Enhancing Feed Efficiency and Animal Production with Total Mixed Rations

Feeding a total mixed ration (TMR) should provide a balanced diet that meets nutritional requirements for livestock.

Items to consider:

- Equipment available
- Feed inventory
- Animal group(s) and production stage
- Feed testing
- Ration formulation
- Weighing ingredients
- Particle size

Suggested TMR feed ingredient order for common mixer types

Auger Mixers	Vertical Mixers	Reel Mixers
1. Grain/concentrates	1. Dry/long forages	1. Dry forage-short
2. Ensiled forages	2. Grains	2. Grains
3. Dry forages	3. Concentrates	3. Silage
	4. Ensiled forages	4. Liquids

What should the mixer do?

In TMR systems, providing a uniform mixture is the goal to minimize sorting and prevent subacute ruminal acidosis. Animals should consume required nutrients with every bite, improving feeding accuracy compared to feeding ingredients separately.

When dry matter in a TMR is > 55%, the addition of water can help reduce sorting and improve feed intake.

Ideally, the TMR should closely match the formulated ration and mixer efficiency can be checked by submitting samples to a laboratory for analysis of nutrient composition.

Mixing time may vary depending on the type of mixer. Typically, three to five minutes is sufficient time starting from when the last ingredient is added. Avoid overmixing, as this can reduce physically effective fiber that is important for digestion and maintaining rumen pH.

How to check mixer efficiency

1. Prepare a mixer load of feed following your regular routine and feed sheet.
2. Unload the mix into a bunk or on the ground without allowing animals access.
3. Measure the distance required to unload the mixture.
4. Divide the distance by 10. This represents the distance between sample collection points.
5. Collect a sample (approximately 200 to 250 grams) of TMR at each of the 10 equally spaced points. It is important to collect the entirety of the delivered TMR top to bottom.
6. Analyze each sample in a Penn State Particle separator and record the outcomes for each sieve and pan.
7. Calculate the average and standard deviation for each of the collection surfaces for the 10 samples.
8. Calculate the coefficient of variation (CV), which is the standard deviation divided by the average multiplied by 100. The goal is to achieve a CV of two per cent or less for the middle screen and pan.
9. If CV exceeds target, investigate why and make required alterations. You may need to change the order of ingredient addition; alter forage length prior to addition; shorten or lengthen mixing time; identify and address maintenance items on the mixer. See Monitoring Total Mixed Rations and Feed Delivery Systems by Oelberg and Stone for further details.

Check feed refusals after feeding, which can indicate if animals are sorting due to particle size differences. If the proportion of long particles left behind is greater than in the initial mix, chop long forages to reduce particle size prior to mixing. A Penn State Particle Size Separator can be used to check mixer efficiency on farm. Table 1 provides suggested particle size parameters for various ration types. It is also important to test the weigh scale on the mixer and calibrate when required.

Table 1. Recommended TMR particle size using the Penn State Particle Separator.

Screen	Lactation TMR (%)	Dry Cow TMR (%)	Corn Silage (%)	Hay Silage (%)	Straw TMR (%)
Top (>0.75" sieve)	6 - 10	10 - 20	5 - 10	10 - 20	33
Middle (0.31 – 0.75" sieve)	45 - 55	50 - 60	45 - 65	45 - 75	33
Bottom (<0.31" sieve)	<50	<40	30 - 40	20 - 30	-

Adapted from Penn State guidelines by T. Overton

Evaluating mixer efficiency is essential for optimal nutrient delivery and meeting production requirements when feeding a TMR. Contact the Agriculture Knowledge Centre at 1-866-457-2377 to connect with your local livestock and feed extension specialist for assistance with feed testing, interpretation and ration planning needs.