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Managing Intake of Lactating Dairy Cows

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Lactating dairy cows must consume large quantities of dry matter (**DM**) to provide the nutrients needed to maintain high levels of milk production. The consequences of low dry matter intake **(DMI)** are lower peak milk yields, lower total milk production, excessive loss of body weight and poor reproductive performance. Research has shown a two pound increase in milk production for each pound increase in DMI. As milk production continues to increase, management of DMI becomes more critical.

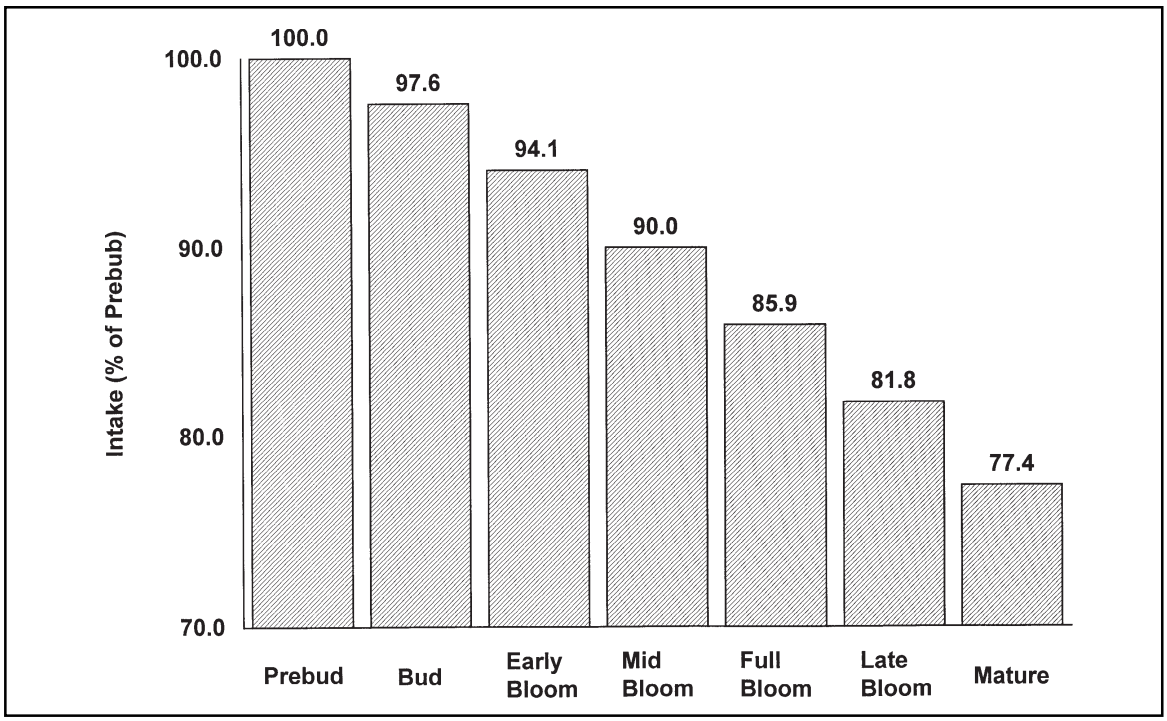
Factors Which Influence Intake

A number of factors affect DMI, including forage quality, nutrient balance of rations, feeding method, ration palatability, moisture content, environmental stress, physical facilities and general management practices.

Forage Quality

The effect of forage quality on DMI is illustrated in Figure 1. High-quality forages support higher DMI than do lower quality forages. This is due in part to their lower fiber content and greater rate and extent of digestion. In contrast, low-quality forages are digested slowly and remain in the rumen for longer periods, limiting rumen capacity. Increasing the amount of concentrate may partially compensate for low-quality forage.

Figure 1. Effect of alfalfa-brome greenchop stage of maturity on dry matter intake.



Adapted from Hibbs and Conrad. 1974. *Ohio Rpt.* 59(2):33.

However, as the amount of concentrate fed increases to maintain milk production, the chance of rumen acidosis and other related metabolic diseases increases.

Nutrient Balance

Rations should be formulated to provide the proper balance of nutrients. Normally, cows eat to meet their energy requirements (Figure 2). Low-energy diets containing bulky, low-quality feeds are digested more slowly and remain in the rumen for longer periods than high-quality feeds. As the cow eats, the rumen stretches or distends due to its limited size and the slow disappearance of the feed previously consumed. In this situation, intake is limited by the capacity of the rumen to hold more and the low digestibility of the feed. As quality increases, dietary energy concentrations increase, as does digestibility. At a given level of milk production, intake would be expected to decline as the energy content of the ration increases.

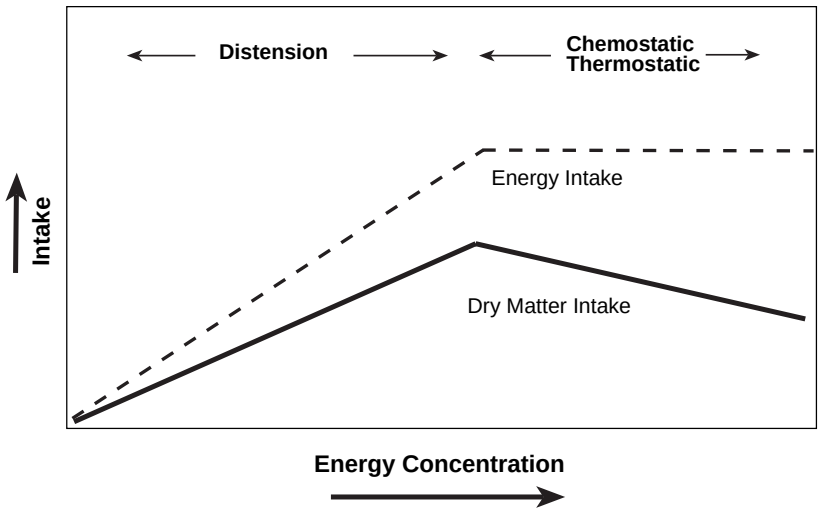
If the energy concentration of the diet is too high, DMI is reduced due to chemicals produced during fermentation. Also, excessive amounts of nutrients may reduce intake due to physiological regulations. Intake is reduced due to chemostatic or thermostatic controls that attempt to maintain a balance in the body. If intake is reduced from that used to formulate the diet, cows will not consume adequate quantities of other nutrients. This could limit milk production.

Typical rations for lactating cows should be formulated to contain 19 to 21 percent ADF, 28 to 32 percent NDF and 35 to 42 percent nonstructural carbohydrates (NSC). Crude protein should not exceed 19 percent of dry matter or 35 percent soluble protein. Excessive amounts of undegradable protein should not be fed, as this may limit microbial growth and ration digestibility. High dietary mineral concentrations, especially salt and sulfur, may limit intake as well.

Feeding Method

Total mixed rations (**TMR**) generally support higher levels of DMI than that observed by feeding ingredients separately. Feeding concentrate in the parlor (slug feeding) generally results in greater drops in ruminal pH that depress intake. Also, when cows are allowed free choice silage and hay, they do not choose the amounts needed to

Figure 2. Effect of dietary energy density on dry matter intake.



Adapted from Montgomery and Baumgardt. 1965. *J. Dairy Sci.* 48:569-574.

supply a balance of nutrients to maintain maximum DMI.

Ration Palatability

Ration palatability can stimulate or inhibit intake. Certain feeds, such as animal by-products, urea and dry, dusty feeds, are not very palatable and reduce intake, if too much is included in the diet. Other feeds, such as molasses, distillers grains and corn-gluten feed, are very palatable and may be used to make rations more acceptable. In certain cases, it may be necessary to include flavor additives in the diet to make unpalatable feeds more acceptable.

Moisture Content

Rations containing more than 50 percent moisture, especially if large amounts of fermented feeds are fed, have been associated with reduced DMI. In contrast, rations which are very dry may benefit from the addition of water to reduce dustiness and make the ration softer. This increases DMI in most situations. Plenty of fresh, clean water should be available at all times. Cows typically drink approximately 1⁄2 gallon of water for each pound of milk produced. Limiting water intake reduces DMI as well as milk production.

Environmental Stress

Table 1 illustrates the effect of increasing temperature on maintenance requirements, milk production and DMI. As temperatures increase, the maintenance requirement of the cow also increases, due to additional energy used to get rid of body heat. To provide the additional energy required for maintenance while maintaining milk yield, cows would need to consume more dry matter. However, as temperature and humidity increase, cows eat less and drink more water to reduce the amount of heat produced and spend more time seeking cooler areas to rest.

The extent that DMI is reduced depends on how high the temperature and humidity go. The nutrient density of the ration must be increased if milk yield is to be maintained when heat stress reduces DMI. In most situations, fiber concentrations are reduced and more concentrate is fed. High-

Table 1. Effect of increasing temperature on dry matter intake, milk production and water intake.

	Required for 59.5 lbs. milk		Expected intakes and yield		
Temperature	Maintenance Requirement	DMI Required	DMI	Milk	Water
°F	(% of required at 68 °F)	(lbs.)	(lbs.)	(lbs.)	(gal.)
68	100	40.1	40.1	59.5	18.0
77	104	40.6	39.0	55.1	19.5
86	111	41.7	37.3	50.7	20.9
95	120	42.8	36.8	39.7	31.7
104	132	44.5	22.5	26.5	28.0

Adapted from the National Research Council. 1981. *Effect of Environment on Nutrient Requirements of Domestic Animals*. National Academy Press, Washington, DC.

quality forages generate less heat when digested, so forage quality should be adjusted first when possible.

Increasing dietary concentrations of sodium (0.4 to 0.6 percent of DM), potassium (1.5 to 1.6 percent of DM) and magnesium (0.3 to 0.35 percent of DM) during heat stress has been shown to reduce the negative effects of heat stress and maintain higher levels of milk production. Evaporative cooling reduces heat stress, so DMI and milk production are maintained. Kentucky researchers observed a 9.2 percent increase in intake and 15.8 percent increase in milk yield with supplemental cooling (Table 2).

Feeding Facilities

Feed bunks should provide at least 24 to 30 inches of linear space per cow to avoid crowding. Ideally, first-calf heifers should be fed and housed separately from the older cows; however, if all cows are housed together, additional space may be needed to reduce competition. Feed bunk space is limited in many dairies, especially those built 15 to 20 years ago that have not added additional space.

The design of the feed bunk may also affect DMI. Cows eat more when bunks provide a grazing posture as compared to feed bunks above ground. Replacing the rough floor of older feed bunks with smooth, plastic liners or tile supports higher DMI and reduces feed spoilage.

Management Practices To Maximize Intake

Feeding management is the most important factor affecting intake. There are several management practices which can help stimulate milk production.

1. Have fresh feed available to cows immediately after milking. Cows are typically hungry and eat greater amounts at this time than any other time.
2. Feed several times each day, especially during hot weather. Cows consume more when fresh feed is available than when feed has had some time to spoil.
3. Clean feed troughs daily. Fresh feed will not become spoiled from old feed and cows will eat more.
4. Turn feed conveyors on, drive the tractor through the feed alley or push feed up to the fence-line feeder. This will stimulate the cows to get up and eat.
5. Monitor moisture content of rations and adjust as needed. Avoid too wet or too dry rations when possible.
6. Provide plenty of fresh, clean water in areas easily accessible to cows.

Table 2. Effect of supplemental cooling on dry matter intake and milk production.

	Control	Cooled	Difference	(% change)
DMI, lbs./d.	77.0	84.1	+7.1	(+9.2%)
Milk, lbs./d.	50.1	58.0	+7.9	(+15.8%)
Rectal Temperature ^{o}F (11 a.m.)	102.6	101.8	-0.8	
Respiration Rate (breaths per minute)	91	75	-16	(-17.6%)

Turner et. al. 1992. *Micro-sprinkler and fan cooling for dairy cows: Practical design considerations.* University of Kentucky Cooperative Extension Service, AEN-75.

7. Provide 16 to 18 hours of lighting in the feeding area. Research has proven that this practice stimulates higher intake levels.

8. Trim feet as needed and maintain facilities to minimize foot and leg injuries. Cows with sore feet or injured legs do not go to the feed trough as often or stay for extended times.

9. Include buffers such as sodium bicarbonate and magnesium oxide in rations containing large amounts of corn silage or concentrate.

10. Feeding hay or haylage along with corn silage encourages higher levels of dry matter intake.

11. When feeding silage or chopped hay, make sure that approximately 25 percent of the material is at least 1 inch long. A minimum amount of long-stem material is needed to stimulate cud chewing by the cow. Observe cows when they are not at the feed trough to determine their chewing times. At least 50 percent of the cows should be chewing their cuds.

Measuring Dry Matter Intake

Dairy producers should know how much feed their cows consume on a daily basis. Accurate estimates of DMI are necessary to formulate rations that provide the nutrients needed to support high levels of production. For example, a 1300-pound cow producing 100 pounds of milk each day should consume 54.1 pounds of DM containing 9.66 pounds (17.9 percent) crude protein and 42.8 Mcal. (.79 Mcal./lb.) of net energy for lactation. If the cow only consumed 50 pounds of DM, the protein and energy consumed would only support 90 pounds of milk. Producers who monitor DMI daily can work with their nutritionist to adjust rations and maintain milk production.

Intake is expressed on a DM basis to adjust for differences in moisture content of feeds normally used in dairy rations. The formula for calculating DMI is as follows:

$$\text{DMI, lb/d} = \frac{(\text{lb. feed fed} \times \%\ \text{DM}) - (\text{lb. feed refused} \times \%\ \text{DM})}{\text{number of cows fed}}$$

The amount of feed offered each day should be recorded at each feeding. The amount of feed refused should be measured once daily. If dry cows and heifers are allowed to clean up the bunk, measurements should be taken before allowing these animals to eat. Producers feeding a TMR will be able to record the scale weight from their mixer. The amount of feed refused can be measured by loading the mixer with the refusal before disposal. Producers who do not have a mixer equipped with scales will have to estimate the amounts fed and refused. For example, weigh the amount of feed in several 10-foot sections of the feed bunk before feeding and then again after the cows have had an opportunity to eat. If baled hay is fed, weigh several representative bales prior to feeding. The amount of hay refused and wasted should be weighed as well. Although this method is not exact, it will provide an estimate of DMI. The DM content of the feed can be determined using an oven, microwave or moisture tester.

Dry Matter Determination

As pointed out previously, several methods are used for measuring the DM content of a feed or ration. The choice of method depends on the type of equipment available. Procedures for measuring DM content of feeds using a microwave or Koster tester are outlined below. Each procedure requires a scale that will measure in grams.

Microwave Oven

A simple and dependable way to measure the moisture content of a forage or ration is by using a conventional microwave oven. Most producers will prefer to use the microwave in some location other than their home, since drying most forages (feeds) will produce some undesirable odors. It is also good to place a small container of water in the corner of the microwave to prevent charring of the sample. The procedure is as follows:

1. Chop the forage sample into 1- to 2-inch pieces and weigh out about 100 grams.

2. Spread the forage evenly on a paper plate.

3. Heat the sample for two minutes and reweigh.

4. Heat the sample for 30 seconds and reweigh. Continue to heat for 30 seconds and reweigh until the last two weights are the same. If charring occurs, use the last weight.

5. Calculate the moisture content using the following formula:

% Moisture = ((W1 - W2)/W1) x 100

Where: W1 = wet forage weight
W2 = last weight after heating
%DM = 100 - % moisture

Note: Remember to subtract the weight of the paper plate from forage weights before making calculations.

Koster Tester

The Koster tester is a dryer specifically built for drying forages and wet feed. This unit has a heating element and fan mounted in the base and comes with a scale. The procedure for drying is similar to that described for the microwave, except more time is required for drying. For specific drying times, producers should refer to the Koster Tester manual.

Summary

Dry matter intake is one of the most important factors affecting milk production. Producers must routinely monitor intake of their cows, if intake is to be managed. Management practices that have been demonstrated to increase intake should be incorporated into the dairy's feeding program. When intake declines, an understanding of the factors that influence intake will help the producer make better decisions. Maintaining high intake will help support higher milk yields and profitability.

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