

Is day-to-day variation in bunkers worth correcting?

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Everyone knows that feed from haylage and corn silage bunkers will vary in composition from day to day. What is not so clear is the magnitude of this variation, and whether it might be worth it, economically and environmentally, to rebalance dairy rations daily to correct the variation. Providing excess feed likely will mitigate the effects of day-to-day silage variability, but this increases feed costs and is less environmentally acceptable.

Many farms rebalance dairy rations weekly. A few attempt daily rebalancing. A better understanding of day-to-day variability of bunkers within a week is the first step to assess the potential benefits of daily rebalancing of rations. The most practical component to focus on for daily rebalancing is dry matter (DM) concentration; however, DM can be difficult to measure accurately, particularly in mixed haylage.

MEASURING DM ON THE FARM

Farms typically do not have a laboratory drying oven, but there are several methods to generate DM values on farm. A Koster moisture tester, a microwave oven, or a kitchen air fryer can be used to accurately determine the moisture in a ~100-gram sample in about 30 minutes or less. All require a small scale to weigh wet and dry forage.

Anyone who has attempted to dry forage in a microwave oven, however, knows how easy it is to char the sample or start a fire. A Koster tester or an air fryer have two main concerns: 1) the time involved to get a result and 2) getting a representative subsample to dry. A 100-gram subsample is very small, decreasing the odds of getting a representative subsample. Adequate subsampling is as critical as the original sampling process.

SILAGE VARIABILITY IN BUNKERS

Every measurement has inherent error. Even a simple tape measure has error associated with readability. If you are to employ a measurement technique to manage on-farm variability, the first step is to understand how that variability compares to the measurement error. What we are looking for is a high variability in the measured parameter and a relatively low measurement error. Consequently, we needed to first assess the variation due to sampling and analysis (measurement error) before we can effectively evaluate the actual day-to-day variation in bunkers.

Sampling bunkers

We collected corn silage and alfalfa-grass haylage samples daily from seven dairy farms in central and western N.Y.

during the winter of 2019 to 2020, with a total of 24 weeks of haylage and 22 weeks of corn silage, sampled daily. Grass percent in mixed alfalfa-grass haylage from farm to farm ranged from 10 percent to 90 percent. Size of silage bunkers ranged from 40 to 110 feet wide with silage stacked 10 to 30 feet high.

Farm crews daily defaced bunkers, and samples were collected from eight to 10 different spots in the pile across the bunker width soon after defacing, avoiding approximately 6 feet on the ends of the bunkers. An O-ring sealed plastic bucket was filled with silage (about 8 to 10 lbs.). Samples were either processed daily immediately after collection, or they were kept at low temperature in sealed buckets until processed. A good representative sample collected from bunkers tends to be too large to process for analysis, such that subsampling of the larger sample is required.

To estimate the variability in sampling and analysis, we collected multiple samples and used multiple subsampling of those samples on several farms. All samples were evaluated for DM in duplicate, and all laboratory analyses were performed in duplicate. This study was recently published in the *Journal of Applied Animal Science*. For additional details of the study, please

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refer to this journal.

Figure 1 shows the range of measurement error for DM compared to crude protein (CP). There is much more error associated with sampling and analysis of DM versus CP. As might be expected, mixed haylage was more variable than corn silage, but much more variable for DM. This variation in sampling and analysis needs to be considered when assessing the actual day-to-day variation in bunker forages.

Weekly variation in DM

We assumed that we need at least a five percent unit range in DM over a week to potentially benefit from daily ration rebalancing. We added two percent units to take into account sampling/analysis variability. A seven percent unit threshold for weekly range in DM was exceeded 14 percent of weeks for corn silage and 42 percent of weeks for alfalfa-grass haylage (**Figure 2, red lines**). A significant range in weekly variability was also found for forage

quality traits such as NDF, ADF, and fiber digestibility.

It is very difficult to evaluate the impact of changes in DM between formulated rations and fed rations. When complex computer models assess the impact of transient changes in ration DM, they often conclude that cows will give up body fat instead of reducing milk production. Therefore it is not practical to simply associate daily variability in forage DM with a loss of x lbs. of milk per day. Nevertheless, it seems likely that daily ration balancing can be economically and environmentally beneficial, if on-farm estimations of DM can be determined with sufficient accuracy.

Bunker sampling issues

There are safety risks to sampling bunkers. At the onset of daily sampling, we were primarily concerned about the risk of bunker face collapse. After many weeks of daily sampling, we reassessed our risks in this order:

- 1** Slipping on ice, often present on bunker floors, frequently lightly coated with snow (plus the requirement to wear slippery disposable boot covers).
- 2** Avoiding the almost constant vehicle traffic, with operators in a hurry and not expecting anyone to be wandering around near bunkers.
- 3** Small, but deadly, risk of bunker face collapse.

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FIGURE 1

Sample variation associated with sampling and analysis of dry matter (DM) versus crude protein (CP).

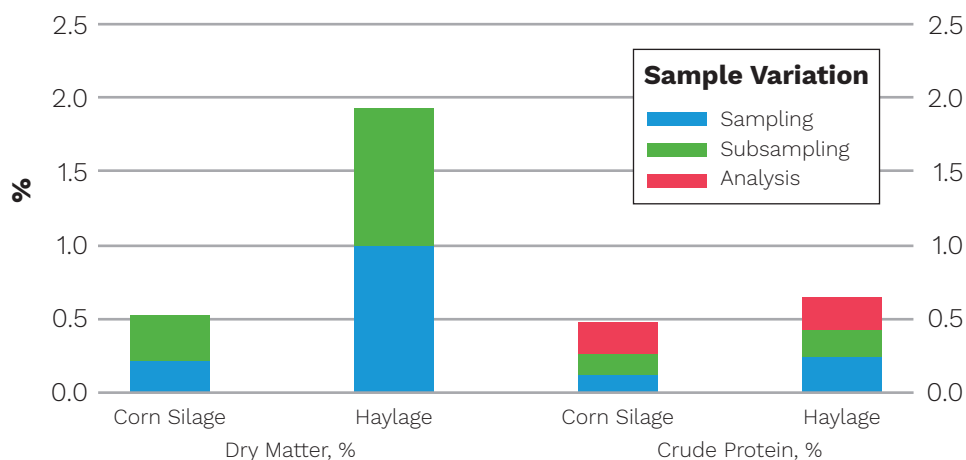
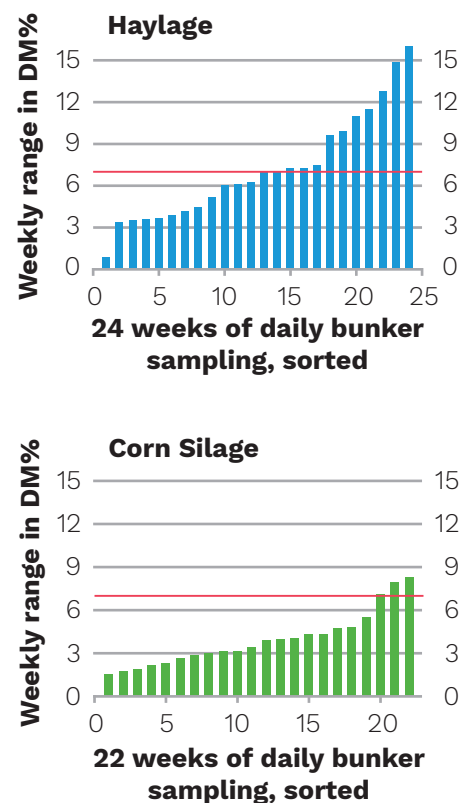


FIGURE 2

Weekly range in dry matter (DM) percentage in haylage and corn silage, sorted from smallest to largest.



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All three of the above could result in serious injury.

SUMMARY

A representative bunker sample requires collection of enough material that it will need to be subsampled to process the sample for analysis. All silage sampling is subject to sampling, subsampling, and analysis variability. Consistent sampling procedures and consistently utilizing the same forage analysis laboratory can minimize variability in all three. In practice, sampling and analysis errors are likely to be larger than we observed, as we were meticulous in our procedures.

Taking into account the random error due to sampling and analysis,

weekly variation in silages was still large enough to potentially benefit from daily rebalancing of rations. Other options to heated drying methods, such as handheld near infrared (NIR) analyzers, may be practical for on-farm moisture estimations. A better understanding of day-to-day variability over a week will be helpful when determining the accuracy required for on-farm silage moisture determinations.

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Sampling bunkers can be dangerous.

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