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The U.S. Department of Agriculture updated their estimates for soybean and soybean meal production with a 2009 crop year production estimate of 3.2 billion bushels for soybeans and 39.8 million tons of meal. U.S. production of soybeans is estimated to be increased by about eight percent and crush and exports near the 2008 crop year levels. The most significant change between crop years is the anticipated price of soybean meal; lower meal prices will be welcomed by the feed formulator.

Soybean Production Data

Crop Year (*)	2007/08	2008/09 (**)	2009/10 (***)	% Change
Acres Planted (million acres)	64.7	75.7	77.7	+2.6
Acres Harvested (million acres)	64.1	74.6	76.8	+2.9
Yield (bushels/acre)	41.7	39.6	41.7	+5.3
Soybean Supply and Use (Million of bushels)				
Beginning Stocks	574	205	110	
Production	2,677	2,959	3,199	+8.1
Imports	10	15	10	-33.3
Total Supply	3,261	3,179	3,320	+4.4
Crush	1,803	1,660	1,670	+0.6
Exports	1,161	1,265	1,265	0.0
Seed and Residue	91	154	174	+13.0
Total Use	3,056	3,069	3,109	+1.3
Soybean Meal Production and Use (Million short tons)				
Beginning Stocks	0.343	0.294	0.300	+2.0
Production	42.282	39.566	39.785	+0.6
Imports	0.141	0.140	0.165	+17.9
Total Supply	42.766	40.000	40.250	+0.6
Domestic Use	33.192	30.800	31.000	+0.6
Exports	9.280	8.900	8.950	+0.6
Total Use	42.472	39.700	39.950	+0.6
Average price ($/ton)	$336	$325	$260-320.	

(*) Marketing year beginning September 1 for soybeans and October 1 for meal;
(**) Estimate and (***) Projection

World Soybean Meal Supply and Use (*)

	Supply	Use	
	Production	Domestic	Exports
	(Million metric Tons)		
United States	36.09	28.12	8.12
Argentina	27.45	0.68	26.80
Brazil	24.49	12.74	11.85
China	34.23	33.80	0.63
India	6.94	2.37	4.80
EU-27	9.53	32.54	0.32
Other Countries	19.48	47.56	2.55
World Total	158.21	157.81	55.07

(*) Projected for the 2009/2010 marketing year.

Reference: *U.S.D.A. Economic Research Service, World Agricultural Supply and Demand Estimates; WASDE-473, August 12, 2009*

Quality Control Procedures Tests for Soybean Meal
In the United States, soybean meal is one of the most consistent feed ingredients available to the feed formulator. This is not the case in all parts of the world. Therefore, quick quality control tests are needed to assay the quality characteristics of meals, especially when the nutritionist is formulating diets with special attention to obtaining maximum performance at minimum feed cost.

During solvent processing of the soybean, lipids are removed and the meal is heated to eliminate the solvent (usually hexane) and to deactivate antinutritional factors such as trypsin inhibitors and lectin. Inadequate heating fails to completely destroy the antinutritional factors, which may have a detrimental impact on animal performance. Excessive heating reduces the availability of lysine (via the Maillard reaction) and possibly, to a lesser extent, other amino acids. Laboratory tests are thus needed to determine whether samples of soybean meal have received adequate, but not excessive, heat treatment following oil extraction. Of tests commonly used, the evaluation of urease activity (UA) is the easiest to perform, and is especially useful in detecting underprocessed soybean meal. It is less reliable for detecting overprocessed meal. The protein solubility (PS) test is the most commonly used assay to detect overprocessed soybean meal, although very high values are indicative of underprocessed meal. The protein dispersibility index (PDI) is also used primarily to detect overprocessed or adequately processed soybean meal.

Urease Test: The enzyme urease is present in soybeans, but is of very limited interest in monogastric nutrition. However, much like trypsin inhibitors and lectins, its activity is reduced by heating. A determination of urease activity is far easier to conduct than are assays for trypsin inhibitor, urease activity is frequently used as a “marker” to indirectly reflect the presence of antinutritional factors in soy products. Historically, urease activities in excess of a 0.15 increase in pH units suggested underprocessing, while activities of less than 0.05 units indicated overprocessing. However, during the past several decades, a change in soybean processing has led to the production of meals with much lower than 0.05 change in pH with no apparent detrimental effect on animal performance. In addition, the former maximum acceptable level of 0.15 pH units is no longer considered as absolute. Older birds, especially laying hens, can easily tolerate meals with a urease value of 0.25 or possibly even higher. Turkey poults may be most sensitive, as turkey starter diets frequently contain in excess of 40% soybean meal. The relative insensitivity of the urease assay as a means of quantifying overprocessing of soybean meal is due to the fact that there is no negative scale in this assay. The test is unable to distinguish between meals which may be barely acceptable versus those which are grossly overprocessed.

Protein Solubility (PS): The solubility of soybean protein in potassium hydroxide solution is inversely related to degree of heat treatment. The PS of raw soybean flour approaches 100%, while meals which have been heated to a dark brown color may have PS as low as 30 or 40%. Although definitive values are hard to establish, it is reasonable to accept that protein solubilities in the range of 78-84% reflect optimum soybean processing. Meals from 84-89% may be fully acceptable for laying hens and older broilers, which are less sensitive to antinutritional factors. In contrast, values lower than 78, and especially lower than 74% PS, reflect an incremental decrease in lysine availability for all animals.

Protein Dispersibility Index (PDI): An alternative means of evaluating the adequacy of soybean meal processing is by the protein dispersibility index (PDI). Protein dispersibility index has been used in the feed industry for almost a quarter of a century, but has only recently gained attention as a method to distinguish soybean meal quality for feed use. Protein dispersibility index measures the amount of soybean meal protein dispersed in water after blending a sample with water in a high speed blender. Work by Batal et al. (2000) suggests that PDI is a more consistent and sensitive indicator of adequately heat processed soybean meal than urease index or protein solubility in KOH. Soybean meal with a PDI of 45% or lower is adequately heat processed. This value is somewhat higher than the range of 15 to 30% recommended by the National Oilseed Processors Association. Further work is needed to determine the optimum range and maximum level for PDI in commercially-processed soybean meal. Combing the PDI test with the urease test could be useful to soybean processors and poultry nutritionists for better monitoring of soybean meal quality. For example, a soybean meal containing low urease (0.3 or below) and high PDI (40 to 45%) may indicate that the sample is definitely high quality because it has been adequately heat processed, but not overprocessed.

This reference also provides detailed descriptions of procedures for determining urease, protein solubility and protein dispersibility index. Quality characteristics of soybean meal sources can be determined following these procedures. *(Note: This is an excellent reference on methodology that can be used to determine the consistence of the soybean meal that the nutritionist is using).*

Quick reference guide for the nutritional value and assessment of soy products. Poultry Science Department, College of Agriculture & Environmental science, University of Georgia. http://www.poultry.uga.edu/soybeans/qualitycontrol.htm

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Soybean Meal Quality

A review of soybean meal was written several years ago by the technical director of the American Soybean Association in Korea. The article discussed the importance of the quality of soybean meal to the feed formulator and livestock/poultry producer in Korea. The article did a nice job of summarizing the importance of soybean quality. The article concluded by stating that the quality of soybean meal can be affected by three key factors: processing conditions, amount of soy hulls and origin. Potassium hydroxide (KOH) protein solubility and urease activity (pH measurement) are important analytical methods to determine whether or not the soybean meal is properly processed. The recommended KOH protein solubitibility for properly processed soybean meal is 75-90% and the pH increase for urease activity is 0.05-0.3. The amount of soy hulls in soybean meal can be adjusted to control the protein level of the final soybean meal product. As poultry digestive tracts are not suitable for fiber, dehulled soybean meal low in fiber will be the best protein source for poultry. Also, the origin of the meal source should be considered as factors affecting performance of poultry because there are large variations in the soybean varieties, weather and soil in which the soybeans are grown, handled and stored. *The full article can be found at:*

Shin, Soo. 2002. Soybean meal quality in Korea: Its effect on broiler and layer performance. American Soybean Association Technical Bulletin; PO45-2002. www.asaea.com

A team of Spanish researchers conducted an extensive survey of the quality of soybean meal that was being imported by Spanish feed formulators. The team obtained analytical data on 262 soybean meal samples and reported the results at the annual Poultry Science meetings. The survey data is shown in the following table.

Country of Origin		United States	Argentina	Brazil
Number of samples		134	77	51
Crude Protein	% DW basis	54.3(*)	52.0	52.9
Neutral Detergent Fiber	%	8.7(*)	10.6	11.8
Stachyose + Raffinose	%	7.7(*)	7.1	7.0
Total Phosphorus	%	0.76(*)	0.79(*)	0.68
Potassium	%	2.57(*)	2.54(*)	2.17
Iron	mg	119	129	193(*)
KOH Solubility	%	87.5(*)	81.8	8.49
Protein Dispersibility Index	%	19.8(*)	16.8	15.1
Trypsin Inhibitor	mg/g	6.1(*)	4.8	5.0
Lysine	%	3.34(*)	3.14	3.21
Methionine & Cysteine	%	1.56(*)	1.47	1.52
Threonine	%	2.12(*)	2.04	2.07

(*) The value is significantly different. ($P < 0.001$)

The researchers concluded that based on nutrient composition and protein quality measurements that the U.S. processed soybean meal is of comparative excellent quality for use in feed formulations.

Matoes, G.G. and co-workers. 2009. Influence of origin on nutritional and quality parameters of soybean meal. Annual Meeting of the Poultry Science Association, July 20-23. Abstract 99.

Soybean Quality and Broiler Performance
Two trials were conducted at the Universidad Politécnica de Madrid (Spain) to study the influence of soybean meal origin on performance of broilers from 1 to 37 d of age. The crude protein, trypsin inhibitor units (TIU), and KOH solubility were 47% and 48.3%, 5.9 mg/g and 3.4 mg/g, and 81.2% and 86.8% for the soybean meals of Argentine and USA origin, respectively. The calculated digestible lysine and AMEn content were 2.54% and 2,310 kcal/kg for Argentine meal and 2.68% and 2,390 kcal/kg for the U.S. meal. For each of the two feeding periods, starter (1 to 21 d) and finisher (22 to 37 d), the diets had similar calculated AMEn and digestible lysine content.

In trial 1, 5,200 straight-run, one-day-old Hubbard chicks were allotted to four treatments with ten replicates (a floor pen with 130 chicks). Origin of the soybean meal did not affect performance at any age. In the second trial, 1,500 straight-run, one-day-old chicks were allocated to six treatments arranged factorially with three soybean meal sources (Argentina, USA, and local) and two levels (0 vs. 250 mg/kg of diet) of plant oil extract rich in terpenes.. The local SBM contained 47.3% crude protein and had similar calculated nutritive value to the Argentine soybean meal. Each treatment was replicated five times. Results showed the birds fed U.S. and Argentine meals grew faster ($P \leq 0.001$), and had better feed utilization ($P \leq 0.01$) than birds fed the local SBM. The inclusion of prebiotic improved body weight gains and feed conversion in birds fed the local SBM, but not in those fed the other meal sources. The researchers concluded that the U.S. soybean meal had more AMEn and digestible lysine for broilers compared to the Argentine and local soybean meal and that the use of a prebiotic may improve performance in broilers fed low quality SBM.

Frikhal, M. and co-workers. 2009. Effect of soybean meal origin on performance of broilers from 1 to 37 days of age. Annual Meeting of the Poultry Science Association, July 20-23. Poster 364.

Comparison of Methods for Determining Digestible Amino Acids
The objective of this study was to determine amino acid digestibility of various feedstuffs using the precision-fed cecectomized rooster assay (PFR), the standardized ileal assay (SID), and a newly developed precision-fed chick assay (PFC). For the PFR, cecectomized roosters were precision-fed approximately 30 g of feed sample and excreta were collected 48 hours post-feeding. For the SID, 16 day-old chicks were fed a semi-purified diet containing the feed samples from days 17-21, with ileal digesta collected at day 21. For the PFC, 22 day-old chicks were precision-fed 10 g of sample mixed with chromic oxide and ileal digesta were collected at 4 hours post-feeding. Apparent digestibilities were similar for SBM and MBM between the SID and PFC assays, with values for corn being lower for the SID than the PFC assay for a few AA. Digestibility coefficients were standardized using a nitrogen-free diet (NFD) for the SID and PFC assays and using fasted roosters for the PFR assay. Standardized AA digestibility values for SBM were generally higher than those for corn and MBM. There were generally no consistent differences in standardized amino acid digestibility values among assays and values were in general agreement, particularly for soybean meal and meat and bone meal. They reported that the standardized values for some amino acids in corn were higher for the PFR than for the PFC and SID assays. The results of the study indicated that all three assays are acceptable for determining the AA digestibility of feed ingredients for poultry.

Kim, E.J. and co-workers. 2009. Comparison of amino acid digestibilities using three different methods. Annual Meeting of the Poultry Science Association, July 20-23. Abstract 93.

Using Enzymes to Improve Broiler Performance
Soybean meal often contains significant levels of soluble galactans, mannans or oligosaccharides of the raffinose series that may cause nutritional disorders when ingested. Cellulases and xylanases are very effective in improving the nutritive value of barley, wheat or rye based diets for broiler chicks through the hydrolysis of soluble glucans and arabinoxylans. A study was undertaken to identify the most important exogenous enzymatic activities for decreasing the detrimental effects associated with the ingestion of soybean meal soluble polysaccharides. The data showed that birds fed on a mash corn-soybean meal based diet supplemented with the enzyme mixture Ronozyme® VP displayed improved final body weight. *In vitro* enzyme assays suggested that the positive effect associated with the intake of Ronozyme® VP is correlated with the presence of galactanase and mannanase activities. This study suggests that hydrolysis of mannans and galactans by exogenous enzymes in maize-soybean meal based diets result in an improvement of broiler performance.

Maria S.J. Centeno, Maria S.J. and co-workers. 2006. Galactanases and mannanases improve the nutritive value of maize and soybean meal based diets for broiler chicks" The J. Poultry Sci. 43: 344-350 (Japanese Poultry Sci. Association).