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GOOD RANGE MANAGEMENT  
Prevents Losses From *Halogeton* Poisoning 

By C. WAYNE COOK, L. A. STODDART, and VIRGIL L. HART

It seems that the proper approach to the problem of halogeton poisoning on western ranges is learning how to graze infested ranges with a minimum of livestock losses. In the past, livestock men have learned to prevent or avoid losses from a number of other poisonous plant species and halogeton is no exception.

It is acknowledged by most scientific investigators that it is not practical to eliminate halogeton (*Halogeton glomeratus*) from the desert ranges of the intermountain area by present known methods. Eradication is not practical because the area cleared must either be revegetated with other more adapted plants or the procedure must be repeated several times a year for an indefinite period. Thus, on desert ranges it is better to encourage plants already present to replace halogeton rather than to eliminate all vegetation, which subjects the area to soil erosion and subsequent reinvansion of halogeton.

Halogeton contains toxic oxalates

Halogeton contains a relatively high content of the soluble oxalates (sodium and potassium oxalate) which are toxic when consumed in relatively large quantities. It was found from studies conducted by the Utah Agricultural Experiment Station that it required from 10 to 18 ounces of the plant to cause death of mature ewes when the soluble oxalate content (calculated as oxalic acid) was 8.2 percent.

It required as much as 18 ounces of halogeton to cause death when the animals had received normal range feed the day before feeding but required only about half that much when they had been without feed for 36 hours and had an empty stomach. Thus, hungry animals are more susceptible to halogeton poisoning because it requires considerably less to cause death.

This results from a chemical reaction of the soluble oxalates with the soluble calcium contained in the ingested forage. The calcium in the stomach or paunch unites with the oxalates in the halogeton forming an insoluble crystal (calcium oxalate) which passes through the digestive tract unabsorbed and is thus harmless. If calcium is not present in the stomach, the soluble oxalates are absorbed into the blood where they unite with the calcium normally present in blood. This causes violent physiological disturbance because of lowered blood calcium. Also, the resultant calcium oxalate crystals are deposited in the kidney causing a blockage of the tubules and destruction to the tissue.

FACTS ABOUT HALOGETON

The elimination of halogeton from the desert ranges of the Intermountain Area by present known methods is not economically or ecologically sound.

Therefore, the proper approach appears to be largely a problem of how to use halogeton infested ranges most effectively.

Hungry animals are more susceptible to halogeton poisoning than animals receiving adequate forage because (1) they are more apt to eat the plant and (2) it requires less of the plant to cause death.

Animals that are, by necessity, trailed through heavily infested halogeton ranges may be immunized against halogeton poisoning to a large degree by feeding once a day while on the driveway. High-calcium pellets would be especially effective.

Halogeton poisoning is more dangerous in the fall than late winter because the toxic material is leached out as the season progresses. Losses of any magnitude during the past five years in northwestern Utah have been observed only while trailing animals on heavily infested driveways.

Ranges with small to moderate amounts of halogeton can be grazed safely by avoiding areas of pure halogeton when trailing or bedding, by moderate use and open herding, and by supplementing animals during stormy weather. Consumption of small to moderate amounts of halogeton over extended periods of time does not appear to have any harmful effects upon breeding ewes.
Sheep grazing an area on desert ranges where halogeton abounds among the vestiges of once vigorous browse plants. Halogeton was consumed only in small amounts and animals were uninjured.

Halogeton has replaced perennial desert shrubs and grasses on this overgrazed and abused range.

Cattle grazing on an area that once supported desert shrubs but since has been plowed and at present supports a dense stand of halogeton and Russian-thistle with no other feed available. These animals obtained their entire forage from this area for several weeks during cold, snowy weather without detrimental effects.

Animals in Halogeton Infested Areas Need Adequate Forage

The practical application of these findings suggests that animals should always be supplied with adequate forage so that they are never on areas infested with halogeton with an empty or partially empty stomach. This is not only true from the standpoint of lesser quantities of the plant required to cause death but, in addition, animals are more apt to consume the plant under these conditions since a hungry animal will consume forage normally undesirable.

Calcium Pellets for Sheep on Trail

Experimental sheep have been fed calcium along with halogeton and it was found that animals could consume about twice as much halogeton without injury when calcium was present as under normal conditions. This suggests the possibility of feeding pellets containing high levels of calcium before trailing over halogeton infested areas. In this way, animals may be, in effect, immunized against the poison of halogeton for the day the supplement is fed. A major part of the work on this project next year will be the development of a calcium concentrate which is inexpensive, effective in counteracting oxalate poisoning, and non-injurious to the animal. Feeding high-calcium pellets to sheep to increase their tolerance for halogeton can be recommended only for short periods while trailing on driveways heavily infested with halogeton. Feeding such a pellet over a long period of time might deprive the animal of phosphorus because the increased concentration of calcium causes the phosphorus to precipitate and pass through the animal unused.

(Continued on page 45)
Leaf Spot
Most Destructive Disease of Italian Prune in Utah

By B. L. RICHARDS

Leaf spot is the most common and most destructive disease of the Italian prune in southwestern Idaho and in Utah. In Utah the disease stands out as a definite threat to Italian prune culture. Many plantings have been recently abandoned and removed, others are, at present, deteriorating rapidly.

Little is known as to the real nature or cause of the leaf spot, however from what is known the disorder falls definitely into the same category as the sweet cherry crinkle leaf and deep suture. Leaf spot is perpetuated through the bud but probably is not contagious.

Distribution and Economic Importance in Utah

But few specific data are available as to the exact distribution and the economic significance of leaf spot in Utah. The disease, however, is regarded as a cause of serious losses both in the quantity and in the quality of fruit. It also brings about marked and frequently fatal deterioration of the tree. Affected stock from nurseries is usually dwarfed and seldom makes satisfactory trees. Some trees are affected so severely that they become decidedly dwarfed and under unfavorable cultural conditions may deteriorate early and finally die. Several plantings over the years in Davis County have deteriorated and have finally been removed. Most of these plantings were pulled out within a period of four years.

Arthur S. Rhoads from his survey of orchards in 1944 in Utah makes the following comments:

"Italian prunes from North Ogden south to Provo and vicinity have been observed frequently to exhibit a marked unhealthy condition and a tendency to die at an early age, also to become unprofitable commercially, although healthy, productive trees occur in the same orchards. The trouble that appears most common and widespread is characterized by more or less numerous chlorotic spots in the leaves, suggestive of a virus disease. The trees fail to make a vigorous growth and have a distinctly unhealthy appearance, with the leaves small and more or less pallid. The fruit begins to color prematurely and a large proportion of it in some orchards is characterized by exudation of gum from one or more points, as though it had been stung by an insect. The tissues of the fruit are occasionally characterized by an abnormal dark brownish color to degeneration into gum. Much of the fruit begins to wither on the trees or falls prematurely. In Utah County growers complained that half of their crop in 1944 was already on the ground and they expected to have little left at maturity. Some growers stated that they were on the verge of abandoning the growing of Italian prunes unless some solution of their trouble can be found soon. In some plantings, especially farther north in the state, the leaves were characterized by the occurrence of brown, necrotic, circular spots, and in one block at North Ogden a distinct crinkle effect was observed. In the case of prune leaf spot we are concerned with one of the most destructive diseases affecting stone fruits."

Varieties Affected

Insofar as is known the Italian prune is the only plant on which leaf spot occurs. Similar leaf symptoms,
Changes in Personnel

D. A. Broadbent who is acting director of the Utah Station while Director R. H. Walker is on leave

Dr. Walker in Near East

During the more than two months that he has been away, Dr. Walker has been traveling in the Near East where he has visited Egypt, Lebanon, Trans-Jordan, Iraq, and Iran to become acquainted with their agricultural problems and to discuss ways in which the United States can best help them solve these problems. With headquarters in Washington, Dr. Walker will work with the land grant colleges and other agencies to find technical personnel to go to these countries to help them improve their agricultural methods and the status of the people who live on the land.

Broadbent an Agricultural Economist

Acting Director Broadbent joined the staff of the Utah Station in 1938 as instructor of agricultural economics after receiving his master of science degree from the University of Illinois. He received his bachelor’s degree at Utah State. In 1940 he was promoted to an assistant professor, in 1947 to associate professor, and in 1949 to professor. He became assistant director in 1948.

His principal assignment in teaching and research has been with the economics of production and marketing of livestock. He is chairman of the subcommittee of the Western Regional Technical Committee studying the marketing of livestock through auctions in the Western States and also the costs and returns from selling livestock through alternative marketing channels.

Acting Dean

Acting dean A. J. Morris is also head of the dairy manufacturing division of the Department of Dairy Industry. He came to USAC from the Branch Agricultural College in 1931. In addition to his duties at the College he is executive director of the Utah Dairy Association.

Departmental Changes

The new fiscal year will see many changes in the various departments.

Dr. Wayne Binns, head of the Department of Veterinary Science has been granted a year’s leave of absence to study at Cornell University. Dr. Binns was awarded the Danforth Foundation Fellowship for advanced study in veterinary science. While he is on leave Dr. M. L. Miner will be acting head of the department. LeGrande Shupe, who is completing his veterinary science training at Cornell, will join the staff July 1.

(Continued on page 48)
Livestock auction markets have increased at a rapid rate in the West in the last ten years. Today there are approximately 2400 such markets selling livestock in the United States with about 500 in the Western States and 9 in Utah. More than 7,000,000 head of cattle and calves are sold annually at the auction markets in the 12 Western States including Texas. In the Intermountain States, 30 percent of cattle going to market are handled by auctions, 27 percent by local dealers and truckers, 22 percent by terminal markets, and 7 percent direct to packers.

Twenty-five years ago there were practically no auction markets in the area. While there are a few large auctions, each handling more than 300,000 cattle annually, most auction markets are small. In 1948 13 percent of all auctions handled about 50 percent of all the livestock sold at auction.

One of the most important contributions made by these markets is in the exchange of stocker, feeder, and breeding animals between farmers and ranchers in the same or nearby communities. Auctions also contribute greatly to year-round feeding of livestock. This is particularly true for the small feeder. And increased feeding, of course, provides a more steady supply of fat livestock for packers, local butchers, and locker plant operators.

Auctions frequently provide the means whereby animals are moved from local deficit to local surplus feed areas, and therefore livestock and feed resources are combined more effectively, resulting in greater total output.

Information on the relative importance of the several marketing agencies used by western stockmen in 1949 was obtained through a cooperative regional study on marketing of western livestock by the agricultural experiment stations of the eleven Western States and Texas and the Bureau of Agricultural Economics under the Research and Marketing Act. A part of the data was obtained from a survey of more than 10,000 individual farmers and ranches of the West.

Various Marketing Channels

The results of the survey show that western livestock are channeled or moved to market in many different ways. The general practice is for producers either to sell at central or terminal markets, at auction markets, to packers, to farmers or feeders in the country, or to dealers. On the Pacific Coast 36 percent of all cattle sales by producers were direct

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for June 1952
to packers, 21 percent were to terminal markets, 18 percent to auctions, 11 percent to other farmers and feeders, and 14 percent to local dealers and truckers. In the Intermountain States 7 percent were packer directs, 22 percent went to terminal markets, auctions; second, in increased sales of fat and semifinished livestock direct from farmers and feeders to packers; and, third, in the general gain in country buying.

Since there are many small farms and ranches in the West, many of them with less than 10 head of cattle, satisfactory local markets have been a basic economic need for certain types of producers for a long time. Local auction markets have aided the small producers by providing additional facilities for selling their cattle.

Importance of Livestock to Western Economy

Livestock has played an important role in the growth and development of the western economy. Today, the inventory value of livestock found on western farms and ranches approximates 4½ billion dollars. The cash farm income obtained from the sale of such animals is the largest single source of revenue to western agriculture. The West uses about three fourths of its total land area for livestock grazing. In addition, feed output from over 70 million acres of western dry and irrigated cropland contributes heavily to western meat animal production.

In the process of this industry's growth, western farmers and ranchers have accumulated considerable knowledge on how to produce meat animals more efficiently. The livestock producers' use of new management techniques has resulted in an increase in total meat animal output of about 34 percent in the last 25 years.

Better Practices Speed Production

Two practices adopted by cattlemen have been primarily responsible for a large part of the gains made. One was the change in the makeup of the cattle inventory. Over a period of years a sharp reduction in the proportion of 2-, 3- and 4-year-old steers has been made, with a corresponding increase in the proportions of breeding stock and younger animals. This shift to a cow-calf form of operation by more farms and ranches has increased annual sales of cattle per 100 head kept. In the early twenties, western cattlemen could sell only about 25 head of cattle and calves yearly for each 100 head on ranches at the beginning of the year without changing inventory numbers. In recent years this has increased to about 41 head and makes possible a higher level of both marketings and slaughter in relation to cattle numbers.

The other practice or improvement in production came in the increased proportion of young animals born and raised to marketable age. This is particularly true with cattle. About 25 years ago the numbers of calves born per 100 cows averaged 70. In recent years this has been increased to about 80 calves per 100 cows.

Other changes which have had their influence on increased output (Continued on page 47)
Deep Suture—A Virus-like Disease of Sweet Cherry

By B. L. RICHARDS

Deep suture has been found affecting the sweet cherry in California, Oregon, Washington, Idaho, Montana, and Utah. This disorder occurs on a number of sweet cherry varieties, but particularly on the Bing. From the standpoint of the effect on the fruit the disease is equal if not more serious than leaf crinkle. There is considerable variation in the severity of fruit deformity even in the same tree and the trouble is more severe some years than others.

Deep suture is generally distributed in Utah orchards and provides a major problem not only in production but in grading and especially in the marketing of the cherry crop. Deep suture is not a transmissible disease. It is, however, uniformly bud perpetuated and in its spread and ultimate control is directly related to nursery practices.

History and Distribution

Deep suture was first described by Reeves in 1935. Kinman, however, had observed what appeared as the same trouble in California in the late 1920's and had described it under the name of rough leaf. The disorder was brought to the attention of Utah workers in 1939. Subsequent surveys in Utah from 1939 to 1944 have shown it to be generally distributed throughout the cherry growing areas.

Economic Importance of Deep Suture in Utah

In a late survey in 1944 Rhoads found deep suture occurring in various counties as follows: Weber County, 25 out of 46 orchards; Davis County, 12 out of 27 orchards; Salt Lake County, 3 out of 9 orchards; Utah County, 8 out of 18 orchards; Washington County, 17 out of 23 bearing orchards. The incidence of tree infection in orchards in the 5 counties averaged less than 1 percent of the trees examined. Rhoads stated that a much higher percentage would no doubt have been found had the survey been made before the fruit was largely harvested. This possibility has been confirmed in subsequent studies of individual orchards in Utah and by reports of surveys made in cherry growing areas in other states. From his detailed survey of cherry orchards Coe estimated that less than 10 percent of properties inspected in Washington State were found free from deep suture. In 1937 Kinman reported 13 percent of the trees affected in 3 orchards in Sacramento Valley, California, and 50 percent of a large number of orchards examined. It is reported from Oregon that it is difficult to find Bing trees free from deep suture from which to obtain buds for propagation. Also from Oregon it is reported that in some fruit districts fruit on affected trees is not picked because packers refuse to handle the product. One orchard in Box Elder County, Utah, showed 21 percent of the trees with a severe form of deep suture.

The degree of fruit malformation and the proportion of the tree shown to be affected vary with the season. Annual crop losses are therefore difficult to estimate. Planting of affected nursery stock involved not only the original cost of the tree, but what is far more serious the cost of maintenance until the worthless nature of the tree is discovered which may take from 5 to 7 years.

Varieties of Sweet Cherry Affected

In Utah Bing is regarded as the principal variety on which deep suture becomes a serious problem. The disorder, however, is frequently found

(Continued on page 46)
The feeding of sugar (sucrose) to beef and swine for short periods before slaughter has been found by workers at the Utah Station to produce slight increases in dressing percentage, improvement in color, increase in sugar content, and lower pH values of fresh cuts. The livers of the sucrose-fed animals were larger, contained more sugar, and had a better flavor and texture when cooked than livers of animals that were not fed the sugar. This information offers great opportunities to packers and others who process livestock. However, the studies conducted at the Utah Station are preliminary in nature and more complete experiments should be conducted on larger numbers of animals before specific recommendations can be made on optimum amounts and time of feeding.

Earlier studies in England, Denmark, Canada, and the United States on swine have shown that the treatment an animal receives a few hours before slaughter may alter the quality of the meat produced. Some of these studies also showed that feeding sucrose to swine a few hours before slaughter had a beneficial effect on the keeping quality of bacon and increased the weight of the liver.

The primary objective of the study made at USAC was to determine the effect on dressing percentage, color, texture, flavor, sugar content, and pH of cuts of meat of feeding sucrose to farm animals before slaughter. Sixty beef animals and 12 swine were fed amounts of sucrose varying from 0 to 25 percent of the ration for three days.
varying lengths of time (3 to 14 days) prior to slaughter. Similar studies are being conducted on sheep and turkeys.

Beef Cattle

The 60 steers used were primarily grade Herefords with a few Shorthorns among them. The control steers received a basal ration containing the following: ground alfalfa, ground barley, dried beet pulp, minerals, and molasses which was added at a level of 10 percent. The steers fed refined sucrose received the same basal ration as the controls; the sugar was in addition to the basal ration and the animals consumed it as desired for 3 to 12 days. Fresh water was available at all times (fig. 1).

A summary of the dressing percentage, liver weights, and percent of sugar in the liver and muscle of beef fed sugar 3 days is shown in table 1. These results on the 3-day feeding show the same general trend as for the 6, 9, and 12 days of feeding of sugar to beef. With 3 days of feeding of sugar, the dressing percentage was increased by 0.7 to 1.7 percent. However, an increase was not always obtained for each of the other feeding periods. The mean values of all treatments for the 3, 6, 9, and 12 days feeding periods was 60.4, 57.8, 59.8, and 59.3 percent, respectively. It appeared that the length of the feeding period as well as the level of sugar fed was important.

Average weights of all livers for the four periods showed increases similar to those in table 1 (14.0, 15.7, and 16.0 for the 0, 2, and 4 pounds of sugar-fed groups). These differences were statistically significant.

Differences in sugar content of the muscle and liver for the combined data for the four feeding periods were highly significant. The mean values for the muscle were 0.173, 0.184, and 0.184, for the liver 2.22, 2.47, and 2.36 for the 0, 2, and 4 pounds of sugar-fed groups, respectively. Both number of days fed and the amount of sugar fed significantly influenced the results.

The pH values tended to be lower for the sugar-fed animals, and in general the cuts from these animals would keep for a longer period of time.

Color of the muscle was measured with a diffuse reflectance accessory attached to the Beckman spectrophotometer. For the 3-day feeding period the control group had the poorest color. However, this was not consistent for each of the other feeding periods. The best color was shown by the muscle of the animals fed 2 pounds of sugar.

Quality of the prime rib roast was evaluated by testing for tenderness on the Warner-Bratzler shear force machine (fig. 2) and by a panel of seven judges. Values for the shear force test are given in table 1. Differences for the combined feeding (Continued on page 47)

Table 2. Average dressing percentage, liver weight, and percentage of carbohydrate in liver and muscle of pork fed sugar

<table>
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<th>Number of animals</th>
<th>Days fed</th>
<th>Dressing yield</th>
<th>Liver weight</th>
<th>Heart weight</th>
<th>Carbohydrate as dextrose</th>
<th>Shear force</th>
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</thead>
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<tr>
<td></td>
<td></td>
<td>percent</td>
<td>pounds</td>
<td>percent</td>
<td>pounds</td>
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</tr>
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<td>0</td>
<td>79.7</td>
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<td>0.80</td>
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<td>3.0</td>
<td>0.5</td>
<td>0.90</td>
<td>7.0</td>
</tr>
<tr>
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<td>3.4</td>
<td>0.7</td>
<td>1.49</td>
<td>9.2</td>
</tr>
<tr>
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<td>0.6</td>
<td>2.00</td>
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</tr>
<tr>
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<td>14</td>
<td>80.8</td>
<td>3.8</td>
<td>0.7</td>
<td>1.54</td>
<td>7.8</td>
</tr>
</tbody>
</table>

Fig. 2. (below) Dr. Wilcox tests the tenderness of a prime rib roast on the Warner-Bratzler shear force machine

Fig. 3. (right) Pigs 0 and 1 were litter mates and were fed the same ration until 14 days prior to slaughter. Pig 1 was fed 2 pounds of sucrose plus the basal ration while pig 0 was fed the basal ration without sugar. The liver of pig 1 weighed 0.6 pound more than pig 0.
Better Yields of *Carrot and Onion Seed* with Closer Spacing and Proper Irrigation

By LESLIE R. HAWTHORN

Closer spacing than is normally practiced combined with satisfactory soil moisture is the key to greater profits in onion and carrot seed production in Utah. A series of field experiments conducted in recent years has shown that much higher seed yields than are now commonly obtained are possible. With all spacings of carrot, and with those of onions where the rows are 30 inches or more apart, low soil moisture is preferable to high. Only when onions are grown for seed in rows closer than 30 inches is frequent irrigation justified.

Irrigation and Spacing for Seed Onions

Experiments with onions from 1947 through 1950 were conducted in such a way that various between-the-row spacings were superimposed on three carefully controlled soil moisture conditions: dry, medium, and wet. Only two or three of the spacings were included each year, but during the course of these studies the following were tried: 36, 30, 20, 18, and 9 inches. The Yellow Sweet Spanish variety was used in all tests. The seed yields obtained from the various combinations of soil moisture and spacing in the different years are given in table 1. The effect of spacing was much more striking than that of soil moisture. As rows were spaced closer together, seed yields steadily increased regardless of the soil moisture. When the data from 1947, 1949, and 1950 were analyzed together, it was found that for every inch closer spacing between 36 and 9 inches, the yield of recleaned seed from the onions under wet, medium, and dry soil conditions in the Utah experiments increased 33, 34, and 23 pounds per acre, respectively. And there was every indication that such trends
would continue if rows were closer than 9 inches. At spacings closer than 30 inches, yields were always higher in the more moist soils, but at spacings of 30 inches and wider seed yields tended to be approximately the same in any one year under all soil moisture conditions.

In Utah, where both land and water are often limited, such findings point the way to more efficient and profitable methods of production. If water is plentiful, it may be highly profitable with seed-to-seed plantings to crowd the seed onions on a limited area and water more frequently with the idea of obtaining seed yields two to three times as great as those normally realized with the wide spacing from the same sized planting. In 1950, at the Utah Station, an average yield of nearly 1,800 pounds of recleaned seed per acre was obtained from five plots in which the rows were 9 inches apart and which had been irrigated once a week for about 12 weeks between May 20 and August 16 (table 1). Even with just one irrigation during that period, there was a yield of more than 1,200 pounds of seed from plants similarly spaced.

The last statement indicates that seed onions may be drought resistant. With severe and uncontrolled infestation of thrips or the presence of a disease, such as pink root, onions would not produce so well, of course, and even with more frequent irrigation they might fail to produce high yields.

LESLIE R. HAWTHORN is horticulturist with the U. S. Bureau of Plant Industry, Soils, and Agricultural Engineering and collaborates with the Utah Station on vegetable seed research. Mr. Hawthorn will present some of the results of his research on onion and carrot seed production before the International Congress of Horticultural Science at its meeting in London this summer.

The fact that soil moisture has little effect on onion seed yield when rows are more than 30 inches apart (because the soil does not dry out so rapidly, there being fewer plants per unit area) is a valuable finding for the grower who would like to raise onion seed but does not have an abundant water supply. Under these conditions, regardless of the facilities for irrigation, it is a waste of time, labor, and water to irrigate a seed crop with widely spaced rows more than once, or at the most twice, between May and harvesttime in the seed year. From onions in Cache County in rows of 36 inches apart in 1947 and 30 inches apart in 1949, without irrigation, the Station obtained seed yields of 502 and 619 pounds per acre, respectively. Because of continuous soil moisture records for depths ranging from 3 to 36 inches below the onions, it is known that the soil in these treatments in 1947 and 1949 became extremely dry; yet the yields just mentioned were obtained.

When onions are grown in rows 30 or more inches apart and are irri-

(Continued on page 40)
Fig. 1. Smooth bromegrass on the left and tall wheatgrass on the right on the Rasmussen dry farm at Clarkston. Note the solid stand of wheatgrass in contrast to the irregular stand of brome. Maximum yields of seed of brome cannot be obtained and annual weeds require hand labor to control. Farmers earn big dividends throughout the life of a seed field by taking every precaution to insure an excellent stand. Smooth brome and tall wheat are about equal in drought resistance, but brome makes a much better quality forage.

By WESLEY KELLER

Grass seed production is a new enterprise for Utah farmers. And those who grow it, provided they have the proper set-up, stand a good chance of finding it profitable. The nationwide emphasis on grassland agriculture, the ever expanding program of reseeding on western range lands, and the relatively recent realization that farm pastures can profitably enter into rotations on the best land on the farm are all contributing to increased demand for grass seed.

But grass seed production is a specialized business, not to be entered into haphazardly. The grower need not own a lot of special machinery, but he should be certain that he has access to harvesting equipment, and can get it the day he needs it. Unlike grain crops, grass seed cannot be harvested most any time after the seed is ripe. In fact, it must be harvested while much of it is still in the ripening process, and delay of a day or two, especially in windy weather, may put half the seed on the ground. Farmers who grow any quantity of grass seed will find it profitable to have access to a clipper cleaner. They should have access to mouse-proof storage. Those farmers who deliver their crop directly from the field to the seed house pay dearly for cleaning they could do themselves, and often tie up their crop for months. Those whose product contains such seeds as morning glory or quackgrass, which they cannot remove, take a real beating. Seed of most grasses can be grown on a wide range of

DR. WESLEY KELLER of the U. S. Bureau of Plant Industry, Soils, and Agricultural Engineering works cooperatively with the Utah Station and the Intermountain Forest and Range Experiment Station on grass breeding.
soils, but, like most crops, the highest yields are obtained from the best land.

In deciding whether to become a grass seed producer a farmer will be confronted with two problems: which grass shall I grow, and how is it best done? These problems are considered in the following discussion, on the basis of limited experience now available.

Which Grass?

Quite a number of grasses, under the right conditions, and at current prices, could yield a profit to Utah farmers. The ones listed in table 1 are among those for which there has been a ready market. Some of the new ones have been highly profitable because of the scarcity of seed. Some of these still offer possibilities of the greatest profit, but they also contain the greatest element of risk. Much of the demand for seed of several new grasses has been from those desiring to become seed growers, and too little, it seems, from those making the type of planting which would prove the true forage value of the grass, and help to establish the range of conditions through which it may be of real value. This condition, together with the all too obvious fact that some of these new grasses have been publicized far beyond their true worth, can bring about drastic reductions in price in a single season, something not likely to happen to the older, better known sorts.

Tall wheatgrass is an excellent seed producer and has been highly profitable up to the present time. However, last fall the price offered was far below that of previous years. As it is expected that production in 1952 will far exceed that of 1951, further reductions in price can be expected.

Intermediate and pubescent wheatgrasses are short-lived as seed producers. On the Forage Experimental Farm yields of intermediate for 4 years were (1) 318, (2) 145, (3) 99, and (4) 46 pounds clean seed per acre. On dry land, yields will not be more than half those given above. Because of difficulty in growing seed of these grasses, the price of seed should probably remain fairly high.

Russian wild-rye is a grass of great interest because of its high palatability and excellent salt tolerance, a combination not found in any other grass adapted to the climate of the West. But the requirements of this species for seed production are apparently very exacting. Some growers have achieved a degree of success by applying heavy nitrogen fertilization, sometimes in conjunction with extra wide row spacings. Anyone contemplating growing seed of Russian wild-rye will do well first to learn all he can from the experiences of others with this grass. Because of the difficulty of growing this seed, and the great promise of the grass as a forage crop, the price of seed should hold up rather well.

All the other grasses listed in table 1 are well established and have relatively large markets.

How To Grow It

Because of the growing interest in grass seed production in Utah, the Utah Crop Improvement Association has set up standards, soon to be published, for the certification of seeds.
of most of the grasses listed in table 1. Commercial seed dealers can provide registered seed essential to the establishment of fields eligible for certification. Growers who can meet the standards are urged to produce certified seed.

For seed production all grasses are best seeded in rows not closer than 3 feet apart. Close-drilled or broadcast stands on irrigated land may yield more seed the first year of seed production, but will be less productive thereafter. Grasses seeded in the spring seldom yield any seed the 1st year, while grasses seeded in the fall may yield improved seed the 1st year and even more the 2nd year.

Companion (nurse) crop seeded between the rows of grass. The walls can be of stiff paper, and are held in place with adhesive tape. A tight fit is not necessary. When ready to plant, put the grass seed in first, and keep the grass compartment fuller than the grain adjacent to it. Two such partitioned units are needed to plant grass and grain in one operation according to the method outlined in fig. 5.

For seed production all grasses are best seeded in rows not closer than 3 feet apart. Close-drilled or broadcast stands on irrigated land may yield more seed the 1st year of seed production, but will be less productive thereafter. Grasses seeded in the spring seldom yield any seed the 1st year. For this reason, on fertile irrigated land with ample water, a grower will profit by the use of a companion (nurse) crop seeded between the rows of grass. This requires that irrigation be applied to meet the needs of the grass and that the grain, preferably barley, be removed promptly when ripe so that water can be applied to keep the young grass growing. Some suggestions on seeding grass and grain in one operation are given in conjunction with figures 4 and 5. Grass should be seeded at 3 or 4 pounds per acre while the grain may vary between 50 and 100 pounds. Grass may be seeded with canning peas, or on pea or grain stubble provided there is adequate water. Land as firm as pea or grain stubble makes an excellent seedbed. Companion crops are never used with midsummer or fall seedings, or on dry land. Grass may be seeded on dry land either in very early spring or late fall.

Compared with the grain crops, grass seeds are very small, and much slower to germinate. Thus, a planting of grass may be a complete failure under conditions which would have resulted in success with grain. But success with grass is reasonably sure if certain conditions are met. (1) When in the proper tilth, work the seedbed until it is firm. This means that a horse may leave a shoe print on the surface, not down in a hole, or that a tractor tire may leave marks, but not a rut. (2) Cover the seed, but never deeper than 1 inch, and less with the smaller seeded grasses, or if seeding very early in the spring or late in the fall. (3) Following a spring seeding, use a cultipacker to insure a close contact between the seed and soil. Chances of success will be increased if the soil is in a state of high fertility, and relatively free of weeds.

Every effort should be made to obtain a good stand. In addition to giving higher seed yields good stands eliminate the hand weeding necessary when the stand is incomplete. After the 1st year, solid stands generally take care of the annual weed problem on dry land. Grass in rows should not be cultivated except to control weeds or close cracks in the ground.

Seed yields are generally much higher on irrigated than on dry land, but this does not mean that application of irrigation water will always increase seed yields. On the good irrigated land of the Forage Experimental Farm near Logan seed yields of intermediate wheatgrass were not increased by irrigation. Crested wheatgrass gave increased yields, up to 25 percent, by irrigation, while tall wheatgrass, which matures in late summer, yielded 2 to 3 times as much seed when regularly irrigated than on adjacent non-irrigated plots.

Neither can the value of fertilizers be predicted with much confidence, except with such species as smooth brome which requires heavy applications of nitrogen to avoid becoming sod-bound. No gain in seed yield resulted from applications of nitrogen to either tall or crested wheatgrass on the Forage Experimental Farm.
while both there and on the Rasmussen dry farm at Clarkston seed yields of intermediate wheatgrass declined less, during 3 years, when given nitrogen than when unfertilized. Experience with fertilizers has been so variable that it is suggested that seed growers experiment with strip applications on their own fields. Those with reasons to believe the response to nitrogen will be profitable can try it to all but a few rows, while those who doubt its value can apply it to only a few rows. Both will find this test interesting and instructive.

Harvest time is the critical period in grass seed production because grasses shatter their seeds so freely. A grower should walk through his field every afternoon while it is ripeing. The first seed crop from a field matures less uniformly than subsequent crops, and it may be worthwhile to cut this first crop with a binder. Seeds too immature to remain plump, and retain viability if cut with an all-crop, continue to mature in the bundle. This first crop may be cut with a binder when the earliest heads begin to shatter. The bundles should be shocked and left standing 10 to 20 days before threshing which may be done with a grain thresher or an all-crop. The bundles should be cut and fed slowly into the machine. Some growers re-thresh the straw, but with careful regulation a good job can be done with one operation.

The second and later seed crops can be successfully harvested with an all-crop harvester, using reduced cylinder speed and little air. Harvesters with rasp-type cylinders generally do the best job. The proper stage to cut arrives soon after the first shattering is noticed. Actually, it is when the loss by shattering has become equal to the gain by ripening. Any seed that has not reached the hard dough stage at the time of harvesting may be damaged. If there is much green material in the seed obtained by direct harvesting, it should be spread out in a thin layer to dry. Otherwise heating may occur, with serious reduction in germination and loss of quality.

Seed fields should be mowed and the straw raked up and hauled off after the seed harvest. This straw makes a suitable feed for wintering horses and dry stock. In a normal season the wheatgrasses will provide tall grazing. The other species will recover and provide grazing soon after the seed harvest, if water is available.

NEW PUBLICATION


This bulletin is concerned largely with new developments for the study of steady flow or equilibrium ground-water flow conditions. It is highly technical and will only be of interest to students of ground-water hydraulics. Single copies of this bulletin may be obtained free from the Utah Agricultural Experiment Station, Logan.
CARROT AND ONION SEED
(Continued from page 35)

irrigated fairly frequently, annual weeds are often a serious problem after bolting begins, as cultivation and hoeing become almost impossible then. The absence of weeds in the plots irrigated least frequently was noticeable every year. Weeds were conspicuously absent also in the plots with 9-inch spacing, even where irrigation was frequent. Apparently onions cast enough shade at such spacing to discourage weed growth.

Close Spacing Increases Carrot Yields

The results with carrots are just as impressive as those with onions. Placing the stecklings closer together in the row consistently increased seed yields. In fact, where they were crowded together, as in an overwintered seed-to-seed planting, seed yields were often higher still than those obtained from closely planted stecklings. Such results encouraged tests where the rows were placed as close as 9 and 18 inches apart. When this was done, seed yields decreased from what they were in plots with rows 3 feet apart. The effect of spacing of stecklings within the row on the yield of carrot seed is shown in table 2.

Yields of carrot seed did not respond to soil moisture to the same consistent extent that yields of onion seed did. However, for Utah, the result was fully as important because in three out of four years the highest yields of carrot seed occurred in the dry plots. In these plots no irrigation water was applied until the soil at a depth of 2 feet had reached a condition so dry that ordinary plants would wilt unless they had roots deeper than 2 feet—as the carrot has. There is considerable evidence to indicate that roots of a carrot seed crop penetrate to depths of 5 feet or more. As an indication of how low soil moisture is likely to favor high carrot seed yields, the data collected in 1951 are rather striking. In that year, the yields from the dry, medium, and wet plots with rows only 9 inches apart were 1,020, 865, and 742 pounds of seed per acre, respectively. In the 9-inch spacing, the stand was extremely dense and the competition for soil moisture presumably great, and yet the yield was higher where the least irrigation water was applied.

Overirrigation Decreases Yields

Such results as have been obtained in the study of onion and carrot seed crops indicate that overirrigation is perhaps easier than might at first be suspected. Certainly they emphasize the fact that not only is overirrigation likely to reduce carrot seed yields and not increase onion yields except at spacings closer than those usually practiced, but also that such practices waste water as well as increase that expensive item, labor. In the 1951 carrot experiment previously discussed, the numbers of irrigations for the low, medium, and wet treatments were 2, 4, and 8, respectively. The amount of labor required was approximately in the same proportion and yet, as already indicated, for all the extra labor in the high moisture treatment, the yield of seed was cut nearly 300 pounds per acre. In some instances, the water which would be saved by less irrigation on a carrot seed crop could be used to advantage on another type of crop.

With seed onions, labor and land may be conserved and seed yields increased by spacing as closely as a 9-inch row is practicable, but also that such practices waste water as well as increase that expensive item, labor. In the 1951 carrot experiment previously discussed, the numbers of irrigations for the low, medium, and wet treatments were 2, 4, and 8, respectively. The amount of labor required was approximately in the same proportion and yet, as already indicated, for all the extra labor in the high moisture treatment, the yield of seed was cut nearly 300 pounds per acre. In some instances, the water which would be saved by less irrigation on a carrot seed crop could be used to advantage on another type of crop.

With seed onions, labor and land may be conserved and seed yields increased by spacing as closely as a 9-inch row is practicable, but also that such practices waste water as well as increase that expensive item, labor. In the 1951 carrot experiment previously discussed, the numbers of irrigations for the low, medium, and wet treatments were 2, 4, and 8, respectively. The amount of labor required was approximately in the same proportion and yet, as already indicated, for all the extra labor in the high moisture treatment, the yield of seed was cut nearly 300 pounds per acre. In some instances, the water which would be saved by less irrigation on a carrot seed crop could be used to advantage on another type of crop.

(Continued on page 47)

Table 1. Yields per acre of seed of Yellow Sweet Spanish onion as influenced by the combined effect of soil moisture and spacing, 1947, 1949, and 1950, inclusive

<table>
<thead>
<tr>
<th>Soil moisture condition*</th>
<th>Spacing between rows</th>
<th>Yield of recleaned seed per acre</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>inches</td>
<td>1947</td>
</tr>
<tr>
<td>Wet</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td></td>
<td>18</td>
<td></td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>1,052</td>
</tr>
<tr>
<td></td>
<td>30</td>
<td></td>
</tr>
<tr>
<td></td>
<td>36</td>
<td>523</td>
</tr>
<tr>
<td>Avg. of wet plots</td>
<td></td>
<td>788</td>
</tr>
<tr>
<td>Medium</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td></td>
<td>18</td>
<td></td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>988</td>
</tr>
<tr>
<td></td>
<td>30</td>
<td></td>
</tr>
<tr>
<td></td>
<td>36</td>
<td>514</td>
</tr>
<tr>
<td>Avg. of medium plots</td>
<td></td>
<td>751</td>
</tr>
<tr>
<td>Dry</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td></td>
<td>18</td>
<td></td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>771</td>
</tr>
<tr>
<td></td>
<td>30</td>
<td></td>
</tr>
<tr>
<td></td>
<td>36</td>
<td>502</td>
</tr>
<tr>
<td>Avg. of dry plots</td>
<td></td>
<td>637</td>
</tr>
</tbody>
</table>

*In the wet plots the soil-moisture tension was kept constantly below 500 cm. at the 6-inch depth in 1947 and at 12 inches in 1949 and 1950. The medium moisture plots were irrigated in 1947 when the soil-moisture tension at the 6-inch depth was equivalent to the wilting percentage; in 1949 and 1950 the depth of measurement was raised to 3 inches. The dry plots were irrigated in 1947 when the soil-moisture tension at the 24-inch depth was equivalent to the wilting percentage; in 1949 and 1950 the depth of measurement was reduced to 6 inches.
†The crop in 1950 was seed-to-seed; in other years, bulb-to-seed.

Table 2. Effect of spacing on the yield of Red Core Chantenay carrot seed, 1946 through 1949

<table>
<thead>
<tr>
<th>Distance between stecklings in the row when set out</th>
<th>Yield of recleaned seed per acre</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1946</td>
</tr>
<tr>
<td>inches</td>
<td>pounds</td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>987</td>
</tr>
<tr>
<td>24</td>
<td>828</td>
</tr>
<tr>
<td>36</td>
<td>508</td>
</tr>
</tbody>
</table>
What's New in Alfalfa Varieties?

By M. W. PEDERSEN, R. J. EVANS, JOHN W. CARLSON, D. R. McALLISTER

Farmers who fail to use the information on new alfalfa varieties, accumulated during the past fifty years through introductions of the U. S. Department of Agriculture and cooperative breeding programs of the state experiment stations, stand to suffer financial losses as a result of low yields, foliage diseases or short life of stands. No one alfalfa has all of the characteristics that are needed for a variety to be good under all conditions. A variety that may be good under a particular environment may be poor under another. For this reason every alfalfa producer should assess his needs in the light of his own experiences and, with the information he can gather, select a variety wisely.

With the release and promotion of these new alfalfa varieties it may be well to review their characteristics in comparison with the standard types that are well known by most farmers. Time has seen the progressive replacement of the old standard alfalfas by superior varieties. Winter hardy types have replaced common varieties in areas where cold winters previously killed the stands. Wilt resistant varieties are being rapidly increased and utilized where they are found to be superior, and many experiment stations have projects to develop varieties to meet special conditions.

The different varieties of alfalfa are listed together with their special characteristics in table 1. The varieties have been classified into six categories i.e. common, Turkistan, variegated, non-hardy, grazing, and new varieties. The original common alfalfa is traceable to early introductions into the United States. It is a regular practice to classify alfalfa seed of unknown origin as common. Thus, it can readily be seen that common alfalfa may include many strains and varieties that have lost their identity.

Turkistan Alfalfa

The Turkistan group includes three varieties that were developed from selections out of Turkistan introductions, namely, Orestan, which came from Oregon; Hardistan from Nebraska; and Nemastan from Utah and Nevada. In general, Turkistan alfalfas are winter hardy and wilt resistant. In addition Nemastan is resistant to the stem nematode. However, the disadavantages of these alfalfas are susceptibility to foliage diseases and poor seed production. In the humid eastern part of the United States Turkistan alfalfas are likely, therefore, to become severely damaged by foliar diseases.
Cross-section of a healthy alfalfa root (right) and a root infected with bacterial wilt (left). A brown ring of discolored tissue in the root is a characteristic symptom of this disease.

Variegated Alfalfa

Variegated alfalfas include Hardigan, Grimm, Cossack, and Ladak. They are characterized by variegated flower color, winter hardiness, and fair seed production. In addition, Ladak is slightly wilt resistant and has been consistently high in seed production (table 2). It is also unique in that it produces a larger proportion of the forage on the first crop than other varieties, which makes it a good alfalfa to grow in areas having a short season. Since our seed yield trials have all been conducted on first crop, Ladak may have thus been favored over other varieties. In other words, had second crop been used for the seed crop, Ladak may not have compared so favorably with the other varieties.

Non-hardy Alfalfa

Non-hardy alfalfas include Peruvian and Chilean, which are being grown mostly in Arizona and southern California where they have been found to be superior in forage production to the northern winter-hardy varieties.

Dry Land Grazing Alfalfa

In recent years considerable interest has been developed in alfalfas suitable for grazing purposes. Types such as Nomad and Rhizoma are not new to research workers, but the use of these varieties in dry land areas has not been adequately tested. Testing of strains considered suitable for dry land is being initiated at certain experiment stations including Utah. In the Middle West a mixture of bromegrass and alfalfa is extensively used for pasture. The standard hay types of alfalfa, such as Ranger or Buffalo, are used in these mixtures because they are superior to the grazing types in forage production where the land is irrigated or where moisture is not too limited. Thus, if Nomad and other dry land varieties are to be accepted, their place would be in the zone of limited rainfall which would seem to be about the same zone as that for crested wheatgrass.

New Varieties

New varieties appear on the market from time to time. A survey of their major characteristics will indicate in most cases whether or not they are suitable for Utah conditions. Ranger and Buffalo have been on the market for about ten years and are regarded as the best varieties to grow where bacterial wilt resistance is essential. In Ranger, desirable characteristics of Turkistan, Cossack, and Ladak have been combined; and as a result we have a hardy, wilt resistant variety that is a good seed producer. Buñolfo, a wilt resistant variety developed from common, is not so winter hardy nor so good a seed producer as Ranger at Logan. Atlantic and Narragansett are not wilt resistant but are superior in forage production in short rotations over a large part of the alfalfa producing region. Data (table 2) show that Narragansett is the best seed producer, however, more evidence will...
be required to be sure of its superiority. In seed production Atlantic is about the same as Grimm. An increase in the use of these varieties is to be expected. The National Seed Program is sponsoring the increase of foundation seed of the four varieties mentioned above which indicates a wide general acceptance over most of the seed consuming area.

Williamsburg was developed in Virginia for resistance to sclerotinia crown rot. Talent is a nematode-resistant variety selected in Oregon from a French introduction. In a preliminary test this variety was about equal to Grimm in hay production, but below it in seed production. DuPuits is not used in this country, but it is the most popular variety in northern Europe. Hay and seed production of this variety are reported to be superior in this region. Cali­verde is a new variety released by the California Station. This variety is resistant to bacterial wilt, downy mildew, and leaf spot. As Cali­verde is an improved California common, it is not expected that its use will extend much beyond the present use of common.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Flower color</th>
<th>Wilt resistance</th>
<th>Winter hardness</th>
<th>Seed production</th>
<th>Nematode resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common</td>
<td>Purple</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Turkistan</td>
<td>Purple</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Orestan</td>
<td>Purple</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Hardistan</td>
<td>Purple</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Nemastan</td>
<td>Purple</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Variegated</td>
<td>Varied</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Grimm</td>
<td>Varied</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Cossack</td>
<td>Varied</td>
<td>+, -</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Ladak</td>
<td>Varied</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Non-hardy</td>
<td>?</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Peruvian</td>
<td>?</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Chilean</td>
<td>?</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Grazing type</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nomad</td>
<td>Purple</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Rhizoma</td>
<td>Varied</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Sevelra</td>
<td>Varied</td>
<td>-</td>
<td>-</td>
<td>-</td>
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</tr>
<tr>
<td>New varieties</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ranger*</td>
<td>Varied</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Buffalo*</td>
<td>Purple</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Atlantic*</td>
<td>Varied</td>
<td>-</td>
<td>?</td>
<td>+, -</td>
<td>-</td>
</tr>
<tr>
<td>Narragansett*</td>
<td>Varied</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Williamsburg</td>
<td>Purple</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Talent</td>
<td>Purple?</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>DuPuits</td>
<td>Purple?</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Caliverde</td>
<td>Purple</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Millard Co.</td>
<td>Purple?</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Wisconsin G</td>
<td>Varied</td>
<td>+</td>
<td>+</td>
<td>+, -</td>
<td>-</td>
</tr>
</tbody>
</table>

*In national foundation seed program.

Table 2. Seed and forage yields of the common varieties of alfalfa in percent of Grimm from yield trials conducted in Utah during the period from 1938 to 1951

<table>
<thead>
<tr>
<th>Variety</th>
<th>Forage</th>
<th>Seed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1938-1951</td>
<td>1945-1951</td>
</tr>
<tr>
<td>Atlantic</td>
<td>106</td>
<td>85 (8)</td>
</tr>
<tr>
<td>Buffalo</td>
<td>102</td>
<td>73 (8)</td>
</tr>
<tr>
<td>Cossack</td>
<td>98</td>
<td>94</td>
</tr>
<tr>
<td>DuPuits</td>
<td>107</td>
<td>122 (1)</td>
</tr>
<tr>
<td>Grimm</td>
<td>100</td>
<td>100 (8)</td>
</tr>
<tr>
<td>Hardistan</td>
<td>104</td>
<td>117 (8)</td>
</tr>
<tr>
<td>Kansas Common</td>
<td>106</td>
<td>91 (4)</td>
</tr>
<tr>
<td>Ladak</td>
<td>106</td>
<td>108 (8)</td>
</tr>
<tr>
<td>Narragansett</td>
<td>105</td>
<td>147 (4)</td>
</tr>
<tr>
<td>Orestan</td>
<td>104</td>
<td>122</td>
</tr>
<tr>
<td>Ranger</td>
<td>104</td>
<td>123 (8)</td>
</tr>
<tr>
<td>Talent</td>
<td>96</td>
<td>60 (1)</td>
</tr>
<tr>
<td>Utah Common</td>
<td>92</td>
<td>57 (2)</td>
</tr>
<tr>
<td>Williamsburg</td>
<td>103</td>
<td>114 (5)</td>
</tr>
</tbody>
</table>

*Number in parenthesis indicates the number of years the variety was tested for seed production.

A Millard County farmer submitted a variety for testing that he had developed. This strain was producing satisfactory seed crops on his farm. In the first year that this strain was tested, it was inferior in both seed and forage production and in addition was quite susceptible to downy mildew. It may be of interest that several varieties developed by farmers have been tested by experiment stations over the last several years. None has shown any superiority, although Grimm, our first winter hardy variety, was developed by a Minnesota farmer.

Wisconsin G is a synthetic from the Wisconsin Station that is not yet ready for release. It is an attempt to combine in one variety the desirable characteristics of several others.

**Recommendations**

Forage yield trials conducted over the past 14 years indicate that the bacterial wilt resistant varieties are superior to the older lines and that the advantage of these improved varieties is pronounced in the fourth year of production (table 2). Where bacterial wilt is serious, the superiority of the resistant varieties is evident as early as the second year after seeding. Although the Turkistans hold up quite well in the fourth year, they have to be discounted because of their poor seed production. Ranger and Buffalo appear to be the best varieties for most parts of Utah, although the seed production of Buffalo is not all that could be desired. At high elevations where the growing season is restricted and bacterial wilt is not a factor, Ladak has an advantage.

When producing alfalfa strictly for seed, price as well as relative yielding ability should be considered. The demand for seed of new varieties in the National Foundation Seed Program is likely to be good. Ranger and Buffalo, in addition to being included in the National Program, are also well adapted to Utah conditions for hay production.
New Sorghums
MAY HAVE A PLACE IN UTAH

By DEVERE R. McALLISTER

Utah farmers have made little use of sorghums except for the manufacture of “Dixie sorghum” molasses and occasional plantings of sudan grass and broomcorn. Recent changes in this crop may make it more suited to our needs for additional feed grain and forage which have been extremely short in supply during the past season and may continue so in the future.

Sorghum has been called the “camel” of the plant kingdom in that it can do well on less water than corn and still produce a crop. Sorghum has to a greater extent than corn the ability to recover and grow after a drought period. This trait should make it a valuable crop where irrigation water is limited to late spring and early summer and where summer rains may help out later. This plant produces an excellent feed grain or the entire plant may be ensilage the same as corn. The grain is suitable for all types of livestock, including poultry.

Earlier Maturing Varieties

Varieties are now available that mature in a shorter season than did the older varieties. For example, new grain sorghums such as Goes, Early Kalo, Day, Colby, Midland, Sudan Kaffir, Sooner, and Highland have pushed sorghum production into Nebraska, South Dakota, and northeastern Colorado from the traditional sorghum belt of Kansas, Oklahoma, and Texas. Our major valleys, Salt Lake, Millard, Cache, and Utah, have growing seasons not unlike those of South Dakota. Although we do not average the 17 to 25 inches precipitation required for sorghum production, we may supplement rainfall with irrigation water. Our cool summer nights may extend the period required to mature sorghums, but the same is true with corn. The shorter growing season and cold nights may always prevent the successful production of sorghums in our higher valleys, because when temperatures drop below 60°F sorghums cease to grow.

Early maturing forage or syrup type sorghum varieties commonly known as sorgos are: Leoti, Black (Early and Minnesota) Amber, Rancher, Early Sumac, Red Amber, Dakota Amber, Atlas, Kansas Orange, and Fremont. These are grown for bundle feed, silage, hay, or syrup production. They usually range in height from 5 to 10 feet and under droughty condition will commonly outyield corn.

Shorter Varieties

New shorter varieties of grain sorghums are now available which permit combine harvesting. Depending upon variety, available moisture, and season, these range from 2.5 to 4.5 feet in height whereas the older types averaged around 6 feet. These new types have caused a revival in the use of sorghums in the southern Great Plains and more recently in Arizona with the latter state now harvesting a $5,000,000 crop annually. Ever increasing labor costs and labor scarcity were causing many farmers in the sorghum belt to switch from sorghum to wheat, but with these combine types available, the trend has been reversed. For instance, when insect and weather damage caused the abandonment of nearly a third of the Kansas winter wheat crop in 1951, many farmers turned to sorghum and raised their second largest crop (44 million bushels) in history. This sorghum crop was the salvation of many of these farmers who had suffered...
Sorghums Use Soil Nitrates

Sorghum is traditionally hard on the soil and the crops that follow are frequently reduced in yield. This is now attributed to the excessive feeding of sorghums on soil nitrates and moisture to and the slow decomposition of the crop residues during which time the available soil nitrates are tied up by the decomposing bacteria. Although the condition lasts for only a few months, subsequent crops may be materially benefited by additional nitrate fertilizer and irrigation.

Sorghum Poisoning

Sorghum poisoning resulting from the accumulation of excessive quantities of hydrocyanic (HCN) or prussic acid causes some losses of cattle, sheep, and goats each year. Losses occur when green plants are grazed but silage, well-cured fodder, and hay usually may be fed with safety. Sudan grass usually contains less prussic acid than other sorghums and rarely causes death unless contaminated with other sorghums. Frozen, drought-stricken, and second-growth plants are especially dangerous because they are small and consist mostly of leaves which, under these conditions may be high in prussic acid. A remedy for prussic acid poisoning is a combination of sodium nitrate and sodium thiosulfate injected intravenously. For cattle, 2 to 3 grams of sodium nitrate in water followed by 4 to 6 grams of sodium thiosulfate in water, while the recommendations for sheep are 1 gram sodium nitrate followed by 2 to 3 grams of sodium thiosulfate.

The last sorghum varietal testing carried on in Utah was reported by R. W. Woodward, D. C. Tingey, and R. J. Evans in Utah Station Bulletin 281, 1937. We are greatly in need of additional information on the new varieties, but no research is currently being done on this crop.

HALOGETON POISONING

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Seasonal Changes in Amount of Oxalates

The content of the oxalates in halogeton is highest while the plant is growing and remains high until it is frozen during the fall. At this time the plant may contain as much as 20 percent, based on oven-dry weights. However, rains and wet snows leach the soluble oxalates from the plant thus decreasing its toxicity. As the season progresses the content gradually reduces until by the following spring it may be as low as 1 percent. Thus considerably more of the plant material is required to cause death in late winter than during the fall.

Most Losses Occur When Trail ing Animals

During the past four to five years the college has been investigating reported poisoning from halogeton in northwestern Utah. These investigations show that the only losses of great consequence have been while animals were trailing over driveways infested with halogeton. In most cases the losses even on trails have been rather small and were likely brought about by rapid trailing or restricting animals to roadways for extended distances.

Animals while trailing rapidly or being moved by force develop somewhat unnatural or depraved appetites. This may be a psychological response to excitement or discomfort. Often if the animal is to eat at all, it must snatch rapidly and aimlessly at whatever forage is present and thus will eat things normally avoided.

This is not at all a strange behavior and it actually occurs among all animals that are driven or ridden for considerable distances. Almost everyone who has ridden horses has observed the unusual forage they will consume when given ample rein to reach the forage as they walk along.

Experimental sheep have been grazed on areas with various amounts of halogeton and with various plant combinations. Other available plants along with halogeton have been big sagebrush (Artemisia tridentata), black sage (Artemesia nova), shad-
on Black Tartarian and on mazzard seedlings.

**Nature and Cause of Deep Suture**

Numerous attempts in Oregon, Washington, and in Utah to transmit deep suture from diseased to healthy trees have failed. Growth from normal scions and buds grafted into trees showing definite deep suture remains normal. Likewise scions and buds from deep suture trees continue to produce deep suture leaves and fruits but fail to transmit the disorder to the healthy plant. It has been demonstrated repeatedly that deep suture is bud and scion perpetuated.

It should be mentioned at this point, that in spite of the failure of all attempts to transmit deep suture artificially, there still remains the possibility that the disease may be of a virus nature and in some way spread in orchards. In the absence of a transmissible agent, spontaneous origin must be postulated. This latter postulate, however, is difficult to accept in view of its occurrence in such a wide range of varieties. There are still those who continue to hold to the virus theory of the origin. On this point there is need for more intensive research.

**Leaf Spot of Italian Prune**

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**Symptoms of Leaf Spot**

**Effect on the leaves**

Leaf symptoms of Italian prune leaf spot are primarily of two types: (1) a distinctive chlorotic mottling (fig. 1.) and (2) a definite tan or brown colored necrotic spot (fig. 2). Both expressions are delayed in their occurrence in the spring and may not appear until early or even late summer.

Leaf motting, which may precede or accompany the necrotic spotting, is widely distributed and is characterized by diffused or clearly delimited light green or rust colored areas. These areas may become so extensive as to produce definite mosaic pattern. Motting may be associated with the necrotic spotting or it may occur as the only leaf symptoms of the disease on entire trees.

The necrotic spots on the individual leaf vary greatly in size, shape, and number. When numerous they coalesce producing large irregular blotches of dead tissue frequently involving much of the leaf margin.

**Control Measures**

Reliance, in the main, must be placed upon the production of clean nursery stock propagated preferably from large bearing trees with a record of freedom from deep suture. Budwood, in any event, should be selected just before fruit maturity and where possible only from certified sources.
Sometimes the entire margin dies and dries up. Spots are also frequently characterized by definite zones, parts of which may drop out producing shot holes of varying sizes.

Effect on fruits.

Leaf spot causes serious reductions in both quantity and quality of the Italian prune fruit. The severe defoliation induced by leaf spot may result in a heavy fruit drop or in a yield of poor quality or sunburned fruit. The affected fruit begins to color prematurely and the fruit tissues become dark brown in color and frequently degenerate into gum. Much of the fruit withers while on the tree and falls off prematurely.

Effect on trees.

Nursery stock propagated from diseased buds and which shows disease symptoms produces dwarfed and unsatisfactory trees. Terminal growth on such trees is usually retarded and severe rosetting may result. Varying amounts of chlorosis in severely affected trees are accompanied by greatly decreased vigor.

Symptoms in the leaf, in the fruit, and in the tree vary with season.

Control

Nursery stock should be propagated from healthy budwood certified to be free from leaf spot and all other bud perpetuated and contagious diseases. Young trees showing leaf spot symptoms should be removed promptly and replaced from healthy stock.

FEEDING SUGAR TO LIVESTOCK PRIOR TO SLAUGHTER
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periods were not significant. Quality scores by the panel of judges were also similar.

The flavor and texture of the livers from sugar fed animals were prefered by two thirds of the people (75) who tested them.

These results indicate a need for further study before definite conclusions can be made as to the amount of sugar which should be fed or length of time of feeding.

Swine

Two litters of pigs, grade Duroc-Jersey and Chester-Whites, were used in this study. They were fed a basal ration consisting of the following on a percentage basis: protein supplement 15, ground alfalfa 5, ground barley 78.5, bone meal, 1.0 and salt 0.5, until they reached a weight of about 200 pounds. Three litter mates of each litter received sugar plus the basal ration for 3 or 14 days prior to slaughter.

A summary of the dressing percentages, percent of sugar in liver and muscle, and the weights of the liver and heart is given in table 2.

When values for the all sugar-fed pigs were compared with the controls, the differences in dressing percentages were significant. The sugar feeding increased the dressing percentage 4.6 percent. Differences were also significant for the sugar content of the muscle and highly significant for the sugar content of the liver. The muscle of the sugar-fed animals contained almost twice as much sugar as those of the controls while the sugar-fed livers contained over twice the amount found in the controls. Shear force differences were not significant.

Liver and heart weights were increased (fig. 3). The sugar-fed livers were preferred for their texture and flavor.

AUCTION MARKETS
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are: reduced death losses through more effective disease control methods; more general use of improved methods; more general use of proved sires; and a decline in number of horses and mules on farms, which, in turn, has made it possible to expand meat animal numbers. Along with these developments has come a growth in the livestock feeding industry, which has increased the number of animals on feed in the West.

The combination of present production and feeding practices makes it possible to reduce substantially the time required to finish livestock for slaughter.

With a higher volume of trade, or higher velocity of cattle marketings generally, ranchers, farmers, and feeders are now required to make more frequent decisions about marketing than formerly. They need to know more about marketing trends and marketing conditions.

CARROT AND ONION SEED
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irrigation in the seed year normally justified.

Arrange for Market Before Planting

Although the results of the experiments reported here indicate favorable conditions for the production of carrot and onion seed in Utah, it is not advisable to grow any vegetable seeds unless one either has a contract with a seedsmen or knows in advance that there is an outlet for the seed produced. It is often difficult, if not impossible, to sell vegetable seed on the open market.

Dr. Lorin E. Harris, professor of animal husbandry, was awarded the fourth American Feed Manufacturers' award of $1,000 which was presented to him during the 43rd annual meeting of the American Society of Animal Production in Chicago. Dr. Harris' contributions to knowledge of the nutrition of animals has been especially important in the areas involving the utilization of urea by cattle and sheep, the effects of feeding DDT-treated forage to farm and laboratory animals, the utilization of the herbage of the western ranges by sheep, and quantitatively defining the nutritional requirement of fur bearing animals. Particularly important are the techniques which he has devised for conducting nutritional studies with range sheep, and for studying the adequacy of the native herbage and in determining the supplements required to permit profitable livestock production on these ranges. These studies were carried out in cooperation with Dr. C. Wayne Cook of the Department of Range Management.
CHANGES IN PERSONNEL
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Prof. James A. Bennett, head of the Department of Animal Husbandry, has been granted a leave beginning October 1 for graduate study.

Dr. S. W. Edgecombe, head of the Department of Horticulture, has resigned, effective August 31, to accept the position of dean of the School of Agriculture of the American University at Beirut, Lebanon. No one has been appointed to take his place. The School of Agriculture is a new school in the American University. It will be financed by the Ford Foundation in an effort to train a limited number of agricultural leaders in the Near East who can return to their home countries and lead in agricultural reform. Dr. Edgecombe will be greatly missed by the horticultural interests in Utah. He has made a real contribution to the industry in the short time he has headed the department at Utah State.

Dr. Vernon L. Israelson, who has spent the past two years on leave with the Federal Housing Administration in Puerto Rico, will return to his position as professor of agricultural economics, July 1.

Dr. Dean K. Fuhriman, formerly a collaborator with the Soil Conservation Service, will return to the College as a member of the staff in the Department of Irrigation and Drainage. Dr. Fuhriman has completed the requirements for his PhD degree at the University of Wisconsin while he has been away and has taught a year at Colorado A & M College. Willis C. Barrett, collaborator in the Soil Conservation Service, will be transferred to New Mexico.

CONTRIBUTIONS TO RESEARCH
February 15, to May 15, 1952

Columbia-Geneva Division
U. S. Steel Corporation

$56,900 for research on fluorosis,
6 tons ammonium sulfate for fertilizer tests

National Institute of Health

$16,400 for research on toxicity of new insecticides

Atomic Energy Commission

$7,600 for study of chlorosis and other minor element deficiency diseases

Amalgamated Sugar Company

Each $2,000 for research on soil, water, and fertilizer problems in relation to sugar beet production

Utah-Idaho Sugar Company

$1000 for study of staphylococcus in turkeys

Utah Poultry and Farmers Cooperative

$1,000 for research on control of alfalfa insects

Julius Hyman Company

$800 for research on control of alfalfa insects

Velsicol Corporation

Heptachlor and chlordane for insect control research

American Dairy Association

$800 to study the distribution of milk by vending machines

Northrup, King, & Co.

$500 for research on hybrid onions, lima beans, and carrot seed

West Coast Sales & Service Company, Tulare, Calif.

$438 Morrill side delivery hay rake for use in harvesting experimental plots

Anaconda Copper Company

4 tons of treble superphosphate for fertilizer research

Bonneville Limited, Salt Lake City

1 ton of muriate of potash for fertilizer research

E. C. Olsen Company, Ogden

15 gal. Dieldrin for insect control research

Dow Chemical Company

2 quarts Systox for insect control research

Western Gypsum Co.

4 tons gypsum for alkali soil studies

Charles Peter, Salt Lake City

30 volumes of journals in agricultural science

American Cyanamid Co.

1 gal. Parathion and 1 gal. Malathion for insect control studies

Stauffers Chemical Co.

2 gal. Sulphenone for insect control studies

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