The Ever Changing World of Feed Additives in The Poultry Industry

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Summary

In today's ever increasing economic climate, commercial poultry companies are trying to help alleviate exorbitant cost even more so then ever before. The main focus on addressing the feed cost issue has been examining the benefits of adding exogenous enzymes to poultry rations. One of the first enzymes to take center stage in poultry diets has been phytase. With organic phosphorus prices continually climbing phytase has played the biggest role in the past years by helping nutritionists realize the benefits that an exogenous enzyme has the potential to break phytic acid bonds in grains and make plant origin phosphorus more available to poultry. Phytase has become as standard as corn or soybean meal (SBM) in commercial poultry diets, which has opened the door to the use of other exogenous enzymes. These exogenous enzymes allow for the improvement of energy and protein digestibility to the animal. The immense pressure from the government to funnel corn away from livestock and towards ethanol production has truly created some major cost issues for commercial poultry companies. Not only has the decreased availability of corn to the poultry sector been an issue but so has the push for bio-fuels, which has also increased the demand for fat making the energy component one of the most expensive in poultry diets. Intense research in recent years has demonstrated that non starch polysaccharide (NSP) enzymes can help to liberate addition energy from plant origin ingredients to the animal. Non starch polysaccharide enzymes have shown true potential in US diets since the introduction of dried distiller's grains plus solubles (DDGS), from ethanol production. This has become a common name in poultry feed ingredients. With increased levels of DDGS in a poultry diet NSP enzymes have been reported to liberate more energy than from the standard corn soybean meal diets of the past. The newest enzyme coming to the market is protease, which is targeted at improving protein digestibility. Not only is there an importance of adding exogenous enzymes to diets with low quality feed ingredients, but it is also important to supplement the diets when fed from hatch to harvest to insure the maximal benefits in growth performance.

The next main issue facing nutritionists is the current push to produce a "natural" chicken. Antibiotic and drug free has also managed to thrust its presence into commercial poultry production creating a need for a replacement to antibiotics. The desire for the production of "natural" chicken has lead researchers and producers to examine the potential of probiotics as a possible alternative to antibiotics. Studies examining the presences of probiotics in a diet have shown some potential in performance based studies when compared to non medicated fed birds. Based on studies with a disease challenge model, there was once again an improvement in birds fed diets with only probiotics. The most significant improvement was seen in birds fed diets containing a combination of antibiotics and probiotics, which were similar or better than the non challenged birds. Based on these studies, probiotics may have a place in poultry feeds for aiding overall health for a "natural" bird. However, probiotics in combination with antibiotics were determined to provide the most benefits.

Issues in formulating least cost diets

The main objective of any industry is to maximize profit. From the standpoint of live production in commercial poultry production the nutritionist is faced with this heavy task. Currently, poultry nutritionists are battling with several issues when formulating diets to minimize cost while still meeting the birds' requirements to allow for maximal performance, which in turn

will give producers their greatest profit. One of the biggest agricultural issues to rear its head in the past 10 years is the dramatic increase in the cost to produce feed (Donohue and Cunningham, 2009). At the same time the production of ethanol has spiked greatly. The production of ethanol is not a new process by any stretch of the imagination, but the real issue is the fact that the majority of the ethanol in the USA is being produced from corn, a major ingredient in livestock feed. In the past, ethanol was produced from a variety of grains, which are commonly associated with the fermented beverage industry. Other countries such as Brazil currently use sugar cane in their ethanol production. However, in the US ethanol production we see corn being channeled away from the livestock sector and towards ethanol production. The start of the US government's push for corn derived back at the turn of the century made livestock feeding more interesting, with the ethanol co-product distiller's dried grains being a new ingredient which nutritionists would have to add to their formulations.

The production of ethanol not only drove up the price of corn but also increased the price of soybean meal, due to farmers who once grew soybeans are now growing corn. The immense pressure from the government to produce ethanol made for the perfect storm in livestock feed, especially in poultry, with a driving demand for the two main ingredients found in all US poultry diets. With the two main ingredients, which combined consisted of more than 95% of poultry diets, having such a dramatic increase in price nutritionists are forced to use alternative feed ingredients. The use of alternative ingredients brings up many question and limitations to what can be used in formulating an acceptable diet. Some of the alternative ingredients that have seen a spike are DDGS, (which has become a fairly common ingredient in poultry diets), peanut meal, and bakery by-product meal just to name a few. Not only has ethanol production affected the cost and availability of the major ingredients, but so has the US demand for biofuel, which has dramatically increased the price of fat in poultry diets. The various feed ingredients being used brings with them variability in the diets and some anti-nutritional factors, such as non starch polysaccharides, which need to be dealt with.

Recently, feed manufactures have seen an increase in the type of exogenous enzymes being produced to help cope with the problems nutritionists are running into with the use of alternative feed ingredients. The use of enzymes in poultry diets gets much of its credit from the enzyme phytase, which is one of the most extensively studied enzymes and has become as common of an ingredient as corn and SBM in commercial poultry diets. Considering that poultry do not produce sufficient amounts of phytase enzyme to hydrolyse the phytic acid (Bedford, 2000) making only one third of the phosphorus in plant based feedstuffs available to the bird. In order to provide birds with sufficient levels of phosphorus in a diet to meet their requirement, inorganic sources are added to feed. This has lead to increasing feed cost (Selle and Ravindran, 2007). When examining a poultry diet it is recognized that phosphorus is the third most expensive component in a diet (Woyengo and Nyachoti, 2011). Since 1999, the price of inorganic phosphorus has increased in price almost five fold making the use of Phytase even more desirable and is a standard in broiler diets at a level of 500 FTU/kg. Phytase has demonstrated its ability to improve phosphorus utilization by liberating phosphorus from grain and oilseeds.

Currently, with the increases in energy costs, many studies have demonstrated the nutrient sparing effects of enzymes, such as the release energy from the feed at a cost lower than the equivalent amount of expensive oil/ fat. Therefore, extensive research is demonstrating that NSP enzymes have the potential to be incorporated into broiler rations to gain back energy values from plant origin feed ingredients. A number of products have entered the market. With early introduction the NSP enzymes were a liquid post pellet application, which are still used today and have proven to be very effective. The advances in technology have allowed for the development of dry products that are heat stable allowing for them to be added before pelleting making the feed manufacturing process a little easier. Not only have we seen improvements in performance with the use of NSP enzymes but there are also improvements in litter quality and in turn results in improved foot quality.

The great success that is being seen with NSP enzymes has made nutritionists consider proteases. As mentioned before, the price of SBM has increased, which is the primary source of protein in commercial poultry diets. Furthermore it appears that the price of protein in poultry diets will continue to increase in the future making proteases a viable option to examine. The use of proteases and other enzymes will provide a direct cost savings to the feed mill. Additionally it may help with consumer perception for those fixated on "natural" or all vegetable fed poultry products. Continuing with the idea of consumer perception, one of the most recognized issues from this standpoint is antibiotic use. Therefore new additives and alternatives to antibiotics are being explored.

Now that we have established cost being a major issue to nutritionists in formulating diets, there is the growing consumer push to a "natural" chicken meaning antibiotic and drug free. The recent removal of 3-nitro has directed focus to antibiotics and what possible alternatives are available. One of the most acknowledged possible alternatives is probiotics. Probiotics are by no means a new concept. Researchers discovered that by introducing a particular bacterial species to the gastrointestinal tract one may be able to increase the number of beneficial bacteria present. R. Fuller in 1989 defined probiotics as live microbial feed supplements which beneficially affect the host by improving its intestinal microbial balance. Probiotics are composed of beneficial intestinal bacteria and generally work on the principle of competitive exclusion. Beyond the performance benefits attributed to the use of probiotics, there is also the ability to prevent intestinal infections, lower serum cholesterol, increase expression of anti-cancer activities, stimulate the immune system, improve lactose utilization, and enhance short chain fatty acid levels (Snel et al., 2002). The most commonly used Probiotics today contain *Lacotbaccillus, Bifidobacteria* spp, and/or *Bacillus* spp.

In conclusion, it can be accepted that the feed manufacturing aspect of the broiler industry is ever changing and new products will constantly be introduced into diets. Each with a goal to aid in rising feed costs and adaptation of poultry products that will give what the consumers perception is at the given time.

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