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Cows need consistent rations for optimal milk production. That's why on-farm feed mixers get a lot of attention in Diamond V's TMR Audit® program, which has been helping to improve dairy operations across the country since 2008.

Many factors are important, including the mechanical condition and operation of the mixer, order of ingredient loading into the mixer, mixer over-filling or under-filling effects, and mixing times. However, one of the most profound findings from thousands of TMR Audits over the years is the impact of location of loading into the mixer. It may seem like a relatively unimportant factor, but proper loading plays a very big role in the mixing performance of both vertical and horizontal mixers.

#### **Critical: Location of loading into the mixer**

In both vertical and horizontal mixers, it is critical to add all ingredients (except large round bales) in the middle of the mixer (Photo 1) or load the ingredients evenly across the mixer. In vertical mixers in particular, TMR Audit findings show that ingredients added at one end of the mixer (Photo 2) tend to stay at that end.



***Photo 1. Proper loading location – center of mixer.***

#### **Tech Topic**

## **Good mixer loading, better TMR consistency**



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***Photo 2. Incorrect loading location – toward either end of mixer.***

In the case of liquid supplements, improper loading accentuates the problem of poor mixing.

During one evaluation, a twin-screw vertical mixer was loaded with a liquid supplement on the back screw (Photo 3) with load-out through the front of the mixer. After mixing,

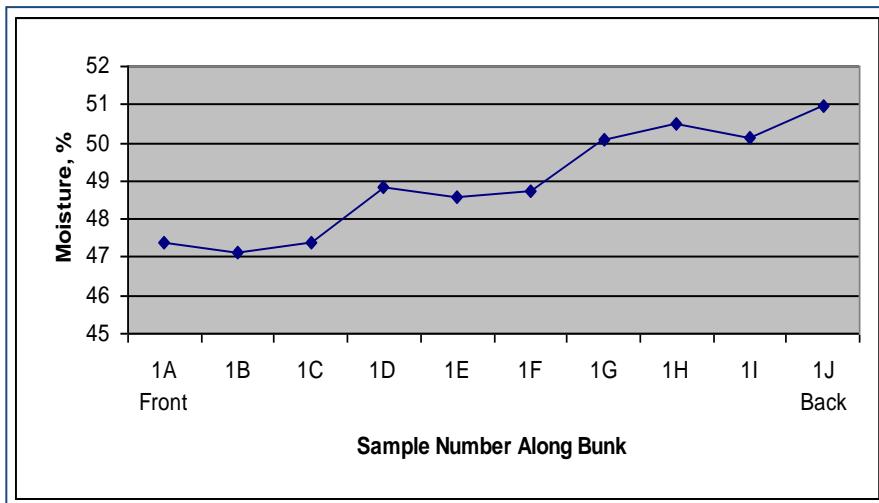
samples were taken as the diet was delivered to the cows. Ten samples were taken from the beginning of the feed-out to the end of the feed-out. Moisture distribution and crude protein (CP) distribution of the TMR were determined (Graphs 1 and 2).

In this evaluation, TMR moisture levels had a range of about 3.5% across the feed delivery. Although it was intended that all cows consume the same diet, this level of moisture discrepancy provided an opportunity for some to sort feed while others received a homogenous diet.

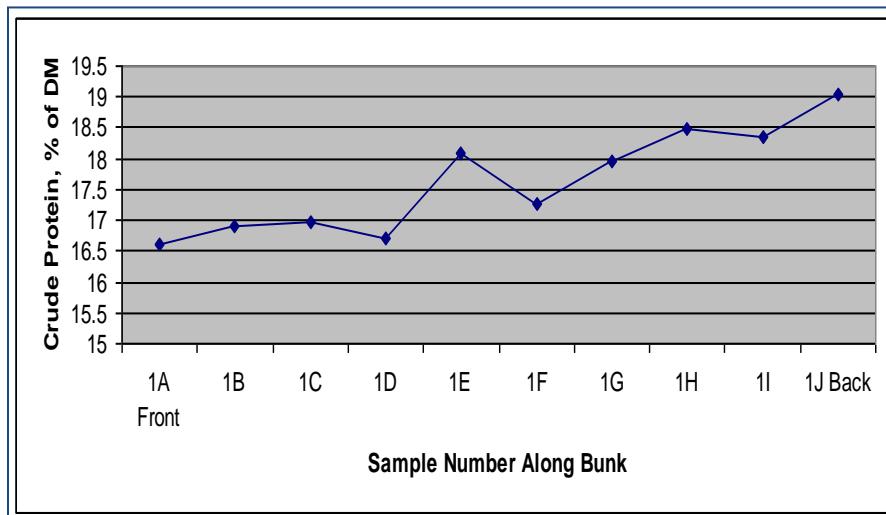
Also, this TMR ranged from just under 17% CP for more than 40% of the feed delivery, up to 19% CP towards the end of the delivery. Therefore, cows fed this ration were taking in significantly different levels of protein. Few were likely to consume the target crude protein that had been formulated.



***Photo 3. Liquid supplement loading location (Graphs 1 and 2).***



**Graph 1. Moisture distribution in TMR mixed after adding a liquid supplement to the back of the mixer (Photo 3).**



**Graph 2. Crude protein distribution in TMR mixed after adding a liquid supplement to the back of the mixer (Photo 3).**

This example uses liquid supplement inclusion to emphasize the importance of location of loading into the mixer. However, exactly how liquids are added to the mixer also is important.

### Loading liquids

Through the TMR Audit process, Diamond V Dairy Advisors have concluded that the best method for adding liquids to any mixer is to have equal distribution centered across the mixer. This can be achieved by using a liquids distribution bar that is roughly two-thirds the length of the mixer (Photo 4).



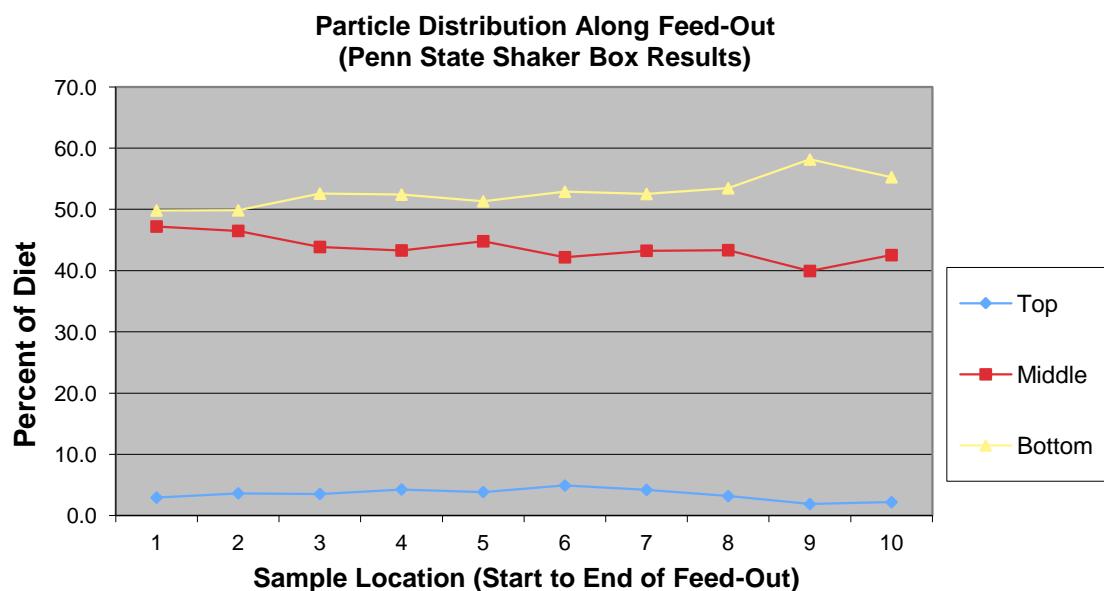
**Photo 4. Liquids distribution bar centered across mixer.**

In determining the best method, Dairy Advisors compared results for water added to the front of a mixer with front load-out (Photo 5). After mixing and distribution, 10 samples were collected along the feed-out. The Penn State Shaker Box was used to determine particle length distribution along the feed-out (Graph 3).



**Photo 5. Water loaded at front of mixer.**

**Graph 3. Particle distribution of a TMR in which water was loaded at the front of the mixer.**



Water added to the front of the mixer tended to stay in the front of the mixer, as shown during sampling in the bottom and middle trays of the Penn State Shaker Box. With more moisture in the front of the mixer, smaller particles stuck to the medium-size particles found in the middle tray.

However, during delivery, the ration became drier and the smaller particles did not have enough moisture to stick to other particles. This resulted in more fine particles in the bottom tray and fewer in the middle tray (indicated in Graph 3 by the separation of red and yellow lines from left to right).

Poor liquids mixing like this can result in sorting by cows. In some cases, considerable dry matter intake variability can occur. The fix is easy: Center the liquid distribution bar over the mixer, with the bar extending two-thirds the length of the mixer.

It is also important to have enough holes in the liquids distribution bar to allow equal flow across the bar (Photo 6). Also, the bar must remain level during operation or there is going to be unequal flow to one end of the mixer.



***Photo 6. Liquids bar with enough holes and kept level for even liquids addition.***

#### **Mixing on the level**

When TMR mixers are not level during ingredients loading or mixing, ingredients tend to migrate to the lowest part of the mixer. This is especially the case for dry, fine ingredients. Again, the result is poor mixing and uneven particle distribution at feed-out.

The two most common causes of off-level mixers are the attachment at the tractor (Photo 7) and an off-level loading area (Photo 8). In most cases, it is easy to re-adjust the attachment to the tractor. In some cases, the attachment cannot be adjusted due to the location of the PTO, but these cases are rare.

Usually, it's a bigger problem to fix the mixer loading area, particularly on sloping ground. The fix may be as easy as moving the mixer a few feet, or as challenging as having to level the area or build it up with concrete. Such fixes make a positive impact on mixing and, while results may be hard to measure, they are going to help reduce variability in rations.



**Photo 7. Off-level mixer – adjustment at tractor recommended.**



Our goal is to ensure cows receive the most consistent ration possible. Best practices of proper loading location, proper liquid loading, and loading and mixing with a level mixer go a long way towards delivering the consistency our cows need.



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