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FS 769

Feeding the dairy herd

Cooperative Extension Service
South Dakota State University
U.S. Department of Agriculture

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Feeding the dairy herd for optimum performance and economical production is the greatest challenge facing dairymen. Dairy cattle must receive palatable feed containing adequate amounts of nutrients in the correct proportion. If a dairyman can accomplish this at low cost, his operation will be profitable.

To do this, a dairyman must grow the crop best suited to his land. He must harvest it for maximum nutrient content. Then he must select the proper least-cost grain mixture and the best feeding system.

Choosing the right combination of feedstuffs and feeding systems is important. Feed costs are the largest single expense in producing milk and account for 40 -60% of total production costs.

NUTRIENTS THAT SUPPLY ENERGY

The dairy cow uses energy to perform body functions such as breathing, circulating the blood, maintaining body temperature, and regulating the chemical reactions necessary for growth, maintenance, and milk production. Historically, the energy value of feeds has been measured in terms of total digestible nutrients (TDN). TDN equals the sum of digestible crude protein, digestible crude fiber, digestible nitrogen-free extract, and digestible ether extract which has been multiplied by 2.25.

The TDN system of measuring energy is expressed in terms of percentages and pounds even though energy cannot be measured directly in this manner. To illustrate this problem, less productive energy is available to an animal from a pound of TDN in poor quality forages than is available from a pound of TDN in grain.

A more precise method of expressing energy value is the net energy (NE) system. The energy value in this system is expressed in megacalories (Mcal). Net energy values will be used in this publication.

Protein. Protein is essential for maintenance, growth, and milk production. It is required for formation of enzymes and certain hormones that control chemical reactions within the body.

Protein requirements are expressed as crude protein (CP). The amount of crude protein in a feed is determined by multiplying its nitrogen content by 6.25 since protein is 16% nitrogen. Nonprotein nitrogen compounds such as urea or ammonium salts are thus included in the crude protein value. Most feedstuffs do contain some naturally occurring nonprotein nitrogen. Since both protein and nonprotein nitrogen can be utilized by dairy cattle, the use of crude protein values is both valid and realistic.

The dairy cow has a very limited ability to store protein in her body. Excess protein is broken down and used as a source of energy. Therefore, the animal must be supplied with an adequate amount of protein each day for maximum production. Cows that receive inadequate supplies of protein and more than adequate supplies of other sources of energy tend to be fat, low producing cows.

Minerals. The minerals that are required to perform essential functions in the dairy cow's body are: *calcium, phosphorus, sodium, chloride, magnesium, potassium, sulfur,* iodine, cobalt, zinc, manganese, copper, iron, selenium, and molybdenum. The first seven minerals are termed macro minerals since they are required in relatively large amounts compared to the others which are needed in trace amounts. Although any of these may be deficient, the macro minerals constitute 70-80% of all inorganic material in the body and need special attention.

Calcium and phosphorus are closely related and must be discussed together. Good calcium and phosphorus nutrition depends on three interrelated factors: (1) having a sufficient supply of each, (2) having a suitable ratio between them, and (3) having an adequate amount of vitamin D. Of the two minerals, phosphorus is usually more of a problem due to low content in most forages.

The total ration (forage and grain) should contain a minimum of 0.60-0.70% and preferably less than 1.0% calcium, and 0.38% or more phosphorus. Deficiency symptoms of calcium and phosphorus include poor feed utilization, reproductive problems, lowered milk production, and increased incidence of milk fever. Deficiencies of either mineral are difficult to detect, but a calculation of need compared to intake will show potential problems.

Recent research indicates that maintaining a specific calcium to phosphorus ratio is not as important as previously thought. A ratio of 3 parts calcium to one part phosphorus has not been proven excessive. If the requirements for both calcium and phosphorus are met, a ratio wider than 2:1 can be tolerated. Adequate amounts of vitamin D should always be provided.

For information on how to set up a balanced feed program see companion Fact Sheet 770 — Formulating rations for the dairy herd.

The amount of supplemental calcium and phosphorus needed in a grain mixture depends primarily on the kind of forage being fed. Pastures, grass hays, and particularly legumes are good sources of calcium, but are relatively low in phosphorus. Therefore, mineral supplements fed with these forages should be low in calcium and high in phosphorus. Corn and sorghum silages are relatively low in both calcium and phosphorus. A mineral supplement which contains high levels of both is needed for these forages.

Generally, calcium and phosphorus requirements are met by adding 1.5% (30 lb per ton) of the proper mineral supplement in the grain mix. It is important to change the kind of mineral supplement and perhaps calcium to phosphorus ratio when changes in forage feeding occur.

Table 1. Suggested calcium-phosphorus supplementation with different forages.

Forage	Ratio of calcium to phosphorus needed	Source
Mostly legume	0 to 1	Monosodium phosphate
Legume-corn silage	1-1.5 to 1	Dicalcium phosphate
Mostly corn silage	2-2.5 to 1	Steamed bone meal

General recommendations on mineral supplements to feed with different forages are presented in Table 1. These recommendations apply when a protein supplement containing no mineral is fed. Many commercial protein supplements contain calcium and phosphorus. Thus, the amount of supplemental minerals may need to be adjusted, depending on the minerals present in the protein supplement.

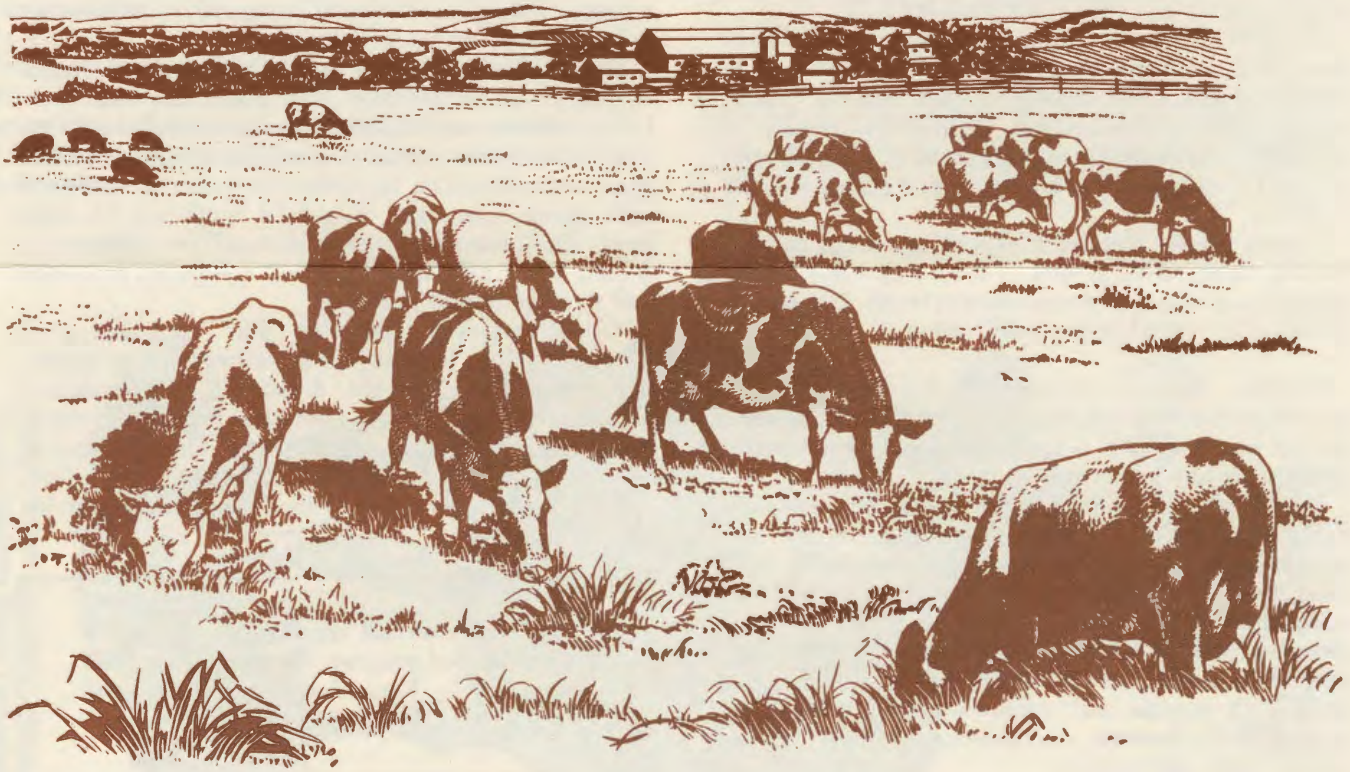
Cows do not possess nutritional wisdom; that is, they do not have the ability to select and consume minerals based on nutritional needs. Many factors, including palatability, determine which minerals are consumed. For this reason, it is recommended to add the proper minerals in the grain mixture. This practice insures that needed minerals are consumed daily and excessive consumption is prevented.

Magnesium, potassium, and sulfur usually occur naturally in large enough quantities in South Dakota feedstuffs so supplementation is not necessary.

Adding trace mineral salt to the grain mix plus providing free access will generally insure adequate intake of all trace minerals as well as sodium and chloride. Trace mineral salt should be added to the grain mix at the rate of 0.5-1% (10-20 lb per ton) depending on how much salt is contained in the protein, mineral, and vitamin supplements.

Vitamins. Vitamins B, C, and K are produced in adequate amounts by the cow. Vitamins A, D, and possibly E must be supplemented in the daily diet.

The vitamin most likely to be deficient is A (carotene). Its most important function is to help maintain healthy mucous membranes of the body (in the mouth, eyes, and respiratory, intestinal, and



reproductive tracts). It is also involved in preventing retained placentas and weak calves.

Good quality alfalfa hay is a rich source of vitamin A. However, hay that has been stored for long periods of time or has been weather damaged may be low in this vitamin. In all cases it is good insurance to feed a supplementary source of vitamin A. The recommended method of supplying adequate vitamin A is to add 3,000-4,000 units to each pound of grain mixture (6-8 million units per ton).

Most cows require 45,000-60,000 units of vitamin A per day. If poor quality old hay or high levels of corn silage are fed, a higher level (6,000-8,000 units per pound of grain) may be needed. If dry cows are not fed grain, the dairyman should administer injectable vitamin A monthly.

Vitamin D is required for proper absorption and utilization of calcium and phosphorus. Generally, adequate amounts of vitamin D are supplied by sun-cured hay and the action of sunlight on the animal's skin. However, confinement housing, and greater use of stored feeds and corn silage may make additional supplementation necessary. To insure adequate intake, it is generally recommended to add 140-200 units of vitamin D to each pound of grain (280,000-400,000 units per ton).

Adequate amounts of vitamin E are usually supplied by grains and forages, therefore supplementation is seldom necessary. However, rations composed entirely of stored feed may need vitamin E supplementation to prevent oxidized flavors in milk.

Water. Dairy cattle need more water than any other nutrient. Water is used to transport nutrients and hormones throughout the body, to carry waste products to the point of excretion, to cool the body when temperatures are high, and to produce milk.

The daily water requirement of a dairy cow will vary from 12-46 gallons depending on body weight, production, moisture content of feeds, and temperature. An adequate supply of clean fresh water should be available at all times.

FEEDING THE LACTATING COW

The traditional method of feeding dairy cows has been to offer forages free choice and feed grain on an individual basis according to production. With the change from stanchions to free stalls it is no longer possible to feed cows individually.

Many times the parlor facilities and milking speed limit grain intake. The average time cows are in the parlor usually ranges from 16-20 minutes per day. With an average grain consumption of .6-1.0 lb per minute, the average cow can only consume 10-20 lb of grain per day. Therefore, even though the ration has been accurately balanced, the eating time in the parlor may be limiting production.

A possible solution to this problem is to group feed the grain ration outside the parlor. Dividing the herd into three production groups (high, medium, and low) would permit a dairyman to feed more closely to each cow's nutrient needs. This method does require additional labor and facilities, however, and may not always be economically feasible.

Another alternative would be to feed a minimum amount of grain (10-15 lb) to all cows in the parlor and provide additional grain to high producers in outside feeding facilities. A final method may be to use a grain feeder which permits feeding additional grain to selected cows without physically separating them.

Another problem with the usual procedure of feeding forages free choice and grain individually is the inaccuracy in predicting forage intake of individual cows. There are large differences in amounts of forages cows eat.

Research at Cornell University showed when cows were offered hay and corn silage free choice, taste preferences differed greatly. The range in individual cow intake of corn silage was between 24-78% of total forage consumed. The wide difference in nutrient levels in alfalfa and corn silage, particularly in their protein and mineral contents, makes it impossible to formulate a grain mix that properly supplements these two forages for each cow. This variation can only be eliminated by mixing the forages and grain mixture and offering the blend as a total mixed ration (TMR).

Total mixed rations, also called complete mixed rations or all-in-one rations, are formulated to specific nutrient requirements. Thus, Dairy Herd Improvement (DHI) production testing and forage analysis are necessary. Accurate measurements of the amounts of feed ingredients used in the mixed ration are also essential for maximizing profits.

Feeding and managing a herd using total mixed rations can save labor and reduce feed waste. It is a useful solution to many of the feeding and management problems where cows are handled as a group and individual cow attention is minimized.

FEEDING THE DRY COW

The nutrient needs of dry cows differ considerably from those of the lactating cow. The cow shifts from low nutrient requirements for maintenance and fetal growth to high requirements for large quantities of milk in a short time period. Loss of profit and animals occurs when dairymen cannot control metabolic and nutritional disorders traced to the dry period. Calving difficulties, fat cow syndrome, milk fever, off feed, and reduced resistance to infection are examples of problems which can arise from improper dry cow nutrition.

Research conducted at the USDA in Beltsville, Maryland, indicates that cows replenish their body reserves at 70-75% efficiency in late lactation, compared to 58% when dry. Slightly overfeeding grain during the end of lactation and then feeding to maintain condition during the dry period appears to be both nutritionally and economically sound.

Grain feeding. The amount of grain fed should be determined by the quality and amount of forage and body condition. In most herds no grain is necessary. Long forage (greater than ½ inch length) is recommended. Excessive energy intake can be controlled by limiting corn silage intake or by diluting forage with stover, straw or similar materials.

Feeding adequate phosphorus (.04-.09 lb) to meet requirements and limiting calcium intake to less than .22 lb per day is more practical than adjusting the calcium to phosphorus ratio. In herds with high levels of milk fever, feeding a calcium deficient diet during the last 2 weeks of the dry period (large breeds .04 lb; small breeds .03 lb) can reduce milk fever significantly. Trace mineral salt and a calcium-phosphorus mineral supplement should be fed free choice.

Fat cow syndrome. Excess energy from grain and/or high amounts of corn silage may result in a metabolic disease called fat cow syndrome. Such cows are more likely to have calving difficulties, displaced abomasums, ketosis, and other health problems. Cows fed hay and/or haylage are less likely to have problems than those receiving free choice corn silage. If corn silage must be offered intake should be limited and some other roughage also fed. In all cases dry cows should be separated from the milking cows to avoid excess energy intake.

Lead feeding. Lead feeding (increasing grain intake prior to calving) recommendations have changed drastically in the last 5 years. Little or no benefit has been noted by increasing grain intake to 20-30 lb prior to freshening. During the last 2 weeks before anticipated calving, grain should be gradually introduced to prepare the rumen microflora for the higher grain diet fed during early lactation. A maximum of 1% of body weight (14 lb for a 1,400 lb cow) should be adequate.

RATING YOUR PROGRAM

Is your ration and management program producing maximum profit? Can you answer yes to these questions?

	Yes	No	?
1. Have all your feeds been analyzed *at least once* during the past year?	☐	☐	☐
2. Do you have your ration balanced every time forage quality or quantity changes?	☐	☐	☐
3. Does your total ration contain 13-16% crude protein?	☐	☐	☐
4. Does your total ration contain .65-.78 Mcal of energy per pound?	☐	☐	☐
5. Does your total ration contain 15-17% crude fiber?	☐	☐	☐
6. Do you add a 1.5% calcium-phosphorus supplement to your grain mix?	☐	☐	☐
7. Do you supplement 0.5-1% trace mineral salt in the grain mix?	☐	☐	☐
8. Is there adequate vitamin A and D in your grain mix?	☐	☐	☐
9. Are your grains coarsely ground?	☐	☐	☐
10. Do you feed grain according to production?	☐	☐	☐

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