

Quantifying the Extent and Impact of Mixing Accuracy on Dairy Farms

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Introduction

Feed efficiency is one of the most important factors to consider in farm production and the accuracy of feed delivery is an important component of farm feed efficiency. It is well known that the diet delivered to the cows can differ from the one that is formulated. Errors in the amounts of feeds included in a diet can increase variability in the diet composition. Frequent or large changes in diet composition can compromise the fulfillment of the nutrient requirements and therefore affect the cow's performance (Sova et al., 2014).

Methodology

Feed delivery records from six dairy commercial farms were collected during the winter of 2020 and summer of 2022. Each of the datasets was subjected to a cleaning process which included standardizing ingredient names and adding the pen count, batch ID, and laboratory analysis to the feed delivery datasets. We then calculated the error in DM delivered for each ingredient by taking the absolute value of the difference between the actual amount of the feeds delivered to each pen and the targeted amount. In addition, we identified outliers, classified them into systematic errors or real errors, amended or removed systematic errors, and summarized the cleaned datasets by pen, feed, and farm to quantify the accuracy of feed delivery across these factors.

Preliminary Results

After analyzing the six farms we found that 1.10% of the data contained systematic errors. The main systematic errors found were due to recording errors during a transition of ingredients, time offsets when the target levels were adjusted, ingredient exhaustion, and typing or software mistakes. The errors observed in Figure 1 between the target and the actual delivered corn silage (lbs DM) do not include systematic errors and illustrate an example of real errors in feed delivery that impact the accuracy of the diet mixing process.

Averaged across all 6 farms, the delivery errors for lactating cow pens showed differences between the ingredients (Figure 2). Corn meal had the largest median error (18 lbs DM) even though the average inclusion rate was relatively small at 11.9%. This was followed by corn silage with a median error of (17 lbs DM) which had a much higher inclusion rate of 30.7%. These were followed by the premix (14 lbs DM), haylage (12 lbs DM), soybean meal (7 lbs DM), and whey (2 lbs DM) which had respective inclusion rates of 19.4%, 11.4%, 3.5%, and 1.5%. Except for corn meal, the median errors appear to decrease

with the ingredient’s inclusion rate. The disproportionate mixing errors with respect to the inclusion rate seen for corn meal represent an opportunity for improving the feed delivery accuracy of this feed and therefore the IOFC of dairy farms. Further investigation into the causes of these errors will help identify specific recommendations to reduce mixing errors.

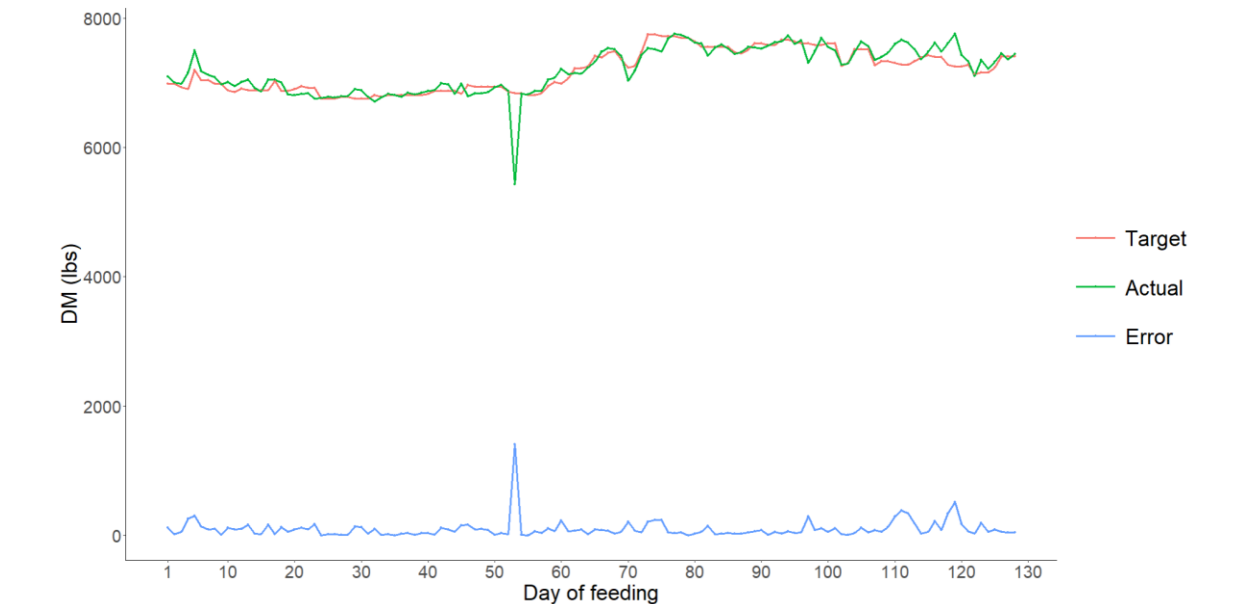


Figure 1. Difference between the target and the actual DM of corn silage delivered to the cows.

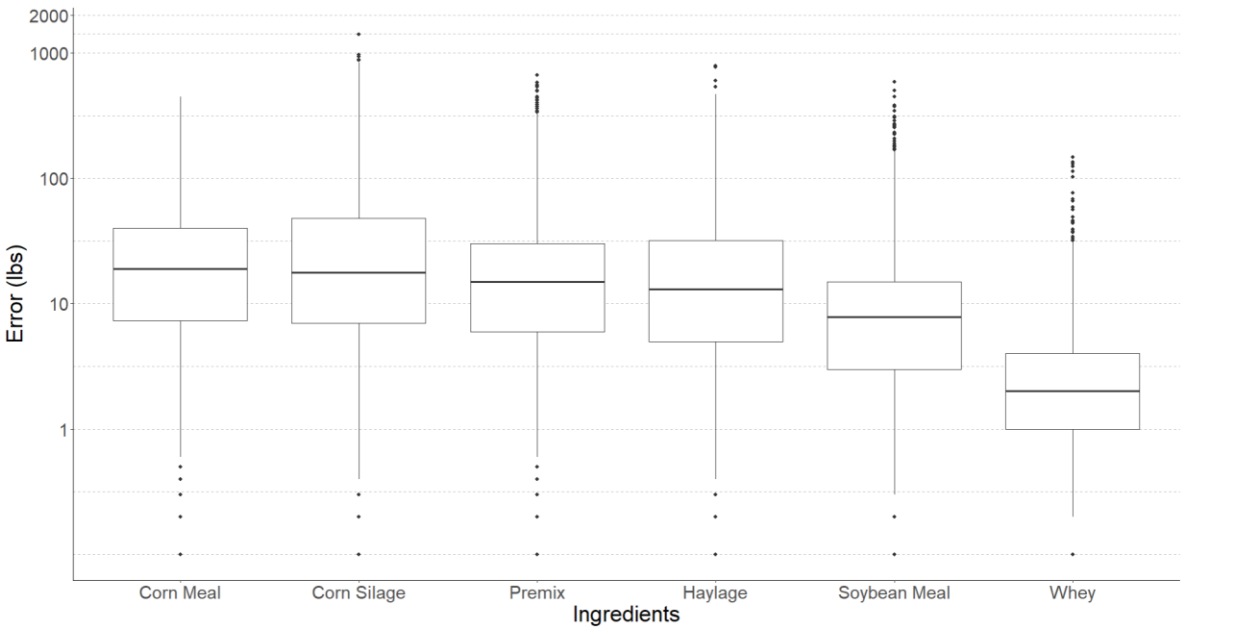


Figure 2. Boxplots of the absolute value of the error in mixing feed ingredients (DM lbs) on a log scale fed to lactating cow pens from six dairy farms over ~6 months.

Take Home Message

The systematic errors found on the datasets show that there is still space for improving methods for feed mixing data collection and cleaning to increase the utility of this data. Our preliminary analysis of the true errors in feed mixing quantified the impact of feeding accuracy on dairy farms and while median errors were relatively small, the data is highly skewed with large outliers that could still represent a false data record despite our rigorous data cleaning method. Feed delivery and inventory software developers and farmers should work together to make the data collection process more accurate and inferences from the data more accessible.

References

Sova, A. D., S. J. Leblanc, B. W. McBride, T. J. DeVries. 2014. Accuracy and precision of total mixed rations fed on commercial dairy farms. *Journal of Dairy Science* 97(1):562-571