Enzyme solutions lower the cost of safer feed

by Gwendolyn Jones, Global Technical Services Manager, Danisco Animal Nutrition.

Energy and phosphorus are generally the two most expensive nutrients in poultry diets. Profitability depends on getting the most of these nutrients out of the grain used in poultry diets, and thus minimising the amount that has to be supplemented via fat or inorganic phosphorus. The availability of these nutrients from grain can be significantly improved by the effective use of enzyme combinations. Therefore it pays to shop around and update your knowledge on what makes an effective enzyme solution for your feed.

Enzyme combinations

Both wheat and corn are highly variable in the amount of energy that the bird is able to metabolise and the majority of phosphorus is present as phytate, a substance which is unavailable to the bird.

Around 65-70% of the energy in corn is derived from starch, but its digestibility in different batches of corn is highly variable, both within and between harvest years.

For wheat, on the other hand, energy digestibility generally depends on viscosity, which is caused by the presence of soluble fibres in the grain – this too varies from year to year.

Harvest year[a]	WHEAT		CORN	
	Viscosity cPs	CV%	% in vitro starch digestibility	CV%
2009	7.92	35.4	40.5	13.8
2008	8.55	29.2	36.4	27.2

[a]Number of grain samples analysed globally by Danisco from harvest year: 268 wheat and 547 corn in 2009, 370 wheat and 473 corn in 2008 (Source: Avicheck databases). CV% = (standard deviation/mean) x 100%

Table 1. Key grain parameters in wheat and corn harvested 2008-2009.

Table 1 shows data collected globally for starch digestibility in corn and viscosity in wheat, taken from the 2008 and 2009 harvests. The high variability (expressed as CV%) shows how dangerous it can be to assume consistent nutritional values from grain when formulating poultry diets.

A recent global survey confirmed that 78% of phosphorus in wheat and 88% in corn is present as phytate. Fortunately, many of the factors which affect digestibility can be targeted by enzyme supplementation. Xylanase breaks down cell walls to expose starch for digestion.

Protease helps to release the starch encapsulated by, and bound to, storage proteins. Amylase, a starch-digesting enzyme, can be added to the diet to help the bird digest starch.

Xylanase also reduces the viscosity of wheat, which in turn reduces variability in the availability of its energy to the bird.

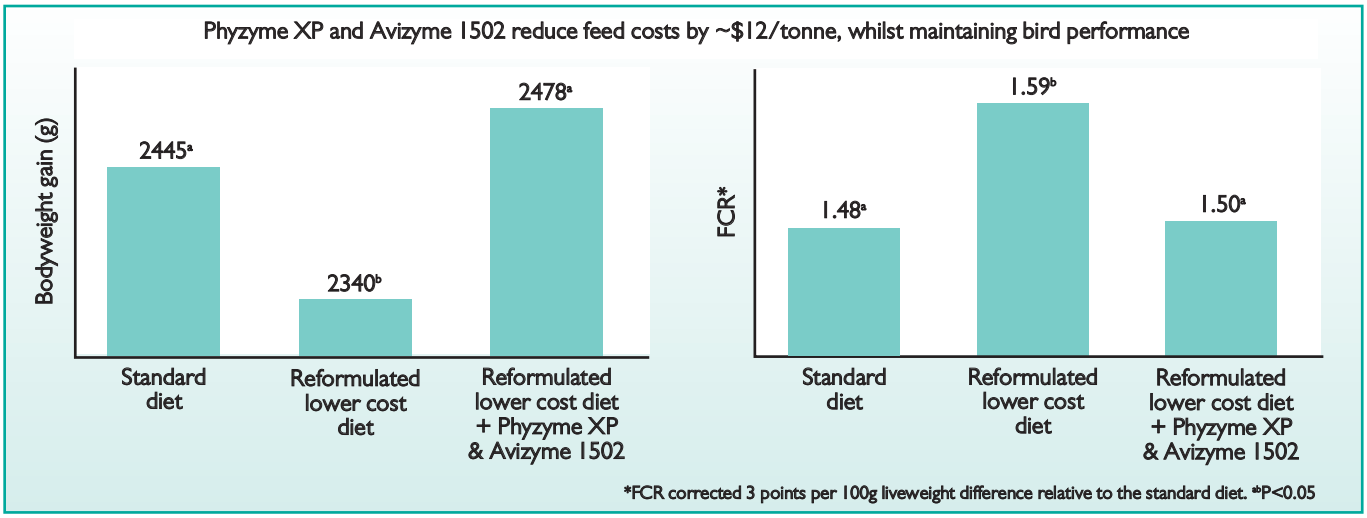
Wheat viscosity is linked to the presence of non-starch polysaccharides (NSPs) such as arabinoxylans, which xylanase degrades.

Another beneficial side effect is that sticky droppings (a by-product of feed viscosity) will also be reduced.

The enzyme phytase is capable of breaking down the phytates in feeds to release inorganic phosphorus, as well as protein, calcium and trace minerals chelated with phytates. It can therefore eliminate or reduce the need for supplementation of inorganic phosphorus.

Continued on page 33

Fig. 1. Effects of feed enzyme solutions on bodyweight gain and feed efficiency of low cost feed formulations. Broilers: average age 42 days. Reformulated diet: ~150kcals reduction in energy; 0.09% reduction in available phosphorus; 0.12% reduction in total calcium (Purdue University, USA).



Continued from page 31

The efficacy of enzyme combinations has been quantified in a study from Purdue University in the USA. Using combinations of xylanase, amylase, protease (Avizyme 1502) and phytase (Phyzyme XP), poultry producers feeding corn-based diets are able to reduce feed costs by around 5% (Fig. 1).

Effective enzyme solutions

Concerns about feed safety and the need for salmonella control have led to a huge increase in the use of heat treatment in pelleted poultry diets.

However, heat treatment actually increases the viscosity of wheat-based diets even more (Table 2).

The effect on poultry performance can be severe. In one trial, increasing the pellet-conditioning temperature for poultry diets poorer feed conversion ratio (4.4%) in the broilers.

As the pelleting temperatures of poultry diets increase more sophisticated technologies are required to protect enzymes from the heat and maintain their bio-efficacy.

One technology, involving the modification of an enzyme by changing its amino acid structure to improve thermostability, has been widely tested in recent years.

This technique includes the substitution of surface amino acids in the enzyme with more hydrophobic amino acids, as well as an increase in the number of specific amino acids which are capable of forming cross-bonds within the enzyme molecule.

This approach was chosen for the development of Danisco Xylanase, which has recently been authorised by the EU commission for use in poultry diets.

It is stable to pelleting temperatures of up to 90°C.

Table 2. Properties of gut contents in broilers fed pelleted diets based on 77% wheat, either non-heat-treated or pelleted at 90°C.

	Wheat	
	Non-heated	Heat treated
Jejunal viscosity (cPs)	15.4[a]	30.2[b]
Dry matter in digestive contents (%)	25.0[a]	19.8[b]
Faecal stickiness score*	2.9[a]	3.2[b]

*Subjective score of cage dirtiness, 5 for the dirtiest cage; [a,b]P<0.05 (Svihus 2006, Norwegian University of Life Sciences)

A second approach – Thermo Protection Technology (TPT) – has been found to be highly effective in protecting Danisco's second generation E. coli phytase from heat.

In carefully controlled trials, the TPT coating technology enabled a recovery rate of 96% of the enzyme, despite exposure to feed pelleting temperatures of up to 95°C.

Other studies have demonstrated a fast release of phytase activity from Phyzyme XP TPT in the gut, with a bio-efficacy equivalent to the uncoated product in mash diets.

Conclusion

As naturally occurring substances, enzymes are ideally placed to meet the complex financial and safety demands now facing the modern poultry producer. Enzyme solutions should certainly be considered by all those who seek to minimise feed costs or improve feed efficiency.

They do, however, require a careful combination of activities to match enzymes to the relevant substrates in the diet and achieve the necessary tolerance to heat.

Ideally, the use of these enzyme solutions should be determined with the help of software tools that determine optimum dosages and maximum cost effectiveness.

The ability to provide such services will no doubt become a major factor in the choice of enzyme suppliers in the future. ■