

Total mixed ration

for dairy cows

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In traditional feeding system of dairy cows in our country, generally green succulent fodders are fed separately and concentrate ingredients or concentrate mixtures are fed with dry roughages like straws and hay or concentrates are fed separately at milking. This system rarely consider the actual requirements of DMI, protein, energy, fibre etc and fails to provide uniform nutrients to the ruminants, this can lead to imbalance ration supply leading to deficiency of certain nutrients or overfeeding of nutrients hence preventing full exploitation of production potentials of the cows leading to overspending on feeds and lowering productivity and profitability.

Key words: Cows, Dairy, Total mixed ration

PROVIDING balanced nutrition every time to the different groups of dairy cows, having different production levels is one of the many challenges that a commercial dairy farmer faces. Production performance of dairy cows varies as per type of feed provided. Providing balance nutrition to dairy animals is an important task to optimise productivity both in milk production and reproduction and to minimize the cost of feed. Dairy cow rations must contain good quality forages, a balance of grains and protein sources plus minerals and vitamins and other feed supplements. To avoid under or over nutrients feeding animal must be fed right amount and right combinations of various feed stuffs. When rations are formulated or balanced correctly to meet the nutrient requirements of a cows, result in optimum feed digestion and utilization. There is a need to change the traditional feeding systems with a total mixed ration (TMR) feeding system, which contains required feeds and required nutrients. This is an effective and profitable way to feed dairy cows. The TMR feeding system was adopted in many developed countries. Every mouthful of TMR

that a cow eats provides a balanced ration. The benefit of a TMR includes less feed selection by the cow, synchronization of carbohydrate and protein availability in the rumen, and lower rumen acidity. TMR may save labour required for feeding cows and it facilitates feeding various types of feeds. The main disadvantage of a TMR is the inability to feed cows as individual nutrient requirement. However, larger dairy farms with more groups of cows are able to minimize this problem. TMR feeding system facilitates a nutritionally balanced ration at all times and allowing cows to consume as close to energy requirements as possible as well maintaining physical form of roughage characteristics required for proper rumen function thus helps in achieving optimum production economically.

WHAT IS TMR?

A total mixed ration (TMR) is a method of feeding cows that complete mixture of all forages, grains, protein feeds, minerals, vitamins and feed additives formulated to a specified nutrient concentration into a single feed mix. This is an excellent concept to

improve the dry matter intake and maintain healthy rumen environment. The knowledge and use of TMR system is necessary before its implementation.

Why feed a TMR?

- TMR feeding to cows provide the nutrient balanced ration in every bite or mouthful when consumes. This overcomes the limitation of depressed dry matter intake (DMI) during transitional period and helps in prevention metabolic disorders.
- Selective feeding of feeds by animals is minimized and cows eat a predetermined amount of forages and concentrates required for optimum production and health.
- Increase in feed utilization (4%) can be expected when using a TMR compared to a conventional ration of forage and grain fed separately, twice daily.
- Farmers can also utilize a greater variety of food industrial by-product as part of TMR and save the cost of feeding.
- Providing a uniform supply of protein and carbohydrates to the rumen bacteria throughout the day enhances rumen fermentation and the production of rumen bacteria.



Fig. 1. Large mixer used for making TMR in commercial dairy farms

- Total mixed ration (TMR) can reduce the labour costs at medium and large dairy farms thereby increasing profitability of the dairy farm.
- TMR provides more control and accuracy of the feed amounts fed than when feeds are fed as separate ingredients.
- Feeding TMR correctly balanced to nutrient specifications can increase milk production up to 4 to 5%.
- Milk composition also improves because of the better rumen fermentation and balance of nutrients being consumed by cows through balanced TMR.
- One of the major advantages of blending all the feeds together in a TMR is that it can mask the flavour of less palatable feeds and can be successfully fed and better utilized by the cow when fed in a TMR rather than when fed as individual separate feeds.
- With the use of TMR mixers, the daily feed intake of cows is easier to measure. By knowing daily feed or dry matter intakes, the correct amounts of feed and nutrients can be fed minimizing wastage and reducing the cost of feeding.
- The TMR system is well adapted to mechanization with a mixer wagon or a stationary mixer with conveyors or mobile feeders.
- Unfortunately, on farms without the facilities for many groups, cows are often too fat or too thin. This is evidence that some cows got too much grain and others didn't get enough. This is especially true on farms with only one milking ration (one-group TMR).
- Mixing or blending devices needed for the ration require small to moderate expenditures for equipment and maintenance.
- Dry forages such as hay or straw are not mixed very well in some TMR mixers. Additional equipment is needed to chop the hay or straw before being added to the mixer.
- Care must be taken in formulating and mixing the ration. If the diet is not balanced correctly or mixed properly, the cow ultimately will suffer reduced performance. While this is true of any feeding system, it is under the control of the person feeding the herd. Remember with a true TMR, cows have no other option for a diet and depend solely on the ration for a balanced diet to achieve production and health.
- Dairy farms need to group cows to effectively utilize TMR feeding. Cows are fed as a group and cows in the group should be as uniform in milk production and body weight as possible. Large variations in milk productions (over 10 kg/day) or body weights (over 100 kg) of cows in a group can result in some cows being over or under fed increasing feed costs and/or loss of milk production.
- Initial capital investment on TMR machine is more than traditional

feeding system.

How to formulate the TMR feed?

Rations for dairy cows are formulated on a dry matter basis and then the amounts of each feed are on as fed basis. Knowing the correct dry matter of ensiled forages, and all other wet grains and feeds fed in the TMR is critical to the mixing. Rations should be balanced for slightly higher nutrient intake than what the average milk production of the group is. The dry matter intake used to formulate the ration to the desired nutrient concentrations should be the same as the actual DM intake of the group. A general guide for lactating cows rations is to formulate them for milk productions about 20% above the average production of the group. By formulating rations slightly above the average milk production, cows are challenged to produce more and if they do not, the extra nutrition generally can be used for growth or added body condition. First lactation cows group ration can be formulated for 25% above actual milk production of the group to provide nutrients for growth of these cows.

Key point before the formulation of TMR

1. Determine average body weight, milk production, and fat test of the group. Determine the realistic, desired amount of milk production to balance the ration.
2. Estimate dry matter intake (DMI) and determine the amounts of individual forages to be fed on a dry matter basis (based on quality

Table 1. Protein requirement of different group of cows for TMR feeding system (based on nutrient requirements of cattle and buffalo)

For Lactating dairy cows				
	Body weight (Kg)	Milk production (Kg/day)	DMI (Kg/day)	Required CP (%) in Formulated TMR (DM basis)
1	300	10 to 15	11.4-13.9	11.4 to 12.9
		15 to 20	13.9-16.4	12.9 to 13.7
		20 to 25	16.4-18.9	13.7 to 14.5
2	400	10 to 15	13.6-16.1	10.2 to 11.6
		15 to 20	16.1-18.6	11.6 to 12.6
		20 to 25	18.6-21.1	12.6 to 13.4
3	500	10 to 15	15.8-18.3	9.3 to 10.7
		15 to 20	18.3-20.8	10.7 to 11.7
		20 to 25	20.8-23.8	11.7 to 12.5
For pregnant cows (8-9 month)				
	Body weight (Kg)	DMI (Kg/day)	Required CP (%) in Formulated TMR(DM basis)	
4	300	7.6	8.06	
5	400	9.7	7.15	
6	500	11.9	6.52	

Source: ICAR Publication, 2013

- and inventory).
3. Work out the quantity of grain and mineral supplements required to meet the nutrient needs of the cow beyond the nutrients supplied by forages.
4. Know the correct number of cows in the group every day and feed for that number. Daily counts of the number of cows in a group before feeding is necessary so the correct amount of feed fed per cow is provided.
5. Cow diet is based on forages, protein, liquid, energy, and vitamins. Farmers should calculate how much of each nutrient cows need and formulate TMR according to them.

Grouping of dairy cows for feeding TMR

Pre-partum: (2-3 weeks before calving up to calving day): These cows have low dry matter intakes (10.5/day kg) for large breeds) but increased protein and energy requirements. The goal is to supply the needed nutrients and to adjust the rumen microbes and the rumen papillae. The diet should contain 32 to 34% NFC (usually (3-3.5 kg) of grain) plus long, effective fiber. The mineral balance of this ration is also critical for avoiding milk fever. Ration palatability is also important.

Early lactation: (0-30 days in milk): These cows have lower intakes but

high nutrient requirements. A primary goal is to provide the nutrients needed to drive the cow towards high peak milk production. Often fresh cows rations are formulated with a slightly higher level of forage NDF than the mid-lactation group ration. Additives such as calcium propionate, niacin and rumen protected choline are often added to fresh cows rations.

Mid-lactation: (30-150 days in milk): Most of these cows should be near peak feed intake and peak milk production. The goal is to maintain high milk production and to get cows bred back at this time. Close attention should be paid to maintain adequate effective fiber in this ration that is balanced for high milk production.

The number of groups used on a particular farm will depend on factors such as, the size, number of cows on farm, milking parlour and holding area constraints, milk production level of herd, and labour constraints.

Factors effecting TMR feeding system

Particle size: Check particle size of the TMR. Every two to four weeks, the particle size of the TMR should be 2 to 3 cm (fiber length).

Proper order of ingredients in the TMR

It is important to maintain length of forage fiber in TMR. There are

Table 2. Guideline for limits (maximum and minimum quantities) of various feed ingredient for making total mixed ration

Ingredient used	Quantity of ingredient (kg/day/cow)
Hay/wheat straw	4-6 kg
Maize Silage (DM-35%)	10-12 kg
Maize grain	4-5 kg
Deoiled rice bran	0.2-0.3 kg
Cotton seed cake	3-5 kg
Soymeal	1-2 kg
Mineral mixture (preferably 'Kalvimin Gold')	50-100 g
Salt	40-60 g
Vitamin E	1500-3000 IU
Yeast	5-10 g
Buffer	50-60 g
Bypass fat	200-400g (mostly for high milk producing cows)

two type of mixer is used for mixing the ingredient for TMR preparation.

(a) Auger/ Reel mixer

Grains/cakes → mineral mixture/vitamin/feed additives → chaffed hay → silage

(b) Vertical/ Screw mixer

Long hay → grains/cakes → mineral mixture/vitamin/feed additives → silage

Timing of feeding

A TMR can be fed once per day, but twice per day is preferable especially during hot, humid summer months. Feeding twice per day, once in the early morning and once in the evening keeps the feed fresher and encourages feed intake.

Watch out for sorting

Cows will take their noses and wiggle down through a TMR to sort out the grain from the forage. This process provides the rumen microbes with a few mainly grain meals and a few mainly forage meals per day, just like component feeding without a TMR. The result is acidosis. Ration dry matter can dramatically affect the incidence of sorting. In the drier ration more sorting happen will be in case of more drier ration. Sorting has been reduced when water was added to rations containing more than 50% dry matter to bring ration dry matter down to 43%. Also, if the ration is

too coarse (especially with coarse-cut dry corn silage) cows will sort more. Feeding cows more frequently will also help reduce problems with sorting.

Observe feed refusals

In general, feed refusal should not exceed 3 to 4%. Feed refusals can be fed to older heifers, steers, or other beef cattle. Refusals should never be fed to pre-fresh or early lactating cows. First-calf heifers should be placed into a higher group than their

production level to compensate for growth that they will have in the first lactation. If there are long forage particles, corn cobs or other noticeable large amounts of any single feed ingredient, this indicates cows are sorting and not consuming a balanced ration. Either chop the long forages or particle feeds finer or replace them in the TMR with feeds that are more difficult to sort.

SUMMARY

Such type of feeding system

besides causing decrease in production performance can also deteriorate reproductive health of the dairy cows. There is need to give serious thought for switching from traditional feeding system to total mixed ration feeding system for improving milk production and reducing metabolic diseases in dairy cows as well for reducing cost of milk production in our country.

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