

Total mixed rations: A tale of three types of feed

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Total mixed rations (TMR) are fed to animals that are entirely dependent on the nutrition the producer provides and have no access to alternative feed sources.

These animals are typically feedlot animals, TMR dairy cows, pigs, poultry and fish. The ration can comprise of loose, mixed feed or pellets. The ration contains all the nutrients that animals need and is formulated by a nutritionist.

Bear in mind, though, that the final feed the animal consumes is not always similar to the formulated ration. There is the 'paper' ration, the 'feed-mixer' ration and the 'trough' ration.

The paper ration

Rations must be meticulously and scientifically formulated. A nutritionist formulates a ration for a target species based on the requirements of those animals during a particular production phase. During formulation, the availability and quality of nutrient sources (raw materials) are taken into consideration.

A nutritionist is a registered professional scientist who formulates balanced rations for the modern, high-producing farm animal.

The feed-mixer ration

The quality of the nutrient sources used in the formulation can be consistent with those used in the feed mixture.

The production method and manner in which self-produced crops are harvested both have an influence on the quality of nutrient sources. Laboratory analyses (e.g. NIRS) serve as verification of the quality of self-produced nutrient sources.

Siloed grain undergoes a grading process to determine its quality – maize can be graded as first, second or third grade (feed grade) and a distinction is made between white and yellow maize. A certificate of analysis confirming

Table 1: Verification and control of raw material quality.

Verification of quality	Precautionary measures for quality maintenance
Certificate of analysis upon receipt of nutrient source	Protect against rain and moisture
Grain grading certificate	Protect against temperature extremes
Inspection – no foreign material and toxins	Pests (e.g. rodents and mites)
Near infrared spectroscopy (NIRS) analysis	Correct management of silage bunker face
Wet chemical analysis	

Table 2: Summary: Feed mixers and mixer wagons.

	Type of mix	Mixing time	Limitation
Horizontal paddle mixer	Concentrates and roughage	Short mixing time	Guard against dead zones.
Single axle paddle			
Double axle paddle			
Horizontal screw mixer	Concentrates and licks	Short mixing time	Cannot mix any roughage.
Single screw			
Double screw			
Double axle, double screw			
Vertical auger	Concentrates and roughage	Long mixing time	Very long mixing time for uniform mixture (less effective).
Drum mixer	Concentrates and licks	Long mixing time	Mixes only small batches. Cannot mix any roughage.
Horizontal TMR mixer	Total mixed rations	Long mixing time	Cannot efficiently mix small quantities of very fine raw materials.
Vertical TMR mixer	Total mixed rations	Long mixing time	Cannot efficiently mix small quantities of very fine raw materials.

that the raw material meets minimum standards will provide peace of mind when purchasing nutrient sources.

Nutrient sources must be stored correctly. They must not be exposed to extreme temperatures and water (e.g. rain), and pest control must be implemented to extend the product's shelf life.

Bunker management is vital when it comes to using silage as a source of

nutrition. Careless management can lead to significant losses, and compromised nutrient quality and availability. *Table 1* illustrates the verification of quality and precautionary measures aimed at maintaining quality.

To assist in maintaining the ready-mixed ration's quality, the nutrient sources must be weighed and mixed according to the formulation – the correct amount of

each raw material must be weighed and mixed in the mixer in the correct order. If the paper ration's instructions are not followed, the feed will end up being vastly different from the formulated feed.

The correct mixer

The type of mixer used influences the mixing time. For fibrous rations such as a TMR for dairy cows, an extended mixing time can lead to fibres being shorter than the recommended guideline. This may cause metabolic disorders such as acidosis. Too short a period in the mixer may deliver a ration that is not uniform and contains too long crude fibres, resulting in selective feeding.

The physical form and palatability of the feed mixture must be acceptable to the animals. Very dusty rations can cause health and feed intake problems. Water, molasses-based products and silage can be utilised to manage dustiness.

Thought must be put into selecting the correct feed manufacturing equipment, including a suitable feed mixer (different mixers perform different functions). The first requirement is that feed must be thoroughly and evenly mixed. *Table 2* provides a summary of available feed mixers and mixer wagons and their key features.

The ration animals ingest

Proper feed trough management promotes optimal feeding practices. Animals will not perform if feed troughs are empty, even if rations are formulated down to the smallest detail using the best nutrients and are mixed in the correct mixer for the stipulated length of time.

Not only is too little feed in the trough detrimental; too much feed is simply uneconomical. Leftover feed in troughs is often contaminated with saliva, which can have a negative impact on feed intake

and livestock production. Removing and discarding old feed is therefore essential.

Each mouthful of feed must contain all the nutrient components, in the right proportions. If feed is not thoroughly mixed, animals will feed selectively and ingest only certain components. Animals that ingest only concentrates may develop acidosis, whereas animals that consume mainly roughage will not produce optimally due to a lack of energy and protein. Even if nutrient components were weighed correctly, the ration animals ingest may be quite different to the ration added to the trough if those components were not thoroughly mixed.

Not only is proper feed trough management an art – it is also a dynamic process. The quantities animals are given require daily monitoring and adjusting to stimulate optimal production and reduce wastage, all in a bid to ensure profitability. **SF**

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