High Production Key to Agricultural Profits in 1951-52

By W. PRESTON THOMAS, GEORGE T. BLANCH, and DEE A. BROADBENT

The year 1951 has been favorable for agricultural production and farm income in Utah. The volume of production this year is about 34 percent above the pre-war period and 8 percent above 1950 (fig. 2). During the first nine months of this year prices paid producers in Utah for agricultural products averaged about 12 percent higher than in 1950 (fig. 1). With an increase in agricultural production and prices, the gross agricultural income for 1951 for the state should result in an estimated gain of about $22,000,000 over 1950 or an increase from $158,000,000 in 1950 to about $180,000,000 in 1951 (fig. 3).

If the $180,000,000 gross agricultural income is realized for 1951, it will be the largest for any year in the history of the state. This would mean an average gross income per farm of about $7,450, which is approximately seven times the 1932 income.

The net farm income for 1951 did not increase at the same rate as gross income because the cost of producing agricultural products increased faster than did sale prices. According to the Bureau of Agricultural Economics the cost of production in agriculture increased about 15 percent in 1951 over 1950. This is compared to an increase of about 12 percent in prices received for farm commodities. Although production costs increased slightly more than prices received, the net return to agriculture is probably the same this year as it was in 1950 because of the increase in volume of production. Generally 1951 was a profitable year for Utah farmers. This is especially true of those who were operating efficient units and who were able to use practices that reduced labor and other high costs in their production and marketing program.

Outlook for 1952

The outlook for agriculture for 1952 is also favorable. The present indications are that the 1952 national income will be high with more jobs available and higher consumer income, thereby maintaining a strong demand for agricultural products.

The present indications are that during 1952 a larger percentage of total national production will go for defense purposes and a reduced amount to civilian use. The tremendous increase in federal expenditures for defense purposes will increase the money in circulation and with a reduction in the amount of civilian goods available there will likely be higher prices. Although

(Continued on page 68)
Grants Give Added Support to Research on Turkey Diseases

Turkeys seem peculiarly susceptible to disease. Death rates are high and financial losses to producers are often severe. Information on the cause, prevention, and cure of some of the more common of these diseases will greatly help producers and make turkey raising less precarious. This is the purpose of the turkey disease research program at the Utah Station. This work has recently been stimulated by two grants, one of $1200 from the Utah Turkey Federation and another of $1500 from the Utah Bankers' Association.

An annual loss of $300,000 to the turkey raisers of Utah and of $10,000,000 to the industry in the United States is caused by the disease of older turkeys known variously as staphylococcal arthritis, synovitis, staphylococcosis, and weak-leg disease. This is definitely the most costly turkey disease in Utah. At the present time we do not know the source of the infection, how the disease is transmitted, nor how to treat or how to prevent it. Any one of these discoveries might well be worth very nearly $300,000 annually to Utah alone. The disease is so costly because it attacks the birds after the twelfth week. Indeed it seems to attack the heaviest birds in the flock. The mortality of those who contact the infection is 100 percent. In a badly afflicted flock, 15 percent of the birds may be lost between the twelfth and twenty-eighth week.

Because of the seriousness of this disease, the Utah Agricultural Experiment Station plans to use these two new grants to intensify the study of the disease. The study includes (1) research to find the strain of staphylococci that causes the disease; (2) investigations on how the bacteria is transmitted to turkeys, whether by insects, wild birds, rodents, turkey raisers, or other possible contacts; (3) search for a drug cure for the disease, and (4) the development of a preventative vaccine.

Dr. C. David McGuire, a new staff member in bacteriology from the University of California who has special training in the bacteriophage sensitivity technique for identifying and determining relationships between the bacteria which cause this disease, is working on the first two phases of the study. Dr. M. L. Miner of the Veterinary Science Department is seeking to cure the disease with drugs. In addition he has charge of the inoculation of the birds with the various vaccine strains developed by Dr. W. W. Smith of the Bacteriology Department. Dr. Miner is also studying the disease as it appears in turkey flocks throughout the state.

Another serious turkey disease in Utah on which research is being conducted is blackhead. Dr. Miner and Dr. D. M. Hammond of the Zoology Department are studying the transmission of this disease.

Above: Dr. M. L. Miner, associate professor of Veterinary Science, and student assistant inoculate turkey with vaccine developed in Bacteriology Department in experiments to find means of controlling leg weakness in turkeys

Left: Dr. D. M. Hammond, head of the Zoology Department, and Dr. Miner observe turkeys for symptoms of blackhead
A NEW variety of fall wheat for irrigated land in Utah is being recommended by the Utah Agricultural Experiment Station. The new wheat is especially adapted for growing on highly productive land where lodging is a problem when common winter wheat varieties are grown. This new variety is named Brevor and was recently released from the Washington Agricultural Experiment Station where it was developed. Brevor is a true winter wheat and should be planted only in the fall.

Brevor is a selection from a series of crosses involving Turkey, Florence, Fortyfold, Federation, and Oro. Several of the varieties contributing to the heredity of Brevor have been grown extensively in this area in years gone by. Turkey was the standard variety for fall planting on dry lands for many years until it was run out by its susceptibility to bunt, especially dwarf bunt. Prior to and during the Turkey era Fortyfold, better known in this area as Goldcoin, was well known by the dry land wheat farmers. Federation was at one time a prominent spring-sown variety in this region, grown primarily on irrigated land. It is still grown to some extent in the state. Oro was grown in northern Utah to a limited extent as a fall wheat, but because of its susceptibility to dwarf bunt it was soon replaced by resistant varieties such as Cache and Wasatch.

Brevor is a soft, white wheat and has especially stiff straw that resists lodging. It threshes easily, yet it does not shatter. It is moderately to highly resistant to all known races of bunt, is moderately winter hardy, and fair in milling quality.

Tested in Logan

Brevor has been grown for a number of years in test trials on the Experimental Farm at North Logan. In these trials it has been consistently among the highest in yield. Under highly favorable conditions on small plots it has yielded more than 100 bushels an acre. Even with these high yields Brevor showed little or no tendency to lodge. Most other winter wheat varieties grown in comparison under the same conditions have lodged severely which makes harvesting difficult (fig. 1). Furthermore, where lodging occurs early the grain is usually shrunken and yields are lowered accordingly.

Brevor Fills Need in Many Areas of State

There is a definite need in many localities in Utah for a variety such as Brevor. Areas with a limited water supply have need of a variety that can be fall sown and will resist lodging, that will produce a good crop even though only enough water is available for one irrigation. A fall-sown variety will usually produce more than one sown in the spring where early summer irrigation water

is limited. In years when moisture is exceedingly short the winter-sown variety is more certain to produce a crop. Furthermore, a considerable acreage devoted to spring wheat could no doubt produce winter wheat to advantage. This is especially true on land infested with wild oats. Winter wheat, by getting a good start in the fall, has a distinct advantage over wild oats which must germinate and start in the spring. While winter wheat will not completely crowd out wild oats, it is a far better competitor than spring wheat.

Brevor has yielded well on dry lands in northern Utah where conditions are relatively more favorable than average. However, since Brevor is a soft, white variety of only fair quality, though it is suitable for use in the poultry and turkey industries, it is not recommended for growing on the dry lands of Utah to replace the hard red winter wheat of superior milling quality.

(Continued on page 78)

Fig. 1. Differential resistance to lodging in wheat varieties sown in the fall on highly productive irrigated land. Brevor, to the left, is highly resistant to lodging, whereas common dry land wheat varieties, such as Cache and Wasatch (right), while satisfactory on dry lands, do lodge severely when grown on highly productive irrigated land.
Agricultural Outlook

(Continued from page 65)

Table 1. Estimates of crops for 1951 and attainable for 1952, Utah *

<table>
<thead>
<tr>
<th>Use of farm land</th>
<th>Acreage</th>
<th>Estimated for 1951</th>
<th>Attainable for 1952</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Acreage</td>
<td>acres</td>
<td>acres</td>
</tr>
<tr>
<td>Corn, all</td>
<td>planted</td>
<td>1,000</td>
<td>1,000</td>
</tr>
<tr>
<td>Corn for grain</td>
<td>planted</td>
<td>26.0</td>
<td>27.0</td>
</tr>
<tr>
<td>Corn for silage</td>
<td>harvested</td>
<td>7.0</td>
<td>7.0</td>
</tr>
<tr>
<td>Sugar beets</td>
<td>planted</td>
<td>19.0</td>
<td>20.0</td>
</tr>
<tr>
<td>Irish potatoes</td>
<td>planted</td>
<td>28.0</td>
<td>35.0</td>
</tr>
<tr>
<td>Beans, dry edible</td>
<td>planted</td>
<td>11.1</td>
<td>13.0</td>
</tr>
<tr>
<td>Vegetables for processing:</td>
<td>harvested</td>
<td>10.0</td>
<td>8.0</td>
</tr>
<tr>
<td>Tomatoes</td>
<td>harvested</td>
<td>24.5</td>
<td>26.1</td>
</tr>
<tr>
<td>Peas</td>
<td>harvested</td>
<td>8.4</td>
<td>8.5</td>
</tr>
<tr>
<td>Sweet corn</td>
<td>harvested</td>
<td>9.4</td>
<td>10.0</td>
</tr>
<tr>
<td>Snap beans</td>
<td>harvested</td>
<td>5.5</td>
<td>6.0</td>
</tr>
<tr>
<td>Other</td>
<td>harvested</td>
<td>1.1</td>
<td>1.0</td>
</tr>
<tr>
<td>Vegetables for fresh market</td>
<td>harvested</td>
<td>3.8</td>
<td>3.8</td>
</tr>
<tr>
<td>Tree fruits</td>
<td>planted</td>
<td>10.0</td>
<td>19.0</td>
</tr>
<tr>
<td>Small fruits</td>
<td></td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Other intertilled crops, total</td>
<td></td>
<td>3.6</td>
<td>3.6</td>
</tr>
<tr>
<td>Acres of multiple use</td>
<td></td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Acres of cropland used for</td>
<td></td>
<td>123.0</td>
<td>132.5</td>
</tr>
<tr>
<td>intertilled crops</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oats</td>
<td>planted</td>
<td>50.0</td>
<td>50.0</td>
</tr>
<tr>
<td>Barley</td>
<td>planted</td>
<td>128.0</td>
<td>135.0</td>
</tr>
<tr>
<td>Winter wheat</td>
<td>planted</td>
<td>350.0</td>
<td>380.0</td>
</tr>
<tr>
<td>Spring wheat</td>
<td>planted</td>
<td>90.0</td>
<td>70.0</td>
</tr>
<tr>
<td>Oats for grain</td>
<td>harvested</td>
<td>44.0</td>
<td>44.0</td>
</tr>
<tr>
<td>Barley for grain</td>
<td>harvested</td>
<td>122.0</td>
<td>129.0</td>
</tr>
<tr>
<td>Grains cut green for hay</td>
<td>harvested</td>
<td>15.0</td>
<td>15.0</td>
</tr>
<tr>
<td>Rye for grain</td>
<td>harvested</td>
<td>7.0</td>
<td>7.0</td>
</tr>
<tr>
<td>Other close-growing crops</td>
<td>harvested</td>
<td></td>
<td>0.5</td>
</tr>
<tr>
<td>Acres of land used for close</td>
<td></td>
<td>634.0</td>
<td>642.5</td>
</tr>
<tr>
<td>growing crops</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hay—all tame except small grains</td>
<td>harvested</td>
<td>394.0</td>
<td>425.0</td>
</tr>
<tr>
<td>Alfalfa</td>
<td>harvested</td>
<td>350.0</td>
<td>375.0</td>
</tr>
<tr>
<td>Other tame hay</td>
<td>harvested</td>
<td>57.0</td>
<td>65.0</td>
</tr>
<tr>
<td>Seeds (hays and clover)</td>
<td>harvested</td>
<td>62.0</td>
<td>64.0</td>
</tr>
<tr>
<td>Alfalfa</td>
<td>harvested</td>
<td>60.0</td>
<td>62.0</td>
</tr>
<tr>
<td>Other (clovers, etc.)</td>
<td>harvested</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>Rotation (cropland) pasture</td>
<td>harvested</td>
<td>60.0</td>
<td>70.0</td>
</tr>
<tr>
<td>Multiple use of land</td>
<td></td>
<td>36.0</td>
<td>35.0</td>
</tr>
<tr>
<td>Acres of land used for sod crops</td>
<td></td>
<td>493.0</td>
<td>539.0</td>
</tr>
<tr>
<td>Total cropland used for crops</td>
<td></td>
<td>1,250.0</td>
<td>1,314.0</td>
</tr>
<tr>
<td>Summer fallow</td>
<td></td>
<td>350.0</td>
<td>350.0</td>
</tr>
<tr>
<td>Idle cropland</td>
<td></td>
<td>145.0</td>
<td>96.0</td>
</tr>
<tr>
<td>Total cropland</td>
<td></td>
<td>1,745.0</td>
<td>1,760.0</td>
</tr>
<tr>
<td>Wild hay</td>
<td>harvested</td>
<td>103.0</td>
<td>105.0</td>
</tr>
<tr>
<td>Open permanent pasture</td>
<td></td>
<td>8,467.0</td>
<td>8,450.0</td>
</tr>
<tr>
<td>Woods pastured</td>
<td></td>
<td>173.0</td>
<td>173.0</td>
</tr>
<tr>
<td>Woods not pastured</td>
<td></td>
<td>11.0</td>
<td>11.0</td>
</tr>
<tr>
<td>Other land in farms</td>
<td></td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Total land in farms</td>
<td></td>
<td>10,599.0</td>
<td>10,599.0</td>
</tr>
<tr>
<td>Grazing land not in farms</td>
<td></td>
<td>32,407.0</td>
<td>32,407.0</td>
</tr>
<tr>
<td>Other land not in farms</td>
<td></td>
<td>9,695.0</td>
<td>9,695.0</td>
</tr>
<tr>
<td>Total land area</td>
<td></td>
<td>52,701.0</td>
<td>52,701.0</td>
</tr>
</tbody>
</table>

*Report on Utah's agricultural production for 1952 prepared by staff of Utah State Agricultural College and various federal agencies in Utah.

The effect of the inflation on agriculture in the long run, however, is not likely to be so favorable. Individual farmers will temporarily benefit from inflation and increased prices, but the farm economy as well as the economy of the country may be injured. The rapid advance in agricultural prices has resulted in excessive land values. Farm land will generally be purchased by young farmers who will incur heavy indebtedness in obtaining ownership. Although there is no indication of decline in prices in the near future, a sharp decline is probable at some future time. When the decline comes, prices of farm products will drop more rapidly than costs and farmers will find themselves in a position of selling farm products at low prices and paying relatively higher prices for goods and services.

The year 1952 will be a year when costs will be uniformly high and there may be wide variation in prices received for various agricultural commodities. Thus 1952 is likely to provide opportunities for some farmers to make high profits. This can be done by producing the commodities that are in strong demand and by organizing and managing the farm business so as to keep production costs about the same next year as in 1951. The United States Department of Agriculture predicts that the farmer's net income or the money left after paying production costs will be about the same next year as in 1951.

More detailed information on the subjects discussed here can often be found in Station bulletins and circulars or may be had through correspondence.
Smoke Generators Appear of Little Value for Raising Orchard Temperatures

S. W. EDGECOMBE, R. K. GERBER, AND O. D. KIRK

Use of army smoke generators to raise orchard temperatures was found of little value in a test made in Weber County on May 9, 1951.

Since these devices have been highly recommended this test was conducted to ascertain their value in raising the temperature in a mature sweet cherry orchard. Nine thermometers were placed in a rectangular area all on the same side of the tree and at eye level as shown in the diagram. These were read and the readings recorded at ten minute intervals as shown in table 1. The first reading indicates the temperature at each position before any smoke was released. Two smoke generators were used at the beginning of the experiment (located at positions S1 and S2). One of the generators (S2), because of change in wind direction, placed smoke only on the area marked by the thermometer at position 7. Consequently it was shut down and was not used after about 20 minutes of operation. A third generator in position S3 was started about 8:10 p.m. and continued in operation until 8:18 p.m. Smoke from this generator adequately covered stations 5, 6, and 9 and at times 8.

Experimental setup. 1 to 9 thermometer locations. S1, S2 and S3 smoke generator locations. Land sloped gently from north to south.

The change in direction of air movement and increased velocity of the wind after 7:50 p.m. greatly lessened the value of the test. By 8:18 p.m. the wind had reached a high velocity and took the smoke rapidly through the orchard.

Each smoke generator used stove oil at the rate of 40 gallons an hour which would be a cost of $4.40 per hour for the oil. Cost of labor would be additional.

The highest raise in temperature from the presence of smoke was at stations 7 and 8 where temperature raised 2 degrees Fahrenheit in less (Continued on page 73)

Table 1. Temperatures at nine locations in an orchard during tests with smoke generators

<table>
<thead>
<tr>
<th>Thermometer locations</th>
<th>Temperature at (p.m.) degrees Fahrenheit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7:41 7:50 8:00 8:10 8:18</td>
</tr>
<tr>
<td>2</td>
<td>55   54   56   56   55</td>
</tr>
<tr>
<td>3</td>
<td>57   54   56   58   57</td>
</tr>
<tr>
<td>4</td>
<td>56   57   56   57   57</td>
</tr>
<tr>
<td>5</td>
<td>57   56   56   58   56</td>
</tr>
<tr>
<td>6</td>
<td>56   55ns 55ns 58s 56</td>
</tr>
<tr>
<td>7</td>
<td>56   57s 56ns 57s 56.5</td>
</tr>
<tr>
<td>8</td>
<td>56   58   58ns 57 56</td>
</tr>
<tr>
<td>9</td>
<td>55   57   55ns 57 56</td>
</tr>
</tbody>
</table>

(Continued on page 73)
HALOGETON (Halogeton glomeratus) is so widespread in Utah and is such a vigorous seeder that it can never be eliminated from desert ranges. Spraying, burning, or scraping will kill the weed but these methods are not economically feasible over such wide areas as now support the plant. Further, these practices kill natural range plants as well as halogeton and leave bare lands where halogeton may invade in even greater amounts. Only on small, isolated areas of new invasion are these practices recommended.

Halogeton, like other poisonous plants, does not necessarily kill animals wherever it occurs. It is not like strychnine, where a chance mouthful will cause death. Stockmen should know that animals are relatively safe if other forage is eaten along with small amounts of poisonous plants. It is only when animals eat most poisonous plants as a major part of their diet that they are killed. Many ranges in Utah have had large amounts of halogeton for ten years with no known livestock poisoning! Experience of stockmen in many areas where halogeton is abundant suggests that livestock can graze these ranges without great danger if stock operators know the plant and if the land and the livestock are intelligently managed.

These are the conclusions of the authors and other investigators after preliminary study of the problem.

Something About the Plant

Halogeton is an annual plant which was accidentally introduced from Europe. It invaded western Utah in about 1935 and since then has spread over most of the northern two-thirds of Utah's desert ranges. This plant is high in oxalate poisons and is known to be dangerous to both sheep and cattle. Deaths have not been widespread, but in Box Elder County several cases are known where severe losses have occurred, especially among sheep. Since the plant is not well understood and the seriousness of the threat is not known, the 1951 Utah Legislature, upon request of

Research Will Attempt to Give Definite Answers to Questions on Halogeton Poisoning

By L. A. STODDART and C. WAYNE COOK
stockmen, appropriated $10,000 to the Agricultural Experiment Station for study of the problem. This money, together with additional Station funds, will be used for research on the weed and its control.

Research Project Designed to Answer Specific Questions

In designing the research project, it was decided that the practical solution to the problem is to learn to live with the plant without excessive animal losses. This is not a new idea; literally hundreds of poisonous plant species grow on Utah’s ranges, but stockmen have learned by devious means to hold livestock losses to a small figure. With this thought, then, research on halogeton is pointed largely at the problem of how to use halogeton infested ranges most effectively and to answer some of the following questions:

(1) Can grasses be planted in halogeton areas? (2) Will such grasses crowd out halogeton, or at least reduce its production to the point that there is not enough to kill stock? (3) Will animals graze these grasses in preference to halogeton when they grow together and hence not be killed? (4) Can halogeton ranges be grazed certain times of the year without danger? (5) Are there natural range plants more palatable than halogeton so that animals will not be poisoned in the presence of these plants? (6) How much halogeton could grow in combination with such plants and still not be dangerous to livestock? (7) Do shortages of water, salt, or other minerals cause animals to eat halogeton when otherwise they would not? (8) Can livestock eat small amounts of halogeton indefinitely without decreasing their meat and wool yields and their reproduction?

Field Work Started

Since halogeton is most abundant and troublesome in Box Elder County, field work is located there. Two graduate student assistants will live in house trailers throughout the winter on range lands near Rosette and devote their full time to this problem under supervision of the authors.

Research at present includes three phases:

First, a large area of almost pure halogeton, located 12 miles west of Snowville, was planted to grass (figs. 2 and 4). Three of the most promising grass species at different rates of seeding were planted in strips to de-
Sheepmen have long recognized that the Rambouillet breed of sheep is well suited to Utah range conditions and as a consequence the range herds of the state are predominately of Rambouillet breeding. The favorable adaptation of Rambouillet sheep results from inherent hardiness, longevity, ability to travel over rough terrain and to produce a heavy fleece of high quality fine wool. Along with these favorable qualities, however, the Rambouillet also has some characteristics that are undesirable and definitely in need of improvement, among which are wool over the face, body wrinkles, and short staple.

It is interesting to note the changes in the ideal type of Rambouillet sheep that have occurred during the past thirty years. Thirty years ago the ideal Rambouillet in the United States possessed several heavy neck folds and an apron and many individuals showed a moderate degree of wrinkling over the body. At the same time the most preferred individuals had a dense cover of wool extending over the face to the tip of the nose. Gradually, however, it was learned that heavy wrinkles and covered faces were not associated with highest utility for lamb and wool production on a clean weight basis. It was found that wool clipped from wrinkled sheep is uneven in length and generally shows great variation in diameter of fiber—the wool from the top or ridge of the wrinkle being coarser than that from the valley or depressed area between the ridges. Heavily wrinkled sheep are also much more difficult to shear than are smooth-bodied sheep. As these facts became generally known the ideal changed and smooth-bodied Rambouillots were sought rather than the wrinkled type.

Breeder of purebred sheep in the state have made considerable progress toward the elimination of excessive wrinkling and in increasing the staple length, but to date the improvement in face cover has been meager. Some open-faced individuals are found in the Rambouillet breed at the present time but these are rather widely scattered among the flocks. There are no purebred flocks in the United States that are predominately open-faced. There is no flock to which breeders can go with the assurance that open-faced Rambouillets of good type can be found in sufficient numbers to fill their needs.

The value of open-face condition has been recognized by commercial sheepmen, and often Columbia rams have been crossed on range Rambouillets for the specific purpose of producing open-faced offspring for replacements. Experimental results obtained at Utah and other agricultural experiment stations indicate that open-faced Rambouillet ewes wean more lambs and lambs that are approximately 10 pounds heavier, on the average, than comparable ewes that have covered faces even though the covered-faced ewes have been clipped around the eye area three times during the year. At the same time, the open-faced ewe will shear about the same amount of clean wool.

The Utah Agricultural Experiment Station has been actively associated...
with research for improvement of Rambouillet sheep for several years. A small experimental flock has been maintained at Logan and the Utah Station is one of the collaborating stations of the United States Department of Agriculture Western Sheep Breeding Laboratory at Dubois, Idaho. At the Dubois station inbreeding has been carried on and 29 lines of Rambouillets have been developed. The work at Logan for the past twelve years has been largely concerned with the elimination of wrinkles and the study of open-faced condition. The small band at Logan is now almost free of wrinkles and the sheep are among the most open-faced in the state.

It is now planned to enlarge this work greatly and to give increased emphasis to production of open-faced Rambouillets. This expanded program will be financed, to a large extent, by a grant of $25,000 from the Kennecott Copper Company for sheep improvement. Much of this grant will be used to purchase superior rams and ewes to be used as foundation breeding stock. The Agricultural Division of Snow College will cooperate in this program and a flock of Rambouillets will be maintained at Ephriam. No attempt will be made to produce inbred lines at either Snow College or at Logan. Selection pressure will be as high as possible for open-faced condition and long-staple wool with other characteristics receiving only little attention.

The first purchase has now been made in this expanded program. An outstanding open-faced Rambouillet ram has been acquired from the Western Sheep Breeding Laboratory at Dubois, Idaho. This ram is a direct descendant of the famous Prince of Parowan, the most famous of all Rambouillets and who was bred in Utah. Other outstanding rams and ewes will be obtained and added to the experimental flock. From this foundation flock superior open-faced individuals will be released (as they become available) to sheepmen in the area.

Upper row: These typical Rambouillets have wool growing over most of the face area. Such individuals are wool-blind much of the time even when the eye area is clipped three times a year.

Center row: Some degree of open-face condition is illustrated here. These sheep would, however, still be wool-blind part of the time.

Lower row: Individuals such as these will not be wool-blind even with a 12-month fleece. Open-faced ewes will wean an average of 10 pounds more lambs each per year.
In testing corn hybrids for yields under Utah conditions at Logan and in various other representative localities throughout the state, some hybrids have been found that are much better adapted to our conditions than others. At Logan, Pioneer 300, Reids National 129, Utahybrid 680, Ohio C 38, and Port Walco 100 have consistently given the best yields. Port Walco 105 also shows promise, but it has only been tested one year. These same hybrids do well over a large part of the state from Cache Valley south to Utah County and in Millard, Sevier, and Iron Counties, and in the Uinta Basin. For valleys where the growing season is shorter with frost likely before September 20 such varieties as Minhybrid 301, Port Walco 90, and Utahybrid 544 are safer choices. Some of the Funks hybrids are recommended for areas such as Greenriver, Moab, and parts of Washington County where the growing season is longer and where the earlier named hybrids do not yield well.

When growing corn for grain only it has been found well to choose an earlier maturing variety than for ensilage.

Corn Yields More Feed Units

Since the development of hybrids with their higher yields, corn has assumed a more important place in the state’s agriculture, especially as a silage crop. Before that time comparative yield tests for corn, wheat, barley, and oats showed corn to be some 15 to 18 percent less productive in feed units than barley. Even with the higher yields of hybrid corn it is doubtful if farmers would prefer corn as a cereal crop to barley because of its longer growing season with the hazards from frost and its higher labor requirements. But with the use of the entire plant in silage, corn now becomes the most productive of the cereal crops in feed units. Farmers in Utah who realize this, now have a place for corn in their rotation and grow a few acres each year.

Corn used as a silage crop is the most productive cereal in feed units. Farmers now find a place for it in their rotation.
Choose Adapted High Yielding Corn Hybrids

State-Wide Variety Tests

So that the Experiment Station might make recommendations as to the highest yielding varieties, a series of corn varietal tests were set up in 15 counties of the state in the early thirties. From the results of these tests a limited number of representative locations have been selected for long-time testing. These are in the Uinta Basin, in Sevier, Iron, and Millard Counties, and at Greenriver. Recently tests of earlier hybrids have been made in areas with higher altitudes such as Panguitch and Rich County. A large central nursery is maintained at Logan. The testing program is under the direction of Dr. R. W. Woodward, collaborator from the U. S. Bureau of Plant Industry, Soils, and Agricultural Engineering, Rex Neilson, assistant professor of agronomy, and Glen Baird, extension agronomist.

Hybrids for testing are obtained from commercial companies, state experiment stations, and the U. S. Department of Agriculture. These are first grown at Logan and then those that appear to be adapted to any particular area are tested in that area.

Each hybrid is grown in 30 foot rows three feet apart in four plots. Each nursery becomes a part of a commercial field and is given similar care. Total green and dry weights are taken in determining yield. At Logan yields of grain are also computed.

Hybrid Yields

Average yields of the better hybrids are given in table 1. In 1951, each corn hybrid was harvested by taking total ears and stalks separately, then calculating green and dry weights of each. Fodder yields of stalks alone taken green ranged from 22 tons per acre for a late immature variety, Dixie 22, to 7 tons for the early Utahybrid 330. Dry weight yields ranged from 5.6 tons for the early immature Dixie hybrid to 2.43 tons for Utahybrid 330. The better hybrids averaged from 3 to 4.7 tons of dry fodder per acre.

Ear weight showed more variability ranging from 1.99 to 3.85 tons per acre dry weight and from 5.32 to 11.74 tons green weight.

Varieties giving good yield of ears as well as ranking high in total weight were Port Walco 105, Pioneer 300, Utahybrid 680, Port Walco 90, Reids National 129, Port Walco 100, and Ohio C 38. The following hybrids gave the highest grain yields: Port Walco 105, Utahybrid 680, Family Farmer, Pioneer 300, Utahybrid 216, and Port Walco 90. These hybrids yielded from 85 to 98 bushels of dry shelled grain per acre.

These tests show that several corn hybrids are well adapted to Utah conditions and will generally reach a satisfactory stage of maturity with a good percentage of ears and grain. Others will give a greater total weight but lack maturity and dry weight of grain. Ears still in the milk or soft dough give excessive juice in the ensilage, much of which is lost by run-off if the corn is chopped.

Early Planting Best

Based on a number of years of testing, early seeding seems to be advisable. A frost in the spring is not so costly as one in the fall when the crop is not yet mature.

Most planting is done in rows 30 to 36 inches apart with plants averaging 8 to 12 inches apart in the rows. Stands that are too thick have a reduced number and size of ears. Cultivation should be often enough to prevent excessive weed growth. Enough water should be applied to prevent stunting or severe curling of the leaves during the day.

DR. D. W. THORNE WINS NATIONAL RECOGNITION

As recognition of his professional and scientific achievements, Dr. D. W. Thorne, head of the Department of Agronomy, USAC, was made a fellow of the American Society of Agronomy at the annual convention held at Pennsylvania State College the last of August. Dr. Thorne has made a name for himself as an authority on arid soils and irrigation since coming to USAC in 1939.

Two other USAC graduates were also among the ten men who were honored by the Society by being made fellows. They are Byron T. Shaw, who since 1948 has been deputy administrator of the Agricultural Research Administration and who is an outstanding soil physicist, and David C. Smith, now at the University of Wisconsin, who has specialized in hybrid breeding of oats and in development of grasses and legumes.

Table 1. Summary of hybrid corn yields for Logan and county-wide tests, 1946-51

<table>
<thead>
<tr>
<th>Hybrid</th>
<th>Logan 6 yr. avg.</th>
<th>Avg. of county tests - 4 years</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Green tons</td>
<td>Dry tons</td>
</tr>
<tr>
<td>Reids National 129</td>
<td>25.18</td>
<td>6.86</td>
</tr>
<tr>
<td>Pioneer 300</td>
<td>23.17</td>
<td>6.75</td>
</tr>
<tr>
<td>Ohio C 38</td>
<td>22.27</td>
<td>6.44</td>
</tr>
<tr>
<td>Port Walco 90</td>
<td>21.56</td>
<td>6.23</td>
</tr>
<tr>
<td>Utahybrid 680</td>
<td>20.96</td>
<td>6.05</td>
</tr>
<tr>
<td>U. S. Hybrid 52</td>
<td>22.69</td>
<td>6.00</td>
</tr>
<tr>
<td>Utahybrid 544</td>
<td>19.91</td>
<td>5.94</td>
</tr>
<tr>
<td>Minhybrid 301</td>
<td>17.46</td>
<td>5.66</td>
</tr>
<tr>
<td>Port Walco 100</td>
<td>21.26</td>
<td>5.66</td>
</tr>
<tr>
<td>K. S. 6</td>
<td>18.06</td>
<td>5.52</td>
</tr>
<tr>
<td>K. S. 6</td>
<td>16.58</td>
<td>5.39</td>
</tr>
</tbody>
</table>

* one year only.

Yield data in county averages are not always complete for all varieties at all locations. Early and late maturing varieties were averaged together.
LIME induced chlorosis is the most important production problem of horticultural crops in many parts of Utah. This nutritional disease, characterized by the development of yellow foliage, occurs on soils having a lime content usually above 10 percent, and a loam to clay texture. In particular conditions associated with such soils appear to prevent the effective utilization of iron so that plants grown on them fail to produce sufficient chlorophyll to maintain the healthy green color of the leaves. In

Left: Severe chlorosis in an apple tree

First illustration below: Radioactive iron was injected into a chlorotic peach tree by placing the iron in a small capsule and inserting this in a hole bored in the trunk of the tree

Lower picture: The amount of radioiron in the plant is determined by placing uniform samples of plant ash under Geiger tubes. The automatic counter records the radiations per minute received by the tube. From the data it is possible to calculate the concentration of radioiron in the tissue

Radioiron
A Tool in the Study of Chlorosis

By F. B. WANN, D. W. THORNE, and JOSEPH WOOLLEY

Farm and Home Science
the absence of chlorophyll, food production by the leaves is curtailed, the crop is reduced, and plants become weakened and frequently die.

Relation of Iron to Chlorosis

The relation of iron to chlorosis is a complex one. It has been known for many years that chlorotic plants contain iron, but many recover if supplied with more iron. In most cases the recovery obtained by such treatments is temporary, but the results indicate that chlorosis is caused by some failure in the normal iron metabolism. Until recently it was impossible to distinguish between iron already present in the plant and that supplied by treatment. Now, however, with the use of radioactive iron, it is possible to trace the movement of the added iron so that eventually a better understanding of the relation of iron to chlorosis may be obtained.

Through the years many aspects of the chlorosis problem have been studied at the USAC. Many chemical analyses for iron in green and chlorotic leaves have been made. Most of these indicate that there is little difference in total iron content of the two kinds of leaves. The iron content of the leaves varies with the plant and with the soil.

In a recent study a number of species resistant to chlorosis were grown on a high-lime soil at Logan and on a lime-free soil at Farmington. Other plants that are usually chlorotic on high-lime soils were also grown on the two types of soil. Chemical analyses at the end of the growing season revealed that the species susceptible to chlorosis contained considerably more iron in the leaves than the resistant species when grown on lime-free soil where both groups of plants were green. On the high-lime soil the susceptible species were chlorotic and contained less iron than the resistant species. The resistant species had about four times as much iron in the leaves when grown on lime-free soil while the susceptible species had nearly eight times as much. A comparison of the iron content of the leaves and the stems in relation to the soils indicated that on the high-lime soil relatively more iron remained in the stem and a smaller proportion went into the leaf than on the lime-free soil. This was particularly marked in the case of the chlorosis-susceptible species. The significance of these findings is that in the susceptible species there was a reduced absorption of iron by the plant when grown on high-lime soils and that the mobility of iron within the plant was also reduced on such soils.

Active and Inactive Iron

Some workers have concluded that iron exists in the leaf in either of two forms—"active" and "inactive"—and that chlorosis occurs when most of the iron is in the inactive condition. This assumption is based on the amounts of iron extracted from green and chlorotic leaf tissue by different solvents. Analyses of such extracts show that chlorotic leaves contain less active iron than green leaves. Just what effect high-lime soils have on the condition of iron in the plant and the resulting relationship to chlorosis are not known.

Several Factors Involved in Chlorosis

The data obtained by chemical analyses of green and chlorotic plants for total iron have not supplied an entirely satisfactory explanation for the cause of chlorosis. They indicate, however, that several factors may be involved, including a reduction in absorption of iron, a reduced mobility of iron in the plant, and a change in the "activity" of the iron in the plant. It is apparent that a better understanding of the exact function performed by iron in cell metabolism is demanded for a solution of the chlorosis problem. When iron is injected in a chlorotic plant and the plant recovers we need to know where the iron goes, how much is required to produce the observed effects, and if possible, what function the iron performs. The production of radioactive iron has provided a means of investigating certain phases of this problem.

Radioactive Iron

Radioactive substances, such as uranium, give off radiations which can be detected. The Geiger tube is probably the most familiar instrument for detecting such radiations. Several types of radiation are produced but in general they occur as a result of a particle being ejected at high speed from the nucleus of the radioactive element. Relatively few of the naturally occurring chemical elements are radioactive, but practically all of them can be made so by bombardment with high-speed particles. The atomic "pile," similar to that developed in the production of the atomic bomb, is the most useful means of producing this effect. If, for instance, a rod of iron is placed in the atomic pile and subjected to bombardment of high-speed particles ejected by this chain reaction some of the iron atoms will be hit and transformed into radioactive atoms. Upon removal from the

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pile the iron rod is dissolved in hydrochloric acid, yielding a solution of iron chloride, some of the molecules of which are "hot" or contain radioactive iron. The radioactivity of the solution is determined by means of the Geiger counter. From this determination it is possible to calculate the number of "hot" molecules present in the solution in relation to the molecules containing the ordinary or stable iron. Chemically the two kinds of iron are identical; both have the same chemical properties and both can be absorbed and utilized by plants. The two are said to be chemical "isotopes." The important difference between the two is that the radioisotope gives off radiations which betray its presence wherever it may go.

Thus, if a plant absorbs radioiron the movement of this material through the plant can be traced by means of instruments which detect the radiations. The radioiron is said to be "tagged" or is referred to as a "tracer" because it is possible to trace its movements in the organism and to distinguish between it and the stable iron which was already present in the organism. Among other "tagged" elements that have been useful in studying problems of absorption, translocation, and metabolism in both plants and animals are the radioisotopes of phosphorus, sulfur, carbon, nitrogen, and iodine.

Determining the Presence of Radioactive Iron

In order to determine the presence of radioiron in plant tissue, it is necessary to dry the tissue and then burn it in a furnace to drive off all the organic matter. The ash which remains contains the radioiron and other minerals present in the original leaf tissue. When this ash is placed in the counting chamber under a Geiger tube, the radiations from the radioiron are detected and recorded automatically by the machine. After treating a plant with radioiron a large number of leaf samples are taken at various distances from the point of application of the radioiron and at various time intervals after its application. Comparing the radioactivity of such samples gives a basis for estimating the rate and amount of movement of radioiron in the plant.

Another method of determining the distribution of radioisotopes in plants is to use a photographic film. The radiations from radioactive substances produce effects in the emulsion on the film similar to those produced by light. A photographic film is placed in intimate contact with tissue containing radioactive isotopes and is allowed to remain undisturbed in the dark for several days. It is then developed in the usual manner. The image produced on the film will reflect the exact location of radioactive material in the tissue with which it was in contact. This method is helpful in giving a general idea of the distribution of the radioisotopes in the tissue, but cannot serve to determine the exact amounts present as can be done with the Geiger counter.

Experiments With Radio-Iron

Several types of experiments, employing radioiron, are being conducted at the radiation laboratory at the USAC. In some of these, the purpose is to determine the effect of certain conditions on the absorption of iron. Plants are grown in soil to which varying amounts of lime and water are supplied in an effort to establish conditions in the root environment which will result in chlorosis in some of the plants. Radioiron is then added to the cultures and after a suitable interval of time the leaves are analyzed for iron, both total and radioactive. If radioiron is present it is apparent that absorption has occurred by the roots.

In other experiments plants have been grown in solution culture. By modifying the solution by the addition of carbonates it was possible to induce chlorosis in some of the plants. Radioiron was then added to the solutions and its absorption and movement through the plants determined.

As was mentioned earlier it has been found that chlorosis of fruit trees can be temporarily cured by the injection of iron phosphate into the trunks of the chlorotic trees. It has also been found that iron in the so-called active state is much more effective in preventing chlorosis than is iron in the inactive state.

In some preliminary experiments radioactive iron phosphate was injected into the trunks of chlorotic and green peach trees. Because of its radiations this injected iron could be detected independently of the iron that has already come into the plants through the roots. In these experiments it was found that, while only about half of the iron that had come through the roots was in the active state, almost all of the injected iron was active. This would indicate that the inactivation of iron is taking place either in the soil or else somewhere in the roots of the trees.

Iron which has been injected into the trunks of trees has been found to move to the leaves at the rate of several feet per day. The very speed of movement of this injected iron would tend to indicate that it is probably merely dissolved in the water which is moving within the tree. If such is the case, this might be one reason why the injected iron is so readily available for use in the manufacture of chlorophyll.

Further studies on the "activity" and on the rate of movement of iron in trees under different conditions will probably give much valuable information as to the manner in which the living tree uses iron. It is hoped that experiments of this sort will lead to a better understanding of the cause and nature of chlorosis so that the disease can be successfully combated in the field.

A NEW WHEAT

(Continued from page 67)

This year about 80 bushels of Brevor were grown on the Experimental Farm at North Logan as foundation seed. This seed will be distributed by the Utah Crop Improvement Association and will be used by its members for the production of registered and certified seed. Anyone interested in seed of this variety in 1952 should get in touch with the Utah Crop Improvement Association with headquarters at Logan.
Hydrogen Peroxide Has a Place in the Making of High Quality Swiss Cheese

HYDROGEN peroxide has been successfully used in treating milk for the making of Swiss cheese at the Utah Agricultural Experiment Station. The peroxide-treated milk was used in comparison with pasteurized and raw milk.

This treatment may have a place in the dairy industry especially in the manufacture of Swiss cheese. However, it would be a mistake to think that peroxide-treated milk should replace raw, heat-treated, or pasteurized milk for cheese making under all circumstances. It does not substitute for quality milk. The hydrogen peroxide treatment is another process in cheese making which is important in that it does destroy bacteria without inactivating the enzymes and at the same time maintains many of the properties of raw milk. This condition may ripen the cheese faster with a finer flavor than is generally found in cheese made from pasteurized milk. Heat-treated milk was not included in this experiment.

The improvement of body, texture, and eye formation which can be accomplished with the peroxide treatment is significant as a prospective contribution to the making of Swiss and other varieties of cheese. In preliminary batches, both cheddar and Jack cheese have been improved in body and texture by using the treatment.

Germicidal Properties of Hydrogen Peroxide

The germicidal properties of hydrogen peroxide have been known since its discovery by the French chemist, Thenard, in 1818. Its application in the preservation and manufacture of dairy products has not been generally accepted by the dairy industry or leaders in public health work principally because the addition of chemicals to foods has been frowned upon. This opposition no doubt results from the fact that most chemical germicides cannot be removed after they have destroyed the organisms present. Often, there is a residual toxic effect after chemical sterilization of food. This is not the case in the use of edible hydrogen peroxide. The purified edible hydrogen peroxide of today is unique among germicides because it can be added to a liquid food such as milk and after the effective germicidal period needed to kill the organisms present, the residual portion can be removed through the addition of catalase. This can be done quickly and completely through the chemical decomposition of hydrogen peroxide into water and molecular oxygen.

History of the Use of Hydrogen Peroxide

Beginning with the attempts of Jablin and Gonnet in 1901 to preserve milk by treating it with hydrogen peroxide, until 1940 when Curran, Evans, and Levition studied the sporocidal action of hydrogen peroxide and the use of crystalline catalase to dissipate the residual peroxide, there have been difficulties encountered because of poor qualities in the peroxide and catalase.

It was difficult for a number of years to obtain hydrogen peroxide free of the heavier metals and sulfuric acid but later electrolytic production of hydrogen peroxide gave a product of high purity. This method was used during the World War II period by Montecatini Mineral and Chemical Society at Linate near Milan, Italy. In the United States, an electrolytic method is employed to make highly purified hydrogen peroxide.

Considerable work was done in Milan, Italy, in the treating of milk for the reduction of bacteria and elimination of pathogens. Satta and Morandi were active in this program and recommended 2 cubic centimeters per liter of milk to be added at the farm or in the plant and to be left for 15 hours before using the milk.

The lack of a good catalase enzyme handicapped the use of hydrogen peroxide for many years. The new highly active enzyme will encourage a much wider use of the treatment.

Early in 1947 Armour and Company started a program involving the

By A. J. MORRIS, PAUL B. LARSEN, and J. DAROLD JOHNSON

Fig. 1. Swiss cheese made from low grade milk using raw (R), pasteurized (P), and hydrogen peroxide-catalase (H) treatments

Fig. 2. Swiss cheese made from a good grade of milk using raw (R), pasteurized (P), and hydrogen peroxide-catalase (H) treatments

A. J. MORRIS is professor of dairy manufacturing and in charge of the college creamery in addition to being assistant dean of the School of Agriculture. PAUL B. LARSEN is associate professor of dairy manufacturing, and J. DAROLD JOHNSON is a graduate student in dairy manufacturing.
use of hydrogen peroxide and catalase in cheese making under the direction of Dr. Z. D. Roundy. The main steps in this treatment of milk were used in the research reported here. Roundy found that under commercial conditions, hydrogen peroxide is capable of destroying approximately 99.9 percent of the coliform organisms in the milk and about 75 percent of the total bacterial flora.

How These Studies Were Made

The milk used in this experiment ranged in quality from rejectable to grade A. Each lot of milk was divided into three portions weighing about 700 pounds each. All milk was clarified at 95 degrees F. The first portion was used raw, the second was pasteurized (phosphatase negative), and the third vat of milk was treated with hydrogen peroxide and catalase.

The hydrogen peroxide was diluted with ten times its volume in cold water before adding to the milk at 120 degrees F. and added at the rate of 0.2 percent. The milk was held at that temperature for 30 minutes then cooled to 100 degrees F. and the catalase added at a ratio of .5 grams to 2,000 pounds of milk.

Complete dissipation of the hydrogen peroxide was checked colorimetrically using 5 cubic centimeters of a 30 percent potassium iodide solution in 10 cubic centimeters of treated milk. A natural color in milk indicated a negative test.

Three cultures were used in the manufacture of the Swiss cheese carrying the bacteria, *Lactobacillus bulgaricus*, *Streptococcus thermophilus*, and *Propionibacterium shermanii*. An average procedure was followed in the making of the cheese except that larger quantities of starter than is customary were used. The cheese was made in small cheddar cheese vats and regular cheddar equipment was adapted to the steps in the process. The curd was pressed in 20 pound Wilson hoops. After salting, the loaves were wrapped in parakote and strapped in 20 pound cheddar cheese boxes for eye development and curing.

What Happened

Little difference was found among the treatments in acidity of vat milk, whey at cutting, and whey at dipping. When the acidity was taken five hours after dipping it was lower in the peroxide cheese. In nearly every case at this point, the pH of the cheese made from the peroxide treated milk was higher than that in the cheeses made from raw or pasteurized milk.

The effectiveness of the treatment of the milk with peroxide is definitely shown by the average bacterial counts which were reduced from 304,280 per milliliter in the raw milk to 1,090 in the peroxide treated milk. Pasteurization reduced the count to 11,485. Reduction in bacterial count by hydrogen peroxide and pasteurization was 99.6 and 96.2 percent, respectively.

In 11 lots of milk of 3 vats each, the coliform count was reduced from an average of 4,339 in the raw to 10 in the pasteurized and 4 in the peroxide-treated milk. Aerobic sporeformers were reduced from 1730 to 88 and 68, respectively. In every case the anaerobic sporeformers of the raw milk were wiped out by the peroxide treatment while they were only reduced in the pasteurized milk. This may be the reason that in fig. 1, showing the effects on rejected milk, we got complete freedom of undesirable gas production in the peroxide milk cheese while in the pasteurized, we frequently got undesirable gas production. It is suggested that pasteurization does not kill all the anaerobes while peroxide is lethal in its effect on them.

Generally eye development was superior in cheese made from peroxide-treated milk. Eighty percent of the treated cheese was grade A, while only 20 percent of the raw, and none of the pasteurized milk cheese was grade A. None of the peroxide-treated cheese graded lower than B on eye formation. This unique quality is illustrated in fig. 1 and 2.

Generally flavor, body, and texture were superior in the hydrogen peroxide-treated cheese when compared with the raw and pasteurized products. The average body and texture score was 18.7 for the raw milk cheese, 18.3 for the pasteurized, and 19.6 for the treated.

The average flavor score of the cheese made from hydrogen-peroxide-treated milk was 34.3. The average flavor score of the raw and pasteurized milk cheese was 33.4 and 32.7, respectively.

Possibilities for Commercial Use of Hydrogen Peroxide

From the results of this study it would be a mistake to conclude that the hydrogen-peroxide-catalase treatment should replace pasteurization or that it is a cure-all for quality improvement. It is another approach to better quality and control in dairy products. In addition to the destruction of bacteria, the treatment offers an avenue to control partially selection of types of organisms for specific uses. It is important that in the destruction of bacteria with peroxide, the milk retains many of the properties and enzymes of raw milk. It gives another type of control of body and texture of cheese.

The manipulation of concentration of hydrogen peroxide and catalase in treating milk along with variation in temperature and time of treatment gives a wide range of application.

Before the hydrogen peroxide treatment can be used by the dairy industry, it must be approved by the U. S. Public Health Service and the U. S. Food and Drug Administration and other health protection agencies. This, of course, will require more proof of the harmlessness of the treatment and its effectiveness in destroying pathogens. The purity of the peroxide and the catalase must be standardized and protected. Regulations and tests will need to be developed to control the application and results of the treatment.

Farm and Home Science
Rats Demonstrate the Value of an Adequate Diet

CLASS demonstrations with rats have convinced girls studying foods and nutrition at USAC that a planned diet of three or even four meals a day containing foods from the basic food groups produces better health, growth, and general condition than the rather sketchy schedule of no breakfast, a few snacks during the day, and a heavy dinner that many of them were following.

Although they read in their nutrition books that a quart of milk, an egg, at least one serving of meat, poultry, or fish, green or yellow vegetable, a vitamin-C-rich food, potatoes, cereals, and butter or margarine were all part of an adequate diet, many of the girls were indifferent and did not apply their knowledge to their own diet. Hence a demonstration was planned to show the results of various diets on the growth of rats, animals that respond to food intake much as do human beings, but whose growth rate is much more rapid.

Rats Become Irritable on Snacks

In the first demonstration a snack diet, such as eaten by many students, was fed to a group of three-week-old rats. This diet included soft drinks, chocolate candy, cup cakes, cookies, white bread, and apples. The rats were allowed to eat all that they wanted of these foods. A second group of rats of the same age was given a diet containing foods used in good lunches. These included milk, vegetables, apples, peanut butter or meat, white and whole wheat bread.

Dramatic results were obtained with these diets within three weeks. The rats fed the snack diet had gained only 4 grams as compared to 68 grams for those on the lunch diet (fig. 1). The rats on the snack diet were nervous and irritable and their fur was rough and unkempt looking instead of being soft and shiny. If one handled these snack-fed rats, the poor muscle tone was evident when compared to the well-fed rats. (Compare rats in picture above)

Diets for Entire Day Compared

While this demonstration was interesting and impressive, the students felt that it did not answer their questions because most of them did not substitute snacks for all three meals. They thought that the poor or inadequate diet should include foods more typical of what many people eat during an entire day. Such a diet could then be compared with a well-balanced diet.

Many people love rich, sweet desserts and are not particular whether they have vegetables, fruits, and milk. For example, one might find the following menus used: a breakfast consisting of oatmeal and top milk, buttered toast, and coffee; a dinner of pot roast of beef, potatoes, gravy, white bread and butter, and apple pie, and a supper of navy beans or cold meat, warmed over potatoes, bread and butter, pickles, fruit sauce, and cake.

DR. ETHELWYN B. WILCOX is professor of foods and nutrition, and is a member of both the teaching and research staffs.

Fig. 1. Gain in weight of rats fed snack and good lunch diet for three weeks

Fig. 2. Gain in weight of rats fed three diets for four weeks

THESE FOODS ARE ESSENTIAL TO THE WELL BALANCED DIET

- Leafy, green, and yellow vegetables
- Citrus fruit, tomatoes, or other high vitamin C foods
- Potatoes, sweet potatoes
- Other vegetables and fruit
- Milk, cheese, ice cream
- Meat, poultry, fish
- Eggs
- Dry beans and peas, nuts
- Flour, cereal, baked goods
- Fats, oils

for December 1951
The foods selected for the rats as representative of this day's menu in the second demonstration were meat, potatoes, butter, white flour, rolled oats, navy beans, apples, lard, and sugar. These foods included all the ingredients of the foods in the menus above (diet 1). To improve this diet, enriched white flour was substituted for the unenriched flour and fruits and fresh vegetables were added (diet 2). To a third diet, enriched flour, milk, vegetables, fruits, and eggs were added. The three groups of rats were selected from litter mates and were the same size when placed on the three diets. They were allowed to eat all that they wanted of the diet.

**Striking Differences in Growth**

Striking differences in growth and appearance in the three groups of rats on the three diets could be seen at the end of four weeks. Poor growth, a rough hair coat, and poor muscle tone were observed in the rats fed the basic inadequate diet (diet 1). They gained an average of 55 grams in the 4 weeks (fig 2). The addition of vegetables, fruits, and enriched flour somewhat improved the rate of growth and the appearance of the rats. These rats gained 50 percent more than the rats on diet 1, or an average gain of 77 grams. In comparison, the rats on diet 3 gained 161 grams. This was 173 percent more than rats on diet 1 and 123 percent more than those on diet 2. The rats on diet 3 showed normal growth, and had good muscular development and sleek, shiny coats.

Such evidence demonstrated to the students the facts that have been proved by years of research in human nutrition.

**AGRICULTURAL OUTLOOK**

*(Continued from page 68)*

![Graph of Agricultural Production](image)

Fig. 2. The trend in crop production in Utah from 1924 to 1934 was downward. From the low period in 1934 to 1951 the trend has been upward. Production in 1951 was 33 percent above the prewar period. Livestock production in Utah has increased since 1924. In 1951 production is 52 percent above prewar.

Costs are to a minimum. With the favorable outlook for agricultural prices and assuming normal precipitation and growing conditions in Utah, the indications are for agricultural production next year to exceed even that in 1951.

A continuation of the defense program in 1952 will further reduce the efficiency and supply of farm labor. Agricultural labor will be both scarce and high priced. It is a time when modern farm machinery and family labor should be fully utilized. Like farm labor, farm supplies used in production will also be scarce and high priced. For protection it is a good time to buy for future needs. Control of needed feed supplies is also good business. Prices of feed grains and forage are relatively low compared to meat prices; hence, a liberal feeding program of livestock will pay.

During this period of shifts to production for defense resulting in changes in availability of goods for domestic and foreign markets, there will probably be a wide variation in prices of various farm commodities and in economic positions of some farm enterprises and agriculture in different areas. The present economic situation in this country and in the world is in such a position that major changes may take place that will greatly change or affect the economy of the country. Under such conditions farmers should be cautious and plan programs on the basis of a war economy.

**Production Analysis**

The staff at the Utah State Agricultural College in cooperation with the United States Department of Agriculture and other federal agencies has just completed a study of agricultural production in Utah for 1952 (tables 1, 2, 3). This analysis shows the production of each crop and kind of livestock for 1952 that is attainable with favorable prices and normal weather conditions. The purpose of this analysis was to attempt to determine for 1952 the agricultural production for Utah as a part of a
If the program proposed for 1952 is attainable, the agricultural production will be 43 percent above the pre-war period and 7 percent above 1951.

This report is the first phase of a more comprehensive analysis of the agricultural productive capacity that is being sponsored by the United States Department of Agriculture, jointly with the land grant colleges. Similar work is being done in every state of the Union. The basic objective is to determine as nearly as possible the total production that can be achieved by 1955, together with an analysis of the requirements for obtaining that total production.

HALOGETON RESEARCH

(Continued from page 71)

determine which species and which intensity of seeding would best crowd out halogeton. When the grass is established, sheep will be grazed on these plots to determine which offers the best and safest alternate feed for livestock.

Second, halogeton was collected in large amounts, ground up, and pelleted with molasses so it would be palatable to livestock. A number of sheep will be fed these pellets in different amounts with and without other range forage. Each animal will be hand-fed a weighed quantity of halogeton each day throughout the winter. This will determine how much halogeton can be eaten without killing the animal when other forage is being consumed too. Also it will show whether small amounts of halogeton can be consumed over long periods of time without killing the animal and without reducing gain, wool yield, or lamb crop. Sheep are now being fed these pellets on the range.

Third, several woven-wire paddocks have been constructed on the range (fig. 3). These enclose about five acres of land and are movable. They are now stocked with small groups of sheep which graze under close observation. During the next seven months, these pens will be moved about at intervals approximating a week, so that the sheep will graze on all possible combi-

national production program during the emergency period.

This study was based on the assumptions that industrial employment, demand for food and fiber, and national income would be high next year, and that farm prices would be relatively favorable. In this analysis, the availability of labor and materials used in production as well as prices and demand for each individual commodity were taken into consideration.

For December 1951
nations of forage, such as halogeton and sagebrush, halogen and saltbush, and halogeton and white sage. On these experimental areas halogen will be present in different amounts. For example, the forage may be 75 percent sagebrush and 25 percent halogen, another time it may be 50 percent sagebrush and 50 percent halogen, another may be 25 percent sagebrush and 75 percent halogen. In addition, tests will be conducted with and without drinking water, and with and without salt.

These tests will be continued throughout the fall, winter, and spring grazing season to study the effect of time of year on the tendency of animals to eat halogen and to see just which range conditions are safe and which are dangerous to livestock. Animals will be observed closely to determine when they eat halogen and how much is consumed when other species are present as an alternate feed supply.

In cooperation with the Veterinary Science Department and the Nutrition Laboratory, studies will be made of the physiology of animals grazing halogen. This will include periodic blood sampling to detect changes in blood calcium content, known to indicate oxalate poisoning. Also, sections will be made of the liver and kidney of all dead animals and also of selected animals that survive the halogen feeding. These studies will aid in determining the exact nature of halogen poisoning and will measure possible permanent internal injury not involving death. They also may aid in developing a prevention or cure for poisoning.

There is every reason to hope and expect that these studies will show ways in which Utah's livestock can safely graze on halogen ranges. There is no reason to fear that halogen threatens the livestock industry with destruction. Its rapid spread and wide adaptation to dry and salty soils do make knowledge of this potentially dangerous plant of great importance to livestock operators. The practical solution of such problems is the purpose of your Agricultural Experiment Station.

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- Grants give added support to research on turkey diseases
- A new wheat for fall planting on irrigated land, by D. C. Tingley
- Smoke generators appear of little value for raising orchard temperatures, by S. W. Edgecombe, R. K. Gerber, and O. D. Kirk
- Research will attempt to give definite answers to questions on halogen poisoning, by L. A. Stoddart and C. W. Cook
- Radioiron, a tool in the study of chlorosis, by F. B. Wann, D. W. Thorne, and J. Woolley
- Hydrogen peroxide has a place in the making of high quality Swiss cheese, by A. J. Morris, P. B. Larsen, and J. D. Johnson
- Rats demonstrate the value of an adequate diet, by E. B. Wilcox

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**CONTRIBUTIONS TO RESEARCH August 15 to November 15, 1951**

<table>
<thead>
<tr>
<th>Utah Bankers Association</th>
<th>$1500 for research on leg weakness in turkeys (staphylococcus)</th>
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<tr>
<td>Utah Turkey Federation</td>
<td>$1200 for research on leg weakness in turkeys (staphylococcus)</td>
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<tr>
<td>Charles Pfizer &amp; Co. Inc. New York City</td>
<td>Terramycin valued at about $250 for research on control of animal diseases</td>
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<td>U. S. Gypsum Company Nephi, Utah</td>
<td>2 tons gypsum for use in study of alkali soils</td>
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<tr>
<td>Charles Rudd &amp; Co. Salt Lake City</td>
<td>20 bags of Chickbed nesting litter</td>
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<td>Modern Magnesium Products, Inc. New York City</td>
<td>Magnesium orchard ladders</td>
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<tr>
<td>Spokane Tent &amp; Awning Co., Spokane, Washington</td>
<td>12 feet Waterbury bruiseless fruit icing tube</td>
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<td>Stark Brothers Nurseries Louisana, Missouri</td>
<td>72 pears</td>
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<td>Lins Gladiolus</td>
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<td>Island Gladiolus Gardens Victoria, British Columbia</td>
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<td>Lasch Bulb Farm New Albany, Indiana</td>
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<tr>
<td>John Bastian</td>
<td>12 gladiolus bulbs of new varieties</td>
</tr>
<tr>
<td>Grant's Pass, Oregon</td>
<td>Collection of bulbs of 16 new lily varieties</td>
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<tr>
<td>Winston Roberts Boise, Idaho</td>
<td>15 dwarf apple grafts</td>
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<td>Oregon Bulb Farms Gresham, Oregon</td>
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<td>Wheelock Wilson Nursery Marshalltown, Iowa</td>
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*Farm and Home Science*