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MORE WATER for southwestern Utah

Through conservation, new development, and elimination of water-loving native vegetation

JAY M. BAGLEY, WAYNE D. CRIDDLE
AND R. KEITH HIGGINSON

Southwestern Utah has reached a stage of development where further expansion for agriculture and industry is dependent on the development of new supplies of water or better use of the existing supplies. Unless the increasing needs of agriculture, industry, and municipalities can be offset by conservation measures and new developments, water problems will become progressively more serious.

Land use

The land area in Iron, Kane, and Washington Counties totals over six and one-quarter million acres, of which about one percent is under cultivation. However, this one percent is extremely important to the economy.

All the irrigated land areas in the three counties were mapped in 1954 by the Utah State Department of Employment Security and the Utah Committee on Industrial and Employment Planning initiated a comprehensive hydrologic study in Iron, Kane, and Washington Counties. The purpose of this study was to analyze the water resources of the area to provide information whereby these resources might be used more fully by the people and by industry interested in locating there. The Utah Agricultural Experiment Station in cooperation with the Agricultural Research Service of the U.S. Department of Agriculture made the study. This article is a brief summary of some of the major problems investigated. A detailed report will be issued shortly.

JAY M. BAGLEY is assistant professor of irrigation and drainage engineering, Utah State University. WAYNE D. CRIDDLE is State Engineer and until July 1, 1957, professor of irrigation and drainage engineering, USU. R. KEITH HIGGINSON is a graduate and former research assistant at USU, now an engineer in the office of the State Engineer.

and classified during 1955 and 1956, according to crop growth and adjacent native vegetation which receive water in excess of direct precipitation. Agricultural land uses are summarized in table 1.

Drainage pattern

Nearly all of Washington County is in the Virgin River Basin which joins the Colorado River at Lake Mead. Most of Kane County drains directly into the Colorado River. Except for a small area in the southeast portion, all of Iron County is located within the boundaries of the Great Basin.

Precipitation and runoff

The ultimate source of all water available for irrigation or other purposes is precipitation. Over
the three counties of study, total precipitation amounts to about 6½ million acre feet each year. Precipitation on the "Arizona Strip" draining into the Virgin River as it flows through Utah would add another million acre feet. The normal annual precipitation falling on

At the far left is a view of the recently completed Kolob Reservoir with capacity to store 5,586 acre feet of water for use in lower Virgin River Valleys. Pictures at left and the bottom of the page show the wide river bed and extensive areas of non-economic vegetation along the banks of the Virgin River in the vicinity of St. George. The two pictures below show other areas of cattails and tules along the river bank and in low lying areas. For each acre of this type of vegetation eliminated, water is available for two acres of irrigated crops in the tri-county area is shown in table 2.

Only a small part of the rain or snow falling on the tri-county area is drained from the land on which it falls. Direct evaporation and transpiration from the land accounts for most of the precipitation. For example, the average precipitation over the entire Virgin River drainage above St. George is 12.99 inches. This amounts to 2,640,400 acre feet each year. Yet, the mean annual historical flow of the Virgin River near St. George, including estimated underflow, is only about 7 percent of the amount of precipitation received. Ninety-three percent is returned to the atmosphere by evaporation and transpiration.

Slightly more than one percent is consumed from irrigation water applied to agricultural crops in the drainage basin. Runoff from the many streams in the entire tri-county area indicates that water yield is in the neighborhood of 6 percent of the total average precipitation. This is used for irrigation, consumed by native vegetation, or flows out of the area.

Storage now limited

Although irrigated areas drawing water directly from a stream are commonly unable to satisfy demands during periods of low flow, many of these streams become raging torrents after heavy rains. They cause damage to diversion systems, adjacent lands, and roads. Reservoirs for stabilizing the flow of natural streams are badly needed for further substantial irrigation development in the tri-county area.

(Continued on page 49)

| Table 1. Summary of agricultural land uses in Iron, Kane, and Washington Counties of Utah, 1955-56 |
| Drainage area | Irrigated crops | Fallow | Roads and farmsteads | Native vegetation | Totals |
| Virgin River Basin | 17,504 | 3,237 | 1,848 | 5,830 | 28,418 |
| Great Basin | 34,536 | 15,003 | 3,555 | 106,470 | 159,564 |
| Colorado River Basin | 2,169 | 304 | 311 | 154 | 2,938 |
| Totals | 54,209 | 28,544 | 5,714 | 112,454 | 190,920 |
| *Areas of native vegetation consuming varying amounts of water in excess of direct precipitation |

| Table 2. Summary of normal annual precipitation occurring in Iron, Kane, and Washington Counties of Utah |
| Drainage area | Area | Average precipitation |
| | | sq. mi. | acres | inches | acre ft. |
| Virgin River Basin* | | 3,820 | 2,444,800 | 12.99 | 2,640,400 |
| Great Basin | | 3,226 | 2,064,640 | 12.44 | 2,134,700 |
| Colorado River Basin | | 4,091 | 2,618,240 | 12.60 | 2,748,140 |
| Total or mean | | 11,137 | 7,127,680 | 12.68 | 7,523,240 |
| *This includes the Fort Pierce wash drainage in Arizona. |
Illustrations show the great variety of modern machinery found on Utah farms today. (Pictures courtesy of Bullen Farm Machinery, Logan)

Since 1940 farmers of the United States have invested in machinery in amounts second only to their investment in real estate. Between 1940 and 1955 machinery and equipment increased from 10.5 percent of total physical assets of farms to 15.1 percent. This represents an increase of nearly 50 percent or about 3 percent per year.

Mechanized farms are the counterparts of the highly advanced industrial and business establishments of the community. Mechanization has brought about a higher output per farm worker over the past few decades and more recently an increasing investment in agricultural equipment has substantially increased each worker's productivity (fig. 2). The machine, when incorporated into the operations of individual farms, tends to reduce the amount of labor required in relation to production. In the past fifteen years, however, prices of farm machinery have doubled and farm wages have quadrupled. The real problem facing farmers, therefore, is how far can they go in substituting machinery for labor.

Investment in machinery has expanded

Farmers' purchases of machinery have been relatively large for more than 10 years, and their inventories of tractors and other machinery have steadily increased. Since 1940 numbers of farm tractors and trucks have tripled. Numbers of grain combines, field forage harvesters, and pickup balers have increased percentage-wise substantially more than numbers of tractors.

Utah farmers have generally followed the national trend in machinery investment. A study made in Cache and Sanpete Counties showed an average investment of $6,120 per farm, or 12.5 percent of total farm investment, in machinery.

In 1850 animals contributed 79 percent of farm labor energy, humans 15 percent, and machinery only 6 percent. It is now estimated that machines do 92 percent of the farm work. Management of and investment in machinery become one of the important phases of farm management.

Prosperous conditions on Utah farms during the 1940's, together
with shortages of labor during the war period, provided an incentive for farmers to adopt changed production methods and a high rate of mechanization resulted. Farmers today need more elaborate and specialized equipment. This means greater investment, both in capital outlay and cash operating expense.

How much power and machinery should a farmer have? What size should the power unit be? How many specialized machines should be added? These and many such questions farmers must answer in order to determine what level of machinery investment is most profitable for their particular farm. Minimum machine costs per acre are not a goal of farm management as maximum profits seldom come through lowest possible machine cost or investment per acre. By the same analysis minimum use of labor does not always mean minimum costs. The problem is not one of using all labor or all machinery, but of determining the combination of the two that gives lowest cost per acre or unit of product.

Farm machinery costs can be classed as fixed or variable. Fixed costs are those that involve machine ownership and variable costs are those factors related to machine operation. Fixed costs would be such things as (1) depreciation, (2) interest on investment, (3) insurance, (4) taxes, and (5) shelter. Variable costs include (1) repairs, (2) fuel, oil, and lubrication, (3) supplies, and (4) labor. Generally speaking fixed costs or costs of ownership are independent of the annual use of the machine, while variable costs are just opposite.

Where do costs originate?

In order to maximize your income you must be able to determine costs of owning and operating different machines. A forage harvester is a good example for figuring these costs on an expensive farm machine. As is the case with nearly all machines, it is necessary to include the power costs and the labor costs of the operator. If the power unit and farmer were not performing this operation, they would be free to do some other work on the farm.

The importance of the various items of cost in connection with a forage harvesting operation is shown graphically in fig. 1. Labor is the biggest item and represents 29.0 percent. Depreciation on investment represents 28.3 percent, power 15.8 percent, interest on investment 9.4 percent, fuel 5.4 percent, and all others 12.1 percent.

The greatest possible saving in costs is effected by prolonging the useful life of the machine, spreading the first cost over more years of service. Proper care and adjustment adds nothing or little to costs.

Studies and surveys have shown a wide variation in the expected life of a machine. Some farmers are getting considerably more use out of their machines than others. This difference in the useful life of a machine is the real secret of low cost machine operation. Timely and adequate repairs, thorough and proper lubrication, and good judgment in the operation of machines are important factors.

Can a farmer afford machinery?

Two general capital positions that affect level of individual farm investment can be recognized: (1) Where available capital is limited and (2) where available capital is not a limiting condition.

If capital is limited all alternative uses of the capital should be examined before a farmer decides to buy a machine. Capital should be put to some other use in the business if it promises a greater return than adding more or better machinery. Some machinery such as plows, harvesters, cultivators, and other basic tillage tools, as well as a power unit, can justifiably be owned in most situations. Justifying the ownership of harvesting machines is more difficult because these require a greater outlay of capital and are used less during the year.

For harvesting machines such as combines, hay balers, and forage
harvesters, which require a high initial investment and are usually more readily available on a custom basis, the farmer with limited capital should apply the opportunity cost principle to his decision about ownership. By this principle he compares returns from the machine with the returns that can be obtained if the funds were invested in fertilizer, livestock, commercial feed, or other possible uses. This process may be illustrated as follows: After figuring all costs, a farm operator with 60 acres of small grain to harvest annually, estimates that the cost of harvesting with his own machine is $4.00 per acre, while custom hiring of a combine is estimated to cost $5.00 per acre. Ownership would save $1.00 per acre or a total of $60.00. This could be regarded as the ownership earning of a combine.

On a machine costing $1,800.00, a return of $60.00 is about 3.3% percent on investment. If he can invest his limited money supply in any way to return more than 3.3% percent he should not invest in a combine. For instance, if the $1,800.00 could be invested in 7 dairy cows and his return would be more than $60.00, the farmer with limited capital should invest in livestock and hire the combine harvesting done.

When ample money is available, should machinery investment be made?

If available capital for machinery investment is not limited and desirable opportunities for greater investments do not exist, the decision on ownership of a machine can be made on the basis of whether or not ownership will add to net income. Here a budgeting method can be used to help arrive at a decision. For example, let us assume that a farmer has 40 acres of hay and is debating whether or not to buy a pickup baler. He has enough power and labor to handle the operation. We can set up the following budget.

Cost of ownership:

| Annual fixed costs | $240.00 |

Operating costs for

| 40 acres @ $6.00 | 240.00 |

Total additional cost $480.00

Costs by custom hire:

| 40 acres of hay cut 3 times at 3 tons per acre custom baled @ $5.00 per ton | 600.00 |

Net difference from ownership $120.00

In this case buying a baler would be profitable. Not only would it add to farm income, but it would reduce risk due to any lack of timing the operation.

The "break even" method of analysis

Another method of analysis that might be applied to a situation of unlimited capital for machinery investment is the break-even method. By this method the farmer calculates the number of acres necessary to cover the expenses of the machine. We apply this method to a field forage harvester as an example. The question is how many acres must be harvested in order to justify ownership from a standpoint of maximizing net income. To determine the break-even point, we must estimate total annual cost and total operating cost per acre.

(Continued on page 50)
BARLEY for your laying hens

J. O. ANDERSON
ROBERT K. WAGSTAFF

It's no secret that egg producers in the intermountain area have had a difficult time making a profit on their operation during recent years. Everyone of them is looking for cheaper ways of producing eggs. Grains make up 75 to 80 percent of the ration of a laying hen. Naturally, when poultrymen see barley prices only 60 to 80 percent lower as much as wheat, corn, and milo prices, they are asking if they can feed more barley. Most of them have always fed some barley to their hens; but only a few have fed rations in which barley was more than one-half of the grain in the ration. What they would like to know is how much barley can be fed laying hens without decreasing production, and how much barley is worth in comparison to other grains. Experiments conducted at Utah State University show that laying hens will produce well on diets containing large amounts of barley. You should feed barley if you want maximum profits.

Dr. JAY O. ANDERSON is associate professor of poultry husbandry; ROBERT K. WAGSTAFF is a graduate assistant.

FOR JUNE 1958

MR. WAGSTAFF FEEDING HENS IN NEW CAGE HOUSE AT THE UTAH STATE UNIVERSITY POULTRY FARM

Tests show that laying hens will produce well on diets containing large amounts of barley. You should feed barley if you want maximum profits.

Droppings of chicks fed barley diets (right) are more sticky and voluminous than those from chicks fed corn (left).

(Continued on page 51)
No one variety of alfalfa is best for all dryland areas of the state. Elevation, precipitation, and many other factors affect yields. The Utah Agricultural Experiment Station, the U. S. Department of Agriculture, and cooperating farmers in various parts of the state have tested many varieties for dryland planting over a period of 5 years in 16 locations where precipitation ranges from 6 to 33 inches a year and with elevations from 4,300 to 10,200 feet.

While these tests do not give the final answers, the findings should be of interest to farmers and ranchers and to government agencies interested in range reseeding.

Difficulties of growing alfalfa on dryland

Difficulties that restrict the use of alfalfa for range planting are many:

1. Range reseeding is generally done in the fall. Alfalfa planted at this time is likely to winterkill.

2. Alfalfa is at times more palatable to livestock than range grasses, and animals eating too much alfalfa are likely to bloat. In small fenced areas, bloat is kept under control by proper management. This is a more difficult problem on large areas of range where production is relatively low and would lead to overgrazing on areas reseeded to a mixture containing alfalfa.

3. Maintaining a stand of alfalfa under dry range conditions is a problem. However, low-growing types such as Nomad may be able to maintain themselves longer than the standard varieties. Longevity may be a better basis of variety evaluation under range conditions than yield. Nomad excelled in ability to survive gopher root cutting, but no variety is resistant to rabbit damage. During the next several years persistence of the different varieties should become more evident.

4. So far, none of the varieties tested has shown superior resistance to drought. This does not mean that varieties do not differ.

Fig. 1. Map of Utah with areas shaded to indicate less than 10 inches of annual precipitation (Yearbook of Agriculture 1941)
Numbers refer to alfalfa variety tests in Table 1

Fig. 2. Lateral roots of Nomad alfalfa regenerate after the tap root has been cut by gophers

Fig. 3. Both these alfalfa plants were cut by gophers. The Nomad plant at the left survived because it was able to grow from a lateral root while the plant at the right died.
Dryland production of alfalfa is limited by moisture, rodents, and problems of seeding. Where stands are established alfalfa increases the nutritive value of range forage.

M. W. PEDERSEN AND D. R. McALLISTER

in this respect, or that drought-resistant varieties cannot be selected and bred, but it will require a longer test period.

Varieties for dryland planting

Where gophers are not a problem and moisture is sufficient for considerable regrowth to occur, Ranger appears to be as good a variety as any available. Where regrowth is limited by lack of soil moisture and at elevations above 6,500 feet, Ladak is superior. However, Ladak is susceptible to bacterial wilt.

Nomad, first discovered in Oregon several years ago, has a tendency to spread under certain conditions. The private seed company promoting this variety reports it to be better than other varieties as a pasture alfalfa under dryland conditions. While in the tests reported here, it showed resistance to root cutting because of its ability to regenerate from lateral roots, only in the plot at Fillmore was Nomad superior to other varieties (fig. 2 and 3). The variety is generally low yielding when grown for hay.

Elevation and precipitation

Stands of alfalfa were satisfactorily established where annual precipitation was as little as 10 to 12 inches at elevations of 4,500 feet or more. Dryland production will be governed by precipitation. At lower levels of precipitation the yield of forage will not be increased by planting alfalfa in a reseeding mixture, but the quality of the forage should be improved.

How the tests were made

All the tests reported here were established by drilling the alfalfa seed into prepared seed beds. Crested wheatgrass was planted in alternate rows in the plots at Cedar Fort, Fillmore, Nephi, and Blue Creek on land suitable for wheat (fig. 1). At Rosebud, Grouse Creek, Park Valley, and Yost the alfalfa was seeded in the spring following fall seeding of crested wheatgrass on land plowed out of sagebrush the previous summer. The Snowville plot was planted for hay on winter wheat land. At Wights Valley the alfalfa varieties were seeded across a series of wheatgrass strains. Grass was not used at Logan or Ephraim. The al-

(Continued on page 56)

Table 1. Summary of dryland alfalfa nurseries in Utah — 1952-1956

<table>
<thead>
<tr>
<th>No.</th>
<th>Location</th>
<th>Annual precipitation</th>
<th>Elevation</th>
<th>Degree of success</th>
<th>Best varieties</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Grouse Creek</td>
<td>10-11</td>
<td>6,000</td>
<td>fair</td>
<td>little difference</td>
</tr>
<tr>
<td>2</td>
<td>Yost</td>
<td>10-12</td>
<td>5,000</td>
<td>fair</td>
<td>little difference</td>
</tr>
<tr>
<td>3</td>
<td>Rosebud</td>
<td>6-8</td>
<td>4,500</td>
<td>failure</td>
<td>little difference</td>
</tr>
<tr>
<td>4</td>
<td>Park Valley</td>
<td>10-11</td>
<td>5,000</td>
<td>failure</td>
<td>little difference</td>
</tr>
<tr>
<td>5</td>
<td>Snowville</td>
<td>10-11</td>
<td>4,500</td>
<td>good</td>
<td>little difference</td>
</tr>
<tr>
<td>6</td>
<td>Bluecreek (1)</td>
<td>10-12</td>
<td>4,300</td>
<td>good</td>
<td>Ladak</td>
</tr>
<tr>
<td>7</td>
<td>Wights Valley</td>
<td>16</td>
<td>5,000</td>
<td>good</td>
<td>Ranger</td>
</tr>
<tr>
<td>8</td>
<td>Logan</td>
<td>16</td>
<td>4,500</td>
<td>good</td>
<td>Ranger</td>
</tr>
<tr>
<td>9</td>
<td>Cedar Fort</td>
<td>14</td>
<td>5,000</td>
<td>good</td>
<td>Ranger, Ladak</td>
</tr>
<tr>
<td>10</td>
<td>Mud Springs</td>
<td>13</td>
<td>6,500</td>
<td>good</td>
<td>little difference</td>
</tr>
<tr>
<td>11</td>
<td>Cottonwood Spring</td>
<td>12</td>
<td>7,000</td>
<td>good</td>
<td>little difference</td>
</tr>
<tr>
<td>12</td>
<td>Ephraim</td>
<td>Major's flat</td>
<td>18</td>
<td>7,100</td>
<td>good</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bluebell flat</td>
<td>30</td>
<td>9,000</td>
<td>good</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Summit</td>
<td>33</td>
<td>10,200</td>
<td>good</td>
</tr>
<tr>
<td>13</td>
<td>Nephi</td>
<td>12-13</td>
<td>5,300</td>
<td>good</td>
<td>Buffalo, Ladak</td>
</tr>
<tr>
<td>14</td>
<td>Fillmore</td>
<td>14</td>
<td>5,400</td>
<td>good</td>
<td>Nomad</td>
</tr>
</tbody>
</table>

*Numbers refer to locations in figure 1.
High quality alfalfa may be partial answer to the problem of an economical feed for Utah swine

HYRUM STEFFEN, JAMES A. BENNETT
AND JAY RISENMAY

The greatest obstacle to a larger and more profitable swine industry in Utah is the lack of an economic feed supply. Utah is well situated with respect to climate and market. Although the average Utah swine grower doesn’t have the know-how in swine production of his more experienced competitor in the corn belt, this limitation should not be insurmountable.

Swine require large amounts of concentrates and these are relatively expensive in Utah. Besides, swine must compete locally with well-developed poultry and dairy industries, both of which are heavy users of concentrates. In order to provide feed for an expansion in hog numbers, more efficient use must be made of the feeds now available for swine. Also the supply of suitable locally-produced feeds must be increased.

Greater use of alfalfa

Greater use of high quality alfalfa, which can be produced in Utah, may offer a partial solution to the feed problem. This excellent roughage should be included in dry lot rations of growing fattening hogs at a level of about 10 percent. It furnishes certain vitamins and unidentified nutrients which swine require in their diet. Because of its high fiber content, which is difficult for swine to digest, amounts in the ration much above 10 percent have not been recommended in the past.

Research findings on use of alfalfa have varied

Experiment stations have varied in their findings on the value of high alfalfa levels in rations of growing fattening pigs. In 1949 and 1950, Dr. Lorin E. Harris and others at the Utah Agricultural Experiment Station included different levels of alfalfa meal ranging from zero to 33 percent in swine rations. At levels above 12 percent the gains of the pigs decreased rapidly. Efficiency of feed use was good up to a level of 6 percent alfalfa meal. Beyond this, efficiency was poor and the added alfalfa meal had practically no effect in reducing the amount of concentrates needed to produce a hundred pounds of gain. The alfalfa meal used in this test was of low quality and contained 34.6 percent fiber and only 13.8 to 15.1 percent protein. The rations were not pelleted and did not contain an antibiotic or vitamin B12 supplement.

Experiment station workers in Nevada tested alfalfa meal in the rations of growing fattening swine in amounts slightly over 50 percent of the diet. In a study using alfalfa meal of excellent quality, they found that pigs getting 30 percent alfalfa gained nearly as rapidly as those receiving 10 percent. Feed efficiency was also good at the 30 percent level. Pelleting a 50 percent alfalfa ration increased the rate of gain 0.2 pound daily and saved about 140 pounds of feed in producing 100 pounds of gain.

In a later study the Nevada workers, using alfalfa meal of lower quality, obtained somewhat poorer results at levels of 30 percent or above. As the amount of alfalfa meal in the ration increased, the rate of gain, dressing percentage, and depth of back fat decreased. The use of an antibiotic in this study improved rate and efficiency of gain even at high levels of alfalfa.

Experiments at USU

During the summers of 1954 and 1955, experiments were performed by the Utah Agricultural Experiment Station comparing levels of 10, 20, and 30 percent alfalfa meal in the rations of growing fattening swine. Twenty-four pigs, half barrows and half gilts, were used in each experiment. All the pigs were from a cross of Duroc and Yorkshire breeds. The pigs were grouped initially according to sex and weight and then randomly assigned to the different ration treatments. In both experiments, two lots of four pigs per lot, containing two barrows and two gilts received each ration. Before go-
ing on test, all the pigs were vaccinated for cholera, wormed with sodium fluoride, and sprayed with a lindane solution for control of lice.

The three rations used were formulated initially as indicated in Table 1 with alfalfa meal replacing barley at the higher levels. An effort was made to have the same amounts of digestible protein, calcium, and phosphorus in each ration. As the pigs reached 100 pounds body weight, the protein content of their rations was reduced approximately 2 percent. All rations were pelleted and self fed. Pigs were housed in the swine barn at the Utah State University and had access to outside cemented runways. Self feeders were kept inside the barn where it was shady and fairly cool. Fresh drinking water was available at all times.

During the experiments all pigs were weighed every two weeks until they neared market weight at which time they were weighed every week. As the pigs reached approximately 210 pounds they were removed from their pens and a final weight was obtained without a prior shrink. In experiment 1 all

(Continued on page 50)

Table 1. Beginning rations fed to growing fattening pigs in experiments 1 and 2

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>Percent in ration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sun-cured alfalfa meal</td>
<td>10.0  20.0  30.0</td>
</tr>
<tr>
<td>Ground wheat</td>
<td>25.0  25.0  25.0</td>
</tr>
<tr>
<td>Ground barley</td>
<td>55.1  45.3  35.5</td>
</tr>
<tr>
<td>Meat scraps (50% protein)</td>
<td>5.0   5.0   5.0</td>
</tr>
<tr>
<td>Soybean meal (41% protein)</td>
<td>3.1   3.3   3.5</td>
</tr>
<tr>
<td>Salt</td>
<td>0.5   0.5   0.5</td>
</tr>
<tr>
<td>Aurofac*</td>
<td>0.5   0.5   0.5</td>
</tr>
<tr>
<td>Ground limestone</td>
<td>0.8   0.4   .</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td><strong>100.0</strong> <strong>100.0</strong> <strong>100.0</strong></td>
</tr>
</tbody>
</table>

Chemical analysis, experiment 1

| Crude fiber                    | 8.65  8.54  12.1  |
| Crude protein                  | 14.9  15.8  16.8  |
| Calcium                        | 1.27  1.09  1.20  |
| Phosphorus                     | .49   .48   .48   |

Chemical analysis, experiment 2

| Crude fiber                    | 6.9   7.8   10.3  |
| Crude protein                  | 15.4  15.8  16.7  |
| Calcium                        | 1.14  1.16  1.20  |
| Phosphorus                     | .54   .54   .52   |

*Contained 1.8 grams of aureomycin and 1.8 milligrams of vitamin B, per pound.
TALL WHEATGRASS
offers promise in the reclamation of saline soils

IN every valley of the state are lands which are not cultivated because of high water tables or salinity, or both. The productivity of these lands is low. In many instances it is not profitable to reclaim such soils but it may be worthwhile to plant a salt and alkali-tolerant grass such as tall wheat.

Characteristics

Tall wheatgrass (*Agropyron elongatum*) is the most promising of the forage plants to grow on saline soils. Of all the grasses we have tested it is the best adapted to the adverse conditions found on such lands. It is tolerant to salt and can withstand considerable drought and cold. It can also withstand some flooding – more than orchard, intermediate, or crested wheatgrass, but less than reed canary grass or tall fescue. It is a coarse, stemmy, non-lodging, late maturing bunchgrass that grows from 2 to 7 feet tall. It is fairly palatable when cut or grazed in the early stages of growth but it should not be compared with such grasses as orchard or brome. On the poorer lands it is often slow to become established after planting. The seeds are large and the plants usually produce an abundance of seed when allowed to

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DR. HOWARD B. PETERSON is head of the Department of Agronomy. Much of his research has dealt with the reclamation of saline soils.

FARM AND HOME SCIENCE
mature. It can be grazed early in the season and then allowed to produce seed. When grown on the poorer land it often improves the physical condition of the soil. The plant in fig. 1 was grown on poor soil; notice how granular the soil has become within the root zone.

Establishing new seedings

Land to be planted should be relatively free of saltgrass and other weeds. It is usually desirable to plow the land and plant an annual for two seasons before seeding a perennial. The growing of an annual allows for cultivation before and after the crop, thus reducing the amount of weeds and saltgrass. It is usually not advisable to clean cultivate the land for a season unless the salt content is too high to permit the growing of an annual. Where a crop is not grown, the salt will move to the surface and concentrate during the summer.

The concentration may then be too great to establish the crop. For the more adverse conditions kochia may be the best possible annual. For a less saline condition sweet clover or hubam clover does as well. Barley can be grown if the land is not wet and the salt content is not over a conductivity of about 12 (12 ECex10³). Farmers can obtain information on the salt content of their soil from the Soil Testing Laboratory at the Utah State University, Logan.

Planting should be done as early as possible in the spring or so late in the fall that the seeds will not germinate until the following spring. Late summer plantings, after the hot season is past, are desirable when water is available for irrigation. Plantings from seedings made by September 1 are usually large enough to survive the winter.

Furrow plantings are best

It is far better to plant in the bottom of furrows than on beds or level land. In Utah many successful plantings have been made in the bottom of furrows where the moisture is more favorable, the salt concentration less, and the seedlings are protected. Where it is possible to irrigate in furrows the seedlings should be made on the edge of sloping furrows as shown in figure 2. The staff at the U. S. Salinity Laboratory has found the sloping furrows far superior to those of regular shape. Seeds so placed do not get covered too deeply, or crusted over as when in the bottom of the furrow. When seeding is done on beds the seeds are in the soil area of greatest salt concentration.

The sloping furrows can be made by using a shoe (fig. 3). This is constructed by bolting or welding a wing on a furrowing shoe. Running the furrows from east to west with the sloping side of the bed on the south side of the furrow bottom has some advantages over running north and south or placing the sloping side on the south exposure. The spacing of the rows is dependent on the equipment to be used and whether or not there is to be irrigation or cultivation. Where cultivating or furrow irrigating, 22 to 24 inch rows are usually most convenient. Even where no tillage operations are to be performed 14 inch furrows are a minimum.

In many instances on uneven land it is possible to obtain water from a drain, a pond, or the regular irrigation system and sprinkle a seeding once or twice while establishing a stand. After it is established the crop will grow on the natural rainfall and moisture from a shallow water table.

Under the most adverse saline conditions we have been successful in planting tall wheat on sloping furrows, mulching lightly with manure, and sprinkle irrigating to establish the crop. Many of our farmers are using combinations of such methods to establish a grass crop on otherwise nearly worthless land.
If you have dryland where the rainfall averages only about 12 inches and you plan to grow grass seed, limit your enterprise to crested wheatgrass. Pubescent and intermediate wheatgrasses show promise for early spring forage but not for seed production. These recommendations are based on studies conducted on tall, intermediate, pubescent, and crested (standard strain) wheatgrasses since 1948 at the Nephi Dryland Field Station. Crested was the only grass that produced satisfactory seed yields under the climatic conditions existing at the station. It also has value as an early spring forage. Pubescent and intermediate produced early spring forage, but not seed.

The experiment initiated in 1948 consisted of four wheatgrasses seeded in solid stands, 30-inch rows, and 48-inch rows. Three rates of nitrogen fertilizer were also tested.

A new planting of the four wheatgrasses was made on October 31, 1953, at 3, 4, and 6 foot spacings. Stands the following spring were excellent, but some seedling mortality occurred, especially with crested during the hot summer months. Crested was slower in starting growth in the early spring following fall planting than the other grasses. It was apparent from this and other studies that it is more difficult to obtain good stands of crested than of the other three.
GORDON A. VAN EPPS is assistant professor of agronomy. He is stationed at Snow College and is now in charge of the research at the Nephi Dryland Station. DR. W. H. BENNETT is now assistant director of the Extension Service, but was formerly associate professor of agronomy. He was in charge of the earlier research with grasses at Nephi. This research is reported in bulletin 271, “Fifty years of dryland research at the Nephi Field Station.”

* Seed yield too low to harvest

The results indicate that annual applications of one hundred pounds of nitrogen per acre are too high for the grasses under the conditions of limited available moisture. The applied nitrogen stimulated vegetative growth which exhausted

For June 1958
Milk is generally recognized as "nature's single most perfect food." It contains about 100 different nutrients including a long list of vitamins, minerals, fats, sugars, and high-quality proteins. Yet, almost one-fourth of the adults in Utah do not drink it. Milk is drunk by some members of the family and used in cooking, however, in virtually every household.

Personal interviews with 1,200 adults in Utah in 1955 showed that 77 percent drank milk compared with 23 percent who did not. Most of those drinking milk consumed 2 or 3 glasses per day (fig. 1). The proportion that drank milk varied from a high of 85 percent of those from 21 to 30 years of age to a low of 70 percent of those over 50.

Of the 1,200 persons interviewed, 93 percent were housewives and 7 percent were male heads of households. Eighty-nine percent were of urban or nonfarm rural families and 11 percent were of farm or part-time farm families. The average number of members per household was 4.0. Nineteen percent of the families had an annual income of less than $3,000, 57 percent had from $3,000 to $5,000, 18 percent had from $5,000 to $7,500, and 6 percent had more than $7,500.

Milk consumption

Results of the interviews show that the adults who drank milk consumed an average of 2.5 glasses per day, or about 3½ quarts per week. They also show that as people grow older, there are not only fewer who continue to drink milk, but those who do, consume less. Those from 16 to 20 years of age drank an average of 2.7 glasses per day compared with 2.3 glasses for those over 50.
RONDO A. CHRISTENSEN is assistant professor of agricultural economics. He joined the staff about a year ago. The basis of this article is a survey made in 1955 by Dr. Wells M. Allred, former member of the agricultural economics' staff, of 1,200 representative Utah households in 19 counties and 51 communities.

Not all fluid milk appears on the table as milk; part of it is used in cooking. The average amount consumed per person for drinking and cooking was about 4.0 quarts per week for the families using milk.

As would be expected, farm families consume more milk per person than urban families, about 25 percent more. Farm families consumed an average of 4.9 quarts per week per person compared with 3.9 quarts for urban families. The proportion drinking milk and the amount consumed per person was about the same for male and for female consumers.

About 33 percent of the families in the study had increased their consumption of fluid milk during the previous year, while 9 percent had decreased theirs. The remainder had continued to consume about the same amount. Most of the increases and decreases in consumption were the result of changes in family size and ages of the children in the family. Total consumption of fluid milk varies little from year to year.

Most of the persons interviewed appreciated the important nutritional aspects of milk and had favorable attitudes toward drinking it. They thought that adults should drink from 2 to 3 glasses per day and that teen-agers and children should drink about four glasses per day. This compares favorably with recommendations by nutritionists who say that adults should daily use 2 or more cups, that teen-agers should use 1 quart or more, and that children should consume 3 to 4 cups. Calcium needs are considered chiefly by nutritionists when they figure the amounts of

The survey showed that:

- About 23 percent of Utah adults do not drink milk.
- About 4.0 quarts of milk are used per week per person for drinking and cooking by Utah families.
- Adults who drink milk consume an average of 2.5 glasses per day, or about 3.5 quarts per week.
- As people grow older fewer continue to drink milk, and those who do, consume less.
- Farm families consume about 25 percent more milk per person than urban families.
- "Dislike the taste" is the main reason given by adults for not drinking milk.
- About 45 percent of the families have most of their milk delivered, 40 percent buy at stores, 10 percent produce their own, and 5 percent buy from neighbors.
- Quality of products sold, good service, and convenience are the three main reasons why families having milk delivered prefer the dairy from which they are buying.
- About 73 percent of those who buy milk at stores always buy the same brand. Quality of milk and habit are the main reasons for doing so.
milk to include in daily food for good nutrition.

Reasons for not drinking milk

A large proportion of the 272 persons who did not drink milk believed that adults should drink milk despite the fact that they did not drink milk for themselves. Their reasons for not drinking milk reflected mainly unfavorable personal attitudes which had been developed over time. Dislike for the taste was the main reason given. Slightly more than half did not drink milk for this reason. A smaller number said that medical reasons prevented them from drinking it. Others did not drink milk because they were overweight or thought milk had too many calories. Actually milk is a basic food in most recommended low-calorie diets. Some did not think adults needed milk, others preferred coffee and drank it in preference to milk, and a few thought the price was too high (table 1).

Approximately three-fourths of the 1,200 individuals surveyed believed that their family was using all the milk that it required and that there was nothing which limited their use of milk. The presence of this attitude among such a large number indicates the difficult merchandising problem which confronts the dairy industry in increasing the use of milk. It is difficult to get consumers to use more of a product when they are convinced that they are using all they need.

Type of milk used

Most families were using pasteurized whole milk, but a significant proportion, 15 percent, were using raw whole milk. Four percent were supplementing their use of whole milk with skim milk. In addition, about 18 percent of the families were supplementing fluid milk with powdered milk. At the time of the survey instant dissolving powdered milk had been on the market only a short while. Since that time both the number of families using it and the amount consumed per family have increased significantly both in Utah and throughout the United States. For instance the proportion of families buying powdered milk in the Salt Lake City area increased from about 19 percent in 1953 to 36 percent in 1957, according to the 1957 Consumer analysis of greater Salt Lake City published by the Newspaper Agency Corporation.

Source of milk

Survey results show that almost as many families in Utah buy fluid milk at stores as have it delivered. Forty percent of the families studied bought most of their milk at stores compared with 45 percent who had it delivered. There is still a sizable proportion who get their milk straight from farm herds or family cows. Ten percent produced their own and 5 percent purchased milk from neighbors who had cows.

Throughout the nation, particularly in the more densely populated areas, home delivery of milk is gradually giving way to purchasing milk at stores. Factors which have

<table>
<thead>
<tr>
<th>Reason</th>
<th>Number of adults</th>
<th>Percent of adults</th>
</tr>
</thead>
<tbody>
<tr>
<td>Don’t like the taste</td>
<td>142</td>
<td>52</td>
</tr>
<tr>
<td>Medical reasons</td>
<td>47</td>
<td>17</td>
</tr>
<tr>
<td>Overweight or too many calories</td>
<td>30</td>
<td>11</td>
</tr>
<tr>
<td>Adults don’t need milk</td>
<td>22</td>
<td>8</td>
</tr>
<tr>
<td>Drink coffee instead</td>
<td>21</td>
<td>8</td>
</tr>
<tr>
<td>Price too high</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Other</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>272</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>
contributed to this trend include the growth of cities, the increased popularity of homogenized milk, the use of lightweight, non-returnable paper containers, the increased differential between store and delivered prices, changes in the mode of family buying, and aggressive sales promotion by chain stores and retail supermarkets. These factors have not combined in such a way, however, to cause the same trend in Utah. In fact in the Salt Lake City area, Utah’s largest population center, the proportion having milk delivered is increasing and the proportion buying milk at stores is decreasing. The Consumer analysis of greater Salt Lake City shows that in 1953 about 49 percent of the families had their milk delivered compared with 52 percent in 1957. The proportion buying milk at stores decreased from 56 percent in 1953 to 50 percent in 1957. The failure of store sales of milk to increase in Utah as they have in most other areas is probably due to the smaller differential between store and delivered milk prices.

There were a number of factors associated with where milk was obtained. Most families having only one or two members bought milk at stores. Larger size households tended either to have milk delivered, produce their own, or buy it from neighbors.

Source of milk was influenced by family income. Low-income families tended to buy their milk from sources where it was less expensive while high-income families tended to buy from sources where it was more costly. The higher the family income the greater the proportion that had milk delivered and the smaller the proportion that bought it at stores, produced their own, or bought it from neighbors.

The proportion of families producing their own milk or purchasing it from neighbors was substantially larger in the smaller communities. Only 3 percent of the households in communities having a population of 10,000 or more produced their own milk or bought it from neighbors compared with 55 percent of those in communities having a population of less than 1,000.

Sixty-nine percent of the farm and part-time farm families either produced their own milk or purchased it from neighbors, whereas 8 percent of the nonfarm families did so.

### Reasons for dairy and brand preference

What are the most important reasons why consumers who have their milk delivered buy from a particular dairy? Such a question is of more than academic interest to milk dealers. If more than one answer was given when consumers were asked this question, the first two answers were recorded. This resulted in receiving 724 reasons from the 536 consumers having their milk delivered. Good products, good service, and convenience

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**Table 2. Major reasons for having milk delivered by present dairy, 536 consumers, Utah, 1955**

<table>
<thead>
<tr>
<th>Reason</th>
<th>Number giving reason</th>
<th>Percent giving reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good products</td>
<td>199</td>
<td>28</td>
</tr>
<tr>
<td>Convenience</td>
<td>177</td>
<td>24</td>
</tr>
<tr>
<td>Good service</td>
<td>157</td>
<td>22</td>
</tr>
<tr>
<td>Habit</td>
<td>79</td>
<td>11</td>
</tr>
<tr>
<td>Friends or family in dairy business</td>
<td>45</td>
<td>6</td>
</tr>
<tr>
<td>Other</td>
<td>67</td>
<td>9</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>724</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

*If more than one answer was given by the 536 consumers having milk delivered, the first two reasons were recorded.

**Table 3. Reason for buying particular brands of milk in stores, 353 consumers, Utah, 1955**

<table>
<thead>
<tr>
<th>Reason</th>
<th>Number of consumers</th>
<th>Percent of consumers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taste or quality</td>
<td>160</td>
<td>45</td>
</tr>
<tr>
<td>Habit or no particular reason</td>
<td>121</td>
<td>34</td>
</tr>
<tr>
<td>Only brand sold in store</td>
<td>39</td>
<td>11</td>
</tr>
<tr>
<td>Cheaper</td>
<td>14</td>
<td>4</td>
</tr>
<tr>
<td>Other</td>
<td>19</td>
<td>6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>353</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>
were the three reasons given the most often (table 2).

There were two main reasons why those who bought most of their milk at stores did so. Thirty-five percent said it was just as convenient to buy their milk at stores while shopping for other food items. Twenty-six percent believed their needs were too irregular for delivery service and bought milk at stores because they could buy it there as needed. Only 9 percent indicated because the price was cheaper. A few preferred to buy milk on a cash basis rather than having an extra monthly bill to pay.

About three-fourths of those who bought milk at stores always purchased the same brand. A fourth said they had no preference. Nearly half of those who always bought the same brand did so because they considered it was fresher, richer, tasted better, or was of better quality. About a third did so out of habit or for no particular reason. Some said there was no other brand from which to choose. Only a few bought a particular brand because it was cheaper since all brands of milk are priced the same in most stores (table 3).

**Significance to the dairy industry**

What do these consumer attitudes and shopping patterns for milk suggest to those of the dairy industry? The reasons given by some for not drinking milk and for consumption being limited by others suggest the following ways by which milk consumption might be increased in the future: (1) Make wholesome milk more readily available to children at an appetizing temperature at home and in school to encourage early in life a favorable taste for milk and a habit of drinking it; (2) promote among calorie conscious people sales of modified skim milk or modified low-fat milk which has extra milk solids added, which is almost if not as palatable as regular milk, and yet contains considerably fewer calories; (3) stress the nutritional importance even to adults of the elements contained in the solid-non-fat portion of milk and that substitutes for these elements are not readily available in other foods; and (4) advertise the bargain one receives for money spent on milk purchases compared with what the same elements cost in alternative sources.

The fact that 23 percent of the adults do not drink milk indicates a potential area where milk consumption might be increased. It is difficult to change people's attitudes and habits, however, once they are established. Perhaps the most effective way of increasing the proportion of adults drinking milk is to do a better job of encouraging more favorable attitudes and habits of drinking milk among children so that when they become adults more

**CRESTED WHEATGRASS**

(Continued from page 43)

formed and these were mainly sterile. This was especially true of those plots receiving nitrogen. Earlier in the growing season before heading, it was observed that the vegetative growth of those plots receiving nitrogen was suffering from drought. This was most pronounced with plants at the 3 and 4 foot spacings. The nitrogen treated plots produced the heaviest forage, but the grasses in these plots were shortest in height. This was probably caused by use of the soil moisture before heading with not enough moisture remaining to allow for production of a seed stalk. The seed heads on plants at the 3 or 4 foot spacing appeared to be blasted open at time of flowering with no additional development taking place.

Seed yields normally will be low and uncertain in areas such as the Nephi Field Station where the average annual precipitation is about 12 inches. Moisture and not fertility appears to be the main factor limiting production under such conditions. In dry farm areas where precipitation is more favor-
able, pubescent and intermediate wheatgrass may have possibilities for the production of seed and also as dual purpose grasses for seed and forage.

MORE WATER
(Continued from page 31)

The number of storage reservoirs presently in use is relatively few. In the entire Utah portion of the Virgin River Basin, there are only about 7,600 usable acre feet of water storage space. Kane County has no usable storage of consequence. Navajo Lake, with a capacity of 12,000 acre feet, although located within Kane County, is used to store water for the Virgin and Sevier drainage basins. Upper Enterprise reservoir in the Great Basin has a capacity of 10,000 acre feet. Lower Enterprise will store 2,000 acre feet, New Castle 3,326, and Yankee Meadow 1,086.

Water use

Water uses can be placed into two broad divisions—those which are depletive and those which are not. Depletive uses are those which change the water from a liquid to a vapor. Transpiration from vegetation and evaporation from water and soil surfaces are examples of depletive uses. Once water is vaporized, it is not subject to further control and use.

Recreation, navigation, and hydro-power production are examples of nondepletive water uses. Most of the water is not actually consumed or vaporized in use, and is available for further uses. Knowledge of present uses and where they occur is essential for the formulation of plans for greater economic use of the water resource. From the acreage of the various crops and vegetative types, normal water uses were calculated taking into consideration local climatic differences.

Agricultural uses

The greatest single depletive use of that portion of the rain and snow melt which drains into the fertile valleys of the tri-county area is for irrigation. In addition to direct rainfall about 90,000 acre feet of irrigation water is consumed each year by irrigated crops. Some 32,000 acre feet is consumed by crops in the Virgin River Basin, 54,000 in the Great Basin within the tri-county area, and 3,700 in the Colorado River Basin portion. In addition to depletive uses by crops and native vegetation, direct evaporation from water surfaces accounts for some depletion.

Use by native vegetation

The use of water by native vegetation is surprisingly high. The study shows that about 77,000 acre feet is consumed by native vegetation, much of which might be salvaged and used for agricultural crops or for other purposes.

Water salvage possibilities

It is somewhat paradoxical that in an area where water is so limited and so valuable, that for every ten acre feet of water actually consumed in producing agricultural crops, 8 acre feet is consumed by native vegetation which has little or no economic benefit.

Most of this uneconomic use is by plants growing in areas of relatively high water table. They send their roots down where they are able to maintain a perennial and adequate supply of water. Many of these plants, although belonging to different plant families, are commonly classed as phreatophytes.

Recovery of water now used by phreatophytes might be accomplished in three ways: (1) Lowering the ground water table by pumping or channelization. (2) Eradication of plants by mechanical or chemical means. (3) Eradication and substitution of plants of higher economic value. Recovery by any of these methods, coupled with efficient management of water would reclaim lands now unproductive and might release some water for new irrigation.

Water spreading possibilities

Often the high flow of surface streams rapidly passes ground water recharge areas without percolating underground to replenish ground water basins. This situation exists in the Cedar City area. Permeable sediments at the mouth of Coal Creek and the irrigated areas in the vicinity of Cedar City are the areas where recharge for pumping districts further down the fan occurs. During periods of high streamflow that do not coincide with periods of irrigation need, water is often not diverted into irrigation works on the higher alluvial areas. Consequently, much of it is wasted past the potential recharge area. Underground sources do not benefit in proportion to the quantity of water flowing down the channel. These flood flows move out into the valley and lower areas where soils are finer textured and do not absorb the water so readily. The unabsorbed water eventually discharges into the low areas and is dissipated naturally by nonbeneficial transpiration and evaporation in Rush or Shurtz Lake vicinities. It is believed that water spreading might be used effectively in the Cedar Valley area. If excess flows could be made to enter the ground at or near the mouth of Coal Creek Canyon, it would contribute toward the maintenance of water at satisfactory pumping depths in the major pumping districts. A rather detailed analysis of water spreading possibilities from Coal Creek indicated that there is an annual average of about 6,000 acre feet of excess water which could be more effectively and efficiently used if directed into evaporation-proof, underground reservoirs to be drawn on as needed.

Dixie Project plans

A plan for development of the Dixie Project in Washington
County, has been prepared by the U. S. Bureau of Reclamation. The plan proposes to conserve waters of the Virgin and Santa Clara Rivers for the purpose of furnishing a supplemental supply of water to 9,035 existing irrigated acres and furnishing 13,615 acres of new lands with water.

The construction of a dam at Virgin City would create a reservoir of 246,000 acre-feet capacity. Lower Gunlock Dam on the Santa Clara River would create a reservoir of 24,000 acre-feet capacity.

Kolob Reservoir Plans
Along with the Dixie Project, the Kolob Reservoir, constructed in 1956 on Kolob Creek, a tributary of the Virgin River, will be enlarged and some 8,000 acre feet diverted through a tunnel for use in the Great Basin area around Cedar City.

Expanded economy through better use of water resources
The completion of the present plans for water development in the tri-county area should have a tremendous effect on the economy of the area. The Dixie Project will put to work most of the usable water supply available to Utah in that area. Putting this water to work, coupled with the availability of power expected from the Upper Colorado River development, will allow for an expanded agriculture, for new industries, and for domestic uses that are so essential for these expansions.

Studies such as the tri-county cooperative study are essential if the basic inventory of water supplies and use necessary for intelligent planning is to be obtained.

FARM MACHINERY
(Continued from page 34)

In this case the total annual cost is $303.00. This is for depreciation, taxes, insurance, storage, and interest on investment. Operating costs per acre are assumed to be $1.87. This is for repairs, fuel, grease, oil, power, and labor. If we subtract the operating cost per acre from the custom rate of $6.00 per acre we have the amount that can offset annual cost per acre. By dividing the resulting figure into the assumed annual cost for ownership we arrive at the number of acres necessary to break even on the two methods.

Using this information in formula we can calculate the break even point to be 72 acres:

Annual cost of ownership ($303)   $303.00 annual fixed cost
Custom rate (6.00)—Operating cost per acre ($1.87) = 72 acres to break even

$112.00 variable costs (60 acres at $1.87 per acre)

$415.00 total cost
$415.00 = 60 = $6.92 per acre

That would be $ .92 above custom rate.

The farmer, however, may still be justified in buying his own machine. He might feel $ .92 is well spent if it reduces the risk and uncertainty of getting the job done on time and in a manner in which he feels could only be done to his satisfaction, by himself, with his own machine. Some farmers have experienced difficulty in getting custom workers to do satisfactory work.

Success of farmers in hiring custom operators who work in a careful and timely manner differs greatly from one community to another. These factors must be considered, in addition to costs, in choosing between owning or hiring a machine.

Cut costs by owning machinery jointly or exchanging with a neighbor

Many farmers have reduced machinery costs and increased annual use by working out cooperative ownership arrangements or partnerships. Closely related to part ownership is the practice of exchanging farm machinery. One farmer may own a baler and another a grain combine; the baler owner bales his neighbor's hay and the neighbor in turn combines the other's grain. Differences in acreages are then compensated for at prevailing custom rates.

The machinery investment problem is not so much whether to own or not to own any machinery at all, but rather when is the individual farmer justified in increasing or decreasing his investment in machinery and equipment. By using the methods outlined in this article, the farmer should be better able to solve his machinery investment problem.

FEED FOR UTAH SWINE
(Continued from page 39)

but two of the gilts were retained for breeding purposes. The barrows and remaining gilts were sent to a local slaughter house where they were killed following an 18 to 24 hour shrink. Carcass data were obtained about 48 hours after slaughter. All pigs in experiment 2 were slaughtered and the same procedure was followed in obtaining final weight and carcass data as in experiment 1.
Results of the experiments are given in table 2. In experiment 1, pigs on each ration showed good feedlot performance. Those receiving the 20 and 30 percent alfalfa made slightly faster and more uniform gains than the pigs getting 10 percent. Differences in rate of gain and feed required per 100 pounds of gain were not significant. In this experiment leafy third crop alfalfa was used. It contained 18.1 percent protein and only 23.3 percent crude fiber. At the 20 and 30 percent levels the added alfalfa meal appeared to have a feed value equal to barley.

A reduction in dressing percentage and average back fat thickness accompanied the increases in alfalfa levels in this experiment, but, because of the small numbers of carcasses studied and the wide variations which existed, these differences were not statistically significant.

Third crop alfalfa was used in experiment 2, but the quality was not as good as that used in the first test. It contained 31.8 percent crude fiber and 14.4 percent protein. All lots of pigs made fairly good gains. Differences in gains on the various levels of alfalfa meal were not significant. However, as the alfalfa meal was increased to the 20 and 30 percent levels a significant decrease in feed efficiency and dressing percentage occurred. In this test a pound of alfalfa replaced only 0.7 and 0.6 pound of concentrates at the 20 and 30 percent levels, respectively. This replacement value was not high enough at the 30 percent level to justify feeding alfalfa meal of the quality used. At the relative prices for alfalfa meal and concentrates which prevailed in 1955, feeding alfalfa at the two higher levels did not lower costs of gains. It had an unfavorable effect on dressing percentage without bringing about a compensating improvement in carcass quality as measured by average thickness of back fat and area of loin muscle. This lack of improvement in carcass quality of feeding high levels of alfalfa meal is contrary to results obtained at other stations.

Quality of alfalfa important

From these two experiments and the previous one performed at the Utah Station by Harris, it appears that quality of alfalfa has a pronounced effect on the use of alfalfa by swine. Research at other stations supports this conclusion. Much of the improvement in feedlot performance of the pigs in the two recent Utah experiments, as compared with that in the earlier one by Harris, can probably be attributed to the beneficial effects of pelleting and the addition of an antibiotic and vitamin B₁₂ feed supplement.

High cost of grinding alfalfa a drawback

Alfalfa must be ground and mixed with the other ingredients in the ration before full fed pigs will voluntarily consume large amounts of it. The high cost of grinding the alfalfa is one of the chief drawbacks to its more extensive use in swine rations. If this cost can be reduced, the feeding of alfalfa meal as a partial replacement for barley in the ration of growing fattening swine appears promising.

In feeding higher levels, farmers should use only high quality leafy alfalfa cut at an early stage of maturity. Including more than 20 percent in the ration under present conditions in Utah appears to be inadvisable unless the alfalfa meal can be obtained for less than about 50 percent the price of barley. The rations should preferably be pelleted and include an antibiotic. A vitamin B₁₂ supplement should also be added unless most of the supplemental protein comes from animal sources.

BARLEY FOR LAYING HENS

(Continued from page 35)

Utah State University help answer these questions.

1957 experiment

During 1957, we fed caged hens diets containing from 0 to 75 percent barley. The grain in the rations other than barley was equal parts of corn, milo, and wheat. When 75 percent barley was fed, 2.5 percent corn was the only other grain in the ration. The results of the experiment are shown in table 1.

You can see that the barley level
of the diet did not effect egg production. Even when 75 percent of the diet was barley, egg production was good. Slightly more feed was required to produce a dozen eggs on the high barley diets, but this feed was cheaper. Each increase of 15 percent in the barley level of the diet decreased cost of feed two dollars per ton with 1957 prices. This difference prevails most of the time in our area. We calculated our return over feed cost for each ration for the 7½-month experiment (table 1). The returns were greatest with high barley diets. The value of the barley used in this experiment was from 87 to 90 percent of the value of the corn-milo-wheat mixtures.

We added fat to two of the rations containing large amounts of barley. The addition of 2½ percent fat did not affect egg production, but did reduce the amount of feed required to produce a dozen eggs. From the standpoint of return per hen, addition of fat was feasible but did not increase returns. The addition of fat increases energy content of the ration which may be practical during the winter months when the hens need more energy.

The weight of each egg produced was determined during two days of the experiment. The eggs produced by hens receiving the two highest barley diets were one-half ounce lighter per dozen than those produced by the hens fed diets with 0 and 15 percent barley. All eggs averaged over 24 ounces per dozen, however.

Value of enzymes

Washington State College has reported that the value of high barley diets for chicks can be increased by soaking the barley in water or by the addition of certain enzyme preparations to the ration. Since then, many different enzyme preparations have been tried in high barley chick diets. Several have been found which improved performance of chicks. These enzymes are now being tried by several groups in diets for laying hens. The results of our experiments for the first 150 days are given in table 2. The barley diets used here contain 79 percent barley and this is the only grain in the ration.

Egg production was as high among hens fed the barley diets as it was among hens fed corn-milo or wheat diets. It was not improved by soaking the barley. Although slightly higher egg production was obtained by addition of the enzyme, we do not consider this difference significant. Feed efficiency was increased by the addition of the enzyme to the barley diet.

A much greater response in egg production has been obtained by adding the enzyme to hull-less barley rations. This seems to follow our results with chicks, where we have much more data. Our experiments with chicks indicate that grains contain certain factors, probably enzymes, which help the chick use the grain. Corn and milo seem to contain more of these factors than barley, and the regular barley seems to contain more than hull-less barley. We have always found that more of these new enzyme preparations must be added to hull-less barley diets than to regular barley diets in order to produce maximum response.

Table 1. Egg production, feed per dozen eggs, and return from hens fed varying levels of barley, 1957

<table>
<thead>
<tr>
<th>Barley level in diet</th>
<th>Percent egg production</th>
<th>Pounds feed per dozen eggs</th>
<th>Return over feed cost per hen</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>65.6</td>
<td>4.18</td>
<td>$1.91</td>
</tr>
<tr>
<td>15</td>
<td>66.0</td>
<td>4.25</td>
<td>2.04</td>
</tr>
<tr>
<td>30</td>
<td>66.9</td>
<td>4.55</td>
<td>1.83</td>
</tr>
<tr>
<td>45</td>
<td>65.5</td>
<td>4.41</td>
<td>2.00</td>
</tr>
<tr>
<td>60</td>
<td>66.9</td>
<td>4.38</td>
<td>2.14</td>
</tr>
<tr>
<td>75</td>
<td>68.0</td>
<td>4.44</td>
<td>2.29</td>
</tr>
<tr>
<td>42.5 (2.5% fat)</td>
<td>66.6</td>
<td>4.10</td>
<td>2.09</td>
</tr>
<tr>
<td>72.5 (2.5% fat)</td>
<td>66.0</td>
<td>4.00</td>
<td>2.14</td>
</tr>
</tbody>
</table>

Table 2. Value of enzymes and soaked barley when used in the ration of laying hens

<table>
<thead>
<tr>
<th>Grain</th>
<th>Hens in cages</th>
<th>Hens in floor pens</th>
</tr>
</thead>
<tbody>
<tr>
<td>% egg prod.</td>
<td>Feed per</td>
<td>% egg prod.</td>
</tr>
<tr>
<td></td>
<td>doz. eggs</td>
<td></td>
</tr>
<tr>
<td>Corn and milo</td>
<td>69</td>
<td>3.9</td>
</tr>
<tr>
<td>Wheat</td>
<td>67</td>
<td>4.0</td>
</tr>
<tr>
<td>Barley</td>
<td>67</td>
<td>4.2</td>
</tr>
<tr>
<td>Soaked barley</td>
<td>67</td>
<td>4.1</td>
</tr>
<tr>
<td>Barley and enzyme</td>
<td>69</td>
<td>3.9</td>
</tr>
<tr>
<td>Hull-less barley</td>
<td>64</td>
<td>4.2</td>
</tr>
<tr>
<td>Hull-less barley and enzyme</td>
<td>73</td>
<td>3.9</td>
</tr>
</tbody>
</table>

Incidentally, the birds used in the cages and floor pens are all from the same brood of chicks. They were all raised together until they were five months old. So far, egg production in the floor pens has been about five percent higher than in the cages.

The droppings from chicks fed barley or hull-less barley diets are more sticky and voluminous than those from chicks fed corn. The right half of the screen in the picture was under a pen of chicks fed a hull-less barley diet. Note how the droppings are matted on the screen. The left half of the screen was under a pen of chicks fed a hull-less barley diet with added enzymes. This part of the screen is almost as clean as one from a pen fed a corn diet. Barley diets tend to produce the same condition in laying hens, but the differences are much less than with chicks.

These experiments indicate that laying hens will produce well on diets containing large amounts of barley. Similar results have been obtained in Idaho and California. We may soon be able to make these high barley diets even better by the addition of enzymes to the feed. Several enzyme preparations of this type will soon be available. It will

(Continued on page 56)
Cooperative Grade A Milking Barns

Offer economies to the small producer

E. M. MORRISON

The establishment of cooperative grade A milking barns in the central and southern parts of the state has been one of the new ideas in dairying. Basically, a cooperative milking barn is built to serve a number of producers instead of each producer having his own. Originally these units have varied in size from 100 to 450 shares. At present, some are not operating at their share capacity.

Known cooperative grade A milking barns are operating in Minersville, Beaver, New Castle, Veyo, Hurricane, Circleville, and Monroe. Other groups that are primarily family farm partnerships operate in various areas of the state. This report is concerned with the cooperative units that have begun in communities as a business venture.

Why are they organized?

Three considerations have been behind the creation of cooperative units: (1) The desire to take advantage of the price differential between grade A and manufacturing milk. Individually the owner of a small herd of cows has justifiably believed he could not afford to make the necessary investment to meet grade A regulations. The combining of small herds has overcome this objection. (2) The desire of farmers to engage in the dairy business and still be freed from the tiring and exacting milking schedule. The operators of some cooperative grade A milking barns have solved this problem by hiring men who specialize in milking and caring for the milking barn. The owner cares for the cows but has no responsibility for milking operations. In most areas it is not difficult to hire the feeding done for a few days if the owner needs to be free from the dairy operations for a short time. (3) Encouragement given by some grade A milk distributors in an attempt to set up a supply of milk at a desired place. In some cases the original impetus was supplied by milk distributors before possibilities of a cooperative unit had been discussed by potential members.

How do they operate?

Three methods are used to accomplish the milking operation. With some units all cows are kept on the producer's place and driven to and from the milking barn twice daily. Milking time schedules are maintained and rotated monthly or semi-annually. By this method no producer is always at either end of the daily schedule. Some herds are driven nearly a mile at one extreme while some are held adjacent to the milking barn. The owner drives his cows to the milking barn on schedule and washes them preparatory to milking.

A second method of handling cows in relation to the milking barn is to have all cows corralled and housed on land belonging to the cooperative. With this system all cows are only a short distance from the holding pen at the barn entrance. In all cases where this
system is used the producer is allotted an area for his corrals and open front shed but the cooperative owns the land. The producer is required to build and maintain fences and buildings. The cooperative generally hires the milking operations performed. Rotation of a milking schedule is less important here although some use the system.

A third method is a combination of the two previously mentioned. Some cows are held on premises owned by the cooperative while others are maintained on producers' premises and driven to and from the milking barn. Rotation of the milking schedule is important with this method.

In all three methods outlined above each cow is given a standard amount of grain while being milked. If the owner desires to feed additional grain he must do so outside the barn.

Each herd's production is weighed and in some cases a sample is taken for butterfat testing. In no cases, at present, is the milk of individual cows weighed and in only a few cases is any attempt made by the owner to gauge grain feeding to milk production.

The organization of cooperative grade A milking barns has generally come into being after discussion and planning among interested farmers. In some cases milk processors have encouraged farmers to cooperate in providing grade A facilities and producing grade A milk and in other cases some outside help has been given. Some have been incorporated under the cooperative laws of Utah, some have not. All have been started by selling stock to prospective members and a share has been identified with the privilege to milk one cow. In some units only selected individuals were given a chance to join the organization. In other cases almost anyone who had an interest was given the chance to join. Sales of stocks in all cases are subject to the approval of the directors.

Operating funds to defray the cost of the milking barn are obtained in a number of ways. In some cases the total cost is assessed on a stock basis and each producer shares in the operating cost whether or not his stock is used to capacity. In some cases the cost is assessed on a pound of milk basis. This has a tendency to assess on the ability-to-pay principle. In other cases the cost is assessed on a pound of milk basis for operating expenses such as labor, power, feed, supplies, and water while special assessments are made on a stock basis for expenses such as equipment, taxes, repairs, and improvements.

Who owns the grade A base?

A grade A base is at present giving the producers some concern and is regarded by them as a limiting problem. In some units the grade A base is allotted to the cooperative. In other units the grade A base is allotted to each producer. Where the base has been allotted to the unit there is no incentive or opportunity for individual producers to increase their size of operation. If the unit decided to expand its stock issue to permit more cows to be milked in its barn all extra milk would be sold as manufacturing milk. Since the portion of the total milk delivered for which a grade A price is paid has to be allotted to the stock percentagewise or according to production, if one producer expanded his operation remaining members would be at a disadvantage. Directors are nearly forced to insist that original status be continued without change.

Where grade A base is owned individually the operator could not acquire more base unless at the same time he could acquire more stock in the barn. To date stock exchange or adjustment among members of the cooperative has been limited. In most cases when a producer retired from the dairy business the association has purchased his stock. Sometimes the stock has been retired and other times resold to members who wish to buy.

As a general rule members are well satisfied with their relations to the cooperative. Some have reactions to the grade A base and the static position they must maintain in their dairying. But few see any way they can improve their cooperative activity.

How much capital is required?

This procedure has advantages and limitations. Cooperative ownership of the milking barn and facilities may decrease investment per cow to produce grade A milk. Data obtained in a recent survey show that investment per cow for a grade A milking barn and equipment amounts to about $250 for herds under 20 cows, about $200 for 25-cow herds, about $170 for 35-cow herds, about $150 for 45-cow herds, and about $125 for 55-cow herds. The largest unit of the cooperative barns has an investment per cow of about $100 although shares currently sell for $200. The smaller units have an investment of $180 to $200 per cow. On this basis the owner of a 25-cow or larger herd is not making any particular investment saving by joining a unit any smaller than 200 cows or shares. The owners of smaller herds can make a substantial investment savings by participating in a cooperative milking barn. Especially is this true when new and more modern innovations are added such as pipeline milkers and refrigerated holding tanks.

Will labor be reduced?

Cooperative ownership of the milking barn and facilities will affect the labor input and the relation of the owner to the dairy labor schedule. The owner of a large herd can economize on hired labor by sharing his hired help with others who also need some help. Where cows are kept on premises adjacent to the milking barn and hired labor performs all milking
operations the operator is freed from the milking schedule and can still be a dairyman but enjoy the freedom of a livestock farmer. Where cows are driven to and from the milking barn twice daily, and even though the milking schedule is rotated each month, the first man on the schedule gets up as early as 2:30 a.m. for the morning milking and starts around 2:00 p.m. for the evening milking. This could seriously interrupt the efficiency of his labor program. On the other hand, a 12 year old boy can drive and wash cows where he might not be able to milk properly 20 to 25 cows by himself.

Owners of smaller herds are spending less time in the milking operation although they are paying someone else to save them time for which they may have no alternative use. When the unit is operating so that cows are driven to and from the barn some inconvenient working hours are necessitated whether performed by the farmer or a member of his family. If the herd is around 10 to 12 cows as some are, the time involved in driving the cows gets to be an important factor.

In larger units the milking operation is performed at a rate of 34 hours per cow per year. In smaller units this figure is about 58 hours per cow. Survey data for individual dairy enterprises show labor for the milking operation to be about 90 hours per cow for a 15-cow herd, about 73 hours for a 23-cow herd, about 60 hours for a 30-cow herd, and about 59 hours for a 45-cow herd. On this basis an owner of a 30-cow or larger herd could save labor per cow even by participating with a small cooperative unit of 100 share capacity. Owners of herds smaller than 30 cows could evidently save a considerable amount of time by participating in a cooperative unit.

In addition to economics in farm production of grade A milk there are factors such as labor savings in hauling milk. These should arise from fewer stops per tank load of milk. Where the benefits of saving fall is not known.

The management problem?

So far as management is concerned the "unit" method raises some problems. As operated at present there is no opportunity for the individual producer to expand his dairy operation. Culling as no individual performance is known. In many units the owner has no close contact with the cow. He would have no opportunity to know if the cow was off milk or if other troubles were developing, many of which are discovered at milking time. Hired milkers and most directors believe their systems would break down entirely if time was taken to keep records on a cow's production. It is possible, however, with milk line meters to obtain individual cow production with little effort.

Since the largest of the milking barn units is now milking 450 cows daily whereas units this large and larger are being operated in many areas of the country there must be a way to get around the management problem. The problem of status quo must be solved and no doubt can be worked out.

Is a cooperative unit worthwhile?

This type of unit merits study and development. It may be the answer to the problem developing in village-type communities where the small herds are increasingly becoming uneconomical and facilities almost prohibit expansion. If the time comes when all milk will be required to be produced in accordance with what we now call grade A regulations, this type of arrangement may prove to be the most economical method of producing milk in many areas. In areas where producers have an alternative use of their time owners of small herds producing either grade A or manufacturing milk may find this method advantageous.

NEW PUBLICATIONS

Cir. 138. Water supply, water use, and its conservation, by George D. Clyde, Governor of Utah, 12 p.

This is an address presented to the 71st annual meeting of the American Association of Land Grant Colleges and State Universities at Denver, Colorado, November 10-14, 1957. The Experiment Station has printed the address because of the importance of the subject to Utah and the western United States, and because Governor Clyde is a former member of the staff whose research was in the area of water conservation.

Cir. 139. Economics of crop and livestock combinations, by Earnest M. Morrison, Department of Agricultural Economics. 11 p.

This publication discusses the best combinations of crops and livestock to produce under various levels of crop and livestock productivity.


The authors conclude that the most important cause of raspberry degeneration in Utah is improper cultural practices. Other causes are soils not suited to raspberries, diseases, mites, insects, and nematodes.

Agriculture . . . Utah's basic industry. An 8-page folder issued by the College of Agriculture.

This folder points out the importance of agriculture in the state and its relation to industrial development.


This is a combined list of available publications published by the Agricultural Experiment Station and the Cooperative Extension Service.

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

Dr. Wynne Thorne, director of the Utah Station, is spending two months in Iraq consulting with the Iraqi government on the reclamation of saline soils and other agricultural problems. The first of July he will accompany other U. S. scientists on a tour of Russia sponsored by the Ford Foundation.
Oregon Releases New Barley Variety Developed in Utah

A new variety of barley, developed at Utah Agricultural Experiment Station by Dr. Rollo W. Woodward, a collaborator in research from the Cereal Crops Research Division of the Agricultural Research Service, has been named and released for commercial production in Oregon.

Dr. Woodward developed the new variety in breeding experiments in 1935 when Bonneville, the new popular Utah barley was developed. It has been continuously tested, along with other varieties, over a wide area of the West but was abandoned for commercial use in Utah because of the superior qualities of the Bonneville type.

The Oregon Agricultural Experiment Station now has found the new barley variety especially well adapted to the muck soils of the Klamath basin and so have given it the name of "Wocus." They will release foundation seed this year, Dr. Woodward has been advised.

The Oregon Station action was taken with the full consent and permission of the Utah Station and Dr. Woodward.

The new variety is closely related to Bonneville but is a six-row club type, early maturing barley with short, stiff straw developed by crossing Coast by Lion by Winter Club. The new variety is limited in its adaption and should not be recommended for other areas.

D. C. Dix

ALFALFA FOR DRYLAND

(Continued from page 37)

alfalfa was in 36-inch rows at Logan with a 20-inch spacing at Ephraim. Grass and alfalfa were seeded at the same time, the alfalfa in 30-inch and the grass in 6-inch rows at Cottonwood and Mud Springs. Nomad, Sevelra, Ranger, and Ladak were included in all plots. Other varieties and strains were grown at various places.

BARLEY FOR LAYING HENS

(Continued from page 52)

probably cost us from $1.00 to $1.50 to add them to a ton of feed. Even now, egg producers should be feeding mostly barley if they want to obtain maximum profit. This type of ration should also be fed during the growing period to allow the birds to become accustomed to it.