Dairying Requires Ability

Dairy husbandry requires as much tact, training and experience as the successful operation of any 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
The dairy industry has become one of Montana's major agricultural enterprises. The relative importance of the industry in comparison with other agriculture enterprises is shown by the following table. Data in this table...
Gross Income 1938

<table>
<thead>
<tr>
<th>Item</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>All cattle and calves</td>
<td>$10,641,000</td>
</tr>
<tr>
<td>Milk</td>
<td>10,253,000</td>
</tr>
<tr>
<td>Sheep and lambs*</td>
<td>6,421,000</td>
</tr>
<tr>
<td>Eggs</td>
<td>3,321,000</td>
</tr>
<tr>
<td>Pigs</td>
<td>2,529,000</td>
</tr>
<tr>
<td>Chickens</td>
<td>1,827,000</td>
</tr>
</tbody>
</table>

*Wool not included

The dairy industry in Montana may be divided into three classes: (1), the production of market milk for consumption in nearby cities and towns; (2), the production of milk and cream for the manufacturers of butter and cheese as the principal enterprise on diversified farms, particularly in the irrigated districts; (3), dairying as a side line to other agricultural enterprises on both irrigated and dry land farms.

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, (1), because dairying makes for, and fits into, a diversified type of farming, (2), 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 system of crop rotation. The legumes in the rotation and the manure from the dairy helps materially in maintaining the 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 skimmilk, 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 rations are supplemented with these dairy by-products.
The sale of veal calves, surplus cows and culled-out animals also adds 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.

The price of dairy products in the past, generally, has been influenced by the industrial situation and, to some extent by the price of other agricultural products. 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.

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 is produced. This hay with a grain ration composed largely of home-grown feeds such as barley, oats, wheat and corn, together with the by-products from the sugar factories and mills, makes a splendid winter ration. Montana Dairy Herd Improvement association records show that these common feeds, give both high and economical production where good dairy practices are followed. The climate and water supply is very favorable for dairying in the irrigated mountain valleys.

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.

On the dry land farms the pasture and winter feed supply are not suited for high and economical production. However, by growing more feed crops such as corn fodder, cereal hay, brome hay and sweet clover or alfalfa and then building up feed reserves for the drouth years, dairying can be made a part of the farm business.

The need for the production of concentrated products of 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.

Montana has a comparatively good market for her surplus dairy products in the Pacific Coast cities.
The Dairy Herd

Success in the dairy business depends largely upon the dairyman's ability to obtain high and economical production. This can be accomplished only by good, well-bred animals, properly fed and managed. The following table will show the importance of obtaining a high herd average. The data are taken from Montana Dairy Herd Improvement association records. The individual cow records 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 milk per cow</th>
<th>Ave. production of butterfat</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>8.13</td>
<td>43.79</td>
<td>43.45</td>
</tr>
<tr>
<td>288</td>
<td>251</td>
<td>6222</td>
<td>103.16</td>
<td>37.11</td>
<td>12.63</td>
<td>49.74</td>
<td>58.42</td>
</tr>
<tr>
<td>259</td>
<td>298</td>
<td>7381</td>
<td>127.30</td>
<td>39.02</td>
<td>13.97</td>
<td>52.99</td>
<td>74.91</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>104.28</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 is advised 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. The low testing breeds will produce milk more economically while the high testing breeds excel in the economical production of butterfat.

4. Personal preference. A person is likely to do well with the breed he likes best.

5. The need of skimmilk in feeding other classes of livestock.

6. The adaptability to the farm.

Fig. 1.—A good, irrigated grass pasture is the cheapest and best feed in summer.

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 profitable animals and continuously culls out the 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 generally 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 these men had used purebred sires was nine years. The dairymen who have been most successful in developing high-producing herds have continuously used good, purebred sires of their chosen breed over a period of years.
Selecting Herd Sires

Because the herd sires are responsible for one-half of the inherited characteristics of all 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.

Fig. 2.—Registered Ayrshire cow and heifer owned by L. M. (Stub) Felton, 4-H member of Missoula county.

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 and their progeny if possible.

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 offspring will be good producers.
4. Bulls whose ancestors and their offspring have but few, if any, production records are likely to be of little value.

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 and out of a family of cows that are easy milkers, with shapely udders well attached to the body. For this reason, it is well to see the animal and the near ancestors and the ancestor's offspring if possible.

7. If a good active proven bull can be obtained, more dependable progress can be made. A proven bull is one who has five or more unselected daughters whose records have been compared with that of their dams. Unless the daughters' records are uniformly good or better than their dams, under similar management and feeding conditions the bull should not be used.
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 winter ration consists of some choice pea green legume hay. The amount of grain should be governed by the quality of the roughage and the condition of the animal. As the animal matures, little grain is needed. Overfeeding may be worse than underfeeding.

Fig. 4.—Moose, 6316, first prize, junior yearling, Brown Swiss bull, National Dairy Show, Columbus, Ohio. Bred by W. O. Bohart, Bozeman.

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. When this practice is followed 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.

**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 stand dry from six to eight weeks before freshening. This necessitates keeping a record of the date of breeding. The gestation period is approximately 283 days.

In some cases the drying up period will take three or four weeks and it may be necessary to feed persistent producers on dry roughages such as timothy hay or corn fodder. Feeds that stimulate milk production, and stripping and massaging of the udder should be avoided. When the milk flow has decreased to 2 to 2½ gallons daily, milking once daily 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.

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 few 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 eight pounds daily is commonly used. The regular herd mixture may be used. Some dairymen claim 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 who may need some grain.

**Care At Calving Time**

Four to five days before calving, it is well to discontinue heavy grain feeding and to place the cow in a 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 in labor 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. In winter 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 and good care.

Fresh cows frequently have caked, swollen udders, a condition not necessarily harmful but troublesome. To relieve this condition the cow should be fed rather lightly on laxative grain rations, be milked frequently and the udder massaged. She should also be kept on a deep bed of dry straw away from drafts. Allowing the calf to nurse for a few days before weaning also helps to reduce the swelling. Some dairymen advise milking cows with badly caked udder before calving.

After calving there is danger of milk fever. As a preventive, it is best to leave enough milk in the udder to create a slight pressure for three 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 days after calving. Cows calving for the first time are seldom if ever affected. See page 31 for symptoms and treatment.

What To Feed

The economical production of milk depends largely upon the ability of the dairymen to select feeds that will make a good, economical ration and to govern the amount to fit the needs of the individual cow. Fortunately, it is not difficult to make up a good dairy ration from the common, Montana feed stuffs in the districts where an abundance of choice legume hay and good pasture grass is produced.

In order to provide the most practical ration the dairymen 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 cheesy 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 butterfat and milk sugar, or is stored as body fat. If a large amount of feed rich in protein is used, the surplus protein is used to a large extent, the same as are the carbohydrates and fats.

Protein is the indispensable material in the ration. It may be likened to cement in the making of concrete. Knowing this, the dairymen will always
aim to give his cows a ration that contains a sufficient amount of high-quality protein along with the necessary carbohydrates and fats. The proportion of protein to carbohydrates and fats for high producing cows 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

<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><strong>Low in protein, but fattening</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dent Corn No. 1</td>
<td>7.3</td>
<td>82.5</td>
<td>1:10.3</td>
</tr>
<tr>
<td>Barley</td>
<td>9.3</td>
<td>78.7</td>
<td>1:7.5</td>
</tr>
<tr>
<td>Oats</td>
<td>9.4</td>
<td>71.5</td>
<td>1:6.6</td>
</tr>
<tr>
<td>Rye</td>
<td>10.3</td>
<td>80.1</td>
<td>1:6.8</td>
</tr>
<tr>
<td>Wheat</td>
<td>11.4</td>
<td>85.7</td>
<td>1:6.5</td>
</tr>
<tr>
<td>Dried Molasses Beet Pulp</td>
<td>6.1</td>
<td>74.3</td>
<td>1:11.2</td>
</tr>
<tr>
<td>Molasses (beet)</td>
<td>2.5</td>
<td>58.8</td>
<td>1:22.5</td>
</tr>
<tr>
<td><strong>High in Protein</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wheat Bran</td>
<td>13.1</td>
<td>70.2</td>
<td>1:4.4</td>
</tr>
<tr>
<td>Oil meal (O. P.)</td>
<td>30.6</td>
<td>78.2</td>
<td>1:1.6</td>
</tr>
<tr>
<td>Cottonseed meal (choice)</td>
<td>37.8</td>
<td>80.9</td>
<td>1:1.1</td>
</tr>
<tr>
<td>Soy bean meal</td>
<td>37.7</td>
<td>82.2</td>
<td>1:1.2</td>
</tr>
</tbody>
</table>

### ROUGHAGE DRIED

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Low in Protein</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sorghum fodder</td>
<td>3.6</td>
<td>52.7</td>
<td>1:13.6</td>
</tr>
<tr>
<td>Fodder corn (medium)</td>
<td>3.5</td>
<td>54.6</td>
<td>1:14.6</td>
</tr>
<tr>
<td>Timothy hay</td>
<td>2.9</td>
<td>46.9</td>
<td>1:15.2</td>
</tr>
<tr>
<td>Prairie hay</td>
<td>2.6</td>
<td>49.2</td>
<td>1:17.9</td>
</tr>
<tr>
<td>Oat hay</td>
<td>4.5</td>
<td>46.3</td>
<td>1:9.3</td>
</tr>
<tr>
<td>Millet hay</td>
<td>5.2</td>
<td>51.5</td>
<td>1:8.9</td>
</tr>
<tr>
<td>High in protein</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Red clover hay</td>
<td>7.0</td>
<td>51.9</td>
<td>1:6.4</td>
</tr>
<tr>
<td>Alfalfa hay</td>
<td>10.6</td>
<td>50.3</td>
<td>1:3.7</td>
</tr>
<tr>
<td>Sweet clover (yellow)</td>
<td>10.5</td>
<td>49.9</td>
<td>1:3.8</td>
</tr>
<tr>
<td>Oat and pea hay</td>
<td>8.9</td>
<td>52.2</td>
<td>1:4.9</td>
</tr>
</tbody>
</table>

### SILAGE AND ROOTS

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn silage</td>
<td>1.1</td>
<td>17.4</td>
<td>1:14.8</td>
</tr>
<tr>
<td>Mangels</td>
<td>1.0</td>
<td>7.3</td>
<td>1:6.3</td>
</tr>
<tr>
<td>Beet pulp (wet)</td>
<td>.8</td>
<td>8.9</td>
<td>1:10.1</td>
</tr>
<tr>
<td>Potatoes</td>
<td>1.1</td>
<td>17.3</td>
<td>1:14.7</td>
</tr>
<tr>
<td>Pea vine refuse</td>
<td>2.6</td>
<td>17.8</td>
<td>1:5.8</td>
</tr>
</tbody>
</table>

The above figures are taken from "Feeds and Feeding" by Morrison
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 the 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 generally high.

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, dried beet pulp or bran, to lighten the mixture. Select the feeds that will supply the total nutrients at the lowest cost. See table on page 13 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 concentrates 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 such fattening feeds as barley or corn. See table on this page for the most economical protein feeds.

If the roughage consists of some hay high in protein, such as alfalfa, and some other roughage low in protein, such as corn fodder or cereal hay, 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 concentrates, 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:

When barley is worth $1.00—

<table>
<thead>
<tr>
<th>Feed</th>
<th>Relative Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn</td>
<td>$1.05</td>
</tr>
<tr>
<td>Rye</td>
<td>1.02</td>
</tr>
<tr>
<td>Wheat</td>
<td>1.09</td>
</tr>
<tr>
<td>Oats</td>
<td>.91</td>
</tr>
<tr>
<td>Cottonseed meal</td>
<td>$1.03</td>
</tr>
<tr>
<td>Bran</td>
<td>.89</td>
</tr>
<tr>
<td>Dried beet pulp</td>
<td>.94</td>
</tr>
<tr>
<td>Molasses</td>
<td>.74</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 .91 (the figure given for oats). Thus, $1.50 \times .91 = $1.36, the relative value of oats.

To supply protein only, the feeds listed have a relative value, approximately as follows:

When bran is worth $1.00, Linseed Oil meal is worth $2.33, cottonseed meal is worth $2.88.

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 Linseed Oil meal worth? Example of how this is figured—$1.30 (price of bran) x $2.33 (figure given for Linseed Oil meal) = $3.03 or the relative value of Linseed Oil meal. Other feeds may be figured the same way.

Observe that the feeds usually purchased to supply the protein, such as bran and Linseed 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 greatly influenced by the 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 gives the protein and total digestible nutrients in 100 pounds of the various feeds listed.

<table>
<thead>
<tr>
<th>Feed</th>
<th>Protein</th>
<th>Total Digestible Nutrients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alfalfa leaves</td>
<td>16.9</td>
<td>57.0</td>
</tr>
<tr>
<td>Alfalfa stems</td>
<td>5.1</td>
<td>40.8</td>
</tr>
<tr>
<td>Alfalfa hay</td>
<td>10.6</td>
<td>50.3</td>
</tr>
<tr>
<td>Wheat bran</td>
<td>13.1</td>
<td>70.2</td>
</tr>
</tbody>
</table>

The table shows that alfalfa leaves contain more protein than wheat bran and that alfalfa stems have much less protein. This means that alfalfa
hay should be cut early and put up to save as many leaves as possible. Al-
falfa 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.

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, mixed, grass 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 early 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 will eventually 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 become unthrifty, 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 places in Montana where the dairy ration
is lacking in lime (calcium) because our soils are high in lime generally,
and legume hays which constitute most of our roughage for winter feeding
contain an abundance of this mineral as indicated by the following table:

<table>
<thead>
<tr>
<th>Calcium Content</th>
<th>Phosphorus Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>Alfalfa</td>
<td>Cottonseed meal</td>
</tr>
<tr>
<td>Red clover</td>
<td>Linseed meal</td>
</tr>
<tr>
<td>Sweet clover</td>
<td>Corn fodder</td>
</tr>
</tbody>
</table>

High

Wheat bran
Shorts and middlings
Cottonseed meal
Linseed meal

Low

Straw
Beet pulp
Timothy hay
Millet hay
The soil in large areas of the state is deficient in phosphorus. In these areas the grass and hay produced will contain a very limited amount of this mineral. Under these conditions it is wise to supplement with a mineral high in available phosphorus, such as sterilized bone meal, unless a large amount of feed high in phosphorus, such as wheat bran or cottonseed meal, is used in the ration. To provide an ample supply of phosphorus, many dairymen use bone meal in addition to the wheat bran or cottonseed meal. The sterilized bone meal may be mixed with the concentrate at the rate of 5 to 20 pounds per 1,000 pounds of feed. Many dairymen also put bone meal in a box to which the cows have free access at all times. A mixture of 25 per cent granulated stock salt and 75 per cent bone meal may also be used. The bone meal box should be placed in a protected place away from the wind and rain.

In some phosphorus deficient areas heavy producing cows will need up to three ounces of bone meal per head daily. Bone meal is also a good source of calcium.

Fields that respond readily to an application of phosphate fertilizer are an indication that the grass and hay produced on the land, before the application of phosphate fertilizer, are likely to be low in phosphorus.

Fertilizing the fields and pastures is a good way to increase the phosphorus content of the grass and hay grown and in turn to supply the animal with the phosphorus needed.

An iodine deficiency is found to exist in some localities. Where this occurs, the calves are usually born with goiters. The 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 or, commercially iodized salt may be purchased.

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. Block salt is usually too hard in winter to provide dairy cows with the salt required.

While numerous other minerals are required for the normal functioning of the body, so far as is known, except in special cases, the only supplementary minerals needed by Montana dairy cows are common salt, calcium, phosphorus and iodine.
The Vitamins

The vitamins play an important part in promoting growth and the normal functions of the cow’s body. Fortunately most well balanced rations for dairy cows contain a liberal supply of the essential vitamins. Vitamin D, necessary in the formation of the bones, is known as the “sunshine vitamin” because direct sunshine results in the production of this vitamin within the body. Thus, animals exposed to direct sunshine need little if any vitamin D in the feed. Well cured alfalfa hay contains a fair amount of this vitamin while the low grade roughages—cereals—and most all concentrates are nearly void of this factor.

When animals are fed exclusively for long periods on bleached forage or stack-burned hay they may suffer from a lack of vitamin A, necessary for normal growth and good health. Well cured, pea green, leafy hays; green grass; all green growing crops and yellow corn are good sources of this vitamin.

In summer when the cattle are out on good pasture and in winter under proper management when the ration is composed of well cured, pea green, leafy hay, particularly alfalfa, and some ground whole grains, the cows will be fairly well supplied with the essential vitamins.

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 and 21 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 record of experiment stations and Dairy Herd Improvement associations. See table on page 6.

Figure 5 illustrates the importance of feeding cows according to their needs. This chart shows that when a good producing cow is fed a full ration as indicated by (A), 50 per cent of her feed is used to maintain her body and 50 per cent 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.

**WHEN THE COW IS FED—**

**JUST ENOUGH**

**A**

50% for MAINTENANCE 50% for MILK PRODUCTION

**TOO LITTLE**

**B**

ENOUGH for MAINTENANCE TOO LITTLE DEFICIT

ENOUGH for MILK

**TOO MUCH**

**C**

ENOUGH for MAINTENANCE ENOUGH for MILK SURPLUS

Fig. 5.—Too little feed means reduced milk production; too much, means waste.

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, rolled oats or
dried beet pulp, 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 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. Cows will consume about 2½ pounds of dry roughage or its equivalent daily per 100 lbs. live weight, in addition to the concentrate.

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 richness 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 gain 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 in 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 1,400 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>10 lbs..........</td>
<td>1.050</td>
<td>4.99</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oat hay 15 lbs......</td>
<td>.675</td>
<td>4.25</td>
<td>6.94</td>
</tr>
<tr>
<td>Grain mixture:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Barley 3 lbs........</td>
<td>.279</td>
<td>2.36</td>
<td>1:5.9</td>
</tr>
<tr>
<td>Oats 2 lbs...........</td>
<td>.188</td>
<td>1.43</td>
<td></td>
</tr>
<tr>
<td>Bran 2 lbs...........</td>
<td>.262</td>
<td>1.40</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.454</td>
<td>17.12</td>
<td></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>15.09</td>
<td></td>
</tr>
<tr>
<td>Grain mixture:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wheat 5 lbs............</td>
<td>.570</td>
<td>4.28</td>
<td></td>
</tr>
<tr>
<td>Dried Mol. Beet Pulp</td>
<td>.122</td>
<td>1.49</td>
<td></td>
</tr>
<tr>
<td>Barley 4 lbs............</td>
<td>.372</td>
<td>3.15</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4.244</td>
<td>24.01</td>
<td>1:4.65</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 18 lbs.</td>
<td>1.908</td>
<td>9.05</td>
<td></td>
</tr>
<tr>
<td>Corn silage 40 lbs.</td>
<td>.440</td>
<td>6.96</td>
<td></td>
</tr>
<tr>
<td>Grain mixture:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Barley 8 lbs...........</td>
<td>.744</td>
<td>6.30</td>
<td></td>
</tr>
<tr>
<td>Oats 4 lbs.............</td>
<td>.376</td>
<td>2.86</td>
<td></td>
</tr>
<tr>
<td>Bran 3 lbs.............</td>
<td>.399</td>
<td>2.11</td>
<td></td>
</tr>
<tr>
<td>C. S. Meal 1 lb.......</td>
<td>.378</td>
<td>.81</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4.245</td>
<td>28.09</td>
<td>1:5.61</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 rules on feeding).

Notes on Feeding

In practical feeding give the cows all the hay they will clean up reasonably well and then feed the refused hay (stems) to the idle 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 and concentrates that will make a balanced ration with the roughage. To get the proper proportions, a trial ration should 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 more than 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. However, too early grazing in the spring should be avoided as it 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. 174, Montana Extension Service, Bozeman.

**Danger From Bloat**

Cows are subject to bloat when first turned on 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 the 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 short intervals of from 30 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 develop can be treated at once. See pages 29 and 30 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, when applied too freely, are inclined to coat the hair and blister the skin and are then more detrimental than the flies.

Watering

While cows are on pasture they should have free access to good water. In winter, frequent and regular watering is very important 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 good results.

The barn should be well lighted for the comfort of the animals and convenience in doing chores. Modern barns are built with approximately 4 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 dairymen 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 whitewashing or painting helps greatly in lighting and cleaning up old barns. A large shed adjacent to the barn into which the cows may go for protection during bad weather when turned out for exercise and watering, is very advantageous. A bed of straw in the shed gives the cows a clean, dry place to lie down.

**Keeping Flies Out Of Barns**

Flies are an annoyance to cows and contaminate their 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 in 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. The electric fly exterminator is also very efficient.
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 when prices are high. 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 per 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 lower, 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, summer and fall. These records are taken from Montana Dairy Herd Improvement associations.

<table>
<thead>
<tr>
<th>Time of Freshening</th>
<th>Number of Cows</th>
<th>Ave. Prod. of Fat, lbs.</th>
<th>Ave. 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 every day except in very 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. Lying on snow or frozen ground is one of the common causes of Mastitis (garget).
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 feet. Broken, 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. With gentle cows the feet may be picked up while another man trims off the surplus hoof by means of nippers. Very practical hoof nippers designed to trim hoofs while the animal is standing are now available. Sometimes it may be necessary to throw the animal to trim the feet.

Fig. 7.—A convenient milk stool for carrying a cloth to wipe off the udder and teats before milking.

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.

A mixture of one part kerosene and three parts mineral oil rubbed into the hair with a cloth or brush gives good results. Coal-tar preparations (sheep dip) or Black Leaf 40 are also used. The objection to the latter preparations 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 dairying. 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 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 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 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 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 780 times every year.

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

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.

4. The machines should not be left on any longer than necessary to extract the milk that 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.

**Milk and Fat Records**

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, recording and testing the milk for one or two days in the middle of each month will give records sufficiently accurate for determining the yearly production. However, many dairymen weigh and record the milk from each cow daily because such production records serve as a guide to the feeder. A sudden decrease in the milk flow is a warning 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 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 four fat tests a year are likely to be too inaccurate to be of much value because of 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, 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.
A cow 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, too short a 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 production when mature, provided 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. \( \frac{294}{70} \times 100 = 420 \).

If there is a dairy improvement association in the community the dairyman should consider becoming 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 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 10 days. This means that the cow should be bred about two months after calving.

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 feed, 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 18 to 24 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 lush pastures containing a high percent of 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.

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 slowly developing lump on lower or upper jaw, throat, or below the ear. Usually the swelling is part of, or attached to, the bone, but there are many of the movable, hard swellings that are due to this same infection. Actinomycosis of the tongue, characterized by salivation, and finally causing the tip of the tongue to protrude from the mouth, is quite common, and is known as “wooden tongue.”

In cases where the bone is not affected, treatment with one level teaspoonful of potassium iodide daily in the feed for a month will generally affect a cure. This treatment is very effective in cases of “wooden tongue.” If the jaw is much enlarged and considerable bony swelling has occurred, it is doubtful if treatment should be attempted. Such a cow is dangerous to other cows, she cannot be used as a dairy cow on account of the risk to human health, and even with treatment, recovery is slow and very uncertain.

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 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 24 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 good dairies where high producing cows are kept. 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 12 to 18 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 will not die for 24 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.

Wherever a veterinarian is available, all milk fever cases should be treated with the intravenous injection of a calcium gluconate or calcium dextrose solution. This method entirely eliminates the ever-present danger of udder infection, which may occur in using the air-pump method. As a rule, the calcium solutions bring about a more prompt recovery than does the air treatment, though with either method relapses may occur, necessitating repeating the 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, careful management to avoid injury of udder 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 teat 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 sores 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.

**Cowpox**

Cowpox is a disease of the udder of cattle, characterized by the appearance of crater-like ulcers on the teats and lower parts of the udder. These may be very small or up to the size of a pea. At first a small, hard lump appears, which soon ruptures, and a slow-healing, ragged sore, or ulcer, appears, which may require 10 days or more to heal. It is not considered to be an important disease, but causes “sore teats” and consequent trouble at milking time.

Medical treatment, except for vaseline or zinc oxide ointment to keep the skin soft, is useless. Affected cows should be kept in a separate corral and milked last, to avoid spreading the disease to healthy cows. The milk of cows affected with cowpox must not be used for human food until after the ulcers have healed.

**Bang’s Disease**

Formerly known as infectious abortion, this is one of the most disastrous diseases of cattle. The general health of the cattle is not impaired, but the breeding efficiency of the herd is cut down to the extent that the herd is unprofitable. There are various indications of the disease; the actual abortion of the calf at five to seven months, retained placental membranes, non-breeding cows, and varied udder trouble.

A rancher running stock cattle, with a low overhead expense, can often get along with the disease in his herd, but a dairyman must get rid of it as soon as possible. The presence of the disease should be reported to the nearest veterinarian, and a blood-testing program started. Repeated tests, with the removal of the diseased cows, will soon clean out the disease, and it will not recur unless new infection is brought in. Vaccination of the heifer calves may be advisable. There is no medical treatment for Bang’s Disease, and money spent on “cures” is entirely wasted.

For detailed information on Bang’s disease, write for Circular 158 of the Montana Experiment Station.