



Managing the Total Mixed Ration to Prevent Problems in Dairy Cows

Donna M. Amaral-Phillips, José R. Bicudo, and Larry W. Turner

Feeding a total mixed ration (TMR) ideally results in rumen bacteria encountering the same mixture of ingredients and nutrients in the cow's rumen throughout the day, a consistency that helps improve fermentation. It may also result in better intake by the cow herself and improve her milk production, health, and reproductive performance. But, as with any fine-tuned machine, minor inconsistencies and improperly followed guidelines in the use of TMR can decrease milk production and increase health problems. Premature culling or even death of cows may result, depending on the severity of the response.

When feeding a TMR, it is important to monitor:

- Dry matter or moisture content of forages and other wet byproducts being fed.
- Amount of TMR consumed.
- Amount of each feed in a TMR batch as the intake of the cow group changes.
- Particle size of the TMR being fed.
- Consistency of the particle size of the TMR being mixed, delivered, and left in the feed bunk.

Changes in Dry Matter Content of Forages and Wet Byproducts

The dry matter content of silages and wet byproducts should be monitored at least twice monthly, preferably weekly. The dry matter content of feedstuffs stored in a bunker silo should also be determined, especially after half an inch of rain has fallen, because a change in the dry matter content of these feeds can greatly affect the nutrient content of the mix being fed and may result in lower milk production or increased health problems.

When nutritionists balance rations for dairy cattle, they assume that the cow will receive a certain amount of dry matter from a particular feed. As the feed becomes wetter, more of the feed needs to be included in the TMR in order to provide the same amount of dry matter to the cows and keep nutrients in their correct proportions. The reverse is also true: as feeds become drier, less of the forage or feed needs to be included. Nutritionists often

include a table along with their balanced rations to help the farmer adjust the amount of forage or wet byproduct to be added to the TMR as the dry matter content of feeds changes.

Amount of TMR Consumed

In order to manage the feed bunk effectively, a daily log should be kept that shows, for each feeding, how much feed was fed and how much feed was left in the feed bunk from the previous feeding. This log becomes extremely important when more than one person is feeding the cows, as when the normal feeder is absent unexpectedly. With a daily log, each feeder can quickly and accurately determine what other people have fed and can adjust the amount of feed accordingly. The nutritionist can also use this information to make sure that the ration is as economical as possible, cows are actually consuming the expected amount of dry matter or feed, and potential problems are noted before they affect performance and the dairy operation's profitability. Table 1 shows a sample worksheet that can be used to record feed intakes and refusals.

Managing the Amount of Each Feed Included in a Batch of TMR

Milking cows need quality feed available 20 hours of a day, so the TMR should be located within 100 to 300 feet of their freestalls or resting place. Feed should be pushed up in front of the cows to stimulate them to come up and eat additional feed. Cows should be fed so that 5 percent of the offered feed is left when they are fed the next time. From a practical standpoint, this means that approximately an inch of feed should be left in the feed bunk at the next feeding, and leftover feed should be removed routinely.

When increasing or decreasing the amount of TMR fed, the amounts of each forage, grain, and each of the other ingredients need to be increased in proportion to the originally formulated TMR. Do not simply feed cows more forage if they clean up feed from the previous feedings.

One of the most common misperceptions when increasing or decreasing the amount of TMR offered is to change the amount of forage offered while holding constant the

amount of grains and other concentrates fed per cow. This change results in a misbalanced ration that can decrease milk production or result in health problems in the cows. One way many farmers adjust the amount of each ingredient in the TMR is to feed their cows as if the group has been expanded by two to five cows or been reduced by two to five cows.

Particle Size of TMR Fed

Cows need to consume adequate amounts of long forages or fiber in their TMR so that they can regurgitate the feed, chew their cud, and secrete saliva, which helps buffer the rumen environment so that the bacteria can efficiently digest forages. Studies show that cows chewing their cud may secrete 5 to 6 pounds of saliva daily. When nutritionists

balance rations for dairy cows, they try to provide adequate amounts of effective fiber, or “chew factor,” so that enough longer particles are present in the rumen to stimulate cud chewing.

When a TMR mix is overmixed, the particle size of the forages decreases. This, in turn, decreases cud chewing time and saliva production, which may lead to an increased incidence of problems such as ruminal acidosis, laminitis (foot problems), displaced abomasum (twisted stomach), decreased feed intake, decreased butterfat, decreased body condition (which may decrease ability to breed), and in severe cases, death. Generally, most models of TMR mixers need only three to six minutes of mixing time.

Table 1. Worksheet to record amount of feed cows are fed.

Week Dates _____ Group ID _____

Record the weight of the TMR wagon when you begin feeding in the *Start Amount* box and the weight of the wagon when you finish feeding in the *End Amount* box. Record the *Total Amount Fed* (obtained by subtracting the *End Amount* from the *Start Amount*).

Amount of feed left in feed bunk—the actual weight of the feed left over—can be recorded or the following codes can be used to denote amount of feed left in the feed bunk:

- E = The bunk is empty.
- 1 = Corncob pieces (mainly corncob pieces left in the bunk).
- 2 = Enough (about 1 inch of feed is covering the majority of the bottom of the bunk).
- F = Full (large mounds of feed left in the bunk).

		Start Amount	End Amount	Total Amt Fed	Amt of Feed Left in Feed Bunk
Mon	a.m.				
	p.m.				
Tues	a.m.				
	p.m.				
Wed	a.m.				
	p.m.				
Thur	a.m.				
	p.m.				
Fri	a.m.				
	p.m.				
Sat	a.m.				
	p.m.				
Sun	a.m.				
	p.m.				

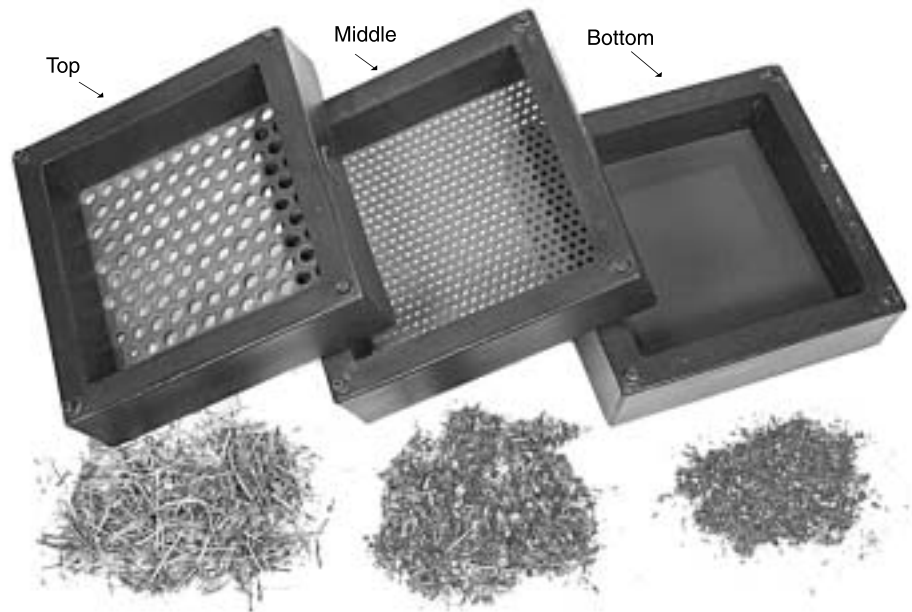


Figure 1. The Penn State Particle Separator Box consists of three boxes that are stacked on top of one another. The top box retains particles of feed or forage that are greater than 3/4 inch. The middle box retains particles between 5/16 and 3/4 inch. The bottom box has a solid bottom and retains particles under 5/16 inch.

The particle size of the TMR should be evaluated using a Penn State particle separator box (see Figure 1). This separator box consists of three separate boxes that allow the TMR mixture to be separated into three particle sizes. These results should then be compared to what is

Generally, TMRs should be mixed from 3 to 6 minutes per load. Do not overmix or run the PTO for long periods of time when loading wet feeds.

expected for a TMR. Expected percentages retained on each of the three boxes are shown in Table 2. Most nutritional consultants have particle separator boxes available, or farmers can purchase one from suppliers such as Nasco. At a minimum, particle size should be determined when forage type and crop year change, a new mixer is purchased, or augers or knives are repaired or sharpened.

Consistency of TMR Fed and Left in Feed Bunk

To make sure that the TMR mixer is functioning adequately and consistently, samples of newly delivered feed should be collected at several different locations in the feed bunk. For example, samples should be collected at the beginning, middle, and end of the feed delivery sequence. These results then need to be compared to one another to detect any potential problems.

Feed not consumed should also be evaluated. This evaluation helps diagnose any problems of excessive sorting behavior in cows. This diagnosis becomes extremely important when greater than 7 pounds of hay per cow is fed daily through a TMR and large amounts of cobs are left in the feed bunk. Even when a balanced ration is mixed properly, sorting of larger forage particles can lead to problems due to imbalances and lack of effective fiber for cud chewing that can result.

Table 2. Recommended distribution of total feed particles by percentage in each of the three boxes of the Penn State Particle Separator Box.

Forage or Feed	Box Location		
	Top	Middle	Bottom
TMR	5-15%	40-50%	< 50%
Corn Silage (3/8 in. TLC and unprocessed)	2-10%	> 50%	< 50%
Corn Silage (3/4 in. TLC and processed)	10-20%	50-60%	< 30%
Haylage	10-20%	30-50%	< 45%

Source: Adapted from Penn State and University of Illinois recommendations.
 Note: TLC is theoretical length of chop. *Processed corn silage* refers to corn silage chopped with a kernel processor on the chopper.

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