Opportunities for nutritionists to reduce feed costs

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The poultry industry continues to face many challenges to obtain maximum profits, relying on increasing efficiency and small margins. Feed accounts for nearly 70% of production cost, and so the impact of feed cost on profitability is constantly being scrutinised. It is considered by many as a 'pressure point' in decision making.

It is the responsibility of the nutritionist to constantly evaluate alternatives that may reduce feed cost without affecting maximum profitability.

From a nutritional standpoint, protein and energy represent the bulk of the cost in a poultry diet and represent a major opportunity for nutritionists to impact overall feed cost.

Improving feed utilisation should always be considered a priority. The use of Near Infrared Reflectance Spectroscopy (NIRS) technology, enzyme supplementation and the inclusion of alternative feed ingredients are some of the several alternatives that will be discussed in this article.

Enzyme supplementation

Feed enzymes largely focus on improved feed cost savings through improved feed utilisation, rather than increases in live performance. They represent one of the greatest tools available to nutritionists to improve feed utilisation. Moreover, enzymes reduce the environmental impact of animal production with the potential to improve gut health and animal welfare.

Phytases, carbohydrases and proteases are used for improving nutrient digestibility of phytate bound phosphorus, removal of non-starch polysaccharides (NSP) that interfere with energy utilisation and protein digestion, respectively.

Today, phytases are commonly used in the industry, but carbohydrases and proteases are slowly being incorporated into poultry diets driven mainly by the difficulty in constantly predicting animal responses when using the latter enzymes. The use of carbohydrases should depend on the major NSP components of the main ingredients in the diet.

Cereals, such as corn and wheat, contain a high amount of arabinoxylans, with wheat arabinoxylans almost doubling the amount of corn arabinoxylans (Table 1).

In contrast, soybean meal contains a small percentage of arabinoxylans but a higher percentage of pectins and oligosaccharides. The effectiveness of carbohydrases is greatly affected by NSP accessibility, or the physical proximity of the enzyme to NSP.

Recent approaches have addressed the changes in intestinal physiology and NSP content of the diet as an enzyme strategy. The bird's intestinal tract is not fully developed at hatch and does not produce critical enzymes (amylase, trypsin, chymotrypsin and lipase) required for nutrient digestion.

Throughout the first days post-hatch and before intestinal maturation is achieved, providing supplemental enzymes for improving energy and protein digestibility is a strategy to consider. In addition, the types of NSPs in the diet change from starter to finisher diets, thus supplementing different types of carbohydrases represents a possible solution.

In a typical feeding programme, a protein source such as soybean meal will decline from starter to finisher, while the energy source such as corn or wheat will increase causing changes in the types of NSPs in the diet. Therefore, addressing this issue with only one type of enzyme throughout the feeding programme will only partially alleviate the problem.

In some instances, the bird has only the capability to produce very small amounts of an enzyme. This is the case for phytase, which must be added supplementally to the diet throughout the growout period. Phytases increase phytate breakdown and improve plant phosphorus utilisation.

The major benefit of using supplemental enzymes is reducing feed costs. Carbohydrase and protease use vary from region to region, depending on substrate availability and ingredient quality.

Average uplift values for carbohydrases are between 40-100 kcal/kg of feed. Phytases are able to fulfil between 0.10-0.15% available phosphorus and 0.05-0.10% Ca in poultry diets. Enzymes provide the nutritionist with a tool to optimise feed utilisation with the potential in reducing nutrient cost

Table 1. Relative NSPs (%) in feed ingredients (Adapted from Ward 2014).

Feed ingredient	Arabinoxylans	Cellulose	Pectins	Beta-glucans	Oligosaccharides	Total NSP
Corn	4.3	2.0	0.9	0.3	0.8	8.3
Wheat	7.1	1.8	0.4	0.6	0.1	10.0
Sorghum	3.7	1.1	0.4	0.1	0.2	5.5
Barley	8.1	3.9	0.5	4.3	0.1	16.9
Soybean meal	0.4	5.9	9.1	0.7	9.6	25.7

NIRS technology

Over the years the industry has depended on wet chemistry analyses to determine macronutrients in feed. Proximate analyses on feed ingredients typically include moisture, crude ash, crude protein, ether extracts, crude fibre and nitrogen free extractives contents. In some instances, urease activity and mycotoxin analyses can be performed.

Most integrators have the capacity to perform wet chemistry analyses in their feed mills. The constraints include the time to perform the analysis, the amount of chemical reagents needed and cost.

In case these analyses are done in an independent laboratory; variabil-

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ity from laboratory to laboratory exists and must be taken into consideration.

Currently, NIRS technology is widely accepted as a means to perform nutrient analyses in feed ingredients. This provides a quick, non-destructive, and quantitative analysis of feed ingredients commonly used in the animal industry.

In practical terms, a feed sample is presented to the light source of NIRS equipment and various chemical bonds from different nutrients are exited.

These bonds are absorbed and the rest are emitted in different wavelengths and frequencies which are then detected by the NIRS machine.

Benefits of NIRS

The benefits of using an NIRS system is that the analysis takes considerably less time, and is considered safer because there is no use of reagents. You can perform more analysis per day and the sample preparation is simpler when compared to wet chemistry analysis. In addition, NIRS analysis allows nutritionists to allow for nutrient variability in feed formulation.

Variability in the nutritional quality of feedstuffs may result in the production of incorrectly balanced feeds.

There might be periods when the nutritionist might be over-or under-formulating energy and amino acids, which can definitely impact performance and production costs.

During periods of high ingredient prices, integrators could be losing a lot of money, and NIRS systems can provide nutritionists with real-time nutrient analysis of ingredient and diets.

In the USA, NIRS technology has had limited use due to its high initial investment and the labour cost associated with its use. In different parts of the world, integrators are able to dedicate one employee to manage the NIRS system.

Another factor is that generally the US has good quality feed ingredients – not the case in some other parts of the world – therefore, there is less of a benefit by using NIRS equipment.

For example, some countries in Europe import their soybean meal from the USA, Argentina or Brazil at different times of the year, with significant variation in nutritional composition (Table 2).

Country	Crude protein (%)	Total amino acid (%)			
		Lysine	Methionine	Cystine	Tryptophan
USA (n=108)	48.2	2.99	0.66	0.73	0.66
Brazil (n=68)	47.1	2.87	0.62	0.68	0.64
Argentina (n=62)	45.9	2.81	0.63	0.70	0.63

Table 2. Crude protein and total amino acid content from soybean meals of different origins (88% dry matter, adapted from Mateos, 2009).

There is more use of alternative feed ingredients in other parts of the world, mainly driven by the high cost of importing corn and soybean meal.

These alternative feed ingredients tend to be highly variable and thus have to be constantly analysed for nutritional composition. Few companies in the USA have adapted NIRS technology for real-time feed formulation with its main use in quality assurance programmes.

In contrast, the technology is widely accepted elsewhere as a tool to identify ingredient nutritional variation and be used in real-time feed formulation.

Alternative ingredients

Market price volatility and availability of raw ingredients for poultry diets increases the pressure to reduce feed costs.

When the price of dietary raw ingredients dramatically increases, the use of alternative, less traditional, raw ingredients may become more economically attractive.

According to Dale (2008) an alternative feed ingredient would be one not used regularly, whose nutrient composition has not been fully defined and for which a maximum level of inclusion is unclear. Such ingredients vary from region to region, from being considered an alternative in one region to being in common use in another.

Continued pressure to reduce feed costs demands a better understanding of the different ingredient alternatives, their potential use and limitations. Some commonly known alternative feed ingredients are corn distillers dried grains with solubles, sorghum, corn gluten meal, canola meal, cassava meal, rice bran, bakery meal, palm kernel meal and cotton seed meal.

Availability, nutritional composition, anti-nutritional factors, handling properties and processing characteristics should be first evaluated. Some ingredients are more suitable for broilers than broiler breeders, and vice versa.

Nutritionists will first try to develop confidence in the quality of particular alternative ingredients and reduce the risk by formulating low inclusion levels. Typical inclusion levels range between 3-20% of the diet, depending on feeding phase.

Conclusion

Poultry production involves converting feed into meat or eggs; with feed representing approximately 70% of total costs. The higher the feed efficiency and the lower the cost of production, the greater the profitability.

Enzyme supplementation, optimising the use of NIRS technology and the use of alternative feed ingredients are some ways to increase feed efficiency. ■

References are available on request from the author