FEEDING TOTAL MIXED RATIONS

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Providing proper nutrition to dairy cows is important for health and optimal milk production. Dairy cow rations must contain good quality forages, a balance of grains and protein sources plus minerals and vitamins. These feed sources provide the nutrients needed by the dairy cow for milk production, growth and reproduction. Feeds must be fed in the right amount and combination to provide a balance of nutrients avoiding excesses or deficiencies. When rations are formulated or balanced correctly to meet the nutrient requirements of the cow, optimum feed digestion and utilization results. Feeding a total mixed ration (TMR) that contains all the feeds and nutrients required by the cow is an effective, efficient and profitable way to feed dairy cows.

What is a Total Mixed Ration (TMR)?

A TMR or Total Mixed Ration is a method of feeding cows that combines all forages, grains, protein feeds, minerals, vitamins and feed additives formulated to a specified nutrient concentration into a single feed mix. The TMR or complete ration mix is then offered free choice.

Why Feed a TMR?

- With a TMR, a cow eats a nutrient balanced ration in every bite or mouthful she consumes.
- Cows eat a predetermined amount of forages and concentrates necessary for good production and health. Selective consumption of feeds by cows is minimized.
- The risk of digestive upsets is reduced, rumen pH stabilized and rumen digestion of feeds optimized as cows have to consume the mix of feeds and nutrients in the TMR rather than selective consumption of individual feed ingredients. Providing a uniform supply of protein and carbohydrates to the rumen bacteria throughout the day maximizes rumen fermentation and the production of rumen bacteria. Consuming a mix of feeds and nutrients with every bite will optimize milk production and keep cows healthy.
- TMR mixers can reduce the work of feeding cows and save labor costs.
- A TMR provides more control and accuracy of the feed amounts fed than when feeds are fed as separate ingredients.
- Feeding a TMR correctly balanced to nutrient specifications can increase milk production 1 to 2.5 kg per cow per day.
- Milk fat and other components can increase because of the better rumen fermentation and balance of nutrients being consumed.
- Small amounts of low quality forages or unpalatable feed ingredients 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.

Disadvantages of Feeding a TMR

- With a TMR, all cows in the group get the same ration. Individual cow feeding is not possible.

- To correctly feed a TMR, a mixer is required. Feed mixers with weighing equipment are expensive.

- 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.

- 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. A minimum of 3 lactating cow groups is recommended for cost effective TMR feeding.

Grouping Guidelines for TMR Feeding

Dairy herds feeding a TMR should have a minimum of 3 milk production groups and preferably 2 dry cow groups. Suggested groups for a TMR fed herd include the following:

- Pre-Fresh or close-up dry cows (2 to 3 weeks before calving). These cows have a low dry matter intake (about 10 kg/day). They need a ration that is high in fiber and contains all the nutrients required to prepare for the impending birth of the calf, the initiation of lactation and help prevent metabolic problems. This ration should contain about 3 kg of grain, 2 to 3 kg of good quality hay plus forage like corn silage and the proteins, minerals and feed additives needed to make the ration very palatable and help prevent metabolic disorders.

- Fresh cow group (1 to 21 days after calving). These cows have a low dry matter intake, but a high nutrient requirement as they begin the lactation. The ration should contain adequate fiber (2 to 3 kg of good quality hay) to help promote good rumen function plus other forages and concentrates to get the cow off to a good start towards high milk production and moving into the high production group.

- High producing older cow (2^{nd} lactation and greater) group (21 to 180 days in milk). This group is where peak milk production and peak dry matter intake occur. The goal in feeding this group is to maintain a high milk production to get cows bred back for next lactation. This group can also be considered a reproduction group where heat detection and breeding occurs.

- First lactation or first calf heifer group. First lactation cows generally do better if they stay in a group of their own. This is do to social as well as nutrition reasons. They are slower to reach peak dry matter intake and milk production than are older cows, but more persistent in maintaining milk production than older cows. This group can stay together for 250 days in milk or more before moving to a late lactation group.

- Mid-lactation cows (180 to 250 days in milk). Cows in this group should be pregnant and milk production should average 75 to 85% of the high group. The ration fed to this group should be higher in forages and slightly less nutrient dense than the high group ration.

- Late lactation pregnant cow group (250 days in milk to dry off) This group is where first lactation cows, over 250 days in milk, can be mixed with older cows if barn space does not allow keeping first lactation cows in their own pen(s) for the entire lactation. The ration will be high in forage with emphasis towards maintaining milk production and avoiding over conditioning or fattening cows.

- Far-Off dry cows (220 to 260 days pregnant). The goal of the dry period should be to prepare the cow for the next lactation. The TMR should contain mostly good to medium quality forages to promote maximum rumen fill and rumination. Adequate protein and proper mineral balance in the ration is required.

Formulating TMR Rations for Groups

Rations should be balanced for slightly higher nutrient intake than what the average milk production of the group is. The dry matter (DM) 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 fro lactating cow rations is to formulate them for milk productions about 20% above the average production of the group. For example, if the group averages 26 kg of milk production per day, the ration should be formulated for 31 kg of milk per day. The DM intake used to formulate the ration should be the actual amount of DM the group is consuming. By formulating rations slightly above the average milk production, cows are changed to produce more and of they do not, the extra nutrition generally can be used for growth or added body condition.

First lactation cow groups can be formulated for 30% above actual milk production of the group to allow for growth of these animals.

Moving Cows Between Groups

- After calving, cows should be moved first to the fresh cow group. Between 14 and 21 days after calving, healthy cows should be moved into the high production group. Cows should remain in a high production group until they are pregnant, milk production drops to 10 percent or more below the average production of the group, and/or body condition score of the cows are greater than 3.

- Cows will usually drop in milk production when moved between groups. To minimize milk production drops, follow these guidelines:

    - Move cows in groups of 4 or more. Individual cows are more affected by social changes and fighting in the groups than are groups of cows.
    - Move cows at feeding time to minimize fighting and social disruptions.
    - Move cows on a regularly scheduled basis. This helps cows get accustomed to moving and social changes.
    - If within about 5 weeks of moving into the high cow group or before 60 days in milk the cow does not reach the average milk production of the group, she should be moved to a lower production group.
    - Try to avoid large changes in ration nutrient content between groups. Drops in milk production resulting from nutritional changes can be minimized as cows move between groups by formulating rations for no more than a 9 kg milk production difference.

Day to Day TMR Feeding

The success of a TMR feeding program requires the person feeding or the dairy manger pay close attention to the following items. If these items are not closely monitored, cows will not consume the correct amount of nutrients necessary for good milk production, reproduction and health.

- Changes in feed dry matter. Rations for dairy cows are formulated on a dry matter basis and then the amounts of each feed fed are on an as is or as fed basis. Knowing the correct dry matter (100 - % moisture) of ensiled forages, and all other wet grains and feeds fed in the TMR is critical to the mixing and feeding of a balanced ration.

    - Every dairy farm feeding a TMR should have a moisture tester. All ensiled forages and wet feeds should be tested at least once and preferably twice a week for moisture or dry matter content.
    - Under estimating the dry matter content of a feed, assuming more moisture is present than there is, results in the feed being fed in a larger quantity than required.
    - Over estimating the dry matter of a feed, assuming less moisture is present than there actually is, results in feeding less of the feed than required.
    - Feeders and dairy managers feeding a TMR can be alerted to changes in the dry matter content of feeds through:
        1. Changes in the size or volume of the TMR mixed.
        2. Cows having larger than normal amount of feed remaining the next day (usually indicates feeds have increased in dry matter).
        3. Cows having no feed remaining the next day (usually indicates feeds have decreased in dry matter content or increased in moisture).

- 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 attained.

- Increase or decrease the amount of TMR mixed according to daily variations in feed intake. Cows do not eat exactly the same amount of feed every day. Weather conditions and environmental temperatures have a big affect on daily feed intakes. When adjusting a TMR for daily intake variation, move the amount of all feeds up or down in proportion. If feed intakes remain consistently 5 percent or about 2 kg as fed more or less than the original amount the ration was balanced for, the ration should be reformulated using the new changed feed intake amount.

- Add feeds to the TMR mixer in the proper order.

    - In mixers with augers, grains and other concentrate mixes are generally added first followed by ensiled forages and dry forages last. With auger mixers, dry forages are best chopped or ground coarsely before being added to the mixer.
    - In vertical mixers with one or two center augers, dry or long forages are generally added first followed by grains, concentrates and then ensiled forages such as corn silage.

- Do not over mix the TMR. Mixing times will vary with the type of mixer, auger or vertical, amount of feed in the mixer, size of the tractor running the mixer and the condition, new or old, of the mixer. In general, mixing 5 minutes after the last feed ingredient has been added should be sufficient time to mix the load thoroughly. With vertical mixers, final mixing time after all ingredients are added often is only 3 to 5 minutes. If the TMR is overmixed, the

particle size is reduced and no long physical fiber remains in the TMR. This will lead to rumen upsets, low cud chewing and acidosis.

- Number of times and when to feed the TMR per day. 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. Many dairy producers feed the TMR while cows are in the parlor being milked so they return to the pen to fresh feed. This is when cows are usually the hungriest and eating encourages cows to stand allowing the udders to dry off and teats to seal before lying down.
- Push feed in several times per day. The TMR should be pushed in towards the pen 6 or more times per day. Cows eat the feed closest to them first. They can only reach out about 72 centimeters from the pen to get feed. Therefore, if feed is not pushed in toward the pen several times per day, the cows that are less aggressive eating may not be able to maximize their feed intake. Pushing feed in several times per day is very important when pens are overcrowded and feed bunk space is less than 46 centimeters per cow.

- Watch for sorting of the TMR. Cows are effective at using their noses to sort through a TMR separating the grain from the forage. Cows will usually eat grain first and leave long forages for a second meal later. By doing this, cows unbalance the TMR consuming only grain at one meal which can lead to acidosis and off-feed problems. The drier the TMR, the more the sorting. A TMR should be between 50 and 55% dry matter. Feeding the TMR more frequently than once per day or pushing feed in often helps reduce sorting problems.

- Observe feed refusals each day. The feed remaining in the bunk just prior to feeding the new TMR should look like the TMR about to be fed. 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.

- Check particle size of the TMR. Every two to four weeks, the particle size of the TMR should be checked. Use a Penn State Particle Size Separator box to check. The goal is to have 6 to 10% of the TMR feed on the top screen, 30 to 50% on the middle screen, 30 to 50% on the lower screen and less than 20% of the feed in the bottom pan. Having a lot of long particles in the TMR or more than 10% on the top screen allows cows to sort the TMR easier.

- Calibrate mixer scales once every three months. Mixer scales should be checked when the mixer is at one-third, two-thirds and full weight capacity. Placing a known amount of weight (25 to 45 kg) on each corner of the mixer at the three weight loads is an easy effective way to test the scales.

PARTICLE SIZE RECORDING SHEET

Sample	Wt	Percent	Comments	Sample	Wt	Percent	Comments
Pen				Pen			
Top (a)				**Top (a)**			
Screen 1 (b)				**Screen 1 b)**			
Screen 2 (c)				**Screen 2 (c)**			
Pan (d)				**Pan (d)**			
Total (a+b+c+d)				**Total (a+b+c+d)**			
Sample	**Wt**	**Percent**	**Comments**	**Sample**	**Wt**	**Percent**	**Comments**
Pen				Pen			
Top (a)				**Top (a)**			
Screen 1 (b)				**Screen 1 (b)**			
Screen 2 (c)				**Screen 2 (c)**			
Pan (d)				**Pan (d)**			
Total (a+b+c+d)				**Total (a+b+c+d)**			

Particle size guidelines - Forages and TMR.

	Particle size separator - 4-box system[1]			
	Top	2nd	3rd	Pan
Feed	---------- % on wet basis ----------			
Chopped hay	15 – 25	> 35	< 30	< 10
Haylage	15 – 25	30 – 40	< 30	< 10
Corn silage				
Unprocessed - 3/8" chop	< 5	50 – 60	< 30	< 10
Processed - 3/4" chop	< 10	50 – 65	< 20	< 5
TMR	6 -10	30 – 50	30 - 50	< 20

[1] For 3-box system (2 screens and pan), total 3rd and pan weights for pan weight.