

TOTAL MIXED RATION IN DAIRY FARMING - A REVIEW

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Abstract: Total mixed ration (TMR) is a popular feeding strategy in modern dairy farming which aims to provide a nutritionally balanced diet. This method involves blending of all ingredients such as forage, concentrates, minerals, vitamins and feed additives into a single homogenous mixture to provide balanced nutrient in each bite. This technique ensures consistent feed intake, better digestion, boost milk production and milk quality, supports optimal growth and reduces digestive problem by preventing selective feeding. TMR is crucial for modern livestock feeding and enhancing sustainable and effective animal production. This paper explores the components, advantages, challenges and developments associated with TMR feeding in dairy cows.

Keywords: TMR, Total mixed ration, dairy cows, Balanced ration, feed efficiency

INTRODUCTION

Feeding TMR helps dairy cows to achieve maximum performance. Higher milk production is accompanied by feeding a nutritionally balanced ration, allowing cows to consume their actual energy requirement and maintaining roughage characteristics such as ration particle size which is required for proper rumen activity (Coppock *et al.*, 1981).

COMPONENTS OF TMR

1. Forages (provides more fibre)
 - a) Silage (fodder sorghum such as COFS-27, COFS-29, COFS-31 silage, maize fodder silage - african tall maize silage and other locally available fodder silages, etc.).
 - b) Hay (sorghum hay, groundnut haulms, alfalfa hay, etc.).
 - c) Pasture grasses (guinea grass, paragrass, rhodes grass, kolukatai grass, etc.) and
 - d) Dry fodders (paddy straw, wheat straw, sorghum stover, oat straw and locally available crop residues).
2. Grains, Oil cakes and Protein supplements
 - a) Grains (such as maize, red sorghum, white sorghum, broken rice, broken wheat, bajra, millets, oats, barley and other locally available grains)

b) Protein supplements (oil cake, oil seed meals) such as coconut cake, sunflower and rapeseed meal, soybean meal, DDGS (Distillers dried grain solubles) and other agro-industrial byproducts

3. Vitamins and minerals (for health and productivity)

4. Additives (to support rumen degradation): yeast, probiotics, prebiotics, buffers

ADVANTAGES OF TMR

Balanced nutrition: with each and every bite contains as same proportions of nutrients and the cow/buffalo will get a nutritionally balanced diet.

Improved feed efficiency: TMR is harder for cows to picky while eating thereby it improves nutrient utilization and reduces feed wastage. It also increases dry matter intake leading to improved energy balance in dairy cows (Teshome *et al.*, 2017).

Enhanced milk production: Feeding of TMR with balanced nutrients to the dairy cows can increase milk production and milk quality due to consistent higher milk fat and other nutrients (Elgersma *et al.*, 2006).

Optimized nutrient intake: TMR prevents selective feeding ensuring cows consume all the components of the ration in proper proportion. It provides more control and accuracy over the amount of feed given than separate ingredients to dairy cows (Rakes *et al.*, 1969).

Better rumen health (enhance rumen functions): TMR can support a stable rumen environment, improve fibre digestion and microbial efficiency. It can lower the risk of digestive issues like Tympany, Acidosis, Ketosis, Left Displaced Abomasum / Right Displaced Abomasum and other metabolic disorders related to rumen by stabilizing the rumen pH and feed digestion. TMR provides proteins and carbohydrates uniformly to rumen microorganism throughout a day, this maximizes rumen fermentation and production of rumen microbial proteins (Beigh *et al.*, 2017).

Better Body condition score (BCS): TMR prevent excessive weight loss during lactation and supports reproductive efficiency in lactating cows (Kolver and Muller *et al.*, 1998).

CHALLENGES IN TMR FEEDING

High initial investment: TMR mixer with weighing equipment are required and needs a substantial capital in modern dairy farming. Dry forages such as hay / straw / stovers may not mix well in the TMR mixer and it needs specialized equipments like shredder, pulverizer etc., to chop them before adding it to the mixer depending upon the type of mixer. (Sova *et al.*, 2014).

Storage and spoilage issues: Improper storage and poor silage quality can cause TMR spoilage leading to economic losses for dairy farmers (Martin *et al.*, 2024).

Quality control issues: Improper mixing can lead to nutritional imbalance and reduce feed efficiency in dairy cows.

Labour management: For TMR preparation it requires skilled labour for ration formulation and machine operation and for regular mixing and management.

Not suitable for small scale farmers: TMR may not be cost effective for small scale and marginal farmers due to high initial investment on machineries and requirement of skilled labours.

FACTORS AFFECTING TMR EFFICIENCY

1. Feed Composition and Nutrient Balance

An optimal TMR must be formulated to meet the nutritional requirements of animals based on their production stage. Imbalances in energy, protein, fibre, and minerals can reduce intake or digestibility, impacting animal health and productivity (NRC, 2001).

2. Particle Size and Physically Effective Fibre

Proper particle size affects rumen function and chewing activity. Too fine a mix reduces fibre effectiveness, while too coarse leads to sorting behaviour and unbalanced intake. (Heinrichs *et al.*, 2002).

3. Mixing Uniformity

Inconsistent mixing leads to feed sorting and variable nutrient intake. Mixer type, mixing time, and loading order affect the uniformity of TMR (Kononoff *et al.*, 2003).

4. Moisture Content and Palatability

Ideal moisture (typically 50-60%) improves palatability and reduces sorting. Too dry mixes are dusty and prone to sorting, while too wet mixes may lead to spoilage or reduced intake. (Sova *et al.*, 2014).

5. Feed Storage and Preservation

The quality of TMR ingredients, especially silage, depends on proper harvesting, fermentation, and storage. Poor-quality silage reduces palatability and nutrient availability (Muck *et al.*, 2010).

ADVANCES IN TMR FEEDING

For enhancing the efficiency of TMR in dairy farming the following advancements to be followed (Stone *et al.*, 2014).

1. Precision feeding technologies

For accurate delivery to the dairy cows automated feed mixers and precision monitoring system will be essential.

2. Nutrient modelling Softwares

For formulating cost effective TMR balanced ration, advance softwares will be useful for nutrient modeling.

3. Alternative feed ingredients

The incorporation of agroindustrial byproducts such as cotton seed meal, DDGS (rice / wheat), beet pulp and other locally available low-cost alternative feed ingredients will reduce the cost of TMR.

4. Fermentation additives

The use of probiotics and prebiotics improves the rumen fermentation thereby improve the animal health.

CONCLUSION

TMR is a highly effective scientifically proven method for dairy cattle by promoting consistent nutrition. However, it requires proper management, investment in equipment and quality control to maximize its benefits. It is most beneficial for large scale dairy farms aiming for better feed efficiency and maximize milk production while it has economic and management challenges, advancement in feeding ration formulations continue to improve its effectiveness.

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