Improve financial returns with targeted enzyme applications

Over recent years poultry producers have come under greater pressure from authorities and consumers. One example is the ban on antibiotic growth promoters and the demand for free-range broilers and layers. Whilst these initiatives have been taken to safeguard public health and animal welfare, they increase the pressure on poultry producer profitability.

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Producers are thus forced to seek alternative sustainable ways to maintain animal health, welfare and performance. Feed enzymes were one of the biggest breakthroughs in animal nutrition in recent years, allowing nutritionists to formulate cheaper diets while maintaining animal performance, reducing production costs and potential environmental pollution.

Today, phytases and carbohydrases are widely accepted in poultry nutrition but, despite this, the way in which feed enzymes are applied to diets remains conservative.

Historically, this has been based on a limited understanding of the level and nutritional influences of enzyme substrates and of the changes enzymes can bring about to animal metabolism and physiology.

In recent times, our understanding in each of these areas has progressed, opening up new opportunities to exploit the full potential of feed enzyme application.

This article will explore the application of phytase and xylanase to overcome the anti-nutritive effects associated with phytate and fibre respectively.

Anti-nutritive effects of phytate and phytase superdosing

Phytate is known to be a potent anti-nutrient, impairing the utilisation of minerals and other nutrients such as amino acids and energy.

Phytase application has evolved significantly in the past 7-8 years with the introduction of the practice of using high doses or 'superdoses' of phytase to move closer to full destruction of phytate (IP6) and its lower esters (IP5-IP1).

Higher doses of phytases can also deliver animal performance benefits through the full dephosphorylation of phytate to create inositol in-situ.

Inositol is the backbone of the phytate molecule, and is reported to improve energy metabolism, helping animals utilise dietary energy more efficiently.

In one broiler trial, it was estimated that one third of the feed conversion rate (FCR) benefits observed with phytase superdosing was caused by inositol provision (Fig. 1).

Response variable	M+C spared (%)	Lys spared (%)	Thr spared (%)
Bodyweight gain (day 0-42)	15.9	8	12.5
FCR (day 0-42)	9.9	11.4	2.9
Carcase weight (day 42)	*	13.6	*
Breast weight (day 42)	*	*	*
Bodyweight gain (day 0-21)	17.2	15.9	4
FCR (day 0-21)	14	19.2	2
AID amino acid (day 21)	16.3	8.1	*
Average (%)	14.70	12.70	5.40

Table 1. Quantum Blue sparing effect on amino acids.

Phytase superdosing can be utilised to deliver improved animal performance simply by topping up the feed with extra phytase without assuming any nutritional contribution.

To achieve this, producers formulating diets with 500FTU/kg of phytase while assuming the standard nutritional contribution from the enzyme should simply add more enzyme to target a final in-feed activity of 1,500-2,500FTU/kg.

This can improve poultry and pig feed efficiency through higher phytate breakdown (usually a reduction of around 3-4 FCR points).

This approach requires an increased feed cost up front and assumes that the extra nutrients released through phytate destruction are converted to more meat or improved animal efficiency.

To build on the commercial benefits of superdosing, AB Vista has conducted extensive research to further understand the quantity of amino acids, minerals and energy that can be spared by the use of higher dosages of Quantum Blue phytase, and also how dietary phytate level could impact animals and enzyme response.

The usual approach is to conduct this research through digestibility assays; however, AB Vista decided to take a different approach, instead running dose response trials with the nutritionally important amino acids, providing a more realistic picture of the impact of phytase inclusion on nutrient requirements.

In a series of six broiler trials conducted to determine animal response with high levels of phytase, results showed that the efficiency in utilising methionine + cystine, lysine

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Fig. 1. Inositol release partially explains phytase superdosing benefit.

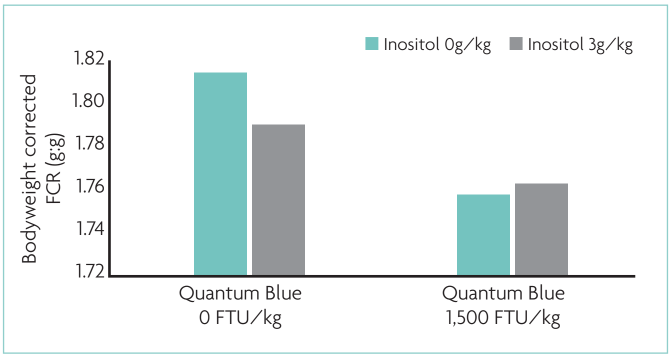
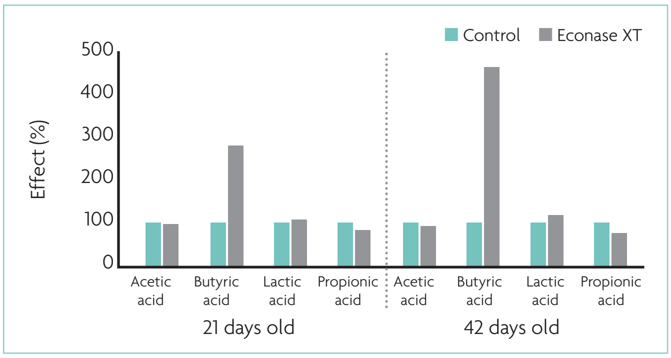


Fig. 2. Effect of Econase XT on ileal volatile fatty acid content of broilers.



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and threonine were improved by 15, 13 and 5%, respectively (Table 1).

This demonstrates the potential feed savings that can be achieved by using higher phytase doses and helps explain where the animal performance benefits of superdosing are coming from.

Optimising fibre breakdown and fermentability

Fibre is a major component of diets, usually comprising 10-15% of normal diets, but it can prove challenging to measure because common analytical methods employed today provide misleading information.

The crude fibre method, which is more than 100 years old, is still widely employed to determine fibre, but, at best, captures 20-25% of the total dietary fibre.

Today, there is a lot of debate about functional fibre and its potential benefit to the digestive physiology of animals. One important thing to remember is that fibre is not directly digested by the animal, but serves as a substrate for the gut microbiota to ferment.

Xylanases are known to increase the solubility of fibre and make it more easily fermentable, thus having marked benefits on gut physiology and the overall balance of gut microbiota (Figs. 2 and 3).

Higher fibre degradation can help reduce protein flow to the lower gut, thereby reducing biogenic amines and ammonia production, and potential problems with dysbiosis.

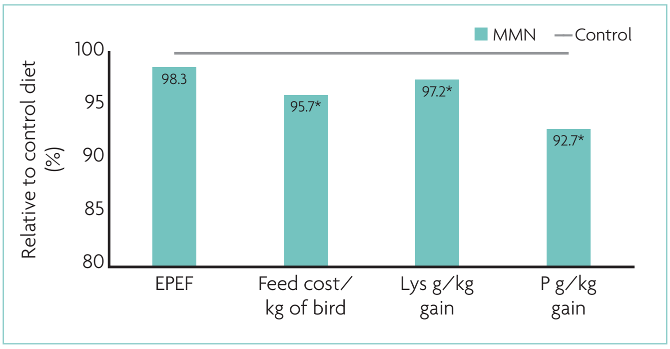
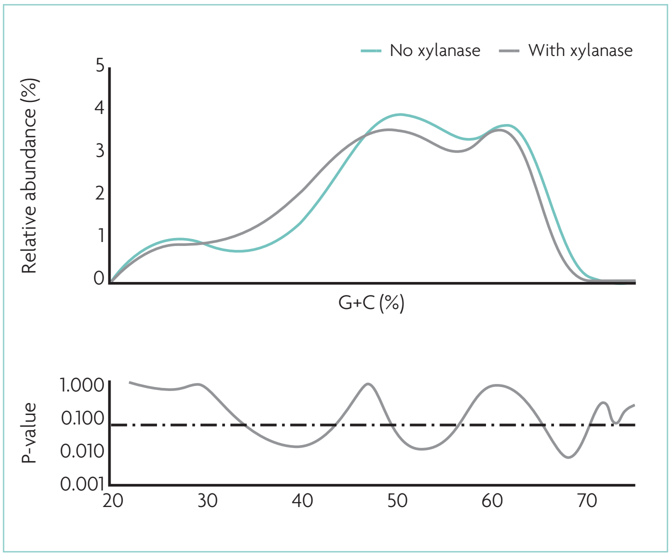


Fig. 4. Benefits of Maximum Matrix Nutrition (MMN) application on broiler chicken production.

Fig. 3. Microbiota profiling (percentage guanine + cytosine) of caecal content of turkeys fed diets with and without Econase XT.



Maximum Matrix Nutrition

With better knowledge of the anti-nutritive effects and potential nutritional benefits of phytate and fibre, coupled with a better understanding of enzyme mode of action, AB Vista has developed an enzyme application strategy called Maximum Matrix Nutrition.

This strategy capitalises on the properties of Quantum Blue, an enhanced E. coli phytase with a high affinity for phytate, in addition to a thermostable and inhibitor-resistant xylanase, Econase XT.

Combining these enzymes enables customers to take higher dietary nutrient contributions whilst maintaining animal performance, enabling considerable cost savings and a reduction in the excretion of nutrients.

Extensive validation trials have been conducted globally with broilers and results show on average, savings of around two cents per kg of live bird, and feed cost savings in excess of US$15/tonne.

When compared with traditional enzyme application, Maximum Matrix Nutrition delivers equal performance at a considerably lower feed cost.

Trials have established that broiler performance can be maintained in diets with reductions of at least 2.5kg/t monocalcium phosphate, 10kg/t soybean meal and 10kg/t fat.

Birds were able to maintain performance while consuming 7.3% less P and 2.8% less lysine (Fig. 4).

It is only in the past few years that an application such as AB Vista's Maximum Matrix Nutrition has been available for feed producers. This is due to advances in understanding of enzyme modes of action and feed substrate contents, resulting from improvements in analytical methods.

Producers are now able to measure the phytate level in diets using NIR technology, and can determine in-feed enzyme activity routinely, ensuring quality assurance procedures are in place to confidently extract maximum value from advanced enzyme application strategies. ■