Methods of Control of Bacterial Canker of Tomatoes Outlined

Disease-Free Seed, Clean Seedbed Soil, and Clean Fields Essential in Eliminating the Disease

By H. Loran Blood
U. S. Bureau of Plant Industry

The tomato has achieved a place of importance as a cash crop in national and state agriculture. Utah stands fourteenth among the states in acreage of tomatoes planted and eighth in the number of tons produced. Utah leads all the states in production per acre and is exceeded only by New York in the gross income per acre received by the grower. Utah farmers receive a gross return of approximately $800,000 annually from tomato production. Net returns are greatly reduced, however, owing to the high cost of production.

Production costs are relatively high mainly because of the expense of irrigation. Possibly other disproportions in production costs in Utah as compared with other tomato-producing areas, can be attributed to faulty cultural practices or to the inroads of plant diseases. Both of these factors increase the cost of production by reducing the number of tons that may be marketed per acre. Inasmuch as the cost of producing an acre of tomatoes, whether the yield is good or poor, is pretty well fixed, a poor yield costs much more to produce per ton than a good yield. When the yield is too poor, the cost of production exceeds the sale price and no profit is realized.*

* (Editorial Note)—High freight rates from the intermountain territory increase the costs of marketing local produce in competition with that from other areas. Increases in marketing costs make it imperative for the producer to pay less for the raw products, processing costs being equal, in order that he may complete successfully with produce from other areas in the national markets. Extra freight costs, therefore, express themselves in lower prices for the raw product and reduced incomes for the grower.

The only ways the net returns to the grower can be increased at present prices are by decreasing the cost of producing each ton marketed, or by increasing the grade or quality of product to command the highest obtainable price. Increased production and better fruit quality often may be obtained by reducing the losses caused by plant diseases that lower both yield and market value of the crop.

The tomato plant disease control program of the United States Department of Agriculture and the Utah Agricultural Experimental Station has for its principal objective an increase in the net return to the farmer from tomato production through the development of effective means of disease control.

Three diseases of major importance in the state are being studied in this program: curly top or western yellow blight (virus), Verticillium wilt (a fungous disease), and bacterial canker.

Bacterial canker will be considered at this time because its control is largely dependent on the use of seed free from the canker organism, and the approach of the harvesting season makes it important that every precaution be taken to obtain clean seed for the production of next year's crop. Other diseases will be discussed in later articles.

Bacterial canker is caused by a bacterium Phytoponas michiganense EFS (Bergey et al) that attacks the tissues of the leaves and stem and damages the plant so severely that little fruit is produced. The disease may be identified by a one-sided withering of the leaves and a breakdown of the stem tissues leaving

(Continued on page 11)
COARSE MASHES MORE DESIRABLE FOR LAYING HENS

Fine Grinding Increases Mortality, Reduces Egg Production and Increases Cost of Grinding

BY BYRON ALDER

Several years ago a mash was mixed for one of the pens of Leghorn hens in the Experiment Station blocks containing a rather high percentage of shorts replacing most of the bran and part of the ground wheat in the mash mixture. After this change was made there was a noticeable drop in egg production in this pen. Observation of the birds as they were eating showed that they had considerable difficulty in swallowing the mixture after getting it into their mouths.

This raised the question of whether the reduced egg production was owing to this unpalatable condition of the feed or to a lowering or changing of the feed values. So a study was started in 1935 on the effect of different types of grinding of ingredients in laying mashes on laying hens. This study has been continued for a period of five years. A total of 1000 Single Comb White leghorn pullets, or 200 birds per year has been used. Housing conditions, methods and feeding, and the ratios used were identical in all four pens except for the variations in grinding the mash ingredients.

All feeds were ground in a hammer mill and a different screen was used for each mash.

Pen one received the coarse mash. In this feed the barley and wheat were ground very coarse, in fact there were some kernels of each not broken. The alfalfa meal was also coarsely ground and contained some bits of stems that were as much as 1/4 inch long. The small amount of fine material that was produced in this course grinding was included so as not to vary the composition of the different mash ingredients. Pen two received the medium coarse and pen three the medium fine mash. Pen four received the fine ground mash; the wheat and barley in this mixture being almost pulverized. The bran and alfalfa meal were reground to make these products fine in texture.

Fresh running water and coarse limestone grit were always available to the birds in all pens. The mash was fed in open reed type troughs and was always available. The whole grain was fed twice daily in a dry straw litter, a light feeding (about 1/4 of daily feed) was given in the forenoon, and a heavy one in the late afternoon.

The formula for each of these mashes was as follows:

- Millrun bran and shorts .................. 25 pounds
- Ground wheat ................................. 22
- Ground barley ............................... 25
- Meat meal and fish meal .................. 17
- Dried milk ................................... 4
- Alfalfa meal ................................ 8
- Fine limestone .............................. 2
- Salt .......................................... 1
- Cod liver oil ................................. 1

The table gives a summary of the data obtained from this study during the five-year period. Fifty Single Comb White Leghorn pullets were started in each pen each year.

The only significant differences in the data given in table 1 are a somewhat higher egg production and a lower mortality when the coarser feeds are fed than when finely ground mash are used. There is little variation in total feed consumption but the reduced mash consumption in the fine ground mashes may account in part for the lower egg production.

One other factor effecting net returns from the use of the finely ground feeds

Table 1. Percentage mortality, egg production, pounds of grit, grain and mash consumed per hen per year (five-year averages)

<table>
<thead>
<tr>
<th>Percentage mortality</th>
<th>Average egg prod.</th>
<th>Average weight of 1 doz. eggs</th>
<th>Mash eaten per hen</th>
<th>Grain eaten per hen</th>
<th>Grit eaten per hen</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Coarse mash ........</td>
<td>16.9</td>
<td>202.4</td>
<td>24.0</td>
<td>33.7</td>
<td>50.9</td>
</tr>
<tr>
<td>2. Med. coarse mash ...</td>
<td>19.5</td>
<td>212.2</td>
<td>24.0</td>
<td>33.7</td>
<td>50.9</td>
</tr>
<tr>
<td>3. Med. fine mash ......</td>
<td>22.8</td>
<td>198.6</td>
<td>23.9</td>
<td>28.8</td>
<td>52.4</td>
</tr>
<tr>
<td>4. Fine mash ...........</td>
<td>28.1</td>
<td>193.7</td>
<td>23.9</td>
<td>31.5</td>
<td>52.0</td>
</tr>
</tbody>
</table>

| 1. Average for two ... | 18.2             | 207.2                         | 24.0              | 34.0              | 50.3             |
| 2. coarse mashes ...... | 19.4             | 207.2                         | 24.0              | 34.0              | 50.3             |
| 3. Average for two ... | 25.4             | 196.1                         | 23.9              | 30.1              | 52.2             |

TWO NEW RESEARCH FELLOWSHIPS ESTABLISHED

Two new research fellowships have recently been established at the Station for graduate students in agriculture. Sears, Roebuck and Company is sponsoring a $450 fellowship in animal husbandry. This fellowship has been awarded to Wendell K. Peterson of Ogden, who received his B.S. degree in animal husbandry from the College in 1939. He will work under the supervision of Dr. Fred F. McKenzie in studying the causes of the low lamb crop among range sheep in Utah. During the months from November to February he will be stationed at the Desert Range Substation of the Intermountain Forest and Range Experiment Station on the desert in western Millard County. There he will supervise breeding and supplementary feeding experiments with range ewes, work started last year by Grant S. Richards, Experiment Station research fellow in animal husbandry. This year Mr. Richards will assist with other phases of the sheep breeding research work at Logan.

A fellowship has also been established in conjunction with a new project in agricultural marketing, being outlined by the Department of Agricultural Economics, for the study of problems in the marketing of fruits and vegetables in Utah. This fellowship will pay $500. The project is not yet completely organized and no appointment has been made for the position.

is that the cost of grinding is materially increased when the grains are ground very fine as evidenced by data published in Wisconsin Station Bulletin No. 420, page 110 wherein they show that the power cost in grinding 100 pounds of barley very fine is 8.1 cents while with coarse ground barley the cost was only 1.72 cents per hundred pounds.

Pen No. 2 receiving the medium coarse mash made the highest average egg production per bird per year every year during the five year study. In every year except one, pens one and two had the lowest percentage mortality.

Since, according to this five-year study, fine grinding of grains, alfalfa, and bran in laying mash mixtures increases mortality, reduces egg production, and increases the cost of grinding, it seems advisable to use coarsely ground mashes.

Farm and Home Science
Lining a Leaky Irrigation Canal with Clay Saves Both Water and Soil

Water Lost from Unlined Canals Would Irrigate Many Additional Acres

By O. W. Israelsen

Preliminary investigations on the use of clay lining for irrigation canals in the Delta Area have shown this material to be both cheap and practical for use in reducing seepage losses. These investigations are being made by the Agricultural Experiment Station in cooperation with the Irrigation Division of the Soil Conservation Service, assisted by the Work Projects Administration, Millard County and the Delta Area irrigation companies.

In Utah the dominant source of water conveyance losses in canals is percolation through the soils of the beds and banks. These losses are usually proportional to the permeability of the soil through which the canal is constructed, and to the hydraulic slope of the ground water table away from the canals in cases where the ground water is in contact with canal water.

The Delta Area includes approximately 75,000 acres of irrigable land of which 40,000 to 50,000 are irrigated. More than 80,000 acres are included in drainage districts. Land slopes in the area are small and the water table in some parts is close to the land surface.

Water Losses and Justifiable Lining Costs

During the season of 1940, from April to September, seepage losses of water from 8 different experimental sections, each approximately one mile long, were measured by direct and indirect methods.

Current meters were used for direct measurements. The average flow in each of the canals ranged from 23 to 72 second feet during the period, the maximum being nearly 200 second feet. Average seepage losses ranged from 2.1 to 10.7 percent per mile.

Delta-Melville canal in process of application of the clay lining showing W. P. A. men compacting the lining by hand.

A water filled cylinder roller used for compacting the clay and also the gravel placed on the clay after it has been compacted.
RESEARCH ATTACKS
PLANT PESTS AND DISEASES

CLIMATIC conditions this year have insured bumper yields of most crops grown in the state. But conditions favorable to crops have also been favorable to plant diseases and insect pests.

Only through the planting of disease-resistant varieties, or continued vigilance in the use of insect sprays and poisons have these pests been kept under control. In many areas heavy losses have been suffered through failure to stop the inroads of pests and disease.

Station investigators are spending much time and money to breed crops resistant to disease, and to find methods to control the myriads of insect pests that destroy crops. Already, varieties of cereals have been developed that are resistant to rusts and smuts—such varieties as Velvon barley, Uton oats, Relief wheat. A new unnamed variety of wheat is now ready to be increased for seed next year and will be released for general planting in the fall of 1942. Sugar beet varieties resistant to the curly top disease are grown throughout the state.

Research workers are now engaged in developing varieties of alfalfa resistant to wilt and root rot. A wilt resistant variety that is superior to any now generally grown is almost ready for release. Breeding of tomato varieties that are resistant to curly top and verticillium wilt is well under way. If sufficient funds are available to continue the program new varieties should be released within a few years. Progress is being made in the development of drought resistant grass varieties adaptable to range conditions.

Station entomologists are working to discover methods of control of lygus bugs that infest seed alfalfa, pea weevils and pea aphids, grasshoppers and crickets, peach twig borers, and many other insects that destroy crops.

Significant contributions are continuously being made in the attack on the devastating plant diseases and insect pests with which the farmers of the state have to contend. These contributions are in keeping with the objective for which the Agricultural Experiment Station was established, namely, to conduct experiments which will make for a more efficient, profitable and permanent agriculture and a better rural home life.

DR. McKENZIE

Dr. McKenzie has just returned from a trip to South America under the auspices of the U. S. State Department where he went at the request of Peru and Chile to develop a special research program in sheep breeding in the mountainous areas. In these countries considerable difficulty has been experienced with low lamb crops with range sheep. The livestock breeding problems of these arid South American countries are very similar to those in Utah and the Intermountain West.

Dr. McKenzie graduated with a B.S. degree in animal husbandry from the University of British Columbia, and received the M.A. and Ph.D. degrees from the University of Missouri. In 1925 he went to Turkey where he spent a year teaching at one of the American universities. Since returning he has been at the University of Missouri. He has made many important contributions in the field of animal breeding. Many of his graduate students now occupy important positions at such outstanding institutions as the University of Wisconsin, Purdue University, Texas A. and M., the Western Sheep Breeding Laboratory at Dubois, Idaho, and the National Agricultural Research Center at Beltsville, Maryland.

The animal research program now under way will be continued by Dr. McKenzie. At present the major emphasis is on sheep and wool production. A study is under way in cooperation with the Forest Service at the Desert Range Experiment Station west of Milford to determine the factors affecting the size of lamb crop in range sheep. The low lamb crop throughout most of the state is one of the important causes of lower profits from the sheep industry. Other studies are being conducted in sheep breeding and the measuring of performance. Methods of sampling and scouring fleeces to determine shrinkage are also being investigated. Studies are being made on the nutritive value of range forage as a feed for both sheep and cattle.

Other investigations are being conducted on the value of beet molasses in the rations of growing and fattening hogs. Dr. McKenzie also plans to establish work in range cattle breeding and improvement.
NEW FOOD COMMODITY PROCESSING LABORATORY COMPLETED

Investigations Conducted on Freezing Preservation of Peas, Lima Beans, Raspberries and Strawberries

By L. H. POLLARD

A new food processing laboratory has just been completed at the Davis County Experimental Farm which will make it possible for research work to be conducted on the freezing preservation of fruits, vegetables, and meats. In addition some work will be done on the canning of various fruits and vegetables.

Experimental work on the freezing preservation of fruits and vegetables in Utah was started two years ago by the Utah Station in cooperation with the U. S. Bureau of Agricultural Chemistry and Engineering. During the last year there has been some reorganization of the work in the U. S. Department of Agriculture and the freezing work has been transferred to the Food Commodity Processing Division of the Regional Laboratory at Albany, California. Mr. H. C. Diehl is head of that division.

In the past in order to freeze the samples it has been necessary to depend upon the facilities of some of the commercial companies who were freezing vegetables. While these companies were cooperative, some delays occurred. Before continuing the work this year it was decided that a commodity processing laboratory should be provided in order to eliminate many of the previous difficulties. It was also decided that such a laboratory should be as centrally located as possible in the freezing and canning crops production area. The Experimental Farm at Farmington seemed to be well located for such types of work so the laboratory was constructed by the Experiment Station at that location.

The laboratory has been completed with the exception of a few details. Some of the machinery is owned by the Commodity Processing Division of the Regional Laboratory at Albany and some of it has been lent by the American Can Company.

This is the only laboratory of its kind in the intermountain region. Because of its location it is admirably suited for research work on frozen food products for the entire region. At the present time freezing work will be conducted on strawberries, raspberries, peas and lima beans. Other crops will be added later as time and facilities will permit. Considerable research work is necessary on poultry freezing and later some of this work can be done in this laboratory.

It is planned that the new laboratory will serve the canning as well as the freezing industry. For a long time there has been a need for more experimental work on the canning of the different varieties of peas, beans and tomatoes. The canning of small samples has been difficult in the regular canneries and consequently only a little of this type of work has been done. Now that this laboratory has been constructed the necessary canning machinery can be installed along with the freezing machinery.

So far this year considerable work has already been done on the preparation of frozen samples of twenty different varieties of peas, as well as many samples of different raspberry and strawberry varieties. Before freezing these samples vitamin-C determinations were made of the fresh material. Later the frozen samples will be tested for their vitamin-C content to determine how well it has been preserved. The samples will also be tested to determine which has the best quality. That information will then be combined with the field data and recommendations will be possible as to the best varieties and methods to use.

Mr. D. G. Sorber of the Regional Laboratory has supervised the processing of the products this year. Professor F. M. Coe, head of the Horticulture Department has charge of the growing of the fruits, and Dr. L. H. Pollard, head of the Vegetable Crops Department handles the production and harvesting of the different vegetables which are to be frozen. Mrs. Almeda Brown, research associate professor of home economics, supervises the testing of the samples for their vitamin-C content as well as making quality appraisals.

PROLONGING LIFE OF CUT FLOWERS

The following chemical formulas are valuable:

No. 1—Dissolve 1 ounce hydrazine sulfate in 1 quart of water, and use this as a stock solution. To another quart of water, add 2 teaspoonfuls of the hydrazine sulfate stock solution, 2 grams manganese sulfate, and 1 tablespoonful of sugar.

No. 2—Dissolve ½ teaspoonful boric acid in 1 quart water. This is useful on carnations.

No. 3—A 10-15% sugar solution prolongs the life of China asters.

No. 4—To 1 quart water, add ½ teaspoonful of potassium aluminum sulfate (commercial alum), ½ teaspoonful sodium hypochlorite (Clorox), 1 pinch ferric oxide (iron rust), and 2 teaspoonfuls sugar. This solution is especially useful on cut roses.

Commercial products are also available.

—E. I. Du Pont de Nemours & Co.
—Agricultural News Letter
Western Sheep Breeding Laboratory Attempts to Solve Range Sheep Problems

Experiment Stations of Western States Cooperate in Breeding Program

The livestock industry is the most important agricultural industry in Utah as well as in the arid West. The vast acreage of land, too arid or too mountainous for crop production, makes available large areas that are valuable only for grazing of livestock, mostly sheep.

In Utah 85 percent or more of the total land area is best suited for grazing. Hence the range livestock industry has developed until it is now the source of considerably more income than is derived from any other agricultural enterprise in the state. In fact, this industry is the backbone of the state's agriculture. Approximately two and one-half million sheep and one-half million cattle are produced annually in the state.

Profitable production with range livestock requires stock adapted to survive under range conditions and which will produce high quality meat. A good yield of high quality wool is also important in sheep. Lamb and calf crops have frequently been too low for efficiency of production. Many difficult problems have been encountered by the livestock men of the West in attaining all of the desirable features that are necessary for success in the industry. Some of the difficulties are deep rooted and of such a nature that the individual stockman could not surmount them without government assistance. Research was needed to solve some of the problems. To meet this need, the United States Department of Agriculture in cooperation with the experiment stations of Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, South Dakota, Texas, Utah, Washington, and Wyoming, established the Western Sheep Breeding Laboratory in 1937 at Dubois, Idaho. The laboratory is operated in conjunction with the United States Sheep Experiment Station, where sheep breeding had been under way by the Bureau of Animal Industry since 1917.

Dr. Julius C. Nordby, formerly professor of animal husbandry at the University of Idaho, is director of the laboratory and in charge of the animal breeding program. This program is formulated with the counsel of the collaborators from the various experiment stations, each of whom is an authority in some phase of animal husbandry, as well as being conversant with the special problems of his state. Dr. Fred F. McKenzie, head of the Animal Husbandry Department, is the collaborator from Utah.

The facilities of the Laboratory comprise approximately 28,000 acres of spring-fall range of the sagebrush grass type, 20,000 acres of summer range on or adjacent to the Targhee National Forest, and Forest Reserve allotments for winter and some summer grazing. The Laboratory is equipped with a central laboratory building with facilities for research in scouring and cross-sectioning of wool, as well as for research in the physiology of reproduction and artificial insemination, an experimental laboratory barn, lambing facilities for about 1,000 ewes at a time, shearing facilities, and dwellings for the personnel. There are about 4,000 experimental sheep of the Columbia, Corriedale, Rambouillet, and Targhee breeds.

The elevation of the various range areas varies from 5,000 to 9,000 feet. Headquarters are located on the spring-fall range at an elevation of 5,500 feet, 8½ miles from Dubois, in the northeastern part of Idaho, about 90 miles west of Yellowstone Park and 25 miles south of the Montana boundary.

The flocks are maintained under
strictly ranch conditions, on high altitude ranges in the summer from which they return when fall storms begin to threaten, or the frost has too greatly injured the feed. They are usually on the winter range until storms become too severe, which occurs generally in January. The remainder of the winter is spent on alfalfa hay in an irrigated valley. The sheep are in the open the year around. Since the improvement sought is based strictly on utility qualities, it is quite important that the management be essentially of the type that is typical of the West for desirable sheep ranching management.

The main objectives of the program are the improvement of already existing breeds that are generally adapted to ranch production and the production of new breeds that fill needs which cannot be filled so well by established breeds. Production is measured on the basis of yield and quality of wool, in pounds of lamb of the desirable type and finish, and in adaptability. The staple length and the quality and uniformity of fibers, as well as the shrinkage, are important factors that are studied with the yield of wool. All useful type characteristics that influence lamb production, ranch adaptability, and general serviceability are closely integrated in the improvement program. Recognition is taken of the dual usefulness of sheep for meat and wool. In general, meat production is emphasized above wool production in ranch sheep.

Moreover, improvement which is designed to serve a large area of diverse environment should not be limited to one breed, but applied to a number of breeds that are variously adapted to western ranch environment. Consequently, aside from breeding and selection in the common breeds, such as Rambouillet and Corriédale, the Laboratory has produced two new breeds, the Columbia and the Targhee.

The Columbia was developed in an effort to contribute stability to the production of a bigger range ewe. The breed is, in general, the result of crossing selected Lincoln rams on Rambouillet ewes, and proceeding from this original cross by breeding the most select first cross rams to first cross ewes, a method which has progressed in general in this manner down through the generations until the Columbia is becoming recognized as an established breed. This breed produces three-eighths quality wool with an average twelve months’ growth of 3½ inches and an average mature ewe fleece weight of about 21 pounds of grease wool. The Columbia produces large lambs that grow rapidly and mature satisfactorily under good ranch conditions.

The Targhee breed is, in general, the product of crossing select Lincoln rams on Rambouillet ewes and mating the first cross ewes back to Rambouillet rams to produce a three-quarter Rambouillet, known commonly as the “comeback.” Some Corriédale breeding has also been used in the production of the Targhee. In size the Targhee is between the Rambouillet and Columbia. The breed is well adapted to range production, and produces lambs of acceptable size and desirable maturing qualities. The annual production of wool for mature ewes is a little more than 11 pounds of half-blood quality wool, about 3 inches in length. While horns are common in the Rambouillet rams, the Columbia and Targhee are being developed without horns. Rigid selection has been practiced since the inception of the flocks so as to avoid the perpetuation of undesirable qualities in wool and lamb production requirements.

Thus, through a central agency the sheep breeding investigations of all the western range states are being coordinated. Here investigations can be undertaken which would be impossible at the various stations because of lack of facilities and funds. Duplication of effort is eliminated.

**NEW PUBLICATIONS**

Cir. 116. Fertilizers for Utah soils—D. W. Pittman and D. W. Thorne. Many Utah soils have been found deficient in available phosphorus which may be overcome by the addition of fertilizer containing large amounts of available phosphoric acid. Nitrogen fertilizers may be needed on fruit and truck crop farms. Mixed fertilizers are not recommended for general use because of cost and because Utah soils seldom need more than a single plant food constituent.

Cir. 117. Lawn weeds and their control—D. C. Tingey and Bassett Maguire. If conditions are made highly favorable for the growth of grass, it will crowd out weeds. Luxuriant lawn is best attained by more liberal use of fertilizer, by raising the cutter bar on the mower to avoid too close clipping, by avoiding too frequent clipping and by thorough irrigation.

Bul. 297. Pale western cutworm—C. J. Sorenson and H. F. Thornley. This bulletin describes the life history and methods of control of this insect pest of dry-farm grains. Cultural methods have been found best for control. They consist of preventing moths from laying eggs in summer-fallowed land. This is done by allowing a crust to form on the land.

Bul. 298. Wool scouring tests in Utah—Alma C. Esplin, Ralph W. Phillips and Milton A. Madsen. On the basis of the data analyzed it is recommended that scouring tests of composite samples be used as a basis for estimating the yield of clean wool in determining the price of grease wool.

Bul. 299. Control of chlorosis in American grapes—F. B. Wann. Grafting of Concord scions on vinifera rootstocks offers a solution of the chlorosis problem in the Concord grape. Other methods of control tried have not proved permanent.

Any of these publications may be obtained free by addressing a card to the Utah Agricultural Experiment Station, giving the number and series of the publication desired.
Pendulous crop in turkeys may be successfully treated by operation

By Wayne Binns

Pendulous crop is greatly enlarged crop (inlusses) of turkeys characterized by a temporary or permanent distention with stagnant liquid or semi-liquid contents. Turkey growers commonly call this condition dropped crop, hanging crop, baggy crop, sour crop, or water crop. The number of cases in flocks in semi-arid sections ranges from 1 to 25 percent. There have been many conflicting opinions regarding the cause of this condition. In 1936 Dr. W. R. Hinshaw and V. S. Asmundson of the University of California found that this condition was an inherited abnormality in turkeys raised where the maximum air temperature and hours of sunshine are high and the relative humidity comparatively low.

The first symptom of this condition is a slight distention of the crop with stagnant liquid or semi-liquid contents. Crops of some turkeys may be distended only temporarily during the time of a short heat wave, after which they return to normal. In other birds the crop continues to enlarge after it once begins until the maximum size is reached. The contents have no odor at first but later become sour and rancid. The appetite is not affected for some time after the onset, if at all, but the food does not seem to be properly assimilated. The affected birds develop very slowly, becoming unthrifty and poor in flesh with the crop, in advanced cases, almost touching the ground. The feathers become worn off from the under side and in most cases large lacerations are found in the skin caused by sharp objects in the ground or from the toes catching in the skin as the bird walks.

The work of Dr. Hinshaw and Asmundson indicates that one-third of all cases make a complete recovery, one-third die as a direct result of the condition, and one-third continue to maturity. The deaths have been owing principally to self-inflicted lacerations of the skin and crop membrane resulting in a rupture of the organ, injury from mates when the bird is unable to defend itself, and from liquid contents of the crop returning to the mouth when the head is lowered and then aspirated into the lungs causing pneumonia. Less than two percent of the affected birds that live to maturity are fit for market and none of these are first quality specimens.

Most of the cases begin soon after the birds are moved out of the brooder house, although some occur during the autumn months and even during the following summer.

The prevention of this condition lies primarily in obtaining poults from breeding stock that is free from pendulous crop. After the birds are put on range ample watering space for all birds should be provided and this should be close to the feed hoppers. If the birds are on range where there is no natural shade available, shade should be provided. Inexpensive sun shelters can easily be made by putting four posts about eight feet long in the ground, then stretching net wire over the posts and covering the wire with straw, limbs, or other material to protect the birds from the sun.

Several methods of treatment of pendulous crop have been tried and it has been found by the Animal Pathology Department that by removing a portion of the crop by surgical operation 85 percent of the badly affected birds can be saved and sold as prime or choice birds.

This operation requires about fifteen minutes for each bird, and few surgical instruments are needed. It is an opera-
tion that the farmer cannot afford to hire done, but he or the herdsman can be taught the procedure and can treat all permanently affected birds during his spare time.

**Operative Procedure**

All instruments necessary for the operation are shown in figure 1. One pair of long mouth forceps, scissors, knife (pocketknife can be used), suturing needle (large darning needle can be used), and linen thread. It is not necessary to use a general or local anesthetic, because there is little pain. The instruments do not need to be boiled, but they should be thoroughly washed before beginning the operation and sanitary measures should be carried out as much as possible.

The birds must be well restrained by tying the legs together with a small piece of strong rope and then hung by their legs (head down) from a solid post or tree so the crop is about level with the operator’s shoulder, making a comfortable position to work.

After the bird has been properly tied and hung, remove all feathers over the area of the enlarged crop, express all liquid contents by applying slight pressure to the crop and extending the bird’s head. Then with a sharp knife make an incision by cutting just through the skin, starting about one inch below the breast bone and continuing down over the crop for about six inches. Then lay the knife aside and with the fingers separate the crop from the skin and breast muscles until it is hanging only by the tube that carries the food from the mouth to the gizzard (esophagus).

Then extend the crop and apply the long mouth forceps across it about one and one-half to two inches from the attachment, close and lock the forceps as shown in figure 2. This is to prevent the crop from turning inside out after a portion is taken off and to prevent hemorrhage. Then with the scissors, cut the end of the crop off one inch from the outer edge of the forceps, keeping both edges even and in a straight line. With the needle and thread begin at the upper end of the cut portion of the crop, and make a small stitch in the outer tissue, being careful not to go through the entire wall. Tie the free end at this point. Then cross to the other edge, about one-eighth of an inch from the cut edge take another stitch in the outer tissue of the wall, being careful not to go through the inside lining. The suture should be pulled tight drawing the two edges together and bringing the outer surfaces in contact with each other as shown in figure 3. Continue this method of suturing until the entire opening is closed, being careful that the thread is always tight and the outer surface of each edge is in contact with the other. Then remove forceps (fig. 4). Wipe off the crop with a clean damp cloth and replace. Then bring the skin together by a continuous suture going through the entire skin and drawing the edges together (fig. 5). When the bird is released, it has a large sunken area in the region of the crop as shown in figure 6. All birds that are treated should be separated from the flock for the first two days following the operation. This will give them a chance to recover from the shock of the operation more rapidly.

The most important procedure of the operation lies in suturing the cut edges of the crop together. If this is done carefully making sure it is tight to prevent leakage and the outer surfaces are in contact with each other, there should be a low death loss from this treatment.

Dr. Ralph W. Phillips resigned his position as head of the Department of Animal Husbandry, July 1 to become senior animal husbandman in the Bureau of Animal Industry. He is stationed at the National Agricultural Research Center, Beltsville, Maryland, and has charge of genetic investigations in the Bureau of Animal Industry. In this capacity, he supervises and coordinates animal breeding and genetics research in the three regional laboratories dealing with sheep, swine, and poultry breeding, and similar work at the numerous field stations located throughout the country, as well as the extensive research in animal genetics and physiology being conducted at Beltsville.

Dr. Phillips will maintain contact with animal breeding work in the West through the Western Sheep Breeding Laboratory, Dubois, Idaho, the Southwestern Range and Sheep Breeding Laboratory at Ft. Wingate, New Mexico, and the U. S. Range Experiment Station, at Miles City, Montana.

During the two years Dr. Phillips was head of the Department of Animal Husbandry, he initiated an animal breeding experimental program that will be of inestimable value to the sheep and wool growers of the state. This work will be continued by Dr. McKenzie.

Dr. D. E. Madsen and Dr. George T. Blanch have both returned from a year spent in study at Cornell University. Dr. Madsen received his M. S. degree in Animal Pathology, and Dr. Blanch, his Ph. D. degree in Agricultural Economics.
LINING CANALS

(Continued from page 3)

Justifiable costs of lining based on the value of the water that may be saved range from 1.8 to 8.9 cents per square foot.

For the indirect methods, water losses from the canals were estimated by keeping records of the position and slope of the ground water table on lines at right angles to the experimental canal sections.

On April 13, 1940, the water table was 9.0 feet below the ground surface at a point near one canal, and on June 5, 38 days after water was turned into the canal, the water table was only 3.5 feet below the ground surface at the same point.

At a distance 1,000 feet from the canal, the water table rose two feet i.e., from a depth of 7.5 feet to 5.5 feet below the ground surface in 38 days. On April 13, 1940, the water table was nearly level, and on June 5, there was a considerable slope away from the canal thus showing that the canal losses contributed to the rise of the water table.

Many similar measurements lead to the conclusion that losses from the canals in the Delta Area contribute greatly to the rise of the ground water table each year.

In one 4,000-foot canal section the loss averaged 6 second-feet or 12 acre-feet per day. This represents a loss of crop production on an area of 500 to 600 acres.

Permeability Studies

Permeability studies were made of 16 soil samples from the Delta Area. The minimum coefficient of permeability as measured in the laboratory was 0.013 feet per year. The ratio of the coefficients of permeability range from 1 to 5,000.

The studies of permeability of soils in the Delta Area lead to two conclusions, namely:

1. That some of the clay soils of the area are sufficiently low in permeability to justify their use in lining canals to prevent seepage losses, and,
2. That some soil materials which irrigators thought might be good are so high in permeability as to be of little or no value for lining canals.

Oasis Clay Used as Lining

The 4,000-foot section of the one canal in which the flow ranged from 60 to 150 second-feet and from which the losses showed a justifiable cost of lining of 8.9 cents per square foot, was lined with Oasis clay 3 inches thick when compacted. Clay was hauled in dump trucks a distance of two miles. The compacted clay lining was covered with a layer of gravel from one-half to one inch thick. The canal has a depth of 3.5 feet, a bed width of 16 feet, side slopes 2 horizontal to 1 vertical and bed slope of 0.6 foot per 1,000 feet.

Methods of compacting the clay soil lining are shown in the figures. The hand method was used entirely during the early period of development; the mechanical method was used later.

The moisture content of the Oasis clay in its natural condition, before being distributed, was near the optimum for compacting. Moisture losses from the clay while hauling it to the canal were negligible, but delays in spreading and compacting sometimes caused appreciable losses. Because of the heavy rains during late March and April while the canal was being lined, it was impractical to compact the clay at a uniform moisture content. In some instances the moisture content during compactions was greater than optimum—in others it was less. There was no water applied to the clay.

Cost of Lining

The average construction cost, i.e., for labor and supervision, not including the research cost elements, was approximately 3 cents per square foot. This is roughly one-third of the justifiable cost computed on the basis of the value of the water saved.

Permeability Comparisons

The bed of the canal as constructed through the Lynndyl gravelly loam was found to vary greatly in permeability, as measured with a constant head permeameter under a pressure head of 2 feet. The coefficient of permeability ranged from 30.4 to 65,000 feet per year.

Permeability coefficients of the completed clay lining, as measured by a variable-head permeameter, were found to be reasonably constant and averaged 0.124 feet per year. The ratio of the permeability of the Lynndyl gravelly loam in the natural canal bed to that of the lined canal bed ranged from 400 to 1 up to 50,000 to 1 and averaged 9,000 to 1. It is thus evident, assuming these measurements are sufficient to represent the average for the entire canal section, that the same quantity of water would flow through the canal bed before lining in one hour as would flow through the compacted clay lining in one year.

Erosion of Clay Lining

Water was turned into the lined canal on May 8, 1941. The initial stream of approximately 35 second-feet caused no erosion of lining. In response to a pressing demand by irrigators for water a few days later a stream of 150 second-feet, the maximum capacity of the canal, was conveyed for several days. This caused some erosion of the outer bank wherever there was a bend or curve in the canal. Inspection of the canal after one month of service showed a large percentage of the lining had resisted erosion. It seems reasonable to expect that the permeability of the canal bed may be lowered by the penetration of soil colloids into the original sandy material, and that the eroding of the clay from part of the canal bank may not seriously increase seepage losses through the lined canal.

Soil Conservation

Years of study of the alkali problem by the Agricultural Experiment Station and the U. S. Department of Agriculture lead to the conclusion that the first steps in conservation of soils against alkali injury are prevention of upward movement of soil water and provision for sufficient leaching by downward movement. These steps necessitate in many cases a general lowering of the water table. Increasing water conveyance efficiencies by lining irrigation canals with clay, or other low-cost materials of low permeability, is a promising method of conserving water and of lowering of water tables and the soil surveys threatened with alkali injury.

Farm and Home Science

The basic assumptions and details of the computations of justifiable costs of lining are presented in Farm and Home Science vol. 1, no. 3, Sept. 1940.
BACTERIAL CANKER

(Continued from page 1)

a yellowish mealy mass from which the pith may be easily separated. A yellowish milky ooze may be obtained by squeezing the petiole of detached slightly wilted leaves. The causal organism may be carried on or within the seed of fruits harvested from fields where the disease occurs. It may also live for one or two years in seedbed and field soils.

Research work of the past few years has resulted in the development of methods for the control, if not the virtual elimination, of this disease as a factor in tomato production. Losses have been steadily decreasing from year to year as a result of the adoption of these methods by the industry. Constant care has to be exercised in seed selection and plant production, however, or the disease will reappear in a destructive manner.

The control of bacterial canker depends upon carefully following three essentials (1) the use of clean seed, (2) the use of clean seedbed soil, and (3) the use of a clean field.

The Use of Clean Seed

Clean seed may be obtained from companies that endeavor to destroy all infected plants in the seed fields and extract their seed by fermenting the crushed fruit pulp for 96 hours before extraction, or treating the seed immediately following extraction with 0.8 to 0.9 percent solution of acetic acid for 24 hours. Farmers or canners who have particularly desirable strains of tomato can save their own seed practically free from contamination with the canker organism by following the same extraction procedure.

The fermentation procedure for seed extraction should be carefully done by making sure the fruit is thoroughly liquified before being set to ferment. This may be achieved by running the fruit through a tomato pulper or some type of tomato juicer and recombining all the juice, seeds, and pulp in a suitable container. Fermentation should be allowed to proceed for 96 hours at a temperature of not over 70 degrees F. The fermenting juices should be thoroughly stirred daily to submerge the pomace that floats to the top.

When the 0.8 percent acetic acid soak treatment is used, the seed should be confined in loose cheesecloth bags before it is dried, and thoroughly agit-
INSTRUCTION IN AGRICULTURE VITALIZED BY RESEARCH

By R. H. WALKER

Since the establishment of the Utah State Agricultural College, of which the Agricultural Experiment Station is an integral part, there has been a close association between the research work of the Station and the college teaching in agriculture. Over a period of years the experimental program has developed new information on the many and varied phases of agriculture which now constitutes the source material for college teaching purposes in agriculture. This information has been produced by scientific investigations of the many difficult problems with which the farmers have been confronted.

In addition to furnishing new information for student instructional work, the Agricultural Experiment Station vitalizes the training of college students. During the four years a student is enrolled in the agricultural curricula at the college, he has numerous opportunities to assist with and participate in one or more phases of the experimental program that is carried on by the Station. Many students are employed each year to assist in caring for livestock, in planting and harvesting crops, in making chemical analyses in the laboratory, in collecting farm management data, in making rural community studies in the field, and in various other activities which are a part of the research program.

The faculty members and instructors in the School of Agriculture, with few exceptions, devote a part of their time to conducting the various investigations of the Experiment Station. They may spend one half or some other fraction of their time in teaching and the remainder in experimental work. Thus the staff members are kept abreast of the vital agricultural problems of the day; it is their job to recognize these problems and then to conduct experiments and investigations which will help the farmer to overcome them. This makes their thinking practical, and it is reflected directly in their classroom work with students.

Last year there were 523 men and women students enrolled in the School of Agriculture at Utah State Agricultural College. Sixty-seven of these graduated with the Bachelor of Science degree, and 14 with the Masters degree. A high percentage of these students have already found their place in their chosen field of work for which they prepared themselves while in college. Requests are made daily for additional young men who are well trained and qualified to take up work in the various agricultural pursuits.

Young people who are well trained in the technical and practical phases of agriculture are greatly needed in the state and in the nation today. Outstanding leadership is needed to assist in guiding the destiny of the farm people toward a more efficient, prosperous, and permanent agriculture. Coordinate with this need is that for optimistic and progressive young people on the farms who have been well trained in the technical and practical phases of agriculture. A great opportunity and challenge is open to those students with vision who have an interest and an aptitude for agriculture and who are willing to prepare themselves properly.

Dr. C. W. Lauritzen of the Soil Conservation Service has been transferred from Waco, Texas, to Logan to assist with some of the irrigation and drainage investigations, also with the range reseeding studies in the Benmore area.

Dr. Lauritzen received his B.S. degree at this institution, afterward receiving his Ph.D. at the Michigan State College.

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