Factors that influence the efficacy of xylanase in corn:soy diets for broilers

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Cereals, including corn, contain arabinoxylan (AX) as part of the fibre fraction; AB Vista data suggests the content to be around 5% (dry matter basis) in corn, 9% in wheat and 8% in barley, with AXs as the largest fibre fraction in all three cereals.

AX is comprised of chains of beta-1,4 linked xylose molecules with arabinose attached to some xylose moieties. Folding and cross-linking of the molecule renders it mostly insoluble in water. The proportion of soluble material is greater in wheat than corn; it is soluble AX that can cause increased digesta viscosity with wheat based diets.

As soluble AX causes a direct increase in the viscosity of digesta, visually causing problems such as wet litter, the use of xylanases in wheat based diets becomes common, as the anti-nutritional effect of AX is visual and easy to observe. In comparison, insoluble AX does not have a clearly visible anti-nutritional effect, but can reduce nutrient digestibility.

Both soluble and insoluble AXs are susceptible to degradation by endo-xylanases such as Econase XT. The enzyme hydrolyses the bonds between xylose moieties, therefore reducing the molecular weight of the molecule to what can be termed xylo-oligosaccharides (XOS).

These smaller molecules are less viscous and provide a rapidly fermentable substrate for certain bacterial populations in the hind gut of animals.

For these reasons, Econase XT is extremely effective in reducing gut viscosity and increasing nutrient digestibility in wheat based diets where there are substantial amounts of both viscous and insoluble AX.

However, it can also be effective in increasing nutrient utilisation in corn based diets where there is a substantial level of insoluble AX but less soluble AX. The following information details how best to use Econase XT in corn based diets for non-ruminants.

Starter phase nutrition

A holo-analysis of all recent AB Vista Econase XT broiler data (49 trials) suggested that starter nutrition is critical to the overall response to the enzyme. We know from experience that in many cases, the beneficial effect of xylanase can take time to develop over the life of a broiler. As described above, xylanase produces XOS which are known to be rapidly fermentable in the caeca and therefore promote the growth of beneficial bacteria. This is often termed a prebiotic effect. The products of fermentation are known to stimulate the production and secretion of gut hormones, such as Peptide YY (PYY), into the blood.

These hormones have effects such as improvement of endothelial cell health within the gut and importantly, increases gastric retention time, therefore increasing nutrient digestibility. The scientific literature supports this mechanism; often, when a non-starch polysaccharide (NSP) enzyme is included in the diet throughout the life of the bird, significant benefit is most evident at final weight, and the effect can be large.

An independent holo-analysis of the literature by Rosen, published in Poultry Science (2006), has also concluded that even if an effect is not seen in early stages, enzyme application should be continued for the full life of the bird for the maximum benefit to be seen at a later stage.

Similarly, the holo-analysis shows that the level of corn in the diet is related to the response observed with xylanase inclusion; the more corn the better. In in vitro assays, corn AX is very rapidly fermented by gut microbes, which could lead to beneficial modulation of the flora. The newly-hatched chick has a less well developed caecal flora, so during the starter phase, it is possible to 'prime' this region of the gut with beneficial flora by using a xylanase.

The holo-analysis also showed that the level of fat in all diet phases, but particularly the starter phase, is critical in promoting a response to a xylanase. An increase in total added fat will decrease the response to xylanase, but the use of some animal fat is beneficial in achieving a xylanase effect. This can be explained as addition of fat in the diet will increase the metabolised and net energy of the diet, improving animal performance even though in a more expensive way.

This increase in the net energy of the diet will also be advantageous for the low quality chicks that have more difficulty to grow.

These low quality chicks are also the birds that benefit more from the increase of nutrient digestibility which results from Econase XT inclusion. A high fat diet may mask the true benefits of Econase XT. The total substitution of added fat is not recommended since a minimum level of fat inclusion is needed to ensure good bird performance.

When energy in a formulation is decreased when adding an enzyme, this can be achieved by dropping added fat but some level of fat, preferably animal fat, should be maintained to maximise response to xylanase.

Linear response

The response to xylanase appears to be linear with fat inclusion, so even a small increase in the level of animal fat may increase the response seen. However, the statistical model shows that the energy level of the diet is opposed to the fat content in terms of the xylanase response. So, if some fat is removed from the formulation but energy is maintained, the response is predicted to be slightly better than if fat is maintained but energy is dropped in the starter.

The animal fat effect is possibly because it promotes gastric retention, more so than vegetable fat, which is beneficial in an under developed proventriculus-gizzard. It is possible that resultant pepsin activity and amino acid digestibility are greater – an ancillary benefit. Fat is also a potent stimulator of PYY in the distal small intestine, hence also promoting gastric retention. ■