Increase Production Through Feeding of Surplus Wheat

WHEAT AS A FEED FOR LIVESTOCK

By R. A. RASMUSSEN

Wheat is usually too valuable as a human food, and hence too expensive, to be used in animal feeding; but, because of the large stores of this grain at present, wheat is now available at prices low enough for its use as animal feed. In general wheat is superior to the other grains in feeding value.

Wheat, from the standpoint of "total digestible nutrients," is superior to all other cereal grains including corn (wheat 85.7 percent and corn 82.5 percent). Thus wheat is primarily an energy or fat-containing feed.

Like the other grains wheat is a good source of phosphorus and a poor source of calcium. Consequently a calcium-containing feed must always be fed with this grain. This requirement is met with alfalfa hay for the herbivores.

Wheat contains 11.3 percent of digestible protein as compared to 9.4 percent for oats, and 9.3 percent for barley. This means that about 2 percent less protein supplement is needed in the ration if wheat is used instead of barley or oats. However, the protein of wheat, like that of other cereal grains does not contain a sufficient quantity of some of the essential amino acids (building blocks) which go to make up proteins. This lack of quality is not serious where alfalfa hay is fed, as to cattle, sheep and horses, for this makes good the deficiency. With hogs and chickens where only a limited amount of alfalfa hay can be fed some animal protein should be fed such as tankage, fishmeal, or milk.

Wheat contains the same vitamins as oats and barley. It is richer than oats or barley in most of the B vitamins. Wheat is also a rich source of vitamin E. Unlike yellow corn, the small grains (wheat, oats, and barley) are poor sources of vitamin A. None of the grains contains any appreciable amount of vitamin D.

Wheat in the Ration of Cattle

Wheat can be used to good advantage as part of the grain mixture of cattle; young, old, or milking cows. As wheat lacks bulk it is usually best to mix about one-third oats and two-thirds wheat, as this helps to prevent digestive upsets and (Continued on page 4)

SURPLUS WHEAT

Unlimited amounts of wheat are available for livestock feed this winter through the Commodity Credit Corporation. In order to make full use of the nation's tremendous wheat reserves in maintaining current record production of war-needed livestock and poultry products, a national feed program has been set up. This action followed Congressional provision for the sale of 125 million bushels of government-owned wheat at prices not less than 85 percent of the parity price for corn. With wheat, on the one hand, piled on the ground for lack of storage space, and feed supplies, on the other hand, being used faster than they are being replaced, the natural solution seemed to be to release some of the surplus wheat for feed.

Any producer may have feed wheat delivered to him upon certification that he will use it for feeding livestock and poultry to increase production of meat, dairy and poultry products. Prices for this wheat average about 93.5 cents per bushel in Utah in December varying from 90% to 96% depending on the part of the state. Each month the price will raise 1/2 cent a bushel to pay for storage. This price is for whole wheat. If ground or cracked wheat is wanted, the purchaser must pay the expense of processing.

This wheat is sold only in bulk and in carload lots, so that feeders wanting less than a carload must pool their orders unless they obtain it directly from regular feed dealers.

The CONVERSION OF SURPLUS WHEAT INTO MUCH NEEDED MILK

By GEORGE Q. BATEMAN

At the present time there is a surplus of wheat over that needed for human consumption in the United States. In contrast to this, there is a large demand for milk and dairy products. In order to supply this demand it is urged that surplus wheat be made into milk and butterfat.

The feeding of wheat in the place of other grains in the dairy ration is not new. Practical farm experience and experimental tests have demonstrated the feeding value of wheat for more than 40 years. Some farmers hesitate to feed wheat because they are not accustomed to doing so or do not appreciate its high feeding value. Another reason wheat has not been fed more extensively is that it is usually too high in price compared to the other feed grains and the price of butterfat.

With the present favorable price relationship of wheat and butterfat, wheat can be added to the grain ration and fed to dairy cattle with profit to the dairyman.

Records kept on the amount of feed consumed and the amount of milk produced by cows in the experimental dairy herd show that cows producing at a high level use less total digestible nutrients per pound of butterfat than these same cows producing at a lower level. In other words, cows in high production will give a higher return for feeds fed than when in low.

The records on feed consumption and butterfat production show that when cows are producing 50 pounds of butterfat a month, 17.3 pounds of total digestive nutrients are used for each pound (Continued on page 11)
DIVIDENDS FROM INVESTMENT OF FUNDS IN AGRICULTURAL RESEARCH

When an individual makes an investment in private business he is deeply concerned about what profits he may reasonably expect to receive. He wants to know what dividend the investment will pay. And so it is with the taxpayers, and that means all of us. We want to know what we are getting for our tax dollar.

The Agricultural Experiment Station is one of those state institutions that is being financed by the taxpayers' dollar. Is the investment made by legislative appropriations to the Station paying dividends? A few examples of the contributions made by the Station will answer this question.

In the 10-year period prior to 1933 the annual loss to the wheat growers of the state caused by smut in wheat was estimated to be over $300,000, and in some years this loss mounted to over a half million dollars. On individual farms the loss varied from as little as 10 percent of the crop to over 90 percent. Some farmers lost practically their entire crop in years when the disease was especially bad. Not only were the farmers affected, however, but also the grain dealers, the flour millers, the railroads that transport the grain to market, and all those with whom the farmer does business. When the farmer's profit was reduced or lost entirely, he had less money to spend and business in general was adversely affected.

As a result of their studies on this serious disease, plant breeders at the College found that the disease could be controlled practically under farm conditions in no other way than to develop a new variety of wheat that is resistant to the disease. So for a number of years plant breeding investigations were in progress. Many of the taxpayers' dollars were spent each year in hunting out disease-resistant heads of wheat, and in crossing them with other wheat heads showing desirable qualities. Thousands of short rows of wheat were grown each year. Microscopic examinations of smut spores were made. Even the chromosomes of the reproductive cells of the wheat were carefully studied. After about 8 or 10 years of these painstaking investigations a new variety was developed that looked promising. It was not resistant to all the 29 known races of smut causing disease in wheat, but it was resistant to all but 6 of them. This was a remarkable achievement in plant breeding.

This new wheat, named "Relief," was then grown in several parts of the state to study its yielding ability under different soil and climatic conditions. It stood up well in these tests, yielding as well or better than our commonly grown varieties in years when smut was not serious, and it was far superior to them in years when the smut was bad. This wheat was multiplied for seed increase, and then released to the wheat growers of the state. This was in 1933. In 1937, it was reliably estimated that this wheat was being grown on at least 85 percent of the wheat acreage of northern Utah.

What dividend did the investment in the plant breeding pay? If only half the smut loss had been prevented, the saving would have been over $150,000 annually. Conservative estimates of the savings are considerably higher than this. In the 10 year period since this wheat was released to the growers the accumulated savings have amounted to well over a million dollars and possibly as high as three or four million dollars.

The average annual appropriation of state funds to the Agricultural Experiment Station for all purposes has amounted to approximately $35,000. This fund has of necessity supported many other experiments and investigations; only a small portion of it has been used in the plant breeding studies for the improvement of wheat. It is obvious that the investment in this work has yielded each year dividends many times greater than the investment itself.

Another example to illustrate the extent of the dividends from the investment in agricultural research is chosen from the study of seepage losses in canals and the development of low-cost methods of lining canals to prevent the seepage losses. Most of us who live in Utah know the importance of irrigation water. In fact we spend huge sums of money to construct dams and build reservoirs for the storage and conservation of our limited water supplies. Plans are made to construct more storage reservoirs as soon as the war is over. Yet each year, according to reliable estimates, we lose at least one-fourth of the water we now have through seepage. Losses of as high as 10 percent of the water in the canal in a distance of about one mile have been recorded.

A year ago, in a canal-lining experiment, a canal in Millard County was lined with a blanket of clay three inches thick, with a layer of gravel one inch thick.

CONSERVATION OF THE NUTRITIVE VALUES OF LAMB AND TOMATOES STUDIED AT STATION

This a Part of National Cooperative Nutrition Studies

A nationwide project has been adopted by the experiment stations for study of the degree to which nutritive values of foods are conserved through the processes of transportation and marketing, storage, methods of cookery, and other home procedures.

Division of the work is made on a regional basis, the western region (comprising the eleven western states) is concentrating on study of 13 foods selected on the basis of their importance to the region as well as their significance in the menus of the armed forces. For each of these foods one station is designated as a "key" station with at least two others participating. It is the duty of the "key" station to explore the field for the particular commodity assigned to that state for research done and for further research needed. From the data thus obtained the "key" station, with its two assisting stations, prepares a plan of research for the commodity.

Utah was assigned two commodities, namely, lamb and tomatoes. These studies are under the direction of Mrs. Almeda P. Brown, research associate professor of home economics. Survey of research accomplished showed practically no work done on conservation of nutritive values of lamb; hence one station in the western region will study this year the effect of cooking by various home procedures on the vitamins of lamb meat; a second will study the effect of pressure canning and of freezing.

Notwithstanding the large volume of research already done on tomatoes some problems of interest to the western region were found which require investigation and were formulated into a program in which three western stations will participate.

The problems, briefly stated, are as follows: 1. What effect does the longer processing time required by high altitudes have on the vitamins of canned tomatoes? 2. Are the vitamins affected when tomatoes are picked green and ripened off the vine? 3. Have tomatoes purchased in the markets lost vitamin C since being harvested? 4. Is vitamin C lost when tomatoes are sliced and left exposed to the air for various periods before serving? 5. Do canned tomatoes lose vitamin C after being reheated for various periods?
Sugar Beet Seed Becoming Important Farm Crop

New Methods of Seed Production Make This a Profitable Crop in Some Areas of State

BY W. W. OWENS

TEN years ago Utah sugar beet growers sent out of the state about $100,000 per year for beet seed. Today the state produces its own seed and sends it shipped in. The industry started with a few rows in a garden in Washington County in 1928. Beet seed is now grown commercially in Washington, Weber, Box Elder, Cache, Wasatch and Morgan Counties. Small test plantings were made the past summer in three other counties.

Seed Produced in Utah During First World War

Beet seed was produced in Utah during the first World War when it was impossible to procure the normal supply from Germany and other European countries. The method used required a large amount of hand labor. Beets were planted in the spring, thinned and cultivated the same as beets for sugar. After digging in the fall they were stored during the winter in pits or silos. In the spring they were replanted and produced seed in the fall of the second year. At the close of the war seed production here was discontinued in favor of the European source of supply. One of the important factors in the establishment of the present industry was the discovery of a new method of production.

New Method of Production

The United States Department of Agriculture and the New Mexico Agricultural Experiment Station planted beets at Las Cruces, New Mexico, on the first and fifteenth of each month commencing September 1, 1922, to determine the proper planting period for that locality during which beets could be raised profitably for sugar production. It was observed that beets planted during September obtained a considerable size before frost stopped their growth. They were not killed by the winter. They resumed active growth with the coming of spring and sent up seed stalks which produced a heavy crop of seed in July, 1923. The agronomist in charge of this work recognized the advantage of producing beet seed by this easy method as compared to the conventional German method. This experiment was immediately changed to one on sugar beet seed production. After many tests in various localities, including St. George, Utah, the government and college investigators clearly demonstrated that beet seed could be produced at home more economically than in Germany.

How Seed is Grown

Seed is planted in early August in the northern counties; about a month later in Washington County. It is planted with a regular beet drill using 15 to 18 pounds of seed per acre. Because it is not always possible to have the seed bed moist enough to germinate the seed, it is advisable to attach shovels to the beet drill so the beets may be watered up if necessary. Additional irrigations are required during the fall to insure a vigorous growth until frost kills the tops. Cultivation and hoeing should be often enough to control weeds. In some fields which have been summer-fallowed or just released from weed control no cultivation or hoeing has been necessary. The beets are not thinned. The roots may only attain a diameter of half an inch or less in the fall. They are left in the field and so far have survived our winters if they had a good start in the fall. In early spring, growth is resumed. The root develops but little more, growth goes into a seed stalk and seed. Irrigation and weed control are continued in the spring. The seed is ready for harvest in July in Washington County and August in the northern counties. It is cut with a mowing machine, placed in windrows or shocks to dry, and threshed with a grain thresher or combine.

Acre Yields

An average crop has been 2,000 pounds of clean seed per acre. In all of the counties some fields have produced twice that amount. The fertility of the soil has a direct effect on yield. Heavy application of barnyard manure and applications of commercial phosphate and nitrogen fertilizers pay big dividends in increased seed yields.

The crop is here to stay. It may increase its acreage in the six counties and it may expand to other counties. The sugar companies which contract for all the seed before it is planted have kept it out of the beets-for-sugar areas. This seems to be a wise arrangement. These companies have cooperated very closely with government and experiment station workers in developing this crop.

Seed is threshed with a grain thresher or combine.

for December 1942
The Contribution of Research to College Teaching

The contributions of the research program to the betterment of agriculture are numerous and many of them have been exceedingly important. Some of these contributions are described in the pages of this publication.

One of the byproducts of this work, however, if it may be called a byproduct, has almost equal value with the major contribution itself—that is, the vitalizing influence that research has on the college student who is preparing himself for his life's work.

The student who has the opportunity of associating with an instructor who is devoting a part of his time to investigation of some sort is exceedingly fortunate. The student not only learns new facts, but he is stimulated by the new discoveries. He learns the scientific method of investigation and develops the scientific method of thinking. Even though the facts may be forgotten when once away from the school room these habits of thinking, if well cultivated, will remain with the student to serve him in solving the perplexing problems with which he is confronted from day to day throughout his life. They contribute to clear thinking, understanding, and self-reliance.

The importance of research in the teaching program has been ably stated by the Council on Research of the Pennsylvania State College. A part of this statement is as follows:

"When the three functions of a great university are considered, there is a tendency in some quarters to look upon research as a luxury, to place it in the category of Sunday driving, pleasant, satisfying but unnecessary. This is unfortunate be-
The U. S. Department of Agriculture is concerned with many problems of the beet sugar industry. This article by the senior pathologist stationed at Riverside, California, deals with only a part of that work, the part conducted in the western states.

**SUGAR BEET RESEARCH**

**By EUBANKS CARNER**

**U. S. Bureau of Plant Industry**

Curly top, the virus disease spread by the beet leafhopper, formerly was the most serious difficulty with which the sugar beet growers in the far west had to contend and therefore was the most important sugar beet problem in this region. Curly top continues to be a problem but since much progress has been made in the control of the disease it no longer dominates the whole situation.

Curly Top Control by Disease Resistance

Plant breeding has been mainly responsible for the progress that has been made in the control of curly top. Use of resistant varieties was one of the earliest methods for curly top control thought of and and the first recorded effort to breed for curly top resistance was made by Dr. C. O. Townsend of the U. S. Department of Agriculture forty years ago, in the summer of 1902. Other investigators later renewed the attack at this same point. Some of these scientists were connected with sugar companies and some with state experiment stations. It was not, however, until 1934 that a commercial variety of sugar beets resistant to curly top reached the beet growers in seed supplies large enough to permit extensive planting. This first curly top resistant variety was called U. S. No. 1. It was developed by the combined efforts of a considerable number of workers in the U. S. Department of Agriculture with the cooperation of several major sugar companies. There have been great advances made in breeding curly top resistant sugar beet varieties since U. S. No. 1 was released.

American Sugar Beet Seed Industry

Sugar beet seed production, practically a new industry in the United States, is an outcome, in large measure, of the success achieved in breeding varieties resistant to curly top. That industry is now so extensive and well established that not only are the beet growers supplied with better adapted varieties than European seed firms could furnish but there is an assured continuous seed supply. The difficulty in getting sugar beet seed from Europe in the First World War constituted a major catastrophe for the American beet sugar industry.

Establishment of the sugar beet seed industry in this country by the method of planting the seed in late summer or early fall and overwintering the plants in the field required the investigation of many agricultural problems. The principles of sugar beet physiology which determine what climatic conditions are required to permit the use of the overwintering method had to be discovered. Understanding of these principles showed the way to the development of the best cultural practices. Such knowledge also made possible precautions against serious deterioration of varieties of high quality. Other problems that had to be solved included correct irrigation practice, soil fertilization suitable for the various areas and control of other diseases as well as curly top in the seed fields. Attention had to be devoted also to prevention of excessive winter injury in relatively cold areas such as northern Utah and southern Idaho. The success that has been gained in meeting the diverse conditions and problems encountered is indicated by the fact that sugar beet seed is now grown extensively in Utah, New Mexico, Arizona, California, Oregon and Washington. Important seed production problems not yet solved are being investigated.

Plant Cover Investigations

Curly top control through management of the plant cover on abandoned farm land and semi-arid range land has also been investigated. Weeds such as Russian-thistle and Jim Hill mustard are host plants for the beet leafhopper. When farmed lands are abandoned or range lands are abused by overgrazing or burning the weed hosts appear in great abundance. Then beet leafhoppers multiply in enormous numbers on such weedy areas and move from them to infest beet, bean and tomato fields and spread in them the virus that causes curly top. Investigations carried on by the U. S. Department of Agriculture in 1942 showed that a well-developed cover vegetation will check the invasion of the beet leafhopper if present at the time of seed-planting. (Top) The first curly-top resistant variety; U. S. No. 1, and a German variety, Old Type. This test was conducted in 1934. Varieties much more resistant to curly top have been bred since then. (Lower) Each pile of beets is the yield from a 0.51 acre plot. The weight of the Old Type pile was 1.1 tons and of the U. S. no. 1 pile, 6.26 tons. Average yields from nine half-acre plots of each variety were: Old Type 2.5 tons per acre and U. S. no. 1, 13.8 tons per acre.

(Continued on page 10)
Results of Station Research: Emergency Agriculture

The emergency has demanded a critical analysis of non-war activities as to their importance in an economy where all effort needs to be directed toward winning the war. But along with the production of the munitions of war must be the production of food. A strong agricultural front is as important as a strong military front, in fact the strength of the military front is conditioned by the agricultural.

The great need for food combined with the shortage of agricultural labor makes the need for better production methods of paramount importance. Agricultural experiment stations throughout the United States since their foundation more than fifty years ago have devoted their energies to discovering methods to increase the quantity and quality of agricultural products and to better the status of rural life.

Nevertheless, it is well to take periodic inventory of the work, especially at the present time, to see wherein the results of research can be put to immediate use and wherein the program can be redirected to give more adequate aid to the farmer in this emergency.

The compiling of the biennial report has given opportunity for this examination of the experimental work in progress at the Utah Station. A brief summary of some of the work that may have practical application during the present emergency is reported herein.

Investigations of Livestock Problems

The largest part of the agricultural wealth of Utah comes from the livestock industry, and from the extensive desert and mountain ranges on which these animals graze. The Station in cooperation with federal governmental agencies is investigating many problems connected with the range livestock industry.

Supplemental Feeding of Sheep

Studies during the past biennium conducted on the desert experimental range west of Milford have shown that supplemental feeding of range sheep on desert range is profitable. When fed cottonseed cake for a protein supplement and phosphoric acid or bone meal for phosphorus-rich supplements, more ewes lambed, more twins were dropped, and the ewes conceived more promptly.

Wool Sampling

Studies have shown that scouring tests of carefully selected composite samples of the wool of any one herd should be used as a basis for estimating the yield of clean wool in that herd in determining the price of greasy wool. As wide variation exists in the amount of shrinkage in herds this method of price determination is far more equitable than the common one used at present where the buyer makes a regional estimate for all wool of a certain grade. These scouring tests are generally applicable to the range area and are inexpensive. They could be carried out in a central laboratory, or in warehouses maintained by growers.

Range Re seeding

Many range lands in the state are of little value for grazing because native grass and other browse species have been killed out by overgrazing. These
practical Applications To War Production Problems

A species have been superceded by such unpalatable plants as downy brome or cheat grass, Bromus tectorum, and Russian-thistle, Salsola pestifer. Investigators at the Utah Station are now finding grasses through breeding and selection that can be used to revegetate these ranges as well as abandoned dry-farm land. Selections of the more common grasses, such as smooth brome-grass, Bromus inermis, and crested wheatgrass, Agropyron cristatum, which yield better than the parent plants have been made. Strains of other wheat grasses have been selected which are superior in drought resistance.

Other studies of the best methods to be used in reseeding abandoned ranges have shown a number of practices which should be avoided. Among these are: (1) Seeding too late in the spring, or, indeed, any spring seeding during years when the land cannot be worked until late in the season, or in springs followed by dry summers; (2) seeding into stands of dense weeds, especially cheat grass; (3) planting of grain along with grass for use as a "nurse crop" on dry lands; (4) planting on sterile or rocky lands upon which plants previously growing did not thrive; (5) excessive "working" of soil, especially plowing and harrowing until the soil is loose; (6) planting grass seed too deep, a difficulty almost impossible to avoid on loose soil.

Pastures on Alkali Land

Much work has been done on the establishment of pastures on the wet alkali lands of Utah. There are hundreds of thousands of acres of such land in the state and if these areas can be made to produce feed, both the livestock and dairy industries will be materially benefited. Strawberry clover has been found especially adapted to such areas. The following other pasture plants were surviving in good condition at the end of a two year test period: meadow fescue, perennial ryegrass, Reed canary grass, smooth brome-grass, and biennial white sweet clover. Red top, slender wheatgrass, English wild white clover, and Pioneer alfalfa showed considerable resistance to alkali and excessive water conditions. Red clover seems to be more tolerant to alkali than either Alsike or Ladino clover.

Economy of Pastures

Studies on the economy of various feeds for dairy cows have shown pastures to be one of the cheapest sources of feed. Butterfat produced from pasture cost 8 cents per pound, while from corn silage the cost was $2.261 and from barley $1.192. These data are for pastures where no fertilizers were used. Use of commercial fertilizers or manure or both should greatly increase pasture production, without greatly increasing the cost. Well cared-for pasture should be a part of every dairy farm set up.

Wilt-Resistant Alfalfa

A new wilt-resistant alfalfa variety promises to give increased production of this important feed crop in areas where wilt is prevalent. This variety is also more resistant to cold than the ordinary varieties and is high producing. Seed of this variety has been grown on approximately 40 acres in well-isolated areas of Utah during the past year. If on further testing this new variety continues to show superiority it will be released for general production throughout the state.
Feeding Sugar-Beet Molasses to Hogs

Hog feeding studies during the biennium have shown that young hogs may be safely fed up to forty percent of the ration in sugar-beet molasses provided they receive the equivalent of 3 percent of hay as fresh cut green alfalfa or 5 percent of dried brewer's yeast.

Alfalfa Meal in Turkey Rations

Alfalfa can also be used to advantage in the economical feeding of turkeys from seven weeks of age until ready for market. Alfalfa meal of excellent quality is available in Utah at a price about half that of most grains. Turkey growers therefore are interested in the maximum amount of this feed that can be used as a part of the mash and still produce well fleshed and well finished birds. Experimental turkeys were fed mashes containing as much as 25 percent of alfalfa meal and showed as good or better finish than those fed only 5 to 10 percent. As this work has only been in progress a year, no general recommendations can be made at this time.

Feeding experiments with turkeys also showed that there is no apparent advantage in using swim milk or wet mash as supplements to the dry mash. The lowest feed cost per bird or per pound of gain was obtained in birds receiving a low protein content (19 percent) mash without any supplement of milk or wet feeds.

New Crop Varieties

New crop varieties and better cultural practices introduced by the Utah Station during the past two years should aid farmers in increasing their crop yields. New varieties of the important cereal crops that are resistant to disease as well as being high yielding, have been released during the biennium.

Velvon Barley

Strains of Velvon, the new smooth-awned variety of barley with relatively stiff straw and with a high degree of resistance to covered smut, are now being produced with a feathered style. This character insures a higher fertility on the barley spike, which means less sterile or empty kernels. The present importance of barley as a feed crop is paramount as shown by the 1942 estimates of production in Utah which exceed wheat by over one million bushels.

Uton Oats

The new oat variety, Uton, developed by this Station, not only has a large white kernel, but it is resistant to both loose and covered smut. It has produced yields somewhat higher than either Swedish Select or Markton. It is recommended to replace both of these varieties.

Wheat Varieties

A number of rust-resistant varieties of spring wheat for irrigated land are being tested at present. It is hoped to release some of these for commercial planting in the near future. In winter wheats a new selection from a Relief-Ridit cross is showing resistance to all the races of covered smut. This selection was planted in the fall of 1941 to increase seed quantities to be tried out on a more extensive scale in 1942.

Corn Hybrids

Corn hybrids, among which are Iowa Hybrid 4206, and Wisconsin Hybrids 680 and 645, have been found to be from two to three weeks earlier than U.S. 52 and are better adapted to the shorter growing season of the state. Although, in the past, corn has not been an important crop in Utah, with the development of hybrid corn, which often out-yields common varieties by 10 to over 70 percent, this crop is attaining importance. When the entire plant is utilized as silage, corn rightfully deserves a place in the agriculture of Utah and is a profitable crop for livestock feed.

Certified Seed

Under a cooperative agreement with the Utah Crop Improvement Association the Station is producing foundation seed stock that is free from weed seed, pure as to variety, and with high viability. Through the use of better seed the farmer is enabled to produce better crops with higher yields.

Control of Tomato Diseases

In the tomato breeding work single plant selections bearing fruit of approximately commercial size have been made from hybrids of Peruvian Wild with Stone and Century which are resistant to Verticillium wilt. It will be some time however, before these selections can be released for commercial production as they must be first tested for canning purposes. Breeding work is also being carried forward in an effort to improve the size and quality of these hybrids.

Work is progressing on the breeding of a tomato variety resistant to curly top, but at the present time no resistant varieties are ready for distribution. This menace may be overcome, to a large extent, by cultural methods developed during the biennium by the Station in cooperation with the U. S. Bureau of Plant Industry. Closer spacing of tomato plants has greatly lessened the incidence of the disease and increased the crop yield. Direct seeding in the field has also lessened the disease. Earliness of planting favored higher yields and less disease.

Sweet Cherry Rootstocks

Mahaleb rootstocks for sweet cherry trees are proving much superior to mazzard and Stockton morello. The hurricane wind of the fall of 1941 failed to injure trees on this stock while many trees on other stocks were blown down or broken off. Trees on this rootstock also survive excessively hot weather and drought as well as surviving severe winters better than trees planted on other rootstocks.

Chlorosis

Research has shown that chlorosis in many areas can be avoided by better methods of irrigation and drainage. A study of chlorosis in Concord grape and other susceptible labrusca varieties has shown that these varieties can be grown successfully in chlorotic soils by grafting on vinifera rootstocks.

Conservation of Soil and Water

The conservation of soil and water is fundamental to productive agriculture in Utah. Studies on soil erosion as influenced by irrigation water show that erosion is negligible with small streams having slopes of less than 1 percent, but that for slopes exceeding 3 percent the erosion becomes serious. Small streams and gentle slopes are also aids to water-application efficiencies, tending to conserve the water in the root zones of the crops instead of wasting it in runoff or deep percolation.

Lining of Irrigation Canals

Other means of conserving water investigated by the station include the lining of canals with low-cost materials. A canal in the Delta Area of Millard County was lined with a blanket of clay three inches thick with a layer of gravel one inch thick placed on the lining. The year before lining, this canal lost 4.6 second-feet of water from the section lined. The year after it lost only 0.4 second-feet. If it is assumed that the loss after lining would have been the same as before lining, the saving of 4.2 second-feet amounts to 252 acre-feet per month, or 1,512 acre-feet during the irrigation season of six months. Irrigation authorities estimate the value of an acre foot of water at $1.35. On this basis the value of water saved in 6 months by lining would be $2,041, which is 40 percent of the cost, of lining. Many irrigation canals in Utah lose, in conveyance and delivery, from one-third to one-half of the amounts of water taken into the canals. Lining of

(Continued on page 10)
Birds have long been known to benefit the farmer and home gardener through eating large numbers of injurious insects which otherwise would damage crop plants. Birds generally occur in abundance around towns and farm land; they also are present on the semidesert breeding areas of the beet leafhopper and throughout the vast areas of range land so important to livestock production in Utah.

In September of 1934 it was observed that warblers, rock wrens, several kinds of sparrows, and other small birds were feeding on Russian-thistle on the semidesert breeding areas of the beet leafhopper. A few birds were collected; an examination of their stomach contents showed that most of them had recently eaten beet leafhoppers.

The stomach of one western chipping sparrow, collected near Timpe in Tooele County, October 13, 1934, contained 24 adult and 131 nymphal beet leafhoppers, a total of 155. Studies have shown 34 different kinds of birds feed upon the beet leafhopper in Utah. Chipping sparrows, rock wrens, warblers, sage sparrows, and horned larks were among the birds more frequently feeding on this agricultural pest.

Larger numbers of beet leafhoppers were eaten in the fall, when beet leafhopper populations usually were high upon a reduced number of host plants. The greatest benefit from the birds feeding upon the beet leafhopper appears to be the reduction of fall populations in permanent beet leafhopper breeding areas, reducing the number of insects on hand to go through the winter, thus lowering spring leafhopper populations.

In addition to beet leafhoppers eaten, insectivorous birds' stomachs were found to contain large numbers of grasshoppers, cutworms, aphids, weevils, leaf beetles, false chinch bugs, Say's plant bugs, Lygus bugs, and dozens of other crop pests.

Grasshoppers have been destructive in Utah during recent years, causing approximately $5,000,000 of crop injury since 1937. In addition range forage has often been seriously reduced. Birds of many kinds have fed consistently upon this abundant pest.

NEW PUBLICATION

Bul. 304, Phosphate reserves of Utah, a revised estimate—J. Stewart Williams and Alvin M. Hanson.

To supplement the work reported in Bulletin 290, phosphate outcrops in Weber, Morgan and Salt Lake Counties, as well as those in the Park City district of Summit County and others west of Midway in Wasatch County were measured and found to contain considerable phosphatic shale of 25 to 35 percent grade, but no rock of 40 percent grade, the minimum quality included in the estimates in Bulletin 290. However, the data recorded for the sections visited are valuable in showing the leanness of these areas, which because of their proximity to the industrial centers of the state, have often been suggested for early development.

This publication may be obtained free by addressing a card to the Utah Agricultural Experiment Station, giving the number and series of the publication desired.

Dr. Russel A. Basmussen, research associate professor of animal husbandry, has accepted a position at the Michigan State College. He left the campus the middle of November. No one has yet been appointed to fill the vacancy.

Professor Arthur D. Smith, cooperator in Range Management, has joined the army and has just received a commission in the army air service.

The sparrow hawk is a relatively common bird which feeds principally upon grasshoppers from the time the nymphs become abundant until late fall. As many as 70 grasshoppers have been found to be present in a single stomach of this highly beneficial bird. One red-tailed hawk had recently eaten 132 grasshoppers.

Kingbirds, blackbirds, curlew snipes, snowy herons, the glossy ibis, shrikes, meadow larks, sage thrashers, and even such small birds as the rock wren and western chipping sparrow take a toll of grasshoppers throughout the season.

Whenever a species of insect becomes abundant, it is more readily and extensively fed upon by birds. In this way they contribute to the control of insect species which become excessively abundant, often flocking to outbreak areas in large numbers to feed upon the abundance of insects present. This has been noticed when seagulls, hawks, and other birds frequented fields which had heavy populations of grasshoppers, cutworms, or other insects. This was particularly noticeable in many alfalfa and small grain fields during the serious army cutworm outbreak which extended over more than 30,000 acres in Utah during the spring of 1941. Large numbers of meadowlarks, robins and blackbirds often were present; their stomachs usually were found to be filled with this cutworm species.

Many of our birds feed upon seeds as well as insects. Some become injurious because of this habit, owing to the quantity of cultivated grain they eat. Many, however, are decidedly beneficial, feeding upon thousands of weed seeds each season. Lark sparrows, blackbirds and horned larks are examples of birds which may be beneficial because of eating large quantities of weed seeds, as well as for consuming pest insects.
NEW SEGMENTED SUGAR-BEET SEED PROMISES TO REDUCE LABOR REQUIREMENTS OF THIS IMPORTANT CROP

One of the most notable improvements in farm practice in many years is the development of segmented sugar-beet seed. It is particularly significant that this new farm practice has come to us at this time when sugar is scarce and increased production is essential, and also when the farm labor situation has reached the most critical point in many years.

Through the efforts of sugar beet companies and the U.S. Department of Agriculture, together with experiment station workers, a method has been developed for crushing the beet seed hull which normally contains two or three beet seed. Individual seeds may then be separated by screening and other mechanical procedure. Beet drills have also been modified for sowing the hulled seed. When the segmented seed is planted thinly in the row there is rather good assurance that the young plants will be separated sufficiently that they can be thinned by the one operation of blocking without having to do the more laborious job of actually thinning the young plants to one in a place.

Small plot experiments and field trials on a large scale during the past few years have proved the practicability of using the segmented seed, and thus practically eliminating the thinning process. The officials of at least one of the sugar-beet-processing companies have become so thoroughly convinced of the practicability of this method that they are planning to have segmented seed sown on the farms of all their cooperating beet growers in 1943.

This new development has promise of materially reducing the labor requirements in growing sugar beets. Still further reductions in the labor requirements of this crop may be attained by the development of the mechanical blocking machine which looks promising in the early experiments. Segmented seed and mechanical blocking machines will undoubtedly go hand in hand to reduce greatly the labor required to produce sugar beets.

RESULTS OF RESEARCH

(Continued from page 8)

Canals will enable irrigation companies to save much water which can be used in the production of additional crops.

Correlation of Studies in Uinta Basin

During the biennium earlier studies made in the Uinta Basin on the soils, irrigation, range and economic conditions have been correlated. Out of this study a technique has been developed for making an economic classification of irrigated farm lands. In the Uinta Basin this classification shows that while 62,436 acres of non-productive land are being irrigated there are 50,206 acres of good land that has no irrigation water at present. This study points out wherein this land can be put under cultivation and inferior land abandoned.

Marketing of Fruits and Vegetables

While the marketing of Utah products is not a serious problem during the war emergency, the results of a marketing study made at the Station during the biennium may well be studied by farmers and other agricultural agencies in order to improve the quality of Utah products. This study showed that fruit and vegetable growers of the state have both production and marketing problems to solve before they can successfully meet competition from other areas, and before

Sugar beet research

Agriculture have revealed how the ranges can be restored or maintained in a condition of highest value for grazing and without the weeds that make abused ranges a menace to farmed land. These studies have also shown how abandoned farm land should be handled to get it past the dangerous weed host stage and converted into good grazing land as quickly as possible.

Headquarters Locations

The Utah investigations are conducted from headquarters in Salt Lake City. That station is the center of plant breeding operations. A field station at Twin Falls, Idaho, serves as headquarters from which investigations in the ecology of leafhopper weed hosts and other wild vegetation are conducted in Idaho, California, Arizona, New Mexico and Texas. Extensive agronomic investigations closely related to the breeding program are also centered at Twin Falls. A laboratory at Corvallis, Oregon, deals with seed production problems in that area with the main emphasis on soil problems. The work in California is conducted from headquarters at Riverside and deals mainly with pathological and agronomic problems. Field supervision of all the far western stations is given from the office at Riverside, California.

Organisation

The U.S. Department of Agriculture investigators conducting the studies referred to are organized in different branches of science, but there are many connecting relationships. Geneticists work out methods of sugar beet breeding and produce improved varieties. Agronomists evaluate the varieties under various conditions of disease, wide and narrow spacing and different degrees of soil fertility. Plant pathologists study the nature of the curly top virus, host plant relationships, and investigate other diseases. Physiologists investigate the conditions required for best performance of beets in seed and sugar production. Soils technologists explore fertilizer requirements and materials and methods of fertilizer application. Chemists study the nature of disease resistance and factors affecting sugar losses from beets after harvest. Plant ecologists investigate the factors responsible for the growth of leafhopper weed hosts in the desert and how to replace them with desirable vegetation. All these workers pull together like players on a team to help the beet growers and the sugar companies regularly produce the big crops of beets and plenty of sugar.
of butterfat produced. When butterfat production is 42 pounds, it requires 20.8 pounds of total digestible nutrients per pound of butterfat. With a butterfat production per month of 37, 32 and 28 pounds, the total digestible nutrients required per pound of butterfat production are 22.6, 24.3, and 25.8 pounds, respectively, for the different levels of production. The data show that as the rate of butterfat production decreases the amount of total digestive nutrients required to produce a pound of butterfat increases.

Using the figures on the amount of total digestible nutrients required to produce a pound of butterfat, it is possible to approximate the amount of butterfat that will be produced from 100 pounds of wheat when fed to dairy cows producing at different levels.

The total digestible nutrients in 100 pounds of high grade western wheat are reported to be 85.7 pounds (Morrison: Feeds and Feeding). The amount of butterfat that will be produced from 100 pounds of wheat when fed to cows producing at different levels, also the value returned per 100 pounds of wheat fed with butterfat selling at 45, 55, 65, and 75 cents per pound are calculated in table 1. These data show that there is a wide variation in the amount returned for each 100 pounds of grain fed depending on the level of production of the cows and price received for butterfat. It should be kept in mind that wheat of poor quality will have a lower feeding value.

The question is often asked how much wheat can be fed to dairy cows with safety. During the winter of 1933 four cows from the experimental herd were fed chopped wheat according to production as the only grain in combination with alfalfa hay for one complete lactation period. Three of the cows were only average producers, so at no time did they receive a large amount of grain. The other cow, E-47, produced 14,031 pounds of milk containing 430 pounds of butterfat during the lactation period of 343 days. During this period the total wheat consumption was 2,892 pounds. During the month of highest butterfat production E-47 consumed an average of 14 pounds of chopped wheat per day. At no time during the wheat feeding period did the cows refuse a significant amount of the chopped wheat offered. The condition of the cows was normal as far as could be determined and they showed excellent condition throughout their lactation periods.

### TABLE 1. Amount of butterfat produced and value returned per 100 pounds of wheat when fed to cows producing at different levels with butterfat selling at varying prices

<table>
<thead>
<tr>
<th>Buttermfat production per month</th>
<th>Buttermfat produced per 100 pounds of wheat</th>
<th>Returns per 100 pounds wheat fed with butterfat selling at:</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>45</td>
<td>55</td>
<td>65</td>
<td>75</td>
<td></td>
</tr>
<tr>
<td>pounds</td>
<td>pounds</td>
<td>dollars</td>
<td>dollars</td>
<td>dollars</td>
<td>dollars</td>
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</tr>
<tr>
<td>28</td>
<td>3.32</td>
<td>1.49</td>
<td>1.82</td>
<td>2.05</td>
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<td></td>
</tr>
<tr>
<td>32</td>
<td>3.53</td>
<td>1.59</td>
<td>1.94</td>
<td>2.29</td>
<td>2.67</td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>3.79</td>
<td>1.71</td>
<td>2.08</td>
<td>2.46</td>
<td>2.84</td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>4.12</td>
<td>1.85</td>
<td>2.26</td>
<td>2.67</td>
<td>3.09</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>4.95</td>
<td>2.23</td>
<td>2.72</td>
<td>3.21</td>
<td>3.71</td>
<td></td>
</tr>
<tr>
<td>E-47 average first 108 days</td>
<td>51.3</td>
<td>4.59</td>
<td>2.07</td>
<td>2.52</td>
<td>2.98</td>
<td>3.44</td>
</tr>
</tbody>
</table>

During the first 108 days of the lactation E-47 consumed an average of 34.6 pounds of alfalfa hay and 12.2 pounds of chopped wheat containing 18.7 pounds total digestible nutrients. The amount of total digestible nutrients used per pound of butterfat produced ranged from a low of 17.2 pounds to 20 pounds. Using the average figure of 18.7 pounds of total digestible nutrients per pound of butterfat produced the gross amount returned per 100 pounds of wheat would be $2.07, $2.52, $2.98, and $3.44 with butterfat selling at 45, 55, 65, and 75 cents per pound, respectively. This shows that wheat can be fed at a profit in fairly large amounts to dairy cattle. Even though this is so, wheat is fed to greater advantage where it makes up only a part of the grain mixture. The Kansas Agricultural Experiment Station has long recommended that when wheat is low in price it can make up from one-fourth to one-half of the grain mixture. The Oregon Station reports that when cows were changed from the normal grain ration to that made up of 75 percent wheat in no case did the cows go off feed and production was normal for the state of lactation. It was observed, however, that the 75 percent mixture was not quite as palatable as when less wheat was used, although the cows usually consumed the feed offered.

During the greater part of the 1942 and 1943 pasture season the grain mixture fed the experimental dairy herd was made up of three parts barley and one part chopped wheat. The grain mixture being fed this winter contains three parts barley, two parts wheat and one part wheat bran. In case wheat bran becomes too high in price it will be dropped from the mixture. Wheat should always be ground for dairy cattle. Grinding wheat increases its feeding value from 15 to 20 percent. However under no circumstances should it be ground fine. Grains ground medium coarse have proved superior to finer ground grains for dairy cattle.

For the most profitable production grain should be fed according to production. The amount to feed will be determined by the cost of the grain and the price of the butterfat. In market milk areas where the price of butterfat is high, grain can be fed to Holsteins at the rate of 1 pound of grain to every 5 to 6 pounds of milk produced and 1 pound of grain for each 4 to 5 pounds of milk produced by the higher testing breeds. In manufacturing areas with butterfat ranging from 50 to 60 cents, grain should be fed to Holsteins at the rate of 1 pound of grain to 6 to 7 pounds of milk and 1 pound of grain for each 5 to 6 pounds of milk for the higher testing breeds. Wheat is a safe and palatable feed for cattle when properly fed.
THE ELECTRIC PIG BROODER

By Harry H. Smith

Pedect contentment in a heated apartment (Arrow points to tin dishpan used as a reflector for 100 watt lamp)

Each year many little pigs are lost because of chilling, and many that do not die may become stunted as a result of being chilled. This trouble may be prevented by the use of a pig brooder. This can be bought at a cost of $8.00 to $15.00, or may be made very cheaply. A small platform will need to be built in one corner of the pen, about ten inches from the floor. This may be made with one inch boards, though two inch material is better; it should be about forty inches in length. A round hole about a foot in diameter is then cut in the top. Over this hole a tin dishpan is placed. This dishpan acts as a reflector for a hundred watt lamp which is attached to a wire run through the bottom of the pan. The light socket should be fastened to the pan. The platform must be protected, so that the sow cannot get on it. The front is left open so that the little pigs can get under it. If the weather is very cold, a gunny sack may be used to cover the opening.

If the little pigs are put back under the light two or three times after nursing, they will soon learn to avail themselves of the comforts of this heated apartment and will spend most of their time there, especially if the weather is cold; they will also be out of danger of being stepped on by the sow.

It has been found at this and several other stations that almost two pigs more were saved per litter when brooders were used and that pigs so cared for were more thrifty and got a better start.

DIVIDENDS FROM RESEARCH

(Continued from page 2)

placed on the lining. The year before lining, this canal lost 4.6 second-feet of water from the section lined. This past summer it lost only 0.4 second-feet. If it is assumed that the loss after lining would have been the same as before lining, the saving of 4.2 second-feet amounts to 252 acre feet per month, or 1,512 acre-feet during the irrigation season of six months.

Irrigation authorities estimate the value of an acre-foot of water in that area at $1.35. On this basis the value of water saved in 6 months by lining would be $2,041, which is 40 percent of the cost of lining.

Many investigations are being conducted by the Agricultural Experiment Station that are yielding dividends equal to those reported here. Others are yielding results that are difficult to measure in monetary values, but which contribute to the good of all humanity. Studies in human nutrition are in this class. It is difficult to measure in dollars and cents the value of the information obtained in our studies on the vitamin content and nutritive value of Utah fruits and vegetables, or of the vitamin levels and requirements of men and women. Nevertheless, these studies have a far-reaching value and pay big dividends in the general well-being of the entire citizenry.

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