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# Utilize NIR analysis to assist in reducing feed ingredient costs

*Emerging near-infrared reflectance (NIR) technologies are making NIR more accessible across the entire feed industry.*

NUTRITION continues to be one of the most critical factors in animal production, with feed costs accounting for up to 80% of the total variable costs.

Least-cost feed formulation software allows nutritionists to construct a diet that meets the requirements of the animal while also considering feed ingredient cost and nutrient content. However, there is considerable variation within an ingredient due to several factors, including cultivar, soil quality and the growing, harvesting and post-harvesting conditions.

The extent of this variability and its potential economic impact is a challenge for feed manufacturers and producers in the U.S. and elsewhere.

## Obstacles, drawbacks

Wet chemistry is the most widely used method to evaluate ingredient nutrient content. While useful, wet chemistry may not address the question of ingredient variability, which presents a risk of underestimating or overestimating nutrients, leading to economic losses and/or poor animal performance.

In addition to inherent wet chemistry variability (user error, assay variability and laboratory-to-laboratory variation), there is an average one- to two-week turnaround time to receive results after ingredient submission.

Published references (such as those included in the National Research Council publications or the *Feedstuffs* ingredient analysis table) are another resource nutritionists use to assign ingredient nutrient values. However, published references only present an average nutrient value and do not provide knowledge of ingredient variability, compositional differences between batches and changes over time.

## New NIR developments

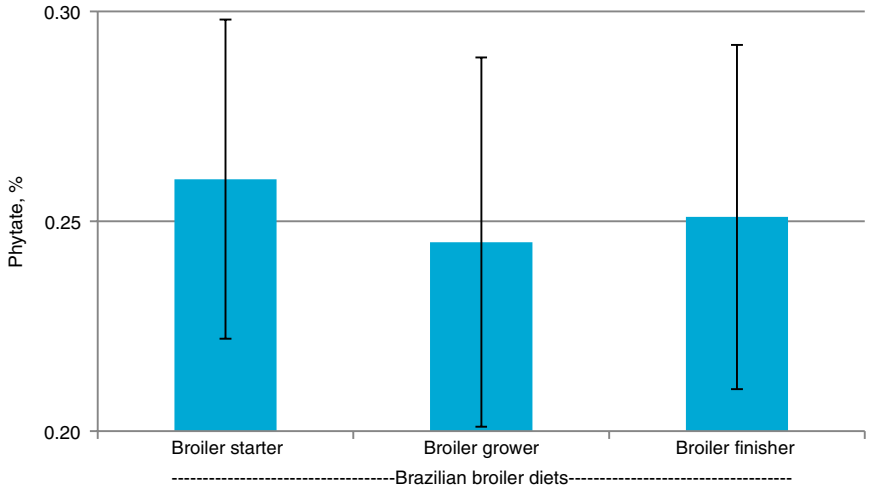
With an increased focus on ingredient knowledge and quality control, near-infrared reflectance (NIR) manufacturers and software developers have introduced new products into the market that are able to help the modern-day nutritionist better understand feed ingredient quality and variability.

NIR obtains a chemical profile of an ingredient sample and, thus, predicts parameters such as water, protein and fat. This enables on-site analysis and represents an opportunity for the nutritionist to better optimize diet formulation and costs.

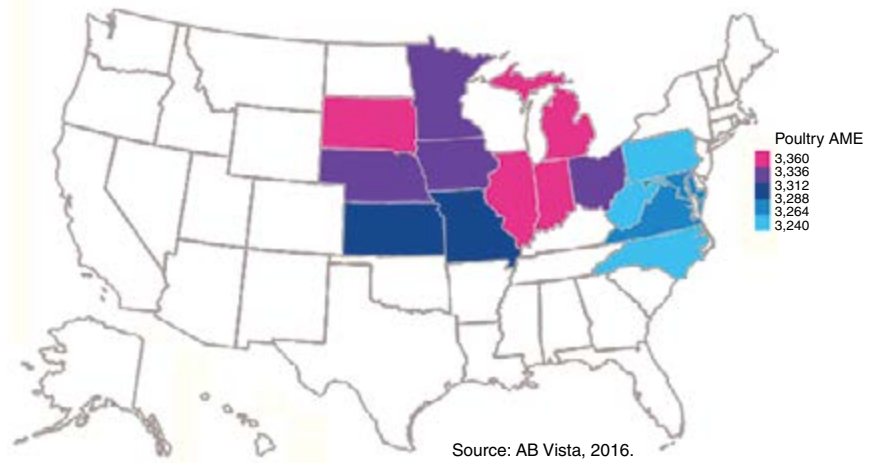
Hardware advances such as portable NIR devices can be used on the farm or in the feed mill, providing greater flexibility, and software developments have allowed web-enabled analyses and programs that transfer NIR data directly into feed formulation software.

NIR equations have previously been limited to predicting proximate values of raw materials. However, advances in NIR technology now make it possible to predict additional parameters, including the phytate content of raw materials and complete feeds, the apparent metabolizable energy

**1. Variability in phytic phosphorus levels in Brazilian broiler complete feeds**




**2. Variability in the average poultry AME (88% dry matter, kcal/kg) value of corn samples (n = 834) collected in a 2016 U.S. corn quality survey**



(AME) content of corn and wheat and the reactive lysine content of canola and soybean meals.

## Measuring phytate

Phytate varies among different feedstuffs and within a single raw material. NIR technology can analyze phytate content, giving the nutritionist confidence that there is enough substrate for a phytase enzyme to act on.

Figure 1 demonstrates the variation in phytate among different Brazilian broiler feeds, illustrating the wide variation within feeds.

NIR can be used as a tool to check the potential substrate for phytase in complete feeds. The presence of higher levels of phytate in broiler feeds means there is greater opportunity to make the phosphate in this phytate available by using higher doses of efficient phytases.

## Corn variability analysis

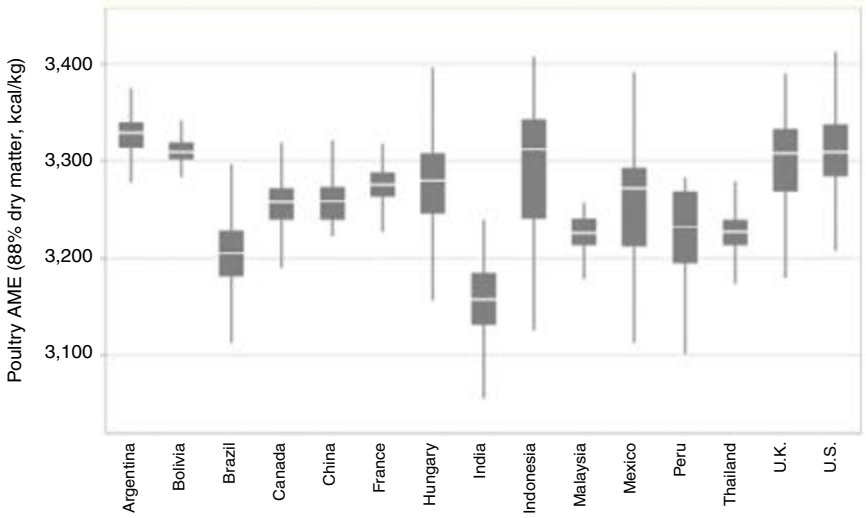
Monitoring corn variability has previously involved time-consuming and expensive methods of analysis. The historical nature of the results meant that past averages and ranges were used as a guide to adjust formulations, but there was little opportunity to adjust formulations based on actual corn batch analysis.

Advances in NIR technology can be used to predict the AME of cereals, including corn, which has been shown to vary by as much as 360 kcal/kg among samples. NIR can help nutritionists better understand their corn variation, optimize diet formulation and monitor incoming corn from suppliers.

As shown in Figure 2, this technology can help track changes in nutritional value, for example, between harvest years and regions. It also enables analysis results to be generated rapidly enough to enable formulations to be adjusted in real time to account for corn quality variation, thereby delivering improved accuracy of formulation, greater consistency of nutrient supply and potentially substantial cost savings by reducing the need to "over-specify" diets.

The data in Figure 3 are broken down by country using a box and whisker plot to show the full extent of the predicted AME variation. It highlights the extent of variation experienced within some countries and the differences among countries.

**3. Variation of poultry AME content in 56,558 global corn samples**




Note: Narrow gray bar shows full extent of variability (excluding outliers), wide gray box shows range for 50% of samples closest to the median and white line indicates median

Source: AB Vista, 2016.

The potential for economic improvement comes when the total AME variability is large, such as in Brazil, Mexico and the U.S., where the range was found to be around 200-300 kcal/kg. Yet, it is also important to recognize that even the 50-100 kcal/kg differences measured in countries such as Argentina still represent considerable potential wins if effectively accounted for during diet formulation.

The reduced cost, quicker turnaround time and ease of use with NIR allow much more frequent analyses of cereal quality.

## Lysine content

Heat damage can also affect the precision and cost-effectiveness of diet formulation. As lysine is heat processed, it loses its nutritional value through the formation of, for example, Maillard products — meaning that reactive lysine (a measure of intact lysine after processing) should be analyzed.

Recent NIR analyses of 300 soybean meal samples showed that reactive lysine accounted for up to 99% of the total lysine. However, reactive lysine can drop considerably when the soybean meal is over-processed, negatively affecting its nutritional value. NIR soybean meal analysis can be used to help identify the extent of the heat damage by evaluating the reactive lysine content.

## Improving accessibility

NIR technology can be used to determine the nutrient content of feedstuffs and feeds in a cost-effective and timely manner. These latest software and hardware developments can help nutritionists better understand their feed ingredients.

Emerging technologies such as centrally maintained online calibrations, pay-as-you-use calibrations, portable NIR and affordable in-line NIR installations are making NIR technology more accessible across the entire feed industry. The subsequent expansion in the number of NIR-analyzed results available for industry-wide interpretation brings additional potential benefits as the main trends in feedstuff variability become both clearer and more accurate. ■