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So You Want to Sample Your Total Mixed Ration (TMR)

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The use of total mixed rations (TMR), rare until the early 1980's, is now the major feeding system in most of the major dairy areas of North America. TMR feeding has numerous advantages, including the ability to use lower cost by-product feedstuffs at low levels in diets, completely mechanizing the feed mixing and delivery system, and minimizing diet sorting by the cows.

However the TMR that is delivered to the cows also has great interpretive and documentation value in that its chemical analysis is, in fact, that of the diet which is being fed and, as such, it should correspond to the diet that was formulated. If it does not, then the TMR may reduce animal performance by undersupplying critical nutrients and/or increase environmental impacts (and waste money) by oversupplying nutrients. While TMR have occasionally been sampled and chemically assayed in the past relative to the former, the emergence of the environmental impact issue has created a new reason to track the nutrient levels of the TMR that are being fed to dairy cattle.

The purpose of this brief article is to outline a TMR sampling protocol that is practical for use on commercial dairy farms.

The Equipment

The equipment required is:

- a 3 ½ gallon plastic bucket
- a pair of latex gloves
- a plasterer's spatula
- a 1 gallon plastic zip sealable plastic bag
- a whisk broom
- a black waterproof marking pen

The Principle

Overall, the principle of successful TMR sampling is to collect a representative sample of the TMR that was delivered to the feed bunk. However unlike sampling of feedstuffs, which can be done at essentially any time of the day, sampling of a TMR has to occur immediately (within ~5 minutes) of the unloading of the TMR at the feed bunk. The reason for this is that cows will sort ingredients within a TMR such that as time from

TMR delivery increases, the TMR in the bunk will diverge more and more from the TMR which was delivered. For example, typically the fibre level of the TMR will increase with time of access by cattle. Unfortunately, this creates the need to be physically present at TMR unloading and this creates an unfortunate amount of waiting time for actual TMR delivery to the feed bunks to occur.

Following the Feed Truck

Sampling the bunkline

The Process – Sampling the TMR at the Bunkline

The first need is to decide what is to be sampled. For example, if a feed truck delivers a single TMR load to a single corral bunkline, then it is almost certain that the desire will be to sample that entire bunkline. However if the feed truck delivers a split TMR load to 2 (or more) corral bunklines, then it may be desirable to sample each bunkline separately or simply the overall load. If the latter, then the number of individual TMR samples (described below) will need to reflect the weight split from the feed truck of the TMR by corral bunkline.

Once the bunkline area to be sampled is identified, then the sites on the bunkline to be sampled must be identified in advance. As the number of individual TMR samples collected should always be 10 per TMR sample, which are required to adequately represent a TMR load, it is best to pre-select points to sample based upon a feature of the corral. For example if there are 40 roof posts along the bunkline, then the sampler could decide to sample at the 3rd post and then at every 3rd post after that through post 36 in order to obtain 10 TMR samples.

Once the entire TMR load has been unloaded at the target bunkline, then the sampler must move resolutely down the bunkline sampling directly in front of each pre-determined post approximately half the distance from the back of the bunk. At each predetermined point, the sample is collected by driving a latex gloved hand in a cuplike fashion into the TMR to the depth of the wrist, squeezing lightly, withdrawing the TMR

sample and (without shaking it - which is a natural tendency) dropping it into the sample bucket. Once all TMR hand samples are collected, the mass should be gently compressed by hand and the gallon plastic bag placed on top to prevent moisture loss.

Some common sense is required in the sampling process if the TMR is not homogeneous. For example if whole carrots or oranges are in the TMR, these should not be avoided in sampling if they are at the pre-determined sampling location. If long forages are used in the TMR, such as straws or grass hays, that do not break up in mixing, it may be necessary to clip them off with a pair of scissors (usually about 2 to 3 cm from the mass) prior to putting the hand sample into the bucket in order to avoid overrepresentation of these dietary components in the collected sample.

The Process – Sampling the Sample

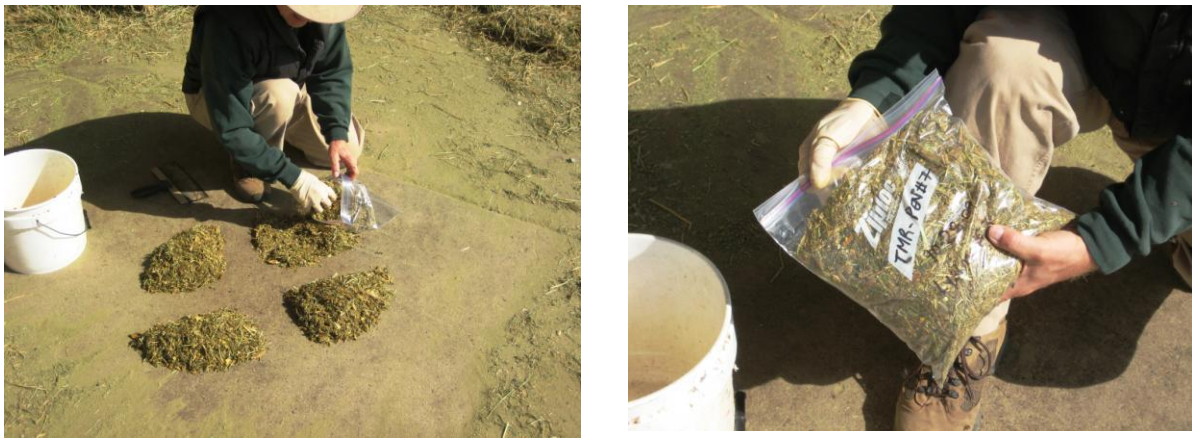
The TMR sample in the bucket will be too large to send to the laboratory for analysis. Thus the next step is to sub-sample the TMR in the bucket in order to create a smaller sample that can be sent to the feed laboratory for analysis. This process, referred to as 'quartering' consists of finding a smooth concrete or composition surface that is out of the wind, briskly dumping the contents of the bucket on that surface and then mixing it with the plasterer's spatula by repeatedly turning the TMR inwards from the bottom to the top until it is evident that the material is well mixed. If there are large feeds in the TMR (such as citrus pulp, carrots or long hays), they should be torn or sliced or clipped with the plasterer's spatula or a pair of scissors into small (quarter sized) pieces/lengths during this process.

Starting to quarter the sample

Once it is clear that the sample is well mixed and ready to be sub-sampled, the plasterer's spatula is used to divide the pile in half and then divide each half into halves. Two opposing quarters are then selected for placement into the gallon plastic bag while the balance is disposed of, or sampled as a reserve. The details of the TMR sample, including location, bunkline, date and TMR identification should be immediately marked on the gallon bag with an indelible black marking pen.

The Process – Storing and Submitting the Sample

The TMR sample can be frozen to be dealt with later or refrigerated if it is to be dealt with within 24 hours. The entire sample should be submitted to the laboratory for chemical analysis with clear instructions that the entire sample is to be dried (at no hotter temperature than 55^0C in order to prevent damage to protein components and the creation of material that will assay as fiber) and ground.



Creating the final sample

The choice of nutrients to assay in the TMR sample depends on the purpose of the sampling. It may be limited to a dry matter (DM) determination, if the only purpose is to calculate the DM intake of the cattle, or it could include components such as crude protein, phosphorus and salt (i.e., Na and Cl) if environmental issues have driven the sampling process (environmentally important analytes will vary regionally relative to regional environmental concerns). Conversely, levels of expensive trace minerals, such as Se, Cu and Co, could be reduced in the ration if it is clear that they are oversupplied.

Frequency of Sampling a TMR and Use of the Data

A TMR can be sampled at virtually any time frequency. However to create a clear record of TMR quality, any time frequency that is longer than monthly makes little sense.

Changes to rations should not be made on the basis of one, or even two, TMR samples. However once a pattern has been established of the absolute value of the nutrients in the samples, as well as deviation from formulated values, then TMR reformulation should be considered.

Summary

Sampling and analysis of TMR samples on commercial dairy farms is simple in principle, but may be complex in practice. However if completed on a regular basis, the analysis data generated can be used to document feeding practices to regulatory authorities and/or fine tune the TMR formulations to reduce their cost.

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