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Are dwarf fruit trees practical for commercial orchards in Utah? How do costs and yield, quality of fruit, and earliness of bearing compare with full-size trees? These and other questions have prompted the Experiment Station to study the performance of dwarf fruit trees.

**Dwarf Fruit**

**Fig. 1.** Three-year-old McIntosh apple on Malling IX rootstock. This tree has produced large, well-colored fruits each year since planting in 1956.

**Fig. 2.** Semi-dwarf apple in commercial dwarf orchard in Roy, Utah. Note swelling of the trunk caused by Clark dwarf interstock.

Though dwarf fruit trees have been cultivated in the Old World for more than a century and now comprise a high percentage of the commercial apple orchards of Europe, it has not been until the last ten to fifteen years that their culture in this country has been considered as more than a home garden curiosity. Nurserymen, extension workers, and university horticulturists have been deluged with questions from home gardeners and fruit growers relative to the performance of these trees. It is claimed that due to their small size many of the more tedious orchard operations, such as pruning, spraying, and harvesting are simplified. Are dwarfs practical for commercial orchards? What kinds of fruits can be obtained from a dwarf tree? Why do they cost more? How do they compare with full-sized trees in yield, fruit size and color, hardness, earliness of bearing, and other characteristics? What is the best planting distance? These and many other questions have prompted the Utah Agricultural Experiment Station to study the performance of certain types of dwarf fruit trees under our environmental conditions.

**How are dwarf trees produced?**

The three general types of dwarfs are: (1) trees grafted on dwarf rootstocks, (2) those with dwarf interstocks, or (3) a true dwarf variety.

*The dwarf rootstock.* Most of the dwarf apples, pears, and other fruits which originate in the Northwest are produced by grafting the desired variety on a selected rootstock. The rootstocks are actually old semi-wild apple varieties from Europe which have been selected and classified by horticulturists of England's East Malling research station according to the degree of dwarfing produced.

The most common clones for rootstocks are the Malling IX, VII, and II. Trees on Malling IX rootstock are extremely small, usually not exceeding 6 to 8 feet in height (Fig. 1). Malling VII produces a semi-dwarf tree, similar in size to a peach tree, while trees on Malling II are about three-fourths the size of a standard apple tree. Trees on Malling IX rootstock come into bearing at an early age and are considered an ideal type for the small property owner. These trees require staking since they have a weak, brittle root system; thus they are generally not planted commercially. The commercial possibilities of Malling VII and II are being studied in Utah and in many areas of the country. They are ideally suited to the backyard orchard where only a 15 to 18 foot spacing between trees is needed.
Except in extremely windy areas the semi-dwarf apples do not need artificial support.

The dwarf interstock. In the dwarf interstock type growth is controlled by the weak root system. To attain better anchorage in the ground and more resistance to wind the dwarf interstock was developed. In this type a vigorous, well-anchored rootstock is used. The dwarf types are grafted or budded on this stock, either IX, VII, or VIII (Clark dwarf). The desired variety is budded or grafted on to the dwarf interstock about 4 to 12 inches above the original graft union. The degree of growth control depends upon the type and length of interstock. A swelling of the interstock (fig. 2) is a common trademark of this type of tree. The double grafting necessary to produce dwarf interstock trees accounts for their higher cost.

Although the interstock method has been limited mainly to apples, other kinds of fruit trees have been produced in this manner. To develop a dwarf pear tree, the Angers variety of quince is used as a rootstock. It is grafted to a compatible variety of pear such as Hardy or Old Home. The desired variety, Bartlett, for example, is in turn grafted to the interstock. Bartlett and many other popular pear varieties are not directly compatible with the quince, thus the use of the interstock.

We are finding that with many other kinds of fruits, through the right combination of rootstock, interstock, and variety, we can obtain numerous variations in size, shape, and bearing potential.

The true dwarf variety. A few cases of true genetic dwarfing have been found in desirable fruit varieties. The Delcon apple, which resembles Delicious, is naturally a semi-dwarf variety, that is, the tree size is smaller while the fruit is of normal size. Several dwarf and semi-dwarf red tart or sour cherry varieties have been introduced recently including Dwarfrich, Meteor, and North Star. The new "spur-type" strains of Delicious (Continued on page 51.)
CASH FARM RECEIPTS
BY COUNTIES, UTAH, 1957

Total receipts higher than for any year since 1953

DOUGLAS C. STRONG

Total Utah farm cash receipts from sale of major agricultural products amounted to $146,805,000 in 1957 which represented an increase of 3.3 percent above the total of $141,756,000 estimated for 1956. The total estimated for 1957 was, also, higher than for similar estimates for Utah in 1954 and 1955, but was considerably below that received for any years from 1947 to 1953.

Total farm cash receipts reported here do not include receipts from government payments to Utah farmers from conservation, wool, sugar, and soil bank programs which amounted to $8,320,000 in 1957. Nor does it include all cash receipts from many miscellaneous livestock and crop enterprises because adequate data by county were not available. Cash receipts, as used here, denote the actual income received from the sale of agricultural commodities. They exclude the value of interfarm sales of livestock, the value of crops used for feed, seed, and household use, and income from off-farm work or investments. Therefore, they do not necessarily indicate the relative importance of the various enterprises, but rather their importance as sources of cash receipts. These estimates of cash receipts should not in any way be confused with the "net income" of Utah farmers.

Total cash receipts from the sale of all livestock and livestock products in Utah were estimated at $106,287,000 in 1957. These accounted for almost 72 percent of the total for all commodities. Cash receipts from crop sales amounted

DOUGLAS C. STRONG is assistant professor of agricultural economics.
Table 1. Estimated total cash receipts from the sale of agricultural products from Utah farms in order of importance by enterprises, 1957

<table>
<thead>
<tr>
<th>Rank</th>
<th>Enterprise</th>
<th>Cash receipts (thousand dollars)</th>
<th>Percent of total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Dairy</td>
<td>$32,417</td>
<td>22.1</td>
</tr>
<tr>
<td>2</td>
<td>Beef cattle</td>
<td>28,129</td>
<td>19.2</td>
</tr>
<tr>
<td>3</td>
<td>Sheep and wool</td>
<td>18,398</td>
<td>13.4</td>
</tr>
<tr>
<td>4</td>
<td>Chickens and eggs</td>
<td>11,395</td>
<td>7.8</td>
</tr>
<tr>
<td>5</td>
<td>Turkeys</td>
<td>10,872</td>
<td>7.4</td>
</tr>
<tr>
<td>6</td>
<td>Wheat</td>
<td>9,322</td>
<td>6.3</td>
</tr>
<tr>
<td>7</td>
<td>Sugar beets</td>
<td>7,181</td>
<td>4.9</td>
</tr>
<tr>
<td>8</td>
<td>Hay (all)</td>
<td>4,027</td>
<td>2.7</td>
</tr>
<tr>
<td>9</td>
<td>Potatoes</td>
<td>2,441</td>
<td>1.7</td>
</tr>
<tr>
<td>10</td>
<td>Hogs</td>
<td>2,374</td>
<td>1.6</td>
</tr>
<tr>
<td>11</td>
<td>Barley</td>
<td>2,348</td>
<td>1.6</td>
</tr>
<tr>
<td>12</td>
<td>Cherries</td>
<td>2,279</td>
<td>1.6</td>
</tr>
<tr>
<td>13</td>
<td>Alfalfa seed</td>
<td>2,246</td>
<td>1.5</td>
</tr>
<tr>
<td>14</td>
<td>Tomatoes</td>
<td>1,804</td>
<td>1.2</td>
</tr>
<tr>
<td>15</td>
<td>Other crops</td>
<td>1,550</td>
<td>1.1</td>
</tr>
<tr>
<td>16</td>
<td>Other livestock</td>
<td>1,381</td>
<td>0.9</td>
</tr>
<tr>
<td>17</td>
<td>Peaches</td>
<td>1,038</td>
<td>0.7</td>
</tr>
<tr>
<td>18</td>
<td>Canning peas</td>
<td>948</td>
<td>0.7</td>
</tr>
<tr>
<td>19</td>
<td>Green beans</td>
<td>881</td>
<td>0.6</td>
</tr>
<tr>
<td>20</td>
<td>Apples</td>
<td>749</td>
<td>0.5</td>
</tr>
<tr>
<td>21</td>
<td>Canning corn</td>
<td>652</td>
<td>0.4</td>
</tr>
<tr>
<td>22</td>
<td>Other grain</td>
<td>607</td>
<td>0.4</td>
</tr>
<tr>
<td>23</td>
<td>Other crops</td>
<td>603</td>
<td>0.4</td>
</tr>
<tr>
<td>24</td>
<td>Pears</td>
<td>575</td>
<td>0.4</td>
</tr>
<tr>
<td>25</td>
<td>Dry beans</td>
<td>464</td>
<td>0.3</td>
</tr>
<tr>
<td>26</td>
<td>Apricots</td>
<td>397</td>
<td>0.3</td>
</tr>
<tr>
<td>27</td>
<td>Berries</td>
<td>275</td>
<td>0.2</td>
</tr>
<tr>
<td>28</td>
<td>Other fruit</td>
<td>131</td>
<td>0.1</td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
<td>$146,805</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Estimated cash receipts from the sale of agricultural products by counties in order of importance in thousand dollars, 1957

- **WEBER** (6) $7,956
- **DAVIS** (8) $6,664
- **SEVIER** (9) $6,155
- **WASHINGTON** (10) $5,048
- **DUCHESNE** (11) $4,679
- **UINTAH** (12) $4,276
- **IRON** (13) $3,608
- **SUMMIT** (14) $3,321
- **RICH** (15) $3,050
- **SAN JUAN** (16) $2,991
- **WASATCH** (17) $2,762
- **BEAVER** (18) $2,672
- **JUAB** (19) $2,662
to $40,518,000 or almost 28 percent of the state total. Of the total sales from crops, approximately 84 percent was received from field and truck crops and 16 percent from fruit and berries. A large portion of crops are used on the farms to feed livestock, hence, the cash receipts from livestock and livestock products are largely derived from the grain and forage produced on the cropped land.

Dairying ranks first

Dairying ranked first among all agricultural enterprises in contributing over 22 percent of the total cash receipts to Utah farmers in 1957 (table 1). Cash receipts from dairying amounted to $32,417,000 of which $26,561,000 was from the sale of dairy products and $5,856,000 from the sale of veal calves and culled cows.

The relative importance of dairying and other enterprises as sources of cash receipts for most counties of Utah is indicated in table 2. Cash receipts from the dairy enterprise ranked first in importance for 10 of Utah’s 29 counties, second for 7 counties, third for 9 counties, fourth for 1 county, and fifth for 2 counties in the state. Only in San Juan County did cash receipts from dairying not rank within the first 5 major enterprises as sources of cash receipts. Cache County led all counties in dairying with estimated cash receipts of $5,390,000 and 16.6 percent of the total for Utah.

Receipts from beef cattle rank second

Beef cattle were the second most important enterprise as a source of cash receipts to Utah farmers. Cash receipts from beef cattle in 1957 amounted to $28,129,000 which was almost 14 percent higher than estimated for 1956. This was a result of the increased number of beef marketed, but more important, to more favorable prices. The beef enterprise is well distributed throughout Utah. Cash receipts from sale of beef cattle put beef production among the first sources of income for all counties in the state. It was the most important in 8 counties, third most important in 7 counties, and fifth most important in 2 counties in 1957. Box Elder ranked first among all counties in sale of beef with $3,085,000 or 11.0 percent of the total.

Receipts from sheep and wool rank third

Cash receipts from the sale of sheep and wool amounting to $18,398,000 were the third highest source of agricultural income in Utah from a single enterprise. Cash receipts from this enterprise were higher than from any other single commodity in 3 counties, second highest in 11 counties, third highest in 5 counties, fourth highest in 4 counties, and fifth highest in 1 county in the state. Sanpete County ranked first in cash receipts from the sheep enterprise in Utah.

Chickens and eggs in fourth place

Chickens and eggs were the fourth highest source of cash receipts in 1957. Poultry production was the most important enterprise in Salt Lake County, second in 2 counties, fourth in 5 counties, and fifth in 3 counties in Utah. Turkeys ranked fifth and were the most important as a source of cash receipts in 2 counties (Juab and Sanpete), fourth for 2, and fifth for 3 counties.

Receipts from wheat highest of all crops

Cash receipts from sale of wheat were higher than for any other crop and ranked sixth in 1957 among all enterprises. Although all counties sold some wheat, cash receipts

(Continued on page 53.)

Table 2. Relative importance of enterprises as sources of cash receipts in Utah counties, 1957

<table>
<thead>
<tr>
<th>Enterprises</th>
<th>Number of counties and rank as source of cash receipts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>First</td>
</tr>
<tr>
<td>Dairy</td>
<td>10</td>
</tr>
<tr>
<td>Beef cattle</td>
<td>13</td>
</tr>
<tr>
<td>Sheep and wool</td>
<td>3</td>
</tr>
<tr>
<td>Turkeys</td>
<td>2</td>
</tr>
<tr>
<td>Chickens and eggs</td>
<td>1</td>
</tr>
<tr>
<td>Hogs</td>
<td></td>
</tr>
<tr>
<td>Wheat</td>
<td>2</td>
</tr>
<tr>
<td>Hay (all)</td>
<td></td>
</tr>
<tr>
<td>Potatoes</td>
<td></td>
</tr>
<tr>
<td>Sugar beets</td>
<td>1</td>
</tr>
<tr>
<td>Alfalfa seed</td>
<td></td>
</tr>
<tr>
<td>Other livestock</td>
<td></td>
</tr>
<tr>
<td>Barley</td>
<td></td>
</tr>
<tr>
<td>Cherries</td>
<td>1</td>
</tr>
<tr>
<td>Beans</td>
<td>1</td>
</tr>
<tr>
<td>TOTAL</td>
<td>29</td>
</tr>
</tbody>
</table>
Survey shows that fresh produce was not available in stores in many small towns — other stores did little to keep attractive displays — many stores did not display prices

ELLIS W. LAMBORN
CLYDE E. NEF

The first contact of many consumers with fresh fruits and vegetables is in the retail store. The freshness of the produce, how many fruits and vegetables are displayed, and the attractiveness of the display have an influence on consumers' buying patterns.

During 1955 about 300 retail grocery stores in Utah were visited three times, once in January and February, once in June, and once in October and November. Three hundred and eleven stores were included in the first visit, 291 in the second, and 280 in the third. Half of the stores in Salt Lake, Ogden, Provo, and Logan were visited. All of the grocery stores in one-fifth of the remaining towns with a population of 200 or more were included.

The displays of fresh fruits and vegetables in the stores visited were observed and essential information recorded on prepared schedules. Store personnel were asked questions concerning the displays only when the questionnaire could not be completed by observation. In much of the analysis, stores were classed into (1) chain stores—those where four or more stores were centrally owned and controlled such as Safeway or Grand Central, (2) voluntary chains—those that were owned independently and did no joint buying or advertising with other stores.

City stores have more attractive displays

More than 50 percent of the displays in stores located in Salt Lake, Logan, Ogden, and Provo rated good or excellent compared to 44 percent in the stores located in cities with 2,500 to 7,000 people, and about 20 percent in stores located in towns with populations of 200 to 2000.

(Continued on page 53.)
Reasonable cooperation among farmers, sportsmen, and game officials can lead to the mutual satisfaction of all.

**THE FARMER AND THE PHEASANT**

**FRANK CALKINS**

FRANK CALKINS is conservation officer for the Utah State Department of Fish and Game. He was formerly a graduate student at Utah State University.

When Utah’s valleys were first tilled and irrigated the stage was unknowingly set for a flamboyant immigrant, the sly and noisy ringneck pheasant. A few of the birds were released near Salt Lake City around the turn of the century. From this modest start pheasants have spread or been introduced into most of the irrigated valleys of the state.

Each year an increasing army of hunters bag about a quarter of a million roosters and spend around three million dollars doing so. By virtue of hunting pressure, dollars spent, and bird numbers the pheasant is unquestionably Utah’s number one upland game bird.

A problem to the farmer

Because of their liking for farm land, pheasants and their hunters have often proved a problem to the farmer. Farmers have made charges about the conduct of some hunters. The hunters have, in turn, taken verbal cracks at the farmers. The State Department of Fish and Game usually ends up as the harried referee in these disputes. The “solution” of these disputes has often been the posting of more and more farms against hunting and the shortening of the hunting season. These steps have only succeeded in forcing more hunters into a smaller hunting area.

Surveying hunting damage

Hoping to sift facts from charge and counter charge the Agricultural Experiment Station and the Cooperative Wildlife Research Unit at Utah State University joined with the Utah Department of Fish and Game to sponsor a survey of this farmer-sportsman problem. The survey was designed to find out, among other things, the extent of actual damage and nuisance caused by upland bird hunters during the 1957 hunting season. Sampling was confined to two counties, Utah and Box Elder. Each year these counties carry about a third of the state’s hunting pressure and a third of the pheasant harvest. The sample was randomized and large enough to assure high statistical reliability. More than 400 farm operators were personally interviewed during the first two and one half months of 1958. The results of the interviews should be fairly representative of the conditions existing between farmers and hunters throughout Utah.

The first question asked was if the farmer had pheasants on his property? At least some birds were reported on 95 percent of the farms.

Next, did the farmer allow the public to hunt on his farm? As table 1 shows most farmers permitted hunting.

<table>
<thead>
<tr>
<th>Table 1. Acres open to or closed to public hunting on sampled Utah and Box Elder County farms during 1957</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acres</td>
</tr>
<tr>
<td>Open to public hunting</td>
</tr>
<tr>
<td>Closed to public hunting</td>
</tr>
<tr>
<td>Totals</td>
</tr>
</tbody>
</table>

What causes a farmer to close his land to hunting? Hunters have claimed it was to provide private hunting for the farmer. Farmers have said it was because of the damage and nuisance hunters have caused in the past. The survey found that over half of those who posted their property did so because they anticipated damage or nuisance and not because they had experienced it. Less than 10 percent posted to insure private hunting. About 15 percent did post because of past trouble with hunters.

How much damage did hunters actually do? Just over 17 percent of the respondents reported damage during 1957. Damage to fences constituted more than 50 percent of the reported trouble. Other types and the extent of damage are shown in table 2.

The most often reported cost was about $2.50.

How often does the average farmer suffer damage from hunters? Nearly 70 percent of the farmers said they had only rarely or never experienced damage. Less
Table 2. Types and extent of hunter damage to sampled Utah and Box Elder County farms during 1957

<table>
<thead>
<tr>
<th>Types of damage</th>
<th>Percent of all damage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fences</td>
<td>58</td>
</tr>
<tr>
<td>Crops</td>
<td>11</td>
</tr>
<tr>
<td>Livestock</td>
<td>9</td>
</tr>
<tr>
<td>Other (theft, careless shooting, rutting land)</td>
<td>22</td>
</tr>
</tbody>
</table>

Table 2 shows that more than 20 percent reported annual damage. Of the farmers who reported damage during 1957, more than half said it was a yearly occurrence. The reasons for this are probably two. (1) Some farms are so located or laid out as to encourage more hunters, and (2) some farmers are hypercritical of any hunters.

Nuisances resulting from hunting greatly exceeded reports of damage as table 3 illustrates.

Table 3. Hunter-caused nuisances as reported by sampled Utah and Box Elder County farmers during 1957

<table>
<thead>
<tr>
<th>Types of nuisance</th>
<th>Percent reporting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fences weakened</td>
<td>32</td>
</tr>
<tr>
<td>Gates left open</td>
<td>27</td>
</tr>
<tr>
<td>Careless or malicious shooting</td>
<td>20</td>
</tr>
<tr>
<td>Livestock frightened</td>
<td>12</td>
</tr>
<tr>
<td>Juvenile hunters</td>
<td>10</td>
</tr>
</tbody>
</table>

It must be noted that some respondents reported more than one nuisance. However, at least one nuisance, in this case, weakening fences, was complained of by almost a third of those interviewed.

Restrictions on hunters

Farms were placed in four categories with respect to the restrictions they placed on hunting. These were:

1. Posted hunting units; here a $1.00 fee is charged for access; the number of hunters is limited;
2. Farms where hunting was possible with the permission of the farmer only;
3. Farms where hunting was open to all, and
4. Farms closed to public hunting.

None of these methods of controlling hunters showed any great superiority to the others. Farms in category 2 were lowest in reported nuisances. Category 3 farms reported the least amount of damage. Posted farms, group 4, reported only slightly less damage and nuisance than the average rate for all four.

Length of pheasant season

Utah's pheasant season, usually lasting three to five days in early November, is considered far too short by most game experts. Their reasons are that many areas do not give up their full share of surplus cocks. This situation results in reduced opportunity for public recreation. One other point on the side of the longer season proponents is that short seasons force an abnormal number of gunners into the fields each day. This may increase the possibility of damage or nuisance.

Landowners have resisted, and according to results of this survey, still resist longer hunting seasons. Is it the fear that a longer season would reduce the number of birds available for the next year? Apparently not, as almost two thirds said pheasants were in no danger of overshooting.

Maximum hunting without inconvenience to farmers

What are some of the means that might be used to provide maximum hunting opportunities for sportsmen without causing inconvenience to farmers? (1) Use the results of this survey to allay fears of some farmers that hunters and mayhem go hand in hand. (2) Impress upon hunters the gravity of their shortcomings as found by the survey. (3) Lengthen the pheasant season in an attempt to lower the number of hunters out on a given day. (4) Encourage the participation of sportsmen in placing fence stiles at strategic points along farmers' fences. Surely there are other solutions and just as surely no one will prove a panacea for the ills caused by public hunting on private land.

It must be said that progress is being made towards the solution of farmer-sportsman problems. Farm groups have joined with sportsmen's clubs throughout Utah and in cooperation with the Fish and Game Department have worked out problems before they become disputes.

Pheasant hunting offers real recreation to sportsmen and at the same time the birds are economically valuable. The degree of posting against hunting has not yet reached serious proportions. Damage to private property has not been too heavy nor too expensive. Nuisances have been much more common and steps should be taken to eliminate the more serious ones. The survey found no concrete reason for limiting the length of the open season save past precedent. Reasonable cooperation among farmers, sportsmen, and game officials can lead to the mutual satisfaction of all and a better program of management for pheasants.
Spring Pastures

from deep-furrow seeding of wheatgrasses and "high water" irrigation

PHIL R. OGDEN AND DARRELL H. MATTHEWS

Range forage for livestock is critically short during the spring in many western areas. Seeding methods and species which help to relieve this shortage are of vital interest to all concerned with livestock production. One phase of study at the Utah Agricultural Experiment Station Livestock and Range Field Station at Cedar City is to study seeding methods, adapted species, and management methods for improving spring forage.

As do many farms in the western states, the Cedar City field station receives flushes of "high water" in the spring when the winter snow pack melts. In many cases this water is the only irrigation water available, and lasts but a short time in the early spring. Use of this limited water to grow pasture grasses such as intermediate or pubescent wheatgrass has greatly improved spring forage quantity and quality at the Cedar City field station. A single spring irrigation gives these species the extra water they need to produce well in this low-rainfall area.

Method of seeding

The method of seeding used is to seed in the bottom of 4- to 6-inch deep furrows spaced 20 inches apart. The pastures are irrigated in the same furrows in which the seed is planted. A regular deep-furrow grain drill can be used. In the absence of such a drill, however, a standard single-disk drill can be adapted to drill in the furrows dug by pulling a cultivator with furrow openers in front of the drill (see pictures). Alternate seed gates can be plugged and the disks of the covered gates adjusted to ride high enough so they do not interfere with the furrows.

Species

The two species which are presently being used are intermediate and pubescent wheatgrasses. These species are palatable to both sheep and cattle, and are drought-resistant to the extent that a single spring irrigation is enough moisture to maintain good forage production. Other species of grass undoubtedly could be planted in this same manner with good results. The above two species are favored over crested wheatgrass because they have a longer season of growth in the spring and are able to respond to the extra moisture from irrigation to make growth during the early summer months when livestock are not on the pastures. Crested wheatgrass becomes dormant early in the year with the advent of hot weather. Intermediate and pubescent wheatgrasses are...
Single disk drill for shallow seeding in the bottom of furrows

also favored over tall wheatgrass for sheep because of the lower palatability of tall wheatgrass.

Seeding rate

Seeding rates used with the deep-furrow seeding method have varied from 5.5 to 12 pounds of seed per acre for intermediate and pubescent wheatgrasses. A rate of 7.5 pounds of intermediate wheatgrass seed per acre resulted in an average of 1.8 second-year seedlings per square foot, and appears to be near a proper amount to seed when furrows are approximately 20 inches apart. Twelve pounds of pubescent wheatgrass seed per acre, seeded in January, resulted in 15.9 first-year seedlings per square foot. Unusually favorable weather and seeding conditions account for this stand, which is considered excessively dense for conditions present in this area.

When to plant

Late fall or winter seeding seems to be essential to the success of deep-furrow seeding where the furrows are also used for irrigation. A comparison of two adjacent plantings of pubescent wheatgrass, the same except for time of seeding, illustrates the importance of proper seeding season (table 1).

The seeding rate on both was 12 pounds per acre seeded in the bottom of furrows spaced 20 inches apart. Both pastures were irrigated twice between May 5 and May 28, 1958.

The pasture seeded January 25, 1958, averaged 15.9 seedlings per square foot with an average height of 6 inches on June 18, 1958. The area seeded April 26, 1958, averaged only 1.1 seedling per square foot with an average height of 1 inch on the same date.

The January seeding resulted in a dense stand of grass; the April seeding was a failure. Plants from the April seeding did not emerge before irrigation, and consequently the crusted soil in the furrows prevented seedling emergence. The seedlings which did emerge from the April seeding did not make enough growth following irrigation to survive the dry summer months.

Seeding between November 1 and the last of February has given best results. Seed planted during this period is in the ground and ready to start growth as soon as growing conditions are favorable. Seedlings will grow to 2- to 4-inch height with winter and early spring moisture, and then can be irrigated

(Continued on page 54)

Table 1. Number of seedlings per square foot and air-dry forage production for November 1956 planting of intermediate wheatgrass planted at 20-inch row spacing in deep furrows

<table>
<thead>
<tr>
<th>Treatment number</th>
<th>Dates irrigated</th>
<th>Seedlings per square foot July 26, 1958</th>
<th>Forage production air-dry pounds per acre July 26, 1958</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>No irrigation in 1957 May 22, 1958</td>
<td>1.3</td>
<td>730</td>
</tr>
<tr>
<td>2</td>
<td>May 31, 1957 May 22, 1958</td>
<td>1.4</td>
<td>1410</td>
</tr>
<tr>
<td>3</td>
<td>June 1 and June 22, 1957 May 22, 1958</td>
<td>1.7</td>
<td>1870</td>
</tr>
<tr>
<td>4</td>
<td>June 22, 1957 May 22, 1958</td>
<td>1.8</td>
<td>2410</td>
</tr>
<tr>
<td>5</td>
<td>June 22 and July 30, 1957 May 22, 1958</td>
<td>2.6</td>
<td>2940</td>
</tr>
<tr>
<td>6</td>
<td>July 30, 1957 May 22, 1958</td>
<td>2.1</td>
<td>2430</td>
</tr>
<tr>
<td>Average</td>
<td></td>
<td>1.8</td>
<td>1965</td>
</tr>
</tbody>
</table>
NEW PUBLICATIONS


This bulletin reports a study made on foothill ranges at Benmore and Tintic Valley in central Utah to determine the effect of sagebrush removal and broadcast planting on seedling establishment and production of four introduced wheatgrasses: crested, intermediate, pubescent, and tall.


This bulletin reports the results of a long time study of carp in Utah. Life histories of carp in five study areas are compared. Included are studies of food habits, age and size, conditions under which the fish thrives, and control measures. Economic exploitation of the fish is also discussed.

Bul. 406. The impact of women leaders of Davis County on a changing order by Carmen D. Fredrickson. Department of Sociology. 29 p.

In this bulletin the author discusses the activities and recognitions of women in Davis County, one of Utah's more progressive counties. After choosing 100 leaders, she inquires into their education, employment, family, and leadership activity in various areas.


The bulletin reports tests to evaluate various methods to determine the relation of harvest time to yield and quality of lima beans grown for canning and freezing. The authors found that when dry and shriveled beans were removed there was little difference in quality due to time of harvesting. Quality was correlated with size of bean. This is a technical bulletin and will be of interest mostly to processors.

Cir. 141. These shrinkage costs in lamb marketing, by N. Keith Roberts. Department of Agricultural Economics.

This circular discusses the various types of shrinkage charges deducted in marketing lambs and compares them with actual shrinkage losses under varying conditions.

A copy of these publications may be obtained by writing to the Bulletin Room, Agricultural Science Building, Utah State University, Logan.

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Cycloptic Type Malformation

A congenital malformation in lambs has occurred for many years in southwestern Idaho on certain range areas used during the breeding season. Incidence of such malformations usually varies from less than 1 percent to more than 8 percent of the lambs affected in each herd. One year a sheeprman had more than 25 percent of his lambs affected out of 8,000 ewes. The affected lambs are commonly called "monkey-faced" lambs because of the similarity in appearance to monkeys.

The deformity is always restricted to the head. It varies from a complete cyclops to a slightly deformed upper jaw which is shorter than normal, causing the nasal openings to be small or turned to one side (fig. 1). Hydrocephalus, harelip, cleft palate, and displacement of the nose may be associated with the facial deformity. Afflicted lambs may be born as a single lamb or as a twin to a malformed or normal one. These lambs are usually born alive and, in the less severe cases, may survive for a short time. However, the usual practice is to kill them at birth, because even though the deformity may be slight, the lamb has difficulty in nursing.

Prolonged gestation

Associated with this congenital anomaly is a condition of prolonged gestation in which the lamb remains alive and continues to grow in utero to excessive size (fig. 2). As gestation continues past the time for normal parturition, the external genital organs decrease in size, become discolored (shading from dark brown to black), and the udder undergoes involution with the skin around it becoming loose. The abdomen continues to enlarge, and frequently the weight of the growing fetus becomes so great that the prepubic tendon ruptures and drops the abdomen down until it almost drags on the ground (fig. 3).

Lambs severely malformed

In all such ewes necropsied, the lambs were severely malformed. Generally, they were alive, but, occasionally, a dead twin fetus would be found undergoing maceration.

The cranium of the severely malformed lamb is usually domed, and the cerebral hemispheres are fused into a heart-shaped, thin-walled, fluid-filled cystic sac, with a normal-appearing cerebellum and brain stem (fig. 4). The olfactory bulbs are absent; and when the eyes are displayed centrally, only one optic nerve is present. No pituitary body has been found in the severely affected specimens on gross examination and serial sectioning of the pituitary fossa.

Occurrence limited to southwestern Idaho

As far as can be determined, the occurrence of congenital, cycloptic-type malformations is limited to sheep ranges in southwestern Idaho. The ranches on which this condition has occurred run from 5,000 to 10,000 head of mostly Lincoln-Columbia crossbred ewes on U. S. Forest Service allotments.

Ewes are bred in bands of 1500 to 1700 starting each year about August 10 and using three to four purebred Suffolk rams for every 100 ewes. The rams are usually

FARM AND HOME SCIENCE
in Lambs

WAYNE BINNS,
EDWARD J. THACKER,
AND LYNN F. JAMES

purchased at ram sales, but some ranchers raise their own purebred male stock. The ewes are purchased as yearlings from breeders in Oregon, Montana, Wyoming, and Idaho.

The disease associated with the range area

The incidence of this disease seems to be directly associated with the range area used by a band during the breeding season. The condition has not been observed in bands bred on private lowland ranges within the general affected area. After the animals have been bred in areas outside the affected ranges, they may be taken to the affected ranges for the remainder of the grazing season without any effect on the lambs.

The results obtained through research by the Animal Disease and Parasite Research Division and the Soil and Water Conservation Research Division, Agricultural Research Service, in cooperation with the Utah and Idaho Agricultural Experiment Stations indicate that this congenital anomaly is not caused by a simple, hereditary character. Numerous chemical analyses have been made on plants, soil, and water for mineral elements; and several species of suspected poisonous plants have been fed to ewes starting at date of breeding. The condition has not been reproduced in the work done thus far. All information seems to indicate that the causative agent may be in something the animals are eating during the short time after breeding, which may be a poisonous plant or a toxic mineral element.

FOR JUNE 1959

Top (fig. 3) Ewes in prolonged gestation. Fig. 1 (second from top) Heads of lambs showing cyclops condition and slight nose deformity. Fig. 2. Lambs from prolonged gestation compared to normal lambs. Fig. 4. Brains, showing hydrocephalus.
Go into a restaurant for a dinner and in a majority of cases you will find coffee included in the price of the meal. But if you prefer milk, chances are greater that you will have to pay extra for it. If you want an extra serving, you might get a second cup of coffee free, but you will almost always have to pay for additional milk.

Why do some restaurants price milk differently than coffee? Is the difference between the cost of a glass of milk and a cup of coffee sufficient to justify this practice?

Individuals in the dairy industry are becoming increasingly more interested in learning the answer to these questions as they search for ways to expand the market for fluid milk. They believe consumption of milk in restaurants would increase markedly if milk were priced on the same basis as coffee.

**Pricing of milk and coffee in restaurants**

In 1955 a survey was made of a representative sample of restaurants in Utah. Of the 74 restaurants surveyed, 28 were in Salt Lake City, 15 in Ogden, 8 in Provo, and smaller numbers in other cities throughout the state.

Of these 74 restaurants, 64 percent served coffee at no extra charge with full-course dinners while only 34 percent served milk at no extra charge. Sixty-one percent served coffee and about one-fourth served milk at no extra charge with breakfasts. The percent serving coffee at no extra charge was about twice that serving milk at no extra charge for both types of meals.

One or more refills of coffee was offered free with full-course meals by 61 percent of the restaurants surveyed and with breakfasts by 54 percent. None served extra milk free.

There have been a few changes in pricing milk and coffee in restaurants since 1955. A recent check of restaurants in Provo, Salt Lake City, Ogden, and Logan showed that about 45 percent now serve milk without extra charge with dinners compared with about 65 percent for coffee. The percent offering milk and coffee with breakfasts is about the same now as in 1955. The proportion offering coffee refills without extra charge has decreased and a few restaurants now offer one free refill of milk.

A relation was found between milk and coffee pricing practices and type of restaurant. Hotel and downtown restaurants serving higher-priced meals tend to offer both milk and coffee with dinners, while most restaurants having lower priced menus charge extra for milk and some also charge extra for coffee served with dinners.

Restaurants sell considerably more coffee than milk. Only 10
Milk Than Coffee in Restaurants?

percent of the restaurants sold an average of 200 or more glasses of milk per day while 74 percent sold 200 or more cups of coffee (table 1). Pricing practices undoubtedly have some effect on this ratio.

Table 1. Variation in daily sales of milk, coffee, and other beverages, 74 Utah restaurants, 1955

<table>
<thead>
<tr>
<th>Average number of servings per day</th>
<th>Milk</th>
<th>Coffee</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 50</td>
<td>31</td>
<td>4</td>
</tr>
<tr>
<td>50 - 99</td>
<td>36</td>
<td>1</td>
</tr>
<tr>
<td>100 - 199</td>
<td>23</td>
<td>21</td>
</tr>
<tr>
<td>200 or more</td>
<td>10</td>
<td>74</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

Costs of preparing and serving milk and coffee

A study of costs shows there is little difference in the cost of a serving of milk and coffee. The average cost per serving of coffee for the 74 restaurants was $4.03 compared with 6.0 cents per serving of milk. These costs were figured by restaurant operators. Product costs per serving were calculated from records kept by the business. Preparation, serving, cleaning, and storage costs incidental to a serving of coffee or milk were estimated.

A common error in comparing the cost of milk and coffee is to consider only the product cost of the two items. Most operators remarked that they had always thought milk to be considerably more costly than coffee and that they were surprised to discover how close in total cost the two beverages were when they added to product cost the estimated preparation, serving, cleaning, and storage costs. When all costs were combined there was an average of only six-tenths of one cent difference per serving between milk and coffee in the 74 restaurants studied.

A detailed cost study of coffee and milk in four Oregon restaurants made in 1957 showed that the average cost per 100 guests served coffee was $4.66 (table 2). Of this $1.92, or about 41 percent, was product costs. Labor was the largest single cost item for coffee and amounted to $2.24, or about 48 percent. The only restaurants which can afford to ignore as an important cost factor the large amount of labor associated with serving coffee are those whose employees are not kept fully busy, and who, therefore, have no productive alternative for the use of their time.

The average cost per 100 guests served milk was $5.30. Of this $4.03, or 76 percent, was product costs. Costs of labor, equipment, and supplies made up the other 29 percent. Labor was a minor cost factor for milk and accounted for only 18 percent of total costs.

The average product cost per 100 guests served was more than twice as much for milk as for coffee, $4.03 compared with $1.92. On the other hand, the combined cost of labor, equipment, and supplies per 100 guests served was more than twice as much for coffee as for milk, $2.74 compared with $1.27.

These figures emphasize the necessity of taking into account all costs if a true picture of the relative costs of milk and coffee is desired. When product costs only are compared — the costs most easily figured — a much different and misleading picture is obtained.

The cost of coffee refills is important both from a product and labor cost viewpoint. When comparing cost of milk and coffee, cost of refills should be included if they are given without extra charge. Doing so places both milk and coffee on a per customer served basis.

The average cost per 100 customers served coffee for the four Oregon restaurants was $4.66. The cost per 100 cups of coffee brewed was $4.01. The difference between these two figures is due to coffee refills given without charge. Free coffee refills increased total costs by 65 cents per 100 customers served.

The ounces of milk served in a glass of milk vary considerably

(Continued on page 54)
Efficiency is a term which has important applications in almost all forms of human endeavor. In general, it is a measure of output in terms of input. The efficiency of any machine, for example, is the ratio of the energy output to energy input, generally expressed as a percentage. When applied to irrigation practice, it usually implies efficient use of water resources. When these resources are plentiful and cheap, efficiency in their use may be of little importance, but as they become more completely used and more costly to develop, efficient use of water becomes more and more important.

**Historical aspects**

The importance of efficient use of water in irrigation was early recognized. Brigham Young in a talk to "Mormon" colonists on June 8, 1856, said:

"In regard to irrigation, I will venture to say that one-half of the water is wasted; instead of being applied where and when it is needed, it runs here and there, perhaps one-half reaches the drooping plants. If people would take a little more pains in preparing ditches, gates, and embankments for economically conducting water where it is most needed, it would be a very great advantage to them."

One of the early uses of the term "irrigation efficiency" was by Beckett, Blaney, and Taylor, who defined it as "the percentage of the water applied that is shown in soil-moisture increase in the soil mass occupied by the principal rooting system of the crop."

Israelsen defines the term "water application efficiency" as

The ratio of the amount of water that is stored by the irrigator in the soil root zone and ultimately consumed (transpired or evaporated, or both) to the amount of water delivered at the farm.

**Objectives of efficient irrigation**

The objectives of an efficient irrigation involve the replenishment
of the moisture in the root zone as uniformly and completely as possible with a minimum of loss. The soil is essentially a storage reservoir, and at each irrigation it is usually desirable to refill this reservoir.

Wherever salt is a problem, some water in excess of that which can be stored within the root zone must be applied over a period of time to maintain a salt balance. As much salt as is added by the irrigation water must be removed from the root zone by deep percolation. This necessary leaching might be accomplished by seasonal rainfall, by periodic leaching, or by applying slightly more water than the soil will retain at each irrigation.

From the above, it might appear easy to apply irrigation water efficiently. This is generally not the case, however. Let us consider the problem from the standpoint of the irrigator. How much water should be applied at any specific irrigation to accomplish this objective, and how can he distribute it uniformly on his field? This requires considerable knowledge, most of which he must gain through experience and observation. Should he attempt to apply four inches depth to the field, or would two inches, or eight inches be more desirable? If he has some knowledge of the water retention properties of the soil, the consumptive use and rooting depth of the crop, and the moisture content of the soil at the time of irrigation, he might be able to make a reasonable estimate of the amount required.

How would he then know when he had applied this amount? He would have to know the flow of his irrigation stream, and how to convert flow to volume and depth on the area irrigated. Actually, most irrigators cannot do this, yet many of them do a fairly good job in accomplishing the basic objectives. By experience, and especially by frequently checking the depth of penetration of the water the irrigator is obtaining with a given practice, he can become fairly efficient in applying an adequate amount of water to wet his soil to the depth of the root zone. He can observe waste that might occur through surface runoff, but it is much more difficult to observe the waste or loss that occurs by deep percolation through excessive applications. He generally has little knowledge of the relative loss that is occurring through direct evaporation from the soil, or by transpiration by weeds.

*Efficiency depends upon losses*

Fundamentally, efficient irrigation involves the application of water as required with a minimum of waste or loss. The principal losses in irrigation practice are:

1. **Conveyance loss** — that which is lost by seepage, leakage, and evaporation between the source and the place of application.
2. **Surface runoff** — that which is lost from the lower end of the field by surface runoff.
3. **Deep percolation loss** — water which penetrates the soil beyond the reach of the roots of the crop.
4. **Evaporation loss** — that which evaporates directly from the soil and that which is lost by transpiration from weeds.

Seepage losses from ditches can only be determined by measuring the flow near the source and near the place of application. This necessitates some knowledge of water measurement and use of suitable devices or instruments. Farmers can sometimes use simple devices such as weirs or Parshall flumes to measure the flow of the stream at both locations. Conveyance losses may be negligible, or in some instances may account for an appreciable part of the available water, depending upon length of ditch, texture of soil, leakage through structures, and other factors. Some knowledge of the conveyance loss is certainly desirable. If it is appreciable, something should be done about it.

The surface runoff is readily observable, but would have to be measured to determine its relative magnitude. Careful attention to the water, along with a suitable method of irrigation and good irrigation layout can do much to minimize, or practically eliminate this loss. The actual loss to the farm can often be eliminated by making use of runoff from one field on lower fields. The runoff can also be salvaged by a "tailwater pumping system" which collects this runoff in a sump at the lower end of the field and pumps it back to the head ditch through a concrete or metal pipe. Such systems are fairly common in some sections of California.

The deep percolation loss is usually the most important, and the most difficult to detect, or to determine the magnitude of. This loss usually varies greatly from place to place in the field, generally being greater at the upper end, and sometimes at the bottom where water is ponded. Unless the field is carefully graded and prepared for irrigation, the water distribution is likely to vary considerably with deep percolation losses occurring in all places receiving excessive amounts. Irrigators like to use a sufficient amount of water, and hold it on the field long enough to obtain adequate penetration on the spots most difficult to irrigate. Gravelly and sandy spots take water more rapidly and retain less than finer textured soils. Dry spots may show up in fields where water is not uniformly applied, unless excessive applications are made.

Deep percolation losses can be reduced by applying amounts that do not wet through the root zone, but this would be objectionable for other reasons. It might result in salt accumulations in the soil, and would require more frequent applications of water with higher direct evaporation losses, and would usually result in higher labor costs of irrigation.

To know what he is accomplishing, an irrigator must make frequent use of a soil auger, a soil sampling tube, or a probe. Ob-

(Continued on page 55)
To help solve some of the problems of farming in the higher agricultural areas of the state is the main objective of the Snow Field Station, located in the geographical center of Utah, just north of Ephraim. Research and demonstration in crops, dairying, and turkey production are the major projects.

The situation at Ephraim

The elevation at the station is about 5500 feet with approximately 12 inches of rainfall. The average frost-free period is around 120 days, though damaging frosts may occur during the early part of June and the first part of September. During the growing season the nights are normally cool and the days warm.

The soil is classified as a Woodrow silty clay loam. It is developed on a smooth alluvial fan where the slope ranges from 1 to 2 percent. The soil is deep and fairly uniform except for a few small sand and gravel streaks. It has a low rate of permeability and is strongly calcareous.

A short water supply with poor seasonal distribution is the most serious agronomic problem faced in the area. The water comes from normal runoff, which is similar to many other areas in the state where water storage is limited or unavailable. Spring runoff comes early and declines sharply as the growing season advances. The water, which is high in mineral sediment, is delivered to the farm by direct stream diversion. The water supply is generally adequate until the first of July after which time it is extremely limited. This situation creates problems in relation to moisture use, crop selection, and conservation of water for optimum crop growth.

Other agronomic problems such as those connected with saline soils, organic soils, wetland meadow areas, dryland farming, and irrigated farming can also be studied in the area.

Problems related to dairying, sheep production, and poultry and turkey production are important to the economy of the area. Especially important are the problems connected with an adequate feed production program including hay and pasture production and management.

Farm improvements

The research program in cooperation with Snow College started in 1952 on the college 60-acre farm. An additional 29 acres of land have been added to the station since this
URAL PROBLEMS of an area

time and another 15 acres are leased. Several improvements have been made in the farm buildings and corrals.

These physical changes and improvements serve as practical models for better farming practices. They will also materially reduce labor costs and will result in increased efficiency in completing research projects.

A land leveling program on the farm has been in progress since 1956. Where water conservation is so vital, it becomes necessary that the land be leveled for maximum water efficiency while irrigating and for better use of labor. Approximately 47 acres of land have been leveled into benches with all side slopes removed.

A new irrigation system is being installed. Cross ditches are located at approximately 400 foot lengths. A reinforced concrete block gate and drop structure has been placed in the cross ditch at the upper corner of each bench to drop the water from one bench to the other, thereby preventing soil erosion. An overnight irrigation storage pond was completed in 1953. As much water as possible at each water turn is run through the pond. This lessens the silting of the irrigation system. Silting is extremely troublesome in this area.

The research program

Research in turkey production is conducted at the Snow Station. This includes disease research in controlling losses from staphylococcal synovitis, which in some years is extremely costly to the industry. Information from feed conversion trials is also being obtained for the benefit of producers. Other phases of management are planned for investigation.

A herd of registered Holstein dairy cows is maintained for breeding studies and feed trials. The breeding work will be integrated with a new study being initiated at Logan. At present, work is directed toward evaluating the economic desirability of pastures compared to drylot feeding. The benefits derived from these investigations will materially aid the dairy industry of the area.

Crop varietal studies have been conducted on the station since 1952. Small grain varietal trials have shown that Bonneville barley yields best under favorable conditions and that Trebi is best under adverse conditions. Lemhi 53, a soft white spring wheat, has been the best wheat variety. A mixture of two or more small grains, when planted in various combinations and rates, has yielded no better than barley planted alone. The only grain mixtures that approach barley are those which are high in barley content.

In hybrid corn trials, several of the new early maturing varieties have shown promise in maturity and yield for the production of a high quality silage. Yields of the silage sorghums have not been as high as those of corn. Several of

(Continued on page 55)
Almost every farmer in Utah grows some grain. He grows grains because they are important constituents of livestock feed and can easily be sold for cash. Grains also fit well into a crop rotation program.

What grains do farmers grow? Which varieties do they plant? Are they growing improved varieties developed by the Experiment Station? What type of seed are they using? Such information is of value to many state agencies, and farmers themselves should be interested in the material so they can improve their practices. The crop they grow is no better than the seed they sow. If they plant an inferior variety, they can expect low yields. Seed grain contaminated with weed seeds can be an expensive luxury, even though the initial cost is lower than that of certified seed.

To determine the kind of grain seed planted in Utah, a survey was conducted in the spring of 1958. About 1200 samples were collected from the drill boxes of farmers chosen at random. Questionnaires were filled out at the time samples were collected to give information on variety, source of seed, and other pertinent material.

This survey was conducted jointly by the Utah Extension Service, the Utah State Department of Agriculture, the Utah State Seed Council, and the State Weed Committee. Samples were collected by county agricultural agents, district agricultural inspectors, and the extension agronomist. The samples are being tested for purity and germination at the State Seed Laboratory. We believe that the survey gives a reasonably accurate picture of the situation in the state.

Fifty percent of the samples col-
lected in the survey were barley, 31 percent were wheat, 13 percent oats, and 6 percent mixed grain. Barley is our most popular spring grain with wheat next in importance. Oats are of minor importance principally because other grains will produce more feed per acre.

What grain varieties were planted?

The percent of each different variety planted is shown in table 1. The varieties of barley grown follow rather closely to Experiment Station recommendations, Bonneville produces the highest yields of any variety in areas where there is sufficient fertility and irrigation water. Trebi and Velvon are adapted to sites with poorer growing conditions. Some growers who are still planting Trebi and Velvon would probably increase their yields by changing to Bonneville. Gem and 2-row are adapted to extremely adverse conditions and usually do not yield well. Other varieties listed obviously are of minor importance.

Lemhi stands alone as the most popular variety of spring wheat in the state. Lemhi 53 is similar to regular Lemhi except that it carries resistance to rust. If the two strains of Lemhi are combined, more than three-fourths of all the spring wheat in Utah is this variety. The old varieties of Baart, Dicklow, and Federation are disappearing.

Almost half of the oat seed planted is Overland. This is an improved variety with a short stiff straw and high yielding ability. Swedish Select comes next in popularity. It is old, of fair yielding ability, and has long straw. It lodges readily but is quite well adapted for planting as a forage crop either alone or as a nurse crop with alfalfa. Uton will produce as much straw as Swedish Select and will yield more grain. It is better as a hay crop but the supply of seed is limited. This is probably the main reason for the low percentage grown.

A surprising number of farmers do not even know what grain variety they plant. The samples of

<table>
<thead>
<tr>
<th>Variety</th>
<th>Barley Percentage</th>
<th>Wheat Percentage</th>
<th>Oats Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bonneville</td>
<td>30</td>
<td>71</td>
<td>44</td>
</tr>
<tr>
<td>Trebi</td>
<td>25</td>
<td>7</td>
<td>23</td>
</tr>
<tr>
<td>Velvon</td>
<td>20</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Gem</td>
<td>8</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>2-Row</td>
<td>5</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Hiland</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Winter Club</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Velvon II</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Frontier</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Alpine</td>
<td>8</td>
<td>6</td>
<td>6</td>
</tr>
</tbody>
</table>

Table 1. Varieties of different grains grown, showing percentages of each

unknown variety in barley were 8 percent, in wheat 6 percent, and in oats 17 percent. Varieties differ greatly in their characteristics, such as disease resistance, quality, and producing ability. Recommended varieties have proved superior in trials all over the state.

Where are the growers getting their seed grain?

Forty-one percent of farmers in Utah are planting seed which they have raised. Eleven percent obtained their seed from other farmers, and 48 percent obtained it from a seed dealer. Preliminary information on seed quality as it relates to freedom from weed seeds indicates that on the average, seed obtained from a seed dealer is best. That obtained from other farmers is next, and the seed grown and planted by the farmer himself contains the most weed seeds.

Certified seed is recognized to be high in quality. Nearly a fourth of all samples tested were certified seed.

Commercial seed sold in the regular channels of trade should be treated with various facilities used for cleaning grain including seed cleaning plants, portable cleaning equipment that is moved from farm to farm on custom work, and farmers' own cleaning equipment.

Seed grain should be treated to control certain seed-born diseases. Seventy-seven percent of the samples were reported to have been treated.

Do the growers know what variety they are planting?

Another phase of the study was designed to determine whether farmers know what variety of grain they are actually planting. Four hundred samples were drawn at random from the total 1200 samples collected. These were planted in 25-foot rows in a nursery. When the grain was mature, each row was harvested separately. Determination of the different varieties and the percent of each was made by head and kernel characteristics:

1. Fifty-seven percent of the samples contained a known variety.
2. Twelve percent were principally of the variety reported but contained one or more other varieties.
3. Twenty-three percent of the samples contained other kinds of grain and other varieties in addition to that reported.
4. Eight percent of the samples contained 50 percent or more of a variety different from that reported.
During the past four years, the Utah Station has cooperated in the "random sample testing" of different strains of egg-producing chickens. The testing of "random samples" is simply a procedure employed in sampling a given strain of chickens which will give an unbiased appraisal of the strain's productive worth.

In this procedure, eggs are taken at random from the nests of chicks of various strains and sent to the Utah Station for hatching and performance evaluations. Some 20 different strains, which are currently popular in Utah, have been evaluated for their productive qualities.

It is interesting to note the shift in emphasis from the once popular scheme of evaluating each hen, to the currently popular random sample system, which evaluates not one individual but a sample from the entire population of chickens making up that strain. This shift has been inevitable in light of newer information relating to the genetics of populations. No longer are we so keenly concerned with the performance of any individual in the population, but rather with the performance of the total population.

Time was when the individual chicken was glorified in terms of how many eggs she produced, the shape and size of her body, characteristic features of comb and waddles, and feather color. However, we have now deemphasized the aesthetic values in favor of sheer economic considerations. These considerations have been greatly enhanced through our increased ability to evaluate the genetic variations within populations, and random sample testing is the result.

During the month, we have begun the Fourth Intermountain Random Sample Egg Laying Test in facilities operated by the Experiment Station. This latest test was begun with a random sample consisting of one case of hatching eggs from each of 15 different breeding flocks from which 99 percent of the commercial chickens in Utah are derived. These eggs were hatched in Experiment Station incubators and are now in the brooder house at the Poultry Farm.

The Third Random Test has just concluded. Characteristics evaluated in this test include: (1) livability of chick, (2) age at sexual maturity, (3) rate of egg lay, (4) size and quality of eggs, (5) efficiency of feed conversion, (6) carcass value at the conclusion of the test.

For the purposes of standardizing the Intermountain Random Sample Test with tests from other areas, birds are rated on a basis of income over feed cost. Such an evaluation excludes costs such as depreciation on buildings, electricity, litter, and labor. Note also that the initial cost of the baby chick is not included in the net income over feed cost returns.

The following is a list of the 18 entries in the Third Intermountain Random Sample Test.

J. DAVID CARSON is associate professor of poultry husbandry and in charge of the random sample testing of poultry strains.
Test ranked in order of their net income over feed cost.

<table>
<thead>
<tr>
<th>Cooperator</th>
<th>Net income over feed cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hy-Line 968</td>
<td>$4.213</td>
</tr>
<tr>
<td>Hy-Line 934B</td>
<td>$3.950</td>
</tr>
<tr>
<td>Creighton Bros.</td>
<td>$3.943</td>
</tr>
<tr>
<td>Hy-Line 934A</td>
<td>$3.886</td>
</tr>
<tr>
<td>Ghostley</td>
<td>$3.679</td>
</tr>
<tr>
<td>Honeggers'</td>
<td>$3.611</td>
</tr>
<tr>
<td>Kimber</td>
<td>$3.635</td>
</tr>
<tr>
<td>DeKalb 101</td>
<td>$3.560</td>
</tr>
<tr>
<td>Ideal</td>
<td>$3.487</td>
</tr>
<tr>
<td>West-Line</td>
<td>$3.475</td>
</tr>
<tr>
<td>Dirkse</td>
<td>$3.236</td>
</tr>
<tr>
<td>Heisdrof &amp; Nelson</td>
<td>$3.233</td>
</tr>
<tr>
<td>Demler</td>
<td>$3.177</td>
</tr>
<tr>
<td>Bender</td>
<td>$3.151</td>
</tr>
<tr>
<td>Yellowstone</td>
<td>$3.051</td>
</tr>
<tr>
<td>Ames In-Cross 313</td>
<td>$2.977</td>
</tr>
<tr>
<td>Ames In-Cross 424</td>
<td>$2.924</td>
</tr>
<tr>
<td>Hansen</td>
<td>$2.618</td>
</tr>
</tbody>
</table>

**DWARF FRUIT TREES**

Continued from page 31

Apples are semi-dwarf, similar in size to trees on Malling II rootstock. This type of dwarfing is rare, however.

**Most fruit trees can be “dwarfed”**

**Apples.** Growth control can be attained either through a root or interstock of one of the East Malling and, more recently, the Malling-Merton clones. The latter are resistant to woolly apple aphid. One true dwarf variety, Delcon, has proved suitable for planting in the home garden.

**Pears.** A series of three types of quince, named Quince A, B, and C, may be used, each being grafted to a compatible interstock of Hardy or Old Home. Quince A, an Angers type, is the best of the series, producing a semi-dwarf tree, while trees on Quince C are extremely dwarfed (fig. 3).

Peaches, plums, apricots, and nectarines. For commercial production, dwarf forms of these fruits are not needed. Standard size trees come into bearing at from three to five years of age and can be controlled in size by pruning. To satisfy the demands of the backyard orchardist, several dwarfing rootstocks have been used with varying degrees of success. St. Julien A and Prunus tomentosa have been used for many types of peaches, apricots, and plums and are especially good for plums. The western sand cherry, *Prunus besseyi*, is compatible with most plums and is fairly successful with peach and apricot, although it suckers profusely.

**Cherries.** No completely satisfactory dwarfing stocks have been found for the sweet and sour cherry, though the need is great from a commercial as well as from the home gardener’s standpoint. Some promising combinations of root and interstock are now being tested in several nurseries and experiment stations throughout the country. The Utah Station has an active program in this field. For the time being one must be satisfied with the true dwarf sour cherry varieties, Dwarfrich, North Star, and Meteor.

**USU dwarf apple studies show results**

To determine the adaptability of the various rootstocks and interstocks for apples, an experimental dwarf orchard was planted at the Howell Field Station, Pleasant View (North Ogden) in April 1956. Included in the two-acre test orchard are all combinations of the root and interstocks discussed.
here. Six varieties, including Delicious, McIntosh, Golden Delicious, Winesap, Gallia Beauty (Rome), and Jonathan were used to find if one variety performed better than another on a particular rootstock or interstock. The trees were obtained from commercial nurseries in the Midwest and Northwest. A planting distance of 17½ by 20 feet was used, as this was believed to be adequate for all trees, including the larger trees. The orchard, starting its fourth season, already is producing some interesting results in terms of earliness of bearing, tree size, quality of fruit, and resistance to wind damage.

Earliness of bearing. This is influenced both by the stock and by the variety. As shown (table 1) trees on Malling IX roots will bear in from one to three years after planting. In fact, each McIntosh tree planted in 1956 produced about 10 fruits the same year. They had to be thinned by hand to prevent the tree from breaking under the weight (fig. 1).

The Delicious variety, on the other hand, has not produced blossoms until this, its fourth year in the orchard. Of all of the varieties under test, regardless of root or interstock, the Delicious is the slowest to come into bearing.

On the other hand, Gallia Beauty, a red Rome type, bears rather consistently the third year after planting.

Tree size. The Clark dwarf interstock has produced the greatest degree of growth control in the semi-dwarf types (excluding Malling IX rootstock). In general, this is correlated also with early production.

Size and quality of fruit. For some unknown reason, the apples produced on dwarf trees, regardless of stock, generally are somewhat larger, have a better color, and are slightly earlier to mature than fruit on standard sized trees. It is too soon to draw conclusions in this test since all fruit trees produce large fruits the first few years.

Susceptibility to wind damage. The interstock or "built up" type of tree supposedly possesses a wellanchored root system, whereas the dwarf rootstock trees may be more susceptible to wind damage. None of the trees in this block has been staked or supported in any way. Only one case of wind damage has occurred, that of a Gallia Beauty with Malling IX interstock and a vigorous Columbia root which broke off at the graft union in August 1958. This may have been the result of partial incompatibility between the Columbia root system and the Malling IX interstock.

Winter hardness. It was first believed that the Malling stocks were more susceptible to low temperatures than seedling stocks. This has not been the case, however. In fact, many experiment stations report increased hardiness in most of the Malling series when used either as a root or interstock.

Disadvantages of dwarf fruit trees

1. Scion rooting. When the graft union is at or just below the ground level there is always danger of the scion variety taking root. Such rooting will result in the loss of the dwarfing effect. Care should be taken in planting to make sure the graft union is above ground level.

2. Cost. This appears to be a distinct disadvantage particularly for the commercial orchardist. Often two or three times as many trees are required per acre as with the standard types, and each tree often costs twice as much. It is difficult to convince growers that the earlier yields from such trees will more than offset the added cost in establishing the orchard. It is anticipated that as the supply of dwarfing stocks increases, prices will be reduced. They will always be higher than regular trees, however, because of the additional work necessary to produce them.

3. Anchorage. Anchorage is a serious problem particularly with the very dwarf types. Staking or trellising of trees on Malling IX rootstock is required throughout most of their lives. Those on Malling VII may require staking as young trees but not after becoming well established.

4. Incompatibility. The problem of incompatibility is causing serious difficulties particularly in finding dwarf stocks for the stone fruits. While a particular variety, such as peach or apricot, may make an apparently successful union on a dwarf rootstock, the union may be weak and may break later in life. Differences in compatibility exist among the varieties which necessitate further study.

Table 1. Common dwarf stocks for fruit trees

<table>
<thead>
<tr>
<th>Kind of fruit</th>
<th>Rootstock</th>
<th>Interstock</th>
<th>Avg. height at 10 years (feet)</th>
<th>Approx. planting distance (feet)</th>
<th>Approx. no. of years to bearing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apple</td>
<td>Malling IX</td>
<td>Interstock</td>
<td>6 to 8</td>
<td>8 by 15</td>
<td>1 to 3</td>
</tr>
<tr>
<td></td>
<td>Malling VII</td>
<td></td>
<td>12</td>
<td>15 to 18</td>
<td>2 to 4</td>
</tr>
<tr>
<td></td>
<td>Malling II</td>
<td></td>
<td>15</td>
<td>22 to 25</td>
<td>3 to 6</td>
</tr>
<tr>
<td>Seedling</td>
<td></td>
<td>Clark dwarf</td>
<td>12</td>
<td>15 to 18</td>
<td>2 to 4</td>
</tr>
<tr>
<td>Seedling</td>
<td></td>
<td></td>
<td>16</td>
<td>30 to 35</td>
<td>5 to 8</td>
</tr>
<tr>
<td>Pear</td>
<td>Quince A</td>
<td>Hardy or Old Home</td>
<td>10</td>
<td>12 by 16</td>
<td>2 to 4</td>
</tr>
<tr>
<td></td>
<td>Quince B</td>
<td>Hardy or Old Home</td>
<td>8</td>
<td>10 by 15</td>
<td>2 to 4</td>
</tr>
<tr>
<td></td>
<td>Quince C</td>
<td>Hardy or Old Home</td>
<td>6</td>
<td>6 by 15</td>
<td>1 to 3</td>
</tr>
<tr>
<td>Peach†</td>
<td>St. Julien A plum</td>
<td>8 to 12</td>
<td>12 to 15</td>
<td>2 to 4</td>
<td>1 to 3</td>
</tr>
<tr>
<td>Nectarine†</td>
<td>Prunus tomentosa</td>
<td>8 to 12</td>
<td>12 to 15</td>
<td>2 to 4</td>
<td>1 to 3</td>
</tr>
<tr>
<td>Plum, apricot†</td>
<td>Prunus besseyi</td>
<td>6 to 9</td>
<td>8 by 12</td>
<td>2 to 3</td>
<td>1 to 3</td>
</tr>
<tr>
<td>Cherry (sour)</td>
<td>Dwarfrich variety</td>
<td>6</td>
<td>6 by 12</td>
<td>1 to 3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Meteor variety</td>
<td>10 to 12</td>
<td>12 to 18</td>
<td>3 to 5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>North Star variety</td>
<td>8 to 10</td>
<td>10 to 15</td>
<td>2 to 4</td>
<td></td>
</tr>
</tbody>
</table>

* A planting distance of 8 by 15 indicates a hedgerow type of planting, eight feet between trees and fifteen feet between rows. Fifteen to eighteen refers to a range of planting distance.

† Peach, nectarine, plum, and apricot have all been grown on each of the stocks listed. The tree size varies considerably with variety and compatibility of the graft.
FRUITS AND VEGETABLES IN UTAH MARKETS
(Continued from page 35)

cated in cities with a population of 2,500 or less. Chain stores tended to have more desirable appearing displays of fresh fruits and vegetables than did the voluntary chains or the independent stores. The appearance rating of the produce department was highest in the fall when fresh fruits and vegetables were in most abundant supply and lowest in the winter when stores were dependent upon storage supplies and shipments from distant points. The best appearing displays were located in chain stores in larger cities.

Chain stores and stores located in larger cities tended to have more frequent deliveries of fresh fruit and vegetables than did independent stores or voluntary chains or stores located in small towns and villages. Chain stores in larger cities (Salt Lake, Ogden, Provo, and Logan) made less use of refrigeration in the display case. These stores relied upon rapid turnover and frequent deliveries (they had enough volume to insist on frequent deliveries) to keep losses at a minimum and the consumer supplied with high quality produce. Smaller stores, ones located in the smaller towns, and independent stores used more refrigeration. Their volume of sales was not great enough to justify daily or frequent deliveries. These small stores had difficulty keeping a good display of fresh looking fruits and vegetables even with refrigeration. When they removed enough spoiled or old produce to keep an attractive display, their losses were excessive, and if they didn’t remove the old merchandise, they didn’t make sales.

In general, a better appearing, neater looking display can be made on the usual dry non-refrigerated rack than can be put up in the usual refrigerated display case. Spray or wet displays are little used in the retail grocery stores in the state at the present time. If produce moves fairly rapidly, a spray tends to help its appearance but if it moves slowly, it tends to speed decay.

In those stores where some but not enough refrigeration was available, green and leafy vegetables seemed to have first call on the space. Potatoes and dry onions, yams, and similar produce were usually not refrigerated. Fruits were usually non-refrigerated, but cases were found where even bananas were kept in refrigerated display in spite of all the education that has been carried on to the contrary.

All stores did not post prices

By far the most common method of price quotation was on a per pound basis which is the method most preferred. Occasionally per each or per dozen was used. Radishes and green onions were quoted on a per bunch basis while lettuce was sometimes priced per head and celery per bunch.

It is usually considered good practice to post prices but only 45 percent of the independent stores did so while 96 percent of the chain stores and 78 percent of the voluntary chains did so. Only 38 percent of the stores located in towns of 2,500 people or less posted prices while in Salt Lake City 68 percent of the stores posted prices. Consumers find it inconvenient and troublesome to shop in a produce department where the prices are not posted.

The average number of fruit displays per store was 8.4. However, 4 percent of the stores had no fruit displays and 30 percent had less than five. There was an average of 17.4 displays of fresh vegetables per store. As would be expected the number of such displays per store was related to size of city and kind of store. Chain stores and stores located in the cities had the most displays. Five percent of stores located in Salt Lake City had no fruit displays but these were mostly specialized meat markets and it is safe to assume that Salt Lake City consumers had plenty of stores left in which to buy fresh fruits. However 7 percent of the stores located in cities with 2,500 people or less had no fresh fruit displays. These stores were mostly general grocery stores. It is evident that there are some people in the smaller towns that have no access to fresh fruits in the retail store.

Practically all stores offered some vegetables but in many cases the selection was limited to “hardware” items such as potatoes and dry onions.

Small stores with relatively slow turnover have difficulty in keeping an attractive display of fresh fruits and vegetables. Their volume is not great enough to justify frequent deliveries. Refrigerated displays, while helping somewhat, are not the whole answer to the problem. However, these stores could begin to post their prices, remove the produce from the shipping container, and clean up the floor and aisles.

It has been suggested that pre-packaging of the produce would reduce the waste and spoilage in the small retail store. While it is easy to demonstrate that this would reduce the loss due to customer handling of the produce it is doubtful if it would reduce the loss due to slow turnover.

CASH RECEIPTS BY COUNTIES
(Continued from page 34)

were among the first 5 most important commodities as sources of income in only 8 of the 29 counties in Utah. Box Elder County ranks first among the counties in cash receipts from sale of wheat. Cash receipts from sugar beets ranked second among all truck and field crops as a source of income, and sixth among all crops in Utah in 1957. Box Elder County produced more sugar beets than any other county. The relative importance of other commodities as sources of cash receipts in Utah are presented in tables 1 and 2.
Utah County ranked first in cash receipts received in Utah in 1957. These amounted to $16,736,000 or 11.4 percent of the total for the state. Box Elder County ranked a close second as measured by percent of total cash receipts received by farmers. Grand County was lowest with only 0.3 percent of the total cash receipts for 1957 in Utah. The first ten counties as listed in order of importance in the pictorial border accounted for more than 70 percent of the total cash receipts received from the sale of agricultural commodities in Utah.

SPRING PASTURES  
(Continued from page 39)

Cash receipts by counties

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Forage production

The number of seedlings per square foot and pounds of air-dry forage production per acre for intermediate wheatgrass planted in November 1956, and receiving different irrigation treatments are shown in table 1.

It is interesting to note the great improvement in production from a single irrigation the first year. Treatment number 1, without irrigation the first year, produced only 730 pounds of forage per acre the second year even though it was irrigated during the second spring. There was little difference in the number of seedlings between the plot not irrigated the first year and treatment number 2 irrigated only in May of both years. However, development and vigor of the latter plants were much better, resulting in doubled forage production. Increased number of irrigations (treatments 3 and 5) and late-summer irrigation (treatment 6) both proved of value in increasing production. These production figures are for the second year after seeding, and the stands probably have not reached peak production. However, these pastures are ready for grazing the second fall after seeding.

A five-year-old intermediate wheatgrass pasture receiving limited amounts of irrigation water each year yielded 245 sheep days of grazing per acre during the spring of 1958. This pasture was also grazed without damage again in the fall, and is typical for this type of pasture.

MILK AND COFFEE

(Continued from page 43)

Table 3. Consumer beverage preference for meals, 128 restaurant patrons, Utah, 1955

<table>
<thead>
<tr>
<th>Meal</th>
<th>Coffee</th>
<th>Milk</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breakfast</td>
<td>70</td>
<td>24</td>
<td>6</td>
<td>100</td>
</tr>
<tr>
<td>Lunch</td>
<td>44</td>
<td>43</td>
<td>13</td>
<td>100</td>
</tr>
<tr>
<td>Dinner</td>
<td>41</td>
<td>43</td>
<td>16</td>
<td>100</td>
</tr>
</tbody>
</table>

About 80 percent of the patrons were of the opinion milk should be offered at the same price and on the same basis as coffee. If it were, 64 percent said they would drink more milk. About 56 percent of the patrons answering the questionnaires said they would be willing to go out of their way to eat in a restaurant which offered milk priced the same as coffee or included milk with the meal the same as coffee.

Reasons for pricing milk differently than coffee

Restaurant operators were asked why in some cases coffee and not milk is included with full-course meals without extra charge, and why with à la carte dinners, a higher price is sometimes charged for milk than coffee.

Many attempts to justify this practice by pointing to the higher product cost per serving of milk than for coffee. Others say that competition forces it and it is customary in the trade. On this point some operators expressed the opinion that because competitors used coffee as a draw on the same basis and price as coffee. This was done by distributing post card questionnaires among restaurant operators who in turn handed them out to patrons. Of the 750 questionnaires distributed 128 were completed and returned.

More than twice as many patrons returning the questionnaires preferred coffee to milk for breakfast (table 3). Milk was preferred by about the same proportion that preferred coffee at both lunch and dinner time.

About 80 percent of the patrons were of the opinion milk should be offered at the same price and on the same basis as coffee. If it were, 64 percent said they would drink more milk. About 56 percent of the patrons answering the questionnaires said they would be willing to go out of their way to eat in a restaurant which offered milk priced the same as coffee or included milk with the meal the same as coffee.


This publication illustrates and describes more than 150 weeds found in the state. A charge of 50 cents is made for this publication.


This is a survey report of the water supply and use in the three counties. It includes a general description of the area, the present land use, the climate, the surface waters, the underground water, water quality, water use, power, irrigation company operating conditions and water problems, and future use of water in the area.
EFFICIENCY IN IRRIGATING

(Continued from page 45)

servations should be made before irrigation to determine the depth of the root activity and the general dryness of the soil. Careful observation of the crop is also essential. A good irrigator learns to detect symptoms of impending drought well before any real damage results.

An irrigator should also observe the condition of the soil shortly after the irrigation. He can easily detect whether or not he is obtaining adequate penetration of water. Inadequate penetration results in inefficient use of the soil with more frequent applications of water required, and generally less than optimum yields.

It is much more difficult, however, to detect the amount of water being lost through deep percolation. If all of his soil has been wet by an application of water, he is assured that he has applied a sufficient amount, but he has little knowledge of what the excess might have been. He might, however, apply a lesser amount next time and observe the results, and thus learn through observation and experience, how to do the job with less waste.

The amount of water lost by direct evaporation from the soil is not easy to determine. It is highest immediately after an irrigation and decreases gradually as the surface soil dries. After a week or so the rate of loss is small, but in this time, especially during the early period of crop growth when the crop does not shade a large portion of the soil area, the total loss by evaporation between irrigations may amount to an inch of water or more. When fairly heavy applications are applied at infrequent intervals, this may be a small percentage of the total, but where light applications are made frequently, as much as half of the water applied may be lost by direct evaporation from the soil without any benefit to the crop. Actually, little can be done to reduce this loss other than to avoid unnecessary frequent applications. When the crop covers and completely shades the soil, this loss is much less and may be of little significance. In some areas, on high return crops, and where water is costly, it has been found economical to cover the soil between rows with impregnated paper or plastic strips, which aids also in weed control. This is not economical for most agricultural crops.

Losses by transpiration from weeds might be appreciable and can be avoided only by weed control methods. Cultivation for weed control may save appreciable amounts of water, but is generally of little value otherwise from a moisture-saving standpoint.

The overall efficiency of irrigation is the product of the component efficiencies. It is only through some knowledge of these component losses that attention can be focused on those where improvement can be made.

More benefit might be achieved by stressing the losses rather than by emphasizing the efficiencies. It is only through this knowledge that methods and practices can be developed that will decrease the losses and thus increase the efficiencies. It is not sufficient for a farmer to know that his irrigation practice is only 40 percent efficient. It would be more helpful if he knew that he lost 10 percent of the available water in conveyance, another 10 percent by runoff, 30 percent by deep percolation, and of that stored in the root zone, 26 percent by direct evaporation from the soil and by transpiration from weeds. Knowing these component losses, the farmer might decide to:

1. Install a concrete pipe distribution system to reduce his conveyance losses.
2. Change his irrigation methods and re-design the irrigation layout, and to pay more attention to his irrigation practices in order to reduce the runoff and deep percolation losses, and,
3. Reduce the frequency of irri-

SNOW FIELD STATION

(Continued from page 47)

the earlier maturing sorghums have been grown for grain, but none matured favorably at the station.

Many legumes have been tested for hay and pasture. Alfalfa produces the highest yields. Ranger and Buffalo have been the best varieties grown.

A number of grass species have been grown but these need further testing and evaluating.

Several pasture plantings of various mixtures will be made during 1959. These consist mainly of alfalfa and one grass, although mixtures of several grasses with alfalfa are being included. The poor seasonal distribution of water enters seriously into pasture management.

A grass and alfalfa mixture does well until the first part of July after which there is little grass growth mainly because of lack of moisture.

As a result the pastures become practically a straight alfalfa planting. This creates a bloat hazard. Emphasis will be placed on pasture management.

Large grass and legume trials are being planted this year for evaluation and for demonstrational purposes. Barley varieties and corn varieties are being grown for yield comparison.

Information from experiments and demonstrations conducted on the station should materially assist farmers.
CONTRIBUTIONS TO RESEARCH
February 15 to May 1, 1959

National Institutes of Health $28,692 to equip metabolism building and enlarge research on effects of insecticides on health
Hess and Clark Company $5300 to study the use of nitrofurazone in controlling bovine coccidiosis
Vick Chemical Division $2600 for studies of staphylococcosis of turkeys
Upjohn Company $1200 for study of staphylococcosis of turkeys
Abbott Laboratories $1055 for research on embryonic death of cattle
Cache Valley Breeders Association $1000 for research on soil fertility
National Plant Food Institute $1000 for experimental tests with insecticides
Shell Chemical Company $500 for research in the use of fertilizers insecticides and miticides for field tests
California Spray-Chemical Corporation $500 for experimental tests of insecticides
Stauffer Chemical Company Trithion for experimental tests
Velsicol Chemical Company $500 for experimental tests of insecticides
Allied Chemical and Dye Corporation Chlor dane, heptachlor, and endrin insecticides for field tests
Corporation Benite and Flyrac for field tests
Amerohm Products, Inc. 1 gallon Butyroc 118 for experimental tests
American Cyanamid Company Maldion, parathion, and thimet for field tests
Anaconda Company 1 ton treble superphosphate for fertilizer research
Chemagro Corporation 120 pounds Guthion wettable and 4 gallons Systox for experimental tests
Dow Chemical Company 1 gallon EDB emulsion for experimental tests
Naugatuck Chemical 30 pounds of Alonap for experimental tests
Niagara Chemical Division Diphecin for tests on the control of rodents
Pennsalt Chemicals Corporation 20 pounds Fenson for experimental tests
Phillips Petroleum Company 4 tons ammonium sulfate and 4 tons ammonium nitrate for fertilizer tests
J. S. Simplot Company 1½ tons treble superphosphate for fertilizer tests
Columbia Geneva Division 3 tons ammonium nitrate and 1½ tons ammonium sulfate for fertilizer tests
U. S. Steel Corporation 1 ton of 16-20-0 fertilizer for fertilizer tests
Western Phosphate, Inc.

FARM AND HOME SCIENCE