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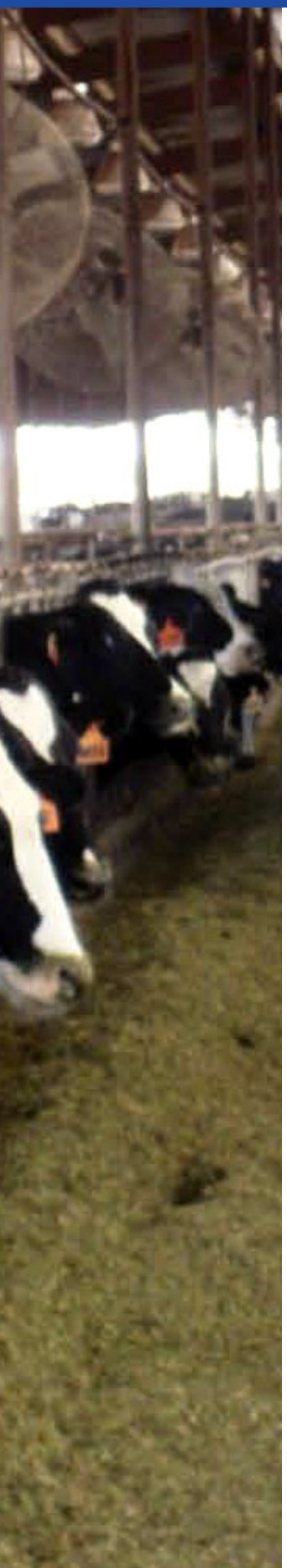

Total Mixed Ration (TMR) Sampling Protocol

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This publication outlines a total mixed ration (TMR) sampling protocol that is practical for use on commercial dairy farms. Data from TMR samples may be used for several purposes, including to determine whether concentrations of nutrients meet identified standards.

The use of total mixed rations, rare until the early 1980s, is now the dominant feeding system on larger dairies in 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, if the TMR is not correctly mixed and fed, animal performance may be reduced by undersupplying critical nutrients, and environmental impacts may be increased (or money may be wasted) by oversupplying nutrients. There are times, under site-specific conditions, when it is valuable to sample TMR in order to compare results of the concentration of nutrients in feed delivered to the animals to a set of standard concentrations (i.e., formulated values). It is essential to establish a desired objective for use of TMR data before expending resources to collect samples. For some objectives, a different set of collected data may provide more accurate information.

The Goal

The goal of successful TMR sampling is to collect a representative sample of the TMR that was delivered to the feed bunk. It is necessary to collect handfuls of material from numerous locations to obtain a representative sample. Unlike sampling individual feed ingredients, which can be done at essentially any time of day, sampling of a TMR must occur within about 5 minutes of the unloading of the TMR at the feed bunk to ensure collection of a representative sample. Animal sorting of feed ingredients begins immediately after TMR delivery and can alter the nutrient content of the TMR. Therefore, the sample collector must be physically present at the time of TMR unloading to assure representative TMR sample collection.

Needed Equipment

Equipment needed includes (fig. 1)

- large plastic bucket
- pair of latex gloves
- plasterer's spatula
- 1-gallon size plastic bag with zip-type closure
- whisk broom
- black permanent marker
- notebook
- scissors

Figure 1. Equipment needed.

Collect Increment Samples at the Bunkline

Step 1. Identify the sample. Label the sample bags with a permanent marker to include sample identification, date and time of sampling, initials of the person taking the sample, the type of material sampled, and the analyses to be performed. In a notebook, record the bunk and ration identification, along with the sample ID to be used by the laboratory.

Step 2. Identify increment sampling sites. Ten individual samples are needed to create a composite sample. In each bunker to be sampled, imagine the appropriate number of sampling locations at regular intervals along the entire bunkline to collect ten samples. For example, collect samples at every tenth stanchion or every third support post.

Step 3. Collect the composite sample. Follow the feed truck at a set, safe distance with your plastic bucket and collect individual samples at the identified sites (fig. 2). Insert a latex-gloved hand into the middle of the pile about wrist deep (fig. 3). Grab and retrieve each increment sample. Collect ten per bunk. Do not squeeze or shake these before dropping them into the plastic bucket. When collection is complete, gently compress the material in the bucket and place a plastic bag on top to prevent moisture loss.

Tips

- Safety is always a concern. Be sure all appropriate individuals are notified that someone will be following the feed truck to sample the TMR. Individuals sampling TMR should directly identify themselves to the feed truck driver. Wearing bright colors may help.

Figure 2. Following the feed truck.

Figure 3. Sampling the bunkline.

Figure 4. Dumping (A) and quartering (B) sample. The intermediate stage of mixing is not shown.

- Do not avoid oversized feedstuffs—large by-product feed ingredients such as whole carrots, citrus, etc.—during sampling.
- Clip long forages, such as straws or grass hays, that do not break up in mixing to about 1 inch from the mass prior to putting them into the bucket in order to avoid overrepresentation of these dietary components in the TMR sample.

Prepare the Laboratory Sample

The composite sample in the bucket is too large to submit for laboratory analysis. It is necessary to mix, quarter, bag, and preserve a representative subsample.

Step 4. Mix the composite sample. Sweep a few square feet of a smooth concrete or composition surface, which is protected from wind and sun, clean with your whisk broom. Dump the contents of the bucket onto this clean area (fig. 4A). Mix the material thoroughly with the plasterer's spatula by repeatedly turning the TMR inward from the bottom to the top until it has a well-mixed homogenous appearance. It may be necessary to tear, slice, or clip large ingredients (such as citrus pulp, carrots, or long forages) with the plasterer's spatula or a pair of scissors into quarter-sized pieces or 1-inch lengths.

Step 5. Quarter the composite sample. Use the plasterer's spatula to separate the well-mixed pile into halves and then into quarters (fig. 4B).

Step 6. Bag the laboratory sample. Place two diagonally opposing quarters into the gallon plastic bag, squeeze out excess air, and seal it tightly (fig. 5). Bag the remaining feed as a reserve sample or return it to the feed bunk. Be sure to sweep up small particles with the whisk broom onto the spatula and include them in the laboratory samples.

Figure 5. Creating the final sample. Fill bag with contents from opposing quarters.

Preserve and Submit the Laboratory Sample to an Analytical Laboratory

Proper preservation and storage is critical to obtaining useful results. Feed ingredients may degrade rapidly under warm or moist conditions, making the analytical data inaccurate.

Step 7. Cool the laboratory samples. Place sealed samples in an ice-cooled chest or refrigerator and deliver them to the laboratory within 24 hours. Alternatively, these samples may be frozen if delivery to the laboratory requires more than 24 hours.

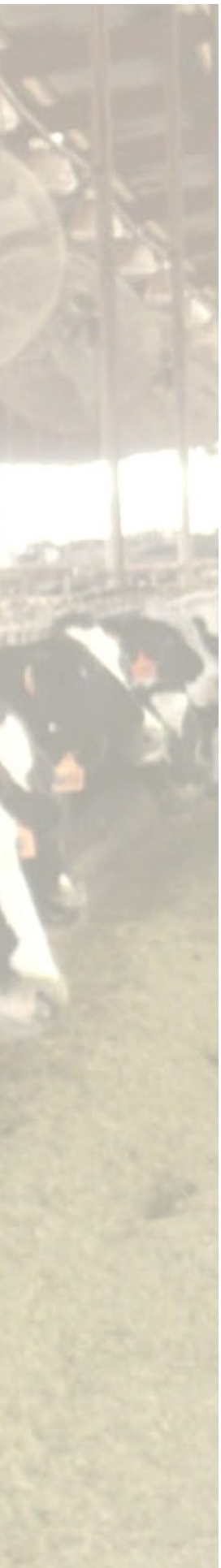
Step 8. Submit the laboratory sample to the laboratory. Work with your dairy nutritionist to determine the appropriate analyses. Standard laboratory analysis packages may not provide the information needed for your objectives.

Frequency of Sampling a TMR

Work with your dairy nutritionist to determine the appropriate frequency at which to collect the TMR. Collect samples regularly to establish sufficient historic data to meet your desired objectives.

Use of Results

The value of TMR sample analysis, at least in a general sense, is to establish a pattern of the concentration of nutrients in the TMR delivered to a group of animals over time. Comparing the results of sampled individual feeds with standard or formulated values may be of value in select situations. Confidence in TMR formulation, and the mixing and delivery processes, will be high when the assayed TMR nutrient concentrations are similar to the formulated values. Additional systematic evaluation of the TMR feeding system may be warranted if analytical nutrient results of the TMR regularly vary from formulated values.



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