Soybean Meal, the Past and Future

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The Composition of Soybeans Today: Measurement, Nutrient Content and Geographical Influence; Seth Naeve (University of Minnesota, St. Paul, MN.) and Nick Bajjalieh (Integrative Nutrition Inc., Decatur, IL.)

Soybean Meal Processing the Mechanics: Yesterday, Today and Tomorrow; Richard Clough (Texas A&M University, College Station, TX.)

Bioassay Measurement and Soybean meal Contribution: Past and Present; Carl Parsons (University of Illinois, Urbana, IL.)

Opportunities That Trait Enhanced Soybean Meal Brings; W.A. Dozier and K.R. Perryman (Auburn University, Auburn, AL.)

Where Soybean Nutrients Can Take Us in the Next 20 Years; John Schillinger and Harlan Hochstetler (Schillinger Genetics, West Des Moines, IA.)

The Composition of Soybeans Today: Measurement, Variation and Geographic Influence

Seth Naeve and Nick Bajjalieh

The nutritional characteristics of soybean meal are the basis for its usage as an ingredient in animal feeds. The composition of the soybeans from which meal is produced is directly related to the nutritional characteristics of the meal from which it is produced. Soybean composition varies not only across geographic regions, but also within. Depending upon how this variation is managed, it represents either a cost or an opportunity. As with any situation, its management is dependent upon an understanding of what is involved and the development of approaches for optimizing benefit through either greater control or adaptation.

Key to a better understanding of this opportunity is the ability to measure nutritionally relevant characteristics with a high level of confidence. While imperfect, as are most other measurement approaches, NIR represents the best tool currently available. Learning's from a project which compared different NIR platforms for their ability to measure total amino acid levels in soybeans are used to identify some of the inherent issues. Information from this as well as some other projects is used to describe the performance capabilities of this analytical tool.

Results from two approaches for surveying the composition of U.S. produced soybeans are presented and used to describe the extent to which the U.S. crop, as it leaves the farmer's field, can vary. The extent to which nutritionally relevant meal characteristics vary, and associated economics, define the near-term opportunity associated with the better management of this important resource.

Soybean Meal Processing and Mechanics: Yesterday, Today and Tomorrow

Richard Clough

Soybean is the key source of protein used in animal feed throughout the world. Important reasons for this are that soybean's protein content is complete and it contains the highest level of protein among the major commodities. The vast majority of soy protein is produced as meal by large oil mills through solvent extraction. The final quality of such meal will be within trading rules specified within the National Oilseed Processors Association; however, the digestibility level of the protein, as well as content of anti-nutrition compounds, may vary. This presentation will cover past and present methods of processing soybean into meal and oil fractions while emphasizing how unit processes impact their quality. The goal is to underscore where there is potential to improve the value of soy feed ingredients by making changes to the processing itself or through the introduction of soybean having novel output traits.

Bioassay measurement and soybean meal contribution: Past and present

Carl Parsons

Several poultry energy bioassays have been used for dehulled soybean meal (SBM) and other types of soybean feed ingredients. In the 1930's and 1940's, the energy value of SBM was estimated as productive or net energy. Later, in the 1950's and 1960's, chick assays (based on excreta collection and ingredient substitution into a reference diet) were developed for determining apparent metabolizable energy corrected to zero nitrogen balance (ME_n) were developed. The ME_n values for SBM were generally in the range of 2400-2450 kcal/kg. In the mid 1970's, the true ME (TME) assay using tube-fed or precision-fed roosters was developed and the initial TME values for SBM were higher than the earlier chick ME_n values. Later work showed that these differences were primarily due to not correcting TME values to zero nitrogen balance and that rooster TME_n values for SBM were similar to chick ME_n values. Currently, both bioassays are used extensively. For amino acid digestibility or bioavailability, several assays have been developed and used. These include the chick growth slope-ratio assay, the precision-fed cecectomized rooster assay (same feeding method as the TME assay), and the standardized ileal amino acid digestibility assay with broiler chickens (SIAAD). The latter two bioassays are used more extensively due to time and costs. In addition, a new precision-fed ileal chick amino acid digestibility assay has been developed which combines the methodology of the cecectomized rooster and SIAAD assays. Research thus far has not shown consistent differences in values obtained among the different assays, although the rooster values tend to be higher than the values obtained with chicks in some instances. The lower values for chicks, when occurring, may be primarily due to collecting the contents of the entire ileal section of the intestine in the ileal digestibility assays. All bioassays, however, seem to be acceptable for determining amino acid digestibility and all of the assays yield high values for amino acid digestibility of good quality SBM (e.g., lysine digestibility is usually 90% or higher).

Opportunities that trait enhanced soybean meal brings

W. A. Dozier, III and K. R. Perryman

Energy content of soybean meal is (SBM) is not well utilized by poultry. Trait enhanced SBM types have been developed by altering carbohydrate composition to ameliorate poor energy utilization of SBM by poultry. These novel SBM types consist of low oligosaccharide SBM (LOSBM) and ultra-low oligosaccharide SBM (ULSBM), which have a reduction in raffinose and stachyose content of 75 and 90%, respectively compared with conventional SBM. Four thousand ninety-two Ross × Ross 708 male broilers were utilized in 6 experiments conducted over 2 yr (2 AME_n assays, 2 amino acid (AA) digestibility assays, and 2 growth assays) to determine the effect of feeding

LOSBM and ULSBM to broilers compared with a conventional SBM (CSBM). In 2010, broilers fed LOSBM had a higher ($P = 0.011$) AME_n (2,241 vs. 2,435 kcal AME_n/kg) and higher ($P < 0.002$) digestible AA content. When these values were used to formulate diets for a 6 week production period, no negative growth or carcass responses were observed, and dietary fat concentrations were reduced between 56.3 and 71.1%.

In 2011, 3 additional experiments were conducted to evaluate LOSBM, ULSBM, and CSBM. Broilers fed diets containing LOSBM had higher ($P = 0.012$) AME_n (2,214 vs. 2,073 and 2,080 kcal AME_n/kg) compared with birds fed CSBM and ULSBM. Both ULSBM and LOSBM had higher ($P < 0.001$) digestible AA content compared with CSBM, with ULSBM having the highest AA digestibility. In the growth assay, broilers were fed diets formulated with determined AME_n and digestible AA values of the 3 SBM types (ULSBM, LOSBM, or CSBM), which resulted in similar growth and meat yield responses. Furthermore, birds fed diets formulated with ULSBM had superior ($P \leq 0.001$) feed conversion from 1 to 28 and 1 to 42 d of age compared with birds consuming LOSBM and CSBM based diets. Diets formulated with LOSBM and ULSBM had fat concentrations reduced by up to 70% compared with CSBM based diets. Due to the better nutrient profile of LOSBM and ULSBM, less supplemental fat can be utilized in diet formulation without any adverse effects on growth performance or carcass characteristics.

Feed Performance of Low Oligosaccharide and Low Trypsin Inhibitor Soybean Varieties

John Schillinger and Harlan Hochstetler

Schillinger Genetics has developed a non-GMO soybean product line-up that promises to deliver improved nutritional value to poultry producers. These products provide improved nutrition through increased protein content, as well as significantly reduced oligosaccharide and trypsin inhibitor contents. The recently released varieties with two or more of these traits perform in a highly competitive manner in the field trials. Data from nine poultry feeding trials conducted 2006-2012 have been positive in regard to higher ME (Kcal/gm) and feed conversion of birds on control diets. The high protein and low oligo soy meals in Dale's studies have produced 2.91 and 2.98 TME values versus 2.75 TME for control meal. The TME/GE values were 61.4% and 62.6% versus 59.0% for controls. Dozier, in 2010 broiler studies, found FCR values for low oligo were 1.470 vs. 1.477 for control for first 28 days and 1.585 vs. 1.601 at 40 days. Dozier also found that birds fed low oligo meal had a significantly higher AME_n (2.435 vs. 2.241 Kcal/gm), compared to the standard corn soybean meal. Hulett (2010) found that birds fed of SG high protein, low oligo and low trypsin diets had improved feed intake, growth rate and FCR compared to control diets. In poultry feeding trials of SG soybeans, where two SG varieties of soybeans with ultra-low (5,000 TIU) and low (16,000 TIU) cold pressed SG meals were compared to SBM. The TME_n values of two low TIU meals were 3.684 and 3.814 versus 3.000 Kcal/gm for SBM control.