DAIRYING REQUIRES ABILITY

Dairy husbandry requires as much tact, training and experience as the successful operation of an industrial enterprise. Aside from a dependable feed supply and a good market for the products, success is dependent upon the breeding, feeding, care and management of the herd.

It is generally true that dairy farmers who read good dairy papers and farm bulletins are making the greatest progress. However, the practical application of much of the material published varies greatly with local conditions. This is particularly true in feeding for economical production. For this reason, dairy farmers will do well to observe carefully what practices are giving the best results under conditions similar to their own.

The object of this circular is to set forth the essentials of economical milk production in Montana under practical farm conditions. The information presented is based upon many years of experience as a herdsman, careful study of dairy herd improvement association data obtained within the state, and close observation of the practical management of successful Montana dairies.

The discussion on the treatment of some common ailments is limited to a few of the common diseases affecting the dairy cow. In most cases the care and treatment suggested are simple and may be applied by the dairyman without much trouble or cost. When in doubt consult a veterinarian.

J. O. TRETSVEN
Dairying In Montana

By

J. O. TRETSVEN, Extension Dairy Specialist

CONTENTS

The Place of Dairying in Montana 3

The Dairy Herd:
Selecting Dairy Cows 6
Selecting the Herd Sire 8
Care of the Herd Bull 9

Care of the Dairy Cow:
The Dry Period 11
Care at Calving Time 11
What to Feed 12
Value of Concentrates 14
Value of Dry Roughage 15
Silage and Roots 15
Pasture 16
Minerals and Salts 16
How Much to Feed 18
Suggested Rations 20
Notes on Feeding 20
Summer Feeding and Management 20
Danger From Bloat 21
Feeding Grain on Pasture 21
Protection Against Flies 22
Watering 22
Housing 22
Keeping Flies Out of Barn 23
Fall vs. Spring Freshening 24
Exercise in Winter 24
Trimming Hoofs 24
Treatment for Lice 25
Milking 25
Frequency of Milking 26
Milking Machines 26
Milk and Fat Records 27
Breeding Records 28
Treatment of Some Common Ailments:
Constipation or Impaction 28
Acute Bloat 29
Chronic Bloat 29
Lump Jaw 29
Sterility 29
Retained Placenta 30
Milk Fever 30
Garget or Mastitis 31
Sore or Injured Teats 31
Infectious Abortion 31
Some Dairy Literature 32

THE PLACE OF DAIRYING IN MONTANA

Within the past 20 years dairying has become one of the important branches of Montana's agriculture. In 1910 the state had approximately 80,000 milk cows; by 1930 the number had increased to 188,000. This increase in numbers has been accompanied by a marked improvement in the quality of the animals. Although the improvement of cattle has been great, especially in the irrigated and more favorable dry land districts, the estimated average production per cow for the entire state still is only 150 pounds of butterfat. By adopting better dairy practices, the average can be greatly increased, and on many farms doubled, with but relatively little increase in expenses.

The relative importance of the dairy industry in Montana is shown by the following table which is taken from the "Montana 1930 Farm Review."
The following table gives the farm value, gross income and cash income from farm production by commodities for 1929 and 1930:

<table>
<thead>
<tr>
<th>Items</th>
<th>1929</th>
<th>1930</th>
<th></th>
<th>1929</th>
<th>1930</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Farm Value</td>
<td>Gross Income</td>
<td>Cash Income</td>
<td>Farm Value</td>
<td>Gross Income</td>
</tr>
<tr>
<td>Cattle and Calves</td>
<td>26946</td>
<td>26069</td>
<td>25287</td>
<td>21366</td>
<td>19530</td>
</tr>
<tr>
<td>Wheat</td>
<td>38741</td>
<td>30861</td>
<td>30715</td>
<td>16332</td>
<td>13882</td>
</tr>
<tr>
<td>Milk</td>
<td>10672</td>
<td>16146</td>
<td>12812</td>
<td>13338</td>
<td>12831</td>
</tr>
<tr>
<td>Sheep and lambs</td>
<td>16184</td>
<td>13906</td>
<td>13781</td>
<td>10630</td>
<td>9943</td>
</tr>
<tr>
<td>Wool</td>
<td>9195</td>
<td>9195</td>
<td>9195</td>
<td>6896</td>
<td>6896</td>
</tr>
<tr>
<td>Hogs</td>
<td>7485</td>
<td>8054</td>
<td>6061</td>
<td>6331</td>
<td>6710</td>
</tr>
<tr>
<td>Sugar Beets</td>
<td>2895</td>
<td>2895</td>
<td>2895</td>
<td>4205</td>
<td>4205</td>
</tr>
<tr>
<td>Hay</td>
<td>30564</td>
<td>3060</td>
<td>3060</td>
<td>25893</td>
<td>3107</td>
</tr>
<tr>
<td>Eggs</td>
<td>5108</td>
<td>4950</td>
<td>3308</td>
<td>4086</td>
<td>3936</td>
</tr>
</tbody>
</table>

The figures show that milk ranked third in value among the major agricultural products of the state. Since 1920, Montana has shipped out increasing amounts of butter and butterfat. In 1930 over seven million pounds of butter and nearly a million pounds of fat were marketed in other states, most of the surplus butter finding a market in Pacific Coast cities.

The dairy industry in Montana may be divided into three classes: First, the production of market milk for consumption in nearby cities and towns, a phase of the industry which is fairly profitable and will increase in volume as the consumption demands of the urban population increase. Second, the production of milk and cream for the manufacturers of cheese and butter, the principal enterprise on many farms, particularly in the irrigated districts. Third, dairying as a limited side line on dry land farms particularly in connection with wheat and beef production. Though conditions are not so favorable for dairying on most dryland farms, many farmers find it profitable to milk a few cows for home use and to help defray living expenses.

Reasons For Dairying

There is an adage that, "Prosperity follows the dairy cow." No doubt, there are many exceptions to this statement but it is true that the dairy cow has contributed much to the prosperity and development of many communities, first, because dairying makes for, and fits well into, a diversified type of farming, second, because dairying helps to reduce the cost of living on the farm. Both of these points are fundamental to success on many farms of the state. Where dairying is carried on, a variety of crops must be produced, and this makes it possible to adopt a rotation. The legumes in the rotation and the manure help materially to maintain soil fertility.
Weeds, particularly Canadian thistle, can be held in check in many places by growing alfalfa. In addition to the sale of dairy products, the skim milk, buttermilk or whey may be used to good advantage in feeding pigs, poultry and calves. It is a well recognized fact that pigs and poultry grow faster and hens lay more eggs when their nations are supplemented with dairy by-products. The sale of veal calves, surplus cows and culled-out animals add to the income. When these various items are added to the returns from the sale of milk or cream, the dairy becomes an important part in making the farmer successful.

Prices of dairy products in the past generally have been influenced by the industrial situation and, to some extent by prices of other agricultural products. Particularly in recent years, there has been a growing demand for dairy products, and this, together with the fact that many people do not like dairy work, have made dairying one of the most dependable phases of our agriculture. The forces that have put dairying on a relatively high plane in the past will, no doubt, operate similarly in the future. Montana has a comparatively good market for her surplus dairy products in the Pacific Coast cities.

Natural conditions are especially favorable for dairying in Montana’s irrigated districts. In summer, irrigated or sub-irrigated pastures produce an abundance of grass for a period of four to five months. In these districts great quantities of cheap, high-grade alfalfa hay are produced. This hay with a grain ration composed of home-grown feeds such as barley, oats, wheat and corn together with a little wheat bran, makes a splendid winter ration for high production, and high-priced protein feeds are not necessary. In addition, there are many other farm feeds and by-products from the mills and factories that can be used. On the dry land farms the natural pasture and winter feed conditions are not so favorable. However, by growing more feed crops such as corn fodder, cereal hay, brome hay and sweet clover and then building up a feed reserve for the drought years, dairying can be made a part of the farm business. The climate and water supply is quite favorable for dairying, especially in the irrigated mountain valleys. Dairy herd improvement association records for the past seven years show that farm feeds, especially where legume hays grow well, are well-suited for high production. Likewise, the cost of production is relatively low where good dairy practices are followed.

The need for the production of concentrated products of a relatively high value to overcome the handicap of distance from larger markets and high freight rates is another important reason why dairying deserves a major place in Montana’s agriculture.

THE DAIRY HERD

Success in the dairy business depends largely upon the ability to obtain high and economical production. This can only be accomplished by good, well-bred animals, properly fed and managed. The following table will
show the importance of obtaining a high herd average. The data is taken from some of the Montana dairy herd improvement association records prior to 1929. The records of the individual cows were divided into five groups according to their production of butterfat.

<table>
<thead>
<tr>
<th>Number of cows per group</th>
<th>Ave. production of fat per cow</th>
<th>Ave. production of milk per cow</th>
<th>Ave. value of Butterfat</th>
<th>Ave. cost of roughage</th>
<th>Ave. cost of grain</th>
<th>Ave. total cost of feed</th>
<th>Ave. return above cost of feed</th>
</tr>
</thead>
<tbody>
<tr>
<td>178</td>
<td>204</td>
<td>5138</td>
<td>87.24</td>
<td>35.61</td>
<td>8.18</td>
<td>43.79</td>
<td>43.45</td>
</tr>
<tr>
<td>288</td>
<td>251</td>
<td>6222</td>
<td>108.16</td>
<td>37.11</td>
<td>12.03</td>
<td>49.74</td>
<td>58.42</td>
</tr>
<tr>
<td>259</td>
<td>298</td>
<td>7381</td>
<td>127.90</td>
<td>39.02</td>
<td>13.97</td>
<td>52.99</td>
<td>74.01</td>
</tr>
<tr>
<td>197</td>
<td>347</td>
<td>8584</td>
<td>147.58</td>
<td>40.21</td>
<td>19.81</td>
<td>60.02</td>
<td>87.56</td>
</tr>
<tr>
<td>90</td>
<td>395</td>
<td>9681</td>
<td>166.07</td>
<td>40.44</td>
<td>21.40</td>
<td>61.84</td>
<td>104.23</td>
</tr>
</tbody>
</table>

From the above table it should be noted that when the production per cow increased from 204 to 251 pounds of butterfat, the total cost of feed increased from $43.79 to $49.74, a difference of $5.95, while the average returns above cost of feed increased from $43.45 to $58.42, or a difference of $14.97. The records show that for every 50 pound increase in the production of butterfat, the returns above cost of feed increases about $15. From the above table it is evident that the farmer who obtains a low average production gets a relatively small income over and above feed costs.

Selecting Dairy Cows

Any of the leading dairy breeds of cattle will do well in Montana if given the proper feed and care. Where feed, water and shelter are not suitable for high production and where some cheap grazing land is available for growing steers, many farmers prefer a dual-purpose type of animal. Before deciding upon a breed of cattle, the farmer will do well to carefully study the merits of the various leading breeds. The following points should be considered before deciding upon a breed of cattle:

1. The advantage of having the same breed of dairy cattle as one's neighbors. This makes it possible to exchange herd sires, to buy well-bred sires collectively and to attract buyers who may be interested in obtaining a large number of animals of the same breeding.

2. The market for surplus cows, culled-out animals, and veal calves.

3. The market for milk or milk products. Where a "lighter" milk is in demand a breed producing milk of lower butter fat content is desirable. Where there is a demand for milk rich in fat or where the economical production of butterfat is the primary object, then a high testing breed should be considered.
4. Personal preference. A person is likely to do well with the breed he likes best.

5. The need of skim milk in feeding other classes of livestock.

6. The adaptability of the farm.

There are both good and poor individuals in every breed. For this reason, the best results cannot be obtained unless the dairymen exercises good judgment in selecting breeding animals and continuously culls out inferior producers as revealed by the milk scales and fat test. Many farmers make a mistake by switching from bulls of one breed to those of another in hopes of developing a superior class of animals that combine all of the good qualities of the various breeds used and none of their defects. Unfortunately, the opposite results are obtained. This system of breeding produces off-colored, ill-shaped and inferior animals. Of 68 Montana dairymen in dairy herd improvement associations with a 300-pound herd average or over, 66 reported using purebred sires. The average length of time

Fig. 1—Agate Valentine Fairview Burke, 549771, Grand-Champion Cow, Pacific International. Bred by David Lea & Son, Stevensville.
these men had used purebred sires was nine years. The dairyman who has been most successful in developing a high-producing herd has used continuously for a period of years good, purebred sires of his chosen breed.

Selecting Herd Sires

Because the herd bulls are responsible for one-half of the inherited characteristics of the calves, great care should be exercised in selecting the sire. The cheapest and most practical method of developing a highly productive herd is by the use of good purebred sires. Following are a few important points that should be considered in selecting a herd sire:

1. Use only purebred sires of the desired breed.

2. As far as possible, select a bull whose near ancestors are not only high producers but are also reproducers of highly productive animals. Since the bull is merely a medium for propagating the dairy qualities of his ancestors, it is well to study carefully the production, breeding qualities and type of his near ancestors. This can be accomplished best by obtaining and studying a copy of the pedigree and by inspecting the living ancestors if possible.

Fig. 2—Dell Bee of Plaintana, 193557, Grand-Champion, Midland Empire Fair, Billings. Owned by Tom Gilkerson, Bozeman.

3. The more high-producing dams and the more sires and dams with high-producing daughters appearing close up in the pedigree, the more-likely his off-spring will be good producers.

4. Bulls whose ancestors have few if any production records are-
likely to be of little value unless the buyer knows that the ancestors were productive.

5. To evaluate an animal's pedigree, the buyer should acquaint himself with the classification of records as are adopted by the breed association. This information may be obtained by writing to the secretary of the breed association. If the buyer is not versed in reading pedigrees he should have someone who knows pedigrees interpret them for him.

6. While high production is of greatest importance, it is well to get an animal of good type. For this reason, it is well to see the animal and the near ancestors if possible.

7. If an active proven bull can be obtained, more dependable progress can be made. (A proven bull is one whose daughters are known to be high producers).

8. Two or more near neighbors may arrange to buy a high-class bull collectively, then by trading bulls with one another at the end of two years, the cost of keeping a good bull at the head of the herd may be reduced to the minimum.

CARE OF THE HERD BULL

The young bull should be fed a ration that will promote good growth and keep him in a thrifty, vigorous condition. The best results will be obtained if the roughage consists of some legume hay. The amount of

Fig. 3—You’ll Do Gallatin Boy, 249178, Grand-Champion Jersey Bull, Montana State Fair, 1929, ’30 and ’31. Owned by F. M. Shoemaker, Arlee.
grain fed should be governed by the quality of the roughage and the condition of the animal. As the animal matures, little if any grain is needed. Over-feeding may be worse than under-feeding.

The continuous use of dry, bleached forage over a long period of time is likely to cause sterility. For this reason, some green soiling crop should be fed in summer unless the bull is out on pasture.

While the bull is young and easy to handle, he should be thoroughly broken to lead and to give his ring when the word is spoken. The bull should never be teased or abused, instead, he should be treated kindly but firmly. The object is to gain his confidence. Regardless of how well he may handle the attendant should never take chances with a bull. The quiet and so-called gentle bulls do most of the killing. When the bull is a year old, he should be rung. Older bulls should always be handled with a well-made staff.

For several reasons, the bull should not be allowed to run with the herd; the cows are bred too soon after calving, accurate breeding records are not obtained, heifers are bred too young, and the bull is often a source of trouble with the neighbors.

The “safety bull pen” provides the best and most practical way of housing and handling a herd bull. Detailed description of this is given in Circular No. 2, “The Safety Bull Pen,” Montana Extension Service, Bozeman, Montana.

![Moose, 6316, First Prize, Junior Yearling, Brown Swiss Bull, National Dairy Show, Columbus, Ohio. Bred by W. O. Bohart, Bozeman.](image)
CARE OF THE DAIRY COW

The Dry Period

The production of a dairy cow is largely dependent upon her physical condition before calving. For this reason the cows should be dried up from six to ten weeks before freshening. This necessitates keeping a record of the date of breeding. The gestation period is approximately 283 days. If the cow does not dry up in due time naturally, do not milk her completely dry. When the milk flow has decreased to 2 or 2½ gallons daily, milking once a day will suffice. As the milk flow continues to decrease it is well to skip two milkings and then three milkings and so on until the cow is dry. In addition to the above treatment, it may be necessary to feed persistent producers on dry roughages such as timothy hay or corn fodder. In some cases the drying up period may take three or four weeks.

The dairyman should always aim to have his dry cows in good, thrifty condition and carrying considerable flesh at calving time. For winter feeding, legume hay should constitute all or a large portion of the roughage. A bucket of sliced roots a day for a couple of weeks before calving is helpful. If the desired condition can be obtained with roughage alone the cost of feed will be reduced, if not, some grain should be fed. The amount will vary with the condition of the animal and the quality of the roughage. From two to ten pounds daily is commonly used. The regular herd mixture may be used. Some dairymen regard a pound of grain fed before calving to be worth two pounds after calving. In summer, while pastures are good, no extra feed is required except for thin animals.

Care At Calving Time

Two or three days before calving, it is well to discontinue heavy grain feeding and to place the cow in large, clean, well-bedded box stall unless the weather is warm, in which case she may be out on pasture. As the time of calving approaches, the udder becomes more distended and the ligaments on either side of the tail head loosen, giving a sunken appearance. It is well to keep watch of the cow while she is laboring but not to disturb her unless assistance is required. In case she fails to pass the afterbirth within 24 hours after calving, it should be removed by a veterinarian unless the attendant is qualified to remove it himself.

After the cow has calved, she may have all the water she wants, but it should be warmed or given in small amounts at a time. Many good dairymen practice giving the fresh cow a warm bran mash for the first feed after freshening. The fresh cow may have all the legume roughage she will eat but it is best not to feed any grain until the second day. As the cow gets over the effects of calving, the grain ration should be gradually increased, taking about three weeks to get her back to a full feed. A bucket of sliced roots daily for three or four weeks helps to give the fresh cow a good start. It is well to encourage the fresh cow to produce her maximum by liberal feeding.
Fresh cows frequently have caked, swollen udders, a condition not necessarily harmful but troublesome. To relieve this condition the cow should be fed rather light, laxative grain rations, milked frequently and the udder massaged. She should also be kept on a deep bed of dry straw and away from draughts. Allowing the calf to nurse for a few days before weaning also helps to reduce the swelling.

After calving there is danger of milk fever. As a preventative, it is best to leave enough milk in the udder to create a slight pressure for three or four days. After that the cow should be milked dry. The disease is most prevalent in high-producing cows after their third or fourth year and usually appears within three or four days after calving. See page 30 for symptoms and treatment.

What To Feed

The economical production of milk depends largely upon the ability of the dairyman to select feeds that will make a good, economical ration and to govern the amounts to fit the needs of each individual cow. Fortunately, it is not difficult to make up a good dairy ration from the available feeds especially in the districts where an abundance of good legume hay and good pasture grass is produced. This is due to the fact that these feeds together with the common home-grown grains make a fairly good ration if properly combined.

In order to provide his cows with the most practical ration the dairyman should know something of the needs of the dairy cow. Protein, carbohydrates and fats are the principal nutrients found in feeds from which the animals build and maintain their bodies and produce milk. The producing cow needs a ration that is fairly high in protein because protein is used for the production of casein (the cheesey matter in milk) and the albumen in the milk. It is also the material from which the tendons, muscles, skin, hair and internal organs are made. The cow uses the carbohydrates and fats primarily for heat and energy, while the surplus is used in the production of the butterfat and milk sugar or stored as body fat. If a large amount of feed rich in protein is used the surplus protein is used to a large extent, as are the carbohydrates and fats. Protein is the indispensible material in the ration. It may be likened to cement in the making of concrete. Knowing this, the dairyman will always aim to give his cows a ration that contains a sufficient amount of protein along with the necessary carbohydrates and fats. The proportion of protein to carbohydrates and fats should not be less than one to six. When milk cows are fed an unbalanced ration containing only a small amount of protein and a large amount of carbohydrates and fats they will not hold up in their milk flow. For these reasons the dairyman should know the relative amount of protein, carbohydrates and fats contained in the various common feeds. This is shown in the following table which gives the digestible nutrients in 100 pounds of feed. The feeds are also grouped according to their protein content.
### Value of Concentrates

#### Low in protein, but fattening:

<table>
<thead>
<tr>
<th>Feeds</th>
<th>Crude Protein</th>
<th>Total nutrients:</th>
<th>Proportion Protein to Carbohydrates and fats</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>100 lbs.</td>
<td>Protein</td>
<td>Carbohydrates and fats</td>
</tr>
<tr>
<td>Dent corn</td>
<td>7.5 lbs.</td>
<td>85.7 lbs.</td>
<td>1:10.4</td>
</tr>
<tr>
<td>Barley</td>
<td>9.0</td>
<td>79.4</td>
<td>1: 7.8</td>
</tr>
<tr>
<td>Oats</td>
<td>9.7</td>
<td>70.4</td>
<td>1: 6.3</td>
</tr>
<tr>
<td>Rye</td>
<td>9.9</td>
<td>81.0</td>
<td>1: 7.2</td>
</tr>
<tr>
<td>Wheat</td>
<td>9.8</td>
<td>81.5</td>
<td>1: 7.3</td>
</tr>
<tr>
<td>Dried beet pulp</td>
<td>4.6</td>
<td>71.6</td>
<td>1:14.6</td>
</tr>
<tr>
<td>Molasses (beet)</td>
<td>2.9</td>
<td>58.7</td>
<td>1:19.2</td>
</tr>
</tbody>
</table>

#### High in protein:

<table>
<thead>
<tr>
<th>Feeds</th>
<th>Crude Protein</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bran and shorts</td>
<td>12.9</td>
</tr>
<tr>
<td>Bran</td>
<td>12.5</td>
</tr>
<tr>
<td>Oil meal (O. P.)</td>
<td>30.2</td>
</tr>
<tr>
<td>Cottonseed meal (choice)</td>
<td>37.0</td>
</tr>
</tbody>
</table>

#### Roughage Dried

<table>
<thead>
<tr>
<th>Feeds</th>
<th>Crude Protein</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fodder corn</td>
<td>3.0</td>
</tr>
<tr>
<td>(medium)</td>
<td></td>
</tr>
<tr>
<td>Timothy hay</td>
<td>3.0</td>
</tr>
<tr>
<td>Prairie hay</td>
<td>4.0</td>
</tr>
<tr>
<td>Oat hay</td>
<td>4.5</td>
</tr>
<tr>
<td>Red clover hay</td>
<td>7.6</td>
</tr>
<tr>
<td>Alfalfa hay</td>
<td>10.6</td>
</tr>
<tr>
<td>Sweet clover (yellow)</td>
<td>10.0</td>
</tr>
</tbody>
</table>

#### Silage and Roots

<table>
<thead>
<tr>
<th>Feeds</th>
<th>Crude Protein</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn silage</td>
<td>1.1</td>
</tr>
<tr>
<td>Sunflower silage</td>
<td>1.2</td>
</tr>
<tr>
<td>Mangels</td>
<td>.8</td>
</tr>
<tr>
<td>Beet pulp (wet)</td>
<td>.5</td>
</tr>
<tr>
<td>Potatoes</td>
<td>1.1</td>
</tr>
</tbody>
</table>

The above tables are taken from "Feeds and Feeding," by Henry and Morrison, except "sunflower silage," which is from Montana Experiment Station bulletin No. 134, by Joseph and Bliss.

In making up a ration select a variety of feeds that will have at least one part of protein to six parts of carbohydrates and fats. Use as much good legume hay, especially alfalfa, as possible. It is the best, and, as a rule, the cheapest roughage available. Select the early cut, well-cured and leafy hay. It is the richest in protein, mineral matter and the essential vitamins. The quality of the protein in choice alfalfa hay fits well with that of our
common grains, making it possible to obtain high production with home­
grown feeds. With choice hay, less grain is required; and the cows may
be maintained in better physical condition.

Silage and roots are excellent feeds for winter and should be used freely
wherever they may be produced at a low cost. In most irrigated districts
the relative cost of silage and roots is too high to be economical.

When hays rich in protein, such as good leafy alfalfa are used in liberal
amounts, select a variety of two or more grains that are relatively rich in
carbohydrates and fats, such as ground barley or corn, with a little rolled
oats or bran to lighten the mixture. Select the feeds that will supply the
total nutrients at the lowest cost. See table on this page for relative value
of feeds.

When roughages low in protein, such as prairie hay or oat hay are
fed, or when liberal amounts of corn silage are used in the ration, the grain
should furnish a large portion of the necessary protein. Such feeds as bran
and oil meal, depending on price, should then be used quite freely with a
limited amount of such fattening feeds as barley or corn. See table on
page 13 for most economical protein feeds.

If the roughage consists of some hay high in protein, such as alfalfa,
and corn fodder or cereal hay or some other roughage low in protein, then
the grain mixture should contain some high protein feeds but less than
where all the roughage is low in protein.

Value of Concentrates

If it is necessary to purchase grain it is well to consult the following
table which gives the relative monetary value of several feeds based on
the total digestible nutrient and protein content.

To supply digestible nutrients the feeds listed have a relative value,
approximately as follows:

<table>
<thead>
<tr>
<th>Feed</th>
<th>Relative Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hullled barley</td>
<td>$1.00</td>
</tr>
<tr>
<td>Corn</td>
<td>$1.08</td>
</tr>
<tr>
<td>Rye</td>
<td>1.02</td>
</tr>
<tr>
<td>Wheat</td>
<td>1.03</td>
</tr>
<tr>
<td>Oats</td>
<td>.89</td>
</tr>
</tbody>
</table>

The table may be used to determine the relative value of feeds at
different prices as follows:

If barley is priced at $1.50 per hundred, the price that may be paid for
oats may be arrived at by multiplying $1.50 (the price of barley) by $.89
(the figure given for oats). Thus $1.50 \times .89 = 1.33$, the relative value of
oats.

To supply protein only the feeds listed have a relative value, approxi-
mately as follows:

When bran is worth $1.00: Bran and shorts are worth $1.01, oil meal
is worth $2.34, cottonseed meal is worth $2.86.
The table also may be used to determine the relative value of feeds at different prices, thus: If bran is priced at $1.30 per hundred as a protein feed, what is oil meal worth? Example of how this is figured—$1.30 (price of bran) x $2.34 (figure given for oil meal) = $3.04, or the relative value of oil meal. Other feeds may be figured the same way.

Observe that the feeds usually purchased to supply the protein, such as bran and oil meal, also have considerable value in furnishing the other nutrients, a point that should be considered in evaluating feeds.

Value of Dry Roughages

The time of cutting and the manner of curing dry roughages greatly influence the feeding value. In general the early cut, leafy, well-cured roughage is the best for milk cows. While the difference in the amount of total digestible nutrients in the dry roughages listed is very slight, the actual value as a feed for milk cows is more nearly proportional to their protein content. Good alfalfa hay heads the list, with choice sweet clover and red clover hay as fair substitutes. Poorly cured and damaged sweet clover hay has but little feeding value and is a dangerous feed. The cereal hays, grass hays and corn fodder, are all relatively low in protein, and have a much lower feeding value for dairy purposes.

The following table will illustrate the difference in feeding value between alfalfa leaves and alfalfa stems; the table giving the protein, carbohydrates and fat content in 100 pounds of the various feeds listed:

<table>
<thead>
<tr>
<th>Protein lbs.</th>
<th>Carbohydrates lbs.</th>
<th>Fats lbs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alfalfa leaves</td>
<td>17.3</td>
<td>35.9</td>
</tr>
<tr>
<td>Alfalfa stems</td>
<td>1.8</td>
<td>46.9</td>
</tr>
<tr>
<td>Alfalfa hay</td>
<td>10.6</td>
<td>39.0</td>
</tr>
<tr>
<td>Wheat bran</td>
<td>12.5</td>
<td>41.6</td>
</tr>
<tr>
<td>Timothy hay</td>
<td>3.0</td>
<td>42.8</td>
</tr>
</tbody>
</table>

The table shows that alfalfa leaves contain more protein than wheat bran and that alfalfa stems have less protein than timothy hay. This means that alfalfa hay should be cut early and put up so as to save as many leaves as possible. Alfalfa stems have little value for dairy cows. Hay that has been bleached from rain and sunshine has lost a large per cent of its feeding value.

Silage and Roots

Most silage and root crops are low in feeding value due to the large amount of water they contain. About three pounds of silage and five pounds of roots are required to replace one pound of hay. This means that when good hay is worth $8 per ton, silage is worth about $2.66 and roots about $1.60. Most silage and root crops are low in protein. See table, page 13.
Fig. 5—A good irrigated grass pasture is the cheapest and best feed in summer.

Pasture

Native dry land pasture has very little value as a feed for milk cows, while the irrigated or sub-irrigated pastures furnish an abundance of choice feed over a long period at a very low cost. The tame mixture pastures are perhaps the best for milk cows, though sweet clover pastures give good results, and usually have a high carrying capacity. With sweet clover or other legume pastures there is more danger of bloat. Crested wheat grass and brome grass make good dry land pasture.

Minerals and Salt

Milk producing animals secrete large quantities of lime (calcium) and phosphorus in their milk. Unless their feed contains sufficient quantities of these minerals, the cows eventually will become unthrifty, and the milk flow will be greatly reduced. The symptoms of a mineral deficiency may not be observed for a few months as the cow has the ability to draw upon the calcium and phosphorus in her skeleton for some time. Eventually, however, and especially toward spring, the cow will show an unthrifty condition, give less milk and exhibit a crippled and stiffened condition of the joints. Cows so affected will have a desire to chew bones, lick the soil and eat rags. Fortunately there are but few cases in Montana where the dairy ration is lacking in lime. The following table lists feeds that are usually high, medium or low in calcium and phosphorus.
While the above table indicates the calcium and phosphorus content of some of the common feeds there is considerable variation from this due to the calcium and phosphorus content of the soil upon which these feeds are grown. When the winter ration is composed largely of well-cured legume hay (particularly alfalfa) and a grain ration that contains some wheat bran or mixed mill feed (bran and shorts), there will be sufficient calcium and phosphorus for cows of ordinary production. The object should be to select a variety of feeds so that both the calcium and phosphorus will be high. Fortunately, most protein-rich feeds are generally high in these minerals. There are many districts in Montana, however, where the soils are deficient in phosphorus. In these districts the hay and grass produced are very low in this mineral. Under these conditions it is well to use a mineral supplement that will supply the animal with the necessary phosphorus. Wherever there is a phosphorus deficiency, sterilized bone meal proves to be a very satisfactory supplement. It is relatively cheap and it contains both calcium and phosphorus in large quantities. The sterilized bone meal may be mixed with the grain at the rate of one or two per cent, or it may be fed with or without salt in boxes where the cows may eat of it at will. Ground lime-stone, air-slacked lime or lime compounds are valuable only when there is a calcium deficiency. When cows are fed green succulent grass or well-cured, leafy hay, they will utilize a much higher percentage of the minerals consumed than when bleached and poorly cured roughage is used.

An iodine deficiency is found in some localities. Where this occurs, the calves are usually born with goiters. This condition can be prevented by feeding potassium iodide in the stock salt. The potassium iodide is mixed with the salt at the rate of one ounce to 300 pounds.

Dairy cows should have all the salt they desire at all times. Some dairymen have the mistaken idea that by forcing their cows to consume large amounts of salt that they will drink more water and in turn produce more milk. An excess of salt is more likely to be detrimental than helpful. It is well to keep granulated stock salt in boxes to which the cows have access. In addition, many good dairymen add a little salt to the grain mixture, using 10 pounds of salt to 1,000 pounds of grain.

**How Much to Feed**

The amount of feed a cow should have depends upon her production.
physical condition, and capacity for food. Thus, each cow must be carefully studied and fed according to her needs. Many high-producing cows get very thin after calving because their rations do not contain enough nutrients or the nutrients are not in the right proportion to produce the milk and maintain the body. It should be the aim of the dairyman to feed his cows at all times in such a way as to maintain them in good physical condition. The cows will not only produce more milk but the lactation period will also be prolonged. It is well to give the cows all the good roughage they will consume, the amount of grain to be adjusted to the production and condition of the individual animals. When the production is high it is evident that more feed is required. The rations given on page 20 show how the amount of feed needed varies with the yield of milk. It is generally conceded that liberal feeding of good dairy cows is the most economical method to follow. This has been verified by the records of experiment stations and cow-testing associations. See table on page 6.

Figure 6 illustrates the importance of feeding cows according to their productive capacity. This chart shows that when a good producing

WHEN THE COW IS FED-

JUST ENOUGH

A

50% for MAINTENANCE  50% for MILK PRODUCTION

TOO LITTLE

B

ENOUGH for MAINTENANCE  TOO LITTLE DEFICIT for MILK

TOO MUCH

C

ENOUGH for MAINTENANCE  ENOUGH for MILK  SURPLUS

Fig. 6—Too little feed means reduced milk production; too much, means waste.
cow is fed a full ration as indicated by (A), 50 percent of her feed is used to maintain her body and 50 percent is available for milk production. If fed a lesser amount as in (B), the same amount is used for maintenance and too little is available for production. Thus, the ration fails to meet the needs of a high-producing animal. In this case the animal loses weight and the milk flow is reduced. The cost of production is also high. If too much feed is given as in (C) the surplus feed is used for increase in body weight. Here again the cost is high.

Some dairymen practice giving all their cows the same amount of feed. Where this system is followed the high producers are apt to be underfed and the low producers overfed. By this method the heavy producers become very thin and decrease in milk flow very rapidly, while the lower producers may maintain their condition or increase in flesh.

When heavy feeding is carelessly practiced the cows are likely to go "off feed" and suffer from indigestion. To avoid this the grain mixture should contain some loose, light feed, such as wheat bran or rolled oats and the amount of grain should be increased very gradually. At no time should the cow be fed more grain than she will clean up. If the cow acts as though she is not hungry and does not lick her manger clean, the grain ration should be reduced. After the cow gets over the effects of calving, she should be fed liberally to encourage high production. As the lactation advances the grain ration should be gradually reduced as the milk flow and her physical condition warrants. Many successful dairymen feed their cows according to some rule. The following rules are common for winter feeding:

Rule I. Feed all the good roughage the cow will consume and 1 pound of grain for every three to four pounds of milk that she produces daily.

Rule II. Feed all the good roughage the cow will consume and only enough grain to keep her in the desired physical condition.

While these rules are fair guides in determining the amount of grain to use, they should not be followed too closely in all cases. The quality of the milk produced and the kind of grain and roughage fed will influence the amount used. Cows producing small quantities of milk do not require as much grain as is called for by rule I. Rule II is perhaps the most practical when the feeding is done by one man and the condition of the cows is closely observed for grain or loss in flesh.

Where an abundance of cheap, high-grade alfalfa hay is produced and grains are relatively high-priced, dairymen use less grain than is called for by Rule I. In some cases no grain is fed at all.

Suggested Rations

Following are a few suggested rations that illustrate how common feeds may be combined to make well-balanced rations:

Ration I. For a cow weighing 1,000 pounds and producing 22 pounds of 5 percent milk.
<table>
<thead>
<tr>
<th>Feeds</th>
<th>Pounds Protein</th>
<th>Pounds total nutrients: Protein, Carbohydrates and fats</th>
<th>Proportion of Protein to Carbohydrates and fats</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sweet clover hay</td>
<td>16 lbs ..........1.000</td>
<td>4.70</td>
<td></td>
</tr>
<tr>
<td>Oat hay</td>
<td>15 lbs ...........675</td>
<td>6.96</td>
<td></td>
</tr>
<tr>
<td>Grain mixture:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Barley 3 lbs.</td>
<td>.270</td>
<td>2.38</td>
<td></td>
</tr>
<tr>
<td>Oats 2 lbs.</td>
<td>.194</td>
<td>1.41</td>
<td></td>
</tr>
<tr>
<td>Bran 2 lbs.</td>
<td>.250</td>
<td>1.22</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.389</td>
<td>16.67</td>
</tr>
</tbody>
</table>

Ration II. For a cow weighing 1,200 pounds and producing 40 pounds of 4 percent milk.

<table>
<thead>
<tr>
<th>Feeds</th>
<th>Pounds Protein</th>
<th>Pounds total nutrients: Protein, Carbohydrates and fats</th>
<th>Proportion of Protein to Carbohydrates and fats</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alfalfa 30 lbs.</td>
<td>3.180</td>
<td>15.48</td>
<td></td>
</tr>
<tr>
<td>Grain mixture:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wheat 5 lbs.</td>
<td>.490</td>
<td>4.07</td>
<td></td>
</tr>
<tr>
<td>Oats 2 lbs.</td>
<td>.194</td>
<td>1.41</td>
<td></td>
</tr>
<tr>
<td>Barley 4 lbs.</td>
<td>.36</td>
<td>3.15</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4.224</td>
<td>24.11</td>
</tr>
</tbody>
</table>

Ration III. For a cow weighing 1,400 pounds and producing 60 pounds of 3.5 percent milk.

<table>
<thead>
<tr>
<th>Feeds</th>
<th>Pounds Protein</th>
<th>Pounds total nutrients: Protein, Carbohydrates and fats</th>
<th>Proportion of Protein to carbohydrates and fats</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alfalfa hay</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18 lbs. ..........1.908</td>
<td>9.29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corn silage</td>
<td>40 lbs .......... .440</td>
<td>7.08</td>
<td></td>
</tr>
<tr>
<td>Grain mixture:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Barley 8 lbs.</td>
<td>.720</td>
<td>6.35</td>
<td></td>
</tr>
<tr>
<td>Oats 4 lbs.</td>
<td>.388</td>
<td>2.82</td>
<td></td>
</tr>
<tr>
<td>Bran 4 lbs.</td>
<td>.387</td>
<td>2.01</td>
<td></td>
</tr>
<tr>
<td>C. S. meal 1 lb.</td>
<td>.37</td>
<td>.78</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4.213</td>
<td>28.33</td>
</tr>
</tbody>
</table>

The above rations illustrate how the feeds are combined to meet the needs of the cow. The roughage given is about what the animal will eat while the grain varies with the amount of milk and the richness. (Refer to the rules on feeding).

Notes on Feeding

In practical feeding it is well to give the cows all the hay they will clean up reasonably well and then feed the refused hay (stems) to the
horses or other cattle. When silage is available, it should replace about one-third to two-thirds of the hay. Dusty or strong-flavored feeds should always be fed after milking. Where two kinds of roughage are available, it is better to give one in the morning and the other at night rather than to feed one kind exclusively until the supply is exhausted. Dairy cows will do better if they have a variety of feed, but they should be fed in the same order and at the same time each day as far as possible. Many practical dairymen feed grain just before milking, while others find it more advantageous to feed after milking. The simplest way to feed concentrates is to make a mixture (several hundred pounds) of the different grains that will make a balanced ration with the roughage. To get the proper proportions, a trial ration may be worked out for a producing cow. Then by means of a truck the grain mixture may be easily carried to the animals, where it is weighed or measured out according to their needs.

A few minutes of study and figuring to get the most practical and economical ration may greatly increase the milk flow and save many dollars on the year's feed bill.

Summer Feeding and Management

There is no feed that improves the physical condition of the cows and stimulates the milk flow as does good pasture grass. While the dairy herd has good pasture the cost of producing milk is at the minimum. It is well, therefore, to provide the animals with good pasture as long as possible. Too early grazing in the spring not only retards the growth of the grass but lowers the production as well. It is best to let the grass get a little start before turning out the cows. As the pastures become dry and short late in the season, dairymen find it profitable to supplement them with hay or other feeds in order to maintain the milk flow. Poor native dry land pasture has little value for milk producing animals. The best pasture is the most economical for milk producing animals. For detailed information about irrigated pastures get a copy of Bulletin No. 114, Montana Extension Service, Bozeman.

Danger from Bloat

Cows are subject to bloat when first turned on to good pasture and especially so if it contains much clover or alfalfa. This trouble is also more prevalent when the grass is wet or during a period when the grass is making very fast growth. As a means of preventing bloat it is well to give the cows a good fill of dry roughage before they are turned out on pasture. Pasturing for short intervals of from forty-five minutes to an hour until the cows become filled up and accustomed to the grass is often practiced. Regardless of these precautions it is well to keep close watch of the animals at first so the cases that may develop can be treated at once. See page 29 for treatment.

Feeding Grain on Pasture

While the herd is on good pasture, little if any grain is required for
cows of low to medium production. The heavy producers will need some concentrates if their milk flow and physical condition is maintained. The amount to feed will vary with the conditions of the pasture.

**Protection Against Flies**

In some localities in Montana, flies and mosquitoes are very troublesome. If possible, the cows should have shade in their pasture. Some dairymen have found it profitable to keep their cows in a shed or the barn during hot afternoons when the flies are bad. Spraying the cows with a good fly repellent will help to keep the cows more quiet. This is especially beneficial at milking time. Some sprays are inclined to coat the hair and blister the skin and are more detrimental than the flies.

**Watering**

While cows are on pasture they should have access to good water. In winter frequent and regular watering is a very important point in the economical production of milk. The highest and most economical production cannot be obtained where cows are watered but once daily. This is especially true where the cows are turned out of a warm barn into an open yard to drink ice water. Under these conditions the cows will not drink enough water, and furthermore, they receive a severe chill that greatly lowers their production. The best results are obtained where the cows have access to water at all times as with the automatic watering device or where they run loose in an open shed so they can go to water at will. If neither of these plans is possible, then the cows should be watered morning and evening. Some good dairymen water in the barn by running the water through concrete mangers, while others turn their cows out for water. Where the cows are watered once or twice daily, better results will be obtained if the water is warmed a little by means of a tank heater.

**Housing**

To do her best the dairy cow must be well housed in winter. When cows are exposed to cold, stormy, wet weather, their milk flow will be reduced. Drafty barns or barns that are excessively warm and poorly ventilated should be avoided as cows kept under such conditions suffer more from the cold when turned out for exercise and water than when the barn is well-ventilated and kept at a temperature near 45 to 55 degrees. Cows that are well-fed and have free access to water and have a good bed of dry straw away from drafts will withstand considerable cold weather without affecting the milk flow. It is for this reason that the "open shed-milking stable" plan of housing is meeting with fair results. An outline of this plan may be had by writing to the Montana Extension Service, Bozeman.

The barn should be well lighted for the comfort of the animals and convenience in doing chores. Modern barns are built with approximately four square feet of window light and 500 cubic feet of space per cow. The essential features of a good barn are comfort and cleanliness for the animal.
and convenience for doing the chores. The aim of the dairyman should be to make the cow as comfortable as possible, and to this end suitable stalls with a deep bed of clean straw are important. All manure and soiled bedding should be removed at least once daily, and the platforms and passages kept clean. Sweeping down the cobwebs and then white washing helps greatly in lighting and cleaning up old barns. A large shed adjacent to the barn into which the cows may go for protection against inclement weather when turned out for exercise and watering is very advantageous. It is well to keep a bed of straw in the shed to give the cows a clean, dry place to lie down. For details of barn plans get a copy of Montana Experiment Station circular 130, "Dairy Barns for Montana Farms."

Keeping Flies Out of Barns

Flies are an annoyance to the cows and contaminate the milk. While it is impossible to get rid of flies entirely the number may be greatly reduced at little expense and trouble. The first and most important thing to do is to destroy their breeding places by hauling out and spreading all manure and litter that accumulates about the barn. Screens placed over the barn windows will be of great help provided means are employed to keep the flies out as the cows pass into the barn. The best way to do this is to hang a piece of cloth cut into strips in the doorway. As the cows pass through the door the strips of cloth will brush the flies off. Spraying the cows in the barn, with some good fly repellent will help to keep the flies out. A large percentage of the flies that get into the barn may be destroyed by means of fly poison or large fly traps placed in or near the windows where the flies congregate.
Fall vs. Spring Freshening

Many successful dairymen arrange to have their cows freshen in the fall or winter. This provides more time for care and management of the cows, and means fewer chores during harvest season. These dairymen also receive greater returns for their dairy products since cows that freshen in the fall are at maximum production in winter months when prices are highest. Calves dropped in the fall will generally do better than those dropped in the spring. By spring the calves can dispense with the skim milk ration, making this feed available for the young pigs, another decided advantage to the farmer. Cows that freshen in the fall and winter nearly always give a markedly increased flow of milk when turned to fresh pasture in the spring. This generally means a larger flow of milk for the year and thus, larger returns from the cow.

When the cows freshen in the spring and summer they produce very economically for a few months, and the labor involved in caring for them is not so great. For these reasons a large number of farmers practice summer dairying. The principal disadvantages of summer dairying are that the value of the products is generally reduced, and the farmer is frequently too busy with his crops to devote much time to the cows.

The following table gives the average record of cows freshening in the winter, spring and fall: These records are taken from Montana cow testing associations.

<table>
<thead>
<tr>
<th>Time of Freshening</th>
<th>Number of Cows</th>
<th>Ave. Prod. of Fat</th>
<th>Average Value of Product</th>
<th>Average Total Cost of Feed</th>
<th>Average Return above Cost of Feed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winter</td>
<td>231</td>
<td>287</td>
<td>$122.60</td>
<td>$54.99</td>
<td>$67.61</td>
</tr>
<tr>
<td>Spring</td>
<td>235</td>
<td>282</td>
<td>120.60</td>
<td>53.86</td>
<td>66.30</td>
</tr>
<tr>
<td>Summer</td>
<td>152</td>
<td>268</td>
<td>116.94</td>
<td>51.50</td>
<td>65.44</td>
</tr>
<tr>
<td>Fall</td>
<td>283</td>
<td>298</td>
<td>129.43</td>
<td>54.52</td>
<td>74.91</td>
</tr>
</tbody>
</table>

The above table shows that the cows freshening in the fall, winter and spring had the highest average production and the greatest return above cost of feed in the order named.

Exercise in Winter

It is generally agreed that cows will do better if they have some exercise each day except in stormy weather. The cows should not be left in the yard so long that they will lie down unless there is clean, dry straw for them to lie on. Lying on snow or frozen ground is one of the common causes of inflamed udders.

Trimming Hoofs

Cows that take but little exercise in winter frequently develop long hoofs. These should be trimmed off before they break or disfigure the animal’s feet. Broken hoofs or very long hoofs often cause severe lameness and lower the production. Hoofs may be trimmed with a long-handled
carpenter's chisel and a heavy hammer while the cow is standing on a plank floor. By placing the cow between two poles about 24 inches above the floor she is prevented from turning around or kicking the man. With gentle cows the feet may be picked up while another man trims off the surplus hoof by means of nippers. Sometimes it may be necessary to throw the animal to trim the feet.

Treatment For Lice

Cattle that are infected with lice rarely do well. The treatment for this pest depends upon the kind of louse and the time of year when treatment is applied. Powdered sabadilla seed dusted lightly over the animal by means of a pepper shaker is very effective for the small gray louse. This powder also destroys the large blue louse but is rather difficult to apply to the flanks, throat, face, and belly, where this specie attacks the animal. Kerosene and lard mixed to the consistency of thick cream and rubbed into the hair often is used with good results. Coal-tar preparations (sheep dip) or Black Leaf 40 are also used. The objection to the latter preparation is that two or more treatments 10 days apart are required and the animal must be soaked all over the body, which is not desirable in cold weather.

Milking

Milking is one of the most particular jobs in handling dairy cattle. Poor milking reduces the flow, shortens the lactation period, and frequently injures the cow. Before the cow is milked her udder and flanks should be brushed or wiped with a damp cloth to remove the dust and loose hair. If the udder is dirty it should be washed and wiped dry. Figure 8 shows a convenient stool for carrying a damp cloth or brush and a covered milk pail. Clipping the long hair off the udder and flanks also helps materially in

Fig. 8—A convenient milk stool for carrying a cloth to wipe off the udder and teats before milking.
producing clean milk. Milking should always be done at a regular time in a quiet manner and at a medium fast rate. By stripping with both hands, one hand on the udder working the milk out of the cells toward the teats and the other hand extracting the milk in the usual manner, all the milk is removed in a short time and the udder slightly massaged. Thorough stripping is important.

**Frequency of Milking**

Good cows will produce more milk and butterfat if they are milked three or four times a day. Breeders of purebred cattle who strive for the maximum production take advantage of this fact. However, under ordinary conditions it is not practical to milk oftener than twice a day except that fresh cows when giving a large flow may be milked three times daily to good advantage.

**Milking Machines**

Milking machines have come to occupy an important place on many of the large dairy farms. When carefully operated according to the directions given by the manufacturers, the standard machines are giving good results. The practicability of the machines for the farmer depends upon the number of cows in his herd and his ability to properly operate and care for the machines. The larger the herd the more economical the machines will be. About one-half the man labor is saved in milking a herd of 40 to 50 cows with the ordinary machines. This includes the assembling and cleaning of the machines. To this should be added taxes, interest, power and depreciation. The essential points in the operation of milking machines are:

1. A steady, dependable power. If a gas engine is used, it should be located in a warm, convenient place and the operator should have enough mechanical ability to operate it 750 times each year.

2. The machines must be kept in good repair at all times and facilities provided to keep them in sanitary condition.

3. Before the machines are attached, the operator should clean the udder and teats and examine the milk from each quarter by squeezing out a squirt or two. Some cows do not milk out readily with the machines. In these cases better results will be obtained if the machines are not attached until the udder and teats are slightly massaged and the cow has let her milk down. In a few such cases dairymen have found it advantageous to milk out a little by hand before attaching the machines. Such cows, however, unless especially valuable, should be disposed of.

4. The machines should be left on only as long as the milk comes freely.

5. Thorough stripping after the machines are removed or by working the udder to force the milk into the teats while the machine is still operating is necessary to keep up the milk flow.

6. A tactful attendant who knows the peculiarities of each cow so that the machines may be operated accordingly.
A record of the production of each cow is an important point in improving the herd. When a healthy, normal cow is properly fed and managed, her real value may be determined by her milk and butterfat records. Thus, inferior animals may be disposed of and the good ones retained for production and breeding purposes. Weighing and recording the milk for one day each week or even one or two days in the middle of each month will give records sufficiently accurate for determining the yearly production. However, it is well to weigh and record the milk from each cow daily because the production records serve as a guide to the feeder. A sudden decrease in the milk flow also serves as a warning to the herdsman that there is something wrong with the cow.

For weighing, a regular spring balance milk scale should be used. Milk sheets can be made at home or they may be purchased at small cost from the leading dairy papers.

Milk samples for making butterfat tests should be taken at regular intervals. Fairly accurate records may be obtained when fat tests are made every month. However, some dairymen make it a practice to test every other month or even every third month. Less than 4 fat tests per year are likely to be too inaccurate to be of much value due to the wide variation in the fat content of the milk. For the milk samples it is best to get a two or four ounce, screw-top sample bottle for each cow. To get a fair sample the cow should be milked dry and the milk poured from one bucket to another or stirred before the sample is taken. A small milk sampler full of milk should then be put into the sample bottle. This process should be repeated each milking for one or two days. Unless the samples can be kept very cool and tested immediately, a tablet of corrosive sublimate should be placed in each bottle to keep it from souring. As a rule dairymen can make satisfactory arrangements with their cream station operator or creameryman for having the testing done.

Considerable work is involved in adding up the milk sheet to determine monthly fat production. A fairly accurate short-cut method is to add up the milk produced on the 5th, 15th and 25th and multiply by 10, if there are 30 days in the month. This sum multiplied by the fat test will give the butterfat production for the month. A herd record book should be kept where the record of each cow may be entered monthly and finally totalled for the year.

Cows should not be condemned on one year's record until the owner has considered the opportunities she had for making a creditable record. Difficulties at calving time, a too short or too long dry period, sickness, unbalanced rations, poor pasture, insufficient feed, and garget are some of the common causes of reduced production. Young cows will produce less than mature animals. The record of an immature cow is a fairly accurate index of her profitable production when mature providing conditions remain the
same. The following table will give the basis for making such estimates:

- 2-year-olds produce 70 per cent of their mature record.
- 3-year-olds produce 80 per cent of their mature record.
- 4-year-olds produce 90 per cent of their mature record.
- 5-year-olds produce 100 per cent of their mature record.

This means that if a cow, calving at 2 years, makes 294 pounds of fat, she will likely make 420 pounds when mature. \((294 \div 70 \times 100 = 420)\).

If there is a dairy improvement association in the community, the dairyman will do well to become a member, providing he has enough cows. Such an organization is of great help to the member in the improvement of his herd. In general, farmers who are obtaining records of their cows either through an organization or privately are making the greatest progress in developing high producing herds.

**Breeding Records**

Records should be kept of the time of service and the date the cows are due to freshen. Without this record the cows may be dried up too soon or they may be milked too long; either lowers production. The best production is obtained when cows are bred to freshen once every 12 months. The average gestation period for cows is 283 days or about 9 months and 1 week. This means that the cow should be bred about two months after calving but not before.

**THE TREATMENT OF SOME COMMON AILMENTS**

**Constipation**

Constipation is a very common ailment of cattle, especially of dairy cattle and may occur without apparent cause. The affected cow first shows a great decrease in milk flow, the next day is visibly sick, refusing food, lying down most of the time, and often grunting or groaning. Very little fecal material is passed, and the absence of feces is practically sufficient for a diagnosis.

A good physic is obviously the logical treatment. Epsom salts in one to two pound doses, or a quart of raw linseed oil, is the standard treatment. Most people prefer epsom salts for cattle, but many stockmen make the mistake of giving too small a dose. For Holstein and other large cows, not less than a pound and a half of salts should be given. No purgative action may be expected for eighteen to twenty-four hours after the dose is given, but if no relief is noted by that time, another dose of salts or oil should be administered. For younger or smaller cattle, the dose of purgative can be adjusted accordingly. There is not much danger of doing serious damage from an overdose of either of these standard purgatives.
Acute Bloat

This is more or less of a seasonal disease, occurring mainly in late May and throughout June, and, in most cases, is due to hungry cattle gorging themselves on legume forage, such as alfalfa, sweet clover, red clover, etc. Losses seldom occur on blue grass, timothy, or wild pastures. Bloat also may occur when least expected. There seems to be no medical treatment that will prevent bloat if legume pastures are used.

In a bloat case, gas forms so rapidly in the paunch, or first stomach, that great distension of the body occurs, and death may follow from sheer pressure on the heart and lungs.

The treatment consists of drenching the cow with a tea cup full of kerosene oil mixed with a pint of milk or raw linseed oil. In severe cases and as a last resort immediate relief may be obtained by tapping the paunch with a trocar or the blade of a sharp knife and allowing the gas to escape through the opening. Such an opening should be made well up on the left side, half way between the hip bone and the last rib.

Chronic Bloat

Chronic bloat is the result of indigestion which may arise from one of many causes. A thorough purgation should be first attended to, with possibly a complete change of diet. Many of these cases are hard to handle. In chronic bloat the cow seldom bloats dangerously, but is off feed and down in milk production, bloating a little every day.

Lump Jaw

Actinomycosis or lump jaw is an infectious disease of cattle, sometimes affecting man, characterized by a slow growing lump on the jaw and throat. Usually the bone of the jaw is affected, but there are many loose swellings of the jaw and throat regions, due to this same infection, that do not become attached to the bone. Infection of the tongue (wooden tongue) is quite common.

In cases where the bone is not affected, treatment with one teaspoonful of potassium iodide fed daily, for a month, will usually effect a cure. If the bone is enlarged and “honey-combed,” recovery is doubtful. The potassium iodide treatment will slow down the progress of the disease, and a radical surgical operation will help greatly, but as a rule, it does not pay to treat cows having enlarged jaw bones.

Sterility

When a promising heifer, or a cow that has been a good producer, will not breed, it is always a question whether to sell her for beef at once or carry her along for months hoping that nature will restore her normal breeding ability. There is nothing the average stockman can do to remedy the trouble. Some veterinarians who have specialized in this line of work
can generally tell whether the cow will breed again or not and whether treatment is advisable. No one can advise the owner as to treatment unless the cow has been thoroughly examined by an expert, for sterility may be due to several causes. Some types of sterility cases cannot be successfully treated.

Retained Placenta

The membranes that surround and protect the calf during its growth in the uterus of the cow, sometimes do not loosen and pass out naturally, as they should. When these membranes are retained for longer than twenty-four hours, they should be removed. The task of removal is not difficult but will prove confusing to the inexperienced.

The hand and arm, first well lubricated with soap suds, is introduced into the uterus, and the membranes gently loosened from their attachment to the button-like cotyledens. The uterus must not be scratched nor the cotyledens pulled off. The membranes should be removed in one piece if possible. Two or three ounce capsules of charcoal introduced into the uterus after the membranes are removed help to prevent the inflammation that might occur otherwise. If the membranes are not removed, they soon decompose and the resultant inflammation may so injure the uterus that the cow will become a non-breeder.

Milk Fever

Milk fever, or calving paralysis, is of common occurrence in dairies where cows are producing well and fed well. A definite chain of circumstances generally precedes an attack of this disease. The cow, usually in the prime of life, a heavy producer, calves normally and is completely milked out shortly after calving. Within twelve to eighteen hours she develops a weakness of the hind quarters, staggers and reels and finally goes down, becomes entirely helpless, stupid, sleepy, and finally becomes unconscious. Most of these cases will die if not treated, but do not die for twenty-four hours or longer, so that there is no great hurry about treatment.

Treatment consists of tightly inflating the udder with air, using either the regular milk-fever pump outfit, or an apparatus rigged out of an automobile or bicycle pump, some rubber tubing, and a milk or teat tube. Care must be taken to prevent udder infection during the process of inflating the udder. A clean towel or cloth should be spread under the udder, each teat washed with a mild disinfectant, and the teat tube sterilized before using. Each quarter of the udder should be tightly inflated, and the teat tied with tape to prevent the escape of air. Complete recovery usually takes place in five or six hours after treatment, and no further treatment is necessary. No case of milk fever is hopeless. As long as the cow breathes, there is a good chance to save her by the above treatment.
Garget or Mastitis

Garget ruins many valuable cows. It is most prevalent in herds affected with contagious abortion, though it is not uncommon in other herds. The number of cases can be greatly reduced by testing for abortion and eliminating the reactors, and by good herd management.

Many cases of garget seem to follow heavy, irregular feeding, drafty barns, irregular and incomplete milking and when heavy producing cows lie on cold, wet or frozen ground. Good, thorough milking, proper feeding and providing the cows with a good dry bed of straw to lie on are important points in preventing this trouble.

Immediate treatment of those cases that develop is necessary. The treatment consists of thorough milking, and massaging the udder several times a day. The cows should be given a deep bed of dry straw in a warm place away from drafts. If the cows have been on heavy feed the grain ration should be reduced for a few days. This simple treatment is very effective if applied at the very beginning of the attack. In severe cases the cow may be given a physic and hot packs applied to the udder for 30 minutes at a time. After the hot packs, the udder should be thoroughly dried and massaged. Medicated salves and other external applications do very little good.

Sore or Injured Teats

If the end of the teat has been cut, bruised or frosted, it is very troublesome and difficult to heal because the sore has to be reopened at each milking. Besides applying some salve or ointment to the end of the teat, a medicated teat dilator or plug should be inserted into the milk duct and left in the duct between milkings, using a new plug at every milking period until the end of the teat is healed. These medicated test plugs can be obtained at most drug stores. They are also advertised in the leading dairy magazines. These plugs are also helpful for "hard milkers."

Small cuts or scores on the teats should be treated after each milking with a salve or vaseline.

Teat tumors, lumps that form inside the teat and block the milk flow, can be removed by special instruments, but very often recur.

Small warts on the teats can be removed by rubbing them with castor oil after each milking.

Infectious Abortion

Infectious abortion, the greatest curse to the cattle owner, is prevalent in all sections of the state. It shows itself in many ways; by the actual abortion of the calf, usually at six or seven months; by non-breeding cows; by retained placenta cases; and by the frequency of mastitis cases.

The blood test is the only reliable method of diagnosis, and no plan of controlling abortion disease in a herd should be considered until a blood
test is made of all cattle on the place. Speaking generally, a stockman with one barn, one good pasture and one water supply, cannot get rid of this disease unless he gets rid of all his cattle and starts over. All plans for control center around the separation of diseased cows from healthy cows as determined by the blood test.

A man who has two ranches, or can outfit two places on one ranch, can, by some expense and unremitting watchfulness and patience, eventually rid his herd of the infection. No medical treatment has any effect on the control or eradication of the disease, either in the individual animal or the herd. For detailed information, write for Montana circular 137 on, "Infectious Abortion of Cattle."

SOME DAIRY LITERATURE

Farmers' Bulletin, No. 1412, "Care and Management of Dairy Bulls."
Farmers' Bulletin No. 976, "Cooling Milk and Cream on the Farm."
Farmers' Bulletin No. 1315, "Cleaning Milk Machines."
Farmers' Bulletin No. 1079, "Harvesting and Storing Ice on the Farm."
Farmers' Bulletin No. 1212, "Farm Dairy Houses."
Farmers' Bulletin No. 206, "Milk Fever."
Farmers' Bulletin No. 1167, "Essentials of Animal Breeding."

(U. S. Department of Agriculture, Washington, D. C.)

Ext. Bulletin No. 110, "Feeding, Care and Management of Dairy Calves and Heifers."
Ext. Bulletin No. 73, "The Production, Care and Marketing of Cream in Montana."

(Montana Agricultural Extension Service, Bozeman, Montana)

Exp. Station Bulletin No. 130, "Dairy Barns for Montana Farms"
Exp. Station Circular No. 137, "Infectious Abortion of Cattle."

(Montana Experiment Station, Bozeman, Montana)