Specifications for Soybean Meal

The National Oilseed Processors Association (NOPA) in the U.S. sets quality standards and describes the various processed products derived from soy. NOPA publishes an official yearbook and trading rules for the purchase and sale of soybean meal and other soy products. Also included are information on contracts, quality, sampling, laboratory analysis, weights and measures, and shipping.

The NOPA quality standards applied to domestic shipments are also followed for international shipments although contracts may be patterned after the North American Export Grain Association (NAEGA) or the Grain and Feed Trade Association (GAFTA). This ensures quality and customer satisfaction.

NOPA Guidelines for Soybean Meal

	Percent Composition	
	Non-dehulled	Dehulled
Protein, minimum	44	47.5 – 49
Fat, minimum	0.5	0.5
Fiber, maximum	7.0	3.3 – 3.5
Moisture, maximum	12.0	12.0
Anticaking agent, maximum	0.5	0.5

Recommended Quality Measurements for Soybean Meal

Ash	*less than 7.5%*
Acid insoluble ash (silica)	*less than 1%*
Lysine	*more than 2.9%*
Protein solubility index 0.2% KOH	*73 – 85% (or more if urease is within specification)*
Protein dispersibility index	*15 – 40%*
Urease activity	*.02 - .30 pH unit rise*
Trypsin inhibitor	*< 4 mg/g of meal*
Bulk density	*57 – 64 g/100 cc*
Screen analysis	*95% through #10 mesh* *40 – 50% through #20 mesh* *6% max through #80 mesh*
Texture	*homogenous, free flowing, no lumps or cakes, not dusty*
Color	*Uniform particle colors of light tan to light brown*
Odor	*fresh, not musty, not sour, not like ammonia, not burned*
Taste	*bland*
Contaminants	*free of urea* *free of ammonia* *free of mycotoxins and mold*

Additional Considerations on Quality:

KOH Protein Solubility: *Over-processing can be estimated by measuring protein solubility in a solution of 0.2% potassium hydroxide (KOH-PS). There has been a great deal of interest in this procedure. Results have been positively correlated to growth rate in both chickens and pigs (Parsons et al., 1991; Lee and Garlich, 1992; Araba and Dale, 1990). Results suggest a decline in soybean meal performance when the KOH-PS is less than 72%. Lee and Garlich (1992) examined soybean meal processed at a commercial plant for various lengths of time with up to 50% additional residence time in the desolventizer-toaster. The results indicate that samples with a high KOH-PS are most digestible as long as urease activity is below the upper recommended limit.*

Protein Dispersibility Index: *The PDI assay has been used for at least 25 years in the food industry. Recent investigations have examined the value of PDI to predict growth of chicks fed various samples of soybean meal (Engram et al., 1999). Results suggest that PDI is useful to further distinguish the quality of soybean meal that is otherwise considered to be of good quality based on urease and KOH measurements. Soybean meal with a PDI between 45 and 50% and urease of 0.3 pH unit change or below indicate extremely high quality, adequately heat processed but not overtoasted meal (Batal et al., 2000).*

Urease: *The presence of active trypsin inhibitor (TI) can be indirectly determined by measuring the activity of urease enzyme present in soy. Both TI and urease proteins are denatured and deactivated during heating. The laboratory method for urease involves mixing soybean meal with urea and water. Natural urease present in raw soybeans will release ammonia from the urea. Ammonia is alkaline and can be measured using a pH meter or an indicator dye. In the American Oil Chemists Society (AOCS) method, the end point is determined by measuring the increase in pH of the sample media. The European Economic Community (EEC) method endpoint reflects the amount of acid required to maintain a constant static pH. The EEC method gives slightly higher results than does the AOCS method. This difference should be kept in mind by buyers who are writing contracts to purchase soybean meal, as there is a greater probability that a meal tested by the EEC method may be overtoasted at the low end of the scale. Although the urease test is routinely done and often used in contract specifications, the results do not correlate well with animal performance. The urease test is only really good for detecting severely under-processed meal. Average urease values of 72 samples of high quality U.S. dehulled soybean meal were recently measured using the AOCS method by an Australian feed company laboratory. An average value of 0.24 with a range of 0.05 to 0.37 pH unit rise was determined. All samples showed urease activity, with over half testing slightly above 0.30 pH unit rise.*

The upper limit for urease after which a performance decline might be expected in young broilers was determined by Waldroup et al., (1985) and again by Engram et al., (1999). Based on the results of several studies using extracted and toasted soy white flakes that were heat treated for various lengths of time in an autoclave, an upper limit of 0.35 pH units rise was determined safe for poultry and swine.

Mycotoxins: *Buyers and users should be aware that mycotoxins might occur in soybean meal. Of considerable importance are mycotoxins such as T2, vomitoxin, fusarochromanone and zearalenone produced by the fungal genus Fusarium. This fungus may grow and infect whole soybeans and soybean meal during storage. These mycotoxins cause big problems for animal producers. Vomitoxin and T2 toxin cause vomiting and feed refusal in swine and upper digestive tract lesion in poultry. Zearalenone may cause severe reproductive problems in gilts and sows due to its strong estrogenic effect. It is recommended that soybean meal be tested for presence of mycotoxins using the ELISA type test kits produced by several diagnostic companies. U.S. producers minimize mycotoxin contamination by harvesting beans at 13% moisture or drying them to this level immediately after harvest. U.S. beans are then stored in aerated bins under cold winter conditions. Soybeans grown in other countries may not be treated so well. They may be harvested green, stored in plastic silage bags and or kept under humid tropical conditions before being sold.*

Recommended Energy Levels for Soybean Meal

		Non-dehulled	Dehulled
Poultry, ME	*kcal/kg*	*2325*	*2500*
	MJ/kg	*9.8*	*10.6*
Swine, DE	*kcal/kg*	*3500*	*3680*
	MJ/kg	*14.6*	*15.4*
Swine, ME	*kcal/kg*	*3220*	*3385*
	MJ/kg	*13.5*	*14.2*
Warm water fish, DE[1]	*kcal/kg*	*3010*	*3160*
Cold water fish	*kcal/kg*	*2780*	*2930*

Equations for poultry:
ME(n) = 38.79 x % CP + 87.24 x % EE + 18.22 x % NFE (Janssen, 1989).
TME(n) = 3247 – (90 x % CF X % DM/100) (Dale, 2003).

[1] *Digestibility values will be greater in extruded versus pelleted finished feed.*

Global Soybean Meal Analysis (1997 to 2003)

Global results indicating that protein, amino acids, and digestibility are highest in U.S. dehulled soybean meal.

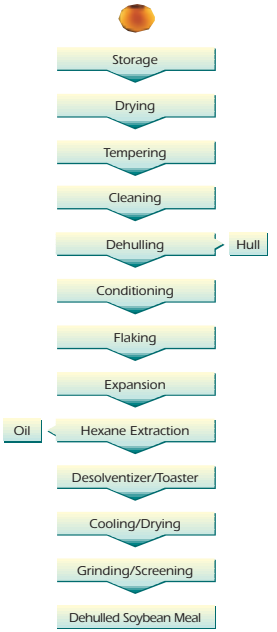
	Dehulled			Non-Dehulled			
	U.S.	Argentina	Brazil	Argentina	Brazil	India	China
Number	*1247*	*3*	*17*	*72*	*459*	*80*	*29*
Moisture	*12*	*12*	*12*	*12*	*12*	*12*	*12*
Crude Protein	*47.8*	*47.2*	*48.8*	*44.7*	*46.7*	*46.6*	*44.2*
Crude Fiber	*3.1*	*3.1*	*3.3*	*6.1*	*5.9*	*6.2*	*ND*
Crude Fat	*1.5*	*2.3*	*1.8*	*1.7*	*1.6*	*1.1*	*ND*
Ash	*6.4*	*6.6*	*6.2*	*ND*	*ND*	*7.7*	*ND*
KOH protein solubility	*86*	*75*	*80*	*78*	*81*	*80*	*ND*
Urease	*0.02*	*0.00*	*0.03*	*0.02*	*ND*	*0.03*	*ND*
Lysine	*2.99*	*2.86*	*2.91*	*2.73*	*2.83*	*2.80*	*2.68*
Methionine	*0.68*	*0.64*	*0.63*	*0.59*	*0.60*	*0.61*	*0.59*
Cystine	*0.73*	*0.73*	*0.67*	*0.63*	*0.70*	*0.64*	*0.65*
M+C	*1.41*	*1.38*	*1.30*	*1.22*	*1.30*	*1.25*	*1.24*
Threonine	*1.85*	*1.79*	*1.86*	*1.76*	*1.79*	*1.80*	*1.71*
Tryptophan	*0.65*	*0.63*	*0.68*	*0.61*	*0.61*	*0.62*	*0.57*
Arginine	*3.43*	*3.44*	*3.47*	*3.28*	*3.47*	*3.36*	*3.38*
Isoleucine	*2.10*	*2.11*	*2.08*	*2.00*	*2.14*	*2.07*	*1.99*
Leucine	*3.57*	*3.64*	*3.64*	*3.44*	*3.57*	*3.54*	*3.35*
Valine	*2.26*	*2.30*	*2.21*	*2.12*	*2.22*	*2.18*	*2.09*
Histidine	*1.22*	*1.25*	*1.30*	*1.23*	*1.24*	*1.26*	*1.17*
Phenylalanine	*2.33*	*2.41*	*2.41*	*2.28*	*2.42*	*2.35*	*2.21*
Tyrosine	*0.40*	*1.62*	*1.57*	*1.47*	*1.72*	*0.65*	*ND*
Glycine	*1.99*	*1.92*	*1.97*	*1.91*	*2.00*	*1.95*	*1.89*
Serine	*2.32*	*2.13*	*2.33*	*2.25*	*2.36*	*2.33*	*2.20*
Proline	*2.34*	*2.30*	*2.36*	*2.26*	*2.34*	*2.30*	*2.21*
Alanine	*2.02*	*2.01*	*2.05*	*1.94*	*2.03*	*1.99*	*1.87*
Aspartic Acid	*5.42*	*5.20*	*5.46*	*5.14*	*5.36*	*5.35*	*5.09*
Glutamic Acid	*8.58*	*8.52*	*8.67*	*8.01*	*8.20*	*8.29*	*7.81*

– Percentage nutrient content (g per 100 g) adjusted to 88% dry matter basis.
– Compiled values are average values (weighted by number of assays) as reported by Degussa AG (1997-2001), United Soybean Board (1998-2000), Novus International (1998-2003), and American Soybean Association (assayed at University of Missouri 1999-2003).
– ND = not determined.

Processing is Critical

Unlike many other sources, U.S. soybean meal is dehulled. This ensures that valuable nutrients such as protein, amino acids and energy are not diluted with indigestible fiber. The removal of hulls, prior to toasting, ensures the valuable amino acids are not inactivated by binding to fiber components.

Processing of U.S. Dehulled Soybean Meal



A precise toasting operation is critical for the production of high quality meal.

- *Under processing leaves residual antinutrients that reduce digestibility:*
  - *protease inhibitors (anti-trypsin)*
  - *allergenic proteins*
  - *lipoxygenase*
  - *urease*
  - *lectins*
- *Over processing reduces digestibility of lysine and other important nutrients.*

Grinding and screening during soybean processing saves money at the feedmill.

Consistency of Quality

Loading ocean-going vessels from pre-analyzed barges makes U.S. dehulled soybean meal more consistent than soybean meal from other origins. Modern infrastructure, both on the farm and in processing plants ensures that U.S. soybeans and soybean meal are stored at low moisture levels to limit mold attack, heat and insect damage. Quality controls instituted by the Oilseed Standards Act, and tested by the U.S. Department of Agriculture, Federal Grain Inspection Service ensure that U.S. soybeans meet or exceed these standards. Further testing of U.S. dehulled soybean meal by the National Oilseed Processors Association and large feed producers in the U.S. industry who buy this meal, ensure that the highest quality standards of meal anywhere in the world are met.

Quality * Consistency * Efficiency * Reliability * Availability

U.S. Soybean Meal Adds Value to Your Feed Production

Commercial feed customers and integrated operations will appreciate having U.S. dehulled soybean meal in their feed. A consistently improved animal growth rate and feed conversion efficiency will enhance the animal producer's profitability. Reduced susceptibility to disease is another real benefit of U.S. dehulled soybean meal as the meal is made from clean, dry, mold and mycotoxin free U.S. soybeans. The higher digestibility of nutrients in U.S. dehulled soybean meal when compared to competitive meals enhances the ability of the animal to fend off disease. The consistency and reliability of U.S. dehulled soybean meal from delivery to delivery, time after time allows both the buyer and user to sleep well at night knowing that the meal will arrive on time and the animals will grow profitably. U.S. dehulled soybean meal is available in any season and can be shipped anywhere in the world.

Appearance of Various Soybean Meal

Soybean Meal (U.S.)

Soybean Meal (India)

Expeller Soybean Meal (Thailand)

Soybean Meal (Argentina)

Soybean Meal (Brazil)

Overtoasted Soybean Meal (India)