DDT Dust Effective For Earworm Control in Market and Canning Corn

By WALTER E. PEAY and HOWARD E. DORST

A 10 percent DDT dust applied at approximately 30 pounds per acre looks the most promising for corn earworm control in sweet corn in Utah. Several materials have been tried as dusts and sprays in recent years, but DDT dust gave the best control when applied two or three times at 3 day intervals starting as soon as any silks appeared. Therefore, the discussion in this article deals only with the results obtained from the use of dusts.

In an effort to aid growers and canners in reducing corn earworm losses, the U. S. Bureau of Entomology and Plant Quarantine and the Utah Agricultural Experiment Station started experiments for the control of the corn earworm in 1948. Canners and growers were cooperative and gave assistance wherever possible.

How The Tests Were Made

The work was conducted in both early market and canning corn fields. Several insecticides were used as dusts. These were applied with both hand and power equipment at approximately 30 pounds per acre. When hand equipment was used, the materials were directed at the silks and ears; but when power equipment was used, the entire plant was treated. The hand dusters were the rotary-fan type that had a continuous flow of dust.

Construction Of Power Duster

The power duster was one especially designed to minimize duster damage to the crop when treating tomatoes and corn (Fig. 1). It was constructed by mounting a small dusting unit on a cub tractor and attaching it to the power take-off. A 22 foot boom was mounted on the right side, which allowed the dusting of 14 rows between roadways. The same size boom fastened in the center would require a roadway every seven rows, or twice as many. The boom was made of aluminum conduit pipe with 3/8 inch holes drilled every 6 inches on the bottom side for the distribution of dust. By starting on the right side of the field and 14 rows in from the edge to allow for the first turn, and by skipping over 14 undusted rows each time at the end where started, the machine could always be turned toward the field. With this procedure, fences or ditches did not interfere with the boom. A 20 foot canvas trailer was fastened to the boom to force the dust down into the corn. The boom was adjusted to hit the corn above the ears, thus bending the stalks over and leaving the corn silk and ears more exposed to the dust. The machine did little damage when corn was treated during the warm part of the day. From 7 a.m. to 7 p.m., the cornstalks were warm enough to bend over without breaking off. In fields where corn was from 5 to 6 feet high, no damage occurred. Even where the corn was from 8 to 10 feet high, the machine caused less than 1 percent damage.
Comparison of DDT, TDE, Parathion, and Methoxychlor

The results were obtained by examining from 50 to 100 ears of corn in each plot just before harvest. Each ear was classified as being free of worm injury, having tip injury, or severe injury.

Three materials—DDT, TDE, and methoxychlor—were used as dusts in 1948. These were applied twice with hand equipment at weekly intervals, starting when the corn began silking. Of the several materials tried, 10 percent DDT dust and 5 percent methoxychlor dust were the only two that gave a significant reduction in worm damage. DDT, the better of the two, increased the amount of worm-free ears by six times and reduced damage 60 percent.

In one field heavily infested with corn sap beetles (Nitidulidae), the 10 percent DDT dust gave excellent control of these insects. In 1949 the power duster was used. The materials were applied twice at weekly intervals at approximately 30 pounds per acre, starting when the corn began silking. The materials used were DDT, TDE, and methoxychlor dusts at 10 percent strengths and parathion dust at 1 percent strength. In seven fields treated, the best results were obtained in fields isolated from other fields. In such fields, 10 percent DDT gave 60 percent control. The average control for all seven fields for DDT was 31 percent as compared with 19, 9, and 4 percent for TDE, parathion, and methoxychlor, respectively.

The power duster was used again in 1950. Work that year indicated that better results were obtained when the applications were made every 4 or 5 days rather than at weekly intervals.

In 1952, the earworm infestations were the heaviest on record. Several insecticides were used, but emphasis was given to testing 10 percent DDT dust with various applications at 3 day intervals, starting at the different stages of silking. All the materials were applied with a power duster at approximately 30 pounds per acre.

### 1952 Tests In Early Market Fields

Five early market cornfields were treated three times with 10 percent DDT dust (table 1).

In field 1, 25 percent of the ears were silking when the first application was made. The field was wet from irrigation 3 days later so the second application was not made until 1 week after the first. The initial application was made on fields 2, 3, and 4 as soon as any silks showed and 3 days later. The better control in those fields could have been because of the earlier initial application or the shorter interval between the applications.

Field 5 was 30 percent silked out when the first application was made. Table 1 shows the percentage of corn ears worm-free, tip damage, severe damage, and control for each field.

<table>
<thead>
<tr>
<th>Field</th>
<th>Worm-free</th>
<th>Tip damage</th>
<th>Severe damage</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DDT Check</td>
<td>DDT Check</td>
<td>DDT Check</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>40 4</td>
<td>23 19</td>
<td>37 77</td>
<td>37</td>
</tr>
<tr>
<td>2</td>
<td>66 20</td>
<td>14 6</td>
<td>20 74</td>
<td>57</td>
</tr>
<tr>
<td>3</td>
<td>60 18</td>
<td>33 33</td>
<td>7 49</td>
<td>51</td>
</tr>
<tr>
<td>4</td>
<td>52 12</td>
<td>35 49</td>
<td>13 39</td>
<td>45</td>
</tr>
<tr>
<td>5</td>
<td>40 7</td>
<td>30 64</td>
<td>10 29</td>
<td>35</td>
</tr>
<tr>
<td>Average</td>
<td>51 12</td>
<td>31 34</td>
<td>17 53</td>
<td>45</td>
</tr>
</tbody>
</table>

The work in this field warrants further testing of a DDT-sulfur combination dust.

(Continued on page 28)
Fig. 1. Production of breeder’s and foundation seed of improved alfalfas requires isolation to prevent cross pollination with other alfalfa. A dry land wheat growing region approximately 15 miles west of Logan is being used for this purpose. Several square miles are involved in the project which includes the production of breeder’s and foundation seed from 7 new strains and varieties of alfalfa.

Fig. 2. (Right) Initial plantings of new alfalfas are made in rows that can be cultivated and hand weeded as a means of facilitating maximum production.

By JOHN W. CARLSON

Vernal Alfalfa

A NEW VARIETY ON THE WAY

VERNAL, a promising new variety of alfalfa for some of the northern areas of the United States, has been developed at the Wisconsin and Utah Agricultural Experiment Stations with the cooperation of the United States Department of Agriculture. The apparent superiority of this alfalfa over Ranger, Buffalo, Atlantic, Grimm, and Ladak for these areas is found in its slightly higher forage yielding capacity, winter-hardiness, and increased resistance to bacterial wilt, a serious soil borne disease that is widely prevalent in most alfalfa growing regions of the United States.

Trials in three widely separated areas in Wisconsin during the last three years show that while Vernal is not winterproof, it has greater winter-hardiness than Ranger under these conditions. In addition severe tests involving artificial inoculation with the bacterium causing wilt disease and field trials on wilt infested soils, show that Vernal alfalfa has higher resistance to bacterial wilt than Ranger. Winterkilling and bacterial wilt alone or interacting with each other are among the principal killers of alfalfa in some areas in the northern part of the United States.

How Vernal Was Produced

The development and release of new varieties of alfalfa for use by farmers involve (1) breeding with preliminary evaluation of component materials; (2) widespread testing for seed and forage production to determine regions of adaptation; (3) production of breeder and foundation seed stocks; and (4) the production of certified seed under conditions that will assure the preservation of distinctive varietal characters, and its distribution through commercial channels. These trials indicate the possible superiority of Vernal alfalfa in (1) resistance to winter injury and bacterial wilt; (2) forage production; (3) tolerance to foliar diseases; and (4) color of foliage.
Approximately 20 years of intensive activity were required to develop Vernal alfalfa. Most of the breeding work was done in Wisconsin. The Division of Forage Crops and Diseases of the United State Department of Agriculture cooperated in the disease phases of the breeding work, and the Utah Station in producing sufficient initial seed stocks to permit its preliminary evaluation in small test plots in Wisconsin, Iowa, Pennsylvania, New York, Minnesota, Nebraska, Utah, and several Canadian provinces.

Further testing of Vernal alfalfa for hay production in Utah will be required, and seed stocks are being produced for this purpose. In the meantime, foundation seed is being increased by growers under contract with the National Foundation Seed Project. Foundation seed will thus be made available for the production of certified seed in quantities sufficient to meet the needs of ultimate users in regions of adaptation.

Since the present supplies of Vernal alfalfa seed are limited, requests for seed should not be made at this time.

**CORN EARWORM CONTROL**

(Continued from page 26)

1952 Tests In Canning Corn Fields

Results obtained in the treatment of early market sweet corn showed that three applications of 10 percent DDT gave good control. It appeared that the best control was obtained when the applications were made every 3 to 4 days. Three applications at 3 or 4 day intervals are expensive and difficult to handle on a large acreage of canning corn; thus, experiments were designed to compare two, three, and four applications for corn earworm control on canning corn. The applications were started in three fields as soon as the corn began silking and in one when it was 50 percent silked. One of the early silking fields was wet 3 days after the first application so the interval was 1 week between the first and second applications. Poor results were obtained in this field and in the one that was 50 percent silked. The worm infestations were so heavy in 1952 that many larvae were feeding on the cornstalks before any silks appeared. As soon as silking occurred, worms entered the tiny ears. If treatments were delayed until from 10 to 25 percent of the ears were silking, many worms were in the ears and could not be controlled.

Good control was obtained in fields where the applications were started as soon as any silks appeared and continued every 3 days as shown in table 2.

<table>
<thead>
<tr>
<th>Applications</th>
<th>Percentage of corn ears</th>
<th>Reduction of severe injury</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Free of worm injury</td>
<td>With tip injury</td>
</tr>
<tr>
<td>Number</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>44</td>
<td>39</td>
</tr>
<tr>
<td>3</td>
<td>59</td>
<td>36</td>
</tr>
<tr>
<td>4</td>
<td>77</td>
<td>19</td>
</tr>
<tr>
<td>Check</td>
<td>10</td>
<td>19</td>
</tr>
</tbody>
</table>

An analysis of the data summarized in table 2 shows a significant difference in the number of worm-free ears in all treatments, but there was no significant difference in the number of severely damaged ears between the treatments. This means that in market sweet corn where the number of worm-free ears is important, three and four applications are desirable. In canning corn where tip injury is not particularly important but where ears with severe injury are the ones that cause the most trouble, the feasibility of three and four applications is questionable, but two applications are certainly profitable.

**UTAH SCIENTISTS WIN NATIONAL AWARD**

Dr. C. Wayne Cook, associate professor of range management, and Dr. Lorin E. Harris, professor of animal husbandry, were winners of the Hoblitzelle National Award in Agricultural Sciences. The two men won the award for their research on a method of measuring the nutritional value of range forage and of predicting and warding off nutritional deficiencies. Each received a gold medal and shared equally in the $5,000 award.

The Hoblitzelle Award is presented every two years to the scientist or scientists who are considered to have made the greatest contribution to agriculture through their research in the previous two years. The winner this year was chosen from a total of 60 nomination by a committee of outstanding scientists from all parts of the nation. Members of the committee were: Dr. Firman E. Bear, Rutgers University, New Brunswick, New Jersey; Dr. John H. Parker, Midwest Barley Improvement Association, Milwaukee, Wisconsin; Dr. John E. Coit, Consulting Horticulturist, Vista, California; Dr. H. C. Knoblauch, Office of Experiment Station, U. S. Department of Agriculture, Washington, D.C., and Dr. G. H. Richter, Rice Institute, Houston, Texas.

Dr. Merthyr L. Miner, acting head of the Veterinary Science Department, has been granted a year's leave of absence for advanced study at the University of Minnesota. Dr. Miner was awarded the Harkness Foundation Fellowship for advanced study in veterinary science. Dr. Wayne Binns, head of the Department, won the same award last year and is now studying at Cornell University. He will return July 1, 1953.

**NEW PUBLICATION**


Replacing ground corn in the mash and wheat in the scratch with barley in turkey rations resulted in decreased rate of growth and more pounds of feed to produce a pound of gain. All barley diets had approximately 86 percent of the feeding value of higher energy diets. Larger amounts of barley may give better results than were obtained in this investigation when the deficiencies of barley are determined and properly supplemented.

Single copies of this publication may be obtained free from the Utah Agricultural Experiment Station, Logan.

Dr. Clyde Biddulph, professor of physiology, has been granted a leave of absence to engage in research in physiology for the Air Force at San Bernardino, California.

Royal A. Bagley has been appointed research assistant professor of veterinary science. He recently received his D.V.M. from Colorado A and M College. He received his B.S. and M.S. degree from USAC.

Dr. Edna Page and Professor A. Alvin Bishop are new members of the Experiment Station staff. Both these individuals have been members of the teaching staff for some time. Dr. Page will do research in foods and nutrition and Professor Bishop in irrigation.

**FARM AND HOME SCIENCE**

Published Quarterly by the Agricultural Experiment Station Utah State Agricultural College Logan, Utah

R. H. WALKER, Director

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Address correspondence regarding material appearing in these columns either to the editor or to the author.

More detailed information on the subjects discussed here can often be found in Station bulletins and circulars or may be had through correspondence.
SECRETARY of Agriculture Ezra Taft Benson in his recent talk to the American Dairy Association stated that one of the ways the industry could improve its position would be to shift more rapidly from production of manufacturing milk (grade C) to production of market milk (grade A). This he advised would make possible increased sale of milk in fluid form and thereby reduce the amount used to manufacture products sold in competition with vegetable oil substitutes.

A recent survey was made of milk sold to dairy plants by Utah dairy producers. Purpose of this study was to compare changes in grade A and grade C milk sales to plants in 1948 and 1952 on a county basis. Results of this study indicate that grade A or market milk sales in 1952 represented 53 percent of the total milk sold in Utah to dairy plants. In 1948, 39 percent of the milk sold to dairy plants was grade A, indicating a significant shift in production of grade A milk. This shift occurred in all but Daggert and Rich Counties from which no grade A milk was sold in 1952. In all other counties a higher percentage of total milk sales was grade A in 1952 than in 1948 (fig. 1).

In Tooele and Salt Lake Counties in 1952, 99 and 95 percent, respectively, of total milk sales were grade A. Both of these counties sold 92 percent of their milk as grade A in 1948. Wasatch County, which sold 80 percent of its milk as grade A in 1948, sold 90 percent in 1952. Utah County, the most important grade A producing county in the state, sold 80 percent of its milk as grade A in 1952 compared to 65 percent in 1948.

While Cache County dairy producers sell more milk to dairy plants than any other county in the state, the portion of their total production which is grade A has been relatively low. In 1948 only 15 percent of milk sold was grade A. However, substantial increases in grade A sales have taken place in the last four years. Information collected for 1952 shows that during the last four years grade A milk has increased to 25 percent of the total. As noted previously, only two counties were not selling grade A milk in 1952 while six counties: Emery, Rich, Garfield, Wayne, Kane, and Daggett, did not sell grade A milk in 1948.

The sale of grade A milk on a statewide basis increased 48 percent between 1948 and 1952. This increase was greatest in counties located at considerable distance from urban areas. Grade A milk sales to dairy plants in Sanpete, Millard, Uintah, and Juab Counties increased more than 200 percent in four years. Washington, Beaver, and Cache Counties showed increases over 100 percent. However, during the period Salt Lake, Weber, Summit, Wasatch, Tooele, and Utah Counties increased their grade A sales less than 45 percent. Grade A milk sales showed the least change in Salt Lake County where only an 8 percent increase was shown.

Utah County dairy farmers sell more grade A milk to plants than those in any other county in the state. In 1952, 15 percent of the grade A milk sold to dairy plants or 44.5 million pounds came from Utah County. Salt Lake County is the second most important source of grade A milk in Utah with 32.8 million pounds being sold in 1952 or 11 percent of the total sales to dairy plants. The third ranking county in grade A sales both in 1948 and 1952 was Weber. These three counties in 1952 sold over a third of the grade A milk in the state. Cache County sold only about 11.9 million pounds of grade A milk in 1948 while in 1952 the county ranked fourth in total sales with 26.1 million pounds being sold to plants.

Grade C Milk Sales From Dairy Farms

Grade C milk sales totaled about 262 million pounds or 47 percent of the total milk sold to dairy plants in 1952. Sixty-one percent of the milk sold to plants in 1948 was grade C. The milk equivalent of cream which is reported as grade C has also decreased. In 1948 cream (Continued on page 48)
Light Frequent Irrigations
INCREASE YIELDS OF SHALLOW-ROOTED CROPS

WHENEVER crops lack sufficient moisture, yields will drop. On shallow rooting crops such as peas, or on soils of limited available water (sands and clays), light frequent water applications will reduce the tendency for the root-zone soil to become too dry. The same also applies to potentially deeper-rooted crops during the earlier stages of growth when the roots are still feeding primarily from shallow soil. Sugar beets and potatoes are undoubtedly sensitive to moisture deficiencies in the top 18 inches of soil during the first half of the growing period. Deep-rooted mature alfalfa on the other hand has sufficient reservoir capacity to meet its moisture needs when the root-zone is near field capacity.

DR. HANSEN is irrigation engineer of the Bureau of Plant Industry, Soils, and Agricultural Engineering and works cooperatively with the Utah Station. Until recently he was with the Irrigation Division of the Soil Conservation Service. The research reported in this article is a part of the Research and Marketing Act Project W-9, in which the Irrigation Division, Soil Conservation Service, the Bureau of Plant Industry, Soils, and Agricultural Engineering, the Utah-Idaho Sugar Company, and the Amalgamated Sugar Company cooperate with the Utah Station.

Phosphorus and nitrogen were applied in different combinations during the rotation. This article is concerned only with the irrigation practice.

While only yields are discussed here, it should not be forgotten that irrigation practice also affects quality, a factor which is often as important as yield.

Sugar Beets and Potatoes
Sugar beets and potatoes are similar in that the rooting system expands at about the same rate during the first half of the growing season with the result that the irrigation practice is similar. Referring to columns 2 and 3 of table 1, it is apparent that the number of irrigations and water applied per irrigation were similar for both crops. Likewise, the total water used by the crop, which includes the irrigation water and stored soil moisture, did not differ greatly. The resulting yields of both crops were significantly better when the soil was kept wet. A more frequent application of water was accompanied by a marked decrease in the amount supplied per irrigation. Other experimental work has shown that the major portion of the increased water used on the wet plots is lost by downward movement beyond the root zone.

Irrigation treatment
Description
1. Irrigated when average soil moisture in the root zone is near the permanent wilting condition.
2. Irrigated when approximately \( \frac{1}{3} \) of the available soil moisture is still in the root-zone soil.
3. Irrigated when about \( \frac{2}{3} \) of the available soil moisture is still in the root zone.
4. Irrigated when the soil moisture in the root-zone is near field capacity.

Good land preparation and an adequate distribution system are essential to proper irrigation.
root zone. Consequently, nitrogen and possibly other nutrients will be carried beyond the roots.

There is a tendency to irrigate too heavily on moist soils. It is imperative that frequent irrigations consist of light water applications. Otherwise, excess loss of water and nutrients will result, and lack of soil aeration will possibly limit production. It is doubtful that 25 to 28 irrigations per season on either sugar beets or potatoes are economically justified. The usual farm practice on well-drained loam soil such as that upon which these tests were conducted is more nearly the number 2 irrigation treatment or 5 irrigations per season. On most farms increased production would result from more frequent light water applications, especially during the first half of the growing season.

Peas

Peas also show considerable response to light, frequent irrigation. Peas begin to bloom and make fruit while the root zone is yet still shallow. This stage of plant growth is sensitive to water deficiency. Even though the soil profile at Logan is usually well filled with moisture in the spring, the shallow rooted peas soon depleted the moisture from the upper foot or two of soil and consequently light, frequent irrigations were beneficial.

Barley

Since barley has deeper roots than peas, the available moisture in the soil in the spring is usually sufficient to produce straw. Because of the heavy top growth as a result of high fertility and good moisture, irrigation water could not be applied after the heads had begun to form without causing lodging. Herein lies the basic difference between grain and peas as far as irrigation practice is concerned. Peas require ample moisture until harvest; in fact, the crop is usually irrigated just prior to harvest. Grain, however, matures in a drier condition; the straw essentially dies as the grain ripens. Undoubtedly, the differential irrigation treatments would have made marked difference in yields had the moisture in the soil been insufficient to produce the straw.

Second-Year Alfalfa

Alfalfa yields can also be explained in terms of availability of moisture. Second-year alfalfa has a deep, established rooting system capable of extracting moisture from an extensive soil moisture reservoir. Analysis of the individual cuttings shows that sufficient moisture is in the soil in the spring to produce the first cutting. The second cutting shows the greatest increase in production from additional light irrigations. Certainly, the seasonal yield indicates that the eleven additional irrigations on the wettest treatment were a total loss. The decidedly heavier application of water per irrigation on alfalfa is consistent with its deeper rooting system and consequently its larger water holding capacity per irrigation.

(Continued on page 46)
Apple in full bloom. A few buds still unopened and a few petals falling from the “king bloom.” Brush points to fully opened side bloom that will be killed by spray.

**Chemical Thinning**

**MAY INCREASE PRODUCTION IN UTAH ORCHARDS**

By RICHARD M. BULLOCK

CHEMICAL sprays have again come to the aid of fruit growers in reducing production costs and in increasing the amount of high quality fruit. A few years ago, insect control was the major factor in the cost of producing fruit. New organic insecticides reduced this cost until today the thinning operation is the major cost in fruit production. Again chemical sprays have been developed to reduce this major cost. The successful fruit grower of the future may well be a chemical engineer.

Fruit thinning is an important part of growing high quality fruit in nearly every fruit growing area. The most striking benefits derived from this practice are increased fruit size, color, and quality and reduced tendency toward biennial bearing. Fruit size can be increased by thinning at any time during the growing season of the fruit, although the increase is greatest when thinning is done early in the life of the fruit and becomes progressively less as the thinning is delayed. To reduce the tendency toward biennial bearing, however, thinning must be accomplished early.

With varieties of fruit that have a strong tendency toward biennial bearing such as Jonathan, Golden Delicious, and Rome Beauty apples, thinning must be done within 35 to 40 days after full bloom to have the greatest influence on making the trees bear good crops of fruit annually. Generally speaking, it is not possible to accomplish this on a commercial scale by hand thinning.

The continued rising cost of hand labor and the increasing difficulty encountered in obtaining sufficient hand labor to accomplish this large operation have increas-

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**DR. RICHARD M. BULLOCK** is head of the Department of Horticulture. He came to Utah State last September from Wenatchee, Washington, where he was in charge of the horticultural field station of the State College of Washington. He will leave USAC August 1, 1953, to return to Washington as superintendent of the Southwest Washington Experiment Station at Vancouver.
ed the interest in developing thinning methods that would require less hand labor and allow the thinning job to be accomplished at an early date.

As a result of this interest, the practice of thinning fruit with sprays applied at blossom time, or shortly thereafter, has grown in favor. In the western fruit growing areas the practice is nearly 10 years old now and has grown from only experimental blocks to a standard practice in the majority of apple and pear orchards and is used quite extensively on peaches.

Since there are definite hazards involved in the chemical thinning of fruit it must be recognized that this is a calculated risk which each grower must accept or reject as he sees fit with his own operation. By becoming acquainted with the experiences of the past 10 years where chemical thinning has been carried on by numerous investigators, and hundreds of fruit growers under thousands of different individual conditions, it is now possible to evaluate the risk fairly accurately for a wide range of conditions. The advantages inherent to this method of thinning with apples and pears would seem to indicate that the progressive grower should be familiar with the practice or should be learning about it through trial blocks in his own particular orchard.

What Can Be Accomplished By Chemical Thinning

More information is available on the benefits of chemical thinning of apples and pears than of stone fruits, although benefits with the latter type fruit are becoming more and more apparent as more experience and information are obtained.

To plan to thin fruits with chemicals to the point where no subsequent hand thinning is necessary would be hazardous because of several factors of importance which are beyond the grower's control. Even so, remarkable reductions in thinning costs have been realized. Such reductions have amounted to as high as 90 percent, and frequently are as much as 50 percent of the hand thinning cost. Even where the apparent reduction in thinning cost is slight the trees are able to set a heavier crop of flower buds for the coming year than following hand thinning. In this way more regular annual bearing is accomplished. Yields have been increased as much as 50 percent over a 2 year period because of overcoming biennial bearing in varieties particularly subject to this behavior. Size averaged approximately 15 percent larger in blossom thinned blocks over a period of 8 years.

With these advantages in mind perhaps it would be well to review the particulars of chemical thinning, especially with apples and pears. In the beginning, it should be emphasized that all chemical thinning practices are carried out on the assumption that fruit set will be heavy. It must be heavy enough to necessitate considerable thinning.

Partially self fruitful varieties such as Jonathan, Golden Delicious, Rome Beauty, and Yellow Newton generally set heavy; weather, the action of thinning sprays applied at bloom time would be more severe than usual. Under these weather conditions the growth of the pollen tube is retarded and, therefore, the flower of young fruit is more vulnerable over a longer period of time, consequently fruit set is greater. Foliation injury also is much greater under cool humid weather conditions.

Tree vigor has an important bearing on fruit set and thinning action by chemical sprays. The thinning action is increased on trees suffering from injury, root injury, low fertility, poor soil drainage, or serious mildew infection, and a lighter than normal concentration of spray should be used.

Materials To Use

Materials generally used for apples and pears are Krenite or Elgetol. More information has been obtained with the use of these materials than any others. Elgetol 30 may be used with equal results but dilutions must take into account the higher concentration of toxicant. With any of the above materials it is important that the contents of the can be thoroughly mixed before dilutions are made since the active material is frequently caked on the bottom of the container.

DN 1 is a dry powder containing 40 percent active ingredient and has given results about equal to Krenite or Elgetol. One pound of DN 1 is equal to 2 pints of Krenite or Elgetol.

DN 289 and Elgetol 318 are liquid formulations that have the advantage of being more easily handled since the active ingredient does not settle out of solution. They are about twice as toxic as Elgetol or Krenite and as a general rule cause too much foliage injury to be used on apples and pears.

Concentration

The effective concentration of Krenite or Elgetol may vary quite widely depending on fruit variety, tree vigor, and weather conditions. As a general rule 1 1/2 pints per 100 gallons spray is a good place from which to start. If weather conditions are poor and tree vigor is low the concentration may be lowered to 1/2 pint for less thinning. Varieties such as Jonathan, Golden Delicious, Yellow Newton, and Winter Banana may require 2 pints and more frequently two individual sprays may be required. If two sprays are applied to these varieties, it is advisable to use 1 1/2 pints per 100 gallons in each spray.

Time of Application

Blossom thinning sprays are most effective when use during "full bloom." At this stage a few petals fall from the king blossoms when shaken or tapped gently. On a tree in full bloom the king blossoms are 12 to 35 hours old. Fertilization

(Continued on page 45)
There are five diseases which seriously reduce both the yield and the quality of the Italian prune crop in Utah. The degree to which the occurrence and severity of these diseases are correlated with high summer temperatures and low relative humidity makes questionable the suitability of Utah climate for commercial production of the Italian prune. Each disease is treated as to its cause, its distribution and economic importance, its symptoms, and its control.

**LEAF SPOT**

**Nature and Cause**

Leaf spot is probably not contagious as all attempts to transmit it have failed. The disease, however, is bud perpetuated. Affected buds and scions used for propagation invariably produce diseased shoots or diseased trees. Leaf spot, therefore, must be regarded more in the nature of a genetic abnormality. The severity of the disease, however, is greatly influenced by soil and weather conditions. Poor soil fertility, high temperatures, and drought intensify it and bring about rapid degeneration of the affected trees. So far as is known affected trees do not recover.

**Distribution and Economic Importance**

Leaf spot is the most common and destructive disease of the Italian prune in Utah. Because of it many plantings have been removed; others are deteriorating rapidly. The disease results in serious reduction both in quantity and quality of the fruit and also in the marked and frequently fatal deterioration of the affected trees. Affected stock from nurseries is usually dwarfed and seldom, if ever, makes satisfactory trees. Arthur S. Rhoads from his survey of prune orchards in Utah during 1944 made the following statement: "Italian prunes from North Ogden, south to Provo and vicinity, have been observed to exhibit a marked unhealthy condition and a tendency to die at a very early age, also to become unprofitable commercially although healthy productive trees occur in the same orchard."

**How to Recognize Leaf Spot**

**Leaf symptoms:** Symptoms of leaf spot on leaves are primarily of two types: (1) a distinct chlorotic mottling (fig. 1), and (2), definite tan or brown colored necrotic spot (fig. 1). Both expressions appear in late spring or early summer. Leaf mottling is characterized by diffused or clearly delimited light green or rust colored areas without killing of the affected tissue. These areas may become so extensive as to produce a definite mosaic pattern. Mottling may be associated with necrotic spotting or may occur as the only leaf symptom.

The necrotic spots vary greatly in size, shape, and number. When numerous they coalesce and product irregular blotches of dead tissue frequently involving large portions of the leaf margin (fig 1).

**Effects on fruit:** Leaf spot reduces the quality and quantity of fruit. Fruits on affected trees are small and poorly flavored. Severe defoliation by the disease may result in a premature and heavy fruit drop or in a yield of small, withered, poorly flavored, sunburned fruit.

**Effects on trees:** Nursery stock propagated from diseased buds produces dwarfed and unsatisfactory trees. Terminal growth is usually retarded and severe rosetting may result. Affected trees are greatly reduced in vigor.

**Control**

Nursery stock should be propagated from healthy source trees which are free from leaf spot and from all other bud perpetuated and contagious diseases. Nursery trees showing leaf spot symptoms should be discarded or if planted by mis-
take removed as soon as recognized and replaced with healthy stock.

**PRUNE DWARF**

Prune dwarf is the only virus disease of Italian prune known to occur in Utah. Infected prune trees seriously damaged become unproductive and worthless. The virus causing prune dwarf may also invade other stone fruit trees, such as apricots, cherries, peaches, and plums.

*Distribution and Economic Importance*

Prune dwarf has not been found extensively distributed in Utah and for this reason the disease has been considered to be of little economic importance. Since the virus affects other stone fruits, however, it may become a potential threat to the stone fruit industry in the state.

*Symptoms*

Leaves on affected branches are small, narrow, distorted, somewhat thickened, and sometimes show an obscure mosaic-like mottle (fig. 2). At the outset of the disease, normal sized leaves show a relatively mild chlorosis. Leaves formed after the onset of the disease are usually smaller. Terminal growth is reduced, thus producing the dwarfed appearance of the disease. In young trees all leaves may show symptoms. In older trees the characteristic leaf symptoms may occur only on certain branches. Diseased trees may blossom profusely; however, the pistils usually abort resulting generally in poor fruit set.

*Control Measures*

Prune dwarf infected trees are worthless and should be removed to prevent spread of the virus to other trees. Only nursery stock known to be virus-free should be planted.

**Fig. 3.** (Upper) Extensive canker of underside of large limb with numerous small fruiting bodies extending to margin of canker

**Fig. 4.** (Center) Active canker in limb to right. The fungus has grown down the limb to within 2 or 3 inches of the crotch as shown by the healthy white tissue below, from which the bark is removed. Limb to left has been killed by advancing and girdling cankers

**Fig. 5.** (Lower left) Longitudinal section through an active perennial canker. Bark removed to show margin of canker and the extent to which the fungus has penetrated into the healthy white bark

**Fig. 6.** (Lower right) Fruiting bodies of *Valsa lucostronia*, the fungus which produces perennial canker in stone fruits
PERENNIAL CANKER

Nature and Cause

What is known as the perennial or valsa canker of stone fruits occurs generally through the United States. Only recently, however, has this disease been recognized in Utah as a serious malady of the Italian prune. Perennial canker is caused by one or possibly two fungi (Valsa leucostoma and Valsa cincta) both of which live from year to year in tissues of the invaded prune tree. While the name perennial canker is commonly used, valsa canker is more specific and indicates the cause of the disease by using the generic name of the invading fungous parasite. Cytospora canker is also used. Year after year as the fungus spreads into the living tissues of the small branches, larger limbs, and main tree trunk, it produces definite cankers from which the disease derives its name (fig. 3). This spread of the fungus into the healthy tissue, with resultant canker formation, is especially rapid in old or weakened trees. In neglected orchards and especially in older prune orchards the disease is destructive and anything which weakens or lessens the vitality of trees encourages infection and canker formation. Badly weakened trees may have as many as 30 to 50 individual cankers. If canker develops in the main trunk death of the entire area may result.

The Occurrence and General Description of Cankers

Cankers may be formed in the prune tree wherever either of the two fungi becomes associated with dead or injured bark. Commonly the fungus enters through pruning stubs and wounds, blossom or fruit spurs, dead shoots, twigs, or buds, or at any point of winter or mechanical injury. The most common ports of entrance for the fungi, however, are frost injuries and unhealed pruning wounds or stubs.

These provide wounded and killed tissues in which the fungi become established. From these points of entrance the fungi become active parasites and invade healthy tissues. The first external symptom of canker formation as the invading fungus moves out into the living tissue is a water-soaked appearance of the bark, frequently accompanied by exudation of gum (fig. 5). Subsequently the surface of the bark becomes depressed and hardened and remains unbroken or it may crack longitudinally (fig. 3). With the progress of the season or during the following year black pycnial fruiting structures develop on the canker surface (figs. 3 and 6). During humid weather amber colored spore tendrils or horns push out from the fruiting structures. When dampened these spore horns dissolve into myriads of minute spores scarcely larger than bacteria, each capable of starting a new canker.

With the continued enlargement of the canker each season, small branches, large limbs, and even the main trunk may be girdled or killed (figs 3, 4, 5, and 6). Thus, dead branches with attached leaves may become a characteristic feature of any old or neglected prune orchard (fig. 7). Canker enlargement takes place most rapidly in the cool damp weather of spring and autumn.

Control

The presence of perennial canker in the orchard is an indication of poor cultural practice. It cannot be over-emphasized that a high state of tree vigor is by far the best insurance against the disease. Where pruning and surgical procedures are involved, care should be taken to sterilize adequately and protect the cut surfaces. In pruning out cankered branches, all cuts should be made well below the invasion area of the fungus.

DROUGHT SPOT

Nature and Cause

Drought spot of Italian prune is considered to be a physiological disease of the fruits. It is caused by water deficiency in the fruits brought about by one or more of such adverse factors as high temperatures, hot drying winds, lack of adequate soil moisture, root or trunk injuries, competition with cover crops, or unbalanced nutrition. Even with adequate moisture in the soil, water loss from leaves may be too great to be replaced by absorption from the soil. The difference may be made up (Continued on page 47)
Studies conducted by the Utah Agricultural Experiment Station on halogeton infested ranges in northern Box Elder County show that animals can graze ranges heavily infested with halogeton if they are handled wisely. The following rules will guide in avoiding losses:

1. Herders must know halogeton to herd intelligently. In this way they can avoid dense patches of the plant.
2. Sparse stands, in mixture with other vegetation, ordinarily can be grazed without danger provided they are not overgrazed and provided animals are allowed to spread out and graze normally. As much as two thirds the diet can be composed of halogeton without harmful results if the plant is consumed slowly over a day's time and along with other feed. However, when eaten all at one time, less than half this amount will kill an animal. This assumes that the halogeton contains about 9 percent oxalic acid which is generally the case in midwinter.
3. Hungry animals are more likely to graze halogeton and, even more important, it is much more toxic to the hungry sheep. It actually takes only about half as much halogeton to kill a very hungry sheep.
4. When it is necessary to move animals across dense stands of halogeton and when they must be moved rapidly, as on a trail, trucking is much better than grazing. However, sheep can be herded across such areas if fed a pellet high in calcium. This pellet will make the animals less hungry, but, in addition, the calcium counteracts the poison in the halogeton. A specific pellet formula is being perfected and will be released in the forthcoming bulletin.

Recent studies have dealt with the spread of halogeton through the consumption of seed and its passage through the digestive tract of animals. Experimental sheep observed on trailing studies in early fall were found to eat a large volume of halogeton seed both from the plant and from the ground. Halogeton seed tends to blow into low spots where it can be spread by animals.

For June 1953

DR. STODDART is professor and head of the Department of Range Management. DR. COOK is associate professor of range management, and BEN P. GOMM is a research assistant in the department. During the past year and a half the Utah Station has cooperated with the Bureau of Land Management in a study of halogeton with the objective of finding how Utah ranchers can graze livestock on halogeton ranges without excessive losses. The Bureau has contributed nearly $10,000 to this study. In June 1952, a preliminary report was released to Utah stockmen in Farm and Home Science, Vol. 13, No. 2. A complete, final report of this research will be published as a Station bulletin in the summer of 1953.
Field experiments are being conducted to study germination and seedling survival throughout the growing season. In the picture at the left a one-foot square frame has been laid down on the area selected for study. Colored toothpicks (notice the shadows in the center picture) are then stuck in the ground by each seedling. The area shown had 167 seedling per square foot when it was established. Different colors of toothpicks are used for different crops of seedlings. Right, the selected area is protected by a metal cage from trampling by range animals.

**Halogeton On Trial**

By LEONARD L. JANSEN and EUGENE H. CRONIN

Slightly more than ten years ago halogeton was indicted for being a sheep killer. The first authenticated report that this plant was probably poisonous to range animals came out of Nevada, but the fact was soon dramatically confirmed in Idaho when one man lost 1,500 sheep in a single day.

During the years which have followed, widespread publicity has been given to halogeton and to its toxic contents of salts of oxalic acid. Sound principles of range management have been developed, however, which have made it possible for us to "live with halogeton" without experiencing more than token losses of range animals from this cause. These principles, worked out by the Range Management Department at the Utah Agricultural Experiment Station and by other agencies, have been reported previously in this publication and elsewhere. But the fact remains that halogeton is still a menace and an unwanted tenant in our desert range areas. It continues to encroach on previously uninfested lands and is spreading or being discovered in ever-increasing acreages each year.

Concern over this continued spread of an extremely undesirable plant grew until local and state organizations of ranchers, stockmen, and weed control specialists recommended and received state and federal aid to combat the problem. All early attempts to control and/or eradicate this pest by chemical and mechanical means, however, proved mostly unsuccessful or economically impractical. Important facts were nevertheless brought to light. The plant is a prolific seed producer; a single specimen left untouched can completely repopulate a relatively large area in two or three seasons. The seeding of infested areas to crested wheatgrass, which is effective in reducing stands of halogeton on sagebrush soils, is not possible under more saline conditions and in areas of lower rainfall. Disturbing the soil and native vegetation in any manner—by overgrazing, road construction, brush eradication, or plowing—is conducive to rapid invasion by halogeton. These facts, however, do not provide the answers which were initially desired.

At a halogeton research conference held in Salt Lake City, October 16-17, 1952, operations and research personnel from eight western states and representatives of several federal agencies critically reviewed and analyzed the accumulated evidence. When the meeting was concluded, the general consensus of opinion was that a definite lack of basic knowledge of the plant and its habits existed. Much more information was needed before further control measures could be intelligently applied in the field.

**Coordination of Research**

At the time of the Salt Lake City conference the three states most seriously affected by halogeton infestations—Utah, Nevada, and Idaho—were already in the process of establishing a unified program of research to be carried out at their respective experiment stations in cooperation with the federal government. The coordination of the new research projects was delegated to an agency of the U.S. Department of Agriculture—the Division of Weed Investigations—which had received an appropriation from Congress for research on halogeton and other noxious weeds. This over-all program, consequently, has incorporated most of the recommendations of the conference, and studies are already in progress at the Utah and Idaho Agricultural Experiment Stations. By the time of the publication of this article work also will be under way in Nevada.

It has been neither practical nor indeed advisable to draw sharp lines of distinction in the research efforts outlined for the various projects. At least some overlap must occur in order to provide bases for general comparison of results. Never-
theless, in Nevada emphasis is to be laid upon basic ecological phases, such as light, temperature, water, and soil relationships under natural growing conditions and in competition with other plants. The studies in Idaho are to be continuations and extensions of research of the past three years. These involve seed dispersal, preparation of seedbeds for reseeding operations, and a search for better plant competitors. A new study of the physiological investigations and anatomical studies are being undertaken. Evaluation of control measures and screening of both old and new herbicidal chemicals are functions of all stations. In addition, studies on the ability of halogoton to adapt to different soil types and at different elevations are being continued by the University of Wyoming.

Physiological-Anatomical Studies

Of the main lines of approach outlined above, the physiological phases probably have less of a backlog of information to draw from than do any of the others. In essence, the over-all objective of the physiological-anatomical studies at the Utah Station is to determine just what makes halogoton tick. What are the requirements for light, temperature, water, mineral nutrients, and pH necessary for growth and development of halogoton? What are the effects of excess quantities of salt? How do any or all of these factors affect the oxalate content of the plant?

In addition, one of the most immediate problems to be tackled will be the biochemical nature of oxalate formation. Crystalline deposits of calcium oxalate are of common occurrence in cells of many species of plants, yet little is known concerning the pathway of production of the oxalic acid. Since the accumulation of such large quantities of oxalates (up to 20 percent of the dry weight of the plant) is indeed a rare phenomenon, and quite fortunately so, halogoton presents an excellent opportunity for elucidating these processes.

The order in which the physiological investigations are to be carried out has been set up along systematic lines based on several stages of growth. Tentatively, the stages of germination, early seedling growth, rapid shooting, and early and late flowering have been selected. Studies of each stage will involve both laboratory and greenhouse work under controlled environmental conditions and also correlated studies in the field. In this manner the factors influencing growth, chemical composition, biochemical processes, and anatomy of halogoton will be investigated, and the relative susceptibility of each stage to different control measures will be determined.

Temperature and pH

The newness of the present program has largely restricted preliminary experiments to the initial two stages of growth—the germination and early seedling stages. In confirmation of less extensive experiments reported by other investigators, two factors—temperature and pH—have been shown to influence profoundly the germination of the black seeds of halogoton. As one can see from figures 1 and 2, only slight germination will take place in three days at temperatures of 59°F and below or in solutions having pH values above 7.5. On the other hand, at least 90 percent germination can be obtained by increasing the temperature to 95°F or by lowering the pH to 5.5 or 6.0.

At first sight these laboratory results would appear to be contradictory to observations made under field conditions. In January of this year tremendous numbers of seeds were found which had already burst their seed coats and started to grow. Many of these were in close proximity to patches of melting snow and ice. Reconciliation of these data with the laboratory findings would appear, then, to require some additional information. In carrying out later experiments in the laboratory, the writers observed that some seeds will germinate within as short a period as 15 minutes after being planted dry on a saturated seedbed at room temperatures or higher. In one experiment approximately 10 percent had sprouted by the end of the first hour. Saturated soil conditions certainly prevailed in the field during January, following the melting of snow. With the unusual sunny weather which also occurred at that time, it is not

(Continued on page 46)
INTERCOMMUNITY CONSOLIDATION FOR BETTER CEMETARY MAINTAINANCE IN RURAL UTAH

By JOSEPH A. GEDDES

The ideal of a well integrated culture in which all areas are effectively organized and in which harmonious integration is achieved cannot be realized in a dynamic, rapidly-changing period. Change brings new needs, and social organization follows in the wake of need. Differing rates of change impose differing rates of improvement in organization. Differing social values bring discrimination in what is to receive attention and what is to be neglected. Rapid change may and usually does drive social organization forward but it does not do so at the same rate in all fields. And yet a well rounded culture such as was achieved by the Greeks, carries civilization to its loftier heights. Greatness appears to inhere in a people whose inner hungers force expanding organization into a widely diversified symmetrical whole.

During the short period of one hundred years, people of Utah have successfully settled and reclaimed an area regarded as unfit for man. They have transferred and implemented the civilization of their time. In addition to this, they have made rather marked headway in two cultural fields: religion and education. The extent of activity, the degree of financial support, the intricacy of organization in these two fields testify to the direction social energy has taken.

Achievements in these fields have come at costs of many kinds. Inventiveness has reduced some of these costs. The application of the principle of voluntary unpaid service to local church organization has increased participation and kept costs down. The high position of Utah among the states in the proportion of young people in college (nearly three times the national level) has been sustained not alone by taxation of the citizens but also by transferring some of the burden to teachers in comparatively low salaries. The absence of children under 18 from farm work because of attendance at school has laid a heavier work burden on rural parents. This burden could not be transferred. Such costs or sacrifices have been clearly recognized and voluntarily assumed.

But there is another kind of cost related to unusual achievement in religion and education that social scientists call opportunity cost. This cost arises when decision is made to spend effort and money for a particular thing rather than for some other things which are also wanted. The less wanted is sacrificed for the more wanted. When Utah people spend more for religion and education they elect to spend less for other things. Relative importance is involved.

A lovely drive in a well maintained city cemetery. The veritable white forest of monuments reflects values of an earlier day which still persist.
The Road Up

In spite of adverse pioneer conditions which negatively influenced the growth of traditions in cemetery building, some progress has been made. The struggle forward in cemetery organizational growth has been slow but there are many bright spots in this struggle. At points where community conscience has emerged, effort has sometimes assumed heroic proportions.

Cemetery organization in Utah developed out of pioneer conditions. Important among them were:

1. Poor roads and horse drawn vehicles made a burial ground for every community mandatory. Later there were not enough people to sustain the cost of a good cemetery.
2. Location where drainage was good was responsible for cemetery sites far above water levels so that beautification was indefinitely postponed.
3. The parsimony of a reluctant nature necessitated placing the most necessary things first. This meant the preservation of life, of good relationship with the Supreme Being, and of education for their children as preferred areas.
4. Those who died met the conditions of death much as they had lived, abstemiously with bare necessities as the daily portion—a dry place for rest in rough country which they had come to know and love.

Until recently advancement in cemetery control has followed two principal lines: The first has made use of voluntary procedure; the second a village incorporation and management under local government. As might be expected, in cemeteries maintained by churches, lodges, and families, voluntary methods have been relied on mainly.

One of the best examples of the application of voluntary approaches occurred between 1937-1940 in Bear River City, Box Elder County. Here the garden club, a woman’s group, with encouragement from the extension staff of the Utah State Agricultural College, made noteworthy progress toward arousing community interest in the improvement of the cemetery, which adjoined the village garbage dump. The cemetery belonged to the city but little progress had been made in improving it. Voluntary procedures were employed. The first year the club members improved their own lots with their husbands’ and sons’ assistance and persuaded their friends to do so. The second year an assessment of $5 per lot was asked of each lot holder. By the end of three years, a lovely entrance had been developed, 60 lots planted to grass, and maintenance placed in the hands of a sexton employed at $600 per season. Widespread cooperation was obtained from various community organizations. Flower shows were held, dances sponsored, refreshments sold. After a three year demonstration effort, these women turned a greatly improved maintenance program back to the village government.

One of the best examples of a shift from voluntary effort to local governmental control occurred in Plain City. Here, a nine year drive was made to make voluntary methods work successfully. This drive was backed by the local bishop and headed by an active chairman of the cemetery committee. During this time widespread interest was developed. The caretaker was employed part-time as janitor of the church and part-time as sexton.

Can a small community maintain a cemetery successfully or is the answer to be found in a larger cemetery district?

The proportion of lots in grass increased each year, but a third of the lots remained in weeds after nine years of effort. Under a voluntary system a third of the owners of cemetery lots were able more or less to hamstring the enterprise. However, facing a stalemate, the majority turned their effort in another direction. They brought about the incorporation of the village and the establishment of a cemetery maintenance district under state law, which gave the cemetery commissioners the right to levy a tax. Through this system the third who would not cooperate under a voluntary plan were brought into participation under authoritative procedures and a well maintained cemetery finally emerged.

Nearly every community has made some efforts extending beyond the annual memorial day clean-up to improve its burial grounds. In some cases these efforts have become sufficiently sustained to bring about a stable form of improved system.

Local Government Has Been Most Successful

There is need in Utah for a more careful analysis of good dividing lines between voluntary and governmental approaches to cemetery control. The proportion of lots in grass increased each year, but a third of the lots remained in weeds after nine years of effort. Under a voluntary system a third of the owners of cemetery lots were able more or less to hamstring the enterprise. However, facing a stalemate, the majority turned their effort in another direction. They brought about the incorporation of the village and the establishment of a cemetery maintenance district under state law, which gave the cemetery commissioners the right to levy a tax. Through this system the third who would not cooperate under a voluntary plan were brought into participation under authoritative procedures and a well maintained cemetery finally emerged.
Grass Seeding

TO INCREASE FEED RESOURCES IN SOUTHERN UTAH

MAX E. ROBINSON and DARREL H. MATTHEWS

Wheatgrasses are proving adaptable for use in southern Utah. On dry lands receiving over 10 inches of rainfall and on the valley farm lands with limited irrigation water, strains of crested wheatgrass, tall wheatgrass, and intermediate wheatgrasses have been established and maintained under grazing use.

Dry-land plantings of crested wheatgrass have furnished between 35 and 75 sheep days of feed per acre annually at the BAC Valley Farm near Cedar City over the past eight years. Tall and crested wheatgrasses planted in mixture on lands receiving limited spring irrigation water furnished between 276 and 555 sheep days feed per acre over this same period. The dry-land crested wheatgrass plantings have compared favorably with rye and other small grains in the amount of feed furnished during favorable years and have been more dependable as a source of spring feed during years of limited moisture.

Establishment of Grass Difficult

To establish grass under southern Utah conditions is not without its difficulties. The long-time average precipitation of 12.6 inches for Cedar City and vicinity cannot be depended upon. Extreme fluctuations occur from year to year in the total amount of precipitation, and long periods of drought are not uncommon. For example, the average precipitation during the past 10 years has been near 10.5 inches, well below average. During some years, such as 1950, as little as 6.7 inches of moisture fell.

To complicate the reseeding problem further, the time of the year when moisture falls is far from consistent. Long-time averages show the months of highest precipitation to be March, April, July, August, and October. June is normally a critical month for moisture, with an average of near .45 inches of precipitation. Years such as 1950 and 1952 aggravate the moisture situation. No precipitation was recorded for June 1950 and only .15 inches for June 1952. October for these two years also yielded less than .05 of an inch of precipitation.

Because of the droughts and hot drying winds in southern Utah, drought-tolerant grasses capable of rapid establishment must be used for successful range seeding. Even these species must be correctly planted on properly prepared seedbeds in order to make the most of the rain that falls. Moisture cannot be spared to run off or to evaporate from the surface of impervious tight soils. Brush and competing weeds must not be allowed to transpire valuable water that otherwise might be used by the grasses.

To find ways to make best use of the rain that falls in the production of grass, the Utah Agricultural Experiment Station has been conducting range seeding tests in cooperation with the Bureau of Land Management, the Intermountain Forest and Range Experiment Station, and the Soil Conservation Service Nursery, Albuquerque.

MAX E. ROBINSON is assistant professor of Range Management and DARREL H. MATTHEWS is assistant professor of animal husbandry. Both these men are stationed at the Branch Agricultural College at Cedar City.

Seeding heavy bottom land with an eccentric disk followed by a cultipacker seeder. This method also shows promise on steep lands of high runoff and in soils of low permeability.
Test plots have been established in the vicinity of Summit and at other localities on sagebrush lands, at the Branch Agricultural College Valley Farm at Cedar City, on dry lands, and on lands with limited amounts of irrigation water.

Experimental plans include tests for (1) methods of removal of sagebrush, rabbitbrush, annual weeds, and other competing vegetation, (2) methods of preparing the soil to conserve moisture, (3) methods of seeding, and (4) time of seeding. Pasture-sized plantings are being made as rapidly as possible to test the various adapted species under grazing use.

Land Preparation

Of the more than a dozen different methods of land preparation that have been tested, the use of heavy Wheatland-type disks or offset disks have proved thus far most practical for removal of sagebrush and for seedbed preparation on lands free from large rocks. From 80 to 90 percent of the sagebrush has been killed by this method. Satisfactory stands have been established by disking in the spring or early summer followed by drilling adapted wheatgrasses in the fall. Broadcasting seed ahead of the Dixie pipe harrow or railroad rails has given only fair to poor stands of grass at Summit and Cedar City. A high percentage of old sagebrush plus dense stands of sagebrush seedlings have occupied most of the areas thus treated. Fire has not proved successful on sagebrush lands where there is insufficient vegetation growth to carry a fire. Fire has been used with good success during November to remove rabbitbrush from heavy bottom-land soils. Good stands of tall wheatgrass and crested wheatgrass have been established by drilling directly into the ashes. On burned plots first treated by heavy disking or chiselling before drilling, more vigorous stands have resulted.

Tests of the eccentric disk, the Noble blade, and various types of brush beaters were conducted during the fall of 1952. The eccentric disk appeared to have some merit as a means of conserving moisture by reducing runoff and increasing the rate of moisture penetration into the soil. The Noble blade was effective in killing sagebrush and rabbitbrush. The brush beaters had the advantage of leaving native grasses undisturbed, and they may prove advantageous when the reduced brush particles are plowed into the soil. Grass seedling emergence is just beginning on these plots. It is, therefore, early to appraise these treatments fully.

Table 1. The carrying capacities of irrigated and dry-land pastures of grass, rye, and other small grains, BAC Valley Farm, Cedar City

<table>
<thead>
<tr>
<th>Year</th>
<th>Dry land Spring</th>
<th>Dry land Fall</th>
<th>Dry land Total</th>
<th>Irrigated Spring</th>
<th>Irrigated Fall</th>
<th>Irrigated Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1949</td>
<td>30</td>
<td>36</td>
<td>66</td>
<td>167</td>
<td>338</td>
<td>555</td>
</tr>
<tr>
<td>1950</td>
<td>49</td>
<td>26</td>
<td>75</td>
<td>140</td>
<td>241</td>
<td>382</td>
</tr>
<tr>
<td>1951</td>
<td>46</td>
<td>0</td>
<td>46</td>
<td>213</td>
<td>63</td>
<td>276</td>
</tr>
<tr>
<td>1952</td>
<td>37</td>
<td>0</td>
<td>37</td>
<td>194</td>
<td>270</td>
<td>464</td>
</tr>
</tbody>
</table>

* Irrigated each spring with high water except in 1950.
† In addition, various amounts of seed were produced.
‡ From 1 to 2 tons of alfalfa were produced per acre.

Table 2. A comparison of plots treated with various applications of 2, 4-D showing differences in grass seedling vigor and density and weed density, Cedar City, Utah, 1952

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Grass seedling vigor rating</th>
<th>Grass seedling density rating</th>
<th>Weed density rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average sprayed with 1 + 2 lbs. 2, 4-D per acre</td>
<td>1.8 1.6 3.2</td>
<td>2.4 2.0 3.0</td>
<td>1.9 2.0 4.3</td>
</tr>
<tr>
<td>Irrigated</td>
<td>1.8 1.6 3.2</td>
<td>2.4 2.0 3.0</td>
<td>1.9 2.0 4.3</td>
</tr>
<tr>
<td>Dry land</td>
<td>1.8 1.6 3.2</td>
<td>2.4 2.0 3.0</td>
<td>1.9 2.0 4.3</td>
</tr>
<tr>
<td>Average all sprayed</td>
<td>1.8 1.6 3.2</td>
<td>2.4 2.0 3.0</td>
<td>1.9 2.0 4.3</td>
</tr>
</tbody>
</table>

* Crested wheatgrass drilled in site October 29, 1951. Rating made November 1, 1952.

For June 1953
Weed-infested lands depleted of moisture after several years of cropping with dry-land rye were successfully seeded during the fall of 1951 by drilling crested wheatgrass directly into the stand of Russian-thistle. Plots disked prior to the drilling of the grass seed did not show any advantage over the undisked land.

Weed Control Improved Seeding Growth

Weed competition was reduced and grass seeding density and vigor improved by treating strips with 2, 4-D during the spring (table 2). Although much of the saving in soil moisture no doubt was used for the increased growth of grass seedlings, soil moisture was consistently higher, even as late as October, on plots treated with sprays (table 3).

Irrigation Helps to Establish Grass Seedlings

The use of irrigation water during years of high water runoff shows real possibilities as a means of successfully establishing plantings of range grasses. All plantings where as little as one irrigation has been made in the spring have been successful. Once established by this method, stands of wheatgrasses have persisted during dry years under comparatively heavy grazing. The advantages of one irrigation as a means of insuring grass stand establishment are shown in tables 3 and 4. Grass stands established by this means may be grazed at least a year earlier than under strictly dry-land conditions where from 2 to 3 years generally are required to establish grass successfully before it is safe to graze. Heavier use generally may be made of grass stands that are well established by this method.

Table 4. The effects of early spring irrigation on the establishment of fall-seeded crested wheatgrass seedlings, Cedar City, November 1952

<table>
<thead>
<tr>
<th></th>
<th>Grass seeding vigor†</th>
<th>Grass seeding density†</th>
<th>Weed density†</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>rating</td>
<td>rating</td>
<td>rating</td>
</tr>
<tr>
<td>Block 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dry land</td>
<td>3.5</td>
<td>2.4</td>
<td>3.0</td>
</tr>
<tr>
<td>Partially irrigated</td>
<td>2.1</td>
<td>1.7</td>
<td>3.3</td>
</tr>
<tr>
<td>Block 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dry land</td>
<td>3.3</td>
<td>2.8</td>
<td>3.6</td>
</tr>
<tr>
<td>Partially irrigated</td>
<td>1.7</td>
<td>1.8</td>
<td>3.7</td>
</tr>
<tr>
<td>Average Dry</td>
<td>3.3</td>
<td>2.6</td>
<td>3.5</td>
</tr>
<tr>
<td>land</td>
<td>Partially irrigated</td>
<td>1.9</td>
<td>1.75</td>
</tr>
</tbody>
</table>

† See table 2 footnotes for interpretation of ratings.

Table 1. Record keeping in community and non-community controlled cemeteries of Box Elder and Summit Counties, Utah, 1950

<table>
<thead>
<tr>
<th>Type of control agency</th>
<th>Possess essentials of good records</th>
<th>Do not possess essentials of good records</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Community controlled</td>
<td>107</td>
<td>83</td>
<td>190</td>
</tr>
<tr>
<td>Non-community controlled</td>
<td>65</td>
<td>165</td>
<td>230</td>
</tr>
<tr>
<td>Total</td>
<td>172</td>
<td>248</td>
<td>420</td>
</tr>
<tr>
<td>Percent</td>
<td>.41</td>
<td>.59</td>
<td></td>
</tr>
</tbody>
</table>

Cemeteries (Continued from page 41)

between authoritative and voluntary procedures, based on the requirements of the job to be done. Each has strengths and weaknesses. Some tasks are unsuited to either alone. On the whole, crisis tasks require authoritative direction. Utah experience seems to show that local government (authoritative) has been more successful in cemetery maintenance than church, lodge, and family groups (voluntary), but less so than cooperative groups such as the group that maintains the Wasatch Lawn Cemetery in Salt Lake City. The crisis element in voluntary cemetery maintenance arises in the refusal of a minority to pay assessments or to maintain their own lots. This can be overcome by the imposition of compulsory perpetual care procedures when lots are sold as at Wasatch Lawn where perpetual upkeep is mandatory, thus eliminating entirely tax or voluntary assessments.

In most cases, superior results with maintenance of cemeteries have come through local government. This may be observed in the area of cemetery record keeping. The position of cemeteries maintained by local government in comparison with lodge, church, and family cemeteries is indicated in table 1.

The General Rural Cemetery Situation

Is Unfavorable

But the general picture is unfavorable. A study in Box Elder and Summit Counties in 1950 reveals the position of rural cemeteries in these counties as on the whole, with a few noteworthy exceptions far to the rear of most fields of social organization in these counties. E. A. Silke in an article in the American City for August, 1951, says, "Generally speaking, unprepossessing cemeteries are more or less taken for granted in small mid-western towns of the United States . . . drab little graveyards on wind-blowed hills, naked of trees, of hedges, and innocent of care. Only a new grove here and there and iron gates leaning at drunken angles proclaim that the cemetery is still functioning." Data from the Utah study show:

1. In Box Elder County less than one cemetery in five is free of weeds. Only 2 in 25 have full grass coverage. In Summit County no cemetery is free of weeds. One in nine has part grass coverage. In no cemetery in these counties can a curbing be found on the cemetery driveways.
2. Modern adequate sprinkling systems are found in only 3 out of 25 cemeteries in Box Elder and 1 out of 17 cemeteries in Summit County.
3. Cemetery records are poorly kept. The chief reliance for preservation of information concerning the dead is the headstone and the map of interments. But in ten cemeteries of the two counties, no map of interments is kept and a check of headstone data showed in one small cemetery that 23 out of 50 headstone recordings had been destroyed. In three-fourths of the cemeteries of Box Elder and in two-thirds of those of Summit less than half of the items necessary for good records are being kept.

Some Promising Trends

Although the movement has not yet become pronounced in either of two promising directions, it is nevertheless real and is increasing in strength. The first of these trends is:

There is increased use of the state cemetery maintenance district act, which permits clusters of communities to join together in forming large cemetery districts. This plan is more elastic and is superior for rural communities to control by incorporated villages. However, enlargement of the cemetery base is per-
missive in nature. No machinery is set up to activate cemetery consolidation as has been done with the schools. Until the people become aware of the advantages of consolidation little change is likely to take place. As a matter of fact, nearly all of the communities that have organized under the maintenance act have incorporated small districts covering the same small areas that were originally implemented by horse-drawn vehicle conditions. This means a grievous tax burden neither necessary nor defensible.

It is possible, of course, that the people of rural Utah may remain unmindful of their cemeteries. This is not likely. But there are some evidences of dawning inter-community perception of the real nature of this problem.

There remains two good alternatives either of which could become dominant or both could operate together.

(1) The people may rely chiefly on the arm of government via the avenue of enlarged maintenance districts supported through a combination of taxation and perpetual care.

(2) The people may develop voluntary cooperative inter-community districts which derive all income from perpetual care imposed at time lots are purchased.

All the advantages of unified planning and of minimum maintenance costs are possible in either of these plans. It seems inconceivable that the present efforts to maintain each tiny cemetery will continue.

If statesmanlike leadership is to emerge, efforts must move in the direction of inter-community cooperation. There is no other way. It is no more possible for each small community to maintain a good cemetery successfully than it is possible to maintain a good one-room school. Both the one-room school and the one-community cemetery were created out of conditions no longer here. Where they exist now they are residues of an age that is gone.

Cemetery Values Also Lag

Utah cemeteries urban and rural still rather strongly reflect the materialistic values of the nineteenth century that dominated cemeteries throughout America. Over-riding individualism, competitive monument building, and ostentatious funerals dominated burial patterns. Many Utah cemeteries are attempting to reduce inequalities. In one cemetery which is organized cooperatively, Christian motivation has come to dominate the entire organization. Individualism is reduced there so that a family owns the lot but may not create a hodgepodge of the cemetery through individual plantings. Inequality in death is eliminated by the use of the flat marker of uniform size for all graves. Unified central planning is achieved with the use of skilled landscape architects. Competitive displays of flowers are slowly receding as quietness, simplicity, and kindliness replace extremes. Although this generation seems to be on the way towards better motivations it will be a long time before a stranger entering our cemeteries can be impressed with the evidence of Christian values reigning there.

Funeral Costs Are Excessive

The average cost of the funeral, exclusive of the burial plot, is estimated by the consulting morticians at $450 in Utah. This is somewhat less than the figures obtained for the United States, $484.50.

Estimates on flower costs of funerals in Utah were obtained with the aid of 21 informed consultants consisting of 7 morticians, 3 florists, 6 L.D.S. bishops, 1 sexton, and 3 prominent community women. The group placed the average floral costs in Utah at $135 per funeral. This is approximately three times the national average.

Davidson estimates the total cost (exclusive of lots and monuments) of funerals in the United States in 1951 at $750,000,000.

If, to this large figure were added medical and hospital costs connected with the "final departure" along with cemetery lot, perpetual upkeep, and other maintenance costs, and competitive monument building expense, it becomes evident that in America the cost of death is greater than the cost of birth and that both infringe on the cost of living.

Extravagance in America, in the area of burial customs, contrasts sharply with the equal and brotherhood of humanity are aiding cemetery values to reflect more successfully than they have in the past the essential dignity of the soul and the equality and brotherhood of man.

CHEMICAL SPRAYS

(Continued from page 33)

has already taken place in them. When sprayed at this stage, there is a tendency for the king blossoms to withstand the spray, while many of the freshly opened blossoms are killed. Although spraying at full bloom is most effective, you may obtain fairly good results by spraying as much as one to three days later. Do not apply the sprays at the heavy petal-fall or calyx stage. When using single applications, wait until most of the blossoms on the north side of the tree are open. At this stage, blossoms on the south side are somewhat past the full bloom stage. If 2 sprays are used on Golden Delicious, Jonathan, and Newton, the first application should be made a day ahead of full bloom (about 75 percent of the flowers open); the second spray should follow 2 to 3 days later depending upon the weather.

Hormone Thinning Sprays

Results with naphthaleneacetic acid are generally more erratic than with the di-nitro materials. However, satisfactory thinning has frequently been obtained with this material on Jonathan and Golden Delicious. This spray may be applied from petal fall until 2 weeks later, and the people of Utah are slowly moving away from competitive demonstrations of family status in funeral practice. This is true in the areas of monument building, flower displays, musical programs, use of noted speakers at funeral services, cost of caskets, and size of processions.

The expensive funerals so general today testify to the dominance of wealth values and a poverty of Christian motivation. In all these things, there must be modifications towards greater simplicity, more genuine dignity, and a strengthening of Christian thinking. There must be less expense and less family ostentation.

Sorrow may purify and enlarge the soul when humility prevades it. More than formerly feel that if the cemetery be a port of entry, the values that dominate it should beckon with a friendly atmosphere, and with lovely surroundings that rise above discrimination.

Sorrow often strikes unevenly and leaves marks behind. Those who emerge with spirits chastened but enlarged with deeper understanding and a broader humanity are aiding cemetery values to reflect more successfully than they have in the past the essential dignity of the soul and the equality and brotherhood of man.
concentration generally used is between 10 and 20 ppm. Results with Delicious and Winesap have been too variable to indicate commercial usage on these varieties.

The effectiveness of this spray from the standpoint of thinning is reduced as the spray is delayed, at the same time the danger of any foliage injury is also reduced. The benefits of this spray are less striking than with the dinitro sprays. Increase in size of fruit has been less, and also the come-back in bloom is not as heavy, although it is much better than following hand thinning.

Chemical Thinning of Stone Fruits

The use of blossom thinning sprays on stone fruits is less well developed than on apples and pears. It has been more difficult to develop a satisfactory program in this case. Perhaps one of the reasons is that compared with apples and pears, stone fruits have much less foliage development at the blossoming period and for this reason less indirect or shock action of dinitro would be expected. This would indicate that on stone fruit the dinitro materials would act primarily as a pollenicide and thus, timing the sprays with reference to pollination and fertilization is more critical than with apples and pears.

HALOGETON STUDIES

(Continued from page 37)

LIGHT IRRIGATIONS

(Continued from Page 31)

Table 1. Irrigation practice related to yield from deep, well-drained, loam soil at North Logan Experimental Farm*

| Crop         | Irrigation treatment | Irrigation number | Irrigation inches | Depth† applied per irrigation inches | Total depth‡ of water used | Yield t./acre | Total water use | Yield increase over dry treatment
<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
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<tbody>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sugar beets</td>
<td>1 (dry)</td>
<td>2</td>
<td>5.2</td>
<td>17.2</td>
<td>13.5</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>(3 year)</td>
<td>3</td>
<td>1.9</td>
<td>25.0</td>
<td>16.5</td>
<td>45</td>
<td>22</td>
<td></td>
<td></td>
</tr>
<tr>
<td>average</td>
<td>4 (wet)</td>
<td>1.2</td>
<td>41.0</td>
<td>17.0</td>
<td>138</td>
<td>26</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Potatoes</td>
<td>1 (dry)</td>
<td>2</td>
<td>4.4</td>
<td>15.6</td>
<td>355</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>(3 year)</td>
<td>3</td>
<td>1.7</td>
<td>28.7</td>
<td>558</td>
<td>84</td>
<td>38</td>
<td></td>
<td></td>
</tr>
<tr>
<td>average</td>
<td>4 (wet)</td>
<td>1.4</td>
<td>40.7</td>
<td>595</td>
<td>161</td>
<td>69</td>
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<tr>
<td>Peas</td>
<td>1 (dry)</td>
<td>0</td>
<td>6.7</td>
<td>990</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>(1 year)</td>
<td>3</td>
<td>9.7</td>
<td>2009</td>
<td>45</td>
<td>103</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>average</td>
<td>4 (wet)</td>
<td>1.3</td>
<td>2346</td>
<td>103</td>
<td>137</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Barley</td>
<td>1 (dry)</td>
<td>5</td>
<td>15.2</td>
<td>70.9</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>(2 year)</td>
<td>3</td>
<td>1.6</td>
<td>65.2</td>
<td>4</td>
<td>-9</td>
<td>-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>average</td>
<td>4 (wet)</td>
<td>3.8</td>
<td>70.0</td>
<td>9</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Second-year</td>
<td>1 (dry)</td>
<td>1</td>
<td>19.5</td>
<td>5.6</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>alfalfa</td>
<td>2</td>
<td>10.1</td>
<td>21.0</td>
<td>5.7</td>
<td>2</td>
<td>2</td>
<td></td>
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<td>(3 year)</td>
<td>3</td>
<td>5.0</td>
<td>22.8</td>
<td>6.0</td>
<td>17</td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>average</td>
<td>4 (wet)</td>
<td>1.3</td>
<td>37.2</td>
<td>6.0</td>
<td>92</td>
<td>8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Sprinkler and furrow irrigation as well as fertilizer treatments are averaged together.
† A depth of 1 inch applied to 1 acre during an irrigation is equivalent to 1-acre inch or the volume of water delivered by a 1-inch rain. Also a 1-inch irrigation is the same amount of water as would be delivered by a 1-inch rain.
‡ Total depth of water used is the irrigation water applied plus any net use of soil moisture during the growing season.

at all difficult to visualize a considerable increase in the surface temperature of the soil, despite a much lower air temperature. This fact will be checked at a later date, but it seems quite logical that if the soil surface were warmed up for only an hour or two, considerable germination could easily have occurred. Once germinated, seedlings can withstand several days of exposure to freezing or near-freezing temperatures without suffering apparent injury.

It is only a matter of conjecture at the present time as to what the results of this and the other coordinated projects under way will eventually reveal about when and where to expect halogeton to grow and survive. That we may be able to predict accurately the areas likely to become infested and develop means to protect such sites before the pest arrives is certainly one possibility of the outcome. In addition, although the emphasis at present is almost entirely confined to halogeton, the nature of the research being conducted is fundamental to range weed problems in general and should have much wider application than relates to halogeton itself.
by withdrawal of water from the fruit. Drought spot then results.

Distribution and Economic Importance

Drought spot is known to occur throughout the state wherever Italian prunes are grown. Losses vary with the severity of fruit diseases in 1944. He reported that the condition was so severe that some growers stated that "they were on the verge of abandoning the growing of Italian prunes unless some solution could be found soon."

Symptoms

Symptoms vary with the season. Several types of injuries are observed. The first symptoms develop when the fruit is partly grown. At this time round or irregular purplish areas appear in the skin. These purplish areas finally turn dark brown in color. Removal of the skin discloses varying patterns of brown necrotic tissue. The affected tissue frequently breaks down into gum pockets of varying sizes. The cracking of the skin over these pockets permits the extrusion of gum (fig. 8).

During certain seasons prune fruits may shrivel from the stem end to about a third or fourth of their length (fig. 8). This shrinking is also accompanied by lines of brownish tissue throughout the underlying flesh. Again, these necrotic line patterns may occur in fruits that show few external symptoms. Seriously affected fruits may frequently show brownish discoloration of the tissue surrounding the pit.

The distribution and severity of drought spot provide evidence that Utah climate is not exactly suitable for Italian prune culture. Aridity and heat are not within the realm of control. The following practice however, may aid in minimizing the severity of the disease:

1. Maintain adequate and uniform water supply through the season.
2. Use proper cover crops in order to prevent competition for water supply.
3. Minimize tree injury from equipment, pruning, frost, and various diseases.
4. Grow prunes on compatible plum rootstocks. Peach should not be used for rootstocks for Italian prunes.

IRON CHLOROSIS

Cause and General Nature

Lime-induced iron chlorosis is widely distributed throughout Utah. Chlorosis is found generally when plants are grown in calcareous soils which iron may be abundantly present but is relatively unavailable to the plant because of the high pH of the soils. Increasing water content of the soils by irrigation or by heavy rains increases the tendency toward chlorosis. Stone fruits vary in susceptibility to chlorosis. The rootstock is in general the dominant factor in susceptibility. The order of susceptibility of stone fruits on the basis of tolerance to lime is peach, sweet cherry, plum, apricot, and almond, if grown on their own roots. Plum or prune grown on peach rootstock is much more susceptible to chlorosis than when grown on plum roots.

Distribution and Economic Importance

Iron chlorosis is widely distributed in Utah prune orchards and causes losses to growers yearly. The deficiency of iron may greatly weaken prune trees and thereby increase their susceptibility to the perennial or vals canker and possibly to other diseases.

Symptoms

Yellowing of leaves is the principal symptom which generally occurs between the veins, frequently leaving a band of green along the veins. None of the color patterns is specific for iron chlorosis as all may be found on leaves made chlorotic from other causes such as potassium or magnesium deficiency. Iron chlorosis appears first and is most completely developed in the leaves of terminal shoots. Older leaves are usually progressively less chlorotic. In mild cases of iron chlorosis, the size of the leaves may appear about normal. Leaf size is greatly reduced by severe chlorosis and the tissues of the leaves may be killed along the leaf margins and between the veins. Severe chlorosis results in decreased growth of shoot or in the most severe cases entire shoots may often die from the tips downward.

Control

The control of iron chlorosis is often difficult. Good drainage and less frequent irrigation may help to improve the condition of affected trees. The disease may be controlled in some plants by spraying with dilute ferric sulfate (less than 1 percent concentration). This treatment is effective for only one year and must be repeated. Injections of iron may be made into branches or the base of the tree is which holes are bored 4 to 5 inches apart, and 2 to 5 grams of soluble iron salt (ferric citrate or ferric oxalate) placed in each hole, which is closed by wax or a plug. Soil treatments may be made by digging holes around a tree and putting ferrous sulfate into the bottom of each hole in contact with the roots. With both injection and soil treatment there is danger of injury to the trees, and cures last only about three years. Since prunes on peach rootstock are more susceptible to iron chlorosis, prunes should be propagated only on plum rootstocks such as myrobolan or mariana.

CONTRIBUTIONS TO RESEARCH

February 15 to May 15, 1953

Northrup King Company
Velsicol Corporation

Ideal Cement Company
Geigy Company

Ethyl Corporation
Charles Peter

Monsanto Chemical Company

Carbide-Carbon Chemical Company
B. F. Goodrich Chemical Company
American Polymer Company

$40 for variety testing of field corn
100 pounds 5 percent Heptachlor
100 pounds 25 percent Heptachlor wettable powder
200 pounds 2½ percent Heptachlor
100 pounds 5 percent Chlordane
5 gallons Heptachlor 2B
100 pounds Ideal phosphate fertilizer
12 pounds seques~rene materials for iron and zinc deficiency studies
2 oz. lindane
15 volumes scientific and technical journals
3 types of Krilium soil conditioner
2 tons calcium phosphate for fluorine studies with calves
7 kinds of soil conditioner
2 kinds of soil conditioner
2 kinds of soil conditioner

for June 1953
are broken down. Opportunities arise and as trade barriers of its milk in out-of-state markets as from 39 percent in 1948 to 53 percent in 1952 reflects a healthy trend for the dairy industry in Utah. Continuation of the grade A market. It will also permit in 1952 ranks second in total milk sales in the state. About 18.8 percent of the milk sold in Utah are only important in counties where difficulties in hauling whole milk make it more profitable for small dairy farmers to separate their own milk and sell the cream.

Total Milk Sales in Utah

Combined grade A and grade C milk sales from dairy farms in Utah also increased from 1948 to 1952. Total sales to dairy plants increased about 51 million pounds. Nearly 557 million pounds of milk and milk equivalent of cream were sold to plants in 1952 as compared to 506 million pounds in 1948.

Cache County continues to lead all other counties in milk sales. Approximately 18.8 percent of the milk sold in Utah in 1952 and 18.1 percent in 1948 originated in Cache County. Utah County ranks second in total milk sales in the state. About 10 percent of the milk sold from dairy farms came from Utah County both in 1948 and in 1952. In 1952 nearly 50 percent of the milk sold to dairy plants by Utah producers came from five counties: Cache, Utah, Box Elder, Weber, and Salt Lake.

Future Trends in Milk Production

This shift from grade C to grade A from 39 percent in 1948 to 53 percent in 1952 reflects a healthy trend for the dairy industry in Utah. Continuation of this trend will enable more Utah producers to share in the higher returns of the grade A market. It will also permit Utah, a surplus milk state, to sell more of its milk in out-of-state markets as opportunities arise and as trade barriers are broken down.

GRADE A MILK

(Continued from page 29)

represented 6.5 percent of the total milk sold in the state while in 1952 cream had declined to only 3 percent. Cream sales in Utah are only important in counties where difficulties in hauling whole milk make it more profitable for small dairy farmers to separate their own milk and sell the cream.

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