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Feed enzymes can help manage price volatility

To manage the risk of price volatility in feed raw materials, the key is to increase flexibility in feed formulations, which allows companies to switch to alternative but cheaper raw materials without compromising bird performance.

By **JANET REMUS***

PRICE volatility in raw materials is at the top of the list of challenges the animal feed industry is currently facing.

In this article, new insights and developments are discussed on how combinations of enzyme activities can be used in risk management strategies to counter feed raw material price volatility in the poultry industry.

Price, supply volatility

Price volatility in raw materials is a fact of life — one that takes its toll on companies that produce everything from basic materials and intermediates to components and consumer goods.

The feed industry faces the same challenges. The past 10 years have seen major price hikes for the main feed ingredients used in poultry diets in the U.S. Corn and soybean prices have approximately doubled over this period (Figures 1 and 2). Recent press releases indicate a two-year high in U.S. corn futures (Feedinfo.com, 2010a) and looming supply problems in wheat, rice, corn and particularly soybeans (Feedinfo.com, 2010b).

Given the likelihood of continued price and supply volatility in the major feed ingredients, companies will be forced to establish core capabilities in actively managing price swings and supply in order to remain profitable.

Risk management

Leading companies are supporting purchasing with risk management capabilities to control the effect of price fluctuations (Accenture, 2009). Having the information and tools to manage risks and down the value chain and consider all of the risks involved.

After these risks are assessed, companies can then choose from among four categories of risk transfer and mitigation techniques: (1) upstream risk transfer to suppliers, (2) downstream risk, (3) risk transfer to outside entities and (4) internal risk mitigation (Table, page 26).

Given the likelihood of continued price volatility within feed markets, nutritionists who are able to use a wider

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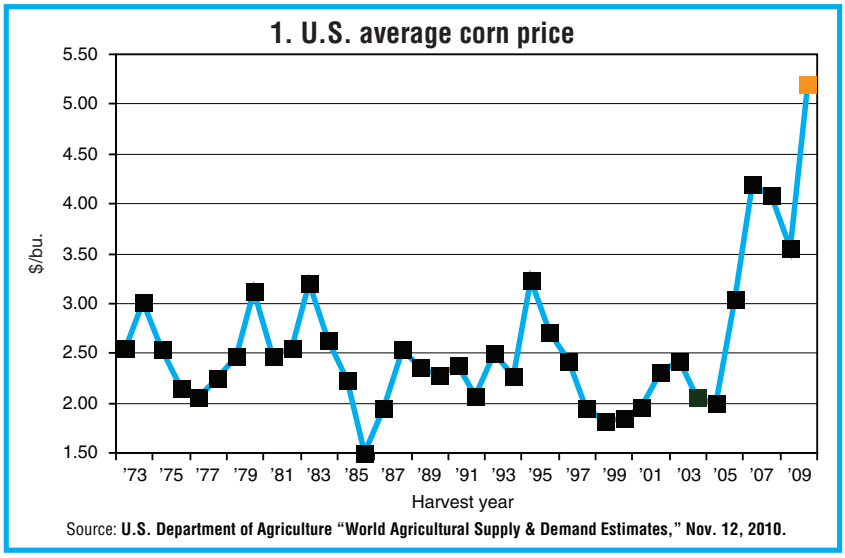
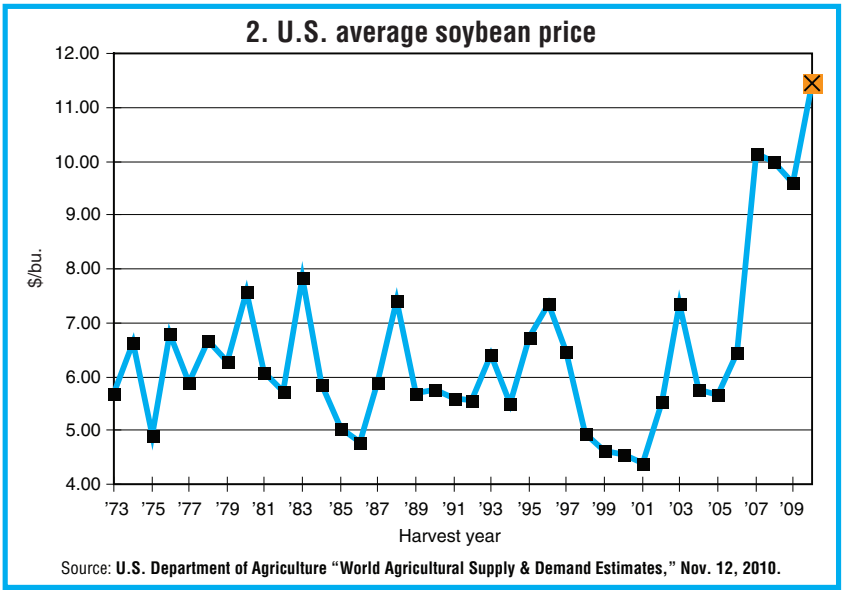


Source: **U.S. Department of Agriculture "World Agricultural Supply & Demand Estimates," Nov. 12, 2010.**



Source: **U.S. Department of Agriculture "World Agricultural Supply & Demand Estimates," Nov. 12, 2010.**

range of feed raw materials stand to gain the most. Therefore, internal risk mitigation of animal feed companies should include strategies to increase flexibility in feed formulation.

It's a matter of being able to spread the risk of any particular feed ingredient becoming overly expensive while being able to take advantage of good-value feedstuffs when they become available. All of these decisions have to be made without any negative impact on animal performance.

Alternative raw materials

In conjunction with the expansion of U.S. feed grain-based ethanol production, the availability of distillers grains has increased proportionally from 5.3 billion lb. to 58.3 billion lb. annually (Figure 3, page 26).

Dried distillers grains with solubles (DDGS) in the U.S. are primarily made from corn. Since DDGS is relatively low priced versus corn and soybean meal, this provides an incentive to include it in animal feed rations. By replacing corn with DDGS, it has been calculated that producers saved close to $1 billion in 2010 (Staff, 2010).

It is estimated that of the distillers grains used domestically, 39% is used in dairy rations, 38% in beef cattle rations, 15% in swine production, 7% in poultry and 1% by other livestock species (O'Brien, 2010). Recommendations for inclusion of distillers grains as an alternative raw material in feed rations vary by livestock species. For broiler feeds, inclusion rates of 10% DDGS have been recommended, although strategies to use more are being examined.

More complex diets

Corn DDGS used as an alternative raw material for poultry diets is potentially a good source of energy, protein and phosphorus. However, including DDGS increases the complexity of the diet and also increases potential variability in its nutritive value. DDGS is a highly fibrous raw material, containing around three times more fiber than corn grain.

Ward et al. (2008) screened U.S.-origin DDGS from modern ethanol plants for non-starch polysaccharides, which is the major part of dietary fiber, and found that arabinoxylans and cellulose were the predominant non-starch polysaccharides. They reported a value of 11.4% arabinoxylans (on a dry matter basis).

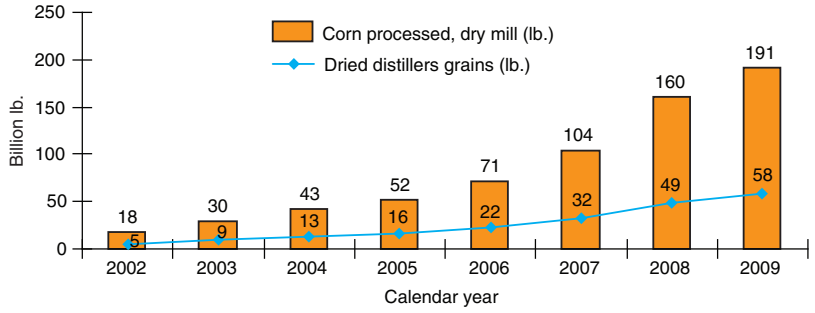
Furthermore, consistency can also be a big problem as the nutrient composition of DDGS can vary from batch to batch and from plant to plant. Batal and Dale (2006) reported that metabolizable energy in DDGS can be highly variable. This variability is much greater than that reported for corn and other grains. Therefore, adding DDGS to poultry diets can reduce the digestibility of energy and increase the variability in that energy value.

Categories of risk transfer and mitigation techniques

Upstream risk transfer to suppliers	Companies can employ sourcing and contracting limit suppliers' ability to pass on additional costs. For example, diversifying the supplier base for priority raw materials gives companies negotiation leverage and limits the power of individual suppliers when prices spike. In some circumstances, it is possible to partner with suppliers to share supply chain risk (such as using fixed, long-term contracts)
Downstream risk transfer	Transfer to customers' companies can include terms and conditions in contracts to adjust the timing of contract expiration and the risk exposure, where both let them pass on additional costs to consumers. For example, when volumes are agreed to for the long term, pricing can be updated frequently as the market changes
Risk transfer to outside entities	Although companies should not rely on them exclusively, hedging strategies that transfer risk to counterparties in the financial markets can be critical. Companies can also transfer risk externally by collaborating with other companies in pursuit of shared goals. Such cooperation can create a win/win situation that reduces both cost and risk
Internal risk mitigation	For internal mitigation, the key is developing flexibility in product development and manufacturing operations. This lets companies switch to cheaper raw materials when prices rise or shift production to different geographic locations that have cost advantages. Companies can also stockpile an inventory of raw materials when prices are low and draw on these when prices spike

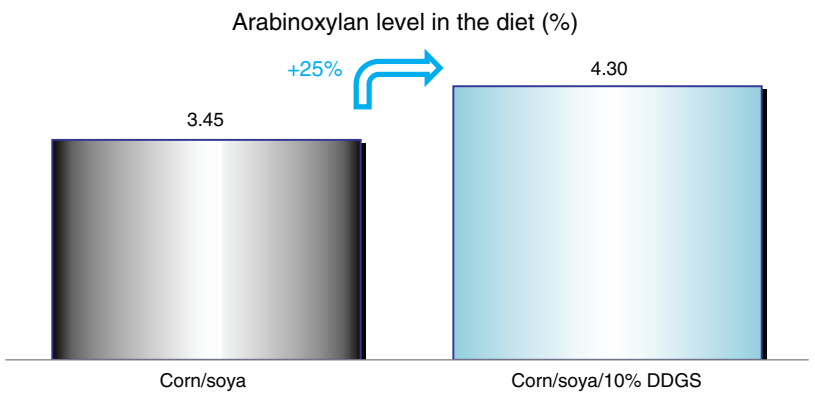
Modified from Shulman et al. (2010).

3. U.S. corn use for ethanol and dried distillers grain production



Source: **Renewable Fuels Assn.**

4. Arabinoxylan level in corn/soy-based poultry diets in response to DDGS inclusion



Equally, lysine digestibility can vary considerably in DDGS since lysine can irreversibly react with starch via the Maillard reaction during heating processes, rendering that lysine relatively unavailable to the bird. Therefore, the use of digestible amino acids when formulating with DDGS is always strongly recommended.

Benefits of enzymes

Fortunately, many of the factors that affect nutrient digestibility and variability in feed raw materials can be targeted by appropriate enzyme supplementation. Feed enzymes offer a tool to increase the opportunity to switch to alternative but cheaper feed ingredients. This increases flexibility when formulating poultry diets to offset the risk of raw material price volatility and its resultant negative impact on profitability.

The most common feed enzyme used in poultry diets is phytase, which releases the phosphorus bound in phytate in grains. This can help reduce dependence on supplementary inorganic phosphorus that, especially in recent years, has been highly variable in price.

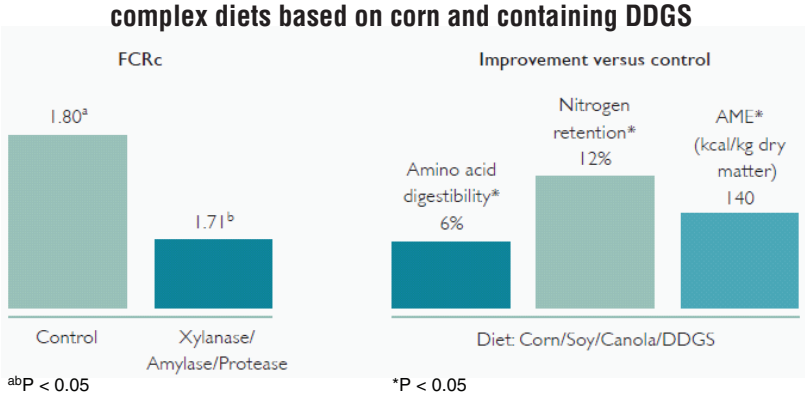
However, there is increasing independent evidence to show that both carbohydrase and protease enzymes can offer an advantage on top of phytase in corn-based poultry diets. This is because these enzymes are able to release extra energy from the starch in corn. Around 65-70% of the energy in corn is derived from starch, but not all of it comes in an easily digestible form, and digestibility has been shown to be highly variable between batches of corn.

A considerable amount of starch can be locked up by fibrous cell walls and bound to storage proteins, making it more difficult for the animal to digest. Furthermore, starch can become more resistant to digestion through drying and heat treatment of corn, which can create protein/starch bonds that reduce starch digestibility.

Specific enzymes can be used to target the substrates that are reducing the availability of energy from corn and can thereby significantly increase the digestibility of dietary energy. For corn-based diets, the most relevant enzyme activities have been shown to be xylanase, amylase and protease.

Xylanase breaks down arabinoxylan in cell walls to expose starch and other nutrients for digestion. Protease helps to release the starch encapsulated by and bound to storage proteins and, in addition, hydrolyzes proteinaceous antinutrients such as lectins and trypsin inhibitors to further improve protein and amino acid digestion. Amylase can be added to the diet to help the bird digest resistant starch more effectively.

5. Performance and digestibility benefits from addition of a combination of xylanase, amylase and protease enzymes to complex diets based on corn and containing DDGS



abP < 0.05

Meta-analysis of six U.S. broiler trials in corn-based complex diets

FCRc = bodyweight-corrected FCR

*P < 0.05

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Note: Phytase at 500 FTU/kg feed in all diets.

Advanced enzyme solutions

As higher levels of alternative raw materials, such as DDGS, are used in poultry diets, the levels of potentially problematic substrates will then increase (Remus, 2008). For example, the level of arabinoxylans in a corn/soybean meal-based poultry diet will increase by approximately 25% in response to including 10% DDGS into the diet (Figure 4, page 26).

Therefore, the nutritionist needs to be aware of these substrates and how much their levels are changing in response to raw material usage in order to determine appropriate enzyme additions. DANISCO Animal Nutrition develops feed enzyme technology and analyzes more than 1,000 grain samples each year to assess changes and variability in substrate levels for enzymes in poultry diets. Recent research has led to optimizing the combination of xylanase, amylase and protease (Axtra XAP) to match the relevant substrate levels in modern, more complex poultry diets or diets that include DDGS (Figure 5).

Conclusion

For internal risk mitigation of price volatility in feed raw materials, the key is to increase flexibility in feed formulations, allowing companies to switch to alternative but cheaper raw materials without compromising bird performance.

Higher inclusion rates of alternative feed materials such as DDGS result in more complex and fibrous poultry diets. This reduces the availability of dietary nutrients and potentially increases variability in feeding value to the birds.

Feed enzymes are known for their ability to increase the availability of dietary nutrients and, thus, increase the opportunity to use alternative feed raw materials in poultry diets. However, changes in dietary substrate levels for enzymes as a result of the use of more complex diets require more sophisticated enzyme solutions.

In Danisco's experience, including the right combination of xylanase, amylase and protease activities, together with phytase, allows the producer to both maintain bird performance and maximize net profit.

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