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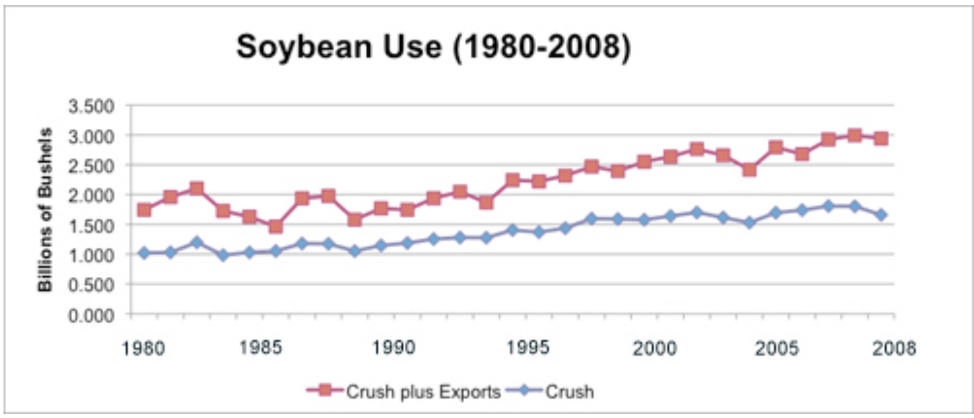
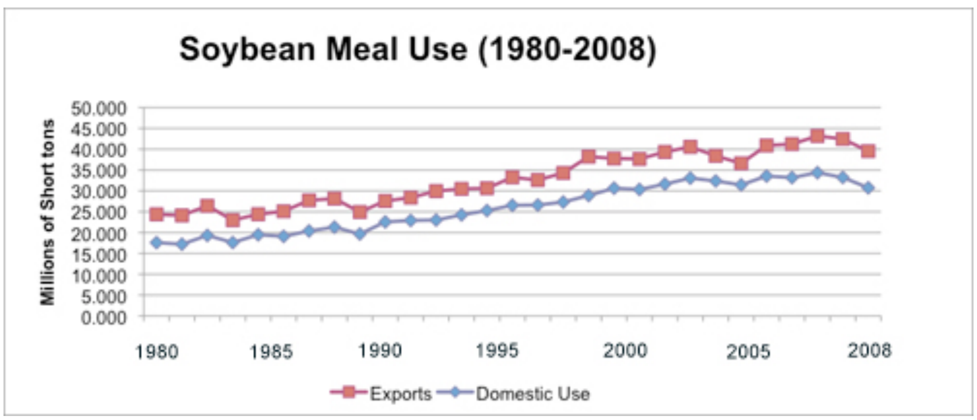
The U.S. Department of Agriculture in September is predicting a record soybean crop; however, the actual values are still to be determined. There is still a lot of concern about the final size of the crop. The weather delays in planting the crop, the relatively cold summer, increasing disease threats and the continued possibility of an early frost will reduce the value of early soybean yield estimates. There are just too many variables still pending to provide accurate estimates of the 2009 soybean crop. In the December Soybean Meal INFOsource newsletter we will provide a detailed review of the soybean and soybean meal supply and demand situation.

To provide some perspective on the soybean and soybean meal use, we developed the following charts which show usage trends since 1980. The two charts show that soybean and soybean meal production has grown steadily over the past twenty-eight years. Both soybean and soybean meal use have doubled since the early 1980s. Smaller increases have been seen in the exports of soybean meal and the growth of the domestic crushing industry. These charts reflect the growth of the livestock and poultry markets in the U.S. and world demand of soybeans. The world need for soy protein is evident and demonstrated in these charts showing the growth of the soybean crop.





Feeding Value of Experimental Soybeans

Two experiments were conducted to determine amino acid digestibility and levels of digestible energy (DE) and metabolizable energy (ME) in five sources of soybean meal (SBM). The five soybean meals included hexane-extracted SBM produced from high-protein soybeans (SBM-HP) and conventional soybeans (SBM-CONV), mechanically extruded-expelled SBM produced from high-protein soybeans (EE-SBM-HP), low-oligosaccharide soybeans (EE-SBM-LO), and conventional soybeans (EE-SBM-CONV). Five diets were formulated to compare SBM sources plus a N-free diet. These six treatments were used in the first experiment to determine amino acid digestibility of each meal. Twelve growing barrows (initial BW: 67.7 ± 1.34 kg) were allotted to a replicated 6 x 6 Latin square design with six periods and six diets in each square. Each period lasted seven days and ileal digesta were collected on day six and seven of each period. Results of the experiment showed that the standardized ileal digestibility (SID) of all amino acids, except tryptophan, were similar for SBM-HP and SBM-CONV, but EE-SBM-HP and EE-SBM-LO had greater ($P < 0.05$) SID of histidine, isoleucine, lysine, threonine and valine than EE-SBM-CONV. The SID of all indispensable amino acids in EE-SBM-HP was greater ($P < 0.05$) than in SBM-HP. The SID of arginine, isoleucine, leucine, and phenylalanine in EE-SBM-CONV was greater ($P < 0.05$) than in SBM-CONV, but the SID of tryptophan was also greater ($P < 0.05$) in SBM-CONV than in EE-SBM-CONV.

Experiment two was conducted to measure DE and ME in the same five sources of SBM as used in experiment one. Forty-eight growing barrows (initial BW: 38.6 ± 3.46 kg) were placed in metabolism cages and randomly allotted to six diets with eight replicates per diet. A corn-based diet and five diets based on a mixture of corn and each source of SBM were formulated. Urine and feces were collected during a five-day collection period, and values for DE and ME in each source of SBM were calculated using the different procedure. Results showed that the ME in SBM-HP tended to be greater ($P = 0.10$) than in SBM-CONV (4,074 vs. 3,672 kcal/kg of DM). The ME in EE-SBM-HP also tended to be greater ($P = 0.10$) than in EE-SBM-CONV and in EE-SBM-LO (4,069 vs. 3,620 and 3,721 kcal/kg of DM), but there was no difference in ME between extracted and extruded-expelled meals. The researchers concluded that SBM processed from high protein soybeans had a greater feeding value compared to SBM processed from soybean with conventional levels of protein because of greater concentrations of digestible amino acids and ME. They also found that extruded-expanded processed soybean meal using low-oligosaccharide soybeans had a greater concentration of most indispensable amino acids than similarly processed meal from conventional soybeans, but the concentration of ME were similar in these two meals. Results of this experiment also showed that amino acid digestibility values in extruded-expelled SBM were greater than in hexane-extracted SBM.

Baker, K.M. and H. H. Stein. 2009 Amino acid digestibility and concentration of digestible and metabolizable energy in soybean meal produced from conventional, high-protein, or low-oligosaccharide varieties of soybeans and fed to growing pigs. J. Animal Sci.87:2282-2290.

Comparing Soybean Products for Turkeys

An experiment was conducted to investigate the effects of diets containing soybean meal (SBM), soybean protein concentrate (SPC), and soybean protein isolate (SPI) on growth performance and gut function of the young turkey. A total of 812 one-day-old male turkey poults were randomly assigned to four dietary treatments, with seven pens per treatment and 29 birds per pen. The four experimental diets containing SBM, SBM-SPC, SPC, and SPI were isonitrogenous and isocaloric and contained similar amounts of total and water-soluble nonstarch polysaccharides. The content of oligosaccharides differed among the diets and averaged 2.4, 1.9, 0.9, and 0.1% for SBM, SBM-SPC, SPC, and SPI, respectively.

When compared with SBM, birds consuming the SBM-SPC and SPC diets had higher ($P < 0.05$) final body weight (4.32 vs. 4.45 and 4.46 kg, respectively). Incorporation of SPI as a substitute for SBM resulted in improved feed utilization from 1.76 to 1.67 ($P<0.05$), but did not affect the final body weight. Significant changes in cecal concentrations of short-chain fatty acids were observed and averaged 130, 103, and 89 μmol/g of digesta for the SBM, SBM-SPC, and SPC diets, respectively. This coincided with the proportional decrease in dietary oligosaccharide content from 2.4 to 0.9% and was further substantiated by a significant decrease in ileum weights. Feeding the SPI diet resulted in the lowest ileal and cecal tissue weights as well as the lowest cecal short-chain fatty acids concentration. There was no effect of diet on digesta pH, viscosity, and mucosal sucrase and maltase activities. Bacterial β-glucuronidase activity was decreased in the cecum from 0.98 to 0.60 U/g ($P=0.08$) with decreased dietary oligosaccharide content. The researchers concluded that partial, or almost complete, substitution of SBM with SPC suppressed the fermentation processes in the ceca and enhanced the growth rate. The substitution of SBM with SPI significantly improved feed utilization with no effect on growth rate of poults during this eight-week study.

Jankowski, J. and co-workers. 2009. The effect of diets containing soybean meal, soybean protein concentrate, and soybean protein isolate of different oligosaccharide content on growth performance and gut function of young turkeys. Poultry Sci. 88:2132-2140.

Soy Phytoestrogens

Genistein, a soy phytoestrogen, is a powerful antioxidant found in soybean. A study was conducted to determine the effects of dietary genistein supplementation on Japanese quail (Coturnix coturnix japonica) laying performance and egg yolk contents of malondialdehyde (MDA), vitamin A, and vitamin E. Malondialdehyde is an indicator of lipid peroxidation, whereas vitamins A and E have antioxidant properties. One hundred and fifty birds, five weeks of age, were randomly assigned to one of three treatments consisting of 50 birds (five replicates of ten) and were fed a basal diet or the basal diet supplemented with either 400 or 800 mg of genistein/kg of diet. The experimental period lasted 90 days with a 17 hour light and 7 hour dark photoperiod schedule. Dietary genistein supplementation (800 mg/kg) increased feed intake, egg production, egg weight, Haugh unit, shell thickness, and shell weight and improved feed efficiency at a greater extent than the other levels (0 and 400 mg/kg). Egg yolk genistein concentration was increased ($P < 0.0001$), whereas egg yolk MDA concentration was decreased ($P < 0.0001$) at the highest level of genistein supplementation. However, genistein supplementation did not affect egg yolk daidzein, vitamin A, and vitamin E levels. There was an inverse relationship between egg yolk genistein and MDA concentration ($R2 = 0.74$, $P < 0.0001$). Results of the present study indicate that supplementing with dietary genistein (800 mg/kg) improved performance, egg quality, and egg yolk genistein content and decreased egg yolk MDA concentration in quail. (Note-the real significance of this study was that feeding ultra-high levels of a soy phytoestrogen did not cause production problems in this model system and the results should apply to other poultry species).

Akdemir, K. and K. Sahin. 2009. Genistein supplementation to the quail: Effects on egg production and egg yolk genistein, daidzein, and lipid peroxidation levels. Poultry Sci. 88:2125-2131.

DDGS Use in Poultry Feeds

Two recent papers have discussed the increasing use of distillers Dried Grains with soluble (DDGS) in poultry feed formulations. With the increasing cost of feed ingredients, the nutritionist is seeking alternative ingredients that can lower feed cost without impacting production performance. In a paper by Dr. Amy Batal (University of Georgia) it was pointed out that DDGS does not just replace corn in the poultry diet, rather it will replace corn, soybean meal, meal and bone meal, phosphorus, methionine and other ingredients. Its use will depend on the relative price of all of these ingredients and other constrains. Dr. Batal cited the main issue with DDGS is price, availability, logistics/transportation and nutrient availability. The lower energy value for DDGS compared to corn (1,280 vs. 1,540 kcal/lbs.) has a major impact on the value of the two ingredients. She indicates that combinations of raw material and ethanol plant processing conditions result in variation in the nutrient composition of DDGS (see following table).

Average Nutrient Composition of DDGS

Component (%)	Mean	Range	CV (%)
TME (kcal/kg)	2,863	2,607-3,054	3.6
Lysine-total	0.78	0.59-0.89	11.6
Lysine-digestible	72	46-84	11.2
Methionine-total	0.49	0.41-0.60	9.7
Methionine-digestible	88	85-92	1.9
Theonine-total	0.98	0.85-1.14	6.0
Theonine-digestible	76	69-83	4.8
Crude Fat	10	4-16	4.3
Calcium	0.03	0.02-0.04	38.4
Phosphorus-total	0.73	0.62-0.77	5.3
Phosphorus-available	70	64-100	x
Sodium	0.25	0.05-0.45	32.8

The potential variation in nutrients is of concern. Dr. Batal concludes that reliable nutrient values are important when using DDGS in poultry diets, especially when high levels of inclusion are used, as the risk associated with nutrient variability becomes greater.

In a review by Dr. Bill Dudley-Cash, the paper by Dr. Batal was referenced and the comments on direct replacement of corn with DDGS were expanded. He provided the following table comparing key nutrient levels in corn, DDGS and soybean meal.

Comparative Nutrient Composition

Nutrient, %	Corn	DDGS	Soybean Meal
TME, Kcal/kg	3,390	2,897	2,458
Crude Protein	7.5	27.0	47.8
Crude Fiber	1.9	8.5	3.0
Crude Fat	3.5	9.0	1.0
Phosphorus, total	0.25	0.89	0.65
Phosphorus, available	0.09	0.55	0.21
Lysine, total	0.24	0.80	3.02
Lysine, available	0.19	0.60	2.75
Methionine, total	0.18	0.51	0.80
Methionine, available	0.16	0.43	0.64
Cysteine, total	0.18	0.50	0.72
Threonine, total	0.29	0.92	2.00
Arginine, total	0.40	1.10	3.60
Tryptophan, total	0.07	0.20	0.70

Dr. Dudley-Cash indicated that it was easy to see why DDGS is not a direct replacement of corn; it contains significantly less energy and three to six times more of some of the other nutrients compared to corn. Compared to soybean meal DDGS is relatively deficient in lysine and contained significantly lower levels of several of the key amino acids.

Both authors discussed DDGS problems with excessive nutrient variability; ingredient handling and flowability problems; and pellet quality concerns. Both agree that DDGS can be successfully used in poultry diets to reduce costs, provided, accurate nutrient levels are used in formulating the diets. Nutrient variability must be minimized through assessment and formulation if production standards are to be met.

Batal, Amy B. 2009. How much DDGS for Poultry? Feed Management; June/July issue; pages 23-23.

Dudley-Cash, Bill. 2009. DDGS an Alternative. Feedstuff; September 7 issue; pages 10-11.

Phosphorus Availability

Forty-eight grower pigs were used to evaluate the effects of feeding low phytic acid (LPA) corn, LPA soybean meal, normal corn (NC), normal soybean meal (NSBM), and phytase on nutrient digestibility and excretion. Barrows weighing about 45 kg were randomly assigned to one of eight dietary treatments in a 2 x 2 x 2 factorial arrangement with six pigs per treatment. Pigs were fed twice daily at three times the metabolizable energy requirement for maintenance. Phytase was added to the diet at 510 phytase units/kg of feed at the expense of corn starch and all diets were formulated to provide 0.39% total P, 0.50% Ca, and 1.0% lysine with no supplemental inorganic phosphorus. Pigs were adapted to metabolism crates and dietary treatments for 7 days followed by a 3-day total collection of urine and feces. Total fecal dry matter excreted, percentage of dry matter of feces and percentage of dry matter digested were not different among treatments. Fecal phosphorus excretion was reduced for pigs fed LPA corn, LPA soybean meal, and phytase treatments. Phosphorus digestibility was increased for pigs fed diets containing LPA corn, LPA soybean meal, phytase and the treatment that contained all three dietary treatments (LPA corn, LPA soybean meal, and phytase). Corn type and soybean meal type had no effect on water-soluble phosphorus excretion. However, pigs fed diets containing phytase tended to excrete less total water-soluble phosphorus than those without phytase inclusion. This study demonstrates that responses from feeding any combination of LPA corn, LPA soybean meal, and phytase were additive, phosphorus digestibility was improved significantly, and phosphorus excretion decreased dramatically thus reducing the potential impacts of phosphorus from pig manure on the environment.

B. E. Hill, A. L. Sutton and B. T. Richert. 2009. Effects of low-phytic acid corn, low-phytic acid soybean meal, and phytase on nutrient digestibility and excretion in growing pigs. J. Animal Sci. 87:1518-1527.