lights in Agricultural Research in Idaho

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## Foreword

C. W. HUNGERFORD, *Vice Director*

**A**GRICULTURAL research is the basis for good farming, and successful farming depends upon the practical use of research information. More and more farmers and farm homemakers are coming to realize that agricultural science has revolutionized the farm and farm home, and that continuation of research is necessary for successful farming in the future.

If we were to analyze the farm management program and operations on a typical up-to-date Idaho farm, we would find that the crops grown, the livestock raised, the farm machinery and power used, the fertilizer and pest control program followed, as well as many other details of farming operations, have been developed and made possible by the investigational programs of the state and federal agricultural experiment stations. To research goes a large proportion of the credit for the present high standards of agriculture in the United States.

In the present war emergency, agricultural research is of immense value in its practical application to agriculture, and agricultural research agencies must play an important part in the present National War Program and an even greater part in the program of post-war reconstruction.

# High Lights in Agricultural Research in Idaho



## Introduction

**A**S a basis of agricultural preparedness for producing the abundance of food and other materials needed by the Nation, agricultural research has much to offer. Research in problems of social adjustment, farm labor, health and nutrition, marketing and distribution, conservation and utilization of soil, water and range, as well as the older and well established program of research in crop and animal production, must be maintained and expanded in order to aid in defense and meet the impacts of war.

Excellent advice to American farmers has been given by R. M. Evans in the *Land Policy Review* for August 1941:

"Agriculture will put the defense effort first. But there is need for agriculture to keep its condition healthy, also. By continuing the emphasis on soil conservation, farmers can meet the demand made on them without waste of soil resources. And by scaling down their debts and maintaining their farm plants in as sound a condition as possible, they will be further adding to the strength of the Nations' defense effort. Through supplies already on hand, by conserving their soil, and by keeping their farming operations sound, farmers are offering to the Nation an agricultural industry that is a strong force for national strength and unity, but also an industry that will be able to meet its problems after the war is over."

Deploring the meager funds now available for research, former President Herbert Hoover states, "Unless we quickly have more . . . discovery and invention and a more efficient application of what we already know, our standard of living and even our civilization will degenerate. We need to increase production of consumer goods so it will parallel armament production and our standard of living will not drop . . . to increase the technological power of an America which will be greatly impoverished and smothered in debt after the war. . . . One of our greatest problems right now is to develop more industrial raw materials which our farmers can produce in substitution for their overproduction of food."

### **Agricultural Planning Movement Helpful**

The development of state, county, and community agricultural planning committees has been of great assistance to the Idaho Agricultural Experiment Station. The Station has been able to keep in close touch with the needs of farmers for specific kinds of research. Although the investigations undertaken always have been for the most part initiated by requests from individual farmers or farm groups, the agricultural planning movement furnishes a systematic contact with the needs and opinions of farmers and

homemakers which is aiding materially in making the research program of the Agricultural Experiment Station more vital and useful. Through this program the research of various Federal agencies in the state and region may be more closely coordinated with the program of the State Experiment Station.

### **Specialty Crops Tested**

Much interest has developed recently in specialty crops producing aromatic seeds, roots, and essential oils. Have they a place in Idaho agriculture? Careful experimentation is necessary with the problems of adaptability, methods of growing and harvesting, diseases and insect pests preliminary to any extended development of these crops. The total demand for most of these materials is relatively small and can be supplied by a few farmers and they will be grown in the region best adapted for their production. There are some indications that some of them can be grown as successfully in Idaho as in any other part of the United States, while others are not so well adapted to our climatic and soil conditions. The Agricultural Experiment Station is carefully testing a number of these specialty crops at the several Branch Stations and at the Experiment Station at Moscow.

### **Agricultural Research Vital in Solution of Wartime Problems**

Every one of the 12 departments of the Idaho Agricultural Experiment Station is engaged in research which already has and will continue to furnish information of assistance in adjusting our farm business to a wartime economy.

Livestock feeding studies at the Caldwell Branch Station have pointed the way to better feeding methods and to the use of feeds containing nutritional factors necessary for maximum growth and fleshing of lambs and steers. When high quality meats in increasing amounts are so necessary for maintaining a correct diet in civilian life as well as in army camps these feeding studies take on added significance.

Poultry products are needed in larger amounts than ever before. Quality products and quantity production depend upon an efficient feeding program using feeds rich in nutritive value and high in vitamin content. Research has revealed the fact that sardine oil is a good vitamin D supplement and that dried whey may take the place of dried milk in poultry rations as a source of vitamin G.

Fruits and fruit juices are very important in the diet. A new fruit juice—prune nectar—made from cull prunes, developed by the Experiment Station in cooperation with the Bureau of Agricultural Chemistry and Engineering of the United States Department of Agriculture, now is being produced commercially in Idaho. Prune nectar is a delicious drink and can be made from fruit which otherwise would be wasted.

Continuous studies over nearly 30 years are demonstrating the value of the addition of organic matter to the soil as it affects



yield and protein content of wheat. This and other studies dealing with the control of soil and water losses, the conservation of our soil fertility and the improvement in yield and quality of farm crops are increasingly important now, when maximum high quality food production is necessary.

The control of pea weevil, the reduction of wireworm damage, the control of many plant diseases and weeds have been made possible through research efforts of the Station. These "leaks in crop production" and "enemies of quality" in food production must be stopped if our highest "goals" are to be met.

The Idaho Agricultural Experiment Station recently joined the other western states in a regional study of the conservation of the nutritive value of foods in the processes of marketing, storage, and cookery. Numerous projects dealing with human nutrition have been given new emphasis and a cooperative research program has been developed.

In the following pages will be found brief summaries of the investigational work of the several departments of the Agricultural Experiment Station and of the four branch stations.

## **Beef Cattle, Horses, Sheep, and Swine**

### **Phosphorus Investigations With Range Sheep**

**T**HE question has been raised as to whether range forages provide sufficient phosphorus for optimum growth and reproduction of range sheep, particularly in the fall and winter months. It also is questionable if pregnant ewes fed on hay deficient or low in phosphorus receive sufficient phosphorus for good reproduction. Although pronounced symptoms of phosphorus deficiency in range sheep are not very common, the possibility remains that slight deficiencies might be detrimental even though they do not cause pathological symptoms. The purpose of this study was to follow the blood phosphorus level of range sheep throughout the year to determine if it varies with seasonal changes in types of feed and also to find out at what times it might be low.

Further studies on the seasonal variations in the blood phosphorus level of range ewes have been consistent with our previous results. Table I gives a summary of the results obtained at different seasons of the year from about 40 head of Columbia ewes which were handled under range conditions at the United States Sheep Experiment Station, Dubois, Idaho.

Blood phosphorus levels in December 1940 were very similar to those of the previous year, although the ewes had been on alfalfa hay for 10 days in 1939 prior to bleeding, but not in 1940.

Cottonseed cake was fed at the rate of  $\frac{1}{3}$  pound per ewe daily for 18 days, while the ewes were on the winter range. After 18 days of cottonseed cake feeding there was an increase in blood phosphorus as shown by a reduction in the percentage of ewes with

Table 1.—Seasonal changes in the blood phosphorus level of range ewes.

Date bled	Previous feeding conditions	Variation in the blood phosphorus level of range ewes, mg./100 ml. plasma			Total No. of ewes	Ewes low in blood phosphorus (per cent)
		2.0-3.5 <sup>1</sup>	3.6-4.5 <sup>2</sup>	4.6-7.0 <sup>3</sup>		
12-16-40	Fall range (104 days) .....	0	7	35	41	0
1-6-41	Winter range (no supplementary feed 21 days) .....	0	7	34	41	0
1-24-41	Winter range (fed $\frac{1}{3}$ lb. cottonseed cake per ewe daily for 18 days) .....	0	2	40	42	0
4-21-41	Winter feed lot (alfalfa hay 34 days; oats $\frac{1}{2}$ lb. per ewe daily, and alfalfa hay 53 days) <sup>4</sup> .....	6	18	14	38	16
6-11-41	Spring range (51 days) .....	2	6	31	39	5
9-13-41	Summer range (94 days) .....	4	11	15	30	13

<sup>1</sup> Low phosphorus level, <sup>2</sup> medium phosphorus level, and <sup>3</sup> normal phosphorus level, <sup>4</sup> a mixture of equal parts bone meal and salt, and salt alone in adjacent troughs, were offered to the ewes during this time.

medium blood phosphorus from an average of 17 to 5 per cent. A similar increase in blood phosphorus occurred the previous winter from December 14 to January 18 when no cottonseed cake was fed.

Lambing and the initiation of lactation appear to have an effect on blood phosphorus levels. Sixteen per cent of the ewes showed low blood phosphorus levels and 47 per cent showed medium blood phosphorus levels at the end of the winter feeding period of 1941. At the time of blood sampling on April 21, about one-half of the ewes had lambed and the others were in the latter stages of gestation. The feeding of oats and alfalfa hay with bone meal available in self-feeders did not prevent the phosphorus level of the ewes from falling below normal. It appears from these data that the demands for phosphorus are so great during the latter part of gestation and the forepart of lactation than even an available phosphorus supplement did not prevent the blood phosphorus level from going below normal. These data suggest that a ewe evidently remains in a negative phosphorus balance during the latter part of gestation and at the first part of the lactation period regardless of the phosphorus intake. Therefore, it appears to be equally as important to supply ample phosphorus in the diet during the dry period and forepart of pregnancy so that the body stores may be replenished for periods of heavy phosphorus demand. During periods of high phosphorus requirement, the body stores are much more available for use than feed phosphorus. (*W. M. Beeson, D. W. Bolin, C. W. Hickman, cooperative with the U. S. Sheep Experiment Station, Dubois, Idaho.*)

#### **Sterile Rams Did Not Respond to Ascorbic Acid Therapy**

The rather striking results obtained by ascorbic acid therapy in the alleviation of sterility in the bovine male suggested its use in the treatment of sterility in rams. Two sterile and two normal rams were used in this experiment. One of the sterile rams was a Hampshire owned by a prominent sheep breeder in the state while the other sterile ram was a Southdown owned by the University of Idaho. Nothing was known of the previous history of these two rams except that they failed to settle any ewes the previous breeding season. A Hampshire and a Rambouillet were used as check rams.

Starting September 10, 1940, semi-weekly subcutaneous injections of ascorbic acid were given to the two sterile rams. Injections of 0.3 gram were given to the Hampshire ram and 0.2 gram to the Southdown ram. After 3 weeks this amount was increased to 0.6 gram and 0.4 gram respectively for the Hampshire and Southdown. After 2½ weeks the injections were increased to 1 gram for 4 weeks. This treatment did not give satisfactory results and the amount was reduced to a semi-weekly administration of 0.5 gram together with a simultaneous oral administration of pure carotene in an amount equal to approximately four times the normal requirement. At the end of the 3-week period the ascorbic acid injections

were discontinued although oral administration of carotene was continued for an additional 2 weeks.

As far as results are concerned, the Southdown ram made no recovery whatsoever. Although the volume of seminal fluid ranged between 0.5 and 1.5 milliliters it was nevertheless practically devoid of all sperm cells and the few present were non-motile. It is quite possible that the germinal epithelium was so completely destroyed that it was incapable of regeneration. The Hampshire ram showed exceedingly varying results. For the first 3½ weeks no sperm were present but from that time on the concentration and motility of the sperm increased markedly reaching a maximum concentration and motility at the end of the sixth week. This effect was not permanent, however, and the quality of the semen deteriorated to the extent that at the end of 10½ weeks there were no longer any motile sperm. The ascorbic acid content of the semen and blood showed no particular relation to one another nor to the quantity of ascorbic acid injected. (*D. E. Brady, G. C. Holm, and W. M. Beeson.*)

### Swine Progeny Testing Points the Way to Efficient Pork Production

Progeny tests on a Poland China swine herd at the University Farm indicate striking differences in prolificacy, rate of gain, feeding efficiency, and type of carcass produced. The elimination of the less efficient types and the concentration of the superior germ plasm of superior individuals is dependent chiefly on adequate testing methods as well as on improved breeding procedures.

The experimental herd had been set up as a four-sire herd which was intensely line bred to a particularly outstanding boar. Results of the past 2 years have been of such a nature as to make it desirable to outcross in order to introduce characters for superior feeding qualities. The Station was fortunate this year in securing two production tested boars which should contribute materially to the progress in this line.

The results from this year of progeny testing show certain improvements over the previous one. Among these are a 6 per cent greater rate of gain as well as a 6 per cent saving in feed over the previous year. In general the carcasses did not show as great a degree of finish this year and consequently had a lower dressing percentage. (*D. E. Brady, W. M. Beeson, C. W. Hickman, and P. J. Carlson.*)

### Desirable to Sharp Freeze Steaks and to Broil Them While Frozen

Steaks cut 0.6 inch in thickness and stored at 6° F. for 39 weeks showed an evaporation rate of from 5 to 10 per cent. The effect of the size and shape of the cut on dehydration is clearly shown by the fact that prime rib roasts cut approximately 4 inches in thickness, weighing an average of 7 pounds, and stored under identical conditions for the same length of time showed an evaporation rate of only 1½ per cent.

Quick freezing appears to have a definite effect as compared with slow freezing in reducing the evaporation during the subsequent storage. The average per cent evaporation after 39 weeks storage at 6° F and at 85 per cent relative humidity is summarized below.

	Slow frozen	Quick frozen
Beef round steaks .....	10.3	9.8
Lamb leg steaks .....	7.6	7.0
Pork leg steaks .....	5.5	4.9

To determine if there was any difference in cooking losses of steaks allowed to thaw before broiling as compared with steaks broiled while frozen, one-half were broiled each way. The percentage total weight loss in steaks cooked thawed and frozen is as follows:

	Beef		Pork		Lamb	
	Quick frozen	Slow frozen	Quick frozen	Slow frozen	Quick frozen	Slow frozen
Cooked thawed .....	31	42	27	30	33	35
Cooked frozen .....	27	35	20	29	32	34

The above figures show that the smallest total loss (drip and evaporation) occurred in the quick frozen steaks, broiled while frozen, and that the largest loss occurred in the slow frozen steaks, thawed before broiling. It appears desirable that thin cuts of meat should be quick frozen and cooked while still frozen to prevent a high loss in evaporation and drip. (*D. E. Brady, Pauline Frei, and C. W. Hickman.*)

#### Feeding Value of Michels' Grass Seed Determined

Michels' grass seed proved to be unsatisfactory for fattening hogs when fed as the only grain along with an animal protein supplement, minerals, and alfalfa hay. The pigs on Michels' grass seed gained slower, required more feed per 100 pounds of gain, and ate more protein supplement to balance their ration than hogs on wheat or barley. Wheat was worth about 8 per cent more than Michels' grass seed, and the pigs on wheat gained about one-half a pound more per head daily. Rye (Rosen) was not as good a hog feed as either wheat or barley, but was superior to Michels' grass seed in producing rapid and economical gains.

The results have indicated that Michels' grass seed is unsatisfactory as a hog feed when used as the only grain, but as to whether it may be used satisfactorily in grain mixtures is being investigated by further research. (*W. M. Beeson, C. W. Hickman, and P. J. Carlson.*)

#### Calculi Not Caused by Vitamin A Deficiency in Sheep

Frequent death losses and impaired breeding of rams of the University flock have resulted in past years from urinary calculi. The disease, popularly known as "water belly," is not uncommon in

commercial feed lots and probably occurs more widely than recognized. Urinary calculi are either kidney or bladder stones which may clog the urinary passages with fatal consequences, especially in wethers or rams.

Since occurrence of the disease is reported to be closely related to the diet, various diets believed to be calculi-producing were fed to 24 experimental wether lambs. The wethers were divided into two lots. One lot was maintained on a vitamin A low dietary regime while the other lot received added vitamin A. Both lots were fed the various experimental rations. The diets investigated contained: (1) 20 per cent wheat bran, (2) 1 per cent magnesium carbonate, (3) 3 per cent bone meal, (4) 2 per cent ground oyster shell, (5) 20 per cent added protein supplement. The basal diet consisted of a grain mixture, beet pulp soaked up with water and molasses, and timothy as the roughage. Blood and urine studies accompanied the feeding experiments.

The feeding of lambs for 154 days on a fattening ration deficient in vitamin A failed to produce urinary calculi. One case of calculi was obtained on a ration high in wheat bran with added vitamin A and two cases of calculi occurred in the University flock. The liver of one of the rams was analyzed and showed a sizable vitamin A content. Therefore, these data suggest that a low vitamin A intake does not cause the production of urinary calculi in sheep.

Mineral imbalance of calcium, phosphorus, or magnesium failed to produce calculi either on a high or low vitamin A intake. The only diet which produced calculi contained 20 per cent wheat bran plus a vitamin A concentrate. (*W. M. Beeson, J. W. Pence, D. W. Bolin, and C. W. Hickman.*)

### **Chronic Swine Erysipelas Can Be Controlled**

Work was concluded on chronic swine erysipelas, the results of which are being published in the February issue of *Veterinary Medicine*.

Recommendations for the control of chronic swine erysipelas are: (1) A strict system of sanitation is necessary. (2) Swine having blood titres of 1-400 and clinical manifestations of arthritis should be eradicated. Even though pigs do not show symptoms but do carry a high titre, it may be advisable to dispose of them. (3) The navels of all new born pigs should be painted with iodine or iodine-glycerine. (4) Weaner pigs should be placed on ground that has not been used for swine production the previous year. (*G. C. Holm and W. M. Beeson.*)

### **Swine Brucellosis Studied**

A preliminary investigation is under way to study the fluctuation in blood titres in the agglutination test used to detect swine brucellosis.

Initial observations indicate that pigs born from reactor sows may be free from the disease and if maintained under sanitary



conditions may continue through the suckling period without becoming infected. (*G. C. Holm, W. B. Ardrey, and W. M. Beeson.*)

## Dairy Production and Manufacturing

### Continuous Use of Proved Sires for 24 Years Proves Value of Program

**M**ANY successful dairy cattle breeders have long contended that the use of proved sires is the most certain method of fixing the inherited factors for increased production and better type. The success attained by the Holstein-Friesian and Jersey herds owned by the University of Idaho confirms this belief.

Seventeen proved sires have been used in the Holstein herd, 14 of which have had daughters and dams tested in the herd. Of the 14 proved sires, 10 increased production, 3 held production approximately equal, and 1 materially decreased production. Daughters of three other sires are in the herd. Eight proved sires have been used in the Jersey herd, 6 of which have had daughters and dams tested in the herd. Of the 6 proved sires, 4 increased production and 2 decreased production.

During 1941, the average herd production (including dry cows) of the combined Jersey and Holstein-Friesian herd, consisting of 42 cows, averaged 11,456 pounds of milk, and 464 pounds of fat. The Holstein herd, composed of 22 cows, averaged 14,275 pounds of milk and 503 pounds of fat, and the Jersey herd of 20 cows averaged 7,136 pounds of milk, and 421 pounds of fat. Each herd had an average type rating of "Good Plus."

Further indication of the success of the proved sire program is the progress made by the Holstein-Friesian herd through successive crosses of proved sires from the foundation cows. The following data show the trend of average production from the 24 foundation cows through 6 successive generations of proved sires. All records were yearly Advanced Registry, made by first lactation heifers without selection, milked three times daily, and adjusted to mature basis using A. R. factors, published by H. W. Norton, Jr.

	No. of cows	Lb. of fat
Foundation cows .....	24	537.1
First generation from foundation cows .....	32	642.6
Second generation from foundation cows .....	36	691.0
Third generation from foundation cows .....	38	705.0
Fourth generation from foundation cows .....	21	722.0
Fifth generation from foundation cows .....	6	747.0
Sixth generation from foundation cows .....	2	776.0

Both herds continued on the qualified list for the highest honor awarded by the respective breed associations. The American Jersey Cattle Club awarded the fifth Constructive Breeder's Registry Certificate to the Jersey herd during the year, which made it the second



Jersey herd in America to qualify for five consecutive years. The Holstein herd was the first Holstein herd in America to qualify for three consecutive years for the Progressive Breeder's Registry Certificate. The University of Idaho dairy herd is the only college herd in America where herds representing both breeds have qualified for these high awards. Qualification is based on combined high 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 these high standards have been attained in a very great extent by the continuous use of proved sires. (*D. L. Fourt and F. C. Fountaine.*)

### Progress Made in Controlling Mastitis

Dairymen and research workers have striven for years to develop a cure for mastitis but as yet no certain cure is available. As the result of long experience and research work, definite practices have been developed and adopted in the University of Idaho dairy herd which have given eminently satisfactory results in controlling the disease.

The practices are: (1) Eliminating infected cows from the herd as non-infected heifers are added. (2) Segregating the infected from the non-infected cows. Infected cows are brought into the barn, milked, and turned out before the non-infected cows are brought in to be milked. (3) Adding an extra head and set of teat cups to the milking machine equipment, 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 are first dipped in warm water before immersing in the chlorine solution. Previous study indicated that it required approximately 2 minutes to sterilize the teat cups. (4) Application of Shortwave Diathermy to the udder for 1 hour daily as soon as possible after the cow has a hard, swollen, or congested quarter. Diathermy usually relieves the congestion before the quarter becomes infected.

Laboratory tests made monthly, on the incidence of congestion in the udder, when each heifer goes into the milking string are used to identify infected cows. If a composite sample of milk from the cow shows a leukocyte count of 500,000 or more per milliliter and has long chained streptococci in incubated samples, the cow is considered infected or positive. Suspicious cases are checked by examining milk from each quarter. (*D. L. Fourt, F. C. Fountaine, G. C. Holm, W. V. Halversen, and V. A. Cherrington.*)

### Idaho Cooperative Dairy Stud Bull Associations Highly Successful

The average dairy farmer in Idaho has a herd of less than 6 cows and cannot afford to own a well-bred bull. Good bull service at a low cost now is being provided to the small dairyman in Idaho by the Idaho Dairy Stud Bull Service plan. The bulls are owned by individuals and cooperative associations of dairymen purchase, at a specified price, purebred bull service delivered to their farms.

A standard form of agreement for the purchase and management of the bull is used in all associations. The quality of the bulls used is indicated by the fact that the average production (on a mature basis) of the dams is 506 pounds of fat.

There are 28 Dairy Stud Bull Associations in operation with an average of 5.6 bulls per association. Last year the bulls in service averaged 176.4 services with 75.4 per cent conceptions for the first service. Bull owners traveled an average of 6.96 miles per service and the cost per conception to the dairyman was \$3.43. (*G. C. Anderson and D. L. Fourn.*)

### **No Apparent Advantage in Feeding Hay More Than Once Daily to Dairy Cows**

There is some difference in opinion among dairymen in southern Idaho as to the relative advantages of feeding alfalfa hay more than once daily. Some dairymen feed hay once daily, while others feed twice and even three times daily. Nine milking cows in the University herd, 5 Holstein-Friesian and 4 Jersey, were divided into two groups and fed alfalfa hay for 2-week periods once daily, twice daily, and three times daily. Under conditions prevailing at the time of the feeding trials no appreciable or significant differences were observed between the frequencies of feeding hay in (1) amount of hay consumed, (2) amount of hay refused, (3) amount of milk produced, or (4) weight of cows. (*D. L. Fourn and F. C. Fountaine.*)

### **Sodium Chloride in Cream May Be Dangerous to Babcock Test Operator**

The practice of adding sodium chloride to cream to help preserve the product is known to cause foaming during the Babcock test and the formation of a grayish-brown deposit at the base of the fat column which interferes with the reading. Observations also indicated that hydrochloric acid gas is released during the test.

In cooperation with the Department of Agricultural Chemistry, cream containing 5 to 13 per cent concentrations of sodium chloride, while being tested by the Babcock test, were analyzed for the hydrochloric acid gas produced, by a modified method developed by the investigators. Results show that the salted cream released hydrochloric acid gas in concentrations dangerous to health. Single samples of 7.5, 10.0, and 13.0 per cent of salt released gas in amounts above the maximum allowable for prolonged exposure. Sets of 12 to 24 samples of cream in any of the concentrations of salt used (5 to 13 per cent), released hydrochloric acid gas in quantities above the maximum allowable for even short exposure ( $\frac{1}{2}$  to 1 hour). The slow rate of diffusion of the gas increases the danger to the operator.

These results indicate not only the danger inherent in testing salted cream by the Babcock method but also the imperative need for ventilating hoods and ventilation in testing rooms where salted cream is tested. (*H. C. Hansen and R. S. Snyder.*)

### Potato-Alfalfa Hay Silage Trials Show Promise

Large amounts of unmarketable cull potatoes are normally available each year in Idaho. These potatoes can be fed raw or cooked to livestock but cannot be kept for any appreciable time. Proper processing, such as ensiling, should make cull potatoes a profitable feed for livestock. Using 50 gallon metal barrels as experimental silos, several formulas using varying proportions of potatoes, alfalfa hay, and molasses were studied. The silage made without the use of any molasses underwent a putrefactive fermentation, was alkaline in reaction, and was considered unfit for feeding.

The following formulas produced silage of good quality which was acid in reaction and palatable:

- (1) 90 lb. chopped cull potatoes  
10 lb. dry chopped alfalfa hay  
0.5 lb. molasses
- (2) 80 lb. chopped cull potatoes  
20 lb. dry chopped alfalfa hay  
24 lb. water  
2 lb. molasses

Further trials on additional formulas are being run in 1942. (*F. C. Fountaine and D. L. Fourt.*)

### Cause of Wintry Flavor in Butter Established

A common flavor defect of butter produced during the winter season is referred to as "wintry" by marketing agencies on the Pacific coast. This defect is very serious in the very best butter produced in the winter in some areas of Idaho. The cause of the flavor has been under investigation for several years but until the past year little tangible evidence had been collected which might be used to show both the cause of the defect and its possible control. Work in representative Idaho creameries in collaboration with the University of California resulted in establishing the possible cause of "wintry" flavor.

Hydrolysis of the butterfat due to the activity of the lipase enzyme is undoubtedly the main cause of "wintry" flavor. Lipase is either present in larger amounts or more active during the winter months because of the larger number of stripper cows being milked or the activating effect of lower temperatures on the enzyme.

Preliminary work indicated that by determining the surface tension of cream, a comparatively reliable forecast could be made as to the possibility of the cream producing butter which would either have or develop the "wintry" flavor.

Observation has shown the following conditions or combination of conditions responsible for the development of "wintry" flavor: milking large numbers of stripper cows, quick cooling, and holding of milk and cream at low temperatures, and feeding of large amounts of dry feed, particularly poor quality hay. (*H. C. Hansen and D. R. Theophilus.*)

## Poultry

### Sardine Oil Is a Good Vitamin D Supplement

**S**ARDINE oil offers poultrymen a satisfactory alternative source of vitamin D for their poultry rations according to the results of experiments recently completed. The drastic curtailment in the supplies of cod liver oil resulting from the war has made it necessary to consider other vitamin D carriers for poultry rations. It is not entirely safe, however, to rely upon either sardine oil or cod liver oil as the sole source of vitamin A when used at levels ordinarily recommended to meet the vitamin D requirements.

Although sardine oil has been used rather extensively in some areas it has not been as popular as cod liver oil in this region. To furnish Idaho poultrymen with more specific information, feeding trials were conducted to compare the relative efficiency of the two oils in supplementing laying rations, primarily as a source of vitamin D and secondarily as a source of vitamin A. The oils were of the same guaranteed potency (400 D, 3000 A) and supplemented the respective rations at the rate of 0.5 per cent of the mash or approximately 0.22 per cent of the total feed intake. Comparisons were made with three different types of mashes: (1) one of the regularly recommended laying mashes (Idaho formula No. 2); (2) a white grain mash containing 7 per cent dehydrated alfalfa; and (3) a white grain mash in which the oil was the only vitamin A supplement. The mashes were freshly mixed every 2 weeks; the scratch grain consisted of wheat, oats, and barley; and the birds were housed continuously from October 1, 1940, to September 1, 1941.

Based upon the number of eggs laid, egg shell thickness, health of birds, and return over feed cost, sardine oil compared favorably with cod liver oil. The vitamin D protection appeared adequate in all groups and the vitamin A requirements were fully met in ration Nos. 1 and 2. Neither of the oils was adequate, however, in meeting the vitamin A requirements of the birds on the No. 3 basal, the white grain mash, since specific throat lesions were observed in birds in both groups. In the case of the cod liver oil as the vitamin A supplement for the white grain rations, these results are not in agreement with those obtained a year ago when the same formula and same experimental procedure resulted in complete protection. No adequate explanation can be given for this lack of agreement because no actual determination of the vitamin A potency was made of the oils in either case. It can only be stated that the oil, the birds, and weather conditions were different than the year before.

The results of these trials give emphasis to previous recommendations that fish oils, used at levels ordinarily recommended for supplying vitamin D, should not be relied upon as a sole source of vitamin A. White grain rations should be adequately supplemented with the best quality of alfalfa obtainable. (*C. E. Lampman and D. W. Bolin.*)

### **A New Vitamin D Concentrate Available for Poultry Rations**

A highly concentrated vitamin D supplement in powdered form, developed industrially by activating animal sterols, proved as efficient as cod liver oil in trials recently conducted with growing chicks. The line test and bone ash were both used as a basis for evaluating the efficiency of the two vitamin D carriers. Further trials are now in progress with laying hens in which this new product is being further investigated. Inasmuch as this product contains no carotene or vitamin A, dehydrated alfalfa of good quality has been incorporated at different levels in the various rations to obtain information on the combined efficiency of the two products in supplying these two essential vitamins. (*J. N. Thompson, C. E. Lampman, L. R. Berg, and D. W. Bolin.*)

### **Dried Whey a Good Source of Riboflavin**

Since the diversion of dried milk into channels for human consumption by the lend-lease program, Idaho poultrymen have found it necessary to consider other sources of vitamin G (riboflavin). Two series of experiments have just been completed in which several products have been studied, including dried whey, dehydrated alfalfa, and two dried distillery by-products. Listed in rank of their efficiency as riboflavin carriers, based on the results of these trials, the order would be dried whey, dried buttermilk, dehydrated alfalfa of good quality, and distillery by-product No. 1. The second distillery by-product proved to be very poor. Dried whey is produced in large quantities in the state and is available at reasonable prices in comparison to other sources of riboflavin. (*L. R. Berg and C. E. Lampman.*)

### **Dried Whey Satisfactory for a Flush Mash**

The regular so-called milk flush treatment for coccidiosis in which dried skim milk comprises 25 per cent of the mash has become prohibitive since the diversion of skim milk to human consumption. It has been generally known that dried whey is more laxative than milk so experiments were conducted in which dried whey was used at various levels ranging from 7½ to 15 per cent of the mash as compared with dried milk at 25 per cent. The higher level (15 per cent) of dried whey proved as efficient as 25 per cent dried milk in producing the desired intestinal flush. The combination of 10 per cent whey and 5 per cent milk was second best in efficiency. In using the dried whey at 15 per cent it should be understood that while it is efficient as a flush, whey is not as nourishing from the standpoint of building up birds which have been weakened by coccidial infection. (*L. R. Berg and C. E. Lampman.*)

### **Whole Oats May Be Used Liberally**

Oats have become more generally used since it has been known that they produce good feather quality and tend to reduce cannibalism. It has not been known, definitely, however, just how high



a percentage of oats could be used in the ration. In experiments recently conducted it was found that oats of good quality may comprise as much as 50 per cent of the ration either as whole or steam rolled oats. In this experiment there was no advantage in using steam rolled oats. The egg production, body weight, and mortality compared favorably and was better in some instances than was the case in groups receiving lower levels of oats under similar conditions. (*C. E. Lampman and J. N. Thompson.*)

### Laying Flock Mortality Influenced by Many Factors

The upward trend of pullet-year mortality in the Station flock this past year was in accordance with an old saying among poultrymen that "Coccidiosis lays the groundwork for many other troubles." An excessive amount of wet weather and an outbreak of coccidiosis, followed later by a slight occurrence of infectious colds and a slight increase in the paralysis-leukosis mortality, were the factors responsible for the increase in laying flock mortality as compared with the two previous years. Leukemia was again responsible for the greater portion of the paralysis-leukosis mortality. The trend in laying flock mortality of the Station flock during the past 8 years is briefly summarized in Table 2. To recapitulate our experiences in this long-time project, attention is called to the fact that the paralysis-leukosis complex was the single disease responsible for the high mortality from 1933 to 1937. During the next 3 years such miscellaneous causes as reproductive disturbances and accidental deaths were the principal factors.

The low mortality of 3.5 per cent for 1939-40 is explained partly by the fact that in addition to the results secured from the selective breeding program, an unusually favorable condition prevailed in that the flock was remarkably free from any complicating or predisposing factors. It seems logical to conclude that the outbreak of coccidiosis this past year, following a period in which the flock was relatively free from serious outbreaks, is at least one of the predisposing factors for increased mortality in 1940-41. (*C. E. Lampman and G. C. Holm.*)

Table 2.—Reduction of mortality in the Experiment Station pedigreed White Leghorn flock by selective breeding (per cent mortality during the first laying year—11-month period).

Year	Total Per Cent Mortality	Paralysis-Leukosis Complex	Miscellaneous
1933-34	44.6	24.1	20.5
1934-35	37.0	20.5	16.5
1935-36	23.7	9.8	13.9
1936-37	27.9	13.2	14.7
1937-38	17.6	6.9	10.7
1938-39	7.1	2.5	4.6
1939-40	3.5	.9	2.6
1940-41	12.1	2.6	9.5

Note: Above mortality includes unthrifty birds which were culled during the year as well as those that actually died.

## Crops, Crop Breeding, and Soils

### High Winter Temperatures and Heavy Precipitation Prevail

THE crop year of 1940-1941 (September 1 to August 31) was characterized by precipitation of 8.12 inches above normal and by high winter temperatures. The amount of precipitation was the third highest on record for the 49-year period that data for crop years are available. The actual amount of precipitation, 30.03 inches, was exceeded during the seasons of 1906-1907 and 1912-1913 when 33.39 and 31.73 inches were recorded. Winter temperatures were especially high with December 3.8, January 5.4, February 7.4, March 7.4, and April 3.8 degrees above normal. Temperatures during the summer months, with the exception of July, were but slightly above normal. July, however, was 3.9 degrees above normal. (*Karl H. W. Klages.*)

### Diseases Influence Yields of Cereals

All winter wheat varieties grown in the nursery were badly lodged and severely attacked by *Cercospora* foot rot. Mild winter conditions together with an abundance of moisture favored a heavy vegetative growth and created conditions favorable to the development of this foot rot. None of the varieties grown showed resistance to the disease.

The spring nurseries were characterized by the development of severe infection of leaf rust and black stem rust. The yields and test weights of varieties and strains susceptible to those diseases were greatly reduced. Varieties with limited or no rust were Merit, Premier, Thatcher, Ceres, and Marquis, also a number of advanced generation crosses involving such rust resistant parents as Hope, H-44, and Thatcher. Among the white wheats Baart and Idaed ranked high in yield with the latter escaping severe stem rust infection on account of its early maturity.

Fourteen standard varieties of barley and 32 advanced generation crosses between Vaughn and Atlas and 10 advanced generation crosses between Faust and Meloy were grown in replicated plots. A number of these crosses outyielded Trebi, the highest yielding of standard varieties. The Vaughn by Atlas crosses are especially promising and will be tested in detail next year. Differential varietal and strain response to the barley scald disease which was present in epidemic proportions was observed.

A number of advanced generation crosses between Markton and Victory and Markton and Idamine appeared promising in comparison with standard varieties of oats. (*H. K. Schultz and Karl H. W. Klages.*)

### Progress Made in Development of Hybrid Corns

Definite progress is being made in the development of Idaho hybrid corns. The value of hybrid corn was demonstrated this year in 11 cooperative corn variety tests conducted in cooperation with



the Agricultural Extension Division in 10 counties of southern Idaho. These tests consisted of the comparison of 19 commercial hybrids and 1 open pollinated variety.

Seven early and medium maturing lines of corn were selected in 1940 from a group of 150 Idaho selfed lines on the basis of uniformity of plant type. These lines were intercrossed in all possible combinations and the resulting single crosses evaluated in 1941 on the basis of stand, yield, maturity, and quality. Some of these single crosses appear promising in comparison with the commercial hybrids available to producers. Double crosses will be made on the basis of predicted values from the single cross data.

Another set of single crosses was made this year. These were made in three groups of eight selfed lines each of early, medium, and late maturing types, crossed in all possible combinations within each group. The resulting single crosses will be tested in 1942. All of this corn breeding work was carried out at the Caldwell Branch Station. (*H. K. Schultz and Donald Peterson.*)

#### **Seed Yields of Grasses and Clovers Good**

An extensive series of experiments on the production of seeds of grasses and clovers was completed this year. It was demonstrated that seed crops of smooth brome, crested wheat, slender wheat, orchard grass, meadow fescue and tall meadow oat grass can be produced to advantage in northern Idaho. A more extensive series of plots, including not only the tame grasses but also the more important native and newly introduced species of grasses and clovers was established this year with the objective of evaluating their merits for forage and seed production purposes. (*Karl H. W. Klages.*)

#### **Soil Management Practices Recommended**

Soil management practices have not only an immediate effect on crop yields, but also greatly influence soil permanency. The set of management plots established in 1938 now have been in progress sufficiently long to give definite indications of yield and soil influences. In these plots all crop residues were returned to the soil, the moldboard plow was used in all cases except where otherwise indicated. The more outstanding results are summarized in Table 3.

The additions of nitrogen-containing materials such as barnyard manure and ammonium sulphate increased wheat yield by 21 and 32 per cent, respectively. The substitution of the wheatland for the moldboard plow reduced wheat yields by 14 per cent. While the burning of straw results in an 8 per cent increase in yield, it is becoming evident from the rilling of these plots that this practice definitely increases the susceptibility of the soil to erosion losses. In the case of spring wheat fall plowing increased production by 16 per cent over spring plowing.

Other soil investigations in progress are as follows: the influence of irrigated agriculture on soil conditions, crop rotation studies, boron investigations, and the use of commercial fertilizers. (*G. O. Baker and Everett VanSlyke.*)

**Table 3.—Effects of soil management practices on wheat yield on the University Farm, Moscow.**

Four-year average of triplicated plots—1938-1941.

Treatment	Yield in bushels per acre	Index
<b>Winter Wheat—Rex</b>		
Plowing .....	29.0	100
Wheatland disc used .....	25.0	86
Straw burned .....	31.4	108
150 pounds of ammonium sulphate per acre applied to straw prior to plowing .....	38.3	132
10 tons of barnyard manure per acre every third year .....	35.2	121
<b>Spring Wheat—Idaed</b>		
Fall plowing, left rough over winter .....	27.8	100
Spring plowing, stubble standing over winter .....	23.4	84

### Soil Survey Continued

The soil survey work is conducted cooperatively with the United States Department of Agriculture, Soil Survey Division. The survey of Gem county is now in progress. It is hoped that this county may be completed during the 1942 season. The area to be surveyed was expanded in 1941 to include the areas in Valley and Boise counties which are included in the Squaw Creek Conservation District. (G. O. Baker.)

## Fruit and Vegetable Crops

### Promising New Apple Variety Is Introduced

THE most permanent and far-reaching advances in horticulture have come about through the origin and introduction of new varieties superior to those formerly grown. The Idaho Agricultural Experiment Station this year is introducing an outstanding new variety of apple that gives promise of taking an important place in the horticulture of Idaho and the Northwest. A cross between Wagener and Jonathan, this variety is the first introduction from nearly 12,000 seedlings grown and tested by the Station. It has been given the name "Idared," which is indicative both of its origin in Idaho and of its beautiful color, which is one of the outstanding characters of this variety.

The fruit of the Idared apple is medium to large in size, averaging larger than Jonathan. In form it is nearly round to somewhat irregular. It has solid, bright red color, and good finish. The flesh is nearly white, crisp, juicy, and unusually fine grained. The flavor is mild sub-acid, rich, and slightly sweet. As grown at Mos-

cow this variety excels both its parents in dessert quality. In baking it holds up as well as Rome Beauty and is superior to that variety in flavor.

This apple keeps well in an air-cooled storage until March or April, and, on one occasion, remained sound until the middle of May. It comes in season with or a little after Jonathan. In tree form it resembles Jonathan but appears more resistant to fire blight. This variety was first selected in 1935 and now has been observed through 7 fruiting seasons at Moscow. Young trees set in the orchard in 1937 bore nearly one box of apples each in 1941. A more detailed description of the Idared apple will appear shortly in a separate publication. (*Leif Verner.*)

### A New Device Measures Potato Tuber Growth

A good potato farmer knows much about the growth and behavior of his vines, and how they are affected by temperature, irrigation, disease, insects, and fertilizers. But he knows very little about how the potato tuber, buried out of sight under the ground, reacts to these environmental influences. The way in which the growth of the tuber responds to these conditions has much to do with determining the size and yield of potatoes at harvest, and may have a direct bearing on such problems as second growth and hollow heart. It seems highly important, therefore, that we learn more about how the tuber itself is affected by the weather, by insects and diseases, and the control measures we use for these, and by various cultural operations.

An instrument developed recently at Moscow has proved well suited for measuring the effects of such environmental influences on tuber growth. This instrument, known as an auxanometer, is placed partly under ground at one side of a potato plant. A small tuber that has been carefully uncovered is placed in the instrument and immediately covered again with soil. Increase in diameter of the tuber as it grows is recorded on a chart fastened to a clock-driven drum on a part of the auxanometer that extends above the ground. By a line traced in ink on the chart it is possible to tell just how rapidly the tuber has grown at any previous time since it was placed in the auxanometer.

A continuous measurement of growth of a Russet Burbank tuber over a period of 5 weeks was secured at Parma in 1941. For a period of 29 consecutive days before the occurrence of killing frost this tuber exhibited a definite growth pattern as shown in Figure 1. Growth ceased entirely each day for an average period of 9 hours. It usually stopped between 8:00 and 10:00 o'clock in the morning and began again between 3:00 and 6:00 o'clock in the afternoon, with continuous growth throughout the night. The periods in which no growth occurred coincided with periods of low humidity. Evidently, when the air was taking water out of the plant rapidly the tuber did not grow. If this condition proves generally true we may assume that the hot, drying summer days that are common in Idaho potato districts are not particularly beneficial

so far as growth of the crop is concerned, and they may actually be detrimental. Further studies with this type of auxanometer should yield important information on factors that influence the growth of potatoes. (*Carl F. Dietz and Leif Verner.*)

### Potato Quality Studies Begun

The unsurpassed quality of Idaho potatoes must be maintained if growers are to compete successfully in eastern markets. However, in spite of the importance of quality little is known of the way in which cultural practices and storage conditions affect it. A study has been undertaken in an attempt to answer this question.

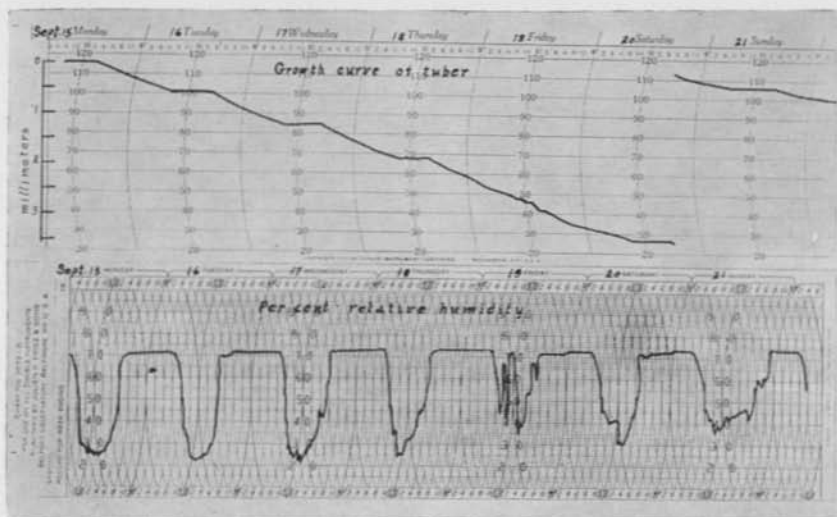


Figure 1. Growth of potato tuber in relation to atmospheric humidity.

Reports from other research workers that the specific gravity of potatoes could be used as an index of their cooking quality, as reflected by mealiness, has given considerable impetus to this study. Since this test is many times faster than a cooking test, it greatly increases the possible scope of the experiment. However, preliminary tests indicate considerable variation in the average cooking quality of potatoes with the same specific gravity which have been grown under different conditions. Although interesting differences in specific gravity have shown up as a result of differential fertilization, rotations, spacing, and maturity-inducing treatments, more work will have to be done to clarify the relationship between specific gravity and cooking quality before these results can be interpreted.

Closely allied with this work were experiments made to determine the effect of the specific gravity of seed potatoes on their behavior when planted. A week of heavy rains occurred immediately after planting and seriously impaired the stand. Under these conditions seed pieces of a specific gravity of 1.085 gave a 53 per

cent stand whereas those with a specific gravity of 1.115 gave only an 18 per cent stand. Between these extremes there was a somewhat inconsistent trend toward decreasing stand with increasing specific gravity. The yields were reduced in proportion to the stand. (*Charles Arnold.*)

### **Prune Nectar Becomes a New Idaho Product**

Hundreds of tons of Idaho's fresh prune crop every year reach the cull pile, where they represent a loss to everyone from the fruit grower to the consumer. How to convert this unmarketable fruit to profitable by-products has been the object of a study carried on for the past several years by the Idaho Agricultural Experiment Station. This work has been done in cooperation with the staff of the Fruit and Vegetables By-products Laboratory of the U. S. Department of Agriculture located at Pullman, Washington. An excellent fresh fruit beverage, known as prune nectar, has been developed through this work, and was produced commercially by an Idaho cannery for the first time this year. Any culls that are not decayed or excessively green are suitable, and in years when prune prices are low, a portion of the marketable crop can probably be converted profitably to prune nectar.

Since canneries can operate most economically when they extend their activities over a long period of time, experiments were conducted this year to determine how long prunes held in storage remain suitable for the manufacture of nectar. It was found that fruit picked at the beginning, at the peak, and at the end of the commercial harvesting season still made an excellent product after 5 weeks in cold storage at 35° F. In fact, both the color and quality of the nectar improved noticeably with storage. Since the average picking season covers a period of 2 to 3 weeks, and since the last fruit picked is still suitable for nectar after 5 weeks of storage, it appears that a cannery should be able to operate continuously for a period of 7 or 8 weeks a year in the production of prune nectar. (*Leif Verner and Carl F. Dietz.*)

## **Agricultural Engineering**

### **Land Conservation, Irrigation, and Drainage Research Reported**

**I**N cooperation with the Soil Conservation Service of the U. S. Department of Agriculture, a map was prepared showing annual yield of run-off from watersheds within the different physiographic zones of the state. The annual yield is expressed in inches depth of water in the same manner as rainfall. According to the best data now available the normal annual yield varies from less than 0.5 inch in the central part of southern Idaho to above 15 inches in some of the higher mountainous areas. A study of 4 years of run-off data from two watersheds for Palouse wheatlands near Moscow has shown a steady decrease of annual run-off in percentage of annual rainfall. These watersheds are under conservation practices.



The replacement of worn and inefficient impellers by modern impellers of improved design in deep well turbines reduced annual power costs in amounts equal to from 30 to 50 per cent of the improvement cost.

Potato irrigation at the Aberdeen Branch Experiment Station again showed no significant difference in yield and quality of potatoes irrigated with cold well water and the warmer canal water. (*Hobart Beresford, Mark R. Kulp, H. S. Riesbol, John L. Toevs, and William Watson.*)

### **Mechanized Production Analyzed**

Idaho farmers face the problem of producing more food with fewer man-hours of labor. The mechanization of potato production has been advanced by the development of special handling equipment. The relation between mechanized production and tuber injury resulting in culls appears to vary more with the management and operation of equipment than it does with the type of equipment employed. Detailed plans have been made of the various types of brushing and washing equipment and for the sorting tables, conveyers, and pilers. The relation among types of equipment, management, procedure, transportation, handling, and storage has been analyzed to determine the factors which contribute to the resulting percentage of cull potatoes.

The topping and loading of beets is one of the hand labor problems in Idaho's agricultural production that is nearing mechanized solution. Almost every beet growing section has shown the progress made by machinery manufacturers and by farmer inventors who have modified and improved old equipment and developed new devices.

Harvesting of new crops with a small combine was made possible through the cooperation of the equipment manufacturers. Although it was impossible to thresh either castor beans or sunflower seed in the field with the standard equipment, the crops listed in Table 4 were threshed without difficulty. (*Norman B. Akesson and Hobart Beresford.*)

### **The Use of Light in Agriculture Increasing**

In cooperation with the Department of Animal Husbandry and Bacteriology a study is being made on the value of Sterilamps for rapid tenderization of beef to be held in frozen storage. Present indications point to the fact that by aging at a temperature of 50° F. it is possible to reduce the time to approximately one-fifth the period required to age at 34° F. The higher temperature is made possible through the inhibitory effect of ultraviolet radiation.

Cooperating with the Department of Plant Pathology, ultraviolet "black light" units were used for the partial identification of ring rot in seed potatoes. A new type of radiant energy lamp brooder was developed, and trials made under the direction of the Department of Animal Husbandry.

Work is now in progress on a commercial application of radiant energy drying of white beans. In order to comply with market regu-

Table 4.—Chemurgic crops threshed with small combine.

Crop	Cylinder speed rpm	Clearance shelling cylinder plate concave		Adjustable chaffer (open)	sieves fine (open)	Wind adjustment above below		Finishing sieve (inches)	Remarks
		(inches)	(inches)			(open)	(open)		
Coriander .....	850	1/4	5/32	1/4	1/3	1	3	Soybean 1/4	Threshed easily, screen over tailings auger, re-separated for better cleaning.
Fennel .....	1,250	1/4	5/32	1/3	1/2	4	1	Wheat 5/32 x 3/4	Tended to break seed unit, may not have been dry enough, screens placed over tailings elevator.
Safflower .....	1,200	5/16	3/8	1/4	1/3	1	3	Wheat 5/32 x 3/4	Threshed easily, screen placed over tailings auger.
Savory .....	1,450	1/4	5/32	1/4	1/4	None		1/12	Threshed poorly, re-separating necessary with cylinder unbelted because fan effect of cylinder blew seeds over sieves.
Soybeans .....	700	3/8	3/8	2/3-3/4	1/3-1/2	6-7	6-7	3/8 x 9/16	Threshed well; coarse stems tend to bridge sieves; and where machine is moved on field sidehills, sieve load becomes unbalanced; easy to overload machine when pitching crop on the elevator canvas.
Spinach .....	1,200	3/8	3/8	2/3	1/3	1/4		5/32 x 3/4	No threshing difficulties.
Sudan grass ..	1,200	3/8	3/8	2/3	1/3	1/2		5/32 x 3/4	Straight combines, threshed easily, screen over tailings auger.



lations white beans must contain not more than 18 per cent moisture. The removal of 4 to 5 per cent excess moisture can be accomplished in 6 to 8 minutes' exposure to radiant energy lamps; however, the beans which have been heated have a tendency to give off moisture which condenses on the beans as they are cooled to room temperature. Methods are being developed for the handling and storing of beans following radiant energy drying. (*Norman B. Akesson, Hobart Beresford, D. E. Brady, W. V. Halversen, and J. M. Raeder.*)

### **Rural Electrification Progress Continues**

Steady progress has been made in the electrification of Idaho farms, reaching a total of 29,919 electrified in 1941. Ninety-six per cent of Idaho farms with dwelling valued at more than \$500 now have electric service, indicating that most of the farms not served are in the lower income group. (*Hobart Beresford.*)

### **Farm Frozen Storage Important for Defense**

Studies made of the frozen locker storage facilities for Idaho reveal that there are 113 locker plants located in 79 towns and villages providing a total of 30,000 lockers, about one-half of which are used by farm families. In addition to an analysis of the facilities available, information was obtained relative to management and operation of the locker plants. Temperature requirements for chilling, quick freezing, and storage; packaging; and length of storage period also were studied. The average chill room temperature was found to be 34° F. Quick freezing room temperatures varied from 0° to -25° F., and although the average storage room temperature varied between 7° and 13°, a number of the plants operated at 0° to plus 5°.

It was found that due to the increased competition in the frozen locker storage field, the storage temperatures are being continually lowered. The maximum temperature fluctuation of 5° was considered allowable by most locker plant managers. Immediate refrigeration to check or prevent enzyme action in fruits and vegetables is being recognized by many locker plant users. Quick freezing at rates which prevent the formation of large crystals is desirable for fruits and berries. Berries placed under immediate refrigeration and frozen within 6 to 8 hours after picking provided a satisfactory product. Information was furnished the U. S. Department of Agriculture on the maximum time allowed by plant operators in Idaho to sharp freeze beef, pork, poultry, fish, fruits, and vegetables, also information relative to the transfer temperatures and maximum time allowed by these operators to effect temperature change, including the highest storage temperature and the maximum fluctuation in temperature during storage. (*Hobart Beresford.*)

### **Improvements in Farm Structural Materials and Methods Noted**

Idaho farmers continuously are looking for lower cost building materials and for designs and methods of construction which per-

mit lower cost construction with standard materials. Methods of stabilizing soil mixtures for farm roads and walks and for footings, floors, and foundations for farm buildings have been studied with particular emphasis on the use of Portland cement as the stabilizing material. A reduction of the amount of cement required for given mixtures has been made possible by the addition of certain fines common to many soils, such as clay. It was found that concrete may be improved by the use of hydrated lime and some active siliceous material such as diatomaceous earth admixed with the cement in amounts not to exceed 5 per cent of each by weight of the cement used. This mix increases the workability of the grout and the resultant concrete is more moisture resistant. Incidental results of these experiments also indicate improved methods of painting concrete and masonry surfaces. (*Hobart Beresford and Walter R. Friberg.*)

## Farm Economics

### Wheat Farms Require Large Crop Acreage

**T**HE fact that the marginality of dry-land wheat farms in western Oneida county is dependent upon sufficient crop acreage under cultivation was determined from a study of complete business records on 60 dry-land wheat farms in 1939. Average prices for 5 recent years and yields for the period 1930-1937 were secured. The conclusions of this study were presented to farmers and to appropriate government agencies and, as a result, land which had been judged as submarginal and purchased by the government will be released for wheat production again.

A "use capability soil survey" of dry wheat lands of Teton, Madison, and Fremont counties by the Soil Conservation Service indicates that one large area now in wheat farms had better be abandoned if the remainder of the top soil is to be saved. A farm business survey for 1939 and budgets based on average yields, market, and cost conditions indicated that farmers could make a reasonable net income on these poorer lands if sufficient acreage per farm were cropped. Farms with small crop acreages have consistently failed to make sufficient income. The important question before the farmers with sufficient acreage is now a matter of permanency of grain farming rather than lack of income. (*Leo Fenske and Paul A. Elke.*)

### More Capital Needed by Black Canyon Settlers

Settlers coming into the raw lands of the Black Canyon Irrigation Project in Canyon and Payette counties need much information, education, and material assistance. About 180 settlers and owners were interviewed and questionnaire filled for each. The main limiting factor in the progress of the area and nearly all individual settlers was a shortage of capital. It is necessary to have available for the area a type of credit which permits an increasing loan for the first 2 or 3 years and small increasing repay-

ments provided thereafter. Much supervision by the lending agency will be necessary. (*Norman Nybrotten and Paul A. Eke.*)

### **Wheat Yields Not Determining for Selling Values of Palouse Land**

The relation of wheat yields to land values in Lewis county have been shown to be of importance but not determining. From 171 records of actual transfers the past 5 years, the above statement can be made. Land in the highest wheat-yield group is sold only at about one-half of the amount justified by the net income. Land with low or marginal wheat yields has sold at about two-thirds as much as the best yielding lands. Yet the low or minus net income from wheat on these low yielding lands indicates little or no actual capital value. However, selling values have been fairly well in line with the values of the one-third shares of the wheat going to landlords on share leases. On the poorer lands operators have been operating at a loss by paying a one-third share rent. As a result of prevailing land prices, operating farmers can purchase the higher yielding lands and pay for them much easier than any lands having lower wheat yields. Lands of low wheat yields probably cannot be paid for from income received from the land. Assessed values are even more regressive, because all grades of crop land have been assessed at about the same figure per acre. (*Norman Nybrotten.*)

### **Improved Pastures Are Direct Benefit to Defense**

The State Agricultural Planning Committee called attention to the need for improved pastures in the June 1 report on the impacts of war and defense. A survey was undertaken to study the pasture situation, and during last summer 160 pasture records were taken on irrigated farms in southern Idaho. These records supplied data on costs of maintaining irrigated pastures, and on the management practices the farmers were following.

An analysis of the pasture records shows that opportunities exist for greatly improved pastures at a slightly increased cost over ordinary pastures. The total costs per acre for operating and maintaining irrigated pastures did not vary greatly between the different kinds of pasture studied. In the southwest district, which includes Ada, Canyon, Gem, and Payette counties, the total net costs per acre average \$18.92 on the mixed pastures, \$18.85 per acre on bluegrass, and \$18.18 per acre on Ladino clover. These costs include charges for all labor spent on irrigating the pasture and other work, water charges, fertilizing costs, fence costs, taxes and interest on the land, and miscellaneous expenses.

The costs per unit of grazing were lower on the improved pastures than on the bluegrass pastures, because the farmer had higher carrying capacities. The Ladino clover pastures in the southwest district produced feed at a rate of 7 cents per cow per day (animal unit) of grazing. This compares to 7.6 cents per animal unit day of grazing on the mixed pastures, and 8.9 cents per animal unit day on the bluegrass pastures. Animal unit days of grazing

per acre produced in 1940 were 264, 240, and 204 respectively on the Ladino clover, mixed, and bluegrass pastures. In the Upper Snake River area the margin in costs per animal unit day of grazing between mixed and bluegrass pastures was more pronounced. The former produced feed at a rate of 6.5 cents per animal unit day of grazing, and the latter, at a rate of 9.2 cents per day.

On the better mixed pastures in southwestern Idaho an average of 1.6 animal units were carried per acre for the season at a cost of 5.6 cents per animal unit day of grazing. Some mixed pastures were carrying as high as 2.5 animal units per acre. The ordinary bluegrass pastures studied carried 0.98 animal units per acre at a cost of about 11 cents per animal unit day of grazing. In the latter case a 15-cow dairy herd would require 16 acres of pasture, while if a good mixed pasture was used, 8 acres would be sufficient. A substitution of this kind would release 8 acres for other crops, and the pasture costs for the season would be about \$140 less. In these critical times, when additional dairy products and other foods are required, the use of good improver pastures will assist greatly in achieving this end. (*Leo Fenske.*)

#### **Relation of Markets and Prices to Dairy**

##### **Expansion Studied for Northern Idaho**

Prices paid for butterfat at more important towns in northern Idaho have been secured from creameries and cream stations. Central market prices in Lewiston, Spokane, Seattle, and Portland have been compiled from newspapers. Volume per month handled by all creameries and stations in northern Idaho has been secured from the State Department of Agriculture at Boise. A questionnaire was filled out by each creamery and cream station on general policy. The data thus collected have shown that: (1) The volume of butterfat is from 2 to 5 times as high in the spring and early summer as during the winter. (2) About half of the creameries pay from 2 to 3 cents premium for sweet or the better grade of cream. (3) Creameries as a general rule paid 1 cent less than was paid in Spokane, but some of the creameries, particularly those closer to Spokane, paid the same price over extended periods. (4) Cream stations paid 1 to 2 cents less than creameries in the same general area. (5) Lewiston, Spokane, and Seattle prices were frequently the same but there seemed to be about a 1 cent spread between each of these markets as a general rule with the highest price paid in Seattle. (*Paul A. Eke and Robert Brown.*)

## **Agricultural Bacteriology**

### **Prevention and Control of Bovine Mastitis Attempted**

**T**HE prevention, control, and cure of bovine mastitis in dairy cows is of great concern to the dairy industry. The Department of Bacteriology has cooperated with the Dairy Husbandry Department and the Station veterinarian in developing a program which will prevent or control this disease.

Additional studies have been made on the antigenic relationship of *S. agalactiae* which is generally considered to be the most common cause of bovine mastitis. A variant of *S. agalactiae* has been found that is agglutinated by the serum from cows suffering with mastitis. Blood serum from calves or cows that have never had mastitis fails to agglutinate this organism.

Gramicidin (Dubos) (Tyrothricin Merck) has been studied as a possible cure for bovine mastitis. Nine different cows were treated with this crystalline bactericidal substance isolated from spore-forming bacteria, which has received great recognition because of its specific property of bringing about the lysis of living gram positive organisms. The application was varied in such a way that the value of the treatment could be determined. For example, in some cases half of an infected udder would be treated, while the other half remained untreated, and also normal quarters were treated as well as diseased quarters. The value of the treatment was determined by examination of the milk for bacteria and leukocytes. The gramicidin proved to be toxic and generally produced an increase in body temperature of the treated animals, which reached a maximum in 6 to 10 hours. Following the treatment, the leukocyte count of the milk increased enormously, but generally returned to normal after 7 or 8 days. Generally this treatment was successful. However, one cow failed to regain normal milk production and several infected quarters continued to show infection after treatment. (V. A. Cherrington, W. V. Halversen, G. Holm, and D. L. Fourn.)

#### **Pullorum Disease in Chicks Studied**

Pullorum disease in chicks is diagnosed by the type of lesions and by the isolation and identification of the causative organism, *Salmonella pullorum*. In certain cases it has been found that although lesions typical of pullorum disease were present, the causative organism was not *Salmonella pullorum*, but a gram positive coccus. The symptoms are similar, but the mortality is generally not as high as that caused by *Sal. pullorum*. A number of these organisms have been isolated from chicks from different sources, and a study of their morphological, physiological, and cultural characteristics has been made. These characteristics closely resemble those of cocci isolated by other workers from hens whose sera showed a positive reaction with pullorum antigen, but from whom *Sal. pullorum* could not be isolated. The inoculation of these cocci into day-old chicks caused the production of lesions similar to those found in pullorum disease but the mortality under these conditions was extremely low. Work is now in progress to determine the antigenic relationship between these cocci and *Sal. pullorum*. (W. B. Ardrey.)

#### **Diagnosis of Poultry Diseases Continued**

Poultry raisers over the state have availed themselves of the laboratory facilities by sending in diseased chicks for diagnosis and post mortem studies. In all, 73 consignments of chicks were sent in for pullorum diagnosis. Of this number, 49 were found to be infected



with *Sal. pullorum*. In the great majority of these cases the chicks originated from outside the state or from hatcheries not cooperating in a pullorum testing program. In addition, approximately 250 consignments of birds were posted, the most prevalent maladies encountered were coccidiosis and paralysis. (*W. B. Ardrey.*)

### **Bacteriological Factors Affecting Growth of Alfalfa Studied**

Researches to determine any bacteriological factors which may be responsible for decreased yields of alfalfa on certain soils which originally supported heavy crops have been continued.

Thirty cultures of root nodule bacteria were isolated from alfalfa plants taken under field conditions in widely distributed areas of the state. These cultures were taken from selected plants dug from fertile fields and from fields where the yield of alfalfa had declined to an unprofitable level. These cultures were used to inoculate seed which was planted in sterilized sand. During the first year there has been no apparent difference in the growth or nodulation of the alfalfa plants inoculated with the various cultures. (*W. V. Halversen and T. C. Cordon.*)

## **Agricultural Chemistry**

### **Stage of Maturity Affects Feeding Value of Balsamroot**

**W**HAT are some of the factors which affect quality and quantity of feed found on the Idaho ranges? An attempt is being made to answer these questions through determinations of chemical composition and dry matter yields at different stages of maturity on several of the major species of Idaho range forages. One of the major forage plants under investigation is the arrowleaf balsamroot, *Balsamorhiza Sagittata*, a member of the sunflower family whose early growth and fair palatability make it a valuable forage plant. The flowers are especially palatable, but all portions of the plant, except the coarse flower stalks, are eaten throughout the grazing season. The average dry matter yield, percentage chemical composition, for four seasons' growth, at different stages of maturity, are shown in Table 5. These results definitely show that arrowleaf balsamroot varies from a rich protein-phosphorus concentrate, in the early stages of growth, to a poor roughage, low in protein and phosphorus, in the latter stages of growth. The greatest amount of high quality feed is produced at the time the plant is in full bloom or before the leaves have stopped growth. Immediately after this stage of maturity, there is a rapid loss of protein and phosphorus content resulting in a low quality forage.

Year-to-year variations in chemical composition were insignificant in comparison to the change of chemical composition with different stages of maturity. Since the plant grows and matures rapidly, a difference of 2 weeks in the time of grazing may make

Table 5.—Dry matter yield<sup>1</sup> and composition of Arrowleaf Balsamroot at different stages of maturity.

Stage of Maturity	Dry matter	Moisture	Protein	Fat	Fiber	N-free extract	Ash	Ca	P
	Grams	%	%	%	%	%	%	%	%
Leaves growing rapidly Flowers appearing .....	13.1	7.7	30.3	4.7	14.6	32.8	9.9	0.91	0.539
Leaves growing rapidly Flowers blooming .....	91.4	7.9	23.0	5.4	15.6	35.3	12.8	1.61	0.455
Leaves growing Blooming over .....	<b>208<sup>2</sup></b>	<b>6.7</b>	<b>17.0</b>	<b>5.1</b>	<b>17.2</b>	<b>39.6</b>	<b>14.4</b>	<b>1.79</b>	<b>0.250</b>
Leaves ceased growth Seed beginning to form .....	268.0	6.9	12.4	3.7	20.4	43.0	13.6	1.96	0.194
Plant drying Seed disseminating .....	234.0	7.8	8.7	2.7	20.8	45.6	14.4	2.24	0.143
Fall Forage .....		7.0	3.6	1.4	30.2	39.2	18.8	2.05	0.059

<sup>1</sup> The yearly average air-dry weight of 20 plants at different stages of maturity for four seasons of growth.

<sup>2</sup> Bold face type represents the stage of maturity and chemical composition when the greatest amount of high quality feed is produced by the plant.



the difference between a high and low quality forage. Because of this, special attention should be given to the stage of maturity in the grazing of arrowleaf balsamroot for a maximum quantity of good quality feed. Arrowleaf balsamroot plants on fall ranges were found to be a very poor roughage, extremely low in protein and phosphorus. (*D. W. Bolin and W. M. Beeson in cooperation with the U. S. Intermountain Forest Service, Dubois, Idaho.*)

### **Cobalt Content of Some Idaho Feeds Sufficient**

Cobalt deficiencies in sheep were first recognized in southern Australia; other areas deficient in cobalt have been found in Florida and Canada. Ruminants such as sheep and cattle are the only animals known to be affected by a cobalt deficient diet. Horses may feed for generations on areas where sheep will show symptoms of cobalt deficiency within 4 months. Sheep on a cobalt deficient ration become less active; their eyes become rheumy and their mucous membranes bloodless. There is a loss of appetite and weight. Weakness progresses until the animal dies. The hemoglobin drops to less than half the normal. A rapid recovery supervenes with the addition of cobalt to the diet.

Cobalt deficient areas often are associated with soil high in calcium. In view of this fact, cobalt was determined on some of the Idaho-grown feeds.

The average cobalt content in parts per million (air dry weight) of some of the Idaho-grown feeds are as follows: northern grown alfalfa, 0.224; southern grown alfalfa, 0.136; timothy, 0.06; corn silage, 0.10; beet pulp, 0.26; wheat, 0.05; barley, 0.045; oats, 0.06; corn, 0.08; sorghums, 0.07; bran, 0.06

The above analyses indicate that feeds, especially alfalfa and beet pulp, contain enough cobalt to prevent cobalt deficiencies. Very small quantities are needed to promote normal physiological functions. (*D. W. Bolin.*)

### **Organic Matter Important in Crop Production**

Addition of 15 tons of manure every third year to various 3-year rotations increased the amount of nitrogen and carbon in the soil except in rotations where fallowing was practiced. Here the increases were small although yield and nitrogen content of the wheat were increased materially.

Fallowing, without manure, increased the available nitrogen in the soil and thus increased the yield and nitrogen content of wheat but decreased the reserve supply of the nitrogen and carbon of the soil very rapidly.

Continuous wheat, with manure, did not give as high yields or nitrogen content of the wheat as wheat grown in 3-year rotations with manure. It gave better results than continuous wheat without manure. The nitrogen and carbon of the soil was increased.

Available nitrogen in the form of sodium nitrate or ammonium sulphate caused some decrease in the carbon of the soil but increased the yield and nitrogen content of the wheat. When sufficient crop residues were added the carbon and nitrogen of the soil

was maintained and the activity of the organic matter was increased. This resulted in increased yields and nitrogen content of wheat. Usually the nitrogen of the soil was not increased materially.

Green manures and crop residues assist in maintaining the organic matter of the soil. Their rapid decomposition increases soil micro-organism activity and assists in releasing other plant food. Crop residues alone will not maintain the carbon and nitrogen of the soil. Green manure or farm manure must be added occasionally.

Thus with increased activity of soil micro-organisms, with high nitrogen and carbon levels and with proper rotation and farm management practices, high crop yields and high nitrogen content of wheat may be secured and the soil organic matter maintained in an active state that will produce a good supply of available plant food for future crops. (*R. S. Snyder and G. O. Baker.*)

### **Stage of Decomposition of Organic Matter Influences Degree of Sorption by Clay Material**

Previous work has shown that organic materials are chemically bound by the clay fraction of the soil. The degree of interaction taking place between the organic and inorganic fractions depends on the nature of the organic matter and the pH of the reacting medium.

The manure and plant residues returned to the soil under farm conditions vary in chemical composition and texture. Therefore, a study was made to determine what effect such factors as stage of decomposition, chemical composition, and grinding have on the sorption of organic matter. The data collected show that decomposition increases the sorption of plant residues. Grinding increases the sorption of materials high in nitrogen but has little effect on low nitrogen material. Nitrogen is the basic element of organic material and must be present if it is to be sorbed. Therefore the increased sorption due to decomposition may be a result of greater nitrogen content and smaller particle size.

Organic matter is bound so tightly that it is more resistant to microbial decomposition. Work is now under way to determine the degree of resistance. (*L. E. Ensminger.*)

### **Various Factors Affect Alkalinity of Southern Idaho Soils**

Soil reaction is an important factor in southern Idaho fertility. In general the alkalinity of soils increased with additional amounts of lime up to about 3 per cent, changing only slightly above that level.

Factors other than lime which affect the alkalinity of these soils must be considered. Rather small amounts of sodium carbonate increased the alkalinity of high lime soils materially. Additions of organic material, such as chopped alfalfa, lowered the alkalinity of high lime soils. (*L. E. Ensminger.*)

### Rancidity in Cheddar Cheese

Homogenization of milk for cheddar cheese manufacture has been shown to develop rancid flavors in the cheese. The degree of rancid flavor developed varied according to the treatment the milk had received previous to homogenization. Cheese made from raw homogenized milk had a pronounced rancid odor and flavor from the time of cutting the curd throughout the entire period of ripening. Cheese made from pasteurized homogenized milk occasionally developed a slight rancid flavor late in the ripening period.

Further work has been done to determine if washing the curd with warm water after milling would in any way influence the ripening of cheddar cheese as determined organoleptically and chemically. Washing the curd from raw and pasteurized milk improved the flavor score. Washing did not improve the flavor of cheese made from raw homogenized or pasteurized homogenized milk. Washing the curd with warm water did not cause material changes in the chemical analyses of cheese except in the reduction of the titratable acidity and an increase in the pH value. (*H. C. Hansen and R. S. Snyder.*)

### Ground Raw Soybean Added to Dehydrated Alfalfa Meal Retards the Destruction of Carotene

Several methods for treating dehydrated alfalfa have been tried in an attempt to prevent or retard the loss of carotene which ordinarily occurs during storage. The most promising method of treatment in these preliminary trials has been the addition of ground raw soybeans to the dehydrated alfalfa.

Several samples of alfalfa with an initial carotene concentration of 24 milligrams per 100 grams were mixed with equal parts of ground raw soybean, and stored at room temperature. After 4 months storage the samples of alfalfa to which the ground soybean had been added contained 17-19 milligrams of carotene per 100 grams. Alfalfa samples stored under the same conditions without the added ground soybean contained 7-8 milligrams of carotene per 100 grams.

These preliminary results indicate that the added soybean helps to stabilize the carotene in dehydrated alfalfa. This work is still in the experimental stage and it is too early to make any definite recommendations.

In view of the effort being put forth by the government in the matter of preservation of feed for national defense, these results may be of interest. (*D. W. Bolin, C. E. Lampman, and L. R. Berg.*)

## Insects

### Dusts Continue to Be Effective for Legume Bug Control

THE problem of legume bug control continues to be of major importance in the alfalfa seed growing sections of the state. Laboratory and field studies have contributed further knowledge concerning the control of these insects. Laboratory work this year showed that legume bug nymphs collected in the field were more resistant to insecticides during July than earlier or later in the season. Climatic factors may have had some influence on this change since July was the only month not having considerable rainfall. Tests with a number of mixtures of *Dry Pyroicide* and rotenone-bearing roots indicate that the lowest effective concentrations of pyrethrins and rotenone in such a dust for legume bug control are 0.125 per cent and 0.50 per cent, respectively. Rotenone-bearing dusts to which pyrethrum flowers were added were not as toxic as similar dusts containing equal amounts of pyrethrins from *Dry Pyroicide*.

Growers have reported increased seed yields from alfalfa dusted with sodium arsenite for mormon cricket control. A 20 per cent sodium arsenite dust tested in the laboratory was found to be as toxic to legume bug adults and nymphs as the *Dry Pyroicide*-rotenone-bearing dust. A 10 per cent sodium arsenite dust was much less effective. Sodium arsenite may therefore possibly be of value in the control of these insects.

Field control of legume bugs on alfalfa by dusting with *Dry Pyroicide*-rotenone-bearing dust was not successful. Nine fields, 3 to 5 acres in size, in the Aberdeen-Grandview district of Bingham County were treated with a dust containing 1 per cent rotenone and 0.25 per cent pyrethrins in an attempt to keep legume bug populations low at the time the alfalfa was beginning to blossom. This work was done in cooperation with alfalfa seed growers of the district. Four fields were dusted once and five were dusted twice. The first application of dust was made 10 days prior to blossoming and the second at the beginning of the blossoming period in those fields treated twice. Those treated once were dusted when the fields were beginning to bloom. Control was not effective when 25 pounds of dust per acre was applied. Applications of 35 to 40 pounds per acre reduced the populations of bugs 80 to 90 per cent, as indicated by bug samples taken 2 to 3 days after dusting. Bug populations rose rapidly on the dusted, as well as undusted fields so that there was no apparent permanent benefit from the dust. No fields produced sufficient seed to warrant yield comparisons.

The dust mixture used in the fields this year is very effective when used against both nymphs and adults in the laboratory; it is less effective when used in the field, even at larger per acre dosages. Available dusting equipment will not distribute the dust to all

parts of the plants at blossom time. There is a need, therefore, for better dusting equipment.

An attempt was made again this year to conduct a cooperative cultural control program in which each grower agreed to start his seed crop at approximately the same time as his neighbor. Frequent heavy rains prevented clipping and working of the fields at the proper time, so that in effect no program was conducted. It was observed that the fields which were heavily pastured by sheep contained practically no nymphs of legume bugs in early June, while fields which were not pastured did contain high populations of nymphs. Feeding on the young plants apparently destroyed the eggs. (*W. E. Shull and R. A. Fisher.*)

### **Commercial Control of the Intermountain Potato Leafhopper Obtained**

Investigations designed to determine whether or not the leafhopper, *Empoasca filamenta* DeLong, was a factor in causing "early maturity" of potatoes, and what methods could be used for control of the insect were conducted in Bonneville County. Three applications of seven different insecticide materials were made on experimental plots at 2-week intervals during the growing season. A fourth application was made on one series of plots. There were 4 different dusts and 3 different sprays used. A dust composed of rotenone, *Dry Pyrocide* and talc, and a spray of lime-sulphur and *Pyrocide 20* proved to be very satisfactory in controlling the leafhoppers. Low populations were maintained throughout the season on the treated plots. There was no difference in vine growth, amount of breakdown, or yields, between the plants in the field having low leafhopper populations and those having high populations. Potatoes grown under cages, some infested with leafhoppers and some leafhopper free, were identical in vine growth and yield. Therefore, no advantage was obtained by treating potatoes for control of the intermountain potato leafhopper. Host plant studies revealed a large number of native wild plants upon which the leafhopper feed and reproduce in the spring. (*W. E. Shull, H. C. Manis, and E. L. Turner.*)

### **Alfalfa in Rotations Reduces Wireworm Population**

Wireworm investigations in cooperation with the Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture, were continued again this season at Parma. Studies on the effect and abundance of wireworms in relation to certain crop rotations have been conducted on a farm near Parma for the last 4 years. Reduction in wireworm numbers on the continuous alfalfa plots has been noticeable again this season. From an average of 6 to 10 wireworms per square foot in 1937, these plots have now an average of less than 3 wireworms. In other plots where alfalfa was followed by potatoes, corn, wheat and sugar beets, an initial low population of wireworms (less than 2 per square foot) has shown no tendency to increase after 2 or 3 seasons. These results are probably only typical of this particular farm and soil condition.



In a survey of wireworm population following several years of alfalfa in Canyon County, alfalfa fields showed an average of 1.6 wireworms per square foot, ranging from 0.02 to 5.8. Fifteen of these fields planted to corn following the alfalfa more than doubled their wireworm population on the average the first season. Fifteen fields planted to sugar beets showed no increase in wireworm population. Twelve fields with the heaviest populations were planted to small grains and showed a slight decrease in wireworm numbers at the end of the first season. Seven fields planted to potatoes increased their wireworm numbers by nearly 50 per cent on the average.

Information on wireworms and their control on irrigated land is now available in Farmer's Bulletin 1866, U. S. Department of Agriculture. This bulletin gives a resume of the life history of several wireworms with pictures of their stages, as well as recommendations for their control under most of the soil conditions found on the irrigated lands of the Pacific Northwest. (*M. C. Lane, F. H. Shirck and W. E. Shull.*)

#### **Reduced Per Acre Pounding of Rotenone Dust Shows Possibility in Pea Weevil Control**

Experiments on the control of the pea weevil, in cooperation with the Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture, were continued again this season at Moscow. Satisfactory control of the pea weevil was again accomplished through the use of dust mixtures containing rotenone. Practically all farmers in the state producing dry peas in areas known to be badly infested with the pest, carried on some dusting work, although dusting operations were hindered by unfavorable weather. The degree of pea weevil control obtained in 1941 was not as satisfactory as in 1940 when, on an average, only 3.75 per cent of the graded peas in Idaho was infested by the pea weevil. In northern Idaho, 4.96 per cent of the peas, on the average, was infested by the pea weevil during 1941. Results of field and laboratory experiments indicated that dust mixtures containing rotenone were the most satisfactory of any of the materials tested for pea weevil control. Considerable data were gathered to show that dust mixtures containing 2 per cent of rotenone applied at the rate of 10 pounds per acre were superior to dust mixtures containing 1 per cent of rotenone applied at the rate of 20 pounds per acre. The results of this work also indicated that it might be possible to reduce the quantity applied per acre of dust mixture containing 1 per cent of rotenone from the recommended rate of 20 pounds to a lower quantity without materially reducing the degree of control achieved.

Studies were made to determine the intensity of infestation that could be expected from a given pea weevil population sample collected with a net with an opening 15 inches in diameter. An average of one pea weevil in 25 sweeps collected at a given locality throughout the season resulted in an infestation in the dry peas of about 2.7 per cent. An average of one pea weevil in 25 sweeps taken before



Pods formed resulted in an infestation in the seed of about 2.5 per cent. (*T. A. Brindley, F. G. Hinman, and W. E. Shull.*)

## Plant Diseases

### Spread of Bacterial Ring Rot on Cutting Knife Prevented

It has been shown previously that in the cutting of seed potatoes, the bacterial ring rot organism can be spread by the knife to as many as 20 consecutive seed pieces, after cutting one diseased piece. Disinfecting the cutting knife appears to be a promising method to limit and possibly control this spread. Of the disinfecting agents tested for this purpose, a 5 per cent solution of lysol at 95° F. proved to be the most effective in preventing the spread of the organism. B. K. (commercial product) solution of 8,000 parts per million and acid mercury solution, at the strength recommended for potato seed treatment, ranked next in that order in preventing spread, whereas 5 per cent lysol at about 50° F., 10 per cent formalin at this same temperature and at 100° F. failed to prevent the spread of the organism satisfactorily. Table 6 shows the results obtained in attempting to control the spread of the bacteria by treating the cutting knife with the above named agents.

**Table 6.—Effectiveness of B. K., Acid Mercury, Lysol, and Formalin in preventing the spread of *Phytophthora septiconica* by the cutting knife.**

Agent	Hills tested	Hills infected	Per cent infection	Average per cent infection
B. K.	95	4	4.2	
8,000 ppm.....	102	5	4.9	4.56
Acid Mercury .....	101	6	5.9	
	94	7	7.4	6.66
5% lysol	88	4	4.5	
95° F. ....	93	0	0.0	2.21
5% lysol	89	13	14.6	
*About 50° F. ....	95	10	10.5	12.5
10% Formalin	81	29	35.8	
*About 50° F. ....	91	9	11.1	22.09
10% Formalin	91	26	28.5	25.79
100° F. ....	99	23	23.2	

\* Treating was accomplished in a potato cellar, the temperature of which was approximately 50° F.

Further field tests with the ring rot organism indicate the possibility of spread from diseased to adjacent healthy hills.

There is a need for further development in the ultraviolet light

method of determining tuber infection since dependence upon the light alone did not completely eliminate all infected tubers. (*J. M. Raeder and H. C. Kirkpatrick.*)

### Tests of Potato Seedlings for Resistance to Viruses Continued

A total of 583 seedlings of various origin were grown and their reaction to various viruses observed. Four hundred and fifty of the seedlings were retained for further propagation and study. Fourteen of these seedlings have been grown for 7 years and 18 have been grown for 6 years, all having been free of virus symptoms during that time. (*J. M. Raeder.*)

### Resistant Selections of Beans Excel

The Great Northern bean U. I. 15 developed from a cross between Great Northern U. I. 1 and Common Red Mexican and released to growers in 1940, performed well in the 1941 trial plots. U. I. 15 is resistant to curly top and common mosaic, whereas U. I. 123, the Great Northern selection that comprises most of white bean acreage, is resistant only to common mosaic. In Table 7 the yields are given for U. I. 15 and U. I. 123 for five different localities. At Buhl and Gooding U. I. 15 considerably outyielded U. I. 123. The curly top disease was severe at both these places and killed many of the U. I. 123 plants, but did not affect the curly top resistant U. I. 15. Therefore, in those areas where the curly top disease does considerable damage, U. I. 15 should be grown instead of U. I. 123.

Development of resistant varieties of garden beans and other field beans is progressing as rapidly as possible. A large amount of hybrid material was subjected to the curly top disease at Buhl the past season. Only those lots or individual plants showing definite resistance were saved for further increase. Certain selections of pinto beans from a cross between Pinto and Red Mexican U. I. 34 have been obtained that are resistant to curly top and mosaic. These appear to be very promising. This project has been continued in cooperation with the State Leaf-hopper Administration and the Bureaus of Plant Industry and Entomology and Plant Quarantine of the U. S. Department of Agriculture. (*W. J. Virgin and Donald Murphy.*)

Table 7.—Comparative yield in bushels per acre of U. I. 15 and U. I. 123 at five different localities.

Selection	Twin Falls	Buhl	Hazelton	Jerome	Gooding
G. N. U. I. 15.....	45.8	57.5	48.6	53.5	54
G. N. U. I. 123.....	47.2	9.2	45.4	45.4	36.3

### Poor Germination of Pea Seed Explained

One of the answers to the question as to why certain lots of normal appearing pea seed fail to germinate has been found.

Bacteria have been isolated from within the seed which may prevent the seed from germinating. These bacteria are present in many lots of seed from various parts of the country. There appear to be different strains of bacteria involved, some seriously affecting germination and others not at all. Some varieties of peas, particularly the large, wrinkled ones, are very susceptible whereas the variety Alaska is usually unaffected by the bacteria. Some of these strains of bacteria are spore formers which make it difficult to devise a treatment that will destroy them and not kill the seed. (W. J. Virgin.)

#### Promising Tomato Hybrid Tested

It eventually may be possible to control the curly top disease of tomato by the use of resistant varieties. Certain progenies from the cross Bison x (Marglobe x *Lycopersicon chilense*) did not become diseased when subjected to a very severe attack of curly top during the season of 1941. All the common varieties included in the test were killed early in the season. Considerable more work will be necessary with these resistant progenies in order to obtain one with desirable tomato characters. (W. J. Virgin.)

#### Low Storage Temperatures Prevent Carrot Rots

Black rot and *Botrytis* rot destroy many tons of carrot roots which are held in storage through the winter months for seed production the following season. Treating the roots with different fungicides prior to storage failed to prevent the rots from developing. Since low temperatures will hold these rots in check to a certain extent, present evidence indicates that storing the roots in pits is superior to storing them in cellars since a more constant low temperature can be maintained in the pits. (W. J. Virgin.)

#### Obscure Fruit Diseases Studied

The most serious disease of peach in Idaho under observation for 6 years has been shown by repeated budding tests to be caused by a virus. The characteristic symptoms appear as discolored, dead areas in the leaves, early defoliation and small, shriveled, bitter tasting fruits. Only parts of a tree are affected at a time but eventually the whole tree dies. The trouble is known as the Western X disease. Surveys indicate that the disease spreads fairly fast and all infected trees should be removed promptly.

Results of transmission studies during 1940-41 by budding and inarching diseased peach scions on healthy trees in the field and in the greenhouse substantiate an earlier conclusion that peach wart, a spectacular disease of the fruit, is caused by a virus. Although natural spread apparently is not rapid, infected trees should be destroyed.

Young peach trees grown in pots to which varying amounts of arsenate of lead were added to the soil, developed symptoms similar if not identical to those of many young peach trees in southern Idaho growing on old apple land. The disease, appearing as a leaf spotting, shot holing and defoliation, is often confused with the

Western X disease, Coryneum blight and certain other troubles. The peach disease caused by arsenical residues in the soil is named systemic arsenic toxicity.

In order to test their comparative resistance to fire blight, the major pear disease in Idaho, 1 tree each of 55 varieties of pears in the plots at Moscow was inoculated with a suspension of fire blight bacteria on May 3, 1941. Some trees were killed outright during the season, others were severely damaged while some Old Home, Suddeth, Tait No. 2, Richard Peters, and Stark Tyson were not affected.

Extensive damage to young sweet cherry and apricot orchards in scattered locations is regarded due to bacterial gummosis. This disease undoubtedly has been present previously but weather conditions this year have been especially good for development of the disease. Tests on control measures involving the use of surgery and wound disinfectants have shown promising preliminary results. (*Earle C. Blodgett.*)

## Nutrition

### Value of Protein of Field Peas Determined

**R**AW Alaska field peas fed as the sole source of protein in certain well supplemented rations does not permit as good growth as casein fed at the same protein levels. The rats fed on the raw field peas at a 10 per cent protein level gained less than half as rapidly as rats on a similar diet in which casein furnished the same percentage of protein. The food intake of the animals on the raw peas was much less than the rats on the casein diet and the gain per gram of pea protein was only about one-half the gain made per gram of protein from casein.

When peas which had been autoclaved at 17 pounds pressure for  $1\frac{1}{2}$  hours were fed at the same protein level as raw peas, the rate of growth was reduced about 40 per cent below the gain on raw peas. If peas were subjected to dry heat in an oven for  $1\frac{1}{2}$  hours at  $140^{\circ}\text{C}$ , the growth was more rapid than for rats on the autoclaved peas but slightly less than with raw peas. Heat treatment, either moist or dry, apparently decreases the nutritive value of the protein of field peas.

The difference in biological value between raw peas and casein was not nearly as great as the differences in protein value as indicated by the growth experiments. Since the biological values were determined with nitrogen balance experiments on adult rats, this variation may be attributed to the difference in the amino acids required for maintenance and for growth. It is highly probable that the protein of peas is more adequate in amino acids required for maintenance than for growth. The raw pea diet was well digested by the adult rats, but never quite so completely as the casein diet. No balance studies have been conducted with baked or autoclaved peas.

The vitamin B complex was supplied apart from the diet by a mixture of synthetic products, some of which were kindly furnished by Merck and Company, Inc., Rahway, N.J. These experiments were conducted in the Home Economics Laboratory in cooperation with the departments of Animal Husbandry and Agricultural Chemistry. (*Ella Woods, W. M. Beeson, J. W. Pence, and D. W. Bolin.*)

### Ascorbic Acid Metabolism Studies Continued

Ascorbic acid, the chemical substance which has been known as vitamin C, is water soluble and therefore cannot be stored to any great extent in the body. It is needed constantly, however, for maintenance of the normal structure of the blood vessel walls, of the bones and of the teeth as well as to help combat the effect of toxins due to infections. It is important then that an adequate supply be provided by the daily diet and a good indicator of the supply is the ascorbic acid found in the blood plasma.

If the supply has been such that the tissues are saturated, the blood plasma value will be 1 milligram, or perhaps more per 100 milliliters of plasma. It is believed, however, that 0.8 milligram or more per 100 milliliters indicates that the daily intake is sufficient to maintain good nutrition so far as this particular factor is concerned. When the value is below 0.4 milligram it is believed that the daily intake is too low.

In studies on men students from eight different boarding places none were found who had blood plasma values of 1 milligram per 100 milliliters and only 18 per cent of them had values above 0.8 milligram while 73 per cent had values below 0.4 milligram.

This study is a part of the Northwest Cooperative Project and will be continued until at least 5 per cent of the men students have been tested. (*Ella Woods.*)

### Potato Studies

The investigation of the factors of the vitamin B-complex has been completed and the only work done this year were two animal feeding tests using pure riboflavin and pyridoxine respectively as standards of comparison for confirmation of previous work. These studies show that the Idaho Russet Burbank potato boiled as for the table contains 62.5 micrograms of riboflavin and 125 micrograms of pyridoxine per 100 grams of potato. (*Ella Woods.*)

## Aberdeen Branch Station

JOHN L. TOEVS, *in charge*

### Certified Potato Seed Stocks Again Tested

**A**LL certified potato seed stocks were again tested in 1941. The test included 161 Netted Gems, 35 Bliss Triumphs, 12 Rurals, 9 Katahdins, 4 Ohios, 2 Chippewas, and 1 Cobbler. All lots were collected in the fall of 1940 and stored in the potato cellar on the Aberdeen Branch Station. The condition of the seed stock after



the storage season and before planting was inferior as compared to the stock the year previous. Considerable rot was present in a large number of the lots and apparently this was not due to storage conditions. A few of the lots from northern Idaho had received some frost damage in transportation.

With the exception of two lots of Netted Gems and one lot of Katahdins, the stands were very good ranging from 93 to 100 per cent. The two low stands of Netted Gems were 87 per cent and the low Katahdin was 83 per cent. Stands from commercial plantings from some of the certified lots over the State were considerably lower than the stands obtained here at the Station. Some commercial plantings also showed more blackleg and weak plants than was evident in the test plots. This brings up the question of effect of storage on condition of potatoes in relation to stand, vigor of plants and presence of disease.

In general the performance of the certified stocks was very satisfactory for the Netted Gems, Rurals, and Bliss Triumphs. Ring rot was found in only two lots, one Bliss and one Ohio. More blackleg and rugose mosaic were noted in 1941 than in 1940. With the exception of approximately 14 lots, all stocks produced a satisfactory yield from the standpoint of the commercial grower.

In 1940 every fourth row and in 1941 every eighth row was planted to seed 1 year from certification, produced on the station. Both years the average of all certified Russet plots outyielded the average of the checks, 7 sacks per acre in 1940 and 12 sacks per acre in 1941.

#### **Potato Fertilizer Experiment Continued**

Since soil fertility plays an important part in the profitable production of potatoes some efforts are being directed towards determining the value of commercial fertilizers. Results so far have indicated 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 fundamental and under ordinary conditions sufficient for the production of a satisfactory potato crop. During the years 1938 to 1940, inclusive, additional nitrogen applications, in the form of sulphate of ammonia or in combination with phosphate gave profitable increases. This was not true in 1941. Nitrogen applications both light and heavy and in combination with phosphate were not profitable, in fact in most cases had a depressing effect on yield of No. 1 potatoes per acre. Potatoes generally made a heavy vine growth in 1941. Plantings were delayed about a week and the first killing frost was a week earlier in the fall. This combination in all probability was responsible to some extent at least, for the inconsistency of the fertilizer treatments in that the heavier vine growth associated with higher nitrogen levels did not give sufficient time to utilize the added fertility.

#### **New Alfalfa Selections Tested Cooperatively**

Bacterial wilt in alfalfa continues to be a problem with present



varieties. Considerable progress has been made in the breeding program by the Office of Forage Crops and Diseases in cooperation with a number of State Experiment stations. The most outstanding selections resulting from this work now are being tested in so-called uniform alfalfa nurseries. One of these nurseries consisting of 20 new selections and 10 varieties was planted at this Station.

In order to speed up this program of testing and comparing some of these new selections, a plan was agreed upon between Utah and Idaho to make three plantings in each State of 20 varieties and selections in duplicate 1/25 acre plots. The Idaho plantings were made at the branch stations at Caldwell, Teton, and Aberdeen.

### **Disease Resistance in Cereals Developed**

The damage of rust on spring wheat in 1941 gives added significance to the work already under way by the Office of Cereal Crops and Diseases. Selections of Lemhi crossed with Hope (which is rust and loose smut resistant) then backcrossed four times on Lemhi showed considerable resistance to rust in the cereal nursery; whereas, Lemhi, Dicklow, Federation, and Idaed (the most common soft white wheats grown under irrigation) had very heavy rust infections. While rust damage does not occur at regular intervals in Idaho, the damage this year was so severe on late plantings that considerable saving could be affected by developing wheats having rust resistance.

The oat improvement program is similar to wheat, namely incorporating stem rust resistance into the better varieties. Some Bannock crosses with Victoria Richland give promise of carrying both stem rust and smut resistance.

The phase of the barley improvement program of particular interest to this state consists in developing a barley that has more stiffness of straw, resistance to loose and covered smuts, and still maintains a yield comparable to that of Trebi. Several selections are now under observation that give promise in this direction.

### **Importance of Sorghums and Corn Increases**

Feed crops are becoming of more importance, particularly in the irrigated sections of Idaho, for two reasons: increase in livestock and decrease in production of alfalfa hay. In many sections bacterial wilt in alfalfa stands has become so severe that the 3-year-old stands become very unproductive necessitating shortening alfalfa rotations. Anticipating demand for information concerning grain and forage sorghums, tests have been conducted in 1940 and 1941 with some of the earlier maturing varieties from states leading in sorghum development.

In 1940, four varieties gave very satisfactory grain yields, but since the season was above average in temperature and length of the growing season, results were not reliable, particularly for the Upper Snake. The number of varieties tested in 1941 were increased. Even though the length of growing season was average, none of the sorghums matured to produce satisfactory grain yields. A few of the forage sorghums on the other hand produced consid-

erable fodder that proved quite palatable. It is entirely possible that some of the grain or forage sorghums may have a place in some of the warmer areas or in sections of limited irrigation water. Of the dual type sorghums (grown for both grain and forage), the following varieties have possibilities from the standpoint of maturity: Early Kalo, Sooner Milo, A. C. Selection I, and Coes. Of the forage types: Extra Early Pink, Dakota Amber, and Fremont showed promise, yet in 1941 none of the above named sorghums reached full maturity.

Similar tests are being conducted with field corn. Hybrid corns are being tested in comparison to standard varieties. Idahybrid No. 330 is the only hybrid that compares favorably for maturity with Minnesota No. 13. These 2 varieties matured satisfactorily in 1940, but not so in 1941.

### Cooperative Work with Grasses Emphasized

The experimental work with grasses, in cooperation with the Nursery Division of the Soil Conservation Service, continued under five main objectives:

1. Cultural practices in relation to securing a good stand.
2. Testing for varietal adaptability under dryland conditions.
3. Testing varieties for seed production under irrigated conditions.
4. Fertilization in relation to seed production under irrigation.
5. Testing a number of grasses alone and in combination with Ladino clover for pasture purposes.

The reseeding of much of the abandoned wheat land and range land presents quite a problem. Much seed and energy have been lost in attempting to establish stands by drilling or broadcasting seed on land infested with cheatgrass and other weeds without any seed bed preparation. In summarizing 2 years' results, indications are that:

1. Summerfallow gives better results than field cultivating previous to seeding and that seeding directly into cheat infested land is a waste of time and money.
2. Good stands were obtained with the shoe press drill and the deep furrow press drill. The desirable features of these two drills seem to be controlling the depth and compressing the soil. The other types of drills used in this test are the deep furrow, single disc and the double disc drills.
3. The outstanding grasses seem to be native bunchgrass (*Agropyron spicatum*) and Crested wheat (*Agropyron cristatum*). Alternate row seedings with Michels' grass looks promising from the standpoint of weed control.

The fertilizer tests consisted of testing different rates of nitrogen (Sulphate of ammonia) application alone and in combination with phosphate and potash. All applications were made to 1-year-old row and solid seedings. From the standpoint of yield, no significant differences were obtained. Differences were apparent in the solid seedings, but stands were too uneven for reliable data. All

row seedings produced excellent yields and from all appearances commercial fertilization of grasses seeded in rows on land of average or above average fertility is not profitable for the first seed crop following the year of seeding.

## Aberdeen Branch Station Potato Research

J. E. KRAUS, *in charge*

### Large Seed Piece and Close Planting Produce Best Yields

**P**RELIMINARY results of 1941 field experiments on spacing of potato plants 8, 12, 16, 20, and 24 inches in the row indicate that the yield of U. S. No. 1 potatoes was highest with the 8-inch spacing and the yields decreased as the distance between plants was increased. The 8-inch spacing also resulted in the production of the highest percentage of U. S. No. 1 tubers, and the lowest percentage of knobby tubers. The same results were obtained with and without application of 225 pounds of ammonium sulphate per acre. However, regardless of spacing, unfertilized plots produced the highest total yield and the highest yield of U. S. No. 1 tubers.

Sixteen combinations involving size of seed piece in relation to size of tuber from which the seed piece was cut were used in the 1941 field experiment. One-, 2-, 3-, 4-, 5-, and 6-ounce seed pieces were used and these were cut from tubers varying from 1 to 16 ounces. In general the larger the seed piece the larger the number of stems produced per plant, the larger the number of tubers produced, and the greater the yield of U. S. No. 1 tubers. There was but little difference in the average size of U. S. No. 1 tubers produced in any of the combinations. One important result was the indication of a fairly high negative correlation between the number of stems per plant and the number and weight of rough or knobby tubers produced. In other words, the greater the number of stems per plant within certain limits, the higher the percentage of U. S. No. 1 tubers produced. (*J. E. Kraus.*)

### Cut Seed Exposed to Hot Dry Conditions Decays Quickly

In response to growers' requests for information on the control of seed piece decay shortly after planting, preliminary greenhouse experiments were started to determine the factors concerned. These experiments show very definitely that exposure of cut potato seed pieces to high air temperatures and low relative humidity for periods of 3 hours or more results in practically 100 per cent decay within 1 week following planting. This was true even when the sets were planted in soil considered to have the optimum moisture content for germination. Similar results were obtained when the sets were planted in soil of low moisture content. On the other hand, if potatoes were cut and stored in the storage cellar at temperatures below 60° F. and where the relative humidity was comparatively

high, practically no seed piece decay was observed, even if the storage period of such sets was as long as 48 hours. Another experiment to determine if there is any relationship between the size of set and the rate of decay indicated that under the conditions of high temperature and low relative humidity mentioned before, large sets decayed as rapidly as small ones and that the decay occurred before there was much evidence of germination.

Field experiments designed to determine the effect of methods of seed handling upon stand and yield of potatoes confirm the results of the greenhouse experiments on seed piece decay. Cut seed pieces stored in a warm room for 10 days and then planted gave poor stands and lower yields. Such conditions would be similar to those reported in the greenhouse studies and resulted in seed piece decay. When potatoes were cut and the seed pieces stored in a shed for a period of 10 days previous to planting, the amount of seed piece decay resulting was dependent upon the temperature, and probably the humidity of the storage room. Very little difference in decay or stand was observed when planting was done on May 9, but when planted on May 19 and June 1, stands were reduced as much as 25 to 30 per cent in those treatments in which the seed pieces were exposed to ordinary outside air temperatures and humidities. This indicates that the prevailing temperature and humidity at the time of cutting the tubers may largely determine the incidence of decay after planting. (*J. E. Kraus and J. L. Toevs.*)

#### **Early Plant Symptoms of Bacterial Ring Rot Described**

The plant symptoms of potatoes infected with bacterial ring rot have been well described in several publications. However, these descriptions have applied in most cases to the late season symptoms on plants infected with the disease during the current season. Symptoms of plants grown from seed which was infected with the disease during the year previous to planting have not been well described. Plants of Idaho Rural potatoes which showed decided fluorescence by the ultraviolet light were planted in the ring rot plots on May 25 at the Aberdeen Branch Station. Many of the seed pieces decayed before germination and only a partial stand was secured. Plants which appeared showed symptoms of the disease at all stages of growth. Many of the plants were very dwarf and not over 6 inches in height on August 1. The upper leaves of such plants were small, pointed, light yellowish-green, crinkled and appeared somewhat like plants infected with rugose mosaic. The plants in general had a rosette appearance. After 3 to 4 weeks, the lower leaves began to curl upwards along the midrib and to die from the margins inward. Eventually these leaves fell off. About this time one or two stems, or the entire plant, may wilt and die. A few plants attain normal size but showed typical wilting of some stems in August. It is believed the early season symptoms of such ring rot infected plants should be more generally known by growers and experiment station workers in order that it can be identified, especially in fields planted with single drop seeds. (*J. E. Kraus, J. M. Raeder, and Hugh C. Kirkpatrick.*)

### Occurrence of Fusarium Wilt Extensive

Surveys were made in the potato sections of southern Idaho in 1941 to determine the extent and severity of fusarium wilt. It has been rather conclusively shown by the Department of Entomology that the so-called "early maturity" of potatoes in many sections is not caused by damage inflicted by the intermountain potato leafhopper as has been indicated by many growers. It has been known for many years that certain types of "early maturity" are caused by infection of the plants by one or more species of fusarium. The survey indicates that cultural conditions, weather conditions and rotation systems play an important part in the occurrence and severity of this disease. Studies are now being conducted in an attempt to determine more definitely the relationship between fusarium wilt and soil moisture, organic matter, and fertilization. (*J. E. Kraus, J. M. Raeder, and J. L. Toevs.*)

### Potato Seed Stock Improvement Continued

Samples of all potato seed lots entered for certification were grown again for the Idaho Potato Seed Growers Association. These were grown in duplicate rows and yields of U. S. No. 1 tubers were secured. Of approximately 166 samples of the Netted Gem variety there were indications that four or five samples had superior yielding ability as compared to a large percentage of the lots. These are being saved for planting in replicated trials in 1942 with the objective of determining whether there are distinct strains of the Netted Gem as far as yield and uniformity are concerned. These along with the selected stocks from other areas will be used as a basis for tuber indexing for seed stock improvement in Idaho. (*J. L. Toevs, J. E. Kraus, and E. W. Whitman.*)

### Methods of Hastening Maturity or Skin Setting on Late Potatoes Tested

Growers of Netted Gem potatoes in southern Idaho sometimes wish to harvest them early before the skin has set on the tubers and before the vines have died. Preliminary work has been conducted by the Department of Horticulture at Parma to determine the feasibility of hastening maturity and reducing feathering of the tubers by killing or injuring the plant foliage. The work was repeated at Aberdeen this year. Green plants that had not been frosted were treated as follows: rolled with a corrugated roller and also with a roller attached to the potato digger; sprayed with ammonium sulphate; sprayed with Sinox; and by cutting the roots under the plants and tubers with an old potato digger from which the chains had been removed. The potatoes were harvested 1 and 2 weeks after treatment. Tubers harvested from plants 1 week after treatment with Sinox spray showed much less feathering than those from check plots. Similar results were obtained by cutting the root systems under the plants, but this method was not as satisfactory as the spray. The other treatments used had very little effect on skinning of the tubers. None of the treatments affected yield to any appreciable extent. (*J. E. Kraus, J. L. Toevs, and Geo. Rothwell.*)



### Lack of Moisture May Cause Jelly-end Rot

In an attempt to obtain preliminary evidence concerning the effect of moisture supply on the occurrence of jelly-end rot, irrigation on several rows of potatoes was withheld after August 18. Comparable rows adjacent to these were irrigated approximately once every 7 days until they were harvested the first week in October. The center row of each irrigation treatment was harvested to determine the yields and percentage of jelly-end rot in the total U. S. No. 1 and No. 2 grades. Of 458 pounds of these two grades produced in the row which was not irrigated, 10 per cent showed distinct jelly-end rot, whereas of 483 pounds produced in the row which was irrigated normally, only 3 per cent showed jelly-end rot. (*J. E. Kraus and J. M. Raeder.*)

### Causes for Cull Grades of Commercial Potatoes Varied

Preliminary investigations were started to determine the predominant causes of cull potatoes when sorted commercially. The objective was to obtain information as to how the grade of marketable potatoes can be improved. Twenty-one collections of single sacks of culls from different lots of potatoes were taken at the time of sorting at three separate warehouses. Samples were taken as the potatoes came from the field and were being graded for commercial shipment. They were collected each day and were again graded and classified according to whether they were considered culls due to size, greening, digger cuts, bruised, rough, diseased, or because they were of another variety than that being graded. Nine-hundred and four pounds of Netted Gems, 588 pounds of Rurals, and 444 pounds of Bliss Triumphs were graded.

The results of this study indicate that varieties differ considerably in respect to cull classification. For example, the highest percentage of the culls of the Netted Gem was due to tubers that were rough or too small; and only a very small percentage was due to digger cuts, bruising, or disease. Approximately 21 per cent of the culls of Bliss Triumph were because of digger cuts, and 17.6 per cent of them were bruised or cracked. The most important factor in the culls of the Idaho Rural was greening, amounting to 31.1 per cent. This preliminary work indicates that much can be done to lower the production of culls by more careful harvesting and by better cultural methods. (*J. E. Kraus and J. L. Toevs.*)

### High Temperatures Not Favorable for Potato Storage

A preliminary study of potato storage at different temperatures in controlled refrigeration rooms shows some very important and interesting implications. Approximately 100 sacks of ungraded potatoes were put into each of three storage rooms without sorting immediately after digging. They were put into the rooms about October 15. The temperatures maintained were 32-34° F., 42° and 52° F., and the respective relative humidities were approximately 90, 95, and 100 per cent. On December 16 the potatoes in all rooms were graded, all culls being removed and weights obtained of storage rots. Those stored at the two lower temperatures kept



exceptionally well, there being only 14 pounds of decayed tubers in the 32-34° room and 22 pounds in the 42° room. However, there were 220 pounds of very rotten tubers in the 52° room and after grading, all tubers in this room were wet and covered with decayed particles. These results may help explain those obtained by some growers in this area who had a comparatively large grade out of their potatoes from cellars after 2 or 3 months storage in 1941. (*J. E. Kraus and J. L. Toevs.*)

## Caldwell Branch Station

R. F. JOHNSON, *in charge*

### Sugar Beet By-Products Profitable for Livestock Feeding

**I**N the old as well as the new sugar beet growing areas, the beet grower and the livestock feeder have access to many by-products of the sugar beet industry for livestock feeding. The by-products are beet tops, molasses, wet beet pulp, and dried molasses beet pulp. The first of these is already on the farm but the others must be transported back to the farm from the sugar refinery and the cost of transportation is an important factor which may easily influence the economy of their use. In spite of the unusual availability and palatability of these by-product feeds, the feeder frequently ponders over such questions as:

- (1) What is their value in relation to the feeds that he may already have on hand?
- (2) Have these feeds any limitations, and
- (3) To what extent should the feeds be used in his particular feeding program?

For the purpose of answering some phases of these questions, 56 yearling feeder steers, 36 feeder steer calves and 500 feeder lambs were fed rations composed of home-grown feeds and some of the sugar beet by-products in variable amounts.

### Methods of Handling Beet Tops Studied

There are different methods of handling beet tops. They may be pastured in the field as they are left after removal from the beets or pastured from small piles containing from 80 to 100 pounds of tops. The piled beet tops may be hauled from the field as needed during the winter or placed in ricks convenient to the feed lot. If the tops are hauled from the field during or immediately after the beet harvest, they may be ensiled in an upright silo, trench silo or stacked above the ground. When the tops are stacked, some feeders make a practice of mixing in straw or other dry material to absorb the surplus juices, although it has been noted that the lambs do not actually relish the straw and consume it only when forced to do so. The tops may be allowed to dry out some in the field before ensiling so as to eliminate the use of straw and to minimize the possible loss of nutrients in the juice run-off from the stack. It has been observed that the beet crowns and

skipped beets were more readily consumed after they have been softened in the ensiling process.

### **Lambs Fatten Economically on Alfalfa Hay and Barley**

Alfalfa hay, either long or chopped, and fed with whole barley has proved a good lamb fattening ration under Idaho conditions. Seventy pound feeder lambs fed 2.08 pounds of chopped hay and 1.06 pounds of barley per day gained 0.33 pound daily. They required 636 pounds of hay and 323 pounds of barley per 100 pounds of gain at a cost of \$6.58 per hundred when chopped alfalfa was \$8.00 per ton and whole barley was \$1.25 per hundredweight.

### **Beet Tops Satisfactory for Lamb Feeding**

Previous studies have given negative results when corn silage and beet top silage were fed as a supplement to alfalfa and barley. The negative results may be attributed to the fact that the lambs were pastured for 6 weeks on third crop alfalfa and grain stubble prior to dry lot feeding and consequently did not respond to a succulent feed in the ration.

Lambs receiving 0.83 pound of beet tops daily in addition to barley and alfalfa hay made as rapid gains as lambs on the standard fattening ration of alfalfa and barley.

As compared with lambs fed alfalfa and barley, those receiving 1.4 pounds of beet top silage in addition to the alfalfa hay and barley gained 5.7 per cent more daily, but the silage did not replace sufficient hay and grain to lower the feed cost but raised it \$0.32 per hundred. On the basis of feed replacement, 1 ton of beet top silage replaced 338 pounds of alfalfa and 88 pounds of barley. At current prices 1 ton of beet top silage was worth \$2.45.

### **Molasses Also Satisfactory for Lamb Feeding**

When 40 per cent of the grain ration was replaced by molasses, the daily gains were increased 2.3 per cent and the cost of 100 pounds gain was decreased \$0.75 per hundred. The molasses fed at the rate of 0.44 pound daily with the alfalfa hay was undoubtedly a factor that induced these lambs to consume an average of 0.15 pound more alfalfa per day. Fed in these proportions, 1 pound of molasses was equal to 1 pound of barley. However, after shipment to market, the molasses-fed lambs, being accustomed to the sweetened forage, did not fill and the shrinkage amounted to 8.37 per cent as compared to 6.26 per cent shrink on the lambs fed alfalfa and barley and had the effect of making the net sale value of the two groups of lambs the same. When the molasses was fed to the lambs on beet pulp, the market shrinkage was 6.57 per cent from the full weight at home. The results and observations would indicate that when molasses is fed with the alfalfa, the practice of gradually eliminating the molasses from the ration about 10 days prior to shipment so that the lambs would be accustomed to eating hay not treated with molasses would be a very profitable procedure.

### **Wet Beet Pulp Excellent for Fattening Lambs**

Wet beet pulp proved to be a very valuable addition to a ration

of chopped alfalfa hay and whole barley. The rate of gain was 16 per cent higher and the feed cost was \$0.48 per hundred cheaper. The lambs consumed 4.1 pounds of wet beet pulp, 1.1 pounds of whole barley, and 1.6 pounds of chopped alfalfa per day. In the daily ration 4.1 pounds of wet pulp replaced 0.6 pound of alfalfa. Of the feed required to produce 100 pounds of gain, 1 ton of wet beet pulp replaced 378 pounds of alfalfa and 65 pounds of barley and gave the wet pulp a value of \$2.32 per ton.

#### **Wet Beet Pulp More Valuable Than Corn Silage or Beet Top Silage for Fattening Calves**

Beet pulp was more valuable than corn silage or beet top silage as a succulent supplement to alfalfa hay and barley when fed to 447-pound weaner calves in a 258-day experiment which concluded with steers at a final weight of 930 pounds. While the amount of succulent feed included in the ration for weaner calves is naturally limited by the capacity of the small animal, the advantage of eliminating digestive disturbances and increasing the efficiency of the other feeds in the ration are sufficient to make the practice of real value. The corn silage, beet top silage and wet beet pulp were fed on the same dry matter basis, which amounted to 6.0 pounds of corn silage, 5.5 pounds of beet top silage, and 15.0 pounds of wet beet pulp daily per steer. In addition, the steers consumed an average of 9.8 pounds of alfalfa hay and 7.9 pounds of ground barley per day. While the average daily gain, the feed cost per 100 pounds of gain, and the finish of the steers fed on a ration supplemented with corn silage or beet top silage were not quite equal to those fed wet beet pulp, the results were satisfactory and the use of these feeds should be encouraged when they are available and relatively low in price. The wet pulp fed steers gained 8 per cent more daily at a feed cost of 100 pounds gain of \$0.52 less and the steers dressed slightly higher than the beet top or corn silage fed calves.

#### **Winter Rations Effect Pasture Gains of Steers**

Three hundred and fifty pound steer calves that were wintered on 12.2 pounds of alfalfa hay and 2.3 pounds of ground barley were 17 pounds heavier at the end of a 103-day period than calves wintered on 14.3 pounds of alfalfa hay. In the 144-day pasture period that followed, the calves were grazed together on bluegrass and mixed grass pastures. The calves wintered on hay gained 10 pounds more than the grain and hay wintered calves but did not fully recover the 17-pound handicap at the beginning of the pasture season. Differences in sleekness of haircoats and general appearance in favor of the grain and hay wintered calves were observed when the calves were turned on to pasture.

#### **Phosphorus Is Limiting Factor in Beet By-Product Rations for Yearling Steers**

Failure of steers to fatten properly on rations made up with beet molasses, wet beet pulp, and alfalfa hay led to a study of the nutritional factors necessary to balance a ration of this type. This

study, along with previous research, has shown that phosphorus and not protein is the limiting factor in beet by-product rations when alfalfa is fed in liberal quantities. This brought up the question as to how much phosphorus a yearling steer needs and how the phosphorus may be supplied. These questions have been answered by the following results:

1. A definite phosphorus deficiency was produced when yearling steers were fed on the following daily rations: (Lots 1, 4, and 5) beet molasses, 4.3 pounds; alfalfa hay, 9.2 to 13.5 pounds; and wet beet pulp, 26 to 33 pounds. Symptoms of phosphorus deficiency in the steers was manifested by low blood phosphorus, slow gains, poor finish, decreased consumption of wet beet pulp, and the eating of boards and dirt. A phosphorus level of 4.5 milligrams per 100 milliliters of blood is considered below normal. A complete summary of the results is presented in Table 8.
2. The addition of 0.05 pound of bonemeal daily to the basal ration was not sufficient to satisfy the phosphorus requirement for yearling steers (lot 2). These steers showed symptoms of phosphorus deficiency, but were not as severely affected as steers in lots 1, 4, and 5. These steers received 1.62 grams of phosphorus per 100 pounds of liveweight, which apparently is inadequate.

Table 8.—Meeting the phosphorus needs of yearling steers.

Lot No.	Daily Ration	Av. daily gain lb.	Feed per 100 lb. gain			Daily phosphorus intake gm.	Phosphorus in- take per 100 lb. liveweight gm.	Blood phosphor- us minimum level mg/100 ml.
			Concentrate lb.	Alfalfa hay lb.	Wet pulp lb.			
1.	Basal ration <sup>1</sup>	1.12	4.3	9.2	29.9	9.10	1.14	3.3
2.	Basal ration + 0.05 lb. bonemeal	1.50	4.3	8.8	57.7	13.33	1.62	4.6
3.	Basal ration + 0.10 lb. bonemeal	2.00	4.3	8.9	61.6	16.90	1.97	5.7
4.	Basal ration + 2.3 lb. more alfalfa	1.04	4.3	11.5	33.3	11.18	1.41	3.1
5.	Basal ration + 4.3 lb. more alfalfa	1.12	4.4	13.5	25.9	12.52	1.55	3.5
6.	Basal ration + barley instead of molasses	1.80	4.3	8.9	54.8	14.77	1.74	4.8

<sup>1</sup> Basal ration consisted of beet molasses, 4.3 lb.; alfalfa hay, 9.0 lb.; and wet beet pulp according to appetite.

3. The feeding of 0.10 pound of bonemeal daily to each steer on a ration of beet molasses, alfalfa hay, and wet beet pulp increased the average daily gain from 1.12 to 2.00 pounds and caused a 34 per cent reduction in the feed required per 100 pounds gain (compare lots 1 and 3). These steers received 1.97 grams of phosphorus per 100 pounds of liveweight. Therefore an intake of approximately 2.0 grams of phosphorus per 100 pounds of liveweight is adequate for yearling steers. A comparison of these data with the phosphorus studies with calves indicates that the phosphorus requirement per unit liveweight is essentially the same for fattening calves and yearlings. The cost of the bonemeal in the above ration amounted to 12 cents per 100 pounds gain or about 35 cents per steer for the fattening period.
4. In lots 4 and 5 increased amounts of alfalfa hay were fed to find out if the phosphorus requirement could be met by feeding larger amounts of hay. Steers in lot 4 receiving 11.5 pounds of alfalfa hay daily developed aphosphorosis which was manifested by slow gains, poor finish, and low blood phosphorus. When steers were fed all the alfalfa hay they would eat (lot 5), the intake of phosphorus from this source was not adequate to meet the requirement for growth and fattening. These data indicate that when beet molasses is fed as the only concentrate feed and wet beet pulp is fed in large quantities, it seems impossible to get the steers to eat enough alfalfa hay to meet the phosphorus requirement. It requires about 2.0 pounds of good quality alfalfa hay per 100 pounds of liveweight to meet the phosphorus needs for fattening steers.
5. A comparison of lots 3 and 6 shows that beet molasses fed at the rate of 4.3 pounds per steer daily was equal to barley as fattening feed, when bonemeal was added to the ration at the rate of 0.10 pound per steer daily. The feeding of larger amounts of beet molasses may cause trouble from scouring and steers going off feed. Four to 5 pounds daily is the maximum amount of beet molasses that can be fed with safety. (*W. M. Beeson, C. W. Hickman, D. W. Bolin, R. F. Johnson, and E. F. Rinehart.*)

#### Little Danger of a Lack of Phosphorus in Lamb Rations

Confirming results announced previously, a 5-year study of the phosphorus requirement of lambs has shown that the only feeding situation in which a phosphorus supplement might be needed in a lamb fattening ration is when lambs are fed solely on beet molasses (without grain) and wet beet pulp with a limited amount of alfalfa hay (about 1.0 to 1.5 pounds per lamb daily).

The study from which these conclusions have been made involved the determining of the quantitative phosphorus requirement for fattening lambs by feeding six different levels of phosphorus. In

order to make up rations that were low in phosphorus, it was necessary to deviate from a *practical fattening ration* by feeding large quantities of dried beet pulp and a limited amount of alfalfa hay. Bloodmeal was used to supply the protein, because it is a protein supplement that does not add an appreciable amount of phosphorus. Different levels of phosphorus were fed by adding bonemeal to the basal ration.

1. The lambs in lots 1 and 2 receiving, respectively, rations containing 0.11 and 0.13 per cent phosphorus showed definite signs of a phosphorus deficiency. The lambs in lot 1 gained only 0.18 pound per day while the lambs receiving ample phosphorus gained about 0.30 pound per day (lots 3 and 4). The lack of sufficient phosphorus in the diet of a lamb is manifested by slow gains, higher feed requirements, poor finish, listless appearance, narrow and leggy conformation, knock-knees, and in eating boards and dirt. The lambs in lots 1 and 2 had a low blood phosphorus level. Five milligrams of phosphorus or above per 100 milliliters of blood plasma is normal for lambs. A complete summary of the results is presented in Table 9.

Table 9.—Phosphorus requirement for fattening lambs.

Lot No.	Ration	Av. daily gain lb.	Feed per 100 lb. gain			Phosphorus in- take per 100 lb. liveweight gm.	Phosphorus in ration per cent	Blood phosphor- us minimum level mg/100 ml.
			Concentrate mixture lb.	Corn silage lb.	Daily phosphorus intake gm.			
1.	Basal mixture <sup>1</sup> + corn silage	0.18	1220	566	1.20	1.49	0.11	2.9
2.	Basal mixture + corn silage + 0.25 per cent bonemeal	0.26	952	389	1.69	1.96	0.13	4.3
3.	Basal mixture + corn silage + 0.35 per cent bonemeal	0.27	894	369	1.89	2.17	0.15	5.2
4.	Basal mixture + corn silage + 0.50 per cent bonemeal	0.31	803	326	2.16	2.41	0.17	5.4
5.	Basal mixture + corn silage + 0.65 per cent bonemeal	0.30	813	338	2.39	2.71	0.19	5.9
6.	Basal mixture + corn silage + 1.00 per cent bonemeal	0.27	895	372	2.93	3.38	0.23	7.3

<sup>1</sup> Basal mixture consisted of beet pulp, dried, 66.5 lb.; alfalfa, chopped, 26.0 lb.; bloodmeal, 7.0 lb.; and salt 0.5 lb.



2. The lambs in lots 4 and 5 receiving, respectively, rations containing 0.17 to 0.19 per cent phosphorus made approximately 42 per cent more gain and required 35 per cent less feed to make a pound of gain.

3. An excess of bonemeal tended to depress the rate of gain (lot 6). This tends to point out that feeding minerals in excess of the amount required exerts a depressing action on the rate and economy of gains.

4. These data indicate that a lamb requires about 2.16 grams of phosphorus per head daily or a daily intake of 2.41 grams per 100 pounds of liveweight.

5. Converting the above results to a practical feed basis, the data show that the phosphorus requirement of lambs may be satisfied by the proper use of farm-grown feeds, such as grain and alfalfa hay. Therefore, the phosphorus needs of lambs may be met by feeding the following amounts of any of the feeds per lamb daily: 2.0 pounds of alfalfa hay, 2.0 pounds of clover hay, 1.0 pound bran, or 0.04 pound of steamed bonemeal.

6. Beet pulp and beet molasses are deficient in phosphorus, but lambs receiving about 2.0 pounds of alfalfa hay or 0.5 pound of grain plus 1.0 pound of alfalfa hay per head daily, as a supplement to pulp and molasses, will receive ample phosphorus.

7. Since the majority of lamb fattening rations in Idaho contain large quantities of good quality alfalfa hay and grain, there is little danger of a lack of phosphorus. Previous studies have shown conclusively that there is no beneficial effect in adding steamed bonemeal to a lamb fattening ration made up principally of barley and alfalfa hay. (*W. M. Beeson, C. W. Hickman, D. W. Bolin, R. F. Johnson, and E. F. Rinehart.*)

### Potato Silage Equal to Corn Silage

When cellar space is not available for storing cull potatoes for livestock feed, the potatoes may be converted into silage. During the "early potato deal," or late summer, a trench silo was dug in the hillside and floored with rough 1" by 12" boards and filled with a quantity of cull potatoes chopped with an ordinary corn ensilage cutter. To the chopped potatoes was added 3 per cent by weight of ground barley to furnish the proper medium for lactic acid fermentation and 3 per cent by weight of chopped alfalfa hay, the purpose of which was to absorb the excess juice from the potatoes. While the hay was added to the potatoes in a proportion which would seem proper to make the product of the same moisture consistency as corn silage, it was a coincidence that the amount of barley and hay added to the potatoes were approximately the same. There was no run-off from the silo and moisture determinations of the silage showed that it contained 40 per cent of dry matter, approximately 10 per cent more than corn silage. The advisability of adding a large percentage of chopped hay or other dry material to potatoes in a trench silo may therefore be questionable. The

silage possessed a characteristic aroma, appeared to be very palatable and the preliminary test of its feeding value for fattening yearling steers proved it to be equivalent to corn silage.

### Yields of Sorghum Silage Not Satisfactory

In the Boise Valley area, the types and strains of sorghums and milos for which seed is now available, cannot compete with adapted corn hybrids for the production of ensilage. Of 18 varieties of dwarf milos and sorghums placed in a series of plots, the amber sorghums produced the greatest yield of forage but it was 46 per cent less than that of hybrid field corn. The yield of forage from the sorghums ranged from 2.5 tons to 9.9 tons per acre, while the field corn produced 18.5 tons of forage per acre.

## Sandpoint Branch Station

RALPH E. KNIGHT, *in charge*

### Climatic Conditions Highly Variable

**T**HE 1941 season was characterized by extremes in monthly temperatures and precipitation, and marked deficiency of snowfall. Mean temperatures for March and July were the highest on record, while the mean minimum for September was the lowest. Precipitation for February, March, and April was very light, whereas the rainfall for May and September was the highest and second highest, respectively, ever recorded here. The total snowfall for the winter of 1940-1941 was only 30.2 inches, second lowest in 31 years and less than half normal. The frost-free growing season of 161 days was approximately 6 weeks longer than average.

### New Cereal Varieties Distributed

Elgin wheat, under observation here for several years, was given rather general distribution for planting this fall. Elgin is a white club winter wheat, a cross of Forty Fold and Hybrid 128. It has shorter, stiffer straw than Mosida, the variety that has been most generally grown, and matures several days later. Yields of the two varieties have been almost identical during the 3 years of plot trials. Elgin is recommended for seeding on the more fertile soils where Mosida is likely to lodge, while the latter probably will continue to be grown under conditions where lodging is not a problem. One hundred bushels of Elgin were seeded on the fertile diked lands of Kootenai River Valley in Boundary County this fall. Its performance will be watched with special interest since the varieties commonly grown there—Mosida, Triplet, and Redit—frequently lodge quite badly. Elgin is very susceptible to bunt and is not recommended for those localities where that disease is prevalent.

In the spring wheat varieties, Premier warrants close attention in the future because of its apparent high resistance to leaf and stem rust. Of the 9 varieties grown in plots, Premier was the only one

that was not heavily infested, and the yield of nearly 30 bushels per acre was correspondingly high when compared with only 15 bushels for Bluestem. Idaed, Federation and Dicklow were particularly susceptible, and the grains were badly shriveled. Since this is the second time in 7 years that rust has been a factor in wheat production here, a variety that is resistant to this disease is highly desirable.

A limited amount of Marida oats was released for trial last spring and because of its very satisfactory performance with farmer growers and on the Station farm, it has been increased for more general distribution in 1942.

### Phosphate Fertilizer Increases Potato Yields

The potato fertilizer project consisted of two replications of 20 plots each. The phosphated plots were rather outstanding in all cases, both in vine growth and in yield. The lowest two-plot average where phosphate was used was 9,457 pounds per acre, whereas the highest average for the duplicate fertilized, non-phosphated plots was 8,624 pounds, and 7,742 pounds per acre for the highest duplicate check plots. The results may be summarized very briefly as follows:

Average yield 10 check plots .....	76 cwt. per acre.
Average yield 14 fertilized plots, no phosphate .....	79 cwt. per acre.
Average yield 16 phosphated plots .....	105 cwt. per acre.

Fertilizers used under the second classification were sulphate of ammonia, muriate of potash, borax, and gypsum. Treble super phosphate at the rate of 15 pounds per acre, alone or in combination with the fertilizers mentioned, was applied to the other 16 plots.

### Observations on Reseeding Work Continued

This marked the end of the second year of observations on the project of seeding burned-over land. Since the plots are located many miles from Sandpoint, all information gained to date necessarily has been from periodical inspections. As a very brief summary of results, the forage grasses and legumes involved may be segregated into the following groups, based upon stand and forage production and on the results secured on one of the less productive soil types at Spirit Lake:

- Group 1.—Failure, or practically so, under the conditions that prevailed.
- Group 2.—Generally unsatisfactory because of poor stand, low forage yield, lack of palatability, short life, or other cause.
- Group 3.—Satisfactory under favorable moisture conditions.
- Group 4.—Results somewhat inconsistent or inconclusive. Some of these would be worthy of further trial.
- Group 5.—Grasses showing the greatest possibilities for reseeded purposes.

Results from seedings made by the Soil Conservation Service on more favorable locations at Joel and Kendrick in Latah County are,

in several instances, at variance with results reported here. It seems likely that one or more additional groupings or classifications might be desirable in order to present a more comprehensive picture of performance under variable soil and moisture conditions.

In Table 10 can be found the grasses and legumes listed in their respective groups, based upon their performance at Spirit Lake.

**Table 10.—Grouping of a number of species, based on stand and forage production to indicate their relative value for seeding burned-over land in Northern Idaho.**

Group 1	Group 2	Group 3	Group 4	Group 5
Bulbous barley	Kentucky bluegrass	Reed canary grass	Blue wild rye	Big bluegrass
Sudan grass	Bulbosa bluegrass		Slender wheatgrass	Beardless wheatgrass
Sweet clover	Meadow fescue		Beardless rye	Crested wheatgrass
Red clover	Pubescent wheatgrass		Thick Spike wheatgrass	Orchard grass
Alsike clover	Tall oat grass		Smooth brome	Timothy*
White Dutch clover	Bluestem		Mountain brome	Red top*
Alfalfa	Michels' grass		Canada wild rye	
			Intermediate wheatgrass	

\* Seeding of timothy and red top should be confined to areas where the moisture supply is favorable.

## High Altitude Branch Station

W. A. Moss, *in charge*

### Climatic Conditions Favorable

Due to an abundance of moisture, 15.7 inches up to December 1, all crop yields on the High Altitude Branch Station were high. The effects of the favorable climatic conditions are brought out by the high average yields of the spring and winter wheats on the variety test plots, namely 38.0 and 37.9 bushels per acre. This represents the highest spring wheat yield since 1925. The yield of winter wheat obtained this season has been exceeded only twice since 1921. Temperatures for the crop year were favorable; there was no killing frost until most of the field crops were matured.

### Branch Station Equipped to Provide Disease-Free Potato Stocks

A new potato storage cellar was completed this year. This will greatly facilitate the handling of the potato crop. A special effort is

made to keep out bacterial ring rot. All the potatoes planted on the station are tested for this disease and all equipment used in handling the crop is thoroughly disinfected with a solution of formaldehyde. In order to guard against the introduction of disease only three varieties, Russets, Rurals, and Bliss Triumphs, are grown. Potatoes for seed stock are grown on the tuber unit basis and all the off-type units removed from the field as soon as they can be recognized.

### Grass Seed Production a Profitable Enterprise

The possibilities of producing grass seed are being investigated in cooperation with the Regional Nursery Division of the Soil Conservation Service and the Department of Agronomy. The results obtained from the nursery and field plots are most encouraging. The need for soil conserving crops capable of yielding cash returns to producers is evident. The grass test includes tame grasses as well as native and introduced species. Some of the yields obtained this year are shown in Table 11. Preliminary work on the utilization of the grasses in Table 11 and other grasses for pasture purposes was started this year.

Table 11.—Yields obtained from various grasses tested in 1941.

Common name	Scientific name	Yield per acre (lbs.)
Smooth brome	<i>Bromus inermis</i>	544
Erect brome	<i>Bromus erectus</i>	633
Mountain brome	<i>Bromus marginatus</i>	819
Crested wheatgrass	<i>Agropyron cristatum</i>	556
Bluebunch wheatgrass	<i>Agropyron spicatum</i>	396
Slender wheatgrass	<i>Agropyron trachycaulum</i>	930
Canada wild rye	<i>Elymus canadensis</i>	520
Blue wild rye	<i>Elymus glaucus</i>	381
Sheep fescue	<i>Festuca ovina</i>	598
Chewings fescue	<i>Festuca rubra</i> var. <i>commutata</i>	259
Big bluegrass	<i>Poa ampla</i>	395

These yields were obtained on duplicated tenth-acre plots.

### Alfalfa Is a Successful Hay Crop on Dry Land

Yields of 3 tons of alfalfa hay per acre demonstrate the value of this crop on dry land farms. The Ladak variety is especially recommended for areas where only one crop per season can be expected. In an endeavor to find better adapted varieties of alfalfa, a triplicated series of plots including 17 varieties was established this year. Good stands were obtained with all varieties.

### Crop Rotations and Soil Management Practices of Special Importance in Dry-Land Areas

The establishment of a permanent agricultural system leading to stable yields and the conservation of soil resources is an im-



portant problem in all areas. It is of special importance in areas with limited precipitation. In view of the great importance of this problem, an extensive series of rotation and soil management plots was established on the Station in 1939 in cooperation with the Soil Conservation Service and the Department of Agronomy. This series of 132 one-tenth acre plots now has been grown for a sufficient length of time to yield valuable data indicating definite trends of value to producers in the region. Since wheat is the most important cash crop of the region served by the Branch Station, it is the principal crop grown on these series of plots and is used primarily for the evaluation of the various systems of rotation and soil management.

Other crops used are crested wheat, alfalfa, grown alone and in mixtures, with smooth brome and crested wheat, sweet clover, potatoes, and flax. The crested wheat is produced for seed. The alfalfa and alfalfa-grass mixtures are grown for hay with the last crop of the sequence plowed under after attaining a height of 18-24 inches. The sweet clover is plowed under the second year.

Winter wheat following the plowing under of an alfalfa-grass mixture, consisting of alfalfa, smooth brome and crested wheat, gave the highest yields of any plot in the rotation experiments, namely 41.8 bushels per acre. This is 9.3 bushels more than the check, wheat after fallow. The plots following the plowing under of straight alfalfa yielded 6.1 bushels above the check plots, while winter wheat on sweet clover fallow ground showed an increase of 3.3 bushels over the check plot. These yields show that the presence of active organic matter in the soil and the physical modifications of the soil produced by legumes and grasses grown alone or in combination have favorable effects. These favorable effects serve not only to increase yields but also may be expected to materially reduce soil erosion losses.

## Changes in Staff Summarized

THE changes in staff of the Idaho Agricultural Experiment Station during the past year have not been numerous. C. A. Michels, Assistant Agronomist, who was associated with the Idaho Agricultural Experiment Station for many years engaged in teaching and research in genetics, died February 21, 1941. He has been succeeded by Dr. H. K. Schultz. Dr. J. N. Thompson, Assistant Poultry Husbandman, resigned April 19, 1941. L. R. Berg was appointed to fill this vacancy. K. H. Parks, Assistant Agricultural Engineer resigned July 9, 1941. W. R. Friberg was appointed to fill this position. W. H. Hoge, Assistant Bacteriologist, resigned August 31, 1941. Dr. T. C. Cordon was hired to fill this position. Dr. Leo M. Christensen, Agricultural Chemist, was granted 10 months' leave of absence September 1, 1941 to direct research chemistry projects at the University of Nebraska.

## HOME STATION DISBURSEMENTS

Detail of Expenditures of State Appropriations<sup>1</sup> and Income Funds  
Idaho Agricultural Experiment Station  
January 1 through December 31, 1941

	Salaries	Help	Expense & Supplies	Capital Outlay	Total
Administration .....	\$.....	\$.....	\$ 185.99	\$.....	\$ 185.99
Agr. Chemistry .....	.....	.....	70.34	29.00	99.34
Agr. Econ. ....	.....	.....	54.72	3.40	58.12
Agr. Engr. ....	729.18	10.00	59.17	.....	798.35
Agron. ....	34.50	132.40	630.41	15.25	812.56
An. Hus. ....	299.31	.....	109.58	.....	408.89
Bacter. ....	.....	.....	17.67	.....	17.67
Dairy Hus. ....	.....	683.86	1,215.15	88.30	1,987.31
Entom. ....	.....	.....	214.14	9.21	223.35
Home Econ. ....	.....	.....	1.25	.....	1.25
Hort. ....	.....	10.00	344.16	24.89	379.05
Plant Path. ....	.....	.....	104.20	.....	104.20
Poultry .....	.....	1,068.56	1,954.51	14.00	3,037.07
Soil Survey .....	147.22	650.00	220.92	.....	1,018.14
<b>TOTAL</b> .....	<b>\$1,210.21</b>	<b>\$2,554.82</b>	<b>\$5,182.21</b>	<b>\$ 184.05</b>	<b>\$9,131.29</b>

<sup>1</sup> Includes general appropriation and institutional funds.

## BRANCH STATION DISBURSEMENTS

January 1 through December 31, 1941

	Salaries	Help	Expense & Supplies	Capital Outlay	Total
Aberdeen .....	\$3,609.90	\$3,965.33	\$3,780.35	\$4,118.95	\$15,474.62
Aberdeen Potato Res. ...	2,204.30	492.78	597.43	8,694.07	11,988.58
Caldwell .....	3,487.50	2,491.06	5,234.79	106.20	11,319.55
High Altitude .....	1,800.00	657.66	1,013.69	1,207.77	4,679.12
Sandpoint .....	3,155.01	665.00	1,055.64	.....	4,875.65
<b>TOTAL</b> .....	<b>\$14,256.80</b>	<b>\$8,271.83</b>	<b>\$11,681.90</b>	<b>\$14,126.99</b>	<b>\$48,337.52</b>

## FINANCIAL STATEMENT

Detail of Expenditures of Federal Appropriations  
Idaho Agricultural Experiment Station  
July 1, 1940 to June 30, 1941

	Hatch	Adams	Purnell	Bankhead- Jones
Personal Services .....	\$ 9,706.79	\$13,134.49	\$51,420.80	\$10,684.74
Supplies and Materials .....	1,871.81	826.61	3,537.70	1,417.52
Communication Service .....	177.05	.....	138.42	2.05
Travel Expenses .....	940.11	103.80	2,061.19	787.05
Transportation of things .....	12.08	8.93	83.67	12.20
Printing and Duplicating or illustrating publications .....	935.31	.....	312.66	.....
Heat, Light, Water, and Power (Services and fuel) .....	58.57	10.44	12.36	.....
Contingent Expenses .....	62.70	10.70	1.50	9.10
Equipment .....	1,135.18	871.16	1,909.82	399.69
Land (Purchase and Rent) .....	.....	.....	205.00	240.00
Structures and nonstructural Improvements .....	100.40	33.87	316.88	166.21
Balance Unexpended June 30, 1941 .....	.....	.....	.....	.....
<b>TOTAL</b> .....	<b>\$15,000.00</b>	<b>\$15,000.00</b>	<b>\$60,000.00</b>	<b>\$13,718.56</b>

# Experiment Station Staff

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D. W. Bolin, M.S., *Assistant*  
L. E. Ensminger, M.S., *Assistant*

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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*