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Do dairy cows convert pasture forage into milk more economically when grazing or when the pasture forage is cut and chopped by machine and fed in dry lot? This question has been discussed in a number of articles in farm journals with few experimental data to back up the answers. To obtain more definite information on this question, a three-year study was started the spring of 1957 on the Dairy Experimental Farm.

Results during the first year point out that although production of cows on pasture and of cows fed green-cut was approximately the same, man and machine labor requirements were much higher for the green-cut feed than for cows grazing pasture.

High Producing Pastures Used for Study

A high producing 5.67 acre pasture of known carrying capacity, seeded in 1950, was selected for the study. The milk produced per acre from this pasture had been measured from 1951 to 1955 by grazing it with dairy cows. In the summer of 1956, the pasture forage was cut and fed to dairy cows in dry lot. The milk (fat corrected milk, FCM) produced per acre from this pasture when grazed was 8212, 7802, 8514, 7801, and 8391 pounds for the years 1951 to 1955 inclusive. When the pasture was cut and fed in dry lot in 1956, the milk produced was 8206 pounds.

For the 1957 study (graze vs. green chop) the pasture was divided into six equal strips. Three strips were grazed in rotation 5 times with 20 head of milking Holstein and Jersey cows. The other three strips were cut four times with a field chopper and fed in dry lot to a similar group of 20 cows. Grain was fed to both groups of cows at the rate of 1 pound for each 10 pounds of milk produced.

The experiment was planned to graze and clip at the time that would give optimum forage production of high quality for each method of harvest. The three plots were grazed starting May 1, May 23, July 9, August 23, and October 1. The other three plots were clipped starting May 23, July 9, August 15, and October 1.

Results of the First Year's Tests

The comparative production data for grazing and green chop both on an acre and per cow basis, labor and machine requirements, also amount of bedding used to keep dry lot cows clean and manure removal data are included in table 1.

Note that the grazing group had been on pasture 22 days before green chop feeding was started. When cows are fed green chop, the winter feeding period must be extended beyond the date cows may be turned out to graze in order to allow time for sufficient growth of forage so that a large volume can be harvested efficiently from a small area. A green chop feeding period, if it is to be efficient, will always be shorter than the grazing period of the same pastures. In this study the pasture season was 159 days and the green chop period lasted 136 days.

There was no difference in milk production per acre or per cow under the two methods. Cows produced 8602 pounds of 4 percent FCM per acre and 29.0 pounds per
day from grazed pasture compared to a production of 8601 pounds and 28.9 pounds per acre and per day, respectively, when fed green chop in the dry lot.

A comparison of the yearly milk production per acre of this pasture from 1951 to 1956 with the 1957 production shows that both the grazed and clipped plots of the pasture produced more milk per acre than during any of the previous years studied. The prior six years production ranged from 7801 to 8514 pounds compared with 8600 pounds for the 1957 study. This 1957 production may not be significantly higher than in some of the other years, but it is notable that pasture can be made to produce at a high level over a long period.

Cows on pasture gained significantly more in body weight, .34 of a pound per day per cow compared to a gain of .10 a pound for cows fed green chop.

**Labor Requirements Greater**

Green chop feeding required 17 more man hours and 15 more machine hours per acre than pasture grazing or an increase of 145 and 172 percent over the man and machine requirements used by the animals when grazing.

During the green-chop feeding periods in dry lot it became necessary to bed a portion of the feed yard with straw as an aid in keeping the cows clean. The green chop feeding in dry lot created problems in sanitation, fly control, and manure removal that did not exist with the group of cows that were grazed on pasture. The cows fed green chop, even when bedded, became soiled and required more time to clean. If the flies are to be controlled, yards must be sprayed and the manure removed at intervals of not longer than 7 days.

The amount of pasture forage cut, chopped, and hauled for the green chop feeding period was 40,008 pounds or 20 tons per acre. The amount fed per cow daily was  (Continued on page 5)

**Table 1. Milk production per acre, weight changes and supplements fed, for grazed pasture vs. green-chop fed to dairy cows in dry lot**

<table>
<thead>
<tr>
<th>Comparative production data</th>
<th>Per acre*</th>
<th>Per cow daily</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Grazing</td>
<td>Green-chop</td>
</tr>
<tr>
<td>Number of harvests</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Length of feeding period (days)</td>
<td>159</td>
<td>136</td>
</tr>
<tr>
<td>Total cow days of feed</td>
<td>296</td>
<td>298</td>
</tr>
<tr>
<td>Supplements fed, grain (lbs.)</td>
<td>1312</td>
<td>1241</td>
</tr>
<tr>
<td>Gain in body weight (lbs.)</td>
<td>101</td>
<td>30</td>
</tr>
<tr>
<td>Total milk produced from pasture and supplements (4% FCM)</td>
<td>9974</td>
<td>9927</td>
</tr>
<tr>
<td>Milk produced from grain (lbs. 4% FCM)</td>
<td>1372</td>
<td>1326</td>
</tr>
<tr>
<td>Milk production from pasture forage (lbs. 4% FCM)</td>
<td>8602</td>
<td>8601</td>
</tr>
<tr>
<td>Total digestible nutrients furnished by pasture forage (lbs.)</td>
<td>5257</td>
<td>5110</td>
</tr>
<tr>
<td>Pasture forage fed as green-chop (lbs.)</td>
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<td></td>
</tr>
<tr>
<td>Man hours for moving cows for milking</td>
<td>7.4</td>
<td>3.0</td>
</tr>
<tr>
<td>Man hours for cutting, hauling, bedding, and manure removal</td>
<td>0.0</td>
<td>26.0</td>
</tr>
<tr>
<td>Man hours for clipping and raking grazed plots (3 times)</td>
<td>4.4</td>
<td>minutes</td>
</tr>
<tr>
<td>Total man hours</td>
<td>11.8</td>
<td>29.0</td>
</tr>
<tr>
<td>Field chopper (hours)</td>
<td></td>
<td>11.0</td>
</tr>
<tr>
<td>Tractor (hours)</td>
<td></td>
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<tr>
<td>Manure spreader (hours)</td>
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<td>2.0</td>
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<tr>
<td>Mower (hours)</td>
<td></td>
<td>2.2</td>
</tr>
<tr>
<td>Rake (hours)</td>
<td></td>
<td>2.2</td>
</tr>
<tr>
<td>Tractor mowing and raking (hours)</td>
<td>4.4</td>
<td>minutes</td>
</tr>
<tr>
<td>Total machine (hours)</td>
<td>8.8</td>
<td>24.0</td>
</tr>
</tbody>
</table>

**Comparative labor and machine requirements**

| Bedding used, straw (tons) | 1.04 | 0.37 |
| Manure moved from dry lot (tons) | 4.32 | 29.0 |

*Cows grazing pastures reached under the electric fence and grazed a small portion of the green chop plots causing a difference in acreage harvested under the two methods—2.63 acres grazed, 2.53 acres clipped.*

![Fig. 1. Production per acre from grazed pasture and green chop in dry lot](image-url)
New bean is high yielding, of good quality, and adapted to Utah growing conditions

The Utah Station releases

Wasatch Bush—a new green-seeded lima bean

Wasatch Bush, a new green-seeded lima bean developed at the Utah Station, has been released for planting this season. The variety has high yielding ability combined with good quality and uniformity of maturity. It is suitable for canning and freezing.

Wasatch Bush is a dwarf type which grows from 12 to 15 inches tall. Individual plants have a spread about the same as the

height. Wasatch Bush is shorter than Clark's Bush and has a much greater concentration of pods at the base of the plant (fig. 2). The pods as shown have a thin, papery wall and are easily shelled (fig. 3). There are from two to four beans per pod, but mostly three. The beans are plump and are not compressed within the pod. Wasatch Bush has a smaller percentage of beans in the larger sieve grades than Clark's Bush. A comparison of the sieve sizes of two varieties is given in table 1. The beans have a pale green skin and when processed the color is similar to Clark's Bush or Early Thorogreen. The variety matures from two to five days earlier than Clark's Bush.

The dry mature beans are not as large as Clark's Bush. By comparison there are approximately 1,300 seeds in a pound of Wasatch Bush and 1,200 in Clark's Bush.

In the three years trials, 1955, 1956, and 1957, of Wasatch Bush, Clark's Bush, and Early Thorogreen (table 2) grown at Farmington, Wasatch Bush out-yielded the other varieties each year. When all of the lines having a pedigree similar to Wasatch Bush were combined the yield again averaged considerably higher every year than that of other varieties. However, it was approximately the same as Wasatch Bush.

Lima beans in the test plots were grown in rows 18 inches apart, and each plot consisted of three rows twenty feet long. The center row was harvested for the yield test. In a seven acre field grown for commercial canning in Utah, it was reported that Wasatch Bush out-yielded all of the other varieties grown in that area.

A panel of 7 experts rated frozen and canned Wasatch Bush equal to Clark's Bush in flavor and color. The panel rated the texture of the new variety a little lower than Clark's Bush but superior to five other varieties tested.

Wasatch Bush came from a cross of Clark's Bush with the white cotyledon selection, Utah 16, developed from some breeding lines obtained from the United States
Department of Agriculture. Selections of this cross were back-crossed to Utah 16, and the more promising lines were tested in 1955. The selection which resulted in Wasatch Bush was increased sufficiently in 1956 to permit commercial trial as well as some increase plantings in 1957. The Utah 16 line has yielded well each year it has been tested, regardless of the weather conditions.

The Experiment Station has a small supply of seed of Wasatch Bush available for trial purposes. Seed can also be obtained from the following seed companies: Associated Seed Growers, Inc., New Haven, Connecticut; Ben Fish Seed Company, Santa Barbara, California; Charter Seed Company, Twin Falls, Idaho; and Ferry-Morse Seed Company, Mountain View, California.

PASTURE OR GREEN CHOP
(Continued from page 3)

134 pounds. At this rate of production per acre and consumption per cow for a green chop feeding period of 135 days, it would be necessary to cut, chop, and haul 182 tons of pasture forage from 9.11 acres to feed the 20 head of cows. Assuming that the cows grazing consumed the same amount of forage per day as the cows on green chop, the grazing group of 20 cows harvested 213 tons of pasture forage from 10.65 acres during a pasture period of 159 days, without the aid of any type of equipment. This ability of dairy cows to harvest large quantities of green forage directly from the stump, at a saving of high labor and machinery costs, cannot be ignored.

Production of Grazing Cows More Uniform

The milk production per acre by periods during the summer and the total for the two methods of harvest are shown in fig. 1. The length of the pasture and green chop harvest periods is also shown. Of the total milk produced during the season, 20 percent was produced at each of the first two grazings, 28 percent at the third, and 22 and 10 percent, respectively, at the fourth and fifth grazings. The green chop plots were harvested 4 times during the summer. Fifty-three percent of the milk was produced from the first cutting, 20 and 19 percent from the second and third cuttings, and 8 percent from the fourth harvest in October. The pastures grazed in rotation gave a more uniform and longer green feeding period than when the same pastures were harvested as green chop.
To Control Dodder

1. Plant only dodder-free alfalfa seed and avoid scattering dodder seed from field to field on combines or other equipment, in infested manure, hay, or irrigation water, or by grazing livestock.

2. Kill to the ground small scattered patches of dodder-infested alfalfa by burning with a propane burner, by spraying heavily with aromatic oil or dinitro-fortified fuel oil, or by cutting, removing, and burning.

3. Growers who wish to make certain of eradicating small widely scattered dodder patches should follow the burning, oil spraying, or cutting by treating the spots with a soil sterilant chemical mixture of borate, chloride, and monuron. Apply at the rate recommended on the package label. This should prevent all growth of alfalfa and weeds on the treated areas for two or more years. This will facilitate easy location and periodic inspection of these trouble spots and their borders in subsequent years for recurrence of dodder.

4. To control a general infestation of dodder in first-crop alfalfa, cultivate frequently and thoroughly with a harrow or a similar implement in early spring, or apply CIPC at 6 to 10 pounds per acre in granular form when the alfalfa is 6 to 8 inches tall and before dodder seeds germinate. CIPC treatment costs $17 to $25 per acre and its success depends largely upon weather and irrigation practice following treatment. Therefore, it is recommended for use only where the dodder infestation is sufficiently heavy and the probable value of the alfalfa seed crop is high enough to justify the risk of unsatisfactory control in 1 or 2 years out of 5.

5. For control of a general infestation of dodder in second-crop alfalfa, burn the alfalfa stubble immediately after removal of the first crop for hay, using a propane or oil type field burner operated at not more than 3 miles per hour. Custom burning usually costs $5 to $6.50 per acre.

Despite the development of improved methods of controlling dodder, keeping dodder off the land in the first place is much easier and less expensive. This may be accomplished by planting only dodder-free alfalfa seed (see figure 1) and by good management practices to prevent dodder from being introduced into clean fields on cultivating or harvesting equipment, in dodder-infested hay, manure, or irrigation water, or by livestock coming from dodder-infested fields. Rotation of alfalfa with nonsusceptible crops such as small grains, corn, and grasses helps to prevent or reduce dodder infestations.

Experiments with isophorpy N-(3-chlorophenyl) carbamate (CIPC) and other herbicides applied in early spring, compared with burning of first-crop alfalfa stubble, were conducted near Fielding, Utah, in 1954; near Sheridan and Lusk, Wyoming, in 1955 to 1957; and near Nyssa, Oregon in 1957. From these studies much more has been learned about the effectiveness of CIPC and other herbicides, about better methods and dates of applying these chemicals, and about the climatic factors that affect results.

Fig. 1. Upper, seed of large-seeded alfalfa dodder. Center, alfalfa seed. Lower, small-seeded alfalfa dodder, all magnified. The seed of large-seeded dodder are especially hard to clean from alfalfa seed because they are about the same size. Dodder seed have rough seed coats, whereas alfalfa seed have smooth ones.
For high alfalfa seed yields

CONTROL DODDER

The performance of CIPC in these experiments is summarized as follows:

1. Dry warm weather in early spring was less favorable to good results with CIPC than were moist to wet weather and moderate to cool temperatures.

2. Late spring rains or irrigations several weeks after CIPC treatments encouraged a new crop of dodder seedlings and resulted in poor control.

3. The granular form of CIPC applied when first-crop alfalfa was 6 to 12 inches tall, but before dodder seed had germinated, tended to give better results than the emulsifiable form of CIPC, applied just as alfalfa began new growth in early spring.

4. The most effective and economical rate of CIPC was 8 pounds per acre. Other rates tested were 4, 6, and 12 pounds per acre.

5. CIPC gave more effective control of small-seeded dodders, which normally germinate in early spring, than it did of large-seeded dodders, which may germinate in late spring or in summer.

Fig. 2. Dodder seedlings about to become attached to an alfalfa plant. Applications of CIPC should be made before dodder reaches this stage in the spring. A cultivation treatment should be started before dodder seedlings emerge.

Fig. 3. A small patch of dodder just getting started in alfalfa. This is the ideal stage for spot treatment. If many patches like this are present before time to cut first crop hay, growing first crop seed is not advisable. Second crop seed may be grown if first crop stubble and attached dodder are thoroughly burned immediately after removing first crop hay.

FOR MARCH 1958
CIPC seldom gave complete control of a heavy infestation of dodder even under the most favorable conditions. The control of small-seeded dodders at rates of 6 or 8 pounds per acre varied from 54 to 100 percent as compared with untreated areas. Large-seeded dodder was not controlled by any rate of CIPC in one experiment.

Even when CIPC gave only partial or temporary control of small-seeded dodders the yield of alfalfa seed usually was increased by the treatments compared with yields of untreated plots. The increases in yield of alfalfa seed ranged up to 243 pounds per acre. These increased yields were sufficient to justify the cost of CIPC treatment only when dodder infestation was heavy and conditions were otherwise favorable for alfalfa seed yields of 300 pounds or more per acre.

CIPC applied to alfalfa stubble immediately after removal of the first crop for hay generally was less effective than when applied in early spring.

Grower Experience With CIPC

A few alfalfa seed growers in Utah and Wyoming have tried CIPC on a field scale with variable results—some good and some disappointing. Growers in California and Oregon have used CIPC, particularly the granular form, somewhat more extensively and with mostly satisfactory results. Results in eastern Oregon with granular CIPC were so promising in 1956 that several growers treated about 500 acres of alfalfa for seed production in 1957 at 6 pounds per acre at a cost of approximately $17 per acre. However, weather conditions were different in 1957 and results were less satisfactory than in 1956.

Other Herbicides

In general, most of the other herbicides tested for control of dodder proved less effective than CIPC for first- or second-crop alfalfa seed or than burning for second-crop seed. One new chemical, 2-chloroallyl diethylthiocarbamate (CDEC), seemed equal to or superior to CIPC in greenhouse experiments; but it was less effective in most of the field experiments conducted in Wyoming in 1956 and 1957. However, granular CDEC applied when alfalfa was 6 to 8
Stubble Burning

Burning alfalfa stubble with a propane or an oil burner immediately after removing the first crop for hay has given consistently better control of dodder in second-crop alfalfa for seed than any of the chemicals tested. Burning at a moderate intensity has given 75 to 100 percent control of the dodder and usually has controlled 90 percent or more. Alfalfa-seed yields on burned plots were lower than on CIPC-treated plots in the 1954 experiments but were equal to those on the best CIPC-treated plots in the 1955 and 1956 experiments. Burning retarded the alfalfa regrowth as much as 7 to 10 days in some experiments and thus delayed the maturation of the seed crop. However, after the initial delay, regrowth on the burned plots usually was normal and produced a normal yield of seed unless caused by an early frost.

Control Of General Infestations

First-crop versus second-crop alfalfa for seed production. The decision on whether to leave the first or the second crop of the season for seed has an important bearing on the chance of successful alfalfa seed production in a field where the soil is heavily infested with dodder seed. Factors that usually affect this decision include the type of dodder present, the value of alfalfa hay, the time of emergence of wild bees, the length of the growing season, and the average yields of seed from first-crop and second-crop alfalfa under local conditions.

Small-seeded dodders tend to develop early in the season and to set seed before the time for harvesting first-crop alfalfa for seed. Thus, if the small-seeded type predominates it is generally advisable to produce alfalfa seed from the second crop rather than the first crop. Large-seeded dodders usually develop later in the season. Where they are the problem species, first-crop alfalfa can sometimes be harvested for seed before the dodder does severe damage or matures seed, particularly in cool, wet seasons when the dodder develops slowly.

An alfalfa field known to be heavily infested with dodder seed should be inspected for developing dodder plants about a week before the first-crop hay is ready for harvest. At this time dodder patches will be small and probably will not show above the alfalfa. Thus, it will be necessary to look at the bases of the alfalfa plants for dodder just starting rapid growth and for dodder seedlings not yet attached (see figures 2 and 3). If a considerable quantity of dodder is present, a severe dodder infestation will likely develop before the time for harvesting first-crop alfalfa for seed. Therefore, instead of trying to grow first-crop seed the farmer should cut the hay immediately and destroy the dodder already present by burning the stubble.

If few or no dodder plants are found, first-crop alfalfa seed probably can be produced fairly free from dodder. In such a situation the first-crop should be left for seed, because of the possibility or even likelihood that a heavy in-
Which method of irrigation

SPRINKLE OR FURROW?

JAY L. HADDOCK

An increasing number of publications on sprinkler irrigation, which discuss the relative merits of this type of irrigation vs. surface irrigation, have appeared during the past decade. Most of these have dealt with irrigation from the engineer's point of view—to determine the most feasible physical method of storing water in the soil reservoir.

However, there are other considerations that relate to yield and quality of crop and nutritional status of plants which may have a bearing on the choice of irrigation methods.

We are frequently asked the question: Which is the best method of irrigation, sprinkle or furrow? Those who expect a categorical answer to this question are unfamiliar with the principles involved in these two methods of irrigation. While methods of irrigation have not been studied adequately, we have made enough observations to say that a question as to the superiority of one method over another must be much more specific than the one asked above if a definite answer is to be given.

Farmers have frequently labored under the notion that irrigation was simply a process of storing water in the soil reservoir for the gradual use of crop plants. While the soil does act like a sponge, irrigation practice is something far more complicated than the physical storing of water. The fertile soil is in a real sense a living dynamic system exhibiting complex physical, chemical, and biological properties. Every small particle of soil contains many kinds of living organisms belonging to...
both the plant and animal kingdoms. The manner in which this body of soil is filled with water has an effect on its physical, chemical, and microbiological properties.

An experiment was conducted over a number of years contrasting the effect of sprinkle and furrow irrigation methods on yield and quality of sugar beets, peas, potatoes, barley, and alfalfa in rotation. Some of the results on yield and quality of crops are shown in the charts on page 12.

From these studies researchers found that method of irrigation significantly affected both yield and quality of crops. It may influence yield in one direction and quality in another. Consequently it is not easy to appraise the desirability of one method over the other. However, the following tentative conclusions may be justified.

1 Seed crops are adversely affected by sprinkle irrigation.

The reason for this is not clear. One of the most obvious assumptions is that sprinkle irrigation interferes with pollination or seed setting in some manner. If this could be definitely established, the time of irrigation could be scheduled to mitigate the harmful influence of overhead irrigation.

2 When the width of row or distance between furrows is greater than the depth of soil to be wetted by an irrigation the greater becomes the advantage of sprinkle over furrow irrigation.

The depth of plant rooting may determine the depth to which a soil is to be wetted during an irrigation. Shallow rooted plants such as peas need light frequent irrigations to moisten the soil. When such a soil should be given one acre inch of water per acre it is impractical to do this by the furrow method. Although one inch of water can be uniformly applied to such a crop by sprinkle methods, other considerations, such as the possible injury to seed setting, favor furrow methods.

3 The more frequent the application and the smaller the quantity of water needed for each irrigation, the greater the advantage for sprinkle over furrow irrigation.

The nature of some crops favors sprinkle over furrow irrigation. Sugar beets make most satisfactory growth if kept moist and growing vigorously during the early growth period when roots are shallow. Excess water during early growth carries growth-stimulating nitrate-nitrogen beyond the reach of shallow roots by deep percolation and puts young plants to great disadvantage. This frequently occurs under early furrow irrigation. The advantage of the moisture is sometimes more than offset by loss of nitrogen. Hence, many farmers prefer to allow beets to go dry during this early period. However, the loss of some nitrogen by early irrigation is less harmful than loss of growing time because of dry soil conditions.

The potato crop appears to favor a moist soil and high hilling during tuber setting as well as during the remainder of the season. Soils can be kept moist with a minimum of

4 Furrow irrigation is more favorable to the yield of some crops, but less favorable than sprinkle methods to quality. Likewise, sprinkle irrigation frequently favors the yield of some crops, but is less favorable than furrow methods to quality.

Shallow rooted crops do best under sprinkle irrigation. Sprinkle irrigation appears to stimulate yields of both sugar beets and potatoes. However, yield is not the only factor affected by this method of irrigation.

Sucrose content and purity of sugar beets are increased by furrow irrigation. Cooking quality of potatoes (mealliness) is improved

Sprinkle irrigation has advantages when light frequent irrigations are needed
under furrow irrigation. Yields of first and second cuttings of alfalfa hay are increased by sprinkle irrigation, but total yield is not increased. All seed producing crops have yielded better under furrow irrigation, but the nitrogen composition of barley is higher under sprinkle irrigation.

While some of the advantages and disadvantages of one method of irrigation over another are inherent in the method itself, others may be modified by timing the irrigation treatment to the physiological development of the plant.

If it were possible to determine precisely the nitrogen-producing potential of a soil it might be possible to balance the fertilization and irrigation regimes of a crop to realize full advantage of both quantity and quality. In the instance of a crop like sugar beets it appears that an accurate soil test would make irrigation adjustment a practical consideration. On the other hand, if an irrigation practice is set as a result of circumstances the fertilization program may be modified to take full advantage of the irrigation practice.

Sprinkle irrigation has an advantage in conservation of soil nitrogen or in saving of fertilizer nitrogen.

Yields of sugar beets are higher under sprinkle than furrow irrigation. The nitrogen content of roots and tops is also higher under sprinkle than furrow methods. If sugar beet tops are returned to the soil in both instances available data indicate that there may be a net loss of approximately 20 pounds of nitrogen per acre under furrow as contrasted to sprinkle methods.
Pioneering a new crop

The average farmer in Cache and Box Elder Counties who grew safflower on his diverted dry land acres in 1957 made going wages and his expenses, plus interest on his money invested in the enterprise. Two farmers out of the 25 whose safflower enterprises were analyzed made a profit of $16 an acre above all costs and one lost $10 an acre.

The difference was in yield. Yields varied from 133 to 1200 pounds of seed an acre. With seed selling at $70.00 a ton, a farmer needs to raise 525 pounds an acre to break even.

Safflower is a new dryland crop in Utah. The seed is used for oil. The crop was grown commercially for the first time in 1957. To determine just how successful this enterprise was, Experiment Station staff members interviewed 25 farmers in Cache and Box Elder Counties and summarized the costs, receipts, and net returns for their safflower enterprise. These enterprises ranged from 25 to 245 acres in size and averaged 80 acres. Yields averaged 516 pounds of seed.

Total costs of production averaged $18.05 an acre. These included seed, fertilizer, labor, use of machinery, and interest on the capital used (table 1). These costs were for one acre of safflower and one acre of fallow land.

Receipts consisted entirely of the net value of the cleaned seed, which, with an average production of 516 pounds an acre at $70.00 a ton, amounted to $18.13 leaving 8 cents per acre net return. In other words the average enterprise paid for the use of all capital, all labor, all cash costs, and left a small margin.

In 1957 the number of acres grown had little effect on the net return per acre. The two enterprises having the highest acre yields were the smallest and the largest enterprises. Labor was a small item and the amount used was not influenced by the size of the enterprise.

Yield was the important item associated with profitability. The third of the enterprises that were most profitable had an average (Continued on page 25)
Like everything else they buy

consumers pick up the check for trading stamps

E. W. LAMBORN and R. H. ANDERSON

Housewives in Utah pay 4 percent more for their groceries for the privilege of licking trading stamps. This conclusion is based on study of retail and wholesale food prices in Salt Lake City. Retail prices of foods in Salt Lake City increased 5 percent with the introduction of stamps while wholesale prices increased less than one percent. The rise in price came after the introduction of S & H green trading stamps in a major chain in November 1956, and leveled off in February 1957 before the introduction of Gold Strike stamps by competing stores. Stores introducing Gold Strike stamps could then say that they did not raise prices with the introduction of stamps. They had already raised their prices. Retail prices have continued at this level since that time.

Retail food prices of about 50 food items were obtained weekly from 8 supermarkets in Salt Lake City and compared with wholesale prices from a major wholesaler. Four competing chains were represented in the 8 retail markets studied. By March 1957, when most of the retail price increases had taken place, wholesale prices had increased only four-tenths of one percent. The retail price rise represented an increase in retail margin at least sufficient to cover the cost of handling the trading stamps.

Influence of Trading Stamps on Prices

The influence of trading stamps on retail prices may vary with the percentage of stores giving stamps in any community. Trading stamps are used as a promotional device to attract and hold customers. If a store is successful in accomplishing this objective it will not be under pressure to increase prices because its costs will not increase in proportion to its volume of sales. Stores losing sales are under pressure to increase prices as a means of maintaining their profit margins, but competitively this is impossible if the stores using stamps hold the line on prices. The long-time effect under this situation would be failure by those losing the greatest volume of business. The result would be fewer, larger, and more efficient stores remaining in the market.

If, on the other hand, the competing stores also introduced trading stamps that were equally acceptable to consumers, all stores would raise their prices to cover the additional cost of the stamps. This was what happened in Salt Lake City. Following the introduc-
Researchers found that housewives in Salt Lake City pay 4 percent more for groceries for the privilege of licking trading stamps.

Fig. 1. Index of retail grocery prices, eight Salt Lake City supermarkets, November 1956 to November 1957

It is unlikely that food stores are now benefited by their use. During the year some of the stores studied gained sales and some lost, but the level of sales after a year is not necessarily related to the kind of stamps or the time they were introduced. Stamps are now continued primarily as a defensive measure. Relative sales of retailers would probably be affected little if all food stores discontinued their use simultaneously.

For the stamps consumers receive from the purchase of $100 worth of food they can obtain at the redemption center about $2.50 worth of merchandise. This would seem to be an inefficient and round-about method of purchasing the items offered by stamp companies at their redemption stores.

Since consumers have little or no choice but to purchase food where trading stamps are given they should accept them and be careful to redeem them. Failure to get stamps with each purchase enhances the profit of the retailer and failure to redeem them increases the return to the stamp company. If dissatisfied with the lack of alternatives open to her, the consumer should often register her displeasure with the retailer. When the number of unsatisfied consumers is large enough some enterprising retailer will undoubtedly provide the alternative of no stamps and cheaper groceries.
Growers of peaches and cherries will harvest increased yields of fruit from the use of plant nutrients in the form of ammonium sulfate and barnyard manure applied to the orchard.

Nitrogen at the rate of 5 pounds

of ammonium sulfate or 500 pounds of barnyard manure per tree at the Howell Field Station increased the yield of Elberta peaches 93 percent. Yields of Lambert sweet cherries were increased 70 percent with use of ammonium sulfate and 36 percent with barnyard manure above yields of unfertilized trees.

A second increment of nitrogen gave a 30 percent increase in yield of peaches and 22 percent increase in the yield of sweet cherries over that of the first addition of nitrogen. A second increment of manure increased cherry yields 41 percent.

Tests have been in progress during the past 10 years at the Howell Field Station, Pleasant View, near Ogden, Utah, to determine the value of various fertilizers and fertilizer combinations on Elberta peaches and Lambert cherries.
Elberta Peaches

During the ten growing seasons since 1948, the trees have produced nine crops of peaches. In 1950, a late freeze killed most of the peach blossoms in the area. Five full crops were produced during this time and four were reduced, two by an infestation of climbing cutworm and two because of poor climatic conditions during winter or blossoming time.

Eight fertilizer treatments were involved, with yearly amounts as follows:

Fertilizer treatments on peaches

Unfertilized
5 pounds of ammonium sulfate per tree (N)
10 pounds of ammonium sulfate per tree (2N)
5 pounds ammonium sulfate plus 2 pounds treble superphosphate per tree (NP)
10 pounds ammonium sulfate plus 2 pounds treble superphosphate per tree (2NP)
5 pounds ammonium sulfate plus 2 pounds treble superphosphate plus 2 pounds 60 percent muriate of potash per tree (NPK)
500 pounds barnyard manure per tree (Man)
5 pounds ammonium sulfate plus 2 pounds treble superphosphate plus 500 pounds barnyard manure per tree (NPMan)

The amounts of N, P, K, and Man were originally set up on a basis of 1 pound, 1 pound, 1 pound, and 200 pounds but, after 5 years, the appearance of the trees showed that this amount was inadequate. Results of the peach fertilizer test are shown in fig. 1. Note that during the first two years, little difference could be seen. At the present time the fertilizer results fall into three groups. On the bottom are the unfertilized trees. In 1957 they produced at the rate of 220 bushels per acre.

Returns
220 bushels at $2.00 = $440.00
Costs
Baskets at 40 cents $ 88.00
Picking at 18 cents 40.00
Handling fee of 15 cents 33.00
Spray materials 10.00
Overhead (water, taxes, depreciation on trees, interest on investment) 94.00
Other labor 110.00
Power 40.00
Total $415.00

This leaves a net return of $25 or 11 cents a bushel.

The second group consists of trees fertilized with N, NP, NPK, and Man. These trees yielded an average of 425 bushels per acre worth $850 at $2.00 per bushel. The costs of production and handling total $580. This leaves a net of $261 or 61 cents a bushel.

The third group consists of trees fertilized with 2NP, 2N, and NP-Man. These trees averaged 550 bushels of peaches per acre which, at $2.00 per bushel, bring in $1100. The costs of production and handling were $707. This leaves a net of $393 or 72 cents a bushel.

It is evident that the largest increase in yield comes from the first increment of nitrogen. Its use makes a difference of 50 cents a bushel. The second increment which costs $25 more, gives an added yield such that an increase of 11 cents a bushel more can be realized.

Lambert Sweet Cherries

Lambert sweet cherries were planted 10 years ago and have produced seven crops. Four of these were full crops. The other three were reduced by temperature and pollination problems.

Six fertilizer treatments were involved with annual amounts as follows:

(Continued on page 23)
Deficiencies of "micro-nutrient" elements have been recognized in Utah orchards for many years. They are evident in almost every species of fruit and in every fruit-growing area.

Spot checks of many orchards for the past few years have indicated that these deficiencies are increasing. Orchards in some areas have gone out of production because of the severity of chlorosis, mostly iron deficiency, while in other areas manganese deficiency is increasing rapidly, especially in apricots. In 1957 more than 530,000 trees in some 900 Utah orchards were examined for visual deficiency symptoms in an attempt to map deficiency areas and fruit varieties most affected, and to find just how widespread these diseases are in the state.

Essential Nutrient Elements

Of the 15 chemical elements known to be essential for plant growth, carbon, hydrogen, and oxygen are supplied by air and water, and the remaining 12 are supplied by the soil. Six of these are used in rather large amounts and are called the "major" or "macro-nutrients." Of these, nitrogen, phosphorus, and potassium are well recognized as the "fertilizer elements" since they are supplied to the soil by man in large amounts. The lack of nitrogen in most soils is a definite factor in fruit production, and the characteristic light green foliage can be seen throughout the state. The remaining 3 elements of this group, calcium, magnesium, and sulfur, are present in ample quantities in Utah soils.

The other 6 elements supplied by the soil are needed by the plants in small amounts and are called "minor elements" or "micro-nutrients." These include iron, zinc, manganese, copper, molybdenum, and boron. The first three (iron, zinc, and manganese) are those deficient in some Utah soils, while levels of copper, molybdenum, and boron are apparently still sufficiently high in the soil for normal plant growth.

Symptoms of Micro-Nutrient Deficiency

Iron chlorosis: The characteristic symptom of iron chlorosis is the gradual appearance of light green to light yellow in the areas between the small veins of leaves. This yellowing increases as the disease becomes more serious, but even the small veins remain green until the most advanced stages of the disease. The symptoms progress from the tip of the stem toward the base. The youngest leaves are most seriously affected. In severe cases the leaves are much smaller than normal and the fruit reduced in size and of poor quality. The weakened trees are more susceptible to winter injury and insect damage.

Manganese chlorosis: The effects of manganese deficiency are first
Mineral Deficiency Diseases increase in Utah orchards

noted as a gradual fading of the green color along the outer margins of the entire leaf. This fading continues and moves toward the center until only the midrib and principal lateral veins are green. In leaves deficient in iron the small network of veins remains green while in those that are deficient in manganese the green is only in the center of the leaf along the principal veins. The fruit is delayed in maturity and is bitter in taste.

**Zinc chlorosis:** The lack of zinc produces a more pronounced effect on tree growth than either iron or manganese deficiency. The leaves are much smaller than normal and are mottled with chlorotic areas. Terminal buds fail to elongate with the result that a tuft of small leaves is produced forming a “rosette” at the ends of twigs. Considerable “dieback” may occur so that this rosette sits on the end of a bare branch.

The chlorotic pattern of zinc deficiency starts as isolated areas of a mottled type which may gradually coalesce until continuous bands of yellow extend from near the midrib to the outer edge of the leaf where they unite to form a continuous chlorotic leaf margin. Since the major veins remain green the pattern is similar to manganese deficiency. However zinc deficient leaves are usually much smaller and distorted in shape.

Zinc deficiency markedly affects the shape of peaches. Many varieties will produce flat, pointed, unmarketable fruit on zinc deficient trees. This may be the case even though only mild symptoms appear on the leaves.

**Distribution of Deficiencies and Fruit Crops Affected**

Results of the survey in 1957 were compared with those of 1948 (table 1). In Washington County more than 40 percent of the fruit trees showed iron deficiency symptoms (table 2). In Cache County 17.2 percent of the trees showed iron deficiency. Manganese deficiency was highest in Weber and Davis Counties where nearly all apricot trees showed deficiency (Continued on page 28)

### Table 1. Comparison of micro element deficiencies in Utah orchards, 1948 and 1957

<table>
<thead>
<tr>
<th>Survey</th>
<th>Iron deficient</th>
<th>Manganese deficient</th>
<th>Zinc deficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>1948-49*</td>
<td>85%</td>
<td>85%</td>
<td>85%</td>
</tr>
<tr>
<td>1957</td>
<td>62%</td>
<td>62%</td>
<td>62%</td>
</tr>
<tr>
<td>Individual trees</td>
<td>5.5</td>
<td>5.5</td>
<td>5.5</td>
</tr>
</tbody>
</table>


### Table 2. Micro element deficiencies of all fruit crops by counties on individual tree basis

<table>
<thead>
<tr>
<th>County</th>
<th>Iron deficient</th>
<th>Manganese deficient</th>
<th>Zinc deficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Box Elder</td>
<td>4.3</td>
<td>3.6</td>
<td>1.8</td>
</tr>
<tr>
<td>Cache</td>
<td>17.2</td>
<td>7.7</td>
<td>1.6</td>
</tr>
<tr>
<td>Davis</td>
<td>10.1</td>
<td>2.7</td>
<td>0.2</td>
</tr>
<tr>
<td>Salt Lake</td>
<td>10.8</td>
<td>1.9</td>
<td>0.3</td>
</tr>
<tr>
<td>Utah</td>
<td>40.2</td>
<td>1.1</td>
<td>0.2</td>
</tr>
<tr>
<td>Weber</td>
<td>7.1</td>
<td>9.2</td>
<td>0.2</td>
</tr>
</tbody>
</table>

**Micro-element deficiency symptoms occurring in Utah orchards**

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Leaves</th>
<th>Stems</th>
<th>Fruit</th>
</tr>
</thead>
</table>

FOR MARCH 1958
Majority of Utah young people do not eat... an adequate breakfast

Study of 1,294 school children showed that citrus fruit and milk were foods most often lacking in breakfasts of students

MARLENE STEGELMEIER
ETHELWYN B. WILCOX

Fig. 1. Distribution of breakfast rating for girls in different age groups

Breakfast, when the word is broken down, becomes “breakfast,” and is self-explanatory. For some 12 or 13 hours the body has been running on food consumed during dinner of the previous day. When breakfast is omitted, the period of fasting is extended to some 18 hours.

Physiologists have found that the human body cannot operate efficiently for this length of time without food. Recent studies show good evidence that people feel better and work better after a breakfast which furnishes a fourth to a third of the day’s total food intake.

A researcher in the midwest found that school boys who omitted breakfast became careless and inattentive during late morning school hours. The boys’ maximum work output was also decreased.

A good breakfast is good insurance against a poor diet for the day. This has been found true in many studies as a good breakfast had a direct relation to the score of the total day’s diet.

In 1954 Galloway and Wilcox found that the majority of groups of northern Utah teenager’s breakfasts were poor. Often the meal

MARLENE STEGELMEIER is home agent at Paris, Idaho, and DR. ETHELWYN B. WILCOX is professor of foods and nutrition. The findings reported here are taken from the M.S. thesis of Miss Stegelmeyer.
did not contain enough milk or citrus fruits.

To get a broader picture of what Utah children were eating for breakfast, 60 kindergarten and 22 first grade children in the Adams school in Logan; 72 girls in the Logan and North Cache high schools; and 341 students at Utah State University co-operated in a study conducted during the 1956-57 school year. Three-day breakfast records plus food eaten up to lunch time were kept by the subjects. These diets, along with 799 collected during previous studies of school children in the Ogden area, and Box Elder and Cache Counties were evaluated for the quality of the breakfast eaten. This made a total of 1,294 Utah school children in the study.

The various foods were given a rating (Table 1); and the diets were evaluated by that scale. A rating of “good” was given for a breakfast ranging from 5.6 to 8.0; “fair” for one from 3.6 to 5.5; and “poor” for one from 0 to 3.5. If breakfast was omitted, the score was indicated with zero.

The following was considered a basic breakfast, though it would differ in amount according to age group:

Fruit or juice, preferably
   citrus .................................. ½ cup
   Cereal .................................. ½ cup

or

Egg .................................. 1
Bread .................................. 1 or more slices
Butter .................................. 1 serving
Whole milk .................................. 1 cup

These foods were grouped as follows: (1) fruit or juice; (2) bread and cereal or eggs or meat; and (3) milk. If the breakfast lacked one of these food groups, it was classified as “fair.” If it lacked two, it was rated as “poor.”

Results of this study are shown in figures 1 and 2. The majority of boys and girls at all ages ate fairly good breakfasts. From 19 to 62 percent more boys than girls ate good breakfasts. The reverse was true, when the breakfasts rating poor, were considered. More girls than boys (30 to 68 percent) were eating poor breakfasts. Differences between boys and girls were greatest in the age groups older than 10 years.

Table 1. Food scores used in evaluating breakfasts

<table>
<thead>
<tr>
<th>Food</th>
<th>Amts.</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk</td>
<td>1 cup</td>
<td>2.0</td>
</tr>
<tr>
<td>Cocoa</td>
<td>1 cup</td>
<td>1.0</td>
</tr>
<tr>
<td>Egg</td>
<td>1</td>
<td>1.0</td>
</tr>
<tr>
<td>Meat</td>
<td>1 serving</td>
<td>1.0</td>
</tr>
<tr>
<td>Non citrus fruit</td>
<td>1 serving</td>
<td>1.0</td>
</tr>
<tr>
<td>Citrus fruit</td>
<td>1 serving</td>
<td>2.0</td>
</tr>
<tr>
<td>Bread</td>
<td>1 slice</td>
<td>0.5</td>
</tr>
<tr>
<td>Cereal</td>
<td>½ cup</td>
<td>1.0</td>
</tr>
<tr>
<td>Butter</td>
<td>1 tbsp.</td>
<td>0.5</td>
</tr>
<tr>
<td>Sugar</td>
<td>2 tbsp.</td>
<td>0.5</td>
</tr>
<tr>
<td>High energy foods*</td>
<td></td>
<td>0.5</td>
</tr>
</tbody>
</table>

*(measured by 100 cal. portions)

The majority of younger children (5-9 years of age) ate an adequate breakfast. Might this be true because of the parent’s influence? In general, there seemed to be a tendency toward a steady increase in the total percentage of boys and girls consuming poor breakfasts with advancing age up to 20 years.

In all age groups studied, citrus fruit was the most frequently missing food in the inadequate breakfasts. Next came milk, bread, cereal, and egg.

An adequate breakfast should contain a serving of fruit or juice, preferably citrus, milk, toast and cereal, toast and egg, or cereal and egg. The size serving of each food depends on the age of the child.

DODDER

(Continued on page 27)

DODDER

Fodder would develop in a second crop of alfalfa grown for seed.

First crop seed. Begin frequent shallow cultivations with a harrow or similar implement just as alfalfa is beginning new growth in early spring; or apply a granular formulation of CIPC at 6 to 10 pounds per acre broadcast by airplane or ground-rig applicator after the alfalfa has reached a height of 6 to 12 inches, but before dodder seeds germinate. A spray formulation of CIPC at 6 to 10 pounds per acre may be applied just as alfalfa begins new growth in early spring, but the delayed treatment with granular CIPC is believed to be more effective under most conditions. Sprinkle irrigation immediately after application usually will increase the effectiveness of either CIPC treatment. However, irrigation thereafter should be delayed until alfalfa has reached the bloom stage to avoid germination of additional dodder and reinforce the crop before it has passed the critical bloom and early seed-setting stages.

CIPC may be expected to give satisfactory control of dodder in years of cool, wet springs with no effective rainfall or irrigations in late spring or early summer. Control is likely to be disappointing in years with warm, dry springs when conditions are less favorable to good results with CIPC, or when irrigation or a late spring rain re-establishes the dodder infestation after CIPC treatment.

Second-crop seed. Where second-crop alfalfa is left for seed, burning or cultivating the alfalfa stubble

(Continued on page 27)
IT TAKES MORE POOR QUALITY WATER

Where irrigation waters contain appreciable amounts of salt larger quantities are required to do the job

J. P. THORNE and D. W. THORNE

It has been known for centuries that salty or brackish waters are harmful to growing plants. No doubt even ancient man was aware of the damage done to crop plants when they were inundated with sea water. The sterility of such bodies of water as the Dead Sea, the Salton Sea, and Great Salt Lake has been common knowledge for a long time. What isn't generally known, however, is the effect of moderately or slightly salty irrigation waters on the crops and soils where they are used for irrigation. In recent years there has been considerable research work done on this subject and as a result of this work we now know much more about how to get along with these poor quality irrigation waters with which we must live.

In terms of the range of salts found in natural waters, crop plants actually will tolerate little salt. Animals, even human beings, can exist on waters too salty for satisfactory irrigation use. Yet in many cases the farmer is faced with the decision—either irrigate with "salty" water or abandon the farm operation.

Salts in Irrigation Waters

A wide variety of salts occurs in natural waters. Some of the most common are sodium chloride (table salt), calcium sulfate (gypsum), magnesium sulfate (epsom salts), and calcium bicarbonate (dissolved lime). Scientists who study water compositions prefer not to think of definite salts in the water, but rather of the ionic (electrified particles) components of these salts. The major ions are: calcium, Ca++; magnesium, Mg++; sodium, Na++; potassium, K+; chloride, Cl–; sulfate, SO4=2; carbonate, CO3=2; and bicarbonate, HCO3=.

Each ion has its own specific characteristics and influence on the soil solution and crop plant. Some ions tend to be more toxic than others. For example, generally plants can tolerate more of the bivalent ions like Ca++, Mg++, and SO4=2 than they can of the monovalent ions like Na+ and Cl–. Carbonate, CO3=2, though a bivalent ion, is quite toxic because it is always associated with OH– ion which produces a caustic reaction even becoming corrosive to plant tissues at its higher concentrations. The positive ions especially affect the physical condition of the soil because they are adsorbed on the soil clay in about the same proportions as they exist in the irrigation water. Waters high in sodium, Na+, usually produce a poor physical condition of the soil which causes poor tilth, aeration, and

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permeability to water. The two factors then, total ions and kinds of ions, are taken into consideration in rating water qualities but for our purpose let us consider the effects of all these ions working together.

Effects of Salty Irrigation Water

Salts dissolved in irrigation water or in the soil solution make it more difficult for plants to get water. The surface of the root hair may be considered as a semi-permeable membrane. It will let water through into the root along with selected ions. The movement of water through this membrane is largely dependent upon the osmotic pressure within the root and that of the soil solution—the more salty the solution the higher the osmotic pressure. When the osmotic pressure of the soil solution becomes high, it becomes difficult for the plant to get water even though the soil itself contains plenty of moisture. To make it possible for the plant to absorb water, the salt concentration of the soil solution must be kept below a certain level. Salts applied in irrigation water become more concentrated in the soil. Studies have shown that this increase in concentration usually ranges from 2 to 10 times that of the original irrigation water. The way in which the irrigation water is used can and does influence the amount of this increase in salt concentration.

Field Observations

During the summer of 1957 studies were made of crops irrigated with well waters of different qualities or salt content. The figures show the reduction in size of potatoes grown with increasing salt content of the irrigation water. These potatoes were taken from two hills in each case. Their relative weights, along with the electrical conductivity, which is measured in units called micromhos, of the irrigation waters, and soil extracts are given in table 1.

Admittedly, these are not adequate measurements but they are illustrative. Irrigation water with a conductivity of 1180 had no appreciably detrimental effect on the growth and yield of potatoes. On the other hand, the much saltier water with a conductivity of 4300 produced a much smaller potato and lower yield. Potatoes have only intermediate salt tolerance and should not be grown where water of conductivity 4300 micromhos is the only source of supply.

Minimizing the Effects of Salty Irrigation Water

First of all, crops with a salt tolerance compatible with the irrigation water should be selected. Then salt concentrations in the soil should be kept at a minimum by proper use of the water. Actually this requires more water than would be needed if the water contained less salt. This excess amount of water is used to leach soluble salts left from previous irrigations from the soil and is known as the leaching requirement. Leaching requirements of as much as 50 percent are practical. Beyond this amount use of excessive water may not be practical. As an example, if potatoes were to be grown where 3 feet of good quality water was needed, 4 feet of a 3000 micromho conductivity water would be needed. The purpose of the extra one and one half feet of water is to leach soluble salts from the soil. Heavier applications and sometimes more frequent applications of water are needed to prevent salt concentrations in the soil from becoming too high. The drier soils get between irrigations the more concentrated the salts become in the soil solution. Therefore, frequent irrigations are needed in using salty waters.

Making Use of Soil and Water Analysis

Every farmer should know the composition of the irrigation water he uses because this is so important in determining how it can best be used. Qualities of water that have been used for a long time are known and appreciated by farmers who use them. Yet when a new source of water is to be used, or there is reason to suspect a change in the quality of the old source, it is imperative that an adequate analysis and quality rating be obtained. These analyses may be obtained from the Soil Testing Laboratory, Agricultural Experiment Station, Utah State University, Logan.

Modern methods of soil analysis provide a means of keeping track of soil salinity so the farmer can find how effective his leaching practices have been. To do this samples of soil representing the root zone must be taken and the salinity or amount of soluble salts determined on these samples. The salt tolerances of many crop plants are fairly well established at the present time. Making use of all available information can make living with poor quality irrigation water more profitable than it has been in the past.

Table 1. Relative weights of potatoes and the electrical conductivity of the irrigation water and soil extracts

<table>
<thead>
<tr>
<th>Conductivity</th>
<th>Conductivity</th>
<th>Relative yield of</th>
<th>Conductivity of water</th>
<th>Soil extract</th>
<th>potatoes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irrig. water</td>
<td>0-6”</td>
<td>6-18”</td>
<td>yield</td>
<td>Micromhos</td>
<td>pounds</td>
</tr>
<tr>
<td>micromhos</td>
<td>micromhos</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>1180</td>
<td>4290</td>
<td>2010</td>
<td>4.3</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>3800</td>
<td>3280</td>
<td>3080</td>
<td>3.2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>4300</td>
<td>16,400</td>
<td>12,300</td>
<td>0.9</td>
<td></td>
</tr>
</tbody>
</table>

FERTILIZERS

(Continued from page 17)

Fertilizer treatments on Lambert cherries

Unfertilized
5 pounds ammonium sulfate per tree (N)

10 pounds ammonium sulfate per tree (2N)

10 pounds ammonium sulfate plus 2 pounds triple superphosphate per tree (2NP)

500 pounds barnyard manure per tree (Man)

(Continued on page 25)
Labor costs vary from 15 to 40 percent of total costs. Larger herds have low labor costs per cow.

Labor cost can make the difference between profit and loss in dairy production. Labor costs vary from 15 to 40 percent of the total cost of producing a pound of butterfat. Assuming a level of production at 350 pounds of butterfat per cow with labor valued at $1.10 per hour, labor cost would vary from $.18 to $.54 per pound of butterfat produced. Labor cost can be minimized, however, and one of the best ways is to keep labor costs per cow at a low figure by increasing the size of herd. It does not take 25 times as many hours to care for 25 cows as it does to care for one cow. In average practice you can care for 2.4 cows in a 35 cow unit in the same time it takes to care for one cow in a 12 cow unit.

These facts came to light as the result of a study of 182 dairy units of varying size and method of operation in Cache and Sanpete Counties. The study covered the operations of herds producing grade A milk and those producing manufacturing milk. The main differences in labor requirements per cow resulted from the size of the herd rather than the method of handling milk.

Producers of grade A milk spent about 46 percent of the labor in

Fig. 1. Distribution of man labor by operation for producing manufacturing milk

Laboring cows with 12 cows or less averaged 147 hours of labor per cow. Herds with 35 or more cows averaged 62 hours of labor per cow. The average decrease in labor requirements per cow was 2.3 hours from the group with small herds to the group with large herds (table 1).

With small herds labor requirements for grade A production were about 14 percent higher than for manufacturing milk production. The difference between the two diminished as the size of herd increased and labor requirements were practically the same at 24 cows per herd.

The influence of man labor per cow on net return was noted by dividing the records of the herds studied into 8 groups starting with those under 60 hours of labor per cow and establishing a class interval of 15 hours (table 2). It was found that as the man hours per cow increase, average number of cows per herd decreased and, likewise, so did net return per cow.

Size of herd is important in reducing labor per cow to a minimum. It has three possible effects:

1. It divides the overhead type of labor such as preparing to milk and cleaning up after milking and an additional 19 percent in preparing and cleaning the milking equipment. These operations account for about two-thirds of the total time spent; they show practically no seasonal variation. The other operations—cleaning the barn, feeding, bedding, and miscellaneous duties—account for the remaining third of the labor required, and, of course, do vary somewhat according to season (figure 2).

The most significant influence on labor requirements per cow was size of herd. The 182 records included in this study were divided into two groups: (1) 134 producers of grade A milk, and (2) 48 producers of manufacturing milk. These were subdivided into groups by size of herd. Herds producing grade A milk with 12 cows or less averaged 147 hours of labor per cow. Herds with 35 or more cows averaged 62 hours of labor per cow. The average decrease in labor requirements per cow was 2.3 hours from the group with small herds to the group with large herds (table 1).

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The influence of man labor per cow on net return was noted by dividing the records of the herds studied into 8 groups starting with those under 60 hours of labor per cow and establishing a class interval of 15 hours (table 2). It was found that as the man hours per cow increase, average number of cows per herd decreased and, likewise, so did net return per cow.

Size of herd is important in reducing labor per cow to a minimum. It has three possible effects:

1. It divides the overhead type of labor such as preparing to milk and cleaning up after milking and an additional 19 percent in preparing and cleaning the milking equipment. These operations account for about two-thirds of the total time spent; they show practically no seasonal variation. The other operations—cleaning the barn, feeding, bedding, and miscellaneous duties—account for the remaining third of the labor required, and, of course, do vary somewhat according to season (figure 2).

The most significant influence on labor requirements per cow was size of herd. The 182 records included in this study were divided into two groups: (1) 134 producers of grade A milk, and (2) 48 producers of manufacturing milk. These were subdivided into groups by size of herd. Herds producing grade A milk with 12 cows or less averaged 147 hours of labor per cow. Herds with 35 or more cows averaged 62 hours of labor per cow. The average decrease in labor requirements per cow was 2.3 hours from the group with small herds to the group with large herds (table 1).

With small herds labor requirements for grade A production were about 14 percent higher than for manufacturing milk production. The difference between the two diminished as the size of herd increased and labor requirements were practically the same at 24 cows per herd.

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Size of herd is important in reducing labor per cow to a minimum. It has three possible effects:

1. It divides the overhead type of labor such as preparing to milk and cleaning up after taking care for one cow. In average practice you can care for 2.4 cows in a 35 cow unit in the same time it takes to care for one cow in a 12 cow unit.

These facts came to light as the result of a study of 182 dairy units of varying size and method of operation in Cache and Sanpete Counties. The study covered the operations of herds producing grade A milk and those producing manufacturing milk. The main differences in labor requirements per cow resulted from the size of the herd rather than the method of handling milk.

Producers of grade A milk spent about 46 percent of the labor in

* Winter—December, January, February. Others follow in 3-month intervals.
Table 2. Hours of man labor related to net return and other measures, Utah, 1956

<table>
<thead>
<tr>
<th>Interval</th>
<th>No. of farms</th>
<th>Avg. no. cows per farm</th>
<th>B.F. total labor cost per cow</th>
<th>Net return</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>hrs.</td>
<td>no.</td>
<td>lbs.</td>
<td>dol.</td>
</tr>
<tr>
<td>Under 40</td>
<td>51</td>
<td>23</td>
<td>36</td>
<td>329</td>
</tr>
<tr>
<td>40-74</td>
<td>69</td>
<td>26</td>
<td>28</td>
<td>332</td>
</tr>
<tr>
<td>75-89</td>
<td>81</td>
<td>25</td>
<td>22</td>
<td>334</td>
</tr>
<tr>
<td>90-104</td>
<td>96</td>
<td>32</td>
<td>20</td>
<td>336</td>
</tr>
<tr>
<td>105-119</td>
<td>110</td>
<td>23</td>
<td>18</td>
<td>357</td>
</tr>
<tr>
<td>120-134</td>
<td>127</td>
<td>21</td>
<td>15</td>
<td>366</td>
</tr>
<tr>
<td>135-149</td>
<td>143</td>
<td>12</td>
<td>14</td>
<td>350</td>
</tr>
<tr>
<td>150 &amp; over</td>
<td>170</td>
<td>20</td>
<td>11</td>
<td>338</td>
</tr>
<tr>
<td>All farms</td>
<td>89</td>
<td>182</td>
<td>21</td>
<td>339</td>
</tr>
</tbody>
</table>

The milking operation over larger numbers.

It makes it possible and worthwhile to adopt all the labor saving devices and methods.

It discourages the non-productive use of labor such as excessive grooming, pampering, and admiring of the animals.

FERTILIZERS
(Continued from page 23)

The amounts of N, P, and Man originally used were 1 pound, 1 pound, and 200 pounds but after five years the appearance of the trees showed this amount to be inadequate.

The results of the sweet cherry fertilizer tests are shown in fig. 2. Only small differences in yield were evident the first two years. At the present time, the yields may be placed into four groups.

The unfertilized trees produced the lowest yields. In 1957 they produced 112 pounds per tree or 2.4 tons on a 50 tree per acre basis. The U.S. Department of Agriculture statistician in Salt Lake City reports that the 1957 sweet cherry crop was worth $380 per ton. Costs and returns were:

- Return per acre: $912.00
- Costs breakdown:
  - Picking boxes: $24.00
  - Sorting and packing: $72.00
  - Overhead: $94.00
  - Spray materials: $10.00
  - Other labor: $40.00
  - Power: $40.00
- Total cost: $520.00
- Net return per acre: $392.00
- Net return per ton: $163.00
- Net return per 20 pound box: $1.63

The trees receiving manure alone produced 3.3 tons per acre. At $380 per ton this gives a gross return of $1,254. From this should be deducted $671 for costs which leaves a net return of $583 or $176 per ton ($1.76 per 20 pound box).

The trees which received 5 pounds of ammonium sulfate produced 4.1 tons an acre at a value of $1,558. After deducting $783 for costs, there was a net of $775 or $159 per ton ($1.89 per 20 pound box).

The trees which received nitrogen at the double rate, either 2N, 2NP, or NMan, produced an average of 5 tons per acre. At $380 per ton this would amount to $1,900.

A grower would do well to include as much barnyard manure as possible up to 500 pounds per tree (12½ tons per acre at 50 trees to the acre) spread around under the tree and then add commercial nitrogen to make up the balance.

SAFFLOWER
(Continued from page 13)

yield of 815 pounds of cleaned seed per acre compared with 504 pounds for the least profitable third. The most profitable group had a net return of $6.25 an acre, the least profitable third of $6.83.

Results of the 1957 crop year can be viewed as encouraging. The new crop was not always planted on the best land; with experience growers can improve their practices. The introduction of a new crop will always require some adjustments before the real potential value is established. Farmers who grew safflower in 1957 were pioneering a new industry. Another crop year will go a long way further in discovering the place for this crop in dryland farm areas. Notable suc-
In 1955 the average net returns on 67 apple orchards in Utah was 20 cents a bushel of apples sold, or $81 per acre of apples (Table 1).

In arriving at the net returns the total costs were subtracted from the total receipts. Total receipts were the amount of money obtained from the sale of apples and their by-products. The by-products represented a minor part of the total. Costs included all of the costs incurred in the production of the apple crop. About 58 percent of these costs required cash and the remaining 42 percent were non-cash.

The most important item of cost was labor. When hired labor was combined with the operator's and family labor it accounted for 36.6 percent of the total cost of producing apples (Figure 1).

Fertilizer, spray, and packing materials totaled 20.5 percent of the cost. Interest on the capital invested was charged against the apple enterprise at the rate of 5 percent, whether the capital was owned by the operator or borrowed or rented, and amounted to 15.9 percent of the total cost. Depreciation of the orchard, which is the gradual wearing out of the trees, amounted to 3.4 percent of the cost of production.

If the 1955 season was a normal or typical year for apple produc-

Table 1. Costs, receipts, and net returns, 67 apple orchards, Utah, 1955

<table>
<thead>
<tr>
<th>Item</th>
<th>Per farm</th>
<th>Per acre</th>
<th>Per bushel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total receipts</td>
<td>$6193</td>
<td>$755</td>
<td>$1.81</td>
</tr>
<tr>
<td>Total costs</td>
<td>5529</td>
<td>674</td>
<td>1.61</td>
</tr>
<tr>
<td>Net returns</td>
<td>664</td>
<td>81</td>
<td>0.20</td>
</tr>
</tbody>
</table>

Table 2. Net returns per bushel related to various efficiency factors, 67 apple orchards, Utah, 1955

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>Less than $0.50</th>
<th>$0.01</th>
<th>$0.60</th>
<th>Average or total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of farms</td>
<td>number</td>
<td>19</td>
<td>21</td>
<td>14</td>
<td>13</td>
</tr>
<tr>
<td>Net returns per bushel</td>
<td>dollars</td>
<td>-1.14</td>
<td>-0.25</td>
<td>0.38</td>
<td>1.13</td>
</tr>
<tr>
<td>Acres of bearing apples</td>
<td>acres</td>
<td>7.1</td>
<td>7.9</td>
<td>6.8</td>
<td>12.0</td>
</tr>
<tr>
<td>Total investment in apple enterprise</td>
<td>dollars</td>
<td>16665</td>
<td>1519</td>
<td>1470</td>
<td>21497</td>
</tr>
<tr>
<td>Investment per bearing acre</td>
<td>dollars</td>
<td>2360</td>
<td>1943</td>
<td>2094</td>
<td>1797</td>
</tr>
<tr>
<td>Bushels of apples sold</td>
<td>bushels</td>
<td>1604</td>
<td>3933</td>
<td>2944</td>
<td>5778</td>
</tr>
<tr>
<td>Total receipts per farm</td>
<td>dollars</td>
<td>2398</td>
<td>5854</td>
<td>4941</td>
<td>13635</td>
</tr>
<tr>
<td>Receipts per bushel</td>
<td>dollars</td>
<td>1.50</td>
<td>1.49</td>
<td>1.68</td>
<td>2.36</td>
</tr>
<tr>
<td>Costs per bushel</td>
<td>dollars</td>
<td>2.64</td>
<td>1.74</td>
<td>1.30</td>
<td>1.23</td>
</tr>
<tr>
<td>Man hours per bushel</td>
<td>hours</td>
<td>0.76</td>
<td>0.55</td>
<td>0.38</td>
<td>0.42</td>
</tr>
<tr>
<td>Yield per acre</td>
<td>bushels</td>
<td>227</td>
<td>499</td>
<td>432</td>
<td>483</td>
</tr>
</tbody>
</table>

Growing Apples can be a successful enterprise in Utah.

DR. ELLIS W. LAMBORN is associate professor of agricultural economics. This report summarizes a recent bulletin, number 403, "Apple production: costs and returns."
tion costs and prices received in Utah, it would appear that it would be profitable to expand the apple industry in the state.

While the average return was 20 cents for a bushel of apples, wide variations were found in the net returns among orchards (table 2). The more successful growers:

1. Had ten acres or more of bearing apples. The average grower had 8.2 acres.

2. Had a yield of about 500 bushels of saleable apples per acre. The average grower in this study obtained 417 bushels of saleable apples per acre.

3. Produced and sold a bushel of apples with about 0.4 of an hour of labor. The average in this study was 0.51.

4. Received $2.36 a bushel for his apples. The selling job can make or lose money for the grower. The average grower received $1.81 per bushel. While some of this difference reflects actual difference in quality, most of the difference can be credited to the selling and merchandising job done. Even with the production of fairly high quality fruit some grading is profitable. However, there were 45 producers included in this study who did no grading.

5. Kept his investment in the apple enterprise at a reasonably low level. As more orchard land is used for residential purposes it will be increasingly difficult for apples to pay the interest charge if the land left in orchard is valued at subdivision prices. Apples, however, may be a good alternative while waiting for the land to be subdivided provided the apples are already planted.

SAFFLOWER

(Continued from page 25)

Producers are encouraging. Current research at the Utah Agricultural Experiment Station on higher yielding, better adapted varieties will be helpful to farmers who are now growing or are considering growing this crop.

Table 1. Costs, receipts, and net returns per acre from safflower production, northern Utah, 1957

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Total</th>
<th>Percent of total cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material:</td>
<td></td>
<td>dollars</td>
<td></td>
</tr>
<tr>
<td>Fertilizer</td>
<td>4.50 lbs.</td>
<td>.19</td>
<td>1</td>
</tr>
<tr>
<td>Seed</td>
<td>21.04 lbs.</td>
<td>1.76</td>
<td>10</td>
</tr>
<tr>
<td>Misc.</td>
<td>----------</td>
<td>.52</td>
<td>3</td>
</tr>
<tr>
<td>Sub total</td>
<td></td>
<td>2.47</td>
<td>14</td>
</tr>
<tr>
<td>Labor</td>
<td>1.3 hrs.</td>
<td>1.30</td>
<td>7</td>
</tr>
<tr>
<td>Power and machinery</td>
<td>1.3 hrs.</td>
<td>3.59</td>
<td>20</td>
</tr>
<tr>
<td>Overhead:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Int. on money in crop</td>
<td>$4 @ 6% @ 8 mo.</td>
<td>.16</td>
<td>1</td>
</tr>
<tr>
<td>Int. on capital</td>
<td>$158 @ 6%</td>
<td>9.45</td>
<td>52</td>
</tr>
<tr>
<td>Taxes and misc.</td>
<td></td>
<td>1.08</td>
<td>6</td>
</tr>
<tr>
<td>Sub total</td>
<td></td>
<td>10.69</td>
<td>59</td>
</tr>
<tr>
<td>Grand total</td>
<td></td>
<td>18.05</td>
<td>100</td>
</tr>
</tbody>
</table>

Receipts: $16 lbs. seed @ $.35 = 18.13
Net returns = .08

Because safflower was grown in 1957 on some submarginal areas where no crops are productive, some dry farmers have decided not to grow the crop in 1958. As a result of this the Pacific Vegetable Oil Corporation has announced that it will not promote the crop this year. However, the Amalgamated Sugar Company has plans to purchase the seed.

For farmers who can obtain seed and have reasonably good land, safflower is considerably more profitable than barley. Yields of from 1200 to 1600 pounds of seed were obtained last year on the better dry land. For barley to be equally profitable would require yields of from 50 to 63 bushels an acre. Approximately 75 percent of growers found safflower more profitable than barley. Growers with low producing land would not find either crop profitable.

The U.S. Department of Agriculture in cooperation with the Utah Agricultural Experiment Station has a breeding and improvement program in progress which is designed to develop more desirable varieties for both dry land and irrigated production. Such breeding objectives are generally not realized in periods of less than three to five years. The development of suitable higher yielding varieties with a higher percent of oil in the seed should make safflower a profitable crop in northern Utah and southern Idaho.

DODDER

(Continued from page 21)

usually gives satisfactory control of dodder. The success of these treatments depends upon irrigating at the right time, destroying any dodder that remains attached to the alfalfa stubble after removal of first-crop hay, keeping the soil surface dry after the treatment, and otherwise making conditions unfavorable for further germination of dodder seed.

Burning alfalfa stubble after removal of the first crop for hay controls dodder effectively. The usual procedure is to irrigate immediately before cutting for hay, in order to hasten the start of any new dodder and make irrigation after the treat-
PENALTY FOR PRIVATE USE TO AVOID PAYMENT OF POSTAGE $300

Utah State University
College of Agriculture
Agricultural Experiment Station
Logan, Utah

J. W. Oman
Director

POSTMASTER: Please return if unclaimed

MINERAL DEFICIENCY
(Continued from page 19)

symptoms. Zinc deficiency was most prevalent in Box Elder and Davis Counties and was found primarily on sweet cherries and peaches.

Peaches, apples, and apricots had the largest amount of iron deficiency. More apricot trees showed manganese deficiency than trees of any other fruit. Zinc deficiency was most evident on sweet cherries and peaches (table 3).

Although the increase in iron chlorosis is alarming, the large number of orchards showing manganese and zinc deficiencies is surprising. Control methods for iron chlorosis are meager and give only limited control or are expensive and time-consuming to obtain effective results. Zinc and manganese deficiencies can be effectively and economically controlled. Zinc deficient trees respond to a dormant spray of zinc sulfate which is effective two or more years. A soil application of manganese sulfate gives control of manganese deficiency for several years.

Table 3. Micro element deficiency in all counties by species of fruit on individual tree basis

<table>
<thead>
<tr>
<th>Fruit</th>
<th>Iron</th>
<th>Manganese</th>
<th>Zinc</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>percent</td>
<td>percent</td>
<td>percent</td>
</tr>
<tr>
<td>Apple</td>
<td>7.8</td>
<td>T</td>
<td>0.7</td>
</tr>
<tr>
<td>Apricot</td>
<td>7.3</td>
<td>16.8</td>
<td>0.3</td>
</tr>
<tr>
<td>Cherry, sour</td>
<td>1.8</td>
<td>0.3</td>
<td>1.3</td>
</tr>
<tr>
<td>Cherry, sweet</td>
<td>3.0</td>
<td>T</td>
<td>T</td>
</tr>
<tr>
<td>Peach</td>
<td>15.0</td>
<td>8.3</td>
<td>1.0</td>
</tr>
<tr>
<td>Plum</td>
<td>6.9</td>
<td>5.4</td>
<td>T</td>
</tr>
</tbody>
</table>

T = trace

CONTRIBUTIONS TO RESEARCH
November 15, 1957 to February 15, 1958

National Institutes of Health $33,062 for studies of the effects of residues of newer insecticides on health
Utah Turkey Federation $5,000 for studies of staphlococcosis in turkeys
Indian Jute Mills Assoc. Inc. $5,000 for canal lining studies
Portland Cement Company $2500 for canal lining studies
Utah Canners Association $500 for studies on the culture of tomatoes and lima beans
United States Steel Corporation 1 ton ammonium sulfate, 2,500 pounds ammonium nitrate for fertilizer studies
Western Phosphate, Inc. 1 ton treble superphosphate, 500 pounds 16-20-0
Anaconda Copper Company 1½ tons treble superphosphate for fertilizer studies
Chemagro Corporation 70 pounds CO-RAL powder for cattle grub control studies
Dow Chemical Company 500 boluses of Trolene for cattle grub control studies

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