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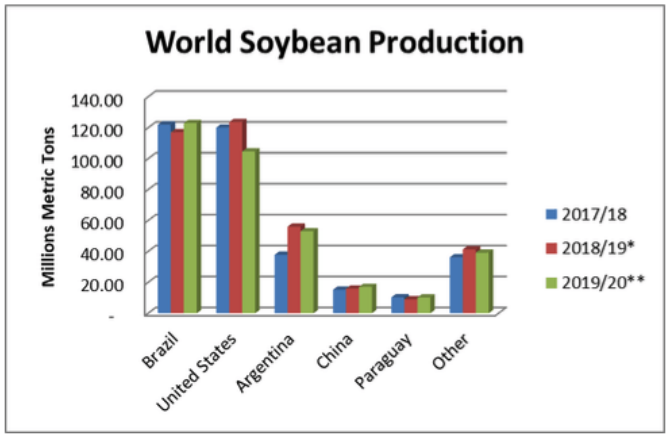
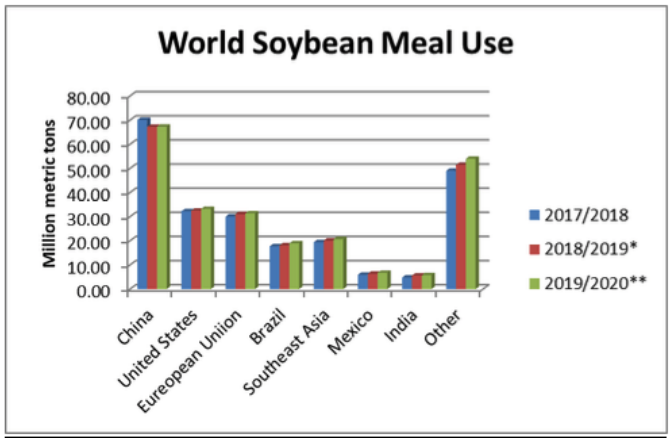
Current Soybean Production and Soybean Meal Use

Three marketing years of soybean production and soybean meal are shown in the following table and chart. Trends in soybean production and soybean meal use levels are relatively consistent over the past three years, whereas, the specific values for individual countries will vary. The final values for the 2019/2010 marketing year are projected and still being influenced by many variables including; weather conditions during planting and growing season are still having a major impact on final soybean production values; swine diseases are directly lowering soybean meal use levels; and trade policies between countries are also having an influence on soybean meal use. Final values for this marketing year will probably be close to the record soybean production and soybean meal use values recorded in the past marketing year.





Improving Crude Protein Digestibility

Improving the utilization of crude protein is subject of many studies because of its economic impact on the animal and poultry industries and detrimental effects of nitrogen excretion to the environment. Protease supplements have been suggested to potentially achieve increased prececal amino acid digestibility in broiler chickens, and thereby allowing reducing the crude protein level in the diet. The effects of protease supplementation on prececal crude protein and amino acid digestibilities have been found to be inconsistent.

The objective of this study was to determine the effects of protease products on the prececal amino acid digestibility and the influence on composition of the microbial community in the small intestine. Treatments considered of three protease products added to the corn-soybean meal basal diet at the level recommended by the supplier and at an 8-fold level. Each dietary treatment was allocated to 8 replicates of 15 birds each. The results of this experiment showed that the effect of protease supplementation on the prececal amino acid digestibility depended on the protease product type and the amount supplemented. The amino acid digestibility of the corn-soybean meal diet was significantly increased by one protease product when supplemented at high level and when phytase was supplemented. In all the other treatments, protease supplementation had no significant influence or it decreased prececal amino acid digestibility.

Borda-Molina, B., T. Zuber, W. Siegert, A. Camarinha-Silva, D. Feuerstein and M. Rodehutscord. 2019. Effects of protease and phytase supplements on small intestinal microbiota and amino acid digestibility in broiler chickens. Poultry Sci. 98(7): 2906-2918. https://doi.org/10.3382/ps/pez038

Importance of Properly Processing Soybeans

This research study investigated the effect of varying trypsin inhibitor activity (TIA), heat-degraded lysine concentration and protein solubility in potassium hydroxide (KOH) on broiler performance and pancreas weight. Two soybean lots were subject to varying thermal, hydrothermal, pressure, and kilning processing. This heat treatment resulted in a total of 34 soybean meal lots varying widely in TIA (0.25 to 23.6 mg/g), heat-degraded lysine (1.40 to 8.60 g/kg), and KOH solubilities (65.5-97.6%) levels. These experimentally-processed soybean were included into a common grower and finisher diet for broiler chicks at fixed amounts (grower: 35%; finisher: 25%) and tested in a 35 day experiment with 1680 broiler chicks.

As expected, excessive levels of TIA significantly depressed broiler gains and feed: gain ratios, and increased pancreas weights.

Hoffmann, D., S. Thurner, D. Ankerst, K Damme and W. Windisch. 2019. Chickens' growth performance and pancreas development exposed to soy cake varying in trypsin inhibitor activity, heat-degraded lysine concentration, and protein solubility in potassium hydroxide. Poultry Sci. 98(6); 2489–2499, https://doi.org/10.3382/ps/pey592

Trypsin Inactivation in Soybeans

Trypsin inhibitors are present in raw soybean meal and in several meal fractions. At least four inhibitors have been separated on DEAE-cellulose columns. All of these fractions can be inactivated by steam heating resulting in an improvement of protein efficiency, improvement of protein digestibility, and destruction of the pancreatic hypertrophic factor. Dr. Rackis found that trypsin inhibitors in defatted soybean flakes can be inactivated by steaming for 15 minutes. Steaming for 20 minutes almost completely inactivates the inhibitor in whole beans containing 25% moisture.

Rackis, J.J. 1966. Soybean trypsin inhibitors: their inactivation during meal processing. Food Technology (20): 1482-1484.

Optimum Soybean Meal Levels for Channel Catfish

The objective of this research study was to optimize soybean meal (SBM) levels in diets for pond-raised hybrid catfish (Channel Catfish Ictalurus punctatus×Blue Catfish I. furcatus). Five 28% protein diets containing 15, 20, 25, 30 and 40% SBM were formulated with digestible nutrients and energy levels to meet or exceed all known nutrient requirements of Channel Catfish. Fingerling hybrid catfish with an average weight of about 25g were stocked into 25 earthen ponds. The fish were fed once daily for the 184 day growing season.

Results indicated that increasing the levels of SBM in the basal diet from 15 to 40% did not significantly affect total amount of diet fed, gross yield, weight gain, and survival of hybrid catfish. The feed conversion ratio was significantly higher in fish fed diets containing ≤30% soybean meal than those fed the 40% soybean meal diet and feed conversion ratio decreased linearly as soybean meal levels increased. Regression analyses show that both carcass and fillet yields increased linearly with increasing soybean meal levels in the diet. No significant differences were observed for fillet protein, fat, and moisture levels among fish fed the diets containing various levels of soybean meal. The research group concluded that a 28% protein diet containing 25% soybean meal appears to support maximum growth of hybrid catfish without marked impact on feed conversion ratio or processed yield.

Menghe H., Li Edwin, H. Robinson, Brian G. Bosworth, Daniel F. Oberle and Penelope M. Lucas. 2014. Optimizing Soybean Meal Levels in Alternative Diets for Pond-Raised Hybrid Catfish. North American J. of Aquaculture 76(1): 61-166. https://doi.org/10.1080/15222055.2013.855284.

Methionine Improves Soybean Meal Use in Tilapia Studies

This study evaluated the effects of increasing levels of methionine supplementation on the success of almost total replacement of fish meal with soybean meal (SBM) in diets for hybrid tilapia. In this study fish were fed for 70 days a fish meal-based diet or SBM-based diets supplemented with five graded levels of DL-methionine.

The researchers reported that fish growth rate, feed conversion ratio and protein gain and retention efficiency improved significantly with increasing levels of dietary DL-Met supplementation. Regression analysis of the effects of supplementing SBM-based diet with graded levels of DL-methionine indicated that a dietary methionine + cysteine level of 15.7 and 12.5 g kg/diet (as fed) was required to reach 95% of maximum weight and protein gain. The researchers concluded that supplementation of SBM-based diet with graded levels of DL-methionine proved an effective strategy in reducing fish meal content in practical diets for hybrid tilapia.

Figueiredo-Silva, C., A. Lemme, D. Sangsue and S. Kiriratnikom. 2014. Effect of DL-methionine supplementation on the success of almost total replacement of fish meal with soybean meal in diets for hybrid tilapia (Oreochromis niloticus × Oreochromis mossambicus). Aquaculture Nutrition 21(2): 234-241.

Soy Products Replace Fish Meal

Many farmers of marine fish are hesitant to use high levels of soybean products in feed due to a fear of reduced feed palatability and digestibility, slower growth, and/or poorer feed conversion compared to traditional feeds containing high levels of fishmeal and fish oil. Some consumers also fear that replacement of the fish meal in the feed could change the nutritional value of edible fish products.

A study was conducted to determine the optimal inclusion levels of soy products in a fish meal-based practical diet for gilthead sea bream (Sparus aurata) one of the main species of marine fish produced in the Mediterranean region. Three isonitrogenous and isoenergetic diets with 45 percent crude protein and 20 percent crude fat were formulated for testing with gilthead seabream. The experimental diet was formulated with fish meal making up 65, 50, or 35% of the total dietary protein. The fish meal was replaced with vegetable sources of protein, mainly soy protein products due to their cost efficiency compared to other plant ingredients. The replacement of fish protein/fat was balanced by the supplementation of the essential amino acids lysine and methionine, phosphorus and a blend of palatability/digestibility enhancers.

The results of the 10-week experiment are presented in the following table. As can be see replacing 30% of the fish meal protein with soy protein resulted in similar growth rates and feed-conversion ratios.

Treatments	**FM65**	**FM50**	**FM35**
Feed Ingredients			
- Fish Meal (%)	45.3	34.8	24.4
- Soybean Meal (%)	18.3	22.5	35.0
- Soy Protein Concentrate (%)	-	7.2	4.6
Fish Performance			
- Growth rate (%/day)	1.60	1.59	1.58
- Feed-conversion ratio	1.13	1.13	1.13

Note: This is another study that demonstrated soybean protein can replace fish meal protein in properly formulated feeds for various fish species achieving both feed cost saving and optimum performance.

Robles, Rocio, Sam Ceulemans, Peter Coutteau and Michael Cremer. 2019. Soy products replace fishmeal, fish oil in gilthead sea bream feed study. Global Aquaculture Advocate Vol. 192, July 30.