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Care, Feed and Management of the Dairy Herd

H. H. Kildee

Iowa State College

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Care, Feed and Management of the Dairy Herd

Abstract
Dairy farming is rapidly increasing in popularity in almost every section of Iowa because the dairy cow has characteristics which not only give her present popularity but also Insure it for all time to come.

One of the chief advantages of dairy farming Is that the dairy cow fits admirably in diversified and Intensive farming where the farmer strives to produce the greatest possible Income from a small acreage and yet retain the fertility of his farm. In Europe, the dairy cow is the foundation of agriculture In the most prosperous countries, such as Denmark and Holland. Proof that she Is adapted to high priced land may be found on the Jersey Isle, where ground rentals run from $50 to $60 per acre annually, and in Holland where farms rent from $30 to $40 per acre. In both places land Is used largely for dairy farming. In Iowa, land Is constantly getting dearer, yet by using silos and soiling crops, tilling the farm Intensively and purchasing some concentrated nitrogenous foods, It is not out of the question to keep one cow to each acre of ground, and even more under certain conditions. Poultry and swine raising may be carried on most successfully on the dairy farm because of the feeding value of the skim milk, a valuable by-product.

Keywords
Dairy Husbandry

Disciplines
Agriculture | Dairy Science

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CARE, FEED AND MANAGEMENT OF THE DAIRY HERD

AGRICULTURAL EXPERIMENT STATION
IOWA STATE COLLEGE OF AGRICULTURE AND THE MECHANIC ARTS

Dairy Husbandry Section

Ames, Iowa
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CARE, FEED AND MANAGEMENT OF
THE DAIRY HERD

BY H. H. KILDEE

Dairy farming is rapidly increasing in popularity in almost every section of Iowa because the dairy cow has characteristics which not only give her present popularity but also insure it for all time to come.

One of the chief advantages of dairy farming is that the dairy cow fits admirably in diversified and intensive farming where the farmer strives to produce the greatest possible income from a small acreage and yet retain the fertility of his farm. In Europe, the dairy cow is the foundation of agriculture in the most prosperous countries, such as Denmark and Holland. Proof that she is adapted to high priced land may be found on the Jersey Isle, where ground rentals run from $50 to $60 per acre annually, and in Holland where farms rent from $30 to $40 per acre. In both places land is used largely for dairy farming. In Iowa, land is constantly getting dearer, yet by using silos and sowing crops, tilling the farm intensively and purchasing some concentrated nitrogenous foods, it is not out of the question to keep one cow to each acre of ground, and even more under certain conditions. Poultry and swine raising may be carried on most successfully on the dairy farm because of the feeding value of the skim milk, a valuable by-product.

DAIRY FARMING INCREASES SOIL FERTILITY

Dairy farms increase rather than decrease in soil fertility. A ton of corn worth from $10 to $14 removes $8.60 worth of plant food. A ton of butter worth over $500 removes only 64 cents' worth of plant food. A dairy cow weighing 1,000 pounds voids 11 to 13 tons of solid and liquid manure each year, which is worth about $25 for increasing crop yields. Many farms which were formerly very poor from the fertility standpoint have been built up in a few years through feeding the crops and purchased supplementary feeds to dairy cows.

Economy of production is another factor in favor of the dairy cow. Quoting Professor W. A. Henry, "Not only is dairying the leading animal industry of our country at this time, but so it must continue indefinitely, for the reason that the cow is a more economical producer of food for human beings than is the ox or pig." And again, "for each 100 pounds of digestible nutrients consumed, the dairy cow yields about six times as much edible solids in her milk as the beef steer or mutton sheep in its carcass."

In addition to being an economical producer, the dairy cow is a more dependable source of profit than the beef steer, because her products are but slightly affected by market fluctuations and because she is a continuous source of revenue, for the cream or milk checks come in at frequent and regular intervals. Then, too, there is a greatly increased demand for dairy products and for grade and
pure bred dairy cattle, not only in the United States, but also China, Japan, New Zealand, South America and elsewhere.

One of the strongest arguments brought against dairy farming is that it is often rather difficult to secure competent help. It will be noticed, however, that the man who makes the milking a part of the day's work instead of attaching it as something in addition to a normal day's work, has little or no difficulty on this score. It is not the milking itself that many hired men and boys object to, but that on many farms they are compelled to do this work early in the morning and late at night in addition to a full day's work in the field.

THE MILKING MACHINE AN ECONOMIC FACTOR

Milking machines are now giving satisfactory results on a great many dairy farms. The efficient mechanical milkers that are coming into common use will serve as a great stimulus to the dairy industry, as they will bring dairy farming into greater favor by removing the greatest obstacle—that of the difficulty of securing competent milkers.

IOWA'S AVERAGE PRODUCTION LOW

In spite of the fact that dairy cows as a class are very economical producers, many cows milked in Iowa at the present time do not pay for their feed, in milk and butter fat. It is safe to say that the average amount of butter fat produced by the cows in Iowa does not exceed 140 pounds per cow per year. At the same time there are many animals in the state that have produced over 500 pounds, several have exceeded 700 pounds, a few 800 pounds and the Guernsey cow,

Fig. 1—Four pure bred Holstein cows owned by Iowa State College. Average record for one year 16,660.3 pounds milk, 857.57 pounds butter fat, average test 3.34%, average net income for butter fat after deducting cost of feed, $110.21 per cow.
Dairy Maid of Pinehurst, produced 910.67 pounds of butter fat in one year.

The world's record for all breeds is 1116.05 pounds of butter fat produced in one year by the junior three-year-old Holstein, Findere Holinggen Payne. The Guernsey cow Murne Cowan ranks second with 1098.18 pounds of butter fat. The Holstein cow, Lilly Al Cortra, bred in Iowa, holds the world's milk record for one year, with 30,451.4 pounds of milk. Considering the fact that the cost of keeping a cow is not in proportion to her production, for poor, unprofitable cows in many cases are fed the same rations as large and profitable producers in the same herd, it can readily be appreciated that the present low average production is unsound and unbusinesslike.

This condition is due both to inferior cows and to improper care, feed and management of the cows. Either one or both factors may play an important part in cutting down profits. Thousands of cows kept on Iowa farms are not returning a profit simply because they are improperly fed and managed, and still larger numbers of so-called dairy cows are not paying for their feed and could not, even though given the very best of care and feed. The term dairy cow, as used in this state at the present time, is a misnomer, as about one-third of these so-called dairy cows have practically nothing in common with the typical dairy cow, either in conformation or productive ability. Nearly one-half of the remaining cows are so fed and managed that they produce about one-half of what they are capable of producing if properly cared for.

An experiment which is being carried on at the Iowa State college dairy farm to determine the effect of feed and environment upon amount of milk and butter fat produced by scrub cows brought from an isolated region in Arkansas is demonstrating that the amount produced, and consequently the profit returned, is materially influenced by the feed and management. Heifers out of these scrub cows and by pure bred dairy bulls are in many cases producing much more milk and butter fat, as two year olds, than their dams have produced as mature animals.

**HOW ONE IOWA HERD IMPROVED**

The following records made by the herd of Peder Pederson & Son in the Benson Cow Testing association in three consecutive years is especially interesting and valuable in this connection, as it shows what can be accomplished on the farm by keeping records, weeding out the poor cows and by proper feeding and management.

<table>
<thead>
<tr>
<th>Year</th>
<th>Average Milk per Cow</th>
<th>Largest net income cow</th>
<th>Average Net income per Cow Fat per cow over cost of feed</th>
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<tbody>
<tr>
<td>1911</td>
<td>5665 pounds</td>
<td></td>
<td>207.7 $ 22.12</td>
</tr>
<tr>
<td>1912</td>
<td>7060 pounds</td>
<td>251.9</td>
<td>53.96</td>
</tr>
<tr>
<td>1913</td>
<td>9697.47 pounds (for the year)</td>
<td>341.98</td>
<td>75.00</td>
</tr>
</tbody>
</table>

Estimate for each of two largest net income cows. 144.00
The increase in production and in the net returns for butter fat, after deducting the cost of feed, in this herd in the course of three years is remarkable and was brought about by use of a pure bred sire, weeding out the inferior cows. Forty per cent of the original herd were sent to the butcher at the end of the first year, and thirty per cent at the end of the second. Their places were filled by grade two-year-old heifers bred on the farm, and the remaining ones given better care and feed. This herd was made up of grades and a few pure bred Holsteins and the number of cows remained about the same during the three years reported.

THE DAIRYMAN A BUSINESS MAN

The successful dairyman is not only a farmer and breeder, but, in the true sense of the word he is a business man from the commercial standpoint, and a producer from the manufacturer's standpoint. He breeds, feeds and selects his cows, each upon its individual merits, for the purpose of converting the raw materials grown on the farm, in the form of grains and grasses, into a finished commodity of commerce—milk and butter fat. The success of a manufacturer of shoes is determined by his ability to turn out a large number of shoes of good quality, such as will command a good price on the market, at a low cost of production. This is equally true of the producer of butter fat and milk. The price per pound of the commodity he produces is determined by its quality. Quality is determined by richness, color and cleanliness.

Not only is the quality and price per pound important, but also the quantity produced and the cost of production. Many cows yield milk extremely rich in quality or butter fat but give such a small amount that they do not pay for the food consumed. Others give a comparatively large amount of milk but so low in its butter fat content that they also do not pay for their feed and keep. The profitable butter fat machine then may readily be summed up as one that has the ability and capacity to produce from a minimum food supply a maximum amount of milk rich in butter fat content.

SELECTION OF COWS

Extreme care is necessary in selecting cows, for no amount of skill in feeding and handling will stimulate a profit from a truly poor cow. A good dairy cow is one with a large capacity for using food above the maintenance requirement and one that uses this food for milk production. Determining the most desirable breed, one must consult his own likes and dislikes first. The man who likes a Holstein cow and dislikes a Jersey will be more successful with the former.

Conditions on the farm and the demands of its market need to be studied before selecting any breed. Jerseys and Guernseys are noted for their high per cent of butter fat, and their economy of butter fat production, especially under intensive farming conditions.
The Guernseys in particular are known for the excellent color of their milk and butter fat. Holsteins and Ayrshires are noted for a larger flow of milk which is lower in per cent of fat. The Holsteins are very popular with Iowa farmers, because they are large, rugged and able to use large quantities of farm grown feeds in the manufacture of milk and butter fat, the milk being very valuable in raising calves, pigs and chickens. The Ayrshire breed is noted for its ruggedness and its rustling ability and yields a fair quantity of milk and butter fat.

As a matter of fact, however, the breed is of less importance in selecting the cow than is individuality, for in every breed there are good individuals and poor individuals. It is important, not only that the breed, but that the strain or family represented be noted for large and economical production of milk and butter fat. Experience has taught that form and function go hand in hand, so it is of utmost importance to demand dairy cows of proper form and type. There are, however, many exceptions to this rule, so that the performance of a cow through a period of lactation and performance of her ancestors, especially her paternal granddam, should have a great deal to do with her selection.

As a rule, sons of great producing cows are more likely to beget large producing daughters than are great producing cows themselves.
This illustrates the fact that cows need not necessarily be pure bred for a buyer or dairymen to take advantage of pedigree. Every cow has a pedigree, but not all pedigrees are on paper. In view of this fact, in selecting grade cows look up and consider the performance of dams as far back as they can be found.

Many buyers wisely use the Babcock test and scales in making their selections. By their use it is possible to determine the exact number of pounds of milk and butter fat produced by an animal. By noting whether she is advanced in her period of lactation and what her care and feed have been, the buyer can come closer to judging her real value as a milk and butter making machine than by any study of mere outward appearance. It has been truly said that the inside of a cow is the darkest place on earth and that, therefore, outward appearances are very deceitful. The scales and the Babcock test are the best guides, particularly the more accurate yearly tests which are to be emphasized rather than short tests.

Beginners in dairy farming should gain their experience and establish their reputation by starting in with grade cows and a pure bred bull. Later, by purchasing one or two excellent cows from time to time, they may get gradually started in pure breeds. By keeping a record of the production of each cow and noting the relative cost of production much can be accomplished in a few years. As former Governor Hoard said: "It is better to grow into dairy farming than to go into it."

**SELECTION OF BULLS**

In selecting bulls to head the herd it is needless to say that only pure bred sires should be used.

Breed type and individual characteristics are entitled to due consideration, yet it is difficult to prophesy by the outward looks and appearance of a dairy bull what sort of calves he will beget from a producing standpoint. More attention should be given to the performance of his ancestors, and especially his dam. A great producing cow is very likely to reproduce her characteristics through her sons, so by all means, after careful study of the bull himself his dam should be investigated—study her form, milk producing machinery, and learn her record of performance. Many of the best breeders of dairy cattle select bulls almost entirely on the individuality and performance of the dams. However, the individuality of the bull himself is important also.

As for age, it is safe to say better results will be attained by buying mature, tried bulls, although this is not the rule usually followed. Bulls capable of begetting useful daughters are plentiful but those capable of begetting daughters that are phenomenal workers are few indeed, and the majority of these are lost before their full worth has been determined.

In selecting a bull to head the herd there must always be borne in mind the old saying "The bull is half the herd." Much data is at
hand showing the great difference that exists between dairy bulls in their ability to sire heavy producing heifers and a good dairy sire that will raise the average production of the herd 50 to 100 pounds of butter fat is a bargain at almost any price while a so-called “cheap” bull may be a source of great loss.

In building up the dairy herd and selecting animals, extreme care is necessary to guard against disease, and especially the most common disease among them, tuberculosis. In buying animals, buy them subject to the tuberculin test, which should be made by a reliable veterinarian, who should give the buyer a certificate stating the temperature before and after the injection of the tuberculin. Reject all animals that react when conditions are known to be normal. Never allow an animal known to be infected with tuberculosis to step on the farm. All animals purchased, even though accompanied by a health certificate, should be isolated and tested again after they have been on the farm ninety days.

Contagious abortion is also very prevalent on dairy farms and much precaution must be exercised to guard against buying animals that will bring the germs of this destructive disease to the farm. In dealing with scrupulous breeders their word will generally suf-

Fig. 3—Imp. Rouge II's Son, owned by Iowa State College. First prize two year old Guernsey bull at 1912 National Dairy Show. A son of Rouge II of the Brickfield.
fice, but in all cases it is wise to isolate the new animals brought to the farm.

**SELECTION OF FEED-STUFFS**

In securing the lowest possible cost of production, and ultimately the largest profit, from the herd, the proper selection of feeds is important. The primary object of the feeder, in all cases, is the maximum production of milk for least expenditure of feed. While each feed stuff is fairly uniform, so far as nutrient content, effect on the system and palatability are concerned, it is impossible to recommend a particular ration which will prove most economical and efficient at all times, because feed stuffs vary in price in different seasons and localities, and also because the feed requirements vary with each individual cow.

The general requirements which should be met by rations for dairy cows are as follows: Palatability, variety, bulk, succulence, balance of nutrients, proper effect upon the system and economy.

Palatability is a factor of great importance, for, no matter how good the ration is from the standpoint of digestible nutrients contained, the best results can not be expected unless it appeals to the cow's appetite. To secure this palatability only feeds of good quality liked by the cow should be fed in a clean manager. All grains, such as oats, barley and corn, give best results when ground.

A cow soon tires of a ration made up of but one or two feeds and as radical or frequent changes in the ration are not conducive to the best results, it is important that feeds be so combined in the ration as to give variety. This variety is essential for the dairy cow because, unlike the beef steer, she is on feed for a long period and for successive periods.

Bulk is required to help make digestion in the roomy digestive tract as thorough as possible; moreover, the bulky feeds grown upon the farm are the cheapest feeds. When bulk is lacking the digestive juices do not act as thoroughly upon the small, compact food mass and all the digestible nutrients cannot be utilized. This bulk is obtained not only through feeding alfalfa and clover hays and corn silage, but also by making the grain ration rather bulky. Corn and cob meal, ground oats and bran are bulky and all are good for the dairy cow.

Succulent feeds are very essential in profitable milk production. During the summer months succulence may be obtained from pasture grass, until the hot, dry weather makes it necessary to add corn silage or soiling crops. For winter feeding, corn silage is the most economical source of succulence under most farm conditions. Succulence is needed partly because the dairy cow is producing a product high in per cent of water, and partly because it has a good effect upon her system.

**WHAT "BALANCE" MEANS**

By balance of nutrients, is meant a proper proportion between the digestible nutrients, protein, carbohydrates, fats and ash. The
best combination will vary with the individual cow, the quantity and quality of milk she gives, the prices of feed stuffs, and her condition as to whether she is pregnant or not. Cows that have a tendency to become too fleshy need less carbohydrates and more protein in proportion, and cows with the opposite tendency more carbohydrates. As milk contains relatively large amounts of protein, fat and ash, the ration fed should carry a liberal supply of these nutrients so that the cow will not have to draw from her own body to make up a deficit. At the Wisconsin Experiment station it was found that in 110 days a dairy cow, fed a liberal ration yet one deficient in lime, gave up 25 per cent of all the lime of her skeleton. Similar results have been secured where cows have been fed rations sufficient only to maintain their bodies and not for milk production. Body tissue is sacrificed in order that the cow may secrete milk. Many of the cows on the Iowa farm today are doing this same thing. They produce milk in fair quantities for a few months after calving, not because of the ration made up solely of ear corn, timothy hay and corn stalks, but in spite of it. However, after they have drawn upon their own bodies as long as they can they rapidly decline in milk flow after five or six months. In
many cases this lack of persistency is due to inherited characteristics as well as to failure to feed especially for milk production.

The proper effect of feeds upon the digestive system can be secured by a study of the characteristics and influence of different feeds. It is important to consider whether the feed or combination of feeds will have a cooling, laxative effect upon the digestive tract, or whether it will be heating and constipating.

The ration must be economical. In selecting feed stuffs, thought must be given to the relative values of different feed stuffs as well as to their price per pound. Home grown feeds should be used so far as practicable. Where the dairy farm produces clover, alfalfa and oat and pea hays a large amount of the only nutrient the Iowa farmer needs to buy, protein, may be secured cheaply.

CHARACTERISTICS OF ECONOMICAL IOWA FEEDS

The characteristics of the feeds which are most economical and efficient for the Iowa dairy farmer are given herewith:

**Corn:** In the corn belt corn must form the basis of the economical ration because it is the cheapest source of the energy supplying carbohydrates or starchy materials. However, it is necessary that feeds rich in protein and ash be fed with it for best results. The too common practice of feeding only timothy hay and corn fodder to milk cows is bad, as it keeps many cows from making a good record and returning a profit. In winter feeding corn may be fed in the form of corn and cob meal, as corn and cob meal is usually equal, pound for pound, to corn meal or corn chop when fed to dairy cows. This is due to the fact that the cob present adds bulk and by separating the starchy particles insures more complete digestion. In summer feeding cracked corn is usually considered preferable, because the cow is getting a great deal of bulky grass.

**Gluten Feed:** This corn by-product is fed by a great many dairymen. In most seasons it is a fairly economical source of protein, but varies greatly in price. Being a corn by-product, it should not be the only concentrated feed used to balance the corn ration, as it does not add sufficient variety.

**Oats:** There is no better grain than oats for cows producing milk, cows about to freshen, or young, growing cattle. It will be noted from the preceding table that they are rich in the desired nutrients. However, often oats are rather high in price compared to many other feeds and consequently can be fed only in limited amounts. There are oat by-products on the market, but they are of little value for milk production.

**Barley:** This is a common feed where corn is not successfully grown, as in the west and north and in northern Europe. Rolled barley, rather than ground, is usually fed. Barley by-products are commonly used for dairy cows. The wet barley products must be fed fresh and therefore are available only near breweries. Dried malt sprouts and dried brewer’s grains are shipped long distances and fed
### AVERAGE DIGESTIBLE* NUTRIENT CONTENT OF LEADING DAIRY FEED-STUFFS

(Taken from Henry's Feeds and Feeding.)

<table>
<thead>
<tr>
<th>Feeds</th>
<th>Total Dry Matter in 100 Lbs.</th>
<th>Total Digestible Nutrients in 100 Lbs.</th>
<th>Total Ash in 100 Lbs.</th>
<th>Weight per Quart</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Protein</td>
<td>Carbohydrate</td>
<td>Fat</td>
</tr>
<tr>
<td>Concentrate:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corn, whole</td>
<td>89.4</td>
<td>7.8</td>
<td>66.8</td>
<td>4.3</td>
</tr>
<tr>
<td>Corn meal</td>
<td>85.0</td>
<td>6.7</td>
<td>64.3</td>
<td>3.5</td>
</tr>
<tr>
<td>Corn and meal cob</td>
<td>84.9</td>
<td>4.4</td>
<td>60.0</td>
<td>2.9</td>
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<tr>
<td>Gluten feed</td>
<td>90.8</td>
<td>21.3</td>
<td>58.2</td>
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<tr>
<td>Gluten meal</td>
<td>90.5</td>
<td>25.7</td>
<td>42.5</td>
<td>6.1</td>
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<td>Corn bran</td>
<td>90.6</td>
<td>6.0</td>
<td>52.5</td>
<td>4.8</td>
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<tr>
<td>Wheat, whole</td>
<td>89.5</td>
<td>8.8</td>
<td>67.5</td>
<td>1.5</td>
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<td>Wheat, bran</td>
<td>88.1</td>
<td>11.9</td>
<td>42.0</td>
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<td>Wheat shorts</td>
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<td>45.7</td>
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<td>70.3</td>
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<td>Oats, whole</td>
<td>89.6</td>
<td>10.7</td>
<td>50.3</td>
<td>3.8</td>
</tr>
<tr>
<td>Oats, ground</td>
<td>88.0</td>
<td>10.1</td>
<td>52.5</td>
<td>3.7</td>
</tr>
<tr>
<td>Canada field peas</td>
<td>85.0</td>
<td>19.7</td>
<td>49.3</td>
<td>0.4</td>
</tr>
<tr>
<td>Cow peas</td>
<td>85.4</td>
<td>16.8</td>
<td>54.9</td>
<td>1.1</td>
</tr>
<tr>
<td>Soy beans</td>
<td>88.3</td>
<td>20.1</td>
<td>23.3</td>
<td>14.6</td>
</tr>
<tr>
<td>Raffir corn</td>
<td>90.1</td>
<td>5.2</td>
<td>44.3</td>
<td>1.4</td>
</tr>
<tr>
<td>Linseed meal OP</td>
<td>90.2</td>
<td>30.2</td>
<td>32.0</td>
<td>6.9</td>
</tr>
<tr>
<td>Linseed meal NP</td>
<td>91.0</td>
<td>31.5</td>
<td>35.7</td>
<td>2.4</td>
</tr>
<tr>
<td>Oats and peas</td>
<td>93.6</td>
<td>37.6</td>
<td>21.1</td>
<td>9.6</td>
</tr>
<tr>
<td>Dried brewer's grains</td>
<td>91.3</td>
<td>20.0</td>
<td>32.2</td>
<td>6.0</td>
</tr>
<tr>
<td>Malt sprouts</td>
<td>90.5</td>
<td>20.3</td>
<td>46.0</td>
<td>1.4</td>
</tr>
<tr>
<td>Dried distiller grains</td>
<td>92.4</td>
<td>22.8</td>
<td>39.7</td>
<td>11.6</td>
</tr>
<tr>
<td>Dried beet pulp</td>
<td>91.6</td>
<td>4.1</td>
<td>64.9</td>
<td></td>
</tr>
<tr>
<td>Alfalmo</td>
<td>90.9</td>
<td>9.8</td>
<td>40.8</td>
<td>0.9</td>
</tr>
</tbody>
</table>

### Roughage

<table>
<thead>
<tr>
<th>Feeds</th>
<th>Total Dry Matter in 100 Lbs.</th>
<th>Total Digestible Nutrients in 100 Lbs.</th>
<th>Total Ash in 100 Lbs.</th>
<th>Weight per Quart</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alfalfa, West United States</td>
<td>92.2</td>
<td>11.1</td>
<td>39.1</td>
<td>0.6</td>
</tr>
<tr>
<td>Red clover</td>
<td>84.7</td>
<td>7.1</td>
<td>37.8</td>
<td>1.8</td>
</tr>
<tr>
<td>Cow pea hay</td>
<td>89.5</td>
<td>5.8</td>
<td>39.3</td>
<td>1.3</td>
</tr>
<tr>
<td>Soy bean hay</td>
<td>88.2</td>
<td>10.6</td>
<td>40.9</td>
<td>1.2</td>
</tr>
<tr>
<td>Oat and pea hay</td>
<td>89.5</td>
<td>7.5</td>
<td>41.6</td>
<td>1.5</td>
</tr>
<tr>
<td>Oat and vetch hay</td>
<td>85.0</td>
<td>8.3</td>
<td>35.8</td>
<td>1.2</td>
</tr>
<tr>
<td>Oat hay</td>
<td>86.0</td>
<td>4.7</td>
<td>36.7</td>
<td>1.7</td>
</tr>
<tr>
<td>Timothy hay</td>
<td>86.8</td>
<td>2.8</td>
<td>42.4</td>
<td>1.3</td>
</tr>
<tr>
<td>Millet hay</td>
<td>86.0</td>
<td>5.2</td>
<td>38.6</td>
<td>0.8</td>
</tr>
<tr>
<td>Corn fodder</td>
<td>57.8</td>
<td>2.5</td>
<td>34.6</td>
<td>1.2</td>
</tr>
<tr>
<td>Corn stover</td>
<td>59.5</td>
<td>1.4</td>
<td>31.2</td>
<td>0.7</td>
</tr>
<tr>
<td>Sorghum, corn, wheat straw</td>
<td>90.4</td>
<td>9.8</td>
<td>35.2</td>
<td>0.4</td>
</tr>
<tr>
<td>Oat straw</td>
<td>90.8</td>
<td>1.3</td>
<td>39.5</td>
<td>0.8</td>
</tr>
<tr>
<td>Rye straw</td>
<td>92.9</td>
<td>0.7</td>
<td>39.6</td>
<td>0.4</td>
</tr>
</tbody>
</table>

### Succulent Feeds

<table>
<thead>
<tr>
<th>Feeds</th>
<th>Total Dry Matter in 100 Lbs.</th>
<th>Total Digestible Nutrients in 100 Lbs.</th>
<th>Total Ash in 100 Lbs.</th>
<th>Weight per Quart</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green corn</td>
<td>28.7</td>
<td>1.0</td>
<td>11.9</td>
<td>0.4</td>
</tr>
<tr>
<td>Green sweet corn</td>
<td>29.6</td>
<td>1.2</td>
<td>12.6</td>
<td>0.4</td>
</tr>
<tr>
<td>Sweet corn</td>
<td>29.6</td>
<td>0.6</td>
<td>11.6</td>
<td>0.3</td>
</tr>
<tr>
<td>Canada field peas</td>
<td>16.3</td>
<td>1.8</td>
<td>6.9</td>
<td>0.3</td>
</tr>
<tr>
<td>Cow peas</td>
<td>16.4</td>
<td>1.8</td>
<td>8.7</td>
<td>0.2</td>
</tr>
<tr>
<td>Soy beans</td>
<td>24.9</td>
<td>3.1</td>
<td>11.0</td>
<td>0.5</td>
</tr>
<tr>
<td>Alfalfa</td>
<td>22.2</td>
<td>3.4</td>
<td>12.1</td>
<td>0.4</td>
</tr>
<tr>
<td>Clover</td>
<td>22.2</td>
<td>2.9</td>
<td>14.9</td>
<td>0.7</td>
</tr>
<tr>
<td>Oats, in milk</td>
<td>37.8</td>
<td>2.5</td>
<td>18.2</td>
<td>1.0</td>
</tr>
<tr>
<td>Oats and peas</td>
<td>29.3</td>
<td>1.8</td>
<td>10.2</td>
<td>0.4</td>
</tr>
<tr>
<td>Oats and vetch</td>
<td>29.0</td>
<td>2.3</td>
<td>10.0</td>
<td>0.2</td>
</tr>
<tr>
<td>Millet, barnyard</td>
<td>25.0</td>
<td>1.6</td>
<td>14.4</td>
<td>0.3</td>
</tr>
<tr>
<td>Wet brewers' grain</td>
<td>23.0</td>
<td>1.9</td>
<td>7.6</td>
<td>1.7</td>
</tr>
<tr>
<td>Wet beet pulp</td>
<td>10.2</td>
<td>0.5</td>
<td>7.7</td>
<td></td>
</tr>
<tr>
<td>Corn silage</td>
<td>26.4</td>
<td>1.4</td>
<td>15.2</td>
<td></td>
</tr>
<tr>
<td>Red clover silage</td>
<td>28.0</td>
<td>1.5</td>
<td>9.2</td>
<td>0.5</td>
</tr>
<tr>
<td>Corn cannery refuse, husk silage</td>
<td>16.2</td>
<td>0.4</td>
<td>10.1</td>
<td>0.4</td>
</tr>
<tr>
<td>Corn cannery refuse, cob silage</td>
<td>28.9</td>
<td>0.3</td>
<td>15.7</td>
<td>0.9</td>
</tr>
<tr>
<td>Pea cannery refuse silage</td>
<td>23.2</td>
<td>2.1</td>
<td>13.1</td>
<td>0.8</td>
</tr>
<tr>
<td>Corn and soy bean silage</td>
<td>24.0</td>
<td>1.6</td>
<td>13.2</td>
<td>0.7</td>
</tr>
<tr>
<td>Millet</td>
<td>9.1</td>
<td>1.0</td>
<td>5.5</td>
<td>0.2</td>
</tr>
<tr>
<td>Sugar beets</td>
<td>13.5</td>
<td>1.3</td>
<td>9.8</td>
<td>0.1</td>
</tr>
<tr>
<td>Turnips</td>
<td>2.9</td>
<td>0.9</td>
<td>6.4</td>
<td>0.1</td>
</tr>
<tr>
<td>Rutabaga</td>
<td>11.4</td>
<td>1.0</td>
<td>8.0</td>
<td>0.2</td>
</tr>
<tr>
<td>Cabbage</td>
<td>16.0</td>
<td>2.3</td>
<td>5.9</td>
<td>0.1</td>
</tr>
<tr>
<td>Potatoes</td>
<td>20.9</td>
<td>1.1</td>
<td>15.7</td>
<td>0.1</td>
</tr>
</tbody>
</table>

*The digestible nutrients in feed are the digestible portions of each nutrient in that feed.
with profit. The dried brewer's grain ranks with bran and oil meal in palatability, has a good effect upon the system and is fairly high in digestible protein. Dried brewer's grains are oftentimes sold under many different brand names.

**Wheat:** This is an excellent feed but, of course, is usually too high in price to be fed except when damaged.

**Bran:** Very wide use is given to bran for dairy cows, as well as young, growing animals. It is fairly rich in valuable constituents, palatable, bulky and has a laxative, cooling effect on the digestive tract. However, bran is rather an expensive feed. In 100 pounds of it there is less than 12 pounds of digestible protein, while there are more than 20 pounds of digestible protein in gluten feed and dried brewer's grains, over 30 pounds in oil meal, and over 37 pounds in cottonseed meal. Except in the case of cows just before and after calving, cows on official test and young, growing animals, other feeds return greater profits than bran. Wheat middlings and shorts are comparatively high in protein, yet are not as palatable as many feeds for the dairy cow and should be fed in very limited amounts, if at all.

**Cottonseed Meal:** This is one of the richest and heaviest of feeds. If of good quality, and fed in limited amounts with other feeds, it is especially valuable for dairy cows, being one of the cheapest sources of protein. When wet, mouldy, or if it has heated, it should not be fed. Cottonseed meal is very constipating in its effect upon the digestive tract and, as it contains a poisonous substance, it should not be fed to swine, young calves or cows soon to freshen. When fed to cows producing milk some cooling laxative feed, such as silage or oil meal, should be fed also and it is best not to feed more than 2 to 2½ pounds per cow per day.

**Dried Distiller's Grains:** These are a very valuable feed for dairy cows, being light, bulky and palatable, and containing a high percentage of valuable nutrients. Ajax Flakes are corn distiller's grains.

**Linseed Oil Meal:** One of the best dairy feeds, is linseed oil meal, as it is high in desirable nutrients, and palatable, and has a laxative cooling effect upon the digestive tract. One to two pounds will improve any ration. Old processed, rather than new, should be purchased, as it has a higher feeding value.

**Alfalfa Feeds:** There are many alfalfa feeds on the market and while they are palatable, most of them are expensive from the standpoint of nutrients contained.

**IOWA HAYS AND THEIR VALUE**

**Alfalfa:** It is conceded by practically all that alfalfa is the very best hay that can be fed to dairy animals. It is rather rich in valuable nutrients, very palatable, has a good effect upon the system, and, as it can be grown upon any Iowa farm, it is very economical feed to help balance the corn and silage ration. In 1912 the field
on the college farm yielded 7.03 tons of field cured hay per acre.

**Clover:** This is an excellent hay and is second to alfalfa in all the points brought out above. Care should be taken to cut it at the right stage of maturity for best results.

**Oats and Canada Field Pea Hay:** This makes an excellent substitute for alfalfa and clover hay where the acreage of these crops is too small to supply the dairy herd. Excellent results have been secured at the college dairy farm from sowing 1 1-2 bushels of oats and 1 1-2 bushels of Canada field peas per acre. These are best sown with a grain drill, sowing the peas first, and deeper, than the oats. To make the best hay it should be cut when just passing from the milk to dough stage.

**Timothy:** While timothy is grown upon nearly every Iowa farm and has a high value as a feed for horses, it should not have a place in the ration of the dairy cow. It lacks the nutrients which the milk producing cow and young, growing animals must have; in addition, it is not very palatable and has a binding effect on the digestive system instead of the beneficial effect of alfalfa or clover. The composition table previously given shows that a ton of alfalfa hay contains about four times as much digestible protein as timothy, seven or eight times as much ash or mineral matter. The man who has only timothy hay for his cows had best sell a portion of it and purchase with the proceeds alfalfa or clover hay and next season get started growing one of the other hay crops.

Straw, corn stover, etc., should not be fed in large quantities as the sole roughage, but the cows will oftentimes relish small quantities if fed in addition to their silage and alfalfa or clover hay.

**SILAGE AND ITS EFFICIENCY**

No dairy farm is complete in its equipment without at least one silo for winter feeding and one with a smaller diameter for summer feeding. The characteristics of good corn silage make it pre-eminently a feed for dairy cattle. It is palatable, succulent, bulky, beneficial to the digestive tract, and economical. These are all essential characteristics of the ration which is essential to the largest and most economical flow of milk. Most dairy farmers in the corn belt realize that to secure the largest possible profits from a herd of cows they must feed corn silage. In regions where corn cannot be grown successfully for silage, many dairy men have silos in which they cure other crops.

Experiments carried on at the different stations show conclusively that silage is far superior to shock corn or hay in milk production. Silage fed cows produced from eleven to eighteen per cent more milk than cows fed fodder from the same acreage.

The principal reason why a dairy cow increases her milk flow when she is turned out to pasture in the spring is that she is receiving a succulent feed. Thus, to secure a large and persistent flow of milk during the winter months some succulent feed must be secured to
Fig. 6—Holstein cow—Geneseo Belle Polkadot, owned by Iowa State College and holder of the following official records:

<table>
<thead>
<tr>
<th>Pounds Milk</th>
<th>Pounds Butter Fat</th>
<th>Average Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 day</td>
<td>108.8</td>
<td>4.1</td>
</tr>
<tr>
<td>7 days</td>
<td>733.6</td>
<td>27.508</td>
</tr>
<tr>
<td>30 days</td>
<td>2,773.0</td>
<td>98.0</td>
</tr>
<tr>
<td>365 days</td>
<td>20,816.2</td>
<td>732.94</td>
</tr>
</tbody>
</table>

take the place of the pasture grass of summer. The two most common succulent feeds for winter are corn silage and roots. Experimental work has proved that the silage, as compared to roots, yields more heavily per acre, costs much less and gives equal results from similar weights of dry matter. Silage is also very desirable for the herd during the latter part of July and the month of August, when the pastures are usually very short, due to hot weather and lack of rainfall. The value of silage or forking crops at this season does not lie solely in the temporary increase in milk flow, but also in maintaining it. If a cow once declines in her milk flow it is practically impossible to bring her back to normal for the remainder of her lactation period.

EFFECT OF SILAGE ON MILK

Contrary to the opinion formerly held, milk from silage fed cows is not inferior in flavor or odor to milk from cows fed dry feed. The condensed milk companies which formerly did not favor milk from silage fed cows are now advising their patrons to put up silos. Great care should be taken, however, to prevent the odor of silage from contaminating the freshly drawn milk, which takes up odors very quickly. It is best to feed the silage just after milking and only what will be eaten up clean at that feed. The silos should be
shut off from the barn proper. The idea still held by some, that corn silage will destroy the teeth and digestive tract of the cow and induce such diseases as tuberculosis, is erroneous.

ROOT CROPS

Many of the root crops furnish succulence to the dairy cow in very acceptable form, yet for the practical man they are too expensive as compared to corn silage to be fed in large quantities or in the place of silage. They are often used for cows on official test.

BEET PULP

Beet pulp is a very good feed and farmers living near a beet sugar factory usually secure the wet pulp for a very reasonable price. Dried beet pulp is an excellent feed and when one cannot have corn silage it proves to be a very valuable substitute. It is best when soaked twelve hours before feeding, allowing from four to seven pounds of dried beet pulp per cow per day when on full feed.

SOILING CROPS

The pastures upon most Iowa farms do not furnish enough feed for the cattle during the hot, dry months of summer. The problem of supplying the necessary succulent feed most economically is important and may be solved by one, or a combination, of the following methods:

1. Better care and management of pastures.
2. Use of summer silo.
3. Use of soiling crops.

Better care and management of pastures is absolutely necessary to secure the best results from farms. In every neighborhood a practical demonstration may be found that a little care given to a pasture will greatly increase its production of feed. But the pasture crop in itself is not enough for dairy farmers or for many beef cattle growers. To secure the greatest possible returns from their land, they find it to their advantage to keep more cattle than they can properly pasture without the aid of silage or soiling crops. The use of silage or soiling crops upon dairy farms results in a saving of land, fencing, feed and manure, and in greater and more profitable production of milk.

SILAGE OR SOILING CROPS

Whether corn silage or soiling crops will be more economical and efficient in supplementing the pasture will depend somewhat on specific conditions. The experimental work which has been conducted along this line has not furnished very conclusive evidence in favor of either. Evidently a silo small in diameter filled for summer use is the most satisfactory and economical solution of the problem on the average Iowa farm. Most of the soiling crops require more labor in getting them to the animals than the average farmer,
who practices mixed farming, wishes to spare from the field work in the busy season of the year.

However, the man who has a large herd of dairy cattle and wishes to secure the best possible returns from his acreage will find it to his advantage to grow some soilling crops. There is nothing better than fresh, palatable, nutritious green feed to stimulate milk production. Then, too, by having in each mixture a leguminous plant, soilling crops can be grown that are superior to corn silage in balance of nutrients. Another class of farmers who profit by the use of soilling crops are the renters who cannot persuade their landlords that silos are necessary fixtures upon farms. To these classes must be added the men who have not put up silos yet and who wish to grow crops to feed in addition to their pastures during the coming summer.

SOILING CROP SYSTEM ON COLLEGE DAIRY FARM

During the past three years soilling crops have been successfully grown and used upon the Iowa State college dairy farm at Ames. Such varieties have been chosen as would furnish a succession of green feed to supplement the limited acreage of blue grass pasture. Under this system the cows have been turned into the pasture nights and forenoons and then put into the barn about 2:30 p. m. and given a liberal allowance of the freshly cut green feed. Under ordinary conditions, the above, or partial, soilling system is more satisfactory than to keep the cows confined all the time and haul all the green feed to them as is done on some of the larger dairy farms. It is also much more satisfactory to feed the cow the green feed on the ground in the pasture, as is sometimes done, with much soiled and wasted feed as a result.

Increased production of milk from decreased acreage has been the result secured at the college dairy farm from this system of soilling crops. By bringing the cows into the barn at the time of day when the heat and flies are especially troublesome and spraying them to remove flies, it is made possible for them to eat their feed in comfort. Thus they are enabled to keep up a normal flow of milk when they would ordinarily decline seriously. Also, because these palatable green crops are used, less grain needs to be fed the heaviest producers, while ordinary producers may be kept up in production and condition without grain.

In 1911 thirty-seven cows were kept on 19 1-2 acres of pasture and in addition were supplied with the soilling crop from 8 acres. Counting the land devoted to both pasture and soilling crops each cow was kept the entire season on .74 of an acre. The value of the soilling crops may be fully realized when it is remembered that the summer of 1911 was one of scanty rainfall and many farmers in the vicinity of Ames were allowing 2 1-2 to 3 acres of pasture for each cow. In 1912, 45 cows were kept on the 19 1-2 acre pasture and in addition were allowed a trifle over 6 acres of soilling crops—or each cow was kept on about .6 of an acre. In addition to this,
In 1912 the cows grazed on a 15 acre meadow for a few weeks, beginning about the middle of August. It was found in 1912 that the entire cost of pasture and soiling crops for each cow, counting rent of land, labor, seed, etc., was only $6.62 for the entire pasture season.

LABOR NECESSARY FOR SOILING CROPS

The objection usually raised to growing soiling crops is the amount of labor necessary to cut and haul the feed to the cows each day. On the college dairy farm this takes two men about one and one-half hours each day. In 1912, with 45 cows, it was found that a team and mower could be used to good advantage in cutting the daily allowance of feed. Considering the value of soiling crops in increasing production and decreasing cost of production of dairy products, it will be found that excellent returns are secured for time spent.

SUCCESSION OF SOILING CROPS USED ON THE IOWA STATE COLLEGE DAIRY FARM

<table>
<thead>
<tr>
<th>Approximate Time of Cutting</th>
<th>Crops</th>
<th>Approximate Time of Sowing</th>
<th>Rate of Seeding per Acre</th>
<th>Average Yield of Feed per Acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 10 to June 15</td>
<td>Alfalfa</td>
<td>Spring or August</td>
<td>20 lbs.</td>
<td>8 tons</td>
</tr>
<tr>
<td>June 15 to July 10</td>
<td>Oats and Canada</td>
<td>April 5</td>
<td>1½ bu. oats...</td>
<td>5 tons</td>
</tr>
<tr>
<td>July 1 to July 10</td>
<td>Oats and Canada</td>
<td>April 20</td>
<td>1½ bu. peas...</td>
<td></td>
</tr>
<tr>
<td>July 10 to July 15</td>
<td>Alfalfa</td>
<td>Spring or August</td>
<td>20 lbs.</td>
<td>4 tons</td>
</tr>
<tr>
<td>July 10 to July 20</td>
<td>Amber Fodder Cane</td>
<td>May 5</td>
<td>70 lbs.</td>
<td>20 tons</td>
</tr>
<tr>
<td>July 15 to Aug. 15</td>
<td>Fodder Cane and Cowpeas</td>
<td>May 15</td>
<td>30 lbs. cane...</td>
<td>12 tons</td>
</tr>
<tr>
<td>Aug. 15 to Sep. 20</td>
<td>Fodder Cane and Cowpeas</td>
<td>June 10</td>
<td>30 lbs. cane...</td>
<td>12 tons</td>
</tr>
<tr>
<td>Sep. 20 to heavy frost</td>
<td>Millet</td>
<td>July 10</td>
<td>3 pecks</td>
<td>3 tons</td>
</tr>
</tbody>
</table>

PREPARING THE COW FOR HER YEAR’S WORK

The proper time to begin feeding a cow for milk production is six to eight weeks prior to freshening. She should have at least this length of time to rest and prepare for the next lactation period. The feeds given at this time should meet the following requirements: Rest and cool out the digestive tract, supply nourishment for the growth of the fetus or unborn calf, and build up the flesh and strength of the cow herself.

For the cows that are to freshen during the summer or early fall it is a good plan to have a small pasture set aside so that they may have abundance of pasture grass and not be molested by the other cows. In addition to this a few pounds of ground oats and in some cases a small quantity of bran will be sufficient. Cows that are to freshen during the winter should receive from 20 to 25 pounds of corn silage, all the clover or alfalfa hay they desire and a grain mixture of 3 parts ground
oats, 2 parts bran and 1 part oil meal. The amount of grain per day is to be governed by the individual animal. Animals thin in flesh may be given a small quantity of corn but should not be crowded, but rather fleshed up gradually. Timothy hay and cottonseed meal are not desirable as they are rather constipating, while laxative feeds are needed at this time. Too large a quantity of corn is likely to have a bad effect upon the system. It is well to reduce the ration slightly just prior to calving as by so doing the danger of milk fever and after-calving troubles is decreased to some extent.

A few days before calving put the cow in a clean, disinfected, well bedded box-stall, if her bowels are not moving freely, a dose of ½ to 1 pound of epsom salts or one quart of raw linseed oil will prove very beneficial. A grain ration of 2 parts bran and 1 part oil meal is very good at this time.

For a few days after calving the cow's drinking water should be luke warm. In addition to alfalfa or clover hay and a small quantity of silage, she should be fed bran mashes or a small allowance of bran, oil meal and ground oats. If the cow does not pass the after-birth promptly and the man in charge does not understand the anatomy of the reproductive organs, a competent veterinarian should be called; that should be done also when the cow has difficulty in calving.

CARE OF COW FIRST THIRTY DAYS AFTER CALVING

If the cow has been properly cared for the first three days she may then be placed on dry and more solid food. The manner in which she is fed during the next thirty days determines largely the character of the work she will do during her lactation period. Experienced feeders of beef cattle realize that thirty days are required to get steers on full feed, and likewise the dairy cow needs to be given thirty days. Without doubt parturition weakens the digestive apparatus and heavy feeding soon after calving is liable to be followed by indigestion, bloat or impaction. During the first thirty days after parturition the maternal instinct is at its highest pitch and during this time, if properly cared for, the cow can be brought to her greatest possible milk flow.

To do this, the feeds must be suited to the Individual cow's needs. Beginning on the fourth day with five pounds of grain daily, the ration should be increased slowly—say at the rate of ½ pounds each alternate day. This rate of increase is rapid enough, for the cow will respond as well to a half pound increase as she will to a pound. This increase may continue just as long as the cow continues to increase profitably in her milk flow. When she ceases to respond, then the feed should be lessened in the same gradual manner for a few days and it will, as a rule, be noted that the cow will further increase in milk flow. The feed given on the day she begins to decline in milk determines practically the amount of grain she should receive. Much less than this amount will not compel her best work and any additional feed will be worse than wasted.

The exact amount and quality of the food will be determined by the condition and individuality of the cows. Seldom do two cows
demand to be fed in exactly the same way. Cows inclined toward beefiness require a narrow ration, or one containing a proportionately large amount of protein; cows of the strictly dairy type, inclined to work hard and become thin in flesh, need to be fed more extensively on foods rich in carbohydrates. Cows of large capacity and the ability to produce great volumes of milk require more than cows with less capacity and ability.

**AMOUNT TO FEED**

The amount of feed given the cow is of great importance. The average dairy cow requires about 50 per cent of a normal ration for maintenance. Consequently, if this cow is fed but one-half the normal ration, she receives simply enough to maintain her body and the milk she gives will be produced at the expense of her body tissues. Under such conditions the flow of milk would no doubt keep up for a time, but the animal would not be able to continue the work and her strength for a very long period. This is one of the chief reasons why cows on many farms drop off rapidly in milk flow after the first two or three months of their lactation periods. It is poor economy to under-feed the dairy cow because her maintenance requirements for the year will remain the same and her milk production will be certain to suffer.

There are cows that are over-fed, thus receiving food in addition to the requirements for maintenance and milk production, and this extra food is used for fat formation. This happens where all the cows are fed alike, irrespective of lactation period and production. This is also poor economy, because when many cows start to “flesh up” they continue to do so at the expense of milk production.

The best ration will depend upon the condition, individuality and record of the cow, but it is a common practice to allow 1 pound of grain for each 2½ to 4 pounds of milk produced, depending upon the richness of the milk, or 7 pounds of grain for each pound of butter fat. In addition to this grain ration, the average cow should receive 1 to 1½ pounds of clover or alfalfa hay and 2½ to 3 pounds of corn silage for each 100 pounds live weight.

Because the prices for the different feeds vary so much from year to year and from one locality to another, it is impossible to designate just what grain mixtures are most efficient and economical. However, the following mixtures meet the requirements of a good grain mixture to be fed in conjunction with corn silage and alfalfa hay, provided the feeds can be bought at a price which will make the ration comparatively economical:

**Sample Mixture A**

- 400 pounds cracked corn or corn and cob meal
- 200 pounds ground oats
- 100 pounds cottonseed meal
- 100 pounds oil meal

**Sample Mixture B**

- 400 pounds cracked corn
- 200 pounds oil meal

**Sample Mixture C**

- 400 pounds corn and cob meal
- 100 pounds ground oats
- 100 pounds gluten feed
- 100 pounds cottonseed meal
- 100 pounds oil meal

**Sample Mixture D**

- 300 pounds corn and cob meal or cracked corn
- 200 pounds oil meal
- 100 pounds cottonseed meal
FEEDING GRAIN IN SUMMER

Dairy farmers are divided in their opinion as to whether or not it pays to feed grain when the cows are on pasture. The practice of many successful dairymen, and the one in vogue at the college dairy farm, is to give the animals no grain the first month they are on grass. Thus they secure a rest. Later a small quantity of such feeds as cracked corn, cottonseed meal, ground oats, etc., should be given the heavier producers in addition to the silage or soil ing crops to keep the cows up in flesh and production.

ENCOURAGING PERSISTENCY OF LARGE MILK FLOW

The persistent cow, or the one that milks well for the entire lactation period, is the profitable cow. In order to induce persistency the following points must be observed in addition to weeding out the non-persistent animals:

1. Proper feeding.
2. Breeding to calve in fall of year.
3. Proper milking and manipulation of udder.
4. Regularity.
5. Kindness.
7. Watering.
8. Salting.
10. Sheltering.

Proper Feeding: Careful and judicious feeding must extend throughout the year and the ration changed to meet the changing needs of the cow. If the cow begins to fatten, lessen the carbohydrates and increase the protein in the ration. If she begins to get poor, increase the carbohydrates. Regulate the amount of feed by the amount of milk and butter fat produced. Cows producing milk rich in butter fat need more grain in proportion than do cows producing a low testing milk.

Breeding to Calve in Fall: Cows bred to calve in the fall will yield from 15 to 25 per cent more milk in the year than if they freshened in the spring, because in the former case when they go out on pasture in the spring they will increase slightly in milk flow, while if they freshen in the spring they are worried by the hot weather and flies, and oftentimes by a scarcity of feed, and soon start to decline in flow. Another factor of importance in this connection is the fact that irrespective of time of freshening, cows will give a slightly higher per cent of fat during the winter months than during the hot summer months. There are many other reasons why it is better to have the majority of the cows calve in the fall; for instance, the higher price paid for butter fat during the winter months, the time available for looking after the herd during the winter months, and the fact that calves born in the fall have a better chance for growth during the first year.
Milking and Manipulating the Udder: The cow should be milked by the same man at the same time each day, and always milked dry, for production is influenced as greatly by proper milking as by proper breeding. After the milk has apparently all been drawn, the udder should be rubbed and massaged, for this stimulates the milk producing glands. Regularly manipulating the udder will add to the persistency with which the cow milks and to the richness of the milk, because the last drawn milk is richest in butter fat.

Regularity: Regularity has been mentioned in several connections, and here it is sufficient to say that no one will be a very successful dairy farmer who is not regular with every detail of the work.

Kindness: No farm animal responds so quickly to kindness as the dairy cow. Harsh words, noise, and milk stools improperly used always decrease the milk flow greatly.

Grooming: Cows groomed will yield more than enough additional milk and butter fat to pay for the ten or fifteen minutes of extra labor daily, not to mention the difference in the cleanliness of the milk and in their appearance. Grooming stimulates the circulation of the blood and in this manner aids in food digestion and milk secretion, as well as in general health.

Watering: In winter cows should have drinking water that is warmed and at all times pure, clean and fresh. The importance of this is realized when it is remembered that about 87 per cent of normal milk is water. A short time ago it was found that one of the college Holstein cows which was producing 100 pounds of milk per day was drinking from 200 to 250 pounds of luke warm water per day. It is readily seen that if that cow had been forced
to drink ice water out of a tank, as many cows in this state are forced
to do, the milk flow would have been materially decreased.

Salting: Salt is quite essential to best results and should always
be available to the cow. Keep salt in front of the cow rather than
mix it with her grain ration.

Keeping the Flies from Cows: By preventing flies from tor-
menting the cows much greater flow of milk is secured during the
summer months and the remainder of the lactation period. The
following home-made mixture has given good results at the college
dairy farm. It is better than several other mixtures tried and quite
as efficient as the prepared sprays costing a dollar per gallon. It
is made as follows:

1 1/2 quarts of any standard coal tar dip.
1 1/2 quarts fish oil.
1 pint of oil of tar.
1 quart of coal oil.
1/2 pint of oil of pennyroyal.

Mix in ten gallons of luke warm soft water in which a bar of laun-
dry soap has been dissolved.

Spray twice a day, in the morning after milking and in the
afternoon when cows are brought in for silage or green feed. When
a half barrel cart with spray nozzle attachment is used two men
can spray a herd of forty cows in ten minutes. This mixture
is not perfect and does not keep all the flies away and, furthermore, it
leaves the coat rather harsh and causes dust to adhere; however, it
is very beneficial and practical.

Sheltering: Shelter from the hot sun of summer and the cold and
winds of winter must be provided if efficient and economical produc-
tion are to be expected.

INFLUENCING BUTTER FAT PRODUCTION

There is only one way that butter fat can be increased with cer-
tainty and in a large way. That is by obtaining a large and per-
sistent flow of milk. However, it is evident that each of the fol-
lowing factors may have a slight influence upon the per cent of fat
in the milk: breed, individuality, age, period of lactation, condition,
excitement, frequency of milking, season of year, temperature, feed,
whether first or last drawn milk and grooming.

Breed and Individuality: The influence of breed and individuality
need not be discussed, as the variations due to these factors are
known to all.

Age: Young heifers will nearly always produce milk testing a
higher per cent of fat during their first lactation period than during
succeeding lactation periods, other conditions being the same. In
her two year old form the heifer will usually produce about 70 per
cents as much butter fat in a year as she will as a mature animal.

Period of Lactation: The fact that cows produce a milk richer
in butter fat toward the close of their lactation periods is well known. However, cows that are in high condition at calving time will produce for a time milk testing much higher than their average for the lactation period.

**Condition:** The physical condition of the cow may affect the test slightly. Cows that are ill will usually test a trifle higher than their average.

**Excitement:** Cows that are excited, either due to some disturbance or to the fact that they are in heat, will usually test slightly higher than the average, but some individuals test lower.

**Frequency of Milking:** It is a common practice to milk cows on official or yearly record work three and sometimes four times per day. It is noticed that the great majority of the cows will give the highest per cent of fat following the shortest interval between milkings. Thus a slightly higher per cent of fat as well as a larger quantity of milk may be secured by these frequent milkings, but with the average cow under farm conditions not enough more to pay for the extra labor.

**Seasons of Year and Temperature:** It has been found that irrespective of the time of calving, cows will give a slightly higher test during the winter months than during the hot summer months.
and, furthermore, that on very hot days the per cent of fat will usually show a marked decrease.

**Feed:** Many have contended that it is possible to increase the percentage of butter fat in milk by feeding certain feeds high fat content. However, experiments have proved that it is impossible to do so to any great extent or for a very long time. Certain oils added to the grain ration have resulted in a temporary increase, but the per cent of fat soon drops back to normal, even though the feeding is continued.

**Whether First or Last Drawn Milk:** The last milk is much richer than the fore milk. A trial showed the fore milk from a Jersey heifer to test 2 per cent fat while the strippings tested over 15 per cent. This shows the importance of proper milking and manipulating the udder.

**Grooming:** The stimulation of the circulation by proper grooming has been found to cause a slight increase in the per cent of fat in the milk.

**REARING THE CALVES**

To successfully rear calves a great deal of care and attention must be given them during the first six months. But this care is well warranted and is highly paid for by the greater number of calves saved from the ravages of scours and other diseases and the better quality of mature animals that they make later in life.

To guard against navel infection, which so frequently causes the death of calves, the following method has proved to be very efficient:

1. Draw liquid from navel cord as soon as calf is born.
2. Apply tincture of iodine liberally to cord, both internally and externally.
3. Dust compound alum powder on the cord every few hours for one day.

The question of whether the young calf should be left with the cow for a few days or whether it should be taken away immediately is one upon which practical dairymen are not agreed. In most cases it is the practice at the college dairy farm to leave the calf and cow together for two or three days so that the calf may secure the first milk, or colostrum, at the normal temperature, which is quite essential in starting the digestive system properly. Then, too, the calf assists in relieving the inflammation in the cow's udder at this time.

During the first three weeks of the calf's life after being taken from the dam, it should be fed from 2 to 3 1/2 pounds of whole milk three times a day. Care should be taken to feed this milk immediately after being drawn, before it becomes cool. When the calf is three weeks of age it may be fed twice a day and skim milk can gradually and slowly be substituted for a like amount of whole milk. Three more weeks should be used in getting the calf onto a whole ration of skim milk. When it reaches the age of six weeks
DAIRY FARM DEPT., Iowa State College, Ames, Iowa

PRODUCE RECORD

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<th>No.</th>
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<th>Date Calved</th>
<th>Weight</th>
<th>Sex</th>
<th>Hand No.</th>
<th>NAME OF CALF</th>
<th>Registry No.</th>
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<td>Oct 21,26</td>
<td>Oct 23,26</td>
<td>97 M</td>
<td>83</td>
<td>Prince DeKal of Ames</td>
<td>Sweeney Bros.</td>
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<td>Dec 3,26</td>
<td>75¢</td>
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<td>Nevada, Iowa</td>
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<td>Mar 22,27</td>
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<td>41215</td>
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MILK AND FAT RECORDS

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<th>Yearly Milk and Composite Fat Records</th>
<th>Official Records</th>
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<tr>
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Fig. 8—A complete calf and milk and fat record devised at Iowa State College.
Fig. 9—The pedigree may be entered on the reverse of the blank in Fig. 8.
I should be receiving from 12 to 16 pounds of warm milk per day. Great care should be taken not to over-feed the calf with milk, as more calves are injured by over-feeding than by under-feeding. At the college farm best results are secured by 16 to 18 pounds per day when on full feed. It is usually advisable to continue the skim milk feeding until the calf is about eight months of age.

GRAIN RATIONS FOR CALVES

A grain ration of equal parts corn, oats and bran, with a small quantity of oil meal, should be provided for the calf. Even when but a few weeks old it will begin to eat the grain, and nibble at the hay. It is best to feed cracked corn at first and then later substitute shelled corn. Whole oats are better than ground oats for the young calf. Clover hay, or mixed clover and alfalfa, is superior to alfalfa alone for the young calf, as alfalfa alone is too rich for the kidneys and digestive tract.

Calves dropped in the fall and early winter will do well on pasture the first summer if provided with some grain and shade, while calves dropped in the spring or early summer are much better off when properly cared for in the barn during the first summer.

PREVENTING SCOURS IN CALVES

Thousands of calves are lost each year, due to what is known as scours. On every farm measures should be taken to guard against this disease, which results from a deranged digestive system. The calves should have warm, clean, light and well ventilated pens. The milk must be fed in regular amounts, at regular times, at a temperature of about 80 degrees F., from scrupulously clean pails. The foam which accumulates on milk while it is being separated should never be fed. The time to feed the grain ration is immediately after the milk is fed, so that the calves will not suck each other's ears and thus take air into the stomach, which causes bloat and produces scours. It is well to have stanchions on one side of the pen so that the calves may be confined for a short time after being fed milk.

Each day during the winter when the weather is favorable, the calves need to be turned out into a sheltered yard for exercise, which is necessary for their proper growth and health. It is also very important that the calves, from a very early age, be given all the pure, fresh water they care to drink each day. The pens should be disinfected frequently. Quick lime is excellent to sprinkle on the floor each time it is cleaned and a frequent spraying with some standard coal tar dip solution will prove beneficial.

SUBSTITUTES FOR MILK

There are several calf meals on the market which seem to give very good results, especially when fed in addition to a small quantity of milk. There are many home made mixtures which are fairly efficient and the following statement concerning "hay-tea" from Henry's Feeds and Feeding may be of interest:
“Stewart gives the following satisfactory experience with a hay-tea ration for calves: ‘If the hay is cut early when it has most soluble matter, and is good quality, the tea will grow good calves, but this extract frequently has too small a proportion of albuminous and fatty matter. Yet, if the hay-tea is boiled down so as not to contain too much water for the dry substance, calves will usually thrive upon it. We tried an experiment by feeding 2 gallons of hay-tea, in which one-fourth of a pound of flax seed and one-fourth of a pound of wheat middlings has been boiled, to each five calves thirty days old. This experiment was continued sixty days, with a gradual increase, during the last thirty days, of the middlings, 1 lb. per day. These calves did well, gaining on an average over 2 lbs. per head per day’.

The Pennsylvania Experiment station in Bulletin No. 60 reports trials with milk substitutes prepared by them. The mixture which gave best results was as follows:

- Wheat flour, 30 lbs.
- Coconut meal, 25 pounds.
- Nutrium, 20 lbs.
- Oil meal, 10 lbs.
- Dried blood, 2 lbs.

In feeding the milk substitute was mixed with warm water at the rate of one pound for six pounds of water and fed from a bucket. The calves were given their mother’s milk for about a week and then the milk substitute gradually replaced the milk, until at the end of two weeks no milk was given.

During the first five or six weeks the calves were given about two pounds of the mixture per day. From this time on until calves were 100 days of age they were fed two and a half pounds per day. After this age they were fed a grain and hay ration. The results, while not equal to those when milk was used, were satisfactory and good dairy heifers were raised at low expense.

**FEED AND CARE REQUIRED BY DAIRY HEIFERS**

In rearing a dairy heifer from birth to freshening, the chief purpose is to grow a large, strong framework and body and that should ever be uppermost in the dairyman’s mind. Every care possible should be given to stimulate the growth of bone and muscle. If a fall calf, of course, it is kept in a warm barn and well fed with skim milk, clover or alfalfa, corn, oats, bran and oil meal until late spring when it may be turned on good pasture. But the feeding of the same grain should be continued all through the summer in a more limited way, increasing the oats and corn at the expense of the bran and oil meal. In the heat of the summer the young animal needs shelter from the heat and flies in the same manner as the cows. When cold weather first comes, give the heifer the run of a shed, always providing her with an abundance of clover or alfalfa hay, corn stover, and a limited amount of silage to keep her growing. Feed largely of these coarse feeds to develop a large, well
distended digestive apparatus. In the past it has been advocated that if the heifer becomes fat she will be worthless as a dairy cow. However, if fed proper foods such as we have mentioned, and if a good growth and large, well distended barrel have been developed, many fat heifers, when they come into milk, make excellent dairy cows. But to feed the heifer fattening foods only is apt to ruin her for the dairy when she matures.

RATIONS FOR DAIRY HEIFER

The following are excellent rations for yearling dairy heifers during the winter months:

1. Silage ..................... 20 lbs. 2. Clover or alfalfa hay ........ 15 lbs.
Clover or alfalfa hay........... 8 lbs. Grass .............................. 1 lb.
Grain .......................... 2 lbs. Roots .......................... 20 lbs.
3. Clover or alfalfa hay........ 15 lbs.
Grain .......................... 3 lbs.

Give the heifers good, comfortable quarters, preferably a shed open to the south, clover hay, corn silage or roots, a little corn, bran and ground oats with some corn fodder and straw once in a while for a change. Silage or roots will take the place of succulent pasture grass and will tend to keep them in good condition. It costs from $60.00 to $60.00 to grow a dairy heifer up to producing age.

WHEN TO BREED

The proper time to breed the heifer will depend upon the breed as well as the growth and development of the individual. Early maturing animals of the Jersey and Guernsey breed should ordinarily be bred to freshen at 25 to 26 months or age, while Holsteins, Ayrshires and Brown Swiss heifers should freshen at about 28 months of age. Heifers that are large and heavy fleshed should be bred younger than smaller heifers of the same breed.

FEED AND CARE OF THE DAIRY BULL

It is important that the herd bull be kept by himself or with other bulls rather than allowed to run with the herd cows. It is essential that the dairy bull receive exercise. This may be provided by having a pasture or paddock opening from his shed or stall so that he may go in and out at will, or by turning him out into a special pasture each day. Many dairymen keep the bull exercised by placing him in a tread mill each day, the power being utilized in some cases to run cream separators, washing machines, grind stones, etc. The dairy bull, being a very nervous animal, should never be abused or teased; that may make him mean.

Dairy farmers are practically unanimous in the opinion that a too liberal ration of silage is not good for the herd bull. When so fed the animal is usually rather heavy middled, sluggish and slow in breeding. The large amount of silage distends the middle unduly and does not supply the balance of nutrients necessary to keep the animal vigorous and active in service. In addition to a small quantity of corn silage, alfalfa or clover hay should be fed and a grain ration of corn, oats, bran and a little oil meal.
HERD RECORDS

"Know your cows" is a stepping stone to success in the dairy business. The only accurate method of determining the relative merits of the cows in the herd and thus make it possible to weed out the cows that do not return a profit, is to make use of the milk scale, Babcock fat test and the feed record throughout the whole lactation period. The following records should be kept and will prove of great value to the dairyman: Production of milk, production of butter fat, feed records and breeding records.

The production records may be kept by all and require but very little time and effort. Blank milk sheets may be secured from the publishers of any dairy paper and it requires about a minute per day to weigh and record the weight of milk at each milking. To determine the production of butter fat, a careful composite sample of each cow's milk for each milking for two days should be taken about the middle of each month. Most of the buttermakers will gladly test these samples.

Good feed records are kept in such a manner that one can estimate quite closely the cost of production, which will vary.

The breeding records are absolutely necessary in the case of the pure bred herd and will prove of great value to the man with a grade herd. Every farmer will find that it pays to record service and calving dates so that the cows may receive the proper care when it is needed. The blanks shown in figs. 8 and 10 illustrate good forms, service and calving dates and other information.

The large record sheet in fig. 8 illustrates an excellent method of keeping all desirable information about the cow, her production records, her calves and her breeding. The value of these records

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Fig. 10 —A convenient breeding record used at Iowa State College.
are many fold. They are of especially great value in selling surplus stock. Likewise such records help in determining which are the profitable cows to be kept in the herd to increase the average production and profit received from the herd. On many farms in Iowa at the present time nine or ten cows are fed and milked where, if records were kept, it would be found that three or four of them were returning all of the profits. Co-operative cow testing associations are of great benefit in this record work, and for the good of dairy patrons the dairy farmers in more localities need to join in this work. A dairy farmer must either keep records or else never expect to be highly successful.

**ESSENTIALS IN DAIRY BUILDINGS**

First class dairy cows are relatively thin in flesh, especially during periods of lactation. For this reason they are more susceptible to cold than are beef cattle or any class of meat producing animals. Thus, from a humane standpoint, dairy cows should have warm, dry quarters during cold weather. From the standpoint of profit, good shelter is essential. Food supplied the dairy cow is for the purpose of milk production. The greater amount of food converted into milk, the greater the dairyman’s profit. If the cow is compelled to withstand the cold she must necessarily convert a portion of her food into heat with which to warm her body, hence a low milk flow and stunted profits for her owner. All first class dairymen realize this point and consequently all good dairy farms are well provided with good barns, for the cows in milk, at least.

**ARRANGEMENT OF BUILDINGS**

In arranging all buildings on the dairy farm the following points are deserving of careful consideration:

- **a. Location.**
- **b. Convenience.**
- **c. Light.**
- **d. Heat.**
- **e. Ventilation.**
- **f. Sanitary conditions.**
- **g. Confinement of odors.**
- **h. Appearance.**

From the standpoint of convenience, it would be advisable to have all buildings located close together, but because of the danger of fire on any farm without adequate fire protection this is not desirable. Neither is it advisable to build extremely large barns. On dairy farms where from five hundred to a thousand cows are kept in milk, it has invariably been found more satisfactory to stable only about fifty or sixty cows in one stable and build a sufficient number of barns to shelter the entire herd.

**LOCATION**

Dairy barns should be built on a spot that is high, well drained, and sheltered from the cold northwest winds of winter. At best the lots and paddocks surrounding barns get very muddy and foul in spring time, but when the barn sets on a high, well drained spot the lots soon become dry after the frost leaves the ground.
TYPES OF BARNs

The following types of barns are used on dairy farms: Basement, round, one-story, and two-story barns, and the covered barnyard or double stabling system. Basement barns are difficult to light and ventilate and should seldom, if ever, be used for housing dairy cows. Too much care in lighting and ventilating the dairy barn cannot be taken. These factors need more attention for dairy animals than for any other class of animals because the cows are confined most of the time for a large portion of the year. If housed in a damp, ill-lighted and ill-ventilated barn, the dairy cow is very likely to become diseased.

Round barns are fairly economical so far as building material is concerned. However, they are nearly always dark and the usual barn odors in them are not confined. Therefore, they are generally not desirable for dairy cattle.

One story barns may easily be made practically ideal, from the standpoint of light and ventilation, but are rather expensive from the standpoint of storage. The one story barn with a monitor roof, while excellent in summer and in warm climates, is cold, hard to ventilate and impractical on the Iowa farm.

Two story barns, if tightly celled and provided with proper window space and ventilation, are very practical on the Iowa farm where the storage room is needed.

The covered barnyard or double stabling system decreases the amount of labor required. It must have great quantities of bedding and, if adopted, the cows must be in small lots and dehorned.

CONVENIENCE

At best a great deal of labor is involved where many cows are milked, but if care and judgment be exercised in locating and building much can be gained by way of convenience in eliminating the work.

In barns where cows face inward the herd must be divided whenever driven into the barn, half of them entering a door on one side and the remainder on the other side. Even though the alleyways back of the cows are quite wide, the walls of the barn become splashed and besmeared with manure and the tidy dairyman who prides himself on cleanliness must spend hours keeping these walls scrubbed. Two alleyways become dirty each day and must be scrubbed and it is a great task to clean the manure from two sides of the barn and carry bedding all around the barn to be placed in the stalls. The task of conveying the milk to the milk room is doubled, also, because there can be no one convenient central point to weigh the milk.

When the cows face outward all enter one large door and seek their stalls; a litter carrier running between the rows of stalls will convey all manure directly from the barn. It is impossible for cows to splash walls with manure. There is only one alleyway to be scrubbed and all waste may be quickly swept up. The personal
experience gained by the writer on dairy farms where each type of barn was in use convinces him that to keep the barn in a clean, sanitary condition requires twice as much work when the cows face in than when they face out.

The best location for the feed room is at the head of one feeding alleyway with a silo adjoining or at the other end of the same alleyway, and a hay chute at the end of the other alleyway. Then with the feed or silage wagon the feeder can quickly and easily feed around the cows, finishing at the starting point.

For convenience a track on which a litter carrier will run should pass by all stalls so they can be quickly and easily cleaned.

FEEDING METHODS

In view of the fact that each cow should be fed individually and all grain weighed to her, the task of feeding is a large one and one of three ways may be used.

1. A row of covered boxes large enough to hold a week’s feed may be built along the wall in front of the cows and the feed weighed up once a week; then the feeder can pass along and give each cow her feed with a small scoop.

2. A feeding wagon may be divided into compartments, each containing a different food, and the wagon fitted up with a spring balance scale. Thus the ration can be weighed and mixed as fed.

3. In the feed room each cow may have a box just large enough for one day’s ration. Each day the feed can be weighed and placed therein. The rack containing these boxes should be mounted on rollers so that they may be rolled along in front of the cows. This method facilitates individual feeding and is quite convenient.

4. A mixture of concentrates which seems most efficient and economical under existing conditions may be conveyed in a feed wagon. Then by means of a scale or a measure of known contents, each cow can be given the amount she requires. Upon most farms this last method would prove most advantageous.

Watering cows in winter entails a great deal of labor if cows are to be watered twice daily, as they should be. Many devices have been patented and placed on the market for installing in cow barns. The most common is the individual basin for each cow in which water is always present. Another system, where cement mangers are used, is a hydrant at one end and a drain that can be plugged at the other. After feeding, the manger is swept out and the water turned in so the cows can drink. Then the water is drained out, so that at each watering time the cows receive good, clean, fresh water. When the cows are watered in an outside tank—and they should get out for a short time each day—a tank heater should be provided.

WARMTH, LIGHT AND VENTILATION

Warmth, sunshine, light and ventilation go hand in hand and all are of exceptional importance. The value of warmth has been referred to and in this connection it may be said that a barn well built
and without cracks, in a sheltered spot, will, as a rule, be warm enough when filled with cows, from the body heat given off.

Sunshine, light and ventilation, however, are not so easily attained. Barns built to run north and south are most desirable as they admit the most light and sunshine. Another advantage gained by building the barn on a line running north and south is that on warm days the doors at each end may be opened and the air of the barn quickly changed. In summer time this guarantees a cool barn. Windows should be large and placed close together, admitting all possible light and sunshine. Light and sunshine are death to germs.

As for ventilation, perhaps the King system, properly installed, is best. This system is simple and consists of fresh air intakes at the ceiling of the barn and foul air outlets at the floor. The outlets extend from the floor to the cupola of the barn and should be lined with tarred felt or paper to make them air tight. The principle on which the King system operates is that foul air is heavier by 15 per cent than fresh air and settles to the floor and is conveyed from the barn through the outlets on a level with the floor as the fresh air enters the intake flues. Another plan which promises to be successful is to use the same outlets for foul air and insert muslin instead of glass in a number of the windows. Still another plan which seems to be very efficient is to have intakes in the side of the barn or windows and have the outlet shaft reach nearly to the floor, the lower part being either of canvas or so constructed as to telescope and thus raise or lower.

SANITARY CONDITIONS

Because in the dairy barn feed for human consumption is being produced and because milk readily takes up impurities, it is very important that sanitary conditions and methods prevail in and about the barn. The public is beginning to realize that there is a great difference between pure and impure milk, and many cities are fighting persistently against the sale of impure milk.

Considering these facts it becomes at once apparent that it is to the dairyman's advantage to produce a pure, wholesome commodity, and to do this his barns, cows and attendants must be clean. All floors, feed mangers and gutters should be of cement and kept scrupulously clean. Gutters, furnished with drains for conducting liquid manure to a cess pool, should be built behind the cows. The cows themselves need daily grooming and udders, teats and flanks should be sponged off before each milking. Milkers and every one who handles milk must be clean. White laundered suits worn while milking and caring for the milk will be a great source of cleanliness. The milk room should at least be separated from the barn by a corridor to prevent odors from entering it. It should have cement floor and walls that can be easily kept clean by washing. Plastered walls are unsatisfactory as steam and moisture and jar of machinery cause plaster to crack and fall.
Whitewashing the interior of the barn at frequent intervals serves not only to make the barn lighter but also destroys many germs. It may be said in this connection that the fewer and simpler the furnishings and equipment in the barn the easier it is to keep clean. For this reason gas pipe partitions in stalls and swinging iron stanchions hung in gas pipe frames are much superior to complicated patent stalls; and, too, they are more comfortable for the cow and keep her cleaner, points well worth considering. The same sanitary conditions are worth observing in the calf pens because dirty surroundings are directly accountable for many of the troubles experienced from calf scours.

CONFINEMENT OF ODORS

About the dairy barn there are many distinct odors and these must be confined to themselves to prevent the milk from becoming contaminated. Silos have an odor peculiar to themselves and should be built away from the barn and connected with it by a corridor the door of which can be kept tightly closed. With this precaution, and by feeding silage only after milking, the milk will not be tainted nor taste of the silage favor. The calf barn has still another peculiar odor and for this reason should be set off from the cow barn. Hay, though without any bad odor, is dusty. The hay chute, therefore, should be a closed apartment and large enough to permit a large amount of hay to be thrown down from the mow at once. After the dust has settled the door may be opened and the hay distributed among the cows. This keeps much dirt out of the barn. The feed room, too, should be a tightly closed room for the same reason.

The cow barn itself has odors not agreeable when found in milk, so the milk room needs to be a distance from the barn. Many milk plants have their milk rooms many yards from the barn and carry the milk in cans over a cable. At least five feet of space should separate the milk room from the barn; this too may be connected with a corridor fitted with swinging doors,—two sets preferably.

Bulls also have a distinct odor, and more than this, they are very troublesome when housed in the same barn as the cows. For these reasons it is advisable to have a separate place for them a goodly distance away. A shed opening into a small pasture of an acre and a half per bull is best. He can go in and lie in the shed out of the hot sun or cold winds and storms or he can remain in the pasture. Unless the weather is very severe he will choose the latter, which is best.

To make a cheap addition to the capacity of the dairy farm it is well to have a shed for dry cows, yearlings, heifers, etc. These animals will otherwise take up expensive room in the cow barn proper when they would be better off in the open air, sheltered from exposure by a cheap, warm shed where they will not detract from the appearance of the milking herd. This shed is best located so that
It will be conveniently accessible from the silos, hay room and feed room of the main barn, as the cattle there kept can be well fed with little labor.

THE KIND OF FLOOR

The features of a good floor for the dairy barn are:
1. Impervious to moisture.
2. Sanitary and easily cleaned.
3. Comfortable for cows.
4. First cost not too great.
5. Durable.

The following floors are in common use in dairy barns:
1. Dirt with cement or wood gutter.
2. Wood.
5. Cork brick.
6. Creosote blocks.
7. Planks dipped in creosote.

The dirt floor with cement or wood gutter is cheap and comfortable; however, it takes up moisture and is not very easily cleaned. It is superior to the wood floor in nearly every respect, especially if made with clay that will pack firmly. Brick floors are not very desirable and as they are rather expensive are used but little at the present time. Cement is the material which comes nearest the requirements for the dairy barn. It is impervious to moisture, sanitary and easily cleaned, the cost is not great and if properly constructed it is very durable. However, it should not be too smooth or the cows are likely to slip and be injured. Furthermore, the cement floor is hard and unyielding and unless a generous supply of bedding is used during the cold weather, udder troubles may occur from contact with the cold cement. These objections may be readily overcome by putting cork brick or creosote blocks on top of the cement in the cow stalls. Either will be found to be very efficient and valuable, but is is impossible to make definite statements concerning their relative durability as they have not been in use long enough.

Planks dipped in creosote are quite an improvement over the undipped planks but not equal to the cement with the cork brick or creosote block in the cow stalls. It is a good idea to have the cement wall extend up to the bottom of the windows, care being taken not to leave a corner or crack for the accumulation of dirt at the junction of the floor and wall.

ARRANGEMENT OF LOTS AND PASTURES

On the dairy farm are old bulls, bull calves, cows in calf, open cows, heifers in calf and those not, and heifer calves. Pastures and grass lots should be provided for each of these classes of animals. No worse mistake can be made than to permit cows heavy with calf and cows that are liable to come in heat to run together. Those in calf are liable to be caused to abort and much loss is thus occasioned. Cows in heat should be at once removed to a separate small pasture until this period is over, for even after considering abortion, such animals may cause cows milking heavily to fret and fall away greatly in their milk flow. Young heifers and heifer calves do best when kept separate and to themselves, for dairy animals come in heat very young and if running with the older animals they are likely to be broken down and ruined at such times. Because of this hot-blooded characteristic, heifer and bull calves should be kept separate after they are three months of age. Many instances are on record where dairy bred heifers have become accidentally impregnated and
practically ruined when only three months of age. Lots and small pastures are very convenient and it is doubtful whether it is possible to have too many of them on the dairy farm.

What might be termed a night pasture is provided by many dairy-men to accommodate the milking herd during the night, close to the barn, so that in the early morning the cows can be quickly got in and milked without wading through wet grass.

**DISEASES COMMON TO THE DAIRY HERD**

It should be stated in this connection that the services of a competent veterinarian are occasionally absolutely necessary and this veterinarian must be on the ground to know all the conditions and to diagnose and treat the case for best results. However, the following treatments have been found very efficient and should be known by all who work with dairy cattle.

**SCOURS OR WHITE SCOURS**

A treatment which was first used and recommended by Dr. L. A. Klein of the South Carolina experiment station, and which is efficient both for ordinary and white scours, is as follows: One part formalin to 4,000 parts of milk. This dilution may be obtained by making a stock solution of one-half ounce of formalin to fifteen and one-half ounces of water. From this stock solution one teaspoonful is added to each pint to be fed the affected calf.

A mixture of equal parts of salol and bismuth sub-nitrate may be given in connection with and preceding the formalin treatment. A dose of this powder would be about one-fourth of a teaspoonful and should be placed well back on the calf's tongue just prior to giving the milk. This treatment may be repeated on the second day if necessary.

Another treatment in case the scours are due solely to indigestion is to reduce the feed and give the calf from one and one-half to two tablespoons of castor oil, repeating the dose on the second day if necessary. Scours in very young calves may be due to the fact that the mother's milk is too rich in butter fat and a change is necessary.

**ABORTION (Slinking the Calf)**

Abortion is the term used for the expulsion of the unborn calf at any time before the completion of the full period of pregnancy. It usually occurs at those three week intervals at which a cow would be in heat if not pregnant. In cows abortion may be either contagious or non-contagious. In case one is not sure, a blood test may be made to determine whether or not contagious abortion is in the herd. Information concerning this test may be secured from a competent veterinarian or by writing to the Veterinary Division, Iowa State College, Ames, Iowa.

Non-Contagious Abortion: Poor condition, weakness, and a too watery state of blood may be a predisposing cause. This may result from poor to scanty feed, excessive drain on the udder while bearing the calf or from feed deficient in certain elements. Sloping, slippery stalls, deep gutters, crowding at feed rack, gate or tank, excitement, offensive odors and irritant poisons are among the causes. Of the last ergot is one of the most active and common.

Contagious Abortion: Contagious abortion spreads very rapidly in a herd and unless extraordinary care is exercised it is very hard to get rid of. It is due to the presence of a germ which may be easily transmitted from one animal to another.
DIRECTIONS FOR THE TREATMENT OF AN ABORTING HERD

1. Burn the aborted fetus and membranes. This material carries the germs of abortion in abundance and burning or deep burial furnishes the only means of getting rid of it in a safe way.

2. Isolate discharging cows. The vaginal discharge from cows that have aborted is very virulent and may furnish the means of infecting other cows. Hence, discharging cows should be kept apart from the herd.

3. Disinfect the premises. This procedure should be executed with the most exacting care. Partial or inefficient disinfection is practically useless. To disinfect, where fumigation with the vapor of formaldehyde cannot be employed, the spray pump furnishes the best means. It should be borne in mind that disinfectants do not destroy germs that they do not come in contact with. So all large accumulations of bedding, forage and manure should be removed and every place that may harbor a germ should be reached with the disinfectant. Especial care should be used to drive it into every crack, knothole, behind every loose board, on top of every beam and into every partly concealed hole as well as upon every exposed surface. A five per cent solution of good (not crude) carbolic acid may be used for this purpose.

Following the disinfection by spraying and the cleaning of the stable, it may be whitewashed with limewater containing one pound of fresh chloride of lime to each three gallons of water. This may be applied with a brush, or, better still, with a spray pump.

The barn yard should be well cleaned out, the manure being spread in some field that the cattle do not have access to.

4. Irrigate the genital passages of the cows that have aborted. This may be done by means of a funnel and a rubber hose five-eighths of an inch in diameter and about four or five feet long. Insert the hose into the vagina and, if possible, into the uterus of the cow. Allow from three to four quarts of the warm solution to flow into the cow and out. Take a fresh hose and irrigate the next cow, allowing first hose to soak in antiseptic solution in the meantime.

This treatment should be repeated every second or third day as long as there is any discharge from the cow. Afterwards it may be used once or twice a week.

There are many solutions recommended for this purpose, a very safe and efficient one being a one per cent solution of permanganate of potash. This solution may be made by using one tablespoonful of the crystals to three gallons of lukewarm water.

5. Irrigate the sheath of the bull. The purpose of flushing out and disinfecting the sheath and the outside of the penis of the bull, is to prevent him from carrying the germ of abortion from one cow to another. The procedure should be enforced before and after each service. This is very important. The sheath may be flushed out by using a small rubber hose and funnel, or by the use of a small syringe. The end of the hose is to be inserted into the sheath beside the penis, the foreskin is held together with the fingers and the antiseptic is poured into the funnel.

6. The long hair at the end of the bull's sheath should be cut off. Moreover it is well to clip the hair from under the belly over a circle one foot in diameter surrounding this opening of the sheath. Then, by washing with a sponge, this area can be easily cleaned before each service.

7. Wash off the external genitals of each cow every day. For this purpose use any of the antiseptics recommended above. They can be applied with a clean sponge. The parts washed should comprise the root of the tail, the anus, the vulva and the surrounding skin for a distance of several inches, and the corresponding portions of the
tail. A separate bucket and sponge should be used for the cows that are pregnant and those that have recently aborted.

8. Do not breed a cow for about ten weeks after she has aborted. About ten weeks are required for the thorough treatment of a cow that has aborted and she should not be bred before the expiration of this period. If she shows any discharge or other indication of vaginal catarrh, she should not be bred for a longer period, or until the parts are in entirely normal condition. The last injection two days prior to service should be a two per cent solution of bicarbonate of soda.

9. A solution of carbolic acid may be administered subcutaneously to each pregnant cow. For this purpose use a three per cent solution of carbolic acid, and of this inject two drams every ten days. Should this cause swelling in some individuals, for these use a smaller amount. This treatment is highly recommended.

Salt Mixture: A mixture made up as follows is highly recommended by a number of the leading dairy farmers and may be used in connection with treatment number 9: ten pounds of sulphur, six pounds copperas, three pounds saltpetre, three pounds air slacked lime, one pound asafetida.

One pound of the above mixture is mixed with each ten pounds of salt and placed where the animals can eat what they desire.

The herd on the college dairy farm was handled in the manner outlined above upon the outbreak of contagious abortion a few years ago and the trouble soon ceased. The above treatment, except the use of the salt mixture, was recommended by members of the Veterinary Department of Iowa State College.

METHYLENE BLUE TREATMENT

In bulletin No. 174 from the Vermont Experiment Station Dr. F. A. Rich reports that by beginning early in pregnancy the use of methylene blue, infectious abortion may be stopped. He states that, "10 to 15 grains (\(\frac{1}{2}\) to \(\frac{1}{2}\) oz.) doses (in capsules) should be given night and morning for seven days, and that after a four weeks' interval the treatment should be repeated for another seven days and continued at four week intervals during the period of gestation." It may be administered by introducing the capsules into the throat by means of a balling gun. It is important that medicinal rather than commercial methylene blue be used.

MILK FEVER

Milk fever is of frequent occurrence and in cows giving large quantities of rich milk much precaution is necessary and very close attention is important the first forty-eight hours after calving.

The feeds used should make the digestive system cool and act as a laxative and the cow should not be placed in a draughty stall or given cold water to drink. The indications of milk fever are as follows: Restlessness, stamping of the feet, throwing the head, wild appearance of the eyes with dilated pupils, and bellowing. These symptoms soon give way to muscular weakness. The animal staggeres, loses power of standing and falls to the ground. Unless quickly attended the cow throws her head around on one shoulder and soon enters a comatose state. When the first symptoms appear the udder should be filled full of air with a milk fever outfit made for the purpose and all feed should be kept from the cow for a time. She should not be drenched while in this condition. Great care should be exercised to properly sterilize the teat tubes, and all that comes in contact with the udder owing to the danger of infection. Full directions accompany each milk fever outfit and one of these outfits should be on every dairy farm,
GARGET

Garget is of very common occurrence. It may be caused by heavy feeding or the cow catching cold in her udder from lying on the cold ground or floor. To remedy the trouble reduce the feed, giving only such feeds as bran, oats, and oil meal; give a dose of salts or raw linseed oil, and massage the affected portion of udder with a mixture of equal parts of sweet oil and Goulard's extract. In severe cases applications of antiphlogistine are very effective. Oftentimes it is necessary to open up obstructed teats to prevent loss of a quarter. This should be done by a competent person with a sterilized instrument made for that purpose.

INDIGESTION AND BLOAT

This occurs very frequently. For the former, feed should be reduced and a pound of salts or a quart of raw linseed oil should be given. In severe cases a veterinarian should be called or infection is likely to follow. For bloat the cow should be given a quart of raw linseed oil followed by a half pint of turpentine.

SORE TEATS

Sore teats may result from various causes. They are oftentimes caused by wet hand milking, which is a filthy method and should not be allowed by either the owners of cows or the consumers of dairy products. Applications of olive oil or carbonized vaseline will be found very efficient in treating sore teats and in removing small warts. In the case of warts it is sometimes necessary to clip off the ends and apply lunar caustic.

COW POX

In cow pox little pale red nodules appear on the teats. The milk flow decreases and soon the eruptions form into blisters which become filled with a straw colored pus. The milking should be done gently and the sore teats washed with a solution of half an ounce of hyposulphite of soda in a pint of water.

BITTER MILK

Bitter milk is sometimes produced by nearly all the cows in the herd. In these cases it is usually caused by the feeding of hay containing weeds, or pasturing the cows in a weedy pasture, although it may be caused by bacteria coming in contact with the milk after it is drawn or by bacteria present in the udder. Some cows will produce bitter milk after milking for several months. Such cows should be dried off and if the same trouble appears during the next lactation period, disposed of.

STRINGY MILK

This condition does not occur very frequently unless the cows drink water from stagnant pools, etc. By giving the cows access to pure water only and by giving each affected cow two drams of bisulphite of soda daily, Dr. Law states that the trouble may be permanently arrested.

BLOODY MILK

This condition may result from various causes such as bruises, eating irritant plants, diseased or inflamed udder or eating too rich food.

TUBERCULOSIS

It is needless to say that a tuberculosis free herd should be maintained. The herd should be tested annually by a competent veterinarian and all reacting animals should be disposed of. It is best to have a quarantine building in which to place suspicious animals for ninety days and then give them a retest as a slight rise in temperature may be due to some other cause.