More Than Half of Utah Chickens Marketed Through Cooperatives

By ROICE H. ANDERSON AND GLENN E. DOWNS

Utah is unique among states in the importance of cooperative associations in the marketing of poultry products. A recent study by the authors reveals that 62 percent of the chickens sold from Utah farms found their way to market through cooperative processing plants. The varied channels through which Utah chickens found their way from the producer to the consumer in 1949-50 are shown in fig. 1.

Market Channel

In its simplest form the market channel for Utah chickens was from producer to assembler to processor to wholesaler to retailer to consumer, but careful study of fig. 1 shows many variations of this route. The function of assembly, for instance, was performed by many different firms or individuals. Most important of these were the commission buyers who purchased for cooperative processors and were really employees of the cooperative, being paid a commission on the chickens delivered rather than a salary or wage. In 1949-50 these buyers purchased and delivered to the cooperative processors about half of the chickens marketed in the state. The assembly function was performed by producers for about 16 percent of the chickens. About 12 percent of these were delivered to cooperative processors and 4 percent to independent processors. Another 16 percent of the chickens were purchased from producers by hucksters, who are independent operators buying from farmers and selling to independent processors. Company buyers, who were owners or employees of the independent processing plants, purchased about 7 percent of the total chickens direct from farmers.

Cooperative associations processed two thirds and independents one third of those chickens which were plant processed. About 7 percent of the total were sold direct from producer to consumer, and were processed either on the farm or by consumers.

As with assembly the wholesaling was performed by several firms. More than two thirds of the chickens processed by cooperatives (about 42 percent of the state's total) were sold to retail stores and restaurants, the wholesaling function being performed by the cooperatives. Independent wholesalers handled only 44 percent of the chickens marketed in Utah and they obtained an approximately equal

(Continued on page 65)

Fig. 1. Channels of distribution for chickens in Utah, 1949-50

DR. ROICE H. ANDERSON is associate professor of agricultural economics. GLENN E. DOWNS was awarded the master of science degree in agricultural economics last June. The research reported in this article was part of a regional study in marketing of poultry.
Fay Moser, research chemist, determines the color of an ear of sweet corn by the use of the Hunter color and color difference meters.

The processing of sweet corn by both canning and freezing is becoming increasingly important in the Intermountain Area. In the handling of this crop as with any other processing crop, it is essential that it be harvested at the proper stage of maturity if an acceptable pack is to be obtained. While all available data indicate that the quality of the processed product is closely correlated with maturity, more information is needed on the relation between stage of maturity, yield, and quality. Also it should be determined which of the tests now available would be best suited for measuring the stage of maturity of the raw product.

To study the effect of stage of maturity on yield and quality of sweet corn the Utah Agricultural Experiment Station has entered into a contract with the Western Regional Research Laboratory of the U. S. Department of Agriculture at Albany, California, whereby the Experiment Station has agreed to furnish the equipment and facilities for the production and processing of sweet corn and the Western Regional Laboratory will finance the processing and testing of the raw and processed product. The corn will be processed by both canning and freezing.

Measures of quality being used on the raw sweet corn are (1) moisture as measured by the Steinlite moisture meter, Makower test, and the calcium carbide method, (2) expressed juice as determined by the succulometer, (3) the refractive index of the expressed juice, (4) alcohol insoluble solids, (5) reducing and total sugar, (6) percent pericarp, (7) color as determined by the Hunter color and color difference meter. Somewhat similar tests will be made on the processed corn.

In addition, subjective appraisal tests will be made on the frozen and canned samples from each harvested plot.

The Experiment Station has installed a new research laboratory at the Farmington Field Station where tests of the raw samples can be made. This laboratory will be used for other research projects in addition to the sweet corn project.
Thin stands in winter wheat, a result of winter killing, are causing serious losses to Utah wheat producers.

Winter Killing
The Cause of Serious Losses in Fall Sown Wheat

By D. C. TINGEY

Loss in stands in fall-sown wheat through winter killing, with the resultant reduction in yield, is causing serious losses to Utah wheat producers. Many factors contribute to these poor stands, collectively they are often referred to as winter killing. The amount of winter killing varies from year to year and from place to place. It may be light to severe and from spotted to a complete destruction of all plants in a field. Where most of the plants disappear, the fields are replanted to spring wheat or are abandoned and continued another year in fallow. A slight loss of plants is not serious since there are usually more plants emerge than the soil and moisture conditions can support. A more serious condition results where a considerable loss of plants occurs, so that those wheat plants remaining are not able to make up the difference in yields. Either the field must be replanted in the spring with the added expense and the possibility of crop failure through drought or the thin stand left with resultant reduced yields.

Some winter killing occurs every year but it has been unusually severe in some areas during the last two years. The winter wheat crop in Utah this year is the poorest in many years. A combination of winter killing, drought, and disease is responsible.

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JULY 1 the heads of two of the major departments of the School of Agriculture relinquished their administrative duties, Dr. W. Preston Thomas of the Department of Agricultural Economics and Dr. B. L. Richards of the Department of Botany and Plant Pathology. Both men will continue their research and teaching on a part-time basis. Dr. Thomas was succeeded as head of the Department of Agricultural Economics by Dr. George T. Blanch who has been a member of the department since 1934. Dr. Frank B. Wann became head of the Department of Botany and Plant Pathology. He has been a member of the faculty in botany since 1926. These men have each written a brief summary of the contributions made by their predecessor in office.

W. P. Thomas

When Dr. W. P. Thomas retired as head of the Department of Agricultural Economics it brought to a close 24 years of outstanding leadership and service in this position. During that time the direction and welfare of the department was his primary interest. Even when on short leaves from College service to pursue further training or to work on other programs he gave considerable attention to the work of his department. As a result of his constant devotion and fine leadership he leaves a record of which he can be justly proud.

Dr. Thomas obtained a B.S. degree from the USAC in 1914 with a major in agronomy. A year later he became the first county agricultural agent in Weber County. He served in that capacity until 1925 when he left to obtain additional training at Cornell University. In 1926 he obtained an M.S. degree in agricultural economics and joined the Utah Agricultural Experiment Station staff to do research work in marketing. Some years later he was awarded a doctor of philosophy degree at Cornell. In 1928 the present Department of Agricultural Economics was organized with Dr. Thomas as head and with one other staff member. Since that time there has been constant growth in the number of the department staff and in the responsibilities they have assumed. Almost from the beginning the department has carried on a program of resident teaching, research, and extension teaching.

The students who have graduated under the direction of Dr. Thomas have made outstanding records. More than 10 percent of the total number have continued on at other schools where they have obtained PhD degrees. An additional 10 percent have obtained M.S. degrees either at this or other institutions. At present his students may be found in positions of high responsibility in nearly all parts of the world, some in educational work, some in government service, some as employees of private industry, and others self-employed as managers of their own farms or other businesses. Hundreds of other students, not majors in his department, have been stimulated and influenced by the practical, common-sense teaching of Dr. Thomas.

During his years of service, Dr. Thomas has become intimately acquainted with many agricultural leaders in Utah. He has acquired a profound knowledge of the basic agricultural problems of the state and has done much through his research and leadership to alleviate the problems. He is particularly well known for his work in the fields of agricultural prices, agricultural cooperatives, and in water resource development. He has headed many committees working in these areas. His opinions and advice have been widely sought and freely given.

Although Dr. Thomas is retiring as head of the department, he will continue to serve students and the public. He will continue as a member of the department staff on a half-time basis doing some teaching and research and counseling with other staff members on their problems—George T. Blanch.

B. L. Richards

After more than 40 years' association with the Utah State Agricultural College, Dr. Bert Lorin Richards resigned as administrative head of the Department of Botany and Plant Pathology to become emeritus professor in the department. His long

(Continued on page 71)
Leaf Crinkle Most Widely Distributed of Diseases of Sweet Cherry in Utah

By B. L. RICHARDS

Leaf crinkle is one of the most widely known and generally distributed diseases of the sweet cherry. The disease has been reported from California, the Pacific Northwest, from the Intermountain states, and from British Columbia. It has become especially well established in Utah and must be considered one of the most serious diseases affecting the sweet cherry in the state. It appears to be on the increase in many Utah cherry growing areas.

While our knowledge about cherry leaf crinkle is far from complete, enough is known to indicate that the disease probably is not contagious, and therefore, losses and continued spread of the disease are unnecessary and can be prevented. Cherry leaf crinkle can be effectively controlled. Control is essentially a nursery problem.

History and Distribution of Crinkle Leaf in Utah

Cherry leaf crinkle was first recognized in Utah in 1938, although it had been reported in California and Oregon as early as 1930. Surveys in Utah over the years from 1938 to 1944 showed the disorder generally distributed throughout the cherry growing areas in Box Elder, Weber, Davis, Salt Lake, Utah, and Washington Counties. The incidence and percentage of this disorder in the five counties are given in table 1. Subsequent to 1944 the disease had been found in Grand, San Juan, and Cache Counties.

In the surveys during 1944 all sweet cherry varieties were included. Had only Bing and Black Tartarian plantings been studied the percentage would have been appreciably higher. Data in table 1 show that the average incidence of crinkle in Washington County was vastly higher than in any of the other 4 counties. The fact that most of the plantings in the county were made with stock from the local nursery possibly provides the real explanation for this difference.

Fig. 1. Upper. Healthy Bing leaf at left, three leaves to right with mottling and distortion typical of crinkle leaf. Lower. Black Tartarian leaves—three to left showing crinkle leaf effects—mottling more subdued than in Bing. Leaf to right healthy
Research on Effects of Fluorine Compounds on Plants and Animals Being Conducted by Station

By D. A. Greenwood

As more industries locate in Utah air pollution from gases containing compounds of arsenic, fluorine, and sulfur becomes increasingly important from an agricultural standpoint. A few years ago the Station published the results of a study on arsenic poisoning of bees as a result of smelter fumes and insecticides. Recently several requests have been received for information relating to the distribution of fluorine compounds in nature and their effect on plants and animals. At present the Utah Station is engaged in comprehensive studies of the effect of fluorides on plants and animals. The results of these studies will be published.

Dr. Delbert A. Greenwood, professor of chemistry, is project leader of the research to determine the effect of fluorides on plants and animals. This is a cooperative project among a number of departments of the Station. Dr. M. C. Cannon and H. M. Nielsen are other members of the Department of Chemistry working on the project. Dr. F. B. Wann and Dr. B. L. Richards represent the Department of Botany and Plant Pathology. Dr. W. Binns and Dr. M. L. Miner the Department of Veterinary Science, Dr. L. E. Harris the Department of Animal Husbandry, G. Q. Bateman the Department of Dairy Industry, and Dr. D. W. Thorne the Department of Agronomy.

Distribution of Fluorine Compounds

Fluorine is a gaseous chemical element of the halogen family having greenish yellow color. It is extremely toxic to plants and animals. Other common members of the same family are chlorine, bromine, and iodine. These elements are so active chemically that they are found only in combination with other elements in nature. Common table salt represents a compound formed by the union of the elements chlorine and sodium. Fluorine unites with sodium, calcium, aluminum, and other elements to form fluorides. Fluorine compounds are widely distributed in nature. The principal fluorine containing minerals which are used in large industrial

Fig. 1. A typical case of fluorine poisoning in cattle showing a rough dry coat with a tight skin and emaciated appearance. The knee, hock, and pastern joints are greatly enlarged and the cannon bones are thickened.

Fig. 2. Leaves of Chinese apricot showing various stages of "scorch"
processes are: fluorite or fluorspar (CaF$_2$), cryolite (Na$_3$AlF$_6$), apatite (3 Ca$_3$ (PO$_4$)$_2$, CaF$_2$), and sedimentary phosphate rock.

Fluorspar is used extensively as a flux in the smelting of many metals and in the ceramic industries. Cryolite is important in the manufacture of aluminum by the widely used electrical process. Apatite and sedimentary phosphate rock are used in the manufacture of superphosphates, and phosphorus. Fluorine compounds are liberated by these industries unless equipment is installed to collect them. There is an expansion in the use of fluorine compounds in different industries and in the treatment of certain public water supplies in the United States to help control dental caries.

Effects on Plants

Excessive concentrations of fluorine compounds, such as hydrogen fluoride and silicon tetrafluoride, produce symptoms on certain plants which resemble the scorch caused by fire; hence the name "leaf scorch" has been used to describe the condition. Starting as a thin band across the tip or along the margins of the leaf, the brown scorch area develops inward. In severely injured leaves only small areas around the bases of the mid-

Fig. 3. Incisor teeth of cattle. Left, animal between five and six years of age, incisor teeth normal. Note smooth ivory appearance and shovel shape. Center, animal between five and six years of age, note dull chalk-like appearance and definite staining of the second, third, and fourth pairs. Fourth pair shows marked wear and roughness of enamel. Right, animal between five and six years of age. All teeth show definite wear. First pair shows excessive wear with marked erosion of enamel.

Fig. 4. Molars and premolars of animals 4 and 5 years of age. Left, all teeth appear normal with an even table surface and sharp cutting edges. The light brown color is caused by feed staining. Right, note uneven table surface and excessive wear making the teeth rounded on cutting surface with a black stain from excessive fluorine.

Fig. 5. Metacarpal bones. Left, animal between 4 and 5 years of age. Bone is normal, fluorine content 675 ppm. Right, animal 2½ years of age. Note increased size of bone, the marked exotosis and roughness over the center area and at the two ends near the articular cartilage, fluorine content 6983 ppm.

(Continued on page 69)
Canning Peas
An Excellent Crop to Intensify Utah’s Irrigated Crop Production

By LYNN H. DAVIS

Canning peas are maintaining their position as a relatively high income crop on farms in Utah despite the fact that the acreage is declining. In a recent study at the Utah Agricultural Experiment Station, total receipts from the enterprise in 1951 averaged $175 per acre which was adequate to pay all costs and leave a net return of $58 per acre. Add to this return the 5 percent interest that was charged on the investment amounting to $22, the return to the farm family for its labor, capital, and management was $102 for each acre of canning peas.

Canning peas offer a means of intensifying production and can be included to advantage on many of Utah’s irrigated farms. They do not require a large investment in specialized equipment since they are planted with a grain drill and are generally harvested with the same equipment that is used to harvest hay crops on the farm. They may be produced with little additional labor other than that supplied by the farm operator and his family.

Production Costs

Following the completion of the 1951 crop year a survey was made in Cache and Box Elder Counties to obtain cost and return data. Ninety-two records were obtained by the survey method from canning pea growers and the records were summarized to give averages for the two county area. Average production cost per acre was $117 (table 1) while receipts, which included a value of $11 per acre for pea vine silage, were $175 leaving a difference of $58 per acre which may be referred to as net return from the enterprise.

Of the various cost items the cost of materials was the largest group of costs and accounted for a third of the cost of producing canning peas. The cost of seed which averaged $27 per acre accounted for 23 percent of total cost. The cost of fertilizers was the next largest item accounting for 9.4 percent of total cost.

LYNN H. DAVIS is research assistant in agricultural economics.

Fig. 1. Upper. Field of peas ready for harvest
Fig. 2. Cutting peas with mowing machine with curlers attached to cutterbar
Fig. 3. Loading the cut peas with hydraulic loader for hauling to the viner station
Fig. 4. Unloading peas at the viner with the conveyor and stack of vines in the background

Farm and Home Science
Overhead costs were second in importance as a group. Interest charges for operating capital and capital investment, taxes, and miscellaneous overhead costs make up the total overhead costs. Interest on capital investment was $21 per acre which represents a charge of 5 percent interest on a $420 investment. The average value of farm land as estimated by the farm operators was $408 per acre. Buildings and horse-drawn equipment constitute the remaining $12 of capital investment as calculated. Interest on capital was the largest of the overhead cost group accounting for 18 percent of the total cost of production.

Labor cost was the next most important cost factor accounting for 21.4 percent of total cost. The average labor requirement was 24.6 hours per acre. This represents the average amount of man-labor required to perform the operations of preparing the land, planting and growing the peas, and harvesting the crop. The average labor cost was $25 per acre with approximately a fifth of total labor cost being supplied by the grower and his family.

Power and machine costs constitute the remaining group of costs and were approximately a fifth of total cost. Power and machine costs include the cost of tractor, truck, and horse power. Tractor power was used to some extent on all enterprises. Horse power was absent or insignificant on most of the enterprises studied.

Table 1. Cost of producing canning peas in Cache and Box Elder Counties, Utah 1951

<table>
<thead>
<tr>
<th>Cost item</th>
<th>Average per acre</th>
<th>Percent of total cost</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Material costs:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manure</td>
<td>tons</td>
<td>5.4</td>
</tr>
<tr>
<td>Commercial fertilizer</td>
<td>lbs.</td>
<td>87.4</td>
</tr>
<tr>
<td>Seed</td>
<td>bu.</td>
<td>4.4</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>38</td>
</tr>
<tr>
<td><strong>Overhead costs:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Int. on money in crop</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Int. on cap. investments</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Land taxes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water and drainage taxes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fees</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Misc. overhead</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>31</td>
</tr>
<tr>
<td><strong>Labor costs:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operator &amp; family</td>
<td>hrs.</td>
<td>21.8</td>
</tr>
<tr>
<td>Hired</td>
<td>hrs.</td>
<td>2.8</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>25</td>
</tr>
<tr>
<td><strong>Power costs:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tractor</td>
<td>hrs.</td>
<td>12.3</td>
</tr>
<tr>
<td>Truck</td>
<td>hrs.</td>
<td>3.1</td>
</tr>
<tr>
<td>Horse</td>
<td>hrs.</td>
<td>3.3</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>23</td>
</tr>
<tr>
<td>Grand total</td>
<td></td>
<td>117</td>
</tr>
</tbody>
</table>

Total Receipts

Total receipts, which averaged $175, were calculated by adding the value of the pea vine silage to the value of the shelled peas. The average value of the vines as silage was $11 per acre. The value of the shelled peas was $154 which represents the average value of 1.75 tons of shelled peas per acre in 1951.

The price range for shelled peas in 1951 was from $1.50 to $2.60 per ton for number 1 grade to $6.00 per ton for number 12 grade. The grade of peas was established by tenderometer readings. The average price paid growers according to the study was $93.75 per ton which is the price for approximately a number 7 grade of shelled peas.

Factors Determining Success

The records were analyzed to determine the association of various factors such as size of enterprise, yield of shelled peas, and grade of peas delivered, with success measured by net returns per acre.

There was no consistent association between size of the enterprise, as measured by the number of acres, with net returns. While size of enterprise was not a major factor in determining success in the canning pea enterprise there was a tendency for the larger enterprises to use less man-labor per acre. To the extent that man-labor was not replaced with machine labor on the larger enterprises there resulted lower production costs which increased net returns.

Tons of shelled peas produced per acre appeared to be the most important single factor affecting success. There was a consistent increase in net returns as yield per acre increased (fig. 5). As yield increased the increase in receipts was more than the increase in costs. With the exception of harvesting costs, costs remain relatively constant between low and high yields.

Closely associated with yield is the grade of peas harvested. Peas become less tender and they gain in weight with maturity. The problem of the farm operator is to decide at which grade and weight of peas he will make the greatest profit. Net returns increased as grade number increased through 5 and then decreased. This indicates that farmers whose peas averaged near grade number 8 made greater net returns per acre than did those who produced the extreme high or low grades of peas.

Balanced performance is important
Two important discoveries made by research scientists within the last five years are proving of tremendous importance to poultrymen and swine growers. In 1948 a red compound, named vitamin $B_{12}$, was isolated from liver by research chemists in this country. This vitamin was shown to be the long sought for antipernicious anemia factor in liver. It also proved to be the principal factor responsible for the activity of APF, a substance associated with animal proteins and required by poultry and swine.

Vitamin $B_{12}$ is synthesized by a large number of microorganisms including those that produce the well known antibiotics used so widely in medical practice. In 1949, Jukes and Stokstad from Lederle Laboratories tested in the ration of chicks an aureomycin fermentation product containing vitamin $B_{12}$. They noticed an increased growth response in excess of that normally expected from vitamin $B_{12}$. This increased growth was attributed to some auxiliary growth factor contained in the fermentation product. Research scientists at other experiment stations soon obtained similar results with turkeys and pigs. In March of 1950 the substance causing the increased growth was shown to be the antibiotic, aureomycin. Jukes and Stokstad from Lederle Laboratories procured the evidence by feeding crystalline aureomycin in the ration of poultry. Cunha and co-workers at the Florida Agricultural Experiment Station obtained concurrent evidence by feeding the crystalline product in the ration of swine. Following these discoveries other antibiotics have been tested with favorable results. Among them are penicillin, terramycin, bacitracin, and streptomycin. Since these discoveries were made, both vitamin $B_{12}$ and various antibiotics have found widespread use in commercial swine and poultry feeds. In 1951 approximately 15,000,000 tons of antibiotic-containing feeds were fed in this country.

HYRUM STEFFEN is associate professor of animal husbandry. He is in charge of the research on swine. The aureomycin used in the swine rations was given to the Station by the Lederle Company.

**Antibiotics**

Beneficial in Rations of Growing and Fattening Pigs

By Hyrum Steffen
plements containing vitamin B₁₂ and antibiotics, either in combination or separately, are now available. Those containing B₁₂ are officially called vitamin B₁₂ supplements. The ones supplying antibiotics are called antibiotic feed supplements. Various trade names are also in use.

Value of Antibiotics in Typical Utah Swine Rations

Most of the experiments testing the value of antibiotics for swine have been made in rations containing corn which are typical for the Middle West. Few tests have been reported with rations composed principally of small grains such as barley and wheat. For this reason the Utah Station considered it important to procure additional information on the value of both vitamin B₁₂ and aureomycin in typical Utah swine rations.

During the winter of 1951-52, 24 pigs were assigned by chance to 4 different treatments as follows: Treatment 1 consisted of a ration of soybean oil meal, barley, wheat, alfalfa meal, bonemeal, limestone, and salt. Treatment 2 was the same as 1 except that 0.5 pound of a supplement containing B₁₂ and aureomycin was substituted for an equivalent weight of barley in each one hundred pounds of ration. The supplement furnished 0.9 gm. of aureomycin and 0.9 mg. of vitamin B₁₂ per hundred pounds of feed. Treatment 3 was also the same as 1 except that 0.22 pound of a vitamin B₁₂ supplement was substituted for an equivalent weight of barley. This supplement furnished the same amount of vitamin B₁₂ as was supplied in treatment 2 but it contained no aureomycin. Treatment 4 was a ration composed of meat scraps, barley, wheat, alfalfa meal, salt, and limestone. Each ration was designed to meet the requirements of the National Research Council standard for growing-fattening pigs. The pigs receiving each treatment were fed individually to permit statistical analysis of the resulting data. Records were kept of their weights and feed consumption. Carcass data were also procured. The results of the experiment are shown in table 1.

Table 1. Summary of 1951-52 swine feeding tests

<table>
<thead>
<tr>
<th>Treatment number and ration</th>
<th>1 Soybean oil meal ration (basal)</th>
<th>2 Basal B₁₂ aureomycin</th>
<th>3 Basal plus B₁₂</th>
<th>4 Meat scraps ration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Items compared</td>
<td>No. of pigs</td>
<td>Avg. initial weight, pounds</td>
<td>Avg. final weight, pounds</td>
<td>Days on test, days</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>37</td>
<td>210</td>
<td>128</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>37</td>
<td>210</td>
<td>104</td>
</tr>
<tr>
<td></td>
<td>5*</td>
<td>38</td>
<td>211</td>
<td>115</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>39</td>
<td>210</td>
<td>121</td>
</tr>
</tbody>
</table>

*Originally 6 pigs. One pig became paralyzed and was removed from the experiment.

Antibiotics Produced More Rapid Gains

The pigs receiving treatment 1, the basal ration, made approximately the same daily gain as those on treatment 4. They required slightly more feed for each 100 pounds of gain. Although they remained in good health throughout the test, their hair coats were duller and their gains less uniform than those of pigs receiving the other treatments. It required a week longer for them to reach a market weight of 210 pounds than it did the pigs on treatment 4 receiving meat scraps. It appears the deficiency in treatment 1 was vitamin B₁₂ rather than quality of (Continued on page 68)

Fig. 2. Carcasses from pigs fed aureomycin and B₁₂ supplement were fatter (upper) than were carcasses from pigs fed a ration composed of meat scraps, barley, wheat, alfalfa meal, salt, and limestone (lower)
Cooperation Between Beekeepers and Alfalfa Seed Growers Can be Profitable to Both

By M. D. Levin

In most areas honey bees are placed in or near alfalfa primarily for honey production and secondarily, if at all, for purposes of pollination. Beekeepers maintain no more colonies than will allow a profitable honey crop. They are reluctant to put more than one colony per acre into an area without compensation from seed growers. The seed grower, for his part, is reluctant to make it worthwhile for the beekeeper to increase the number of colonies per acre until he can be shown that it is profitable for him to do so.

Colonies Needed for Maximum Pollination

Where 20 to 30 percent of the bees are pollen collectors, two or three colonies per acre should be sufficient for maximum pollination, and one colony may produce enough seed to make a profitable crop. However, if maximum pollination is obtained, the honey crop will be reduced because of the diminishing numbers of untripped flowers available for nectar secretion. If the seed grower will be satisfied with less than a maximum crop, the beekeeper may be able to produce some honey. Most of Arizona but, unfortunately, only a few areas in Utah and California have such high percentages of pollen collectors. On only a few fields in the Delta Area of Utah have high percentages of pollen collectors been observed. Therefore, one colony to

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Table 1. Number of colonies and acres of seed alfalfa in the Delta area, Utah

<table>
<thead>
<tr>
<th>Year</th>
<th>Colonies</th>
<th>Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>1947</td>
<td>9,716</td>
<td>18,912</td>
</tr>
<tr>
<td>1948</td>
<td>13,057</td>
<td>23,107</td>
</tr>
<tr>
<td>1949</td>
<td>13,387</td>
<td>26,625</td>
</tr>
<tr>
<td>1951</td>
<td>12,446</td>
<td>38,780</td>
</tr>
</tbody>
</table>

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MARSHALL D. LEVIN is a member of the Legume Seed Research Laboratory of the U. S. Department of Agriculture at Logan. He is employed by the Bureau of Entomology and Plant Quarantine to work with insects beneficial in alfalfa pollination. Mr. Levin received his training at the Universities of Connecticut and Minnesota.
the acre would not be enough for maximum pollination. However, the Delta Area rarely has even one colony per acre (table 1). In the years 1947, 1948, and 1949 there was about a half colony and in 1951 only a third of a colony per acre.

These figures indicate what is well known—that Delta is a good area for honey production. They also indicate that the seed growers there would probably benefit by the importation of many more colonies of bees. A minimum of one colony per acre is necessary for adequate pollination of alfalfa and more would be beneficial near the fields when there are few pollen collectors. In other parts of the state, especially northward, from three to five colonies per acre are necessary for a good pollination job, because rarely do the pollen collectors exceed 5 percent of the bees in a colony.

A seed grower who has 150 colonies next to his 50-acre field may think that he will get the pollination supplied by three colonies per acre. However, he may not be considering the 1,000 acres of seed alfalfa that may be within three quarters of a mile of his field, to say nothing of the roadside ditchbank sweetclover and mustard. All this will spread the bees over much more than his 50 acres.

The ideal situation would be to have 6 to 10 thousand colonies in an area containing 2 to 3 thousand acres of seed alfalfa. Admittedly, Utah is a long way from this community approach to pollination, but growers in parts of California have made it pay. Utah alfalfa seed growers may have to also, to meet their competition.

Compensation for Pollination Service

It is generally considered that bees cannot store much honey where there are three to five colonies per acre. The seed grower in Utah must recognize the probability of little or no surplus honey under such conditions and eventually compensate the beekeeper for the reduction of his honey crop, as is being done in California.

The amount of surplus honey that a colony will store depends in part on its reserve stores when it is moved into the field. It has been said that colonies moved into a field of alfalfa after blossoms have appeared make much less honey than do bees moved in one to three weeks beforehand. Frequently beekeepers move in colonies that are light and have little reserve stores. It may take the bees one to three weeks to fill up the brood nest before they can start storing surplus. Perhaps if these colonies are allowed to retain reserve stores of honey, or fill up on preliminary flows, they will begin to gain weight and store surplus soon after being set down in the field if blossoms are available. Further research is required before this can be accepted as the final explanation.

At any rate, in operating bees for pollination instead of honey, it is important to maintain as large reserves of honey and pollen as possible. Since bees doing a good pollination job are not likely to produce much honey, they should have enough in the hive to carry them through. To allow them to cut down on their brood rearing early in the pollinating season would probably cause a shortage of field bees for second-crop bloom.
If any first-crop seed is to be pollinated, there should be a large population of adult bees when the colonies are moved into the field. Colonies with only enough bees to cover five to seven frames have been moved into seed fields for pollination. These one-story nuclei, which might store 60 pounds of honey in less crowded situations, will not do a satisfactory job of pollination. Where two to five colonies per acre are present, these weak colonies have difficulty in maintaining their weight, whereas two or three-story colonies in the same field frequently gain weight. The states of Colorado and Oregon have set up standards that colonies must meet to be considered good for pollinating alfalfa. These standards protect the beekeepers as well as the seed growers. Most of them refer only to the amount of brood and “bees to cover.” It might be a good idea to include required honey and pollen reserves as well. In areas of low pollen collection and overstocked fields, bees may not be able to gather as much pollen as they require to maintain their strength. If extra frames of pollen are not available for feeding, it may prove advantageous to feed pollen supplement.

LEAF CRINKLE OF SWEET CHERRY

Economic Importance of Crinkle Leaf

Judged from the point of view of current losses, crinkle leaf ranges as possibly the most serious disorder of the sweet cherry in Utah. Losses from this disorder are multiple in nature including the original cost of the infected tree together with the cost of planting and maintenance of trees at least until they are found to be worthless. Trees when severely affected are unprofitable. Even when but few branches of the tree show crinkle the fruit, which is usually misshapen and under-sized, becomes mixed with the healthy fruits resulting in a lower grade and a lower price for the entire lot. All too frequently in Utah the high percentage of crinkle trees has rendered entire plantings commercially unprofitable.

In Utah most colonies moved into seed fields should be much stronger. A strong colony with plenty of reserves will store surplus when smaller colonies are barely holding their own. A strong colony will store more than twice as much as an ordinary colony on a good flow, as well as do a much better job of pollination. Future investigations should provide more definite evidence on this point.

When Should Bees Be Moved Into Alfalfa Fields

The question frequently arises—when should bees be moved into alfalfa fields and how long should they be kept there? In Utah we recommend that the first bees be moved in as soon as blossoms show, and that the full consignment of bees be in well before peak bloom is reached. If pollination is rapid and complete, and the moisture supply is fairly low so that there will be only one peak of bloom, some of the bees can be removed after the peak is past. Some should be left to pollinate the late blossoms, but all can be removed about four to six weeks before the expected frost or cutting date, depending on local climatic conditions and harvesting practices. In Cache Valley the main pollinating job is over by the middle of August, as flowers tripped after that time will probably not mature because of frost. In other areas a reduced number of colonies left in the field after a corresponding date might well store some honey. Bees removed can be placed in locations for late honey flows to build up for winter, if the beekeeper is fortunate to have such locations available. Of course, any such movement of bees should be done only in agreement with the seed grower. The timing would have to be worked out according to local conditions.

If the beekeeper furnishing bees for pollination has enough colonies, he can maintain reserve colonies in a honey-producing area. He can then replace colonies dwindling in overstocked areas by fresh ones, and thus enable the weakened colonies to recover and prevent the pollination service from suffering. Some seed growers in California believe that an influx of new colonies to an alfalfa-seed field causes a spurt of pollinating activity, although observations in Utah so far do not bear this out. Where this spurt of activity does take place, both beekeeper and seed grower will benefit from an exchange of fresh colonies for weakened ones.

Table 1. Incidence and percentage of crinkle leaf in Utah orchards

<table>
<thead>
<tr>
<th>County</th>
<th>No. of plantings and bearing trees examined</th>
<th>Incidence of crinkle</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Orchards</td>
<td>Trees</td>
</tr>
<tr>
<td>Weber</td>
<td>46</td>
<td>8608</td>
</tr>
<tr>
<td>Davis</td>
<td>27</td>
<td>7155</td>
</tr>
<tr>
<td>Salt Lake</td>
<td>9</td>
<td>1325</td>
</tr>
<tr>
<td>Utah</td>
<td>18</td>
<td>7350</td>
</tr>
<tr>
<td>Washington</td>
<td>23</td>
<td>2708</td>
</tr>
<tr>
<td>Totals</td>
<td>123</td>
<td>27146</td>
</tr>
</tbody>
</table>

Varieties Affected

In Utah crinkle leaf symptoms have been observed on Bing, Black Tartarian, Black Republican, and mazzard seedling. The disorder, however, is most common on the Bing and Black Tartarian. The new handbook on "Virus diseases of stone fruits in..."
North America" lists the following varieties on which crinkle has been observed: Eagle, Burbank, Dr. Flynn, Ox Heart, Sheldon, and Waterloo. While Kinman reported leaf crinkle on Lambert, experiences in Utah agree with those reported by Reeves from Washington that crinkle leaf has not been found and probably does not occur on Lambert or Napoleon varieties. Crinkle-like symptoms have been observed in the Italian prune by Reeves and Cochran and by various workers in Utah. Since transmission is impossible the identity of the disease in the prune is uncertain.

Nature and Cause of Crinkle Leaf

Crinkle leaf so far as known is not transmissible and therefore is probably not of virus origin. Although it resembles in many respects some of the virus diseases common to stone fruits it is thought to be more of the nature of a frequently occurring mutation or bud sprout. Many instances have been observed where crinkle has appeared on one or more branches of Bing trees that were known to be free from any previous crinkle expression. Thus, it appears that crinkle symptoms may develop spontaneously in the Bing and Black Tartarian varieties at most any time during the life of the tree.

Although crinkle is not transmitted, it has been demonstrated repeatedly that buds from crinkle trees will invariably reproduce diseased branches or diseased trees. In one experiment in Utah, for example, 100 mahaleb seedlings were budded with buds from a Bing tree showing crinkle leaf. Eighty-seven of the inserted buds survived the winter and produced trees. All 87 trees developed crinkle leaf. Scion wood and buds from normal trees grafted into crinkle branches appear to produce normal growth invariably. Likewise crinkle-affected scions grafted into normal tissues have never, in our experience, caused other parts of the tree below or above the graft union to develop the disorder.

In Utah crinkle is frequently found in mazzard and Black Tartarian seedlings suggestive that the factor responsible is in the embryo or that the disease producing factor may pass through the seed from the crinkle plants to the offspring. In one poorly kept orchard in LaVerkin, Washington County, it was noted that of 77 Black Tartarian seedlings 28 or 36.8 showed definite symptoms of crinkle leaf. Crinkle leaf mazzard seedlings are common in nursery plantings.

Fig. 2. Upper. Cherries in top row from healthy Bing branches, lower cherries from crinkle branches showing distinctive mottling, distorted sutures, and pointed shape

Lower. Upper row healthy Bing fruits from healthy branches. Lower row from crinkle branches showing pointed condition, inhibited suture development

Symptoms of Crinkle Leaf

Leaf Symptoms

Crinkle in the sweet cherry is characterized by a distinctive deformity of both leaves and fruits as well as by a general unproductiveness in severely affected trees. Leaves are variously misshapen and small, narrow, and usually wedge-shaped at the base, and with extremely dentate and irregular margins. Highly irregular, often streak-like chlorotic areas, extending in the general direction of the later veins, develop on either side of the midrib (fig. 1). Inhibited growth areas are usually lighter green and with increased and greatly distorted venation. In milder cases the leaves appear to be affected princi-
pally along the margins. Occasionally half of a leaf may be generally affected and the other side free, though greatly reduced in size.

### Tree Symptoms

The extent to which trees are affected by crinkle varies greatly. In many cases, where the disorder apparently is of recent origin, crinkle leaves may occur on a single spur or on but one or perhaps a few branches of a tree, the foliage being normal throughout the balance of the tree. In fact, all gradations of crinkle may occur, from trees in which only a single spur is involved to those in which every leaf may exhibit the disorder. Leaves and fruits in trees propagated entirely from diseased buds are invariably affected throughout. In cases where a greater proportion of the tree is affected, the general appearance is so distinctive as to be easily detected from a distance. The total leaf surface of an affected tree is less than normal; however, affected trees may be seriously reduced in size.

### Distribution of Crinkle Leaf on Trees

Affected trees often show a striking and erratic distribution of crinkled leaves. Cases have been noted where crinkled foliage occurred toward the ends of limbs and again farther back, with normal foliage in between. The reverse of this situation has also been observed, where normal foliage occurred at the ends of the limbs and again farther back, with crinkle foliage in between. Trees with the foliage severely crinkled throughout the crown may have several scattered branches with normal foliage scattered through the interior of the crown. One forked tree was observed in which all the foliage on one of the two trunks was severely crinkled, while that on the other was entirely normal.

### Effect on Fruit

Fruits on trees severely affected by crinkle are characteristically malformed, being more or less flattened and ridged on the suture side and generally more cone-shaped or pointed than the normal fruit (fig. 2).

The fruit on affected trees ripens unevenly, and in certain fruit varieties the mottling or splashing is more prominent (fig. 2). Affected fruits are often borne at an angle from the fruit stems (fig. 2). Malformations are frequently more prominent in young developing fruits than in the mature state.

### Control

One or all of the following operations may be involved in the control of crinkle leaf: (1) bud selection, (2) roguing, (3) surgery, (4) top working of affected trees.

1. **Bud selection:** the fact that crinkle-affected buds invariably give rise to crinkle shoots or trees demands the most rigid selection of budwood to be used for propagating purposes. Both growers and nurserymen should learn to recognize crinkle leaf symptoms in the leaves of various varieties even in their mildest expression. It is essential to avoid budwood from trees which show any signs of crinkle or from trees in such a state of culture that the disease symptoms may not be detected. Freedom from disease can best be assured by the establishment of an official and effective inspection and certification service.

2. **Roguing:** Trees on which the major portion of leaves show crinkle are invariably unprofitable and should be rogued out or topworked. Mazzard seedlings to be used for rootstock should be rigidly inspected and all affected plants destroyed. In like manner, all nursery trees should be inspected at a period most favorable for observing leaf symptoms, and crinkle plants rogued out. In this connection, certification for freedom from crinkle should be included in the state certification program.

3. **Surgery:** Crinkled shoots and branches should be pruned out. There is no reason for preserving affected branches. Many trees partially affected can be saved and converted into good producers by proper pruning early in the life of the trees.

4. **Top-working:** Top working of a severely affected tree to the same or other desirable variety may be a means of eliminating crinkle and of saving time in producing a profitable tree. Top working, if effective, must be done as early as possible and only with buds and scions known to be free from crinkle.
CHICKEN MARKETING
(Continued from page 49)

volume from cooperative and independent processors.

With the exception of 6.6 percent of the chickens sold direct from producer to consumer and 1.5 percent sold through retail sales rooms of the independent processors, all of the retailing was done by retail stores and restaurants not connected with other stages of distribution.

Cooperative Processors Vertically Integrated

The cooperative processors are vertically integrated to a considerable extent; that is, they perform the marketing functions in more than one stage of distribution. For most of their volume they perform the functions of assembling, processing, and wholesaling. Independent processors, on the other hand, obtain most of their volume from hucksters and sell their dressed chickens through wholesalers.

The integrated system of marketing used by the cooperatives has several advantages which lead to efficiency in marketing, the most important of which is the elimination of successive buying and selling operations between the various stages of distribution. In the integrated system ownership was retained by the cooperative processors from the time the chickens were purchased from the farmer until they were sold to retail stores and restaurants. In the nonintegrated system used predominantly by independent processors ownership of the chickens changed three times from the producer to the retailer.

Chickens Sold Out of State

In 1949-50, 42 percent of the chickens sold by Utah processing plants were shipped to out-of-state markets and 58 percent were sold within the state (table 1). Seven of the 12 processors from whom data were obtained sold all of their chickens within the state. Of those selling in out-of-state markets one processor sold 95 percent of his total volume in these markets and the others ranged from 10 to 50 percent.

Complete ready-to-cook dressing of chickens at processing plants results in a more attractive product for the consumer and saves the time of the butcher at the retail level. The product prepared in this manner is more perishable however; and if not moved into consumption in a relatively short time, it must be preserved by freezing.

The upward trend in complete dressing at the plant will undoubtedly continue as a result of consumer demand for this service.

STAFF CHANGES

Dr. Richard M. Bullock, in charge of the Tree Fruit Experiment Station of the Washington Agricultural Experiment Station at Wenatchee, has been appointed head of the Department of Horticulture at USAC to replace Dr. S. W. Edgecombe who has accepted the position of dean of the new School of Agriculture of the American University of Beirut, Lebanon.

Dr. Bullock was born in Kansas and obtained his B.S. degree from Kansas State College in 1940. He received his M.S. and Ph.D. degrees from the State College of Washington.

Dr. Eldon J. Gardner has recently been made a member of the Station staff. Dr. Gardner has been a member of the teaching staff since 1949. He was formerly associate professor of zoology at the University of Utah. He received his B.S. and M.S. degrees at the USAC and his Ph.D. degree from the University of California.

Dr. Gardner's research will be of a fundamental nature and will deal with the genetic and cytological analysis of tumorous head in the fruit fly, Drosophila melanagaster. It will be supported in part with funds from the American Cancer Society.

Dr. Rex Hurst, formerly instructor in agronomy, will return to the Station staff as assistant professor of statistics. He has recently completed the requirements for the Ph.D. degree at Cornell University. Dr. Hurst replaced Rulon Brough who accepted a position at Brigham Young University.

Wayne D. Criddle of the Soil Conservation Service has replaced Willis C. Barrett as a federal collaborator in soil and water conservation. Mr. Criddle was transferred from Boise, Idaho. He is a graduate of USAC and the University of Wisconsin and was formerly stationed at Logan. Mr. Barrett has been transferred to New Mexico State College.

Dr. Paul Fitzgerald, in charge of the Provo Veterinary Laboratory, has resigned to accept a position with the Columbia-Geneva Division, U. S. Steel Company.

Table 1. Percent of chickens sold within the state and out-of-state by Utah processing plants, 1949-50

<table>
<thead>
<tr>
<th>Plants</th>
<th>Percent of chickens sold by processors</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Within state</td>
</tr>
<tr>
<td>1</td>
<td>60%</td>
</tr>
<tr>
<td>2</td>
<td>50%</td>
</tr>
<tr>
<td>3</td>
<td>30%</td>
</tr>
<tr>
<td>4</td>
<td>100%</td>
</tr>
<tr>
<td>5</td>
<td>100%</td>
</tr>
<tr>
<td>6</td>
<td>100%</td>
</tr>
<tr>
<td>7</td>
<td>100%</td>
</tr>
<tr>
<td>8</td>
<td>100%</td>
</tr>
<tr>
<td>9</td>
<td>100%</td>
</tr>
<tr>
<td>10</td>
<td>100%</td>
</tr>
<tr>
<td>11</td>
<td>100%</td>
</tr>
<tr>
<td>12</td>
<td>100%</td>
</tr>
<tr>
<td>All plants</td>
<td>58%</td>
</tr>
</tbody>
</table>

Table 2. Extent of dressing chickens in various Utah processing plants, 1949-50

<table>
<thead>
<tr>
<th>Processing plant</th>
<th>Percent processed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Dressed*</td>
</tr>
<tr>
<td></td>
<td>percent</td>
</tr>
<tr>
<td>1</td>
<td>50%</td>
</tr>
<tr>
<td>2</td>
<td>80%</td>
</tr>
<tr>
<td>3</td>
<td>50%</td>
</tr>
<tr>
<td>4</td>
<td>85%</td>
</tr>
<tr>
<td>5</td>
<td>85%</td>
</tr>
<tr>
<td>6</td>
<td>100%</td>
</tr>
<tr>
<td>7</td>
<td>60%</td>
</tr>
<tr>
<td>8</td>
<td>90%</td>
</tr>
<tr>
<td>9</td>
<td>90%</td>
</tr>
<tr>
<td>10</td>
<td>90%</td>
</tr>
<tr>
<td>11</td>
<td>15%</td>
</tr>
<tr>
<td>12</td>
<td>95%</td>
</tr>
<tr>
<td>Total</td>
<td>60%</td>
</tr>
</tbody>
</table>

*Blood and feathers removed.
The relationship of soil fertility to human nutrition and health is a widely discussed subject. Hardly a month goes by without the publication in some popular magazine or trade journal of an article on this topic. There is certainly a general relationship of large significance. Many peoples throughout the world are malnourished because the available land is not productive enough to supply them with either the total amount or the kinds of food needed. Their health suffers accordingly. Much more specific relationships are implied by statements that various diseases occurring in our own population are directly traceable to soil deficiencies. The questions at issue are of obvious significance to agriculture because nutritional quality is a very important factor in the market for its products. What are the facts as determined by research?

Nutritional Relationships Not Comparable
For Animals and Man

The importance of the soil in relation to certain mineral nutritional troubles in grazing animals has long been known. These findings are frequently cited as evidence that the human population may similarly suffer from troubles caused by soil deficiencies in certain areas. Aside from trouble caused by iodine deficiency, however, the intake of which is governed primarily by the water rather than the food supply, no specific human ill has been traced to a specific soil deficiency. Actually, the general situation is by no means comparable for animals and man. Differing from the case of the grazing animal, man's food generally comes from a variety of localities across the country. Home-produced food may play a very minor role in the diet he chooses. Also, much of his food is so altered by manufacturing, preserving, and cooking processes that one cannot properly attribute to soil factors any nutritive deficiencies that may be noted.

The statement that human diseases are caused by area soil deficiencies is based upon inferences rather than experimental evidence. For example, someone may point out that certain diseases, not necessarily nutritional, are increasing in an area where there is evidence that the soil lacks certain nutrients needed by food crops, or is low in general productivity. Then the conclusion is drawn that the character of the soil is responsible for the ill health, or at least for a higher incidence of certain specific diseases. Other factors, such as low economic status, lack of medical service, and ignorance, are disregarded. Commonly little or no attention is given to the source and kind of food actually eaten. If these basic factors are neglected the above conclusions have not the slightest basis. Moreover, no foundation whatever exists for the speculation that declining soil fertility may be responsible for the increase in degenerative diseases such as cancer, arthritis, and heart troubles.

Fertile Soils Can Mean Better Health

In addition to their influence in producing a larger total food supply, fertile soils also widen the choice of crops that can be grown. Every farmer knows that if a soil is suitable for growing a legume such as alfalfa instead of timothy, the forage produced can be markedly richer in protein, calcium, and carotene. This can in turn benefit human nutrition by increasing the supply of milk, meat, and eggs produced in a given area. In addition, fertile soils can contribute directly to better health through the production of important food crops in kinds and amounts otherwise impossible. For example, without fertilization with various elements, the soils of the Eastern seaboard would not produce the nutritionally superior fruits and vegetables so important to the diet. In all of these respects, soil conservation and improvement can result in better human nutrition.

By contrast, there is little basis for the frequently made claim that the fertility level of the soil markedly influences the nutritive value of specific food crops and animal products. The fact that grazing animals are malnourished on soils lacking in certain minerals is apparently responsible for the idea that their produces used for human food may be lacking in the minerals, and other essential nutrients as well. Thus it has been stated repeatedly that milk from cows obtaining their feed from poor soils will not build good bones in children because the milk will be low in calcium and phosphorus. This statement is totally untrue, as many experiments have shown. So also is a statement that poor soils lower the muscle- and blood-building value of meat. While certain trace elements are known to vary in meat, milk, and eggs accord-

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**FEEDING SUGAR TO LIVESTOCK**

Through an error the following acknowledgement was omitted from the article "Meat quality and dressing percentage increased by feeding sugar to livestock prior to slaughter" which appeared in the June issue of Farm and Home Science:

This study was financed in part by a grant from the Sugar Research Foundation, Inc. The sugar used was furnished by the Amalgamated and the Utah-Idaho Sugar Companies. We are especially grateful for the cooperation of Drs. R. C. Hockett and R. F. Phillips of the Sugar Research Foundation; V. Jensen of the Amalgamated Sugar Company; J. Keane and R. Gaddy of the Utah-Idaho Sugar Company; S. Jolly, C. Hinderlieder, H. T. Sandan, P. Vermillion and P. C. Smith of the Ogden plant of Swift and Company; G. Brittan, T. Bennion, and C. Burton of the Western Livestock Feed Association; and to Prof. B. H. Crandall and M. Habib and other members of the staff of the Utah State Agricultural College.

**Farm and Home Science**

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**Dr. L. A. Maynard** is in charge of the Nutrition Laboratory at the New York Agricultural Experiment Station at Ithaca. This article is reprinted with permission from Farm Research, the quarterly publication of that station because of the widespread interest in the subject discussed.

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ing to the animals’ ration, there is no evidence that these particular minerals are ever deficient in the human diet.

The vitamin content of milk and butter is markedly influenced by the food of the cow, but the effect here is due to the kind of roughage consumed, its stage of maturity at harvest, and storage factors. In none of these does the soil play a direct role. The level of certain vitamins found in eggs varies according to the feed of the hen, but the potency of this feed is dependent upon the ingredients chosen and not upon any soil effects. On the basis of present evidence, it may be concluded that the soil has little, if any, practical effect upon the nutritive value of the animal products which provide over 30 percent of the calories of our diet and much higher percentages of several of the special nutrients.

One might expect the answer to be different for the foods obtained directly from the soil, such as cereals, vegetables, and fruits. The fact that specific types of food crops as harvested do vary widely in certain minerals and vitamins suggests a definite soil relationship. Since, however, other factors such as variety and climate are known to have an influence, one must have specific evidence regarding the effect of soil.

Cereal Products Modified in Milling

The general question is not of practical significance for the cereals which make up nearly 30 percent of the human diet, for their products used as food are so modified in milling as to make variations as grown of little concern. Fruits and vegetables are important sources of various minerals and vitamins needed by man. The soil does have an influence on their mineral content, but significant relations in terms of the minerals in which the human diet is likely to be lacking have not been established, despite widespread and enthusiastic claims to the contrary. Extensive experiments have failed to show that, for a specific variety of vegetables, calcium, the mineral most frequently deficient in the human diet, is significantly and regularly higher when the crop is grown in a soil high in the element, either naturally or through fertilization. In fact, calcium content may be decreased by fertilization with the other elements. Experiments have been similarly unsuccessful in demonstrating any consistent relationship to soil fertility of the iron or other major element content of fruits and vegetables. There appears to be a more direct relationship with certain trace elements. Where copper, manganese, zinc, and boron improve plant growth, there tends to be an increase in the plant as well, but the reverse can happen. There is no evidence, however, that these trace elements are ever deficient in an otherwise good diet, in terms of man’s needs.

Fruits and vegetables are very important sources of vitamin C and carotene for the human diet. Genetics and climatic factors have a large influence on their content in crops as harvested. By contrast, neither the nature of the soil nor fertilizer treatments have been found to exert any large or consistent effects. The story is the same for other vitamins insofar as they have been studied.

Unfounded Claims Cause Serious Harm

On the basis of present evidence it must be concluded that the state of fertility of the soil has no important influence on the content of a specific food crop or animal product, with respect to those nutrients that are at all likely to be deficient in the human diet. It must be agreed, however, that the evidence is incomplete. By no means all of the minerals and vitamins have been studied. The possibility cannot be ruled out that, because of their nature or as the result of specific treatments, certain soils may contribute values to human health that are not now visualized. The importance of this possibility, as well as the recognized gaps in present knowledge, fully justifies the continuance and expansion of research in the general field. This research must be carefully planned and controlled, however, in contrast to the superficial observations which, without any adequate data, are now used to attribute various human ills to soil deficiencies. The enthusiasts who are making these claims, in the interest of promoting various soil treatments or dietary additions, are doing both nutrition and agriculture serious harm by undermining public confidence in foods and dietary practices of unquestionable value.

By contrast, there are sound bases for promoting soil conservation and improvement as a service to human nutrition and health. More fertile soils and improved cultural practices will provide more nutrients per acre, and, particularly, more of the animal products, fruits, and vegetables that supply the nutrients most likely to be deficient in the diets of many of our people. We should not be complacent about the adequacy of our present level of food production, in view of our rapidly increasing population and especially in view of a future emergency we must be prepared to face. As we think of these things, programs for soil conservation and improvement take on an added significance accordingly.
protein because the addition of B₁₂ (treatment 3) gave results that were better on the average than those obtained with the use of animal protein (treatment 4).

The addition of vitamin B₁₂ and aureomycin (treatment 2) to the basal ration improved the rate of gain 22.6 percent and saved 90 pounds of feed for each 100 pounds of gain. Pigs on treatment 2 receiving this fortified ration reached market weight 24 days sooner than those on treatment 1. Throughout the test their hair coats were glossier and their gains much more uniform. The disadvantage of adding the antibiotic to the ration of these pigs showed up in the carcasses which were fatter and of somewhat poorer quality from the standpoint of lean to fat ratio.

Aureomycin Improved Rate & Economy of Gain

Supplementing the basal ration with vitamin B₁₂ greatly improved both the rate and economy of gains. The performance of pigs getting this ration (treatment 3) was not as good, however, as that of the pigs getting aureomycin in addition (treatment 2).

Substituting meat scraps for soybean oil meal in the ration of pigs receiving treatment 4 had no advantage providing adequate amounts of vitamin B₁₂ were present in the soybean oil meal ration.

Runt Pigs Do Well on Antibiotics

An interesting companion experiment to the one just described was performed with runt pigs. Only four runts were available and they ranged in weight from 17 to 23 pounds when the test started. They were segregated into two treatments at random and fed the rations given the pigs receiving treatments 2 and 4 in the experiment just described. The two runts receiving the vitamin B₁₂ and aureomycin supplement made excellent gains. Both of them reached the market weight of 210 pounds within 125 days. Their average daily gain per pig was 1.66 pounds. In every respect their performance measured up to that expected from normal non-runtly pigs.

The other two runts, receiving a well balanced ration with meat scraps as the principal source of protein, made poor gains. After 98 days on test they only weighed an average of 79 pounds. One runt weighed only 128 pounds when the experiment was terminated at the end of 152 days. Their average daily gain for the 152 day period was only 1.12 pounds or about a half pound less daily than the runts getting the antibiotic and vitamin B₁₂ supplement.

These tests indicate that vitamin B₁₂ and aureomycin may be expected to improve the feedlot performance of growing and fattening pigs receiving typical Utah rations. Faster and more uniform gains may be expected with more economical use of feed. Greatest benefits are obtained early in the feeding period. Runt pigs especially respond to a remarkable degree. None of the pigs in these tests showed symptoms of scouring. Where such trouble is present the antibiotic has been shown in other experiments to be effective in reducing or eliminating it.
veins remain green. In addition to the marginal scorch, the presence of circular or irregular necrotic areas in the leaf blade may represent the injury caused by fluorine compounds. This is particularly true of grape. Various stages of scorched Chinese apricot leaves are illustrated in fig. 2.

During a growing season Chinese apricot trees may be completely defoliated two or three times by excessive continued exposure to fluorine compounds.

There appears to be great variations in the ability of different plants to tolerate fluorine compounds. Leaves of certain varieties of gladiolus (Shirley Temple), Chinese apricots, Italian prunes, and Concord grapes appear to be sensitive to fluorine compounds. Under certain conditions they will show scorching from fluorine compounds while other trees or plants growing near them will not exhibit any signs of injury even though they may have a comparable fluorine content in the leaves.

It should be noted that symptoms similar to the ones described above may be caused by toxic chemicals other than fluorine compounds or by virus and nutritional diseases. The investigator in the field should be aware of the various factors which can cause injury to plants and obtain supporting laboratory data to confirm or reject a given diagnosis.

There is a great need for additional comprehensive studies on the effects of fluorine compounds, other toxic chemical agents, and of nutritional and virus diseases on plants in order to diagnose properly the cause of plant injuries in the field on the basis of leaf symptoms.

Effects on Animals

Fluorosis or chronic fluorine poisoning develops in animals when they consume rations containing excessive concentrations (30 to 100 parts per million fluorine on dry basis) of fluorine compounds for many months. A critical period is during the calcification and eruption of their teeth. There is considerable variation in the toxicity of different fluorine compounds.

The first detectable symptom of chronic fluorine poisoning in young animals is a hypoplasia of the teeth which has been called mottled enamel, dental fluorosis, darning, and gaddur. The condition consists of an irregular distribution of grayish white blotches or chalky areas over the entire surface and involving all teeth. The teeth of animals affected by fluorosis may be classified as follows: 1, questionable; 2, slight mottling of enamel; 3, mild (definite mottling and staining of teeth and some teeth may show slight wear); 4, marked (definite mottling and staining of enamel and definite wear); and 5, excessive (definite wear, erosion and staining of teeth) (fig. 3 and 4).

Animals exhibiting marked or excessive symptoms of fluorosis will frequently chew hay for longer periods of time than animals with normal teeth. These animals will lap cold water like a cat and spend several minutes trying to get enough water to meet their requirements. Such animals have a rough dry hair coat with a tight skin and unthrifty appearance. The joints of the hock, knee, and pasterns may be enlarged and stiff. In general, the bones will be enlarged and exostosis (extra bone growth) may appear on the rib and leg bones (fig. 5). Sometimes animals may exhibit intermittent lameness which may be confused with foot rot or other causes. Occasionally the lameness in the front legs may be so severe that animals may move around on their knees. After several days of lameness, the animals may show definite signs of recovery regardless of treatment given. Lameness may recur many times. The fluorine content of the bones of animals with severe fluorosis will be increased many fold (5 to 20). In order to make a correct diagnosis of fluorosis in animals, gross symptoms should be correlated with adequate laboratory fluoride determinations on green forage, hays, grain and mineral mixtures, water, urine, and bones.

There is also a need for additional information on the effects of fluorides on all forms of animal life.

For those who wish further information on the subject the following bibliography will be helpful:


De Eds, F. Chronic fluorine intoxication. Medicine 12: 1-60. 1933.


Severe killing of plants in winter wheat the past 2 years has required a considerable acreage to be replanted in the spring. In 1951 spring wheat did fairly well. This year, because of prolonged spring drought, the yield of spring-sown wheat on the dry lands is low and in many cases a complete failure.

Winter killing may be caused by one or more of the following: (1) direct effect of low temperatures, (2) smothering, (3) physiological drought and (4) heaving. In addition there are other factors which cause poor stands in winter wheat. Among these are: (1) low soil moisture at the time of seeding and drying of soil after seeding, (2) soil crusting, (3) snow mold, (4) miscellaneous seedling diseases and (5) insect pests.

Low Temperatures as Related to Winter Killing

In climates where low temperatures occur with little or no snow cover, the direct effect is often one of the most important causes of winter killing in wheat. On freezing, water in the plant cells is withdrawn to the intercellular spaces and this results in the concentration of the cell sap with attendant increase in salt and higher hydrogen ion concentrations. These conditions bring about an irreversible precipitation of the proteins as well as other changes in the cell, and death of the plant follows. It has been reported that winter wheat, if properly hardened, can withstand temperatures as low as -25°F. without a snow cover and as low as -40°F. when protected by snow. Since wheat plants are usually protected by snow, and temperatures in this area are seldom so low, it is doubtful that low temperatures are a common cause of winter killing here.

Smothering as a Cause of Winter Killing

Plants must have some oxygen to carry on respiration even though they are making little or no growth. Heavy snow or the accumulation of an ice sheet over the plants may exclude the air and if extended for any considerable period of time may result in the wheat smothering. This is probably a common cause of wheat killing in this area, particularly where snow drifts and accumulates to a considerable depth. The excessive snow accumulation of the past winter undoubtedly resulted in considerable smothering of winter wheat.

Heaving as a Cause of Winter Killing

Wheat grown on heavy land, as is often the case in this area, may be killed from heaving. Killing is particularly likely in the early spring. As the soil freezes it expands, breaking the wheat roots. When this occurs the plants are lifted out of the soil. Dessication follows and the plants die before they can become re-established. In some seasons when the snow disappears early in the spring, following by freezing and thawing temperatures, heaving is an important cause of winter killing. Because there was little or no freezing and thawing this past spring after the snow left, there was little damage from heaving in this area. Late sown wheat that has not become well established is more susceptible to heaving than are large, well established plants.

Physiological Drought as a Cause of Winter Killing

Physiological drought is a term used to describe a condition where there is ample water in the soil but for some reason, such as being frozen into ice, the plants are unable to absorb it. If this condition is continued for a prolonged period of time the plants die for lack of water.

Other Causes of Poor Stands In Winter Wheat

Drought is a common cause of poor stands in fall wheat. In the fall of 1951 this was particularly true. There was some precipitation in late August and the early part of September. Some wheat growers who did not have their soil in condition for seeding immediately, lost much of the moisture in seedbed preparation. The soil moisture at sowing time was just enough to moisten the seed and much of it rotted and died without emerging. Other growers waited for moisture that did not come and were compelled to plant in dry soil just before winter set in. Some of these plantings gave poor emergence, in some cases as a result of soil crusting. Others gave good spring emergence but later were badly thinned or destroyed by seedling diseases.

Another condition related to drought may exist and result in thin stands or a complete loss of plants. Wheat planted in soil with ample moisture in the surface 2 or 3 inches with a layer of dry soil below may not, because of lack of additional rain, emerge or the seedling may die soon after emergence.

Snow mold

Snow mold has caused serious losses in winter wheat during the past two years. Some believe this disease is on the increase and is associated with the use of trashy fallow. This, however, has not been definitely established.

Snow mold in the Intermountain Area is thought to be caused by species of Typhula. The disease is also referred to in the literature as Typhula blight. The development of the disease on cereals and grasses is associated with a heavy cover of snow or cloudy weather with temperatures slightly above freezing, usually without frost in the soil. It is the opinion of some that a well developed wheat plant with a good vegetative growth is better able to recover from snow mold damage than a plant less well established.

Diseased plants are conspicuous as the snow disappears by the presence of a white mycelial mat over the plants and adjacent soils. Infected plants gradually lose their green color, wither, and turn brown. The disease...
is spotted, and may, in severe cases, destroy the entire field. Killing of the plants ranges from dead leaf tissue to invasion and rotting of the culms, crown, and root tissue. As the snow disappears, the temperatures rise, and sunshine increases, the disease disappears.

This disease is prevalent on winter cereals and many grasses, and is world-wide in occurrence.

Seedling blight

Seedling blight was severe, in some areas, in the spring of 1952. The exact cause of the disease was not determined, however various pathologists isolated spores of species of Fusarium and Helminthosporium molds.

The prevalence of the disease in 1952 was though to be associated with the high temperatures that prevailed soon after the snow left which predisposed the wheat seedlings to the disease. Had the wheat developed under normally cool temperatures the disease may not have occurred. Some observations indicated that where wheat was sown on soil high in fertility, particularly nitrate, the percentage of plants that died, as a result of the disease, was less than where the wheat was growing in soil low in nitrates. Low fertility may also have been a predisposing factor.

Diseased seedlings were characterized by a light brown to reddish brown water-soaked cortical rot and blight either before or after emergence. Leaves of diseased plants that emerged turned yellow before death. Many infested plants that recovered retained yellow leaves for a considerable period of time. In certain areas in some fields yellow leaves prevailed throughout the season, this may have been caused by a separate undetermined malady.

Insects

Some years, and in certain areas, insects have played an important part in reducing stands of winter wheat. Insects do their damage largely in the early spring. In 1951 cutworms and the false wireworm did considerable damage in the central part of the state. This year, however, it is reported that the damage from these insects is light.

Causes for This Year's Poor Winter Wheat Crop in Utah

Causes for the poor winter wheat crop in Utah this year are many. Their relative importance is not known and they, no doubt, varied from place to place.

Unfavorable soil moisture conditions during seedling time, late seeding, excessive accumulation of snow during the winter, prolonged duration of snow well into spring, hot dry weather during spring and early summer have produced a combination of conditions unfavorable for winter wheat.

Unfavorable soil moisture conditions at seedling time resulted, in many cases irregular and poor stand emergence. In other cases the late seeding with an early snow cover delayed emergence until after the snow was in early spring. The hot weather that followed caused excessive soil crusting so that seedlings were unable to emerge. The excessive accumulation of snow resulted in considerable smothering and the prolonged duration of snow into late spring aggravated the development of snow mold. The hot weather that followed the disappearance of the snow seemed to pre-dispose the wheat to seedling diseases. The lack of rainfall during April and May failed to wash the applied nitrogen fertilizer into the soil so that, in many cases, low soil fertility may also have been a pre-disposing factor, particularly in the death of infected seedlings. On top of all these ailments the prolonged spring drought extended into early summer helped to complete the series of unfavorable conditions which have resulted in such a generally poor wheat crop. Utah has had other poor wheat crops but seldom has the crop been subjected to so many adverse conditions as the crop of 1952.

Canning Peas

(Continued from page 57)

in the canning pea enterprise. It is more profitable to be better than average in several factors such as those discussed above rather than excel in only one. For example, high yields are desirable providing they are not obtained at the expense of some other factor such as labor efficiency or excessive fertilizer cost.

What about 1952 costs and receipts? Costs are somewhat higher in 1952 than they were in 1951. Labor cost shows the greatest increase. Receipts per acre will be lower than a year ago since contract prices were not changed and weather conditions during the growing season indicate that yields will average lower for the 1952 crop than they were in 1951. Present reports show an average yield of approximately one ton of shelled peas per acre as a state average for the 1952 canning pea crop.

Department Heads Retire

(Continued from page 52)

association with the College started when he obtained the B.S. degree in 1914. The following year he was assistant professor of botany and in 1916 received the M.S. degree in plant pathology. After two years as a research fellow at the University of Wisconsin, he obtained his PhD degree in 1919. Returning to the Utah State Agricultural College he became head of the Department of Botany and Plant Pathology in 1925, a position he held until his retirement. During a portion of the time (1945-50) he was also dean of the Graduate School. He is a member of a number of professional and honorary scientific societies including the American Association for the Advancement of Science, American Phytopathological Society, Sigma Xi, and Phi Kappa Phi.

Dr. Richards has made many contributions to the field of plant pathology through the publication of fifty or more scientific papers on a variety
of diseases and host plants. His early interest was in the relation of soil temperature to disease, an area of research which he helped to pioneer at the University of Wisconsin in his graduate studies. The several virus diseases affecting potato seed production soon claimed his attention and for several years he directed a program of virus-free potato seed production which was of major significance to the state’s potato industry. Other diseases on which he worked included late blight of sugar beets, stinking smut of wheat, sugar beet root rot, cucurbit wilt, psyllid yellows of potato, strawberry root rot, alfalfa wilt, and alfalfa white spot. He contributed significantly to the information on the etiology and control of all of these diseases. In 1937 he discovered western x disease on chokecherries in Utah. This discovery initiated an intensive study of the virus diseases of stone fruits which is still in progress. As a result of his critical investigation about 25 virus diseases have been recognized on the stone fruits. His studies on the transmission of various viruses by budding on different stone fruit varieties clarified several cases of quick decline in these fruits which had been observed for many years but for which no explanation was previously available. When the final stage of the virus investigations is reached through the development of a virus-free budwood source for nursery stock, progress toward control of these diseases will be achieved.

It is impossible to evaluate in dollars and cents the worth of the research work which Dr. Richards has done for the state. However, the significance of his reports and his contributions to agriculture are indeed great. In the case of the virus diseases of stone fruits his contributions have made it possible for the fruit growers to set up a program which may salvage an industry that otherwise appeared headed for destruction–Frank B. Wann.

CONTRIBUTIONS TO RESEARCH
May 15, to August 15, 1952

<table>
<thead>
<tr>
<th>Organization</th>
<th>Amount</th>
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<tbody>
<tr>
<td>Utah College Industry Farm Electrification Committee</td>
<td>$7800 for study of rural electrification</td>
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<tr>
<td>Sugar Research Foundation</td>
<td>$4000 for studies on feeding sugar to animals prior to slaughter</td>
</tr>
<tr>
<td>Dow Chemical Company</td>
<td>$3000 to investigate the utilization of urea as affected by feeding various levels of methionine and sulfur</td>
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<tr>
<td>Sharp and Dohme, Inc.</td>
<td>$2500 for study of coccidiosis in cattle, sheep, and poultry</td>
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<tr>
<td>Ogden Grain Exchange</td>
<td>$1200 for grain breeding research</td>
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<tr>
<td>United States Smelting, Re·fining, and Mining Co.</td>
<td>$1200 for study of the economic importance of the less common mineral elements in plant nutrition in Utah</td>
</tr>
<tr>
<td>Farmers’ Grain Cooperative, Ogden</td>
<td>$150 credit for dehydrated alfalfa for studies on supplemental feeding of range sheep</td>
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<tr>
<td>Amalgamated Sugar Co. Utah-Idaho Sugar Co.</td>
<td>1 ton sugar each for studies on feeding sugar to animals prior to slaughter</td>
</tr>
<tr>
<td>International Minerals and Chemical Corporation</td>
<td>3 ton defluorinated rock phosphate for fluorosis studies</td>
</tr>
<tr>
<td>Vegetable Growers Cooperative, American Fork, Utah</td>
<td>Celery plants to plant a half acre to study insect control problems</td>
</tr>
<tr>
<td>Barlocker Hatchery and Breeding Farm, St. George, Utah</td>
<td>100 Broad Breasted Bronze turkey pouls for use in turkey breeding program</td>
</tr>
<tr>
<td>Lederle Division American Cyanamid Co.</td>
<td>50 pounds of Aurofac for supplementary feeding studies with swine</td>
</tr>
<tr>
<td>Velsicol Corporation</td>
<td>10 gal. chlordane</td>
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<tr>
<td>Chemagro Corporation</td>
<td>10 gal. heptachlor for research on control of legume seed insects</td>
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<td></td>
<td>1 gal Systox spray</td>
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