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WHEN SHOULD YOU IRRIGATE Sugar Beets?

VAUGHN E. HANSEN and JAMES R. BARKER

It is widely accepted that it takes a good farmer to make money growing sugar beets. Invariably farms producing high tonnages of beets are those that are managed by progressive farmers applying the latest practices. Over the years many ideas have grown up, especially about irrigation practices, that extended research has shown to be wrong.

Irrigation Practice

Early Irrigation (before July 1)

A commonly accepted idea is that if it is necessary to irrigate sugar beets to insure germination they might as well be plowed under and a new crop planted; in other words, many farmers believe that early irrigations are harmful. Experience from many sugar beet areas under widely varying climatic and soil conditions indicates that this concept is erroneous.

Another erroneous concept is that early irrigation causes the beet to be short and stubby, and that a better shaped beet is produced if the soil is allowed to dry out so that the beet has to "go to water." The idea of keeping the soil dry so that the beet will go after water sounds like starving a pig to make him grow longer. Experimentation in the laboratory and practice on the farm have shown conclusively that the sugar beet should never be allowed to suffer for water.

In one sugar producing area of the western United States a few years ago, farmers generally believed that it would ruin a crop of beets to irrigate them early. Now the idea has completely reversed itself and 75 percent of the sugar beet acreage is irrigated for germination. The difference in practice has come from gaining an understanding of the basic principles that must be adhered to to insure good results for early irrigation.

An essential criterion for good irrigation practice is light, frequent water applications during the fore part of the season. Heavy applications (wetting the soil to 4 or more feet) will frequently leach the available nitrogen below the roots. On soils low in nitrogen a heavy early irrigation frequently causes the leaves to turn yellow. The yellow color is not caused by the early irrigation but rather by the heavy irrigation which in turn caused a nitrogen deficiency.

The desirable practice is to plant the crop as early as possible, provide sufficient fertilizer, and irrigate frequently with light applications till the roots are well established. As the season progresses, increasing amounts of water should be applied at each irrigation.

Another asset of early irrigation is that the added moisture will assist in dissolving the commercial fertilizers so that they can be utilized by the plant.

Late Irrigation (after August 15)

One caution with regard to late irrigation should be observed. A late irrigation on a field which has not had sufficient water will often produce a new growth of foliage. This new foliage will result in some reduction in final yield and in a considerable reduction in sugar content. Late season top growth should

(Continued on page 2)
Irrigation of Sugar Beets

(Continued from page 1)

be avoided. Beets which have received adequate irrigation during the season will not produce new top growth as a result of late irrigations.

In those areas in which the winter precipitation is not sufficient to fill the root zone of the soil with the needed moisture for the coming season, it is common practice to give the soil a rather heavy late-season irrigation to prime it for the following year. This not only insures adequate moisture for the early part of the coming season, but it also permits the farmer to plant his crop at an earlier date than would be possible if he had to irrigate before the crop was planted.

General Irrigation Recommendations
Again it should be emphasized that good control and even distribution of the water throughout the season are essential to high sugar beet production.

It should also be reemphasized that the sugar beet should never be allowed to suffer for water; never wait for a rain. Irrigate when the sugar beets need water.

The call system of irrigation (where water is provided when needed rather than at a fixed interval) provides the farmer with the irrigation water when the sugar beet needs it. This not only gives the farmer more opportunity to adapt his irrigation practice to needs of the crops but also results in a saving of water.

A general rule for determining the amount of water to apply per irrigation is as follows: in a well developed soil profile, apply sufficient water each irrigation to wet the soil to a depth in feet,
CIPC

Gives Promise of Controlling Dodder in Alfalfa

Experiments at Logan, Utah, in 1953 revealed a promising new chemical method of controlling dodder (Cuscuta spp.) in alfalfa seed fields. The new herbicide is CIPC (isopropyl N-3-chlorophenyl carbamate) which was applied as a pre-emergence treatment early in the spring just as alfalfa began growth. Extensive field experiments and demonstrations are planned in 1954 to check the 1953 results and to determine the conditions under which CIPC can be expected to give effective and economical control of dodder in alfalfa without injury to the crop.

Dodder in alfalfa seed fields is one of Utah’s most troublesome weed problems. During the past 3 or 4 years this pest has spread rapidly and now it infests in varying degrees. (Continued on page 20)

Both MR. LEE and MR. TIMMONS are employed by the Section of Weed Investigations, Field Crops Research Branch, U. S. Department of Agriculture. They are both stationed on the USAC campus and cooperate with the Utah Station. Mr. Timmons has charge of weed investigations for the USDA throughout the Western States.

To Control Dodder

1. Small widely scattered dodder patches can be most effectively and economically killed by spraying the dodder and infested alfalfa to complete coverage with an aromatic weed oil or dinitro-fortified oil-water emulsion. The alfalfa top growth is killed in treated spots but the roots are uninjured and produce normal regrowth.

2. In heavily infested fields where spot treatment is not economically feasible, spraying the dodder infested alfalfa stubble after the first crop has been removed with 80 to 120 gallons per acre of an aromatic weed oil can be expected to reduce the amount of dodder 60 to 80 percent and under some conditions to increase the yield of alfalfa seed somewhat. Stubble treatments with a 1 to 10 dinitro-fortified oil-water emulsion at 120 gallons per acre can be expected to reduce the dodder 50 to 65 percent and under some conditions increase the yield of alfalfa seed somewhat. The economic feasibility of such stubble treatments is questionable considering the fact that the costs of aromatic oil range from $24 to $36 per acre, while the cost of dinitro-fortified aromatic oil-water emulsions range from $7 to $14 per acre.

3. Burning dodder-infested alfalfa stubble with a weed burner gave practically complete control of dodder but reduced alfalfa seed yield 27 percent and cannot be recommended for general use pending further research.

4. Pre-emergence application of CIPC at 3 to 9 pounds per acre in early spring 1953, gave 96 percent control of dodder and increased alfalfa seed yields approximately 70 to 140 percent (147 to 212 pounds per acre). Pending further research, this method can be recommended only for trial use on small areas. For such trials it is suggested that formulated CIPC be applied at the rate of 3 or 4 quarts per acre in 40 gallons or more of water. The spray treatment should be made just as alfalfa begins growth in early spring. Such treatment would cost $11 to $15 per acre.
With the recent death of Dr. Frank B. Wann, the fruit and vegetable growers of Utah and students of plant science at Utah State Agricultural College have lost one of their staunchest friends and greatest helpers. Dr. Wann came to Utah in 1926 from professional work at Cornell University.

Even before coming to Utah he was interested in the problem of iron deficiency in plants and had published scientific papers on his studies in the field. Soon after his appointment as associate professor of plant physiology at USAC in 1926, he started to study the yellowing of fruit trees, berry plants, ornamental shrubs, and flowers growing on soils high in lime. He found that the yellowing of the leaves, or chlorosis, results from a deficiency of iron. Later he demonstrated that fruit trees sick with chlorosis could be restored to normal green color by boring holes in the trunks and inserting capsules of iron salts. He also showed that chlorosis in the American grape can be controlled by grafting on vinifera rootstocks.

He was the first to prepare lists of ornamental flowers and shrubs that would remain naturally green on soils high in lime. He also delved more deeply into the problem in the greenhouse and chemical laboratory and published important scientific papers on the processes by which iron is assimilated by plants, the manner in which it is moved about through plants, and the role it plays in plant growth.

Dr. Wann led the investigations which first showed that about 7 percent of the fruit orchards of Utah are being injured through deficiencies of zinc. He also found that more than 20 percent of Utah orchards contain trees suffering from manganese deficiency. Through his studies satisfactory and practical procedures have been developed for correcting these deficiencies. These control measures include spraying the leaves and bark of trees deficient in zinc, and treating the soil around plants suffering from manganese deficiency.

Vegetable growers have also benefited from his help. He worked for years on the cause and control of black heart and pithiness in celery. Although no fully satisfactory control methods have been found for these problems, his studies mark definite progress in their final solution.

In recent years, Dr. Wann devoted his research energies to a study of the effects of industrial pollution of air on crop plants. He directed the gathering of thousands of plant samples through central Utah. This has probably been the most thorough study ever made of fluorine accumulations in crops growing under field conditions.

Dr. Wann was a friendly and thorough teacher. He was never too busy to spend an hour with a student in need of help. His unique ability to clarify complex biological problems and to inspire and lead his students will be remembered by a host of students. Through his classes, many young men at Utah State became interested in botany. His encouragement led many students to go away to the leading universities of the world and to become renowned authorities in plant science. Others are better farmers and agricultural specialists because of the training given them in Dr. Wann's classes.

Dr. Wann was a friend to all. He never assumed an air of importance. He was quiet and reserved, but his quiet observations led his students and associates to think more broadly of the world about them. Although physically handicapped since birth, he never in word nor act invited sympathy. He always assumed a full share of the work to be done. He was respected by both faculty and students for his great good judgment, his sterling character, unfailing courtesy, and his innate kindness.

Frank Burkett Wann was born in Warsaw, Indiana, in 1892. He obtained a bachelor of science degree from Wabash College in Indiana in 1914. He later studied at Washington University, St. Louis, and then went on to Cornell University where he studied, did research, and taught. Cornell University awarded him the degree of doctor of philosophy in plant physiology in 1920. He then served on the faculty at Cornell until 1923 when he was awarded a research fellowship from the National Research Council to continue his research at Cornell until 1926. He came to Utah State as associate professor of plant physiology. He became head of the Department of Botany and Plant Pathology in 1952.

In 1920, Dr. Wann married Elizabeth Berrells of Ithaca, New York. She was his constant companion until her sudden death in September of 1948. They are survived by a foster daughter, Merci Ann Wann. Merci Ann is a senior at Utah State majoring in child development.

—D. Wynne Thorne
A dense stand of mule ear on a mountain range. Inset, closeup of mule ear

Herbicides
Give Economic Control of Mule Ear on Range Lands
D. C. TINGEY and C. WAYNE COOK

Grasses on overgrazed mountain ranges of the Intermountain area are being crowded out by the invasion of wyethia (Wyethia amplexicaulis) or mule ear, also known as green dock and black sunflower. This plant, a tufted perennial with smooth waxy leaves and a thick woody taproot, is seldom eaten by cattle when other forage is available and only occasionally by sheep when the plants are still young. Since it is relatively unpalatable, it increases in density, and on some ranges it has increased almost to the exclusion of other species.

Natural rehabilitation of mule-ear-infested ranges by protection from grazing requires many years and is believed beyond the realm of economic practicability. Consequently, a study was started in 1947 to find more expedient methods of eliminating the plant.

Results of this study have shown that wyethia can be successfully controlled by spraying with 2,4-D. Ethyl and butyl esters have been found most effective. The minimum dosage for satisfactory control is 2 pounds of 2,4-D acid per acre applied before the plants come into bloom.

Yield responses of desirable forage plants where mule ear was eradicated were impressive. In one case, 5 years after the treatments were made, a series of untreated plots infested with mule ear yielded 280 pounds of desirable forage an acre, and where the weed had been eliminated, the yield was 1,353 pounds an acre. Bunch wheatgrass, Kentucky bluegrass, and needle-and-thread grass increased in direct proportion to the extent of mule-ear eradication.

Characteristics Of Mule Ear
Mule ear reproduces wholly by seed, yet it is an aggressive plant, and once it becomes established, it competes with extreme tenacity. It is common throughout most of the mountainous and foothill areas of the western United States. Frequently it occurs in thick stands averaging from only a few square rods to several hundred acres. Other weeds and grasses are generally intermixed with mule ear in varying quantities as understory growth. Dense stands of this plant are found most commonly on open flats, parks, broad ridges, and gentle slopes that have been abused by overgrazing.

Control Studies
Studies on the control of this weed have been conducted by the Utah Station at two locations: in the mountainous area near Tony Grove Ranger Station, 24 miles up Logan Canyon, and on the Glenn range near the pass on Highway 91 between Brigham City and Logan. Both areas are typical summer ranges of northern Utah. Annual rainfall is about 30 inches at Tony Grove and about 25 inches on Glenn’s range. Elevation at Tony Grove is about 7,000 feet and on Glenn’s range about 6,000.

(Continued on page 16)
IN TESTS conducted throughout the corn growing areas of the state over many years, the following corn hybrids have produced the highest yields and are therefore recommended by the Experiment Station for planting in the principal valleys of the state: Portwalco 90, Ohio C38, Utahybrid 544, Portwalco 100, Utahybrid 680. Other hybrids tested over a shorter period showing promise include: Keystone 38, Funks G91, Ohio C47, Pax Utah Hybrid, Pioneer X9805, Family Farmer, Keystone 38A. All these hybrids mature in average seasons when planted by May 15 and harvested by the middle of September.

Since no corn breeding is done in the state, we must rely on seed from other areas. Sometimes seed of a hybrid that produces well in Utah may not be available; consequently, more than one hybrid is recommended. Also, climatic conditions in the state vary to the extent that growing seasons range from 50 to more than 180 days, so no one hybrid will do equally well in every area. At present some western seed companies are producing seed of adapted hybrids.

TESTING PROGRAM

Through an extensive testing program hybrids have been tested and selected for the principal corn growing areas of Utah. For more than 15 years from 10 to more than 40 hybrids have been tested at Logan each year from which 7 to 10 of the better ones are tested throughout the state. In 1953 more than 40 hybrids were included in the program, and yields of both silage and grain determined. Data were also taken on height, dates of tasseling and silking, stage of maturity, and ratio of ears to stalks. All hybrids were ranked on long-time yields, both on a green and dry basis. Adapted hybrids show remarkable correlation for green and dry yields.

DR. WOODWARD is agronomist with the Field Crops Research Branch, Agricultural Research Service, U. S. Department of Agriculture, and works cooperatively with the Utah Station in cereal breeding. MR. NIELSON is assistant professor of agronomy at USAC. Bulletin 367 "Hybrid corn trials in Utah" is just off the press. A copy will be sent free on request.
ADAPTED HYBRIDS, EARLY PLANTING, CLOSE SPACING, NITROGEN FERTILIZER, AND FREQUENT LIGHT IRRIGATIONS BEST PRACTICES

R. W. WOODWARD and R. F. NIELSON

Early Maturing Hybrids
Early maturing hybrids have failed to compete with the hybrids recommended above except in limited areas with short growing season. Three of these are Minhybrid 301, KS-6, and Utahybrid 330.

Hybrids For Grain Production
While corn is grown for grain only to a limited extent in the state, in the tests in 1953, 42 hybrids yielded from 64 to 140 bushels of shelled corn an acre. Highest grain yielding hybrids were Utahybrid 680, Keystone K48, Portwalco 90, Utahybrid 544, Funks G77A, Kings-croft K3A, Keystone 44, Pioneer X9805, Family Farmer, and Pax Utah Hybrid.

HYBRID CORN FOR UTAH
Corn hybrid recommended for the principal valleys of Utah:
Portwalco 90
Ohio C38
Utahybrid 544
Others showing promise:
Keystone 38
Funks G91
Ohio C47
Pax Utah Hybrid
All these hybrids mature in average seasons where seeding takes place by May 15, and harvest is completed by September 21.

The pictures on these two pages illustrate some of the steps in determining superior hybrids for recommendation to Utah farmers: (lower left) The authors examine ears of silage corn to determine stage of maturity, (left center) picking ears for green weight measurement, (right center) chopping samples for dry weight determinations, (lower right) general view of corn silage harvest at experimental nursery, (upper right) range of maturity of corn ears at harvest time showing variations from early milk stage on the left to hard dough stage on the right.
Turkey producers who are looking for ways to reduce costs, ways to utilize their brooder coops and equipment during a greater part of the year, ways to increase their farm income, and to improve their general economic conditions may well follow the example of turkey growers in Sanpete County who produced turkey fryers during 1953. This enterprise was profitable for the average fryer producer in 1953. Net return averaged about $0.20 per bird after all costs had been deducted from total receipts. The return per hour of labor above all other costs was more than $2.00.

The turkey fryer enterprise consists of the production of turkeys, usually of the Beltsville White variety, for marketing at about 14 to 16 weeks of age. The term turkey fryer, as used by the trade, may be misleading since the birds, which weigh about 6 pounds eviscerated, can be roasted if that is preferred by the consumer.

Industry leaders in Sanpete County, interested in the enterprise requested that an economic study be made of the industry by the Experiment Station. As part of the study a personal interview was conducted with 14 turkey fryer producers in that area who had completed enterprises up to October 1, 1953. Thirteen of the enterprises produced Beltsville White turkeys and one produced Nebraskan variety. The enterprise which produced Nebraskan fryers was not included in this report.

The study was conducted to ascertain the inputs and outputs of the enterprise and to determine 1953 costs and receipts.

All items of cost were charged to the enterprise at market value in calculating total costs. This was done even though the item was produced on the farm. Total receipts were calculated by adding to the value of the birds sold or used at home, the fertilizer value of the droppings.

Costs of Production

On the basis of these calculations total receipts from the production of Beltsville White turkey fryers averaged $245.37 per 100 birds raised, of which 99 percent was from the sale or home use of the birds and one percent was fertilizer credits (table 1).

Feed was the most important item of cost. An average of 28 pounds of feed was fed per fryer at a cost of $1.35 or 60.8 percent of total cost. Approximately 90 percent of the feed was in the form of a prepared mash; the balance being scratch grains and other feeds. It took 4.7 pounds of feed to produce one pound of eviscerated turkey fryer.

Poult cost was the next most important cost item. Beltsville White poult cost $0.45 each. The poult cost per poult raised was $.48.

The average labor requirement was 17.7 hours per 100 birds raised. This included all labor to prepare for brooding, care for the poult in the brooder coop and on range until loaded on the truck for delivery to the processing plant, and to clean the buildings and equipment in preparation for the next lot of turkeys. An average hourly wage of $.94 was charged against the enterprise. Labor costs accounted for 7 percent of total costs.

Overhead costs included such items as depreciation and repairs on buildings and equipment, interest on operating and fixed capital, taxes, fees, insurance, and miscellaneous overhead costs. As a group they accounted for about 7 percent of total costs. Depreciation and repairs of buildings and equipment were the largest items of overhead costs. These together with interest charges accounted for about 90 percent of overhead costs.

The main material costs were incurred in brooding the birds. Fuel cost was about $.02 per bird raised.

A charge for trucking, which included trucking feed, turkeys to the range, equipment, and all other uses of the truck, except hauling the birds to the processing plant, was made. This cost amounted to about $.03 per bird raised.

Net return was calculated by subtracting total costs from total receipts. An average net return of $.25 per bird resulted from turkey fryer production for
Table 1. Receipts, costs and net return for thirteen turkey fryer enterprises
Beltsville White turkeys, Sanpete County, Utah, 1953

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>Per 100 birds raised</th>
<th>Percent of total</th>
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<tr>
<td></td>
<td></td>
<td>Amount</td>
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<td></td>
<td>dollars</td>
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<td>Sale &amp; home use of birds</td>
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<td>.4047</td>
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<td>Fertilizer credits</td>
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<td><strong>TOTAL</strong></td>
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<td>Costs:</td>
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<td>Feed:</td>
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<tr>
<td>Mash</td>
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<tr>
<td>Scratch</td>
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<tr>
<td>Other</td>
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<td><strong>TOTAL</strong></td>
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<tr>
<td>Poult cost:</td>
<td>poult</td>
<td>100</td>
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<td>Labor cost:</td>
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<td>Overhead:</td>
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<td>Blds. &amp; equip., depr. &amp; rep.</td>
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<tr>
<td>Int. on op. cap.</td>
<td>dollars</td>
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<td>.05</td>
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<td>Litter</td>
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<td>Med. &amp; veterinary</td>
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<td><strong>TOTAL</strong></td>
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<tr>
<td>Truck costs:</td>
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<td><strong>TOTAL</strong></td>
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<tr>
<td>Net return</td>
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</table>

The thirteen enterprises showed variation in nearly all aspects. For example, there was variation in the facilities used, in the kinds and amounts of feed fed, and in the rate of growth. Probably most important from the producers' point of view was the variation in the profitability of the enterprises. Net return per hour of labor above all costs except labor was $2.10.

Some Enterprises More Profitable

(Continued on page 24)
Good feed yards and sheds save hay when wintering cattle

Panquitch Farm

STUDIES TO IMPROVE FARM PRACTICES IN AREAS OF HIGH ALTITUDE

REX F. NIELSON

The Experimental farm of the Utah Agricultural Experiment Station at Panguitch is becoming a center for research and demonstration of farming practices for areas of high elevation and short growing season. Since such areas are predominantly dependent on livestock as a source of income, the research there is centered around an improved type of livestock and an increased feed program.

History of the Farm

The Panguitch Farm was established as a field station of the Utah Agricultural Experiment Station in 1911. Prior to that time it was operated by the federal government as an Indian School. In 1920 a manager was placed on the farm and experimental work was initiated. This work was carried on until 1932 when it became necessary to close the farm as a result of lack of funds during the depression. The farm was leased to private operators until the spring of 1952 at which time it was reactivated as an experimental farm. A limited amount of research work was conducted from 1949 to 1952.

At the time the farm was reactivated a research program was developed that would provide information on problems vital to the agriculture of the area and to similar areas throughout the state. The Experiment Station has been assisted by the Extension Service, Soil Conservation Service, and local people in the program being carried out on the farm.

Cattle Breeding Research

A herd of registered Hereford cattle was transferred from Logan to Panguitch in June 1952, forming the nucleus of the beef breeding research project. Various phases of cattle improvement through breeding are being investigated. The benefits derived from this research work are currently being made available to farmers of the area in that a limited number of bulls from the herd are available for purchase at Panguitch annually. These animals will aid materially in improving local grade herds.

Phosphate Fertilizer Needed

It has been clearly demonstrated on small experiments and on large field tests that the application of phosphate fertilizer at the rate of 85 pounds of $P_2O_5$ per acre can increase the yield of alfalfa hay as much as 100 percent in the Panguitch valley. At the present time Velvon barley is one of the highest yielding varieties tested.

Variety Trials

Variety trials on cereals have been made and are being continued in search of varieties well adapted to the area.

The growing season at Panguitch is short, averaging about 74 frost free days; however, it is not unusual for it to freeze every month of the year.

A number of research projects involving various phases of agronomic work are in progress at the present time. These projects are designed to take into consideration the short growing season. Information from some of these studies is already being used to obtain higher yields of alfalfa.

Variety Trials

Variety trials on cereals have been made and are being continued in search of the highest yielding varieties tested.
A number of legumes for hay and pasture have been tested. The majority of the cold-resistant standard alfalfa varieties in addition to new ones are being tested on the farm to determine their adaptation. Results from a one year trial indicate that Ranger and Ladak produced the highest yields. The new varieties Nomad and Sevelra, which have received wide publicity, were found to be unadapted to the area. Combination plantings of various grasses and alfalfa were made in 1953 to determine those giving the highest yields. It will require several years before sufficient data can be collected from which to make definite recommendations. Several miscellaneous legumes appear to be extremely promising. Tests conducted this past year indicate that vetch or field peas in combination with oats produces high yields of good quality forage. Such a combination can be used to advantage as an emergency hay crop when alfalfa stands have been lost from winter killing.

Sweet clover did exceptionally well in 1952 and 1953. Spanish was the highest yielding variety in both years, but it produced rather coarse stems. Grundy County, Alpha, and Madrid varieties produced high yields of fine leafy vegetation. Alaskan and Wisconsin Mildew Resistant were the outstanding red clover varieties. All others tried winter killed badly. Wisconsin Mildew Resistant showed some winter injury, but Alaskan came through undamaged.

Alsike clover strains 24296 and 24302 were far superior in forage yield to any other strains tried.

In cooperation with the canning industry, a test plot of canning peas was planted. The results are encouraging as both yield and quality were high. Canning industry officials were optimistic and additional test plantings will be made.

**Better Farming Practices**

In addition to the research work carried out on the farm, some of the better farming practices are being demonstrated to point out improved methods. A practical up-to-date wintering shed and feed yards for cattle have been built on the farm. Such structures can serve as models for similar structures that are needed by the beef industry of the area. The cost of feeding properly housed animals has been found to be considerably less than it is when animals are left to winter without shelter. In an area such as Panguitch where winters are long and cold and feed supplies limited, good shelters are essential.

**Land Leveling**

A land leveling program has been in progress on the farm for the last two
years. Where the control of water is vital, it becomes necessary that land be leveled before proper irrigation methods can be effectively used. One field of 30 acres was leveled in the fall of 1952. It required the labor of 2 men for 6 days to irrigate 20 acres of this field the first time prior to leveling. After leveling and when proper irrigation structures had been installed, one man was able to irrigate the same field in 2 days and do a more effective job.

The Sevier River divides the farm in two and severe bank erosion has been in progress along the channel for many years. This erosion had reached a point where it endangered some of the farm land. The erosion has been greatly reduced by using old shade trees anchored as rip-rap along the channel. These measures are somewhat temporary, but will do the job until willows and other vegetation can be planted and become established, providing a permanent type of control. There is need for a considerable amount of this type of river bank stabilization at numerous places on the Sevier.

Drainage
A high water table on the west part of the farm has been largely corrected by installing a tile drain. Although the drain has been in use only one year, it has already dried up marshy areas in several of the fields and lowered the water table around the farm home making the previously water-filled basement now usable.

These practices of making use of information at hand have shown remarkable results in improved production. Alfalfa hay yields are in excess of 3.2 tons per acre. These yields are made possible by eliminating spring grazing, proper fertilization, and cutting two crops instead of one. The average yield of alfalfa hay in the Panguitch Valley is 2.2 tons per acre. Barley yields on 20 acres of land that had been leveled were 63 bushels per acre. This is surprising in view of the fact that some local farmers were of the opinion that the land would not produce enough grain to replace the seed. By using barnyard manure and commercial fertilizers plus controlled irrigation, newly leveled land can be made to produce a satisfactory crop the first year.

The interests of the farmers can be best served by making use of information made available from experiments and demonstrations now in progress. Visitors are welcome at the farm at all times.

Pastures MOST VALUABLE FEED CROP FOR IRRIGATED LAND

GEORGE Q. BATEMAN, MILO L. DEW, and GEORGE E. STODDARD

Pasture is the most valuable feed crop that can be grown on fertile irrigated land. This statement has been verified by a seven-year study at the Dairy Experimental Farm at North Logan. Over the seven-year period the pasture averaged 7,967 pounds of milk an acre. In 1953 it produced 9,007 pounds an acre. In order to get an equivalent production of milk an acre from alfalfa hay, corn silage, or barley, it would be necessary to have a yield of 6.9 tons of alfalfa hay, 18.7 tons of cured corn silage, or 186 bushels of barley.

During the pasture season of 1953, slightly more than 20 acres of pasture were grazed by a herd averaging 36 head of purebred Holstein cows. Pastures were grazed continuously from April 27 to September 27 with the exception of two periods totaling 13 days when it was necessary to put the cows in another pasture until the grass had grown sufficiently for grazing.

Rotation Grazing
The 20 acres were subdivided into 10 strips of approximately 2 acres each. The cows were allotted just enough forage for a 24-hour period by subdividing each 2-acre strip. The herd was given an allotment of new forage each day of the pasture season.

Milk And Butterfat Production
A record was kept of milk and butterfat production and of supplementary feeds fed. The total production for the 20-acre field and the average production per acre are given in table 1.

Total production per acre was 10,352 pounds of milk containing 382 pounds of butterfat. Supplementary feed amounted to 1,236 pounds of grain and 166 pounds of alfalfa hay. By subtracting the 1,347 pounds of milk and 50 pounds of butterfat calculated to have been produced from the supplementary feeds, the data indicate that milk produced from pasture alone amounted to 9,007 pounds containing 332 pounds of butterfat.

Total value of butterfat produced with butterfat selling at 90 cents a pound amounts to $298.80. Subtracting the cost of supplementary feeds at $20 per ton for alfalfa hay and $3.50 per hundred for grain, or a total of $43.26, leaves a gross value of pastures of $255.54.

Pastures Can Be Maintained Over Long Periods
The 20-acre pasture used in this study was seeded at three different dates. One pasture of 5.92 acres was 7 years old, one of 5.67 acres was being grazed for the third year, and the remaining 8.43 acres was in its second year of production. All three of these pastures produced at relatively the same level. This demonstrates that pastures can be maintained at high levels of production over

| Table 1. Production from 20.02 acres of improved pasture, 1954 |
|---|---|---|
| Acres | Total 20.02 | Production per acre |
| Milk production (pounds) | 207,290 | 10,354 |
| Percent butterfat (percent) | 3.69 | 3.69 |
| Butterfat production (pounds) | 3,652 | 182 |
| Supplementary feeds fed | 24,742 | 1,236 |
| grain (lbs.) | | |
| alfalfa hay (lbs.) | 26,964 | 1,347 |
| Estimated production from supplementary feed | 995 | 50 |
| milk (lbs.) | 180,326 | 9,007 |
| butterfat (lbs.) | 6,657 | 332 |
| Production from pasture | 207,290 | 10,354 |
| butterfat (lbs.) | | |
Table 2. Milk production per acre from pasture

<table>
<thead>
<tr>
<th>Year</th>
<th>Pounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>1947</td>
<td>6899</td>
</tr>
<tr>
<td>1948</td>
<td>7270</td>
</tr>
<tr>
<td>1949</td>
<td>7127</td>
</tr>
<tr>
<td>1950</td>
<td>8195</td>
</tr>
<tr>
<td>1951</td>
<td>8314</td>
</tr>
<tr>
<td>1952</td>
<td>8960</td>
</tr>
<tr>
<td>1953</td>
<td>9007</td>
</tr>
<tr>
<td>Avg.</td>
<td>7967</td>
</tr>
</tbody>
</table>

long periods. Milk production per acre per year over the 7-year period is given in table 2.

**Pasture Mixtures**

The most productive pastures are made up of a combination of high yielding grasses and legumes. The pastures on the experimental farm are planted with orchard grass (3), smooth brome (4), tall oatgrass (4), Ladino clover (2), wilt-resistant Ranger alfalfa (3), and red clover (3). While mixtures containing high percentages of legumes yield the highest, legumes should not make up more than 50 to 60 percent of the forage or there is danger of bloat.

**Management Practices**

The experimental pastures were manured every other year with approximately 10 spreader loads of manure and an application of 200 pounds of treble superphosphate.

Irrigations were frequent enough so that the ground did not become excessively dry. They were at about 14-day intervals.

The pastures were strip grazed in rotation. Following the second or third grazing, the pastures were clipped to control weeds and unpalatable forage. Fields were then raked to remove clippings. The pastures were harrowed in late fall after grazing and again in the early spring to distribute droppings.

Pastures were grazed from four to five times during each season.

High production from pasture is achieved by adopting good cultural methods and livestock management.

High economic milk production from managed pastures is only part of the long time return that is reflected in increased yields of crops when planted on pasture land that has been plowed and put into the rotation.
Can Farmers Make Money Growing Contract Crops

E. M. MORRISON and L. H. DAVIS

How much will it cost to grow an acre of peas or corn or tomatoes in 1954, and how much profit can a farmer expect to make on an acre of any of these crops? Can he make more money growing peas than corn? These are questions a farmer would like to know the answers to. Such information can help him decide what he should grow.

While no one can give the exact answers to these questions since so many factors are involved, costs and returns studies made by the Department of Agricultural Economics of the Utah Station can give the farmer some idea what he may expect to receive from growing some of the crops grown under contract in Utah.

Costs and returns in the production of the important agricultural enterprises on Utah farms have been under study for a number of years. In each case investigations have been initiated by a detailed study of forms to reflect the average conditions of the enterprise. Each succeeding year sufficient additional field and other data are collected to reflect the changes in prices, costs, and method of production to determine the current costs and returns for that year.

The information reported here for sugar beets, peas, tomatoes, and sweet corn for canning is based on enterprise studies. For each commodity reported, the figures are based on a stated constant yield and should be so interpreted. This method of reporting will not show the exact returns for a particular year if the yield per acre is greatly different from the constant yield figure used. The figures thus reported have the advantage of measuring trends in the contract price (Continued on page 22)

Table 1. Costs and returns per acre from the production of sugar beets, 1945 to 1953 with cost prospects for 1954

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total receipts‡</td>
<td>$188</td>
<td>$203</td>
<td>$211</td>
<td>$199</td>
<td>$199</td>
<td>$214</td>
<td>$224</td>
<td>$228</td>
<td>$228</td>
<td>$228</td>
</tr>
<tr>
<td>Costs of production</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Material</td>
<td>$14</td>
<td>$15</td>
<td>$16</td>
<td>$16</td>
<td>$21</td>
<td>$21</td>
<td>$22</td>
<td>$22</td>
<td>$22</td>
<td>$22</td>
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<tr>
<td>Overhead</td>
<td>$26</td>
<td>$27</td>
<td>$29</td>
<td>$32</td>
<td>$31</td>
<td>$32</td>
<td>$33</td>
<td>$33</td>
<td>$33</td>
<td>$33</td>
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<tr>
<td>Labor</td>
<td>$73</td>
<td>$90</td>
<td>$95</td>
<td>$101</td>
<td>$100</td>
<td>$86</td>
<td>$69</td>
<td>$70</td>
<td>$68</td>
<td>$68</td>
</tr>
<tr>
<td>Power</td>
<td>$21</td>
<td>$24</td>
<td>$28</td>
<td>$27</td>
<td>$44</td>
<td>$51</td>
<td>$54</td>
<td>$60</td>
<td>$60</td>
<td>$60</td>
</tr>
<tr>
<td>TOTAL</td>
<td>$134</td>
<td>$156</td>
<td>$167</td>
<td>$177</td>
<td>$174</td>
<td>$178</td>
<td>$174</td>
<td>$184</td>
<td>$182</td>
<td>$182</td>
</tr>
</tbody>
</table>

* Preliminary † Estimated ‡ Includes value of tops.

E. M. MORRISON is associate professor of agricultural economics and specialist in farm management. MR. DAVIS is a research assistant in the same department.
Estimates of the rates of removal of potash and its addition to the soil indicate that some soils in Utah may become deficient in this plant nutrient. However, at the present time there is little if any need for potash fertilizer on Utah soils. Most of our soils are naturally high in available potassium and plants grown on these soils also have a high content of potassium. These are the major conclusions of a two-year study on the potash fertilizer needs in Utah.

During the past several years there have been a number of claims of increased crop yield or improved crop quality as a result of potash application. However, these claims have not been supported by experimental data. Several farmers have said their crops were better after having used potash but they did not leave part of the field unfertilized with potash for comparison. Thus the improvement noted could well have been caused by some other factor other than the applied potash.

Soils Sampled Throughout the State

The first objective of the two-year study mentioned above was to determine the potash status of soils over the whole state. To do this it was necessary to choose a crop that is quite universally grown in Utah and yet one that has a high requirement for potash. Alfalfa was chosen as the crop that meets these requirements best. Samples of alfalfa and of the soil immediately under the alfalfa were collected in all irrigated areas of the state. In every case the soil samples represented 0-6 inches depth and the alfalfa the portion that is ordinarily harvested as hay. As far as possible the samples were collected just before the alfalfa was mowed.

Available potassium was measured on all soil samples and total potassium content in all alfalfa samples. Areas where potash was low were located using these data.

Yields of Alfalfa

The second objective was to see if yield increases or improved growth of alfalfa could be obtained on any of these "low" areas by applying potash fertilizer. Field plot experiments using different rates of potash were set out on four of the lowest testing soils. An adequate and uniform application of phosphate was made on each of the experimental areas to make sure that lack of phosphorus would not restrict crop growth. This was necessary because the available phosphorus was low on these four sites.

Alfalfa yield increase as a result of applied potash was obtained on only one of these four plot experiments (table 1). The increase, while significant, is still not of economic importance because the amount obtained over the unfertilized...
Irrigation water. In many areas of the

1.09
1.14
1.03
2.10
1.00
1.14
0.90
2.00
0.96
1.22
1.02
2.17
1.02
2.22
1.4
* N.S.
* N.S.
* N.S.

state we would not need to add potash even if the soil were deficient because ample supplies are carried in the irrigation water. For example, the Bear River at Cutler Dam carries so much potash that during one season three acre-feet of water, which is a reasonable amount to apply to alfalfa, would add 130 pounds of K₂O. This is equivalent to 260 pounds of muriate of potash fertilizer containing 50 percent K₂O. In similar terms, the Jordan River, at Lehi, would add 490 pounds per acre; the Provo, at canyon mouth, 100 pounds; the Sevier, at Yuba Dam, 360 pounds.

In view of the high content of available potassium found in most Utah soils and the appreciable amounts carried in the major irrigation streams, it is obvious that if any need for potash exists in Utah it must be in small, localized areas. The measurement of available potassium in the soil is a reliable index to the potash fertility and should be used where there is any question about the need for potash. The critical level for potassium in alfalfa has also been determined and found to be about 1 percent for hay cut at quarter bloom.

Some of the irrigation waters are more pure and therefore do not carry such large amounts of potassium. The Logan River, for example, would add 20 pounds of K₂O per acre with a three-foot water application. This would be equivalent to about 40 pounds of muriate of potash fertilizer. A number of the mountain streams would add similar amounts if used near the mouths of the canyons. All of these streams however, become richer in potash as they flow through the valleys.

In general, soils that are sandy or that are high in organic matter, such as muck and peat soils, are more apt to need potash than others. Also, soils that are formed under moderate or high rainfall and are leached free from soluble salts are usually lower in potassium than others. These facts were considered while making the survey study and all areas likely to be low in potassium were sampled quite intensively. Also, areas where potash reportedly had improved yields were sampled intensively. A total of 219 alfalfa fields and 36 orchards were sampled.

For a number of years the fertilizer trials that have been conducted by the Experiment Station throughout the state have included potash as one of the fertilizer treatments. Data in table 2 summarize the results of 12 out of 68 such fertilizer trials and show that no benefit has been obtained from the potash.

The reasons for presenting data from only these twelve are that potassium content of the alfalfa was available on these and not on the others and crops other than alfalfa were used in a number of the remaining 56 experiments.

In 1953, samples of leaves were collected from apricot and peach trees along with samples of soil from under these trees. Only one of these samples fell in a range that could be low, while many of the leaf samples contained extremely high amounts of potassium. A sample of apricot leaves from the Perry bench south of Brigham City contained 4.2 percent potassium.

Incidentally, the analyses of the soil samples from some of these orchards indicate that excessive amounts of phosphate are being used on many of our orchards.

Irrigation Water High in Potassium

Another factor that must not be overlooked in studying the potash available to a crop is the amount carried in the irrigation water. In many areas of the

<table>
<thead>
<tr>
<th>Location</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check</td>
<td>0.94</td>
<td>1.09</td>
<td>1.03</td>
<td>2.10</td>
</tr>
<tr>
<td>100 lbs. K₂O/acre</td>
<td>1.00</td>
<td>1.14</td>
<td>0.90</td>
<td>2.00</td>
</tr>
<tr>
<td>200 lbs. K₂O/acre</td>
<td>0.96</td>
<td>1.22</td>
<td>1.02</td>
<td>2.17</td>
</tr>
<tr>
<td>300 lbs. K₂O/acre</td>
<td>1.02</td>
<td>1.30</td>
<td>1.02</td>
<td>2.22</td>
</tr>
<tr>
<td>L. S. D. 5 percent</td>
<td>N.S.</td>
<td>0.14</td>
<td>N.S.</td>
<td>N.S.</td>
</tr>
</tbody>
</table>

Table 2. The yield per cutting and potassium content of alfalfa as influenced by commercial fertilizer. Average for 12 locations 3 replications.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Yield tons/acre</th>
<th>Percent K in hay</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. fertilizer</td>
<td>1.35</td>
<td>2.25</td>
</tr>
<tr>
<td>Phosphate</td>
<td>1.59</td>
<td>2.17</td>
</tr>
<tr>
<td>Nitrogen + phosphate</td>
<td>1.70</td>
<td>2.27</td>
</tr>
<tr>
<td>Nitrogen + phosphate + potassium</td>
<td>1.64</td>
<td>2.30</td>
</tr>
</tbody>
</table>

### HERBICIDES FOR CONTROL OF MULE EAR

*(Continued from page 3)*

Spray treatments were made with a hand compression sprayer operated at 30 pounds of pressure. Nozzles that delivered a fan-shape spray were used. Dust applications were made with a small hand duster. For large areas, treatment by airplane would be most economical.

Herbicides Used

Most of the herbicides used were forms of 2,4-D. In addition, the isopropyl ester of 2,4,5-T was also used. Results showed that ethyl and butyl esters and the emulsifiable form of 2,4-D gave the best control and are all about equally effective. Next in effectiveness was the isopropyl ester of 2,4-D, followed by the 2,4,5-T and the low volatile ester of 2,4-D. The amine and sodium salts were about equal and the least effective in the eradication of mule ear.

Rates Of Application

In the tests, rates of application varied from 1/2 to 5.3 pounds of 2,4-D per acre. The higher rates were more effective in the eradication of mule ear. In no case was enough chemical applied to give complete eradication in either one or several applications, although some of the treatments reduced the mule ear to only an occasional plant in a plot. Two pounds per acre seems to be the minimum dosage that can be used to obtain a satisfactory kill.

Stage Of Growth

Applications were made at various stages of growth. Mule ear was found more susceptible to herbicides prior to bloom, and it became more resistant at bloom and after.

16

Farm and Home Science
Amounts Of Water

Different amounts of water were used in applying the herbicides, but no significant difference was found among the amounts used which were 10, 80, and 160 gallons per acre.

Spray Versus Dust

Spraying was definitely more effective than dusting. Leaves of mule ear have a smooth surface, and it may be that the dust was blown off the plants before it had a chance to get into solution and be absorbed.

From results of these tests repeat treatments cannot be recommended. The second application on the average was only about half as effective as the first. Four pounds of sodium salt applied in one year were more effective than two pounds applied in each of two years.

Range Rehabilitation

When mule ear plants are killed by selective sprays, other perennial plants not harmed by the treatment respond rapidly. Many desirable forage plants more than doubled the space they once occupied on the plots before mule-ear eradication. Bunch wheatgrass and sheep fescue grass made the greatest increase; however, Kentucky bluegrass and Sandberg also made substantial increases.

Untreated plots infested with mule ear produced only 280 pounds of palatable forage an acre, whereas, on plots where 70 percent or more of the mule ear plants had been eradicated, the production was increased to 1,353 pounds an acre in only 5 years after treatment, or an increase of 383 percent.

Density estimates on the Glenn range on 135 plots variously treated to reduce mule-ear plants show that total foliage cover may vary only slightly, but species composition may change materially. Bunch wheatgrass, Kentucky bluegrass, and needle-and-thread grass increased in direct proportion to the extent of mule-ear eradication. Untreated plots produced only 180 pounds of air-dry forage per acre, whereas, on plots where 13 percent of the mule ear had been eradicated, 430 pounds were produced, and on plots where 50 percent and 86 percent had been eradicated, 610 and 880 pounds, respectively, were produced. Even with slight reductions of mule ear, the carrying capacity of the range was about doubled, and when the mule ear was reduced 50 percent, the carrying capacity of the range was more than trebled.

Even partial reductions in mule ear stands produces increased production of grass and other desirable forage. In the foreground only about 60 percent of the mule ear has been killed by herbicides, however grass has increased more than three times its production before treatment. Partial control results from application of the herbicide at the bloom stage of growth, too light an application, or use of the salt forms of 2,4-D

for March 1954
Spray Tests, 1953

Two hundred fifty-six trees were included in the 1953 spray tests with the following arrangement:

- Total trees in the tests: 256
- Number of treatments: 8
- Trees per plot: 8
- Replicates: 4

Results Obtained With Delayed-Dormant Treatments

With treatments 1, 2, and 3, all insect and mite infestations were well-controlled up to June 15, when the calyx spray was applied, that no miticide was added except the malathion in treatment 2, because no infestations were observed in plots that were to receive the other treatments. On the unsprayed check plot, prior to application of the calyx spray, the following pests were observed:

1. Brown (clover) mite: a moderate, but threatening infestation;
2. Fruit-tree leafroller: a few;
3. Green fruitworm: a trace;
4. Green apple aphid: a few; a moderate infestation of each of the following:
   5. Rosy apple aphid;
   6. Woolly apple aphid;
   7. Leaf-blister mite.

Cover Spray Treatments

For the control of codling moth larvae (apple worms), fruit-tree leafroller, and

C. J. SORENSON, emeritus professor of entomology, has worked with the control of insect pests on tree fruit for many years. DR. R. M. BULLOCK was former head of the Department of Horticulture.
green fruitworm, 75 percent wettable DDT at 1 1/3 pounds per 100 gallons of water was used in one-half of the treatments, and methoxychlor (marlate) 50 percent wettable at 2 pounds, was used in the other half. The miticide added to either DDT or methoxychlor in each of the eight treatments specified below was the one being tested for the control of mites and aphids. The combination sprays used are specified in table 1. All sprays were applied with a 300-gallon power sprayer at a pressure of from 500 to 600 pounds. Cover sprays were applied July 11, July 31, and August 25. Specified amounts of insecticides and miticides are per 100 gallons of water. A liquid spreader-sticker (du Pont) was used according to recommendations by the manufacturer.

Bait Trap Captures

Codling moths were first captured in bait traps on June 10, 1953, during the bloom stage of apple trees. Moth capture was comparatively light, and quite spasmodic during the season. Peak numbers of moths captured occurred on or between the following dates:

June 10, July 4 to 8, July 26 to 29, August 11 to 22. No moths were captured after August 28.

Results Obtained With Cover Sprays

A. Codling moth (apple worm) control at harvest time:

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Mites</th>
<th>Aphids</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>75-W, 1 1/3 lbs.</td>
<td>trace to heavy</td>
<td>light</td>
</tr>
<tr>
<td>50-W, 2 lbs.</td>
<td>light to heavy</td>
<td>moderate</td>
</tr>
</tbody>
</table>

B. Fruit-tree leafroller and green fruitworm control:

Damage by each of these two pests was prevented, except a mere trace.

C. Mite and aphid control: Results are given in table 1.

Table 1. Results obtained with each of eight different miticides tested for the control of mites and aphids in USAC apple orchard, 1953

(Amounts of materials specified under treatments are per 100 gallons of mixed spray)

<table>
<thead>
<tr>
<th>Treatments and dates of application: June 15, July 11, July 31, and August 25</th>
<th>Intensity of infestations</th>
<th>At harvest time</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Just before application of cover sprays</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mites</td>
<td>Aphids</td>
</tr>
<tr>
<td></td>
<td>Brown &amp; 2-spot</td>
<td>Woolly</td>
</tr>
<tr>
<td>1. Chlorobenzilate, 1 1/2 lbs. (dichlorobenzilicacid ethyl ester) 25-W Unsprayed check tree</td>
<td>trace to moderate</td>
<td>0 to a few spots</td>
</tr>
<tr>
<td>2. Malathion 25-W, 2 lbs. (A phosphate) Unsprayed check tree</td>
<td>trace to moderate</td>
<td>0 to a few spots</td>
</tr>
<tr>
<td>3. Metacid 50% emuls., 1 pt. (A phosphate) Unsprayed check tree</td>
<td>trace to moderate</td>
<td>0 to a few spots</td>
</tr>
<tr>
<td>4. Ovotran, 2 lbs. (A sulfonate) Unsprayed check tree</td>
<td>trace to moderate &amp; general</td>
<td>0 to a few spots</td>
</tr>
<tr>
<td>5. Dimite 25% emuls., 1 1/2 pts. (A carbinol) Unsprayed check tree</td>
<td>trace to moderate &amp; general</td>
<td>0 to a few spots</td>
</tr>
<tr>
<td>6. Asamite 15-W, 2 lbs. (A sulfite) Unsprayed check tree</td>
<td>trace to heavy</td>
<td>0 to light</td>
</tr>
<tr>
<td>7. Sulphon, 2 lbs. (A sulphone) Unsprayed check tree</td>
<td>trace to heavy</td>
<td>0 to light</td>
</tr>
<tr>
<td>8. NP-602, 4 lbs. Unsprayed check tree</td>
<td>trace to heavy</td>
<td>0 to light</td>
</tr>
</tbody>
</table>

for March 1954
IRRIGATION OF SUGAR BEETS

(Continued from page 2)

equal to the number of months since planting. For instance, any irrigation within a month after planting should not wet more than the top foot of soil.

Two general criteria can be used to determine the need for irrigation. The first and probably the most frequently used is the wilting of the plant. In the early part of the summer, when the weather is milder, wilting of the leaves in the mid-afternoon is not a sufficient criterion for soil moisture need. However, later in the season when temperatures are higher, wilting becomes a rather useful tool to determine irrigation needs. Under no conditions should the soil be allowed to become dry enough to cause the plant to wilt at other than the hottest portion of the day. The other method of determining the need of irrigation is from an examination of the soil moisture. Soil Conservation Service technicians can readily supply interested farmers with the so-called "feet chart", which interprets the appearance and pliability of the soil in terms of soil moisture.

Land Preparation and Cultivation

Related to Irrigation

One of the first essentials for good irrigation is adequate land preparation. If sugar beets are to be irrigated by surface methods, it is essential that the land be well prepared. The furrows must be deep enough to keep the water away from the beet and close enough together to allow the water to reach the roots.

Two frequent excuses for excessive tillage are to save water by reducing evaporation from the surface, and to allow air to get into the soil. Neither reason is applicable to sugar beets. The principle advantages of cultivation are to increase the intake rate of the soil on the heavier soils, to control weeds, and to eliminate the tendency for crusting. It is true that some evaporation is prevented by creating a mulch on the surface, but rather careful studies have indicated that the amount of water lost from damp soil exposed by cultivation is usually in excess of that which is prevented by the formation of the mulch.

Three rather serious detrimental results of tillage should be kept in mind. First, each time that the field is cultivated the top soil is loosened up and made susceptible to erosion. This becomes serious when the slope of the ground is two percent or greater. Farmers growing sugar beets on steeper ground can easily observe the increased erosion after a cultivation. Another serious disadvantage of cultivation, and one which is not as easy to evaluate, is the damage to the roots beneath the furrow. Extensive and careful tests have shown that the sugar beet has a heavy root system immediately under the furrow. Deep chiseling or cultivation in the furrow and near the beet is definitely harmful to this rooting system. The third item of serious consequence with over-tillage is the change in the soil structure which results from working and packing the soil. In fact the packing which occurs under the tires of a tractor may reduce the infiltration of that particular furrow much more than the infiltration is increased by breaking the surface crust.

Fall plowing has two distinct advantages and is usually desirable for sugar beet culture. The first advantage is that snow and rain during the winter season will penetrate the soil much more readily on a fall-plowed field than on a field which has not been plowed. Another advantage is that fall plowing makes it possible to prepare the field for planting earlier in the spring.

Care should be taken to avoid a hardpan unless the soil is extremely permeable or unless there is considerable upward pressure from beneath, which tends to bring water near the surface and deposit alkali. Since these are rather restricted cases, it can be said with almost universal generality that the formation of a hardpan should be avoided. Varying the depth of plowing often aids in the elimination of a hardpan. In some areas of the West farmers have adopted the practice of chiseling slightly deeper than the usual plowing depth. Such a practice aids considerably in breaking up any existing hardpan. It also leaves the more fertile, richer soil on the top. It is not advisable to turn up new soil every year. It has been found that the best results can usually be obtained by leaving the top soil on top of the ground.

If You Grow Sugar Beets

Irrigation for germination as well as early irrigation following emergence when necessary can be followed with excellent results, if the soil has been prepared adequately, if the water is distributed uniformly, and if an excessive amount of water is not applied.

Early irrigation does not produce a stubby beet. When yellow leaves result from early irrigation, it is generally the result of insufficient nitrogen fertilizer and an excessive application of water which leached the available nitrogen below the feeding depth of the roots.

High yields are the result of adequate water and fertility throughout the season. The plant must not suffer for water or nutrients if maximum yields are to be obtained.

Irrigation after August 15 causes new top growth if beets have previously become dry. If beets have had adequate water, new growth does not start. If new growth occurs, both yield and sugar content are reduced.

Cultivation produces only slight benefit in the form of reduced evaporation, increased water intake, and increased aeration; on the other hand, too frequent cultivation disturbs feeder roots and increases erosion hazards. Weed control is the primary benefit of cultivation.

Fall plowing allows better penetration and storage of winter precipitation and allows earlier planting. Hardpans should be avoided by varying depth of plowing or by chiseling.

If You Grow Sugar Beets

IRRIGATION FOR GERMINATION

(Continued from page 3)
Dodder is an annual plant coming from seed every year. Thus, if it can be prevented from producing seed, alfalfa seed can be kept clean and dodder eventually can be eradicated. In past years several hand methods of cutting and bagging or cutting and burning infested alfalfa have been employed to control dodder patches. These methods require much hand labor and are now too expensive to be economically feasible.

Findings of Exploratory Experiments from 1950 to 1952

After an extensive search of literature revealed that practically no research work had been reported on dodder control, exploratory work was started in Utah in 1950. It was found in experiments conducted in 1950 and 1951 that spraying the dodder patches with one of the aromatic weed oils or a dinitro-fortified furnace oil-water emulsion was just as effective and much cheaper than the old hand methods, because it required only one-fifth as much time. In making these spray treatments, the aromatic weed oil or oil-water emulsion was sprayed over the alfalfa and dodder in the patch so that all vegetation was thoroughly covered. The dinitro-fortified oil-water emulsion used was mixed at the rate of 50 gallons of furnace oil, 1 gallon of an oil emulsifier, 70 gallons of water, and 1 quart of general dinitro. This treatment killed alfalfa growth to the ground in treated patches but the alfalfa crowns and roots were uninjured and produced normal regrowth.

It is important that the treatments be made as soon as dodder patches can be found and before the dodder begins to form seeds as these may mature even after a treatment applied when green seed is forming. It is then desirable to patrol the field at frequent intervals later in the season, to locate and treat new dodder patches and those that were missed by earlier treatments. Where the dodder infestation is heavy, this method will no longer be economically feasible and other means of control must be used.

Other experiments conducted from 1950 to 1952 compared many different stubble treatments in which the alfalfa stubble was sprayed with aromatic weed oil, dinitro-fortified oil-water emulsions, and various combinations of these materials after the first crop hay was removed. Several of these treatments reduced the number of dodder patches and the amount of mature dodder seed 50 to 65 percent and increased the alfalfa seed yield somewhat, but none was sufficiently effective and economical to be recommended for general use when the cost was considered.

Some experiments were conducted in which certain chemicals such as CMU, 2,4-D, sodium PCP, TCA, and amine dinitro were applied as pre-emergence treatments at rates which normally would be high enough to control most annual weeds. However, none of these materials was effective in controlling dodder and most of them were quite injurious to the alfalfa.

Results of 1953 Pre-emergence Experiments

During the winter of 1952-53 greenhouse tests showed that the two new chemicals, SES (sodium salt of 2,4-dichlorophenoxy ethyl sulfate) and CIPC had noticeable effect upon the germination of dodder seeds. These chemicals acted on the dodder seed in different ways. The SES tended to inhibit the germination of the seed while the CIPC increased germination but caused an abnormal growth of the seedlings which developed.

A normal dodder seedling forms a long, slender, silky thread-like shoot often reaching a length of from 3 to 5 inches. This shoot rotates until it comes into contact with a favorable host-plant. It twines around the host plant and sends out suckers or haustoria. Once attached to the host plant it draws all of its food material from this plant. If no host plant is available the dodder shoot has the ability to lie on the soil for from one to several weeks, depending upon the soil moisture, humidity, and other factors, and remains capable of attaching itself to any host plant which contacts it.

Where the soil was treated with CIPC it was found that the dodder shoots that developed never attained a length of more than .5 to 1 inch and were much thickened. These abnormal growth habits prevented the dodder shoot from coming in close contact with a host plant and thus prevented it from attaching to the alfalfa.

Using this greenhouse study as a basis, an experiment was started in March 1953, comparing these two chemicals. SES was tested at 5, 7, and 9 pounds per acre and CIPC at 3, 6, and 9 pounds per acre. Two dates of application were used. The first series of treatments was applied April 1, when the alfalfa was just starting to grow. The second series was applied May 6, after the early growth of alfalfa had been clipped and removed from the plots so that the chemical could be applied directly to the soil.

Table 1. Control of dodder in alfalfa seed fields by the use of pre-emergence herbicides, Greenville Farm, North Logan, Utah, 1953

<table>
<thead>
<tr>
<th>Treatment data</th>
<th>Result data — Averages of 6 replications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Chemical &amp; rate of application in 80 gal. of water per acre</strong></td>
<td><strong>Number of dodder patches in each plot</strong></td>
</tr>
<tr>
<td><strong>Treatment</strong></td>
<td><strong>6-8</strong></td>
</tr>
<tr>
<td>A. Treatments made April 1, 1953. Alfalfa was just beginning to grow on this date.</td>
<td></td>
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<tr>
<td>1 CIPC, 3 lbs.</td>
<td>0</td>
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<tr>
<td>2 CIPC, 6 lbs.</td>
<td>0</td>
</tr>
<tr>
<td>3 CIPC, 9 lbs.</td>
<td>0</td>
</tr>
<tr>
<td>4 SES, 5 lbs.</td>
<td>5</td>
</tr>
<tr>
<td>5 SES, 7 lbs.</td>
<td>4</td>
</tr>
<tr>
<td>6 SES, 9 lbs.</td>
<td>3</td>
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<tr>
<td>7 Untreated</td>
<td>3</td>
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<tr>
<td>B. Treatments made May 6, 1953. Alfalfa clipped and removed from plots so that chemical could be applied directly to the soil.</td>
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<tr>
<td>8 CIPC, 3 lbs.</td>
<td>0</td>
</tr>
<tr>
<td>9 CIPC, 6 lbs.</td>
<td>0</td>
</tr>
<tr>
<td>10 CIPC, 9 lbs.</td>
<td>0</td>
</tr>
<tr>
<td>11 SES, 5 lbs.</td>
<td>7</td>
</tr>
<tr>
<td>12 SES, 7 lbs.</td>
<td>6</td>
</tr>
<tr>
<td>13 SES, 9 lbs.</td>
<td>6</td>
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<tr>
<td>14 Untreated</td>
<td>8</td>
</tr>
</tbody>
</table>

*Where the number of dodder patches exceeded 10 per plot it became impossible to differentiate between individual patches. Thus 10 patches per plot constituted a complete infestation.
they developed so late in the season that no seed was formed. Alfalfa seed yield averaged 347 pounds per acre on these CIPC plots, as compared to 200 pounds per acre on the untreated check. Unlike the greenhouse tests, SES failed to be effective under field conditions and alfalfa seed yield averaged only 220 pounds per acre as compared to 200 pounds on the untreated check. Small-seeded dodder yields with the SES treatment averaged 766 pounds per acre as compared to 371 pounds per acre on the untreated check. Under these conditions it would seem that SES benefited the dodder rather than inhibited it.

On the series of plots treated May 6, CIPC again gave outstanding results. However, a few patches of small-seeded dodder did develop as the season advanced, and some dodder seed was formed. Yield data show the average alfalfa seed yield to be 365 pounds per acre as compared to 153 pounds on the untreated check. Small dodder seed yields averaged 36 pounds per acre on the CIPC plots as compared to 1051 pounds per acre on the untreated check. As in the early series SES was ineffective with an average alfalfa seed yield of 138 pounds per acre and a small dodder seed yield of 1092 pounds per acre.

It was noted that CIPC had a temporary burning and stunting effect on the alfalfa at both dates of application. However, later in the season there was no evidence of this effect. SES caused a slight curling and reduction in size of the alfalfa leaves and reduced the diameter but not the height of stems. These symptoms which were similar to 2,4-D injury were visible until the alfalfa reached the blossom stage.

A statistical analysis of these data showed that both the reduction in dodder and the increased alfalfa seed yield caused by CIPC were highly significant and that the results from different rates of CIPC were not significantly different. The 3-pound rate was just as effective as the 9-pound rate. At 3-pounds per acre the treatment would cost about $11.00. Since 3 pounds gave 100 percent control of dodder at the early date, future research will compare lower rates of CIPC to determine whether the cost of effective treatment can be reduced. Because the results with CIPC cover only one year's field trial, they must be substantiated with further field tests before definite recommendations can be made.

Results of 1953 Stubble Treatments

An extensive experiment conducted in 1953 compared 26 different treatments of aromatic oils, dinitro-fortified aromatic oil-water emulsions, dinitro-fortified furnace oil-water emulsions, dinitro-fortified aromatic oil-water emulsions followed by CIPC, and burning with a kerosene weed burner.

The most effective treatment in this experiment was burning with a weed burner. It gave 100 percent control of dodder but reduced alfalfa seed yield by about 27 percent. This reduction probably was the result of retarding the alfalfa causing immature seed at harvest time. The next best treatment was the straight aromatic weed oil at 80 to 120 gallons per acre. The treatments gave almost 80 percent dodder control but they showed a tendency to reduce the alfalfa seed yield somewhat. The remainder of the dinitro-fortified aromatic oil and furnace oil-water emulsion gave reductions in dodder infestations from 0 to 70 percent but results were not consistent for any particular chemical or rate of application.
Overhead costs include interest on capital at 5 percent, building and equipment upkeep and depreciation, taxes, water, and drainage.

Labor costs include value of the operator’s time, the operator’s family labor, and all hired labor.

Power costs include costs of using horses and operating tractors and trucks plus the cost of equipment used with tractors.

Sugar Beets
The costs of production for sugar beets have increased $50 per acre from 1945 to 1953 with $43 of the increase occurring between 1945 and 1948. Receipts have tended to increase but at a slower rate. The cost estimates for 1954 for those items which are used in sugar beet production indicate a $2 decrease in total costs. The low returns for 1948 and 1949 are the result of lower price per ton and an increase in costs of production.

The trends in labor and power costs reflect the increased adoption of mechanical methods of growing and harvesting sugar beets. The decrease in labor costs is the result of lower labor requirement, and the increase in power costs is the result of greater use of machines and of higher operating costs for power equipment. Labor requirements have been reduced ever further than the cost figure indicates since wage rates have been increasing during this period.

Canning Peas
The cost of producing canning peas increased each year from 1945 to 1951. Since 1951 a slight decrease in costs has occurred. Prospects are for still another slight decline in costs.

Canning Tomatoes
The cost per acre of producing canning tomatoes increased every year except 1953 when it remained the same as 1952. A slight increase in costs is indicated for 1954.

Canning Corn
Sweet corn for canning became an important enterprise in 1945. Since that time costs of production have increased rather consistently.

Of the three canning crops reported, the net returns for canning sweet corn have been consistently least favorable. Costs for 1954 will remain at about $140 per acre.

### Table 4. Cost and returns per acre from the production of canning sweet corn, 1945 to 1953 with cost prospects for 1954

<table>
<thead>
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<tbody>
<tr>
<td><strong>Total receipts</strong></td>
<td>$132</td>
<td>$131</td>
<td>$126</td>
<td>$136</td>
<td>$127</td>
<td>$110</td>
<td>$139</td>
<td>$139</td>
<td>$139</td>
<td>$139</td>
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<tr>
<td><strong>Costs of production</strong></td>
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<td><strong>Material</strong></td>
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<td><strong>Overhead</strong></td>
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<tr>
<td><strong>Labor</strong></td>
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<tr>
<td><strong>Power</strong></td>
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<tr>
<td><strong>TOTAL</strong></td>
<td>$94</td>
<td>$103</td>
<td>$117</td>
<td>$129</td>
<td>$124</td>
<td>$126</td>
<td>$132</td>
<td>$139</td>
<td>$140</td>
<td>$140</td>
</tr>
<tr>
<td><strong>Net return</strong></td>
<td>$38</td>
<td>$28</td>
<td>$9</td>
<td>$7</td>
<td>$3</td>
<td>$16</td>
<td>$7</td>
<td>$7</td>
<td>$1</td>
<td>$1</td>
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</table>

* Preliminary. † Estimated. ‡ Includes value of the stover for pasturing or ensilage.

### CORN HYBRIDS

(Continued from page 7)

**Cultural Practices**
Even the best hybrids may not yield well if proper cultural practices are not followed. Corn feeds heavily on nitrogen; as a result, most of the corn fields in Utah show varying degrees of nitrogen deficiency throughout the season. Closely associated with nitrogen nutrition is soil moisture. Experiments conducted at Logan have shown clearly that excessive irrigation tends to hasten and exaggerate nitrogen deficiencies. Insufficient water, however, will not enable the plants to make proper use of the nitrogen present. Closely associated with nitrogen and moisture is plant population. High plant populations need high levels of both moisture and nitrogen for high yields.

**Spacing**
Maximum yields can be obtained with an 8 to 10 inch spacing of corn plants in the rows, with rows 36 inches apart. This close spacing may result in reduced yields if sufficient soil moisture and fertility are not maintained. Each farmer must determine what spacing is best adapted to his conditions depending on water availability and the fertility level he can most economically maintain in his soil. However, corn needs frequent light irrigations as the roots do not penetrate deeply into the soil.

**Time Of Planting**
Time of planting is variable in Utah, but in general, earlier plantings are more successful than late plantings. It is more desirable to risk frost hazard in the spring than to delay planting with the possibility of the immature corn being frozen early in the fall. Early seeding at 10 to 14 pounds per acre is recommended.

Some of the higher valleys in Utah are not adapted to corn production regardless of the variety planted. This is largely because of late spring and summer frost; however, perhaps more important is the fact that mean daily temperatures are too low to mature corn successfully.

**Stage Of Maturity To Harvest**
The proper stage of maturity at which to harvest corn has long been a problem among farmers. Some prefer the corn to be green and succulent when cut regardless of the ripeness of the grain. Others want the grain to be mature no matter how dry the stalks become. Somewhere between the two is perhaps the most satisfactory stage. Data reported from work done at the Montana Station indicate that on the basis of total digestible nutrients produced, corn cut in the early milk stage makes equally as good silage as that cut in the late dough stage.

**TURKEY FRYERS**
(Continued from page 9)

bird raised varied from a minus $2.30 to a positive $2.54, with an average of $2.30 per bird. Based on a lot of 5,000 turkey fryers raised, the range from the least profitable enterprise to the most profitable would make a difference of $3,850 in farm income from the turkey fryer enterprise.

While it is not possible with a study of 13 enterprises to measure reliably relationships between factors such as percent mortality and profitability, it is logical to assume that death loss, feed conversion, labor efficiency, and size of enterprise are factors which are associated with profitability, and that it is more profitable to have good performance in
Step four:
Add the values calculated in the three previous steps.
- $0.18
- $0.02
- $0.06

$0.26 equals 90 percent of total costs.

Step five:
Divide $0.26 by 90 percent and multiply by 100 to find out what 100 percent of the costs are.

Example:
$0.26 \times 100 = \$0.29$

equals price per pound needed to meet costs.

Changes in prices of feed, labor, and poultry can be inserted into the three steps where appropriate, or when feed conversion, labor requirement, and percent death loss change. Adjustments can be made and an estimated cost of production calculated as of that particular time.

The Future
The future development of the turkey fryer industry in Utah depends upon its continuing profitability as a farm enterprise. Reports indicate that a big majority of the fryers produced in Utah are consumed in the eastern United States. Consumption of turkey fryers in the Intermountain Area can probably be stimulated to create new demand for a new Utah product.