

COMPARING SOYBEAN MEAL PROCESSING CONDITIONS

The digestibility of soybean meal in animal diets can be impacted by the quality of soybeans and soybean meal. Soybean quality is impacted by genetics, environment, management, transportation, storage, and handling. Soybean meal quality is impacted by soybean quality as well as soybean meal processing, transportation, storage, and handling. When evaluating processing conditions, certain indicators can be used to evaluate if soybeans and soybean meal were handled and processed correctly, at origin or destination. These metrics are important because they indicate the quality of the processes, which relate to the quality of the soybean meal produced.

While animal nutritionists have different opinions as to the relative importance of each, there is general agreement that the following four common processing indicators should be used to evaluate soybean meal quality:

Reactive Lysine to Total Lysine Ratio (RLys/Lys): This ratio measures reactive lysine, which is available for digestion in monogastric animals, to total lysine content. Reactive lysine is the amount of total lysine that is bioavailable to the animal. A higher ratio means less heat damage to the soybean meal.

TIA (Trypsin Inhibitor Activity): Trypsin inhibitors are antinutritional factors that are negatively associated with protein digestion. Trypsin activity in the soybean plant is a protective mechanism and increases when under stress. Correctly processed soybean meal should have TIA less than 2.5mg per gram of soybean meal (or 0.25%). TIA should be reduced with proper heat treatment.

KOH Solubility: KOH Solubility differentiates overheated soybean meal from correctly processed meal. Correctly processed soybean meal should have a KOH value between 73-86%. Values lower than 73% have been shown to decrease animal performance because less protein is soluble.

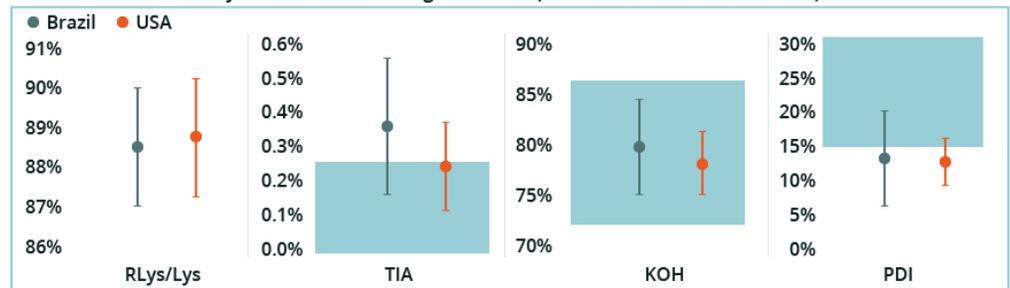
PDI (Protein Dispersibility Index): PDI is considered a more consistent and sensitive indicator of adequately heat processed soybean meal than KOH solubility. Soybean meal with a PDI of 15-30% is adequately heat processed.

Properly processed soybean meal will have higher reactive lysine to total lysine, low TIA, and adequate KOH and PDI. These indicators are sensitive to heat during processing, so precision in soybean meal processing is critical.

¹Data obtained from Evonik and summarized based on international trading specifications and includes observations with crude protein values between 46.0-49.0% and fiber values between 3.5-3.9%.



Soybean Meal Processing Indicators (Mean and Standard Deviation)



Note: the green shading represents the preferred range for each indicator. For Rlys/Lys, no range is specified as higher values are preferred.

The following are comparative summaries of these indicators between the U.S. and Brazil using soybean meal data¹ collected from January 2020 through May 2021.

The U.S. has a slight advantage in the Reactive Lysine to Total Lysine Ratio (Rlys/Lys).

The difference between these mean values is statistically different (t-test at 1%). There is also a slight advantage when considering the variability (standard deviation), with the ratio in U.S. soybean meal being 0.6% less variable.

U.S. soybean meal has significantly lower Trypsin Inhibitor Activity (TIA)

and on average is within the preferred range of being correctly processed. The TIA for U.S. soybean meal is 2.4 mg per gram of meal (or 0.24%), which is within the preferred limit. This compares to 3.6 mg per grams of meal (or 0.36%) in Brazilian meal, which is above the preferred limit. The difference between these mean values is statistically different (t-test at 1%). In addition, TIA in U.S. soybean meal is more consistent, with 34% less variability (standard deviation). The U.S. has an advantage in TIA likely due to improved drying conditions and better equipment used during processing.

KOH is lower in U.S. soybean meal. The difference between these mean values is statistically different (t-test at 1%). However, the variability (standard deviation) of KOH in U.S. soybean meal is 34% lower.

Protein Dispersibility Index (PDI) is slightly lower in U.S. soybean meal. These mean values are not statistically different (t-test at 1%). Nevertheless, PDI in U.S. soybean meal is much more consistent, with 50% less variability (standard deviation).

For a more holistic understanding of the quality of soybean meal, it is important to look at all indicators as a group and not in isolation. **Considering these four processing indicators, U.S. soybean meal is processed under better conditions.** The higher moisture content in soybeans grown in other regions requires increased heat application to the whole soybean and in processing the soybean meal. The higher damage reported in soybeans from these regions also influences these indicators. These factors impact the quality of the soybean meal and is demonstrated in the differences of these indicators when comparing the U.S. and soybean meal from other origins. It should also be noted that storage of soybean meal can negatively impact these indicators, so storage conditions and length of storage are critical to the quality of the soybean meal. Correct processing has implications for the quality of the protein in the meal. If soybean meal processing indicators are outside acceptable levels, soybean meal inclusion in diets will be minimized and alternative ingredients will be used in formulating diets. In addition, these indicators reveal a more consistent (less variable) soybean meal, ensuring a more uniform product that is more predictable and reliable when formulating animal diets.

To learn more about how U.S. Soy can enable your business, please contact your U.S. Soybean Export Council (USSEC) region or country representative; or submit your contact details via <https://ussec.org/contact/>.

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