Efficient Pasture Production Depends Upon Systematic Application of the Proper Fertilizers

Use of Fertilizers on Pastures Increases the Quantity and Improves the Quality of Herbage

By G. Q. Bateman

Good pasture is the best feed there is for dairy cows when it is composed of young tender herbage that is grown on soils rich in plant food, and that have been managed in such a manner as to produce an abundance of feed through the summer feeding period. Good pasture, in addition to furnishing the most perfect feed for dairy cows, is usually cheaper than the usual harvested crops that are fed.

The relative efficiency and economy of the production of milk from pasture will depend to a large measure on how well pastures are managed with relation to the application of fertilizers. Recent experiments conducted at the Dairy Experimental Farm, in cooperation with D. W. Pittman of the Agronomy Department, show that in every case where pastures were fertilized with commercial fertilizers containing available phosphorus or nitrogen, or with manure, there was an increase in the amount of herbage produced.

The fertilizers used in these tests were triple superphosphate (43 percent P₂O₅), ammonium sulfate (21 percent nitrogen), and fresh manure that was taken directly from the gutter. The manure used contained a high percentage of the liquid portion. Both heavy and light applications of the commercial fertilizers were made and in addition the fertilizers were applied in combination with each other. In the heavy applications triple superphosphate was applied in one application, at the rate of 600 pounds, ammonium sulfate at 500 pounds, and the two in combination at the rate of 300 pounds of each per acre.

The amount of green herbage produced per acre for the five year period was 38,600 pounds from the untreated area, 63,250 pounds for the plot receiving phosphate, 55,820 pounds where a combination of phosphate and ammonium sulfate was applied, and 42,990 pounds where ammonium sulfate was the fertilizer used. These figures show that the pasture plots receiving heavy applications of phosphate, phosphate and ammonium sulfate, and ammonium sulfate, produced 63.8 percent, 44.6 percent and 11.2 percent, respectively, more pasture herbage than the pastures that were not fertilized. The response to the nitrogen fertilizer was immediate and lasted for a short period while the effect of phosphate was persistent and was still in evidence at the end of the fifth year.

In a later experiment where the amount of fertilizer applied was reduced, ammonium sulfate applied at the rate of 200 pounds per acre increased the amount of herbage produced.

(Continued on page 9)

Results obtained with light applications of commercial fertilizers and manure applied to pastures at the Dairy Experiment Farm

<table>
<thead>
<tr>
<th>Amount of nitrogen in clover</th>
<th>Increase over no treatment</th>
<th>Phosphorus content (air dry basis)</th>
<th>Nitrogen content (air dry basis)</th>
<th>Percent of forage in clover</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pounds</td>
<td>Percent</td>
<td>1935</td>
<td>1936</td>
<td>1937</td>
</tr>
<tr>
<td>None</td>
<td></td>
<td>1.2</td>
<td>2.2</td>
<td>1.8</td>
</tr>
<tr>
<td>Phosphate 200 lbs.</td>
<td></td>
<td>1.2</td>
<td>2.4</td>
<td>2.0</td>
</tr>
<tr>
<td>Ammonium sulfate 200 lbs.</td>
<td></td>
<td>1.2</td>
<td>2.4</td>
<td>2.0</td>
</tr>
<tr>
<td>Phosphate and ammonium</td>
<td></td>
<td>1.2</td>
<td>2.4</td>
<td>2.0</td>
</tr>
<tr>
<td>100 lbs. of each</td>
<td></td>
<td>1.2</td>
<td>2.4</td>
<td>2.0</td>
</tr>
<tr>
<td>Manure 20 ton</td>
<td></td>
<td>1.2</td>
<td>2.4</td>
<td>2.0</td>
</tr>
<tr>
<td>Manure 10 ton Phosphate</td>
<td></td>
<td>1.2</td>
<td>2.4</td>
<td>2.0</td>
</tr>
</tbody>
</table>

*All chemical analyses were made under the supervision of D. W. Pittman, Agronomy Department.

**Average of the 3 year period, 1935-37.
USE OF FROZEN FRUITS IN ICE CREAM INVESTIGATED

It is Hoped Through This Use to Create a New Market for Surplus Fruit in the State as Well as to Improve the Flavor of Ice Creams

By A. J. MORRIS

As a new market for surplus fruit and as a means of adding variety and quality to the ice creams already on the market, the use of frozen fruits in ice cream has many possibilities. Freezing is the only known method to make available fresh fruits every month in the year. To find more information about their use in ice cream, the Dairy Manufacturing Division of the Station is cooperating with the Horticulture Department, the Rocky Mountain Packing Company, the U. S. Bureau of Agricultural Chemistry and Soils, and eight commercial ice cream factories, in a project to find just which varieties of fruits make the best ice cream and sherbets.

So far the different varieties of fruit have been used in ice cream from the regular college creamery mix. These same varieties will be used later in sherbets. One pound of frozen fruit was added to each gallon of ice cream. The samples of ice cream were numbered and judged in replicate on different days by a selected jury, expert in tasting ability. These tests will be repeated two or three different years so that variations in any one year in the flavor of the fruit caused by condition and degree of ripeness will not be the deciding point.

Peach varieties judged best for ice cream were: Libbey x Polaro, Champion, Sunbeam, Ontario x Polaro, Arp Beauty, W. Hale, and Ontario Elberta. Varieties not so good were J. H. Hale, Carmen, Lecton, Early Elberta, Fay Elberta, St. Free, Klondyke, South Haven, and Rose Bud. Inferior varieties were Ideal, Jubilee, Maxine, Red Bird and Tuscan.

The consensus of opinion of the jury was that plums and prunes were not as suitable for ice cream as some of the other kinds of fruit. Some of them produced ice cream that resembled sour milk, others lacked flavor, and still others gave a sickly sweet taste to the product. It is quite possible that if the amount of some varieties used had been reduced the blend would have been better. Plums are probably more suitable for sherbets.

The varieties of cherry ice cream liked best were: Napoleon, Giant, Bing, Elkhorn and Tartarian. Royal Duke, Centennial, Lambert, and Reine H. were acceptable or average in quality. Wragg, Montmorency, and Dyhouse were considered inferior as ice cream varieties.

To obtain information on consumer acceptance of the various kinds of fruits in ice cream, two kinds were sold each month in the sales room of the college creamery along with the four standard varieties (vanilla, strawberry, chocolate and maple nut) and some miscellaneous ones. No advertising or suggestions were made to the customer as to merits of any variety.

(Continued on page 11)

CANNING CROP IMPROVEMENT STUDIES INSTIGATED

Canning Crops Industry Provides Funds for Establishment of Research Fellowship

For a number of years there has been a growing need for an investigation of factors that influence the yield and quality of canning crops. Many studies have had to do with crop production and soil management in general but few studies have been directed specifically to the production of high-yielding canning crops of superior quality. Limited funds available to the Station have not permitted the initiation of these investigations in the past.

Through the efforts of the Utah Canners Association in cooperation with The American Can Company, The Anaconda Sales Company, The American Potash Institute Inc., and the Nitragin Company, funds have been made available to the Station for the establishment of a research fellowship for the purpose of studying the effects of fertilizer application and legume seed inoculation on the yield and quality of canning crops. It is planned that this fellowship will continue for a period of three years and that the annual contribution of funds for support of the research will amount to $1,350. This will be sufficient to pay the salary of a research assistant who will conduct the work and also the current operating expenses. The research will be under the supervision of Dr. L. H. Pollard of the Vegetable Crops Department and Prof. D. W. Pittman of the Agronomy Department.

For the first year, at least, the research will be confined to the study of yield and quality of peas and tomatoes. Experimental plots on canning peas have been established on the Experiment Station farm at North Logan, and at Mapleton, Utah. The experimental plots on canning tomatoes will be located at Kaysville, Utah, and at Mapleton, Utah. The effects of varying amounts of different kinds of fertilizer containing the plant foods, nitrogen, phosphorus, and potassium will be studied. The effects of inoculating pea seed with cultures of root-nodule nitrogen-fixing bacteria will also be determined.

The results over a three-year period should not be unduly influenced by the peculiar seasonal conditions of any one year. It is hoped that information obtained will aid growers in producing crops of superior yield and quality.
Utah Conditions Especially Favorable For Turkey Production
Use of Locally Grown Feeds Recommended
By BYRON ALDER

There are few sections of the country where conditions are more favorable for successful turkey production than in Utah. The dry climate, comparatively cool nights during the summer and early fall, the irrigated cultivated areas adjacent to cheap range land, all aid materially in the control of disease and stimulate rapid growth of highest quality turkeys at comparatively low cost.

There is a surplus of grains produced in this area that can usually be marketed to better advantage in the feeding of turkeys than in shipping to other distant centers. Grains are, therefore, usually cheaper in this state. This is a decided advantage in turkey production since feed costs usually represent sixty percent or more of the cost of producing turkeys and the grains make up eighty to ninety percent of the feeds used during the growing and finishing periods. Cooperative marketing organizations have developed efficient methods of marketing turkeys with considerable reduction in the costs of grading, packing, and shipping.

To procure reliable information on some of the turkey production problems under Utah conditions the Poultry Department of the Experiment Station started a series of turkey-feeding studies in the spring of 1935. From six to twelve pens of turkeys have been included in this work each year up to the present. The birds were all kept closely confined so that additional feed that might be used to supplement any ration used could not be obtained from range. The data obtained from these studies appear to justify the following conclusions: During the first six or seven weeks (the starting period) the poult grew more rapidly on an all mash feed containing a fairly high percentage (21 to 24 percent) of protein. A combination of milk, meat meal, and fish meal was used for the protein supplement. Some grains were hopper-fed after the fourth week.

Skim Milk Reduces Mortality

Skim milk to drink replacing from eight to ten percent of dried milk in the mash resulted in a lower percentage mortality, but gave no increase in the rate of growth. There was somewhat more labor required when feeding the skim milk to keep feeding conditions clean and sanitary. But when skim milk is available on the farm it makes an excellent supplement to a starting ration.

A mixture of corn and wheat as a part of the mash or grain mixture gave no advantage over barley and wheat, or barley, wheat, and oats, when measured in terms of finished weight, in condition of the birds at market time, in pounds of feed required to produce a pound of gain, or in livability of the flock. Since in Utah corn is usually higher in cost than barley or wheat the heavy feeding of corn resulted in from 1/2 cent to as high as 4 cents increase in feed cost per pound of turkey produced during this period.

After the birds were eight weeks old a mash containing seventeen to eighteen percent of crude protein gave just as good results, but at lower feed cost, in rate of growth and feed consumed per pound of gain as similar mashes containing higher percentages of protein. Both grains and mash were hopper-fed and the birds permitted a free choice of these feeds.

The feeding of soaked or wet feeds appeared to have no advantage but did add to the labor cost in feeding the flock. Comparatively simple mixtures largely of home produced feed gave satisfactory results. The growing ration that appeared to give the best results under these conditions was made up as follows:

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Millrun (bran and shorts)</td>
<td>23 pounds</td>
</tr>
<tr>
<td>Ground wheat</td>
<td>24 pounds</td>
</tr>
<tr>
<td>Ground barley</td>
<td>24 pounds</td>
</tr>
<tr>
<td>Meat meal (50 to 55 percent protein)</td>
<td>8 pounds</td>
</tr>
<tr>
<td>Fish meal (60 to 65 percent protein)</td>
<td>8 pounds</td>
</tr>
<tr>
<td>Limestone, fine</td>
<td>2 pounds</td>
</tr>
<tr>
<td>Salt</td>
<td>0.7 pounds</td>
</tr>
<tr>
<td>Alfalfa meal</td>
<td>10.3 pounds</td>
</tr>
</tbody>
</table>

TOTAL .......... 100.0 pounds

A grain mixture of equal parts of wheat and barley, or wheat 40 pounds, barley 30 pounds, and oats 30 pounds should be hopper-fed and always available to the birds. When the birds are on range where there is green feed growing there would be no particular (Continued on page 10)
Farm and Home Science

Published Quarterly by the Utah Agricultural Experiment Station
Logan, Utah

R. H. WALKER, Director
GLADYS L. HARRISON, Editor

Address correspondence regarding material appearing in these columns either to the editor or to the author.

More detailed information on the subjects discussed here can often be found in Station bulletins and circulars or may be had through correspondence.

FARM AND HOME SCIENCE

THE reception given the first issue of Farm and Home Science has more than exceeded our expectation.

We can only trust that future issues may justify the hopes expressed by our friends and supporters that this publication will bring the farmer and his friends and supporters that this

SCOPE OF STATION WORK

MANY people of the state have held the opinion that Station investigations are confined to the work in the laboratories and experimental farms at Logan and that problems in other sections of the state do not receive the attention they deserve. While it is true that many investigations are underway in the laboratories on the campus and many variety tests, fertilizer investigations, feeding studies, and other research work, are conducted on the experimental plots in Cache County, the work of the Station takes its staff members into every part of the state.

Many of the crop production studies and fertilizer tests are conducted at the Branch Agricultural College at Cedar City. Improved practices in dry farming are worked out at the Nephi Dry Land Station in Juab County.

This summer the soil surveys under the direction of D. S. Jennings and LeMoyne Wilson are at work in Uintah, Duchesne, Iron, Millard, Sanpete, Sevier and Juab Counties.

Experiments in reseeding of abandoned farm land under the direction of A. F. Bracken are underway in the Benmore Area in Tooele County. The Station is cooperating with the Soil Conservation Service in an attempt to find grasses, trees and shrubs that will grow in problem areas and act to prevent erosion. The areas selected for study at present are LaSal, Church Rock and Monticello in San Juan County, Spanish Valley in Grand County, Beaver Dam in Cache County and Price in Carbon County. Other range reseeding studies are being made in cooperation with the Forest Service.

Studies of the adaptability and yields of various cereal crops are being made by R. W. Woodward and D. C. Tingey in a wide diversity of locations throughout the state. Plots are maintained in Iron, Sevier, Salt Lake, Cache and Sanpete Counties.

Weed eradication plots under the direction of R. J. Evans and D. C. Tingey are located this summer in Pleasant Grove, Richfield, Ephraim, Palmyra, and Logan.

While the major part of the work in horticulture and vegetable crops is conducted at the Davis County Farm there are projects in other parts of the state. The production of onion seed is being studied by L. H. Pollard in Hurricane. Breeding work with tomatoes and beans to find varieties resistant to plant diseases and insect-carried virus diseases under the direction of L. H. Blood, is also being conducted in Hurricane.

The peach mosaic survey takes Station workers into every fruit-producing area of the state each summer. Studies of chlorosis of dewberries are being conducted by F. B. Wann and D. W. Thorne in Provo.

Research in virus diseases of stone fruits is being conducted by B. L. Richards and F. B. Wann in Bountiful, Hurricane, Springville and Brigham City. Studies of fertilizers and cover crops for peach orchards are being made by A. L. Stark and D. W. Thorne near Spanish Fork and Willard.

The work of the Department of Agricultural Economics this summer covers a wide area. It is conducting a sheep study in the Cedar City area, a beef cattle study in Rich County, a dairy study in Weber, Morgan, Davis and Box Elder Counties, a farm management study in Sanpete and Sevier Counties, and a land utilization study in the Uinta Basin. It has other projects underway in Carbon, Emery, San Juan, Wayne, Grand and Salt Lake Counties. Social studies are being made in Garfield, Grand, Plute, Weber, Millard, Sevier, Box Elder, Cache and Utah Counties by J. A. Geddes and J. N. Symons.

Studies of eradication and control of insect pests are state wide. Special studies on the beet leafhopper are being conducted by G. F. Knowlton and H. E. Dorst in Box Elder, Davis, Weber and Salt Lake Counties. The lygus bug and its relation to alfalfa seed production are being studied by C. J. Sorenson in Millard, Uintah and Duchesne Counties.

Causes of bee losses are being studied by G. F. Knowlton in Utah, Salt Lake, Box Elder, Davis, Weber and Wasatch Counties. Berry insect control is being investigated in Cache, Salt Lake and Utah Counties; pea aphid control in the canning districts of northern Utah as well as Sanpete, Sevier and Iron Counties. Grasshopper and Mormon cricket control work is conducted throughout the state.

Surveying of range resources under the direction of L. A. Stoddart is in progress this summer in Utah County.

Snow survey data are gathered on practically all the high watersheds. There are now 83 courses being measured annually in Utah under the direction of G. D. Clyde. Other irrigation investigations to study the efficiency of water-application are being conducted in Millard and Utah Counties by O. W. Israelson. Underground water and pumping investigations are being conducted in Iron County by G. D. Clyde and Theron Ashcroft, of the Branch Agricultural College, in cooperation with the State Engineer.

Although the foregoing is by no means an inclusive list of the projects being conducted by the Experiment Station throughout the state, it gives an idea of the scope and far-reaching extent of the work. The Agricultural Experiment Station is trying, with the limited funds available, to serve the rural people of the entire state, and in helping better the conditions of the rural people, to improve conditions everywhere in the state.
R I N G R O T of the potato is a bacterial disease which spreads rapidly. The bacterium responsible for the disease, *Phytophthora sepedonia*, affects the potato vine, causing a distinct and rapid wilt and frequently complete collapse of the potato plant. It also produces a definitive ring rot both in the field and in storage.

Ring rot in North America was described from the State of Maine in 1933. Since then it has spread rapidly throughout the United States and Canada until today it is reported from twenty-seven different states. In the west it is now known to be present and of economic importance in Idaho, Oregon, California, Montana, Wyoming, Nebraska, Colorado and Utah. It is a significant fact that ring rot is prevalent in every state from which Utah ordinarily imports seed.

During 1939, ring rot was located in 10 counties in Utah, and it is definitely possible that the disease will be found in every potato district in the state into which seed has been imported from outside areas.

Some of the fields studied by the Experiment Station in Utah last year showed as high as from 50 to 65 percent of the plants infected; losses were obviously heavy.

That the spread of ring rot throughout the country has been so phenomenal is the result of the infectious nature of the disease. Probably no plant disease known to science has spread so far and so rapidly in so short a time. Evidence has accumulated which indicates that the organism which causes ring rot multiplies rapidly and is transferred from diseased to healthy tubers in the bin, by the hands, by the cutting knife and by infected containers of every type such as sacks, and buckets, and by the planter and digger. The rapid spread from plant to plant in the field is likewise a definite possibility. There is some evidence that in irrigated districts the trouble will spread more rapidly in the field and thereby become a more important problem. We may expect continued spread in the west in the next few years unless effective control measures are put into effect.

Recognition or the diagnosis of the disease is not a simple problem. The first symptoms on the foliage do not become evident until late July or early August. In early varieties the foliage at this late date has begun to mature and wilt. With the occurrence of Fusarium and Verticillium wilts so prevalent in Utah fields, the disease may escape notice altogether. The first evidence of ring rot in the field is slight wilting of the leaves and the terminal portion of stem. Such wilting may appear in the entire plant or may involve a single stem. The affected leaves become somewhat mottled and of a pale green color. Later the leaves become chlorotic and the margins turn brown and dry up. Frequently under severe conditions the disease may completely kill the plant. In contrast with the late expression of black leg or Fusarium or Verticillium wilts, the vascular bundles of ring rot stems generally appear normal in color and the presence of the organism can be detected only by laboratory tests.

By the time wilt is noted in the vine the tubers have become affected and may show such infection in all stages from the slightest dis coloring of the vascular tissue to complete disintegration of the tuber. In the early stage of tuber invasion the organism acts chiefly the vascular system near the stem end of the tuber. The involved portions appear yellowish white in color and may result finally in a crumbly or cheesy decay. Secondary decay organism may invade the affected tubers and with the ring rot bacterium produce complete disintegration. Under such severe conditions of attack the tuber may completely disappear by harvest.

When harvested and in storage, affected tubers are rapidly invaded both by the ring rot organism and by various secondary forms which cause complete collapse of the vascular ring and inner pith of the tubers leaving frequently but an empty or hollow shell, or, frequently, as in the field, but a mass of decayed debris. In both the field and in storage decay increases with the rise of temperature or of the moisture content of the soil or air, and may vary from an occasionally affected tuber to from 25 to 35 percent of the yield. In Cache Valley heavy losses in storage have been observed as early as December.

In consideration of control measures it is imperative, first that every grower and research worker acquaint himself with the disease to the point that he be able to recognize it both in the field and in the bin; second, that the infectious nature of ring rot be recognized and spread of the disease be prevented by more careful handling of potatoes and by sterilizing all equipment and storage facilities used. Third, that it be recognized that ring rot is transmitted from year to year and from locality to locality by the tuber.

The only effective means so far known for control is ring-rot free seed. Certified seed, thereof, offers the best guarantee against the introduction of ring rot into your field.

A new project to study this disease and find methods for its control has been initiated at the Station this spring.
Cultural Practices Seem to Offer Best Control of Lygus Bugs in Alfalfa Seed Fields

Biology and Control of Lygus Bugs Discussed

By C. L. SORENSON

Practices which today seem to offer the best control of lygus bugs in alfalfa-seed fields are: (1) keeping fields, ditch banks, fence lines, and roadways clean at all seasons of the year; (2) selection by the entire community or district of the same alfalfa crop for the production of seed; (3) management of the irrigation of seed fields on irrigated farms in such a manner as to provide optimum moisture relationships for seed production; (4) if second growth alfalfa is selected for seed production, then the entire community should cut first crop alfalfa at the same time so as to eliminate the opportunity of female lygus bugs migrating to uncut fields where they may continue laying their eggs; myriads of lygus eggs are destroyed when cut alfalfa dries; (5) making a thoroughly clean job of cutting, raking and hauling the hay; (6) hauling hay off fields as quickly as practicable, then immediately and thoroughly dragging the fields so as to cut off all green growth, thus temporarily destroying the food supply of the bugs and forming a dressing mulch which, heated by the hot summer sun, destroys most of the young bugs (nymphs) that escape their previous operations; (7) leaving the fields unirrigated for a few days after dragging them.

Prior to 1933 Lygus bugs were generally known in Utah as the tarnished plant bug. Scientific identification of a large series of these bugs at that time revealed that the tarnished plant bug did not then occur in this state but that all specimens in the collection sent for identification were one or the other of two closely related species of plant bugs which are known as Lygus elisus Van Duzee and Lygus hesperus Knight. The scientific name of the tarnished plant bug is Lygus pratensis Linnaeus. Collectively these and other species of the genus Lygus are now generally referred to as lygus bugs.

These bugs belong to the insect group Hemiptera, (true bugs) and family Miridae which include many of the commonest and most numerous of all insects. This entire group of insects is characterized by the possession of a more-or-less flattened body; 4 membranous wings, the basal half of the front pair of which is more or less thickened; sucking type mouth parts; and development from egg to adult through a series of nymphal (immature) stages which somewhat resemble the adults with the exception that the young have no wings.

The two species of lygus bugs occurring in Utah vary considerably in color. L. elisus is yellowish green and lightly mottled, whereas L. hesperus is yellowish, reddish or dark-brown and heavily mottled. These insects are about 3/16 inch long and approximately one-half as wide. Both species possess a distinct V-shaped light-yellowish mark on the back.

These bugs are lively runners even when newly hatched and the adults fly readily. Very young lygus nymphs are sometimes confused with aphids (plant lice) which they superficially resemble. Lygus nymphs may be distinguished from aphids, however, by their rapid running in contrast with the extremely slow awkward movements and longer, more slender legs of aphids.

Lygus bugs are worldwide in their distribution. In Utah they have been found in every environment, on farms, in orchards and gardens, on deserts and mountains, in canyons and forests. A list of the host plants of these bugs includes more than 100 cultivated and wild species. Although few plants escape their attack, yet these bugs apparently prefer certain species of plants. In Utah alfalfa appears to be the preferred host plant during most of the year.

Heavy populations of lygus bugs in alfalfa-seed fields of the Uinta Basin and Millard County first came to the attention of entomologists of the Utah Agricultural Experiment Station during the summer of 1926. Investigations to ascertain effects of the feeding of these bugs on alfalfa and their relationship to alfalfa-seed production were begun by the Utah Station in 1930.

These investigations soon revealed that lygus bugs cause serious bud blasting, blossom drop, and increased amounts of brown shrivelled seed in alfalfa. The amount of injury inflicted was found to increase directly with the intensity of bug infestation. Greater numbers of lygus bugs have been consistently found in alfalfa fields than on any other crop in this state; in statewide surveys no alfalfa field has been found which has not harbored some of these insects.

Life History

Lygus bugs in Utah overwinter in the adult stage. They remain active in fields, grasslands, on roadsides and waste-land vegetation until arrival of fall frosts when they seek winter protection within alfalfa crowns and grass clumps, under crop refuse, weeds, and other protected places.

With the first warm days of spring, these bugs emerge from their winter quarters, feed upon the sap of available green plants and soon begin laying eggs. Egg-laying continues until late fall. In alfalfa, eggs are laid predominantly in the upper two inches of the stems, also in the buds, and leaf petioles.

The incubation period of lygus eggs averaged approximately 13 days in the Uinta Basin. The mean total time required for development from freshly laid eggs to the emergence of adults was found to be 36.5 days.

(Continued on page 10)
The value of grease wool is determined by the amount of clean wool it contains, and the fineness, strength, length and uniformity of the fiber. The percentage of clean wool in any given quantity of grease wool is the principal factor used in determining raw wool values. Prior to manufacturing, most of the wool is handled in the grease state. But even though this is the case the prices are based upon clean wool values. To illustrate the influence of shrinkage upon the price of grease wool, the following hypothetical case is presented. Two lots of similar kinds of wool worth 90 cents per pound scoured basis are to be evaluated. Lot 1 shrinks 65 percent and lot 2, 60 percent. The grease value of the two lots are 31.5 cents and 36 cents respectively, or a difference of 4.5 cents per pound of grease wool is caused by shrinkage.

Fleece weights and shrinkages of fleeces vary widely, being influenced by the individuality of the sheep and previous care and management. The shrinkage of any given lot of wool is affected directly by the amount of natural exudations contained in the fleece and the extraneous foreign matter. On account of the hygroscopic nature of wool, the moisture content is also an important factor to be considered in determining wool values.

Wool growers are in need of economical methods by which the percentage of clean wool in the sheared fleeces from each flock can be satisfactorily determined. This would give them a more reliable basis to use in selecting individuals for higher wool production and facilitate the marketing of wool.

From 1926 to 1934, the Utah Agricultural Experiment Station in cooperation with range sheepmen conducted an experiment to determine the effect of feed, water, and shelter upon fleeces of Utah ewes. Fleeces used in this study were taken from sheep kept under two widely different conditions. One hundred ewes were secured from range herds to begin the experiment. One-half of this number was farm fed each winter and the other was placed with the herd on desert ranges.

### Discussion of Results

The results of shearing weights and scoured fleece weights of the experiment are summarized in the table. Six years out of the eight the farm group had a larger average shearing weight than the range group. The average shearing weight for the eight years was 9.5 pounds for the range group, and 10.6 pounds for the farm group.

There was a marked variation in shearing weights from one year to the next. This variation is particularly noticeable from the period from 1932 to 1934. Farm and range groups did not respond in a similar manner during the different years. This is in accordance with what might be expected, as climatic conditions during the different years may not exert similar effects on the farm and range.

The average wool shrinkage for the eight years was 66 percent for the range group and 59 percent for the farm group, a difference of 7 percent in favor of the farm-fed sheep. On account of the lower shrinkage of farm wool the average scoured-wool weights of the farm sheep were larger during every year of the trial.

Results of this experimental study indicate the difficulty of determining the wool-producing ability of sheep and the wool values from the grease weights of fleeces. Scoured fleece weights provide a more accurate measure of comparative wool production of sheep kept under different conditions. The fact that shearing weights are not a reliable indication of clean wool weights indicates that there is a definite need at the present time for the development of a rapid and accurate method for determining the percentage of clean wool in any given quantity of grease wool.

From the evidence presented it would seem that the usual practice of wool buyers to pay higher prices for range wool as it is sheared from the sheep than for farm wool is not justified.
IRRIGATION AND DRAINAGE RESEARCH

Objectives of ProgramOutlined

By O. W. ISRAELSEN

That irrigation is the foundation of agriculture in Utah and the West is common knowledge, but comparatively few understand the problems of irrigation agriculture.

The urgent necessity for efficient and economical use of water supplies is recognized by many thoughtful leaders. But, that lack of information concerning methods of reducing water losses in canals and ditches, and on the farms; and concerning the quantitative relations of precipitation, stream flow, consumptive use of water by native vegetation and by farm crops; erosion of soils due to irrigation and numerous similar water problems, now constitutes a major factor contributing toward inefficient or wasteful use or actual loss, is known to few. The growing population slowly but positively increases the need for research concerning the basic water factor in the advance of the civilization of the West.

Because irrigation and drainage methods and the relations of water supply and utilization are influenced so much by variable climatic, water shed, and soil conditions; long-time, continuous, painstaking research is positively essential to the accumulation of information so necessary to the efficient control and intelligent use of the waters of the West. The available funds are inadequate to study simultaneously all of the irrigation and drainage problems that need investigation, and therefore concentration of emphasis on particular problems from time to time is desirable; yet reasonable continuity of effort in some phases of research is essential. This may be best obtained by keeping in bold relief the meaning and significance of the primary objective in irrigation and drainage research.

Each irrigation and drainage research project at the Station aims to accumulate and interpret factual data that will contribute to the solution of a particular problem and, therefore, objectives for each project are of necessity restricted in scope. There is, however, a more general objective in irrigation and drainage research; an objective that does not change greatly from year to year, or from decade to decade; an objective that has probably been a major motivating element to the research workers during the half century of the Experiment Station’s great accomplishments in irrigation and drainage research; an objective which to the irrigation and drainage research staff of today is considered of paramount importance. An attempt is made in the following paragraph to define this general objective clearly.

Primary Objective

The primary objective in the Experiment Station irrigation and drainage research is to discover facts that will make possible and practicable, a more efficient and economical use and control of Utah’s water resources, under conditions that will assure the permanence of soil productivity and of agriculture under irrigation.

If this objective is sound and adequate then the primary responsibility of irrigation research workers is seeking new truths, new principles, new methods, and new practices, concerning the factors underlying the economic use of water in irrigation, that will increase efficiency and economy in irrigation agriculture and contribute to the permanence of agriculture under irrigation.

It is almost self evident that progress toward the primary objective may be most satisfactorily made by concentrating funds and energies on certain secondary objectives from time to time. There is listed herewith some of the secondary objectives toward which current research is directed and others for which new irrigation and drainage research projects are needed.

Secondary Objectives

1. To learn more about efficiencies in the application of water in irrigation, particularly as related to methods and rates of application of irrigation water on different soils.
2. To learn more fully the possible savings of water through storage of flood flows in the form of capillary soil moisture.
3. To ascertain the water requirements of basic crops, i.e., the yield-water relations, under climatic and soil conditions in which such studies have not heretofore been conducted.
4. To study further the methods of watershed management for the purpose of determining how to obtain the greatest net return from the range, timber, and water resources of the state. Such a study would involve the question of water consumption by native vegetation, soil erosion, and stream channel losses.
5. To study further the precipitation-runoff relationships in order to determine the safe water yield from the principal watersheds of the state and to determine the proportion of such yield that contributes to the valley ground-water supplies naturally, or that may be made to contribute by artificial water spreading.
6. To evaluate the specific water conductivities of different soils in order especially to be able to compute the upward or downward flow of water in saturated and in unsaturated soils.
7. To study the hydraulics of irrigation and drainage wells as related to water yield, cone of depression, and economic pumping.
8. To continue the study of consolidation of irrigation companies including the problem of redistribution of the available water supply for greater efficiency and the development of available sources of supplemental water.
9. To study the erosion of soils on irrigated land caused by faulty irrigation practices and to formulate bases for design of water distribution systems on the farms that will reduce erosion to a minimum.
10. To find economical and efficient ways of lining irrigation canals to reduce seepage losses and thus to conserve water for use in irrigation and protect soils from the menace of rising water tables and alkali concentration.
PASTURE PRODUCTION
(Continued from page 1)
creased pasture yields 21.5 percent over a three year period; 200 pounds of treble superphosphate gave an increase of 37.5 percent; 100 pounds of superphosphate and 100 pounds ammonium sulfate raised the yield 45.2 percent; barnyard manure applied at the rate of 20 tons per acre stepped up production 14.7 percent; while a combination of manure and phosphate gave an increase in yield of pasture forage of 34.3 percent.

The pasture area that received treble superphosphate at the rate of 600 pounds per acre produced 211 percent more herbage the first year and 96.7 percent more the second year than did a similar area of unfertilized pasture. The year of the high increase of 211 percent was the first year after the fertilizer had been applied and was the drought year of 1934. When treble superphosphate was applied at the rate of 200 pounds per acre there was an increase the first year of 55.1 percent, the second year of 55.1 percent, and the third year of 36.6 percent in green grass and clover harvested per acre.

Increased Phosphorus Content of Pasture Herbage

The application of fertilizer to the pastures not only increased their yield but also affected the composition of the forage harvested. In all cases where the phosphate was applied the forage coming from these plots had a higher phosphate content than did forage from unfertilized areas. The first year after the heavy applications of phosphorus the plots showed a phosphorus content of 0.36 of a percent (on a dry matter basis) in the forage as compared to 0.17 of a percent from untreated plots. The lighter applications of phosphorus gave similar but less conspicuous results. The average percent of phosphorus in the herbage (dry matter basis) from the unfertilized plots for the years 1935, 1936, and 1937 was 0.22 percent compared to approximately 0.27 percent in the forage from the plots where treble superphosphate was applied.

Best Method of Supplying Phosphorus to Dairy Cows

The fact that the phosphorus content of pasture forage can be increased by the application of phosphate-bearing fertilizers is of importance to dairy-men having high-producing dairy herds. Phosphorus is one of the minerals most needed in the dairy ration, and is the one most likely to be lacking in Utah grown roughages. The growing of pasture herbage of high mineral content is the best way to supply the necessary minerals in the dairy ration.

Phosphorus Increases Percentage of Clover

In every case where phosphorus was applied the amount of clover in the herbage increased. The percentage of clover in the forage from the phosphated plots ranged from 30 to 53 percent compared to 13 to 27 percent in forage from the check plots. On the other hand the application of nitrogen in the form of ammonium sulfate stimulated the grasses at the expense of the clovers.

Nitrogen Higher in Phosphated Herbage

Chemical analysis showed a slightly higher nitrogen content in the herbage from the phosphated plots. This is explained by the fact that clovers and other legumes, their growth stimulated by the application of treble superphosphate, made up a higher percent of the green forage harvested, the increase in nitrogen coming from the legumes.

Increase from Manure

While the increase in forage yield from the application of manure was not so great or immediate it was substantial and probably as the manure works into the sward there will be a more lasting effect. The last year's results show the manured plots coming into the lead.

Treble Superphosphate Plus Ammonium Sulfate or Manure

When treble superphosphate was applied in combination with ammonium sulfate or manure the increase in herbage production was greater than when ammonium sulfate or manure was applied alone. The increase in production from treatments with ammonium sulfate and manure is no doubt caused by the nitrogen they contain. The liquid fraction of the manure is high in nitrogen. Where manure is properly taken care of and the urine conserved so that it can be applied to the land there is no necessity to purchase a nitrogen fertilizer such as ammonium sulfate.

Livestock Carrying Capacity Increased

When fertilizers are applied to pastures, the livestock carrying capacity is increased in direct proportion to the increase in green herbage produced. In addition the animals grazing the fertilized pasture herbage are consuming a more nutritious feed. Herbage grazed from fertile soils, in addition to being higher in phosphorus and nitrogen, is likely to be more digestible because of a lower crude fiber content.
VITAMIN C

(Continued from page 1)

For the past eight years various studies have been made in the home economics laboratory of the Utah Experiment Station for the purpose of learning something of human needs for vitamin C. Without going into detail it is necessary only to say that as a result of these studies we have come to agree with those who believe that for the average individual not less than 50 milligrams of vitamin C (ascorbic acid) should be provided every day.

Realizing that to the person who has not given much attention to matters of this kind the measure, 50 milligrams, has little meaning, the accompanying table of vitamin C values of some common foods which have been determined in this laboratory is offered.

For practical purposes only the first column and the last will be needed, but column 2 is added for the purpose of demonstrating that the results are based upon a sufficient number of determinations to justify confidence in their reliability. Determinations have been made on a substantial number of other foods, which will be reported as soon as present results can be verified.

Vitamin C (ascorbic acid) values of some common foods

<table>
<thead>
<tr>
<th>Food substance</th>
<th>Number of titrations</th>
<th>Average number of food substance</th>
<th>Common measure furnishing approximately 50 mgms. of vitamin C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grapefruit</td>
<td>22</td>
<td>32 mgms.</td>
<td>One-half (medium size) grapefruit</td>
</tr>
<tr>
<td>Lemon</td>
<td>10</td>
<td>47 mgms.</td>
<td>One lemon</td>
</tr>
<tr>
<td>Oranges</td>
<td>37</td>
<td>42 mgms.</td>
<td>One orange, large</td>
</tr>
<tr>
<td>Valencia</td>
<td>44</td>
<td>51 mgms.</td>
<td>One orange, medium</td>
</tr>
<tr>
<td>Naval</td>
<td>5</td>
<td>41 mgms.</td>
<td>One-four-oz. glass</td>
</tr>
<tr>
<td>Orange juice (canned)</td>
<td>42</td>
<td>15 mgms.</td>
<td>Two and one-fourth cups</td>
</tr>
<tr>
<td>Peas, fresh (uncooked)</td>
<td>21</td>
<td>11 mgms.</td>
<td>Three and one-half cups</td>
</tr>
<tr>
<td>Peas, frozen</td>
<td>176</td>
<td>34 mgms.</td>
<td>One and one-eighth cups</td>
</tr>
<tr>
<td>Raspberries, average of</td>
<td>17 varieties (uncooked)</td>
<td>26 mgms.</td>
<td>Two and three-eighths cups</td>
</tr>
<tr>
<td>Raspberries, canned</td>
<td>35</td>
<td>14 mgms.</td>
<td>Two medium tomatoes</td>
</tr>
<tr>
<td>Tomatoes, Stone</td>
<td>98</td>
<td>26 mgms.</td>
<td>Four medium tomatoes</td>
</tr>
<tr>
<td>Tomatoes, Stone</td>
<td>11</td>
<td>13 mgms.</td>
<td>Four medium tomatoes</td>
</tr>
<tr>
<td>Tomatoes (greenhouse grown)</td>
<td>26</td>
<td>12 mgms.</td>
<td></td>
</tr>
<tr>
<td>Tomatoes (early market)</td>
<td>10</td>
<td>21 mgms.</td>
<td>One cup</td>
</tr>
<tr>
<td>Tomato juice</td>
<td>54</td>
<td>21 mgms.</td>
<td>One cup</td>
</tr>
<tr>
<td>Tomato juice, canned</td>
<td>13</td>
<td>23 mgms.</td>
<td>One cup</td>
</tr>
</tbody>
</table>

CONTROL OF LYGUS BUGS

(Continued from page 6)

Three to five broods of lygus bugs are annually produced in Utah. New generations do not appear with any uniform regularity. With the exception of early spring, all growth stages of lygus bugs (eggs, five nymphal instars, and adults) may be found simultaneously in alfalfa fields throughout the growing season.

Control

Like most hemipterous insects, lygus bugs are unusually difficult to control. Adverse winter weather, consisting of subzero temperatures with little or no snow cover or with the latter condition prevailing, together with the occurrence of alternate thawing and severe cold periods, is perhaps the greatest factor in the natural destruction of lygus bugs. These pests are attacked by few natural enemies and the degree of control effected by them is negligible.

Lygus bugs possess an extremely high resistance to most known insecticides. During the past three years the Utah Agricultural Experimental Station has performed tests in which every insecticide and combination of insecticides which was thought to possess any lethal effect on these pests has been tried without finding one that proved satisfactorily efficient or the present cost of which was not prohibitive for field use. Cultural methods at present offer the best means of control.

PASTURE PRODUCTION

(Continued from page 9)

Manure Plus Phosphate

A program for fertilizing the main pastures at the Dairy Experiment Farm was decided upon based on results obtained in this experiment. The data indicated that a combination of treble superphosphate and manure containing the urine would give the best results. Every three years treble superphosphate is applied at the rate of 200 pounds per acre, and manure is applied directly from the barn gutter at the rate of from 10 to 15 tons per acre. The phosphate is applied in the fall of the year, broadcasted by hand. The manure is put on with the spreader, starting as soon as the cows are placed in the barn in the fall and in some years continuing until time to harrow pastures in the spring. One of the advantages of pastures is that manure can be spread on them when it is impossible on any of the other farm land.

TURKEY PRODUCTION

(Continued from page 3)

The recent expansion of turkey production emphasizes the need for each grower to operate on a most efficient basis. The use of good range and every possible precaution to control losses are important. Reducing feed costs by the greatest possible use of local farm produced feeds is equally important. Good feed troughs to prevent waste of feeds by the birds billing the feed out, or winds blowing it out, or waste when adding fresh feed, are necessary. The feeds should be kept clean and always available to the birds.

The feed consumption per pound of gain increases rapidly as the birds approach maturity. A well planned marketing program to select and market the birds as soon as they are finished or ready for market may also aid in reducing feed cost.

Good, plump, well-fleshed birds with a good layer of fat under the skin are the goal of every feeder.
FROZEN FRUIT
(Continued from page 2)

He bought at will according to the list of varieties on the menu board.

The sales were distributed as follows:

<table>
<thead>
<tr>
<th>Variety</th>
<th>% of sales</th>
<th>Variety</th>
<th>% of sales</th>
</tr>
</thead>
<tbody>
<tr>
<td>November</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vanilla</td>
<td>13.9</td>
<td>Maple</td>
<td>20.6</td>
</tr>
<tr>
<td>Chocolate</td>
<td>15.0</td>
<td>Apricot</td>
<td>9.1</td>
</tr>
<tr>
<td>Strawberry</td>
<td>13.1</td>
<td>Peach</td>
<td>9.9</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td></td>
<td></td>
<td>18.4</td>
</tr>
<tr>
<td>January</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vanilla</td>
<td>17.8</td>
<td>Maple</td>
<td>29.0</td>
</tr>
<tr>
<td>Chocolate</td>
<td>18.9</td>
<td>Mont.</td>
<td>9.5</td>
</tr>
<tr>
<td>Strawberry</td>
<td>9.5</td>
<td>Raspberry</td>
<td>6.4</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td></td>
<td></td>
<td>8.9</td>
</tr>
<tr>
<td>March</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vanilla</td>
<td>25.3</td>
<td>Maple</td>
<td>21.2</td>
</tr>
<tr>
<td>Chocolate</td>
<td>17.4</td>
<td>Satsuma</td>
<td>5.5</td>
</tr>
<tr>
<td>Strawberry</td>
<td>12.8</td>
<td>Cantaloupe</td>
<td>3.7</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td></td>
<td></td>
<td>16.1</td>
</tr>
</tbody>
</table>

From this introductory survey of consumer acceptance it was found that the seven kinds of fruit ice cream were favored in the following order: strawberry, peach, cherry, apricot, raspberry, Satsuma plum and cantaloupe.

In analyzing these sales to students it should be kept in mind that the consumer demand may be different in commercial sales areas than on a college campus. All the ice cream sold on the campus went over the counter in cones. Sundaeas, malted milks and ice cream sodas generally require vanilla ice cream. Therefore as given below in the summary of the sales of ice cream varieties in the State of Utah during the summer of 1939, vanilla represented over half the sales made.

Survey of variety sales of ice cream in the State of Utah. (May to September, 1939, inclusive):

<table>
<thead>
<tr>
<th>Variety</th>
<th>% of total sales</th>
<th>Variety</th>
<th>% of total sales</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vanilla</td>
<td>58.10</td>
<td>Cherry</td>
<td>2.14</td>
</tr>
<tr>
<td>Chocolate</td>
<td>7.00</td>
<td>Boysenberry</td>
<td>0.01</td>
</tr>
<tr>
<td>Strawberry</td>
<td>9.80</td>
<td>Orange</td>
<td>1.30</td>
</tr>
<tr>
<td>Maple</td>
<td>3.00</td>
<td>Pineapple</td>
<td>1.90</td>
</tr>
<tr>
<td>Peach</td>
<td>0.50</td>
<td>Cantaloupe</td>
<td>0.00</td>
</tr>
<tr>
<td>Red rasp.</td>
<td>0.55</td>
<td>All others</td>
<td>15.16</td>
</tr>
<tr>
<td>Black rasp.</td>
<td>0.40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apricot</td>
<td>1.40</td>
<td></td>
<td>100.00</td>
</tr>
</tbody>
</table>

From the above summary we find that 16.74 percent of the sales in the state were fruit ice creams and 9.15 percent fresh fruit varieties as compared with 23 percent on the college campus.

NEW PROJECTS

Virus diseases of stone fruits

An agreement has been entered into with the U. S. Bureau of Plant Industry relative to investigations to determine the nature of suspected virus diseases of stone fruits. Investigations will be made by B. L. Richards, who has charge of this project, to determine plants affected by, and the symptoms of, the disease. Studies will also be conducted relative to the dissemination and control of the disease.

Causes of bee losses

The U. S. Bureau of Entomology and Plant Quarantine and the Utah Agricultural Experiment Station will cooperate in a study under the direction of G. F. Kuykendall of the causes and extent of the recent heavy losses of honeybees in Utah.

Influence of fertilizers, seed inoculation and harvesting practices on the yield and quality of canning crops

Improving the quality of canning crops will be an important contribution both to the canners and the farmers of the state. Affects of different types and amounts of fertilizers, of seed inoculation of peas, and of various harvesting practices, will be studied in relation to yield, quality, and production of such crops as peas, tomatoes, and Maize. Project leaders are L. H. Pollard and D. W. Pittman.

Influence of cover crops, fertilizers and moisture supply on yield and grade of fruit in orchards

These studies directed by A. L. Stark and D. W. Thorne will be made in an attempt to increase the yield per fruit tree in Utah, which at present is low compared with other fruit-producing areas in the western United States. There are indications that this condition is the result of lack of knowledge and application of satisfactory soil management and irrigation practices.

Soil-borne diseases of the potato

The object of these investigations is to determine and study the general nature of the various soil-borne diseases affecting the potato crop in Utah. The distribution, economic importance and methods of control will also be studied. The project is directed by B. L. Richards.

Commercial grain grading and testing

This project has as its objective the furnishing of qualified seed and grain laboratory service. Grain samples are analyzed for a small fee for anyone wishing this service. This laboratory is in charge of R. J. Evans, D. C. Tingley and A. F. Bracken.

Utilization of Jerusalem artichokes in lactic acid production

At present lactic acid is produced principally from refined glucose sugar and from skim milk and whey. It is the purpose of this work which is under the direction of A. A. Anderson and J. E. Greaves to develop a lactic acid fermentation process using Jerusalem artichokes.

Freezing preservation of Utah fruits and vegetables

Two phases of this project, the freezing preservation of Utah fruits, and the vitamin content and quality appraisal of frozen foods, were reported in the first issue of this publication. The utilization of frozen fruits in ice cream is described in this issue. A review of the freezing preservation of vegetables will appear later. This is a cooperative project with the U. S. Laboratory of Fruit and Vegetable Chemistry, the Rocky Mountain Packing Corporation, the American Can Company, the Utah Ice and Storage Company, and the Utah Agricultural Experiment Station. Station project leaders are F. M. Coe, L. H. Pollard, Mrs. A. P. Brown, and A. J. Morris.

Factors affecting the lamb crop in range sheep

This study will be made in an attempt to find the causes of the small lamb crop in the state and to develop methods for increasing it. The project leaders, R. W. Phillips, A. C. Espein, R. A. Ramsussen, and M. A. Madsen, will cooperate in this study with the Intermountain Forest and Range Experiment Station at Orderville.
HOUSE OVER-CROWDING PREVELANT IN MANY RURAL UTAH COMMUNITIES

Bedroom Space Found Inadequate in Most Utah Homes

By JOSEPH A. GEDDES

Congestion has been considered an urban disease. If there is one thing more than another a country man takes pride in, it is elbow-room. Most of his working hours are spent out-of-doors working his land. Air is free and usually pure. He is master of the land he works and of the ground on which he walks.

Yet rural people are more crowded than they realize and crowding too often occurs at places that are detrimental to satisfactory living. The chief focal points at which crowding develops among rural people are: (1) the house, (2) the bedrooms, (3) the small sized farm, (4) the overgrazed pasture or range, (5) the down town street or sidewalk, (6) the public building, (7) the church, and (8) the school-house along with the school bus.

In a study by the Rural Sociology Department of seven rural communities in the state in which conditions are thought to be similar to those existing in many rural areas, it was found that in many homes the house is too small for the size of family that lives in it. A house that has one room for each person in the household exclusive of halls and bathrooms is held by housing authorities to be adequate (fig. 1). In the study of the seven rural communities it was found that two houses in each hundred are one room houses and eleven homes in each hundred are two room houses. One of these communities had 10 one-room houses out of a hundred and another had 20 two-room houses out of each hundred. The average number of people in the household for the 7 communities was 4.8 and for the two communities where the one- and two-room houses were greatest the average size of household was larger still, being 5.1 and 5.2. Only a little over half of the families were in possession of houses which reached the standard of one room per person, the percentage for farm families being 52.5 and for nonfarm families 54.6.

Another point at which overcrowding shows itself strongly in rural Utah communities is in bedroom space. In the seven communities more than 1 percent had no bedroom and one out of three had one bedroom only. In one of the villages, which had an average household of 5.1, more than half, 52.5 percent, of the homes had but one bedroom (fig. 2).

An accepted standard of adequacy of bedroom accommodation is 0.6 of a bedroom per person. In the seven communities only a minority of the homes reached this standard, among farm families, 31.6 percent, and among nonfarm families, 24.2 percent.

The crowding of bathroom accommodations on Saturday evening and Sunday morning is another form of crowding well known in rural Utah.

Crowding of ownership of land into farms too small to provide a satisfactory living for a family has gone far in Utah. Population pressure on the land comes with large families and with no means of preserving farms from subdivision. Denmark does not allow land holdings to be subdivided and permits a transfer of a holding to a son or son-in-law only. Thus a farm that is able to provide a satisfactory living for a family is preserved for the next owner whose family it continues to serve. Utah has many half-sized farms and part-time jobs.

Grazing land may be overcrowded with sheep, cattle, or wild life. Protection from overgrazing in any form acts as a preserver of favorable conditions.

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