# Role of **xylanase** in diets with superdosed phytase

Non-starch polyssacharide (NSP) degrading enzymes, bacterial endoxylanase in particular, still prove to be very cost effective, even in combination with superdosing of phytase.

By Ronny Mombaerts and Anne Goderis, Nutrex, Belgium

Phytases and xylanases act on complete different substrates and improve broiler performance by other modes of action.

Phytase supplementation is not just about liberating phosphorous, as recent publications have shown. The presence of phytate (IP6) in the GI-tract also leads to poor digestion of protein and minerals, increased mucus production, and in general a worse intestinal health. Besides phytate itself, the degradation products of phytate, such as IP5, IP4 and IP3, also exert similar anti-nutritional effects in the animal. Initially, phytase action is degrading one anti-nutrient and simply replacing it by another. Higher phytase inclusions of two to three times the normal dosage, also referred to as superdosing, should further degrade phytate, IP5, IP4 and IP3, resulting in end products without anti-nutritional effects.

Since superdosing of phytase is gaining interest in the feed industry, and more attention is being paid to the 'extra-phosphoric effects', some doubts are arising whether there will still be a sufficient additional effect of non-starch polysaccharide (NSP) enzymes. Although the effect of combining both classes of enzymes may not be strictly additive, still enough arguments exist to justify the cost effectiveness of using both combined. Even if phytase is superdosed, the mode of action of improving animal performance is entirely different for both categories of enzymes, which makes a strong overlap in their effects unlikely. The expected effects of NSP enzymes and phytases on each of the claimed benefits are as follows:

***Improvement of protein digestion***

Lie *et al.* (2009) described this anti-nutritional effect of phytate as being caused by the ability of phytate to chelate with certain

amino acids and its ability to reduce the activity of endogenous proteolytic enzymes in gizzard, duodenum and jejunum. Complementary to this is the positive effect of certain NSP enzymes on protein digestion which is related to the liberation of the encapsulated protein fraction thanks to the break-down of plant cell-wall material.

***Improvement of mineral digestion***

Release of phosphorus (P) and other minerals, bound to phytate, is the first and well understood reason to use phytase. There is no doubt about the efficacy and it is widely accepted to include these effects when formulating diets. NSP enzymes do not play a crucial role in this respect.

***Reduction of digesta viscosity***

Little research is available about the role of phytate on gut viscosity, and probably phytase use does not have much, if any, direct impact on this parameter. NSP enzymes, however, were originally used in particular to eliminate digestive problems caused by soluble NSP's, present in high viscous raw materials such as wheat, barley and rye. It is interesting to note that if changes in viscosity have a clear effect on feed passage rate, there could be an interaction between phytase and NSP enzyme use. Use of an NSP enzyme with optimal activity in a more acidic environment would cause a fast reduction in viscosity in the stomach and gizzard, which would increase the passage rate there.

Since the majority of phytate degradation happens in that part of the GI tract, this also decreases the time available for the phytase to work optimally, apart from other implications associated with a reduced residence time of the feed in the stomach or gizzard. For this reason, the use of NSP enzymes with a more neutral pH optimum, could be advisable to allow for a more complete phytate degradation.

***Creation of inositol***

In case all phosphate groups are removed from phytate, inositol is formed. Inositol has a metabolic function similar to insulin, and may regulate glucose transport and protein deposition (Yamashita *et al*, 2013). NSP enzymes have no activity in this field.

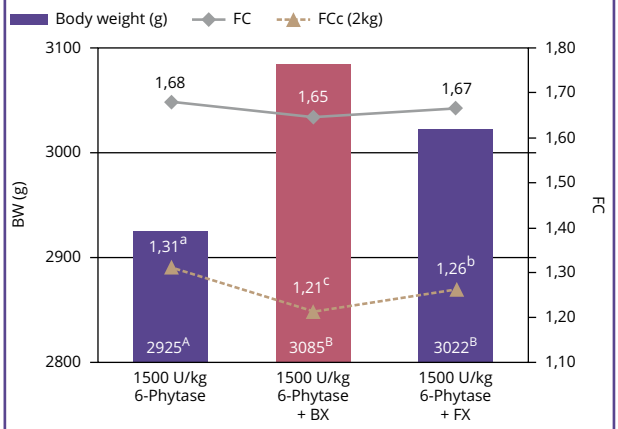
***Support of general intestinal health***

In relation to gut health, both classes of enzymes can be useful, but by acting on a completely different substrate. Phytase destroys IP6, IP5 and IP4, which are harmful components for gut health, while the activity of specific types of NSP-enzyme creates prebiotic substances which can stabilise the microbiota composition in the hindgut. Improvement of protein digestion, in which both enzyme classes can play a role, will also contribute to improved gut health.

## Research trials in broilers

To study the effect of two different xylanases added on top of superdosed phytase, a broiler trial was conducted at the trial farm of the Catholic University of Leuven, Belgium. Diets (wheat, corn and soy bean meal based) were fed in pellet form and provided *ad libitum*. Three dietary treatments were included in the trial setup : a standard wheat-corn based diet supplemented with 1500 FTU/kg feed of 6-phytase (SD), SD with additional bacterial (*Bacillus subtilis* - Nutrase Xyla, Nutrex) endo-1,4-β-xylanase (100 mg/kg feed) = BX, and SD with additional fungal (*Trichoderma citrinoviride*) endo-1,4-β-xylanase (100 mg/kg feed) = FX.

Figure 1 - Body weight and feed conversion for the different treatments.




In this trial, significant treatment effects were observed for final body weight (P= 0.001) and corrected feed conversion (P=0.001), while feed intake was not influenced by the treatments (P=0.48). The results in *Figure 1* show that both NSP enzymes were able to increase significantly the final body weight of the animals. Adding the xylanases increased final body weight by 5.5% and 3.3% for BX and FX respectively. Improvement of daily gain without change of feed intake means that feed utilisation became more efficient thanks to xylanase supplementation. Corrected feed conversion improved by adding xylanase in a superdosed phytase diet. $FC_{cor-2\,kg}$ improved by 7.5% and 3.8% for the BX and FX supplemented group, respectively.

## Conclusion

Although both xylanase sources improved the performance of the broilers, it's important to mention that they cannot be considered as equally effective. BX fed broilers were 63 g heavier ($P < 0.1$) at the end of the trial and their $FC_{cor-2\,kg}$ was 0.05 lower ($P < 0.05$) compared to the FX animals.

These data confirm the hypothesis that due to the fact that phytases and xylanases act on completely different substrates, they improve broiler performance by another mode of action. The effect of xylanase activity, which is (depending on the type of xylanase) a combination of reducing viscosity, liberation of entrapped nutrients and creation of prebiotic substances, cannot be achieved by phytase, even when superdosed. Based on this trial, the technical or economic benefits of adding xylanase in combination with superdosed phytase should be clear. However, a closer look at the source and type of xylanase is important as efficacy among xylanases can differ substantially.

*References available upon request*

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