Superdosing phytase remains beneficial at lower inorganic P prices

In the last two years, increasing prices of inorganic phosphorus (P) sources has led to higher inclusion levels of phytase in poultry diets. While previously the inclusion of phytase was usually fixed at 500 and 1,000 FTU/kg of feed, levels have since increased to 1,500 and 2,000 FTU/kg.

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These higher levels of phytase reduce the cost of the feed by replacing inorganic P. Although the recent drop in prices of inorganic P sources has tempered this tendency, it is still economically viable to consider higher dosing (often termed superdosing) of phytase as it optimises animal performance.

The antinutritional effects of phytate

Phytate-phosphorus, the storage form of P in plants, is composed of a myo-inositol ring with six phosphate groups attached. As this molecule carries a very negative charge, it will bind in the gastro-intestinal tract with any nutrient which has a positive charge (Fig. 1).

This binding can be to macrominerals like calcium (Ca), microminerals such as zinc and copper, but also amino acids.

When these nutrients are bound to the phytate molecule, they are unavailable for absorption by the animal.

In addition, phytate is known to increase the loss of endogenous protein. This lost protein will be replaced by protein from the feed which is then not available to the animal to enhance performance.

By superdosing phytase, more phytate is broken down which reduces the binding of valuable nutrients, ensuring they stay available to the animal, enhancing its performance.

In large broiler studies it is shown that increasing the inclusion levels of the heat stable phytase OptiPhos Plus improves protein digestibility as well as P digestibility.

The general trend is that with increasing concentrations of phytase, protein digestibility also increases (Table 1).

Realistic expectations

Looking at the claimed improvements in protein digestibility as reflected in proposed matrix values for some phytases currently on the market, it shows that claims of up to 4-5% improvements are being made. In most cases, the supporting studies were carried out with feed formulations not at all similar to the commercial specifications of feeds.

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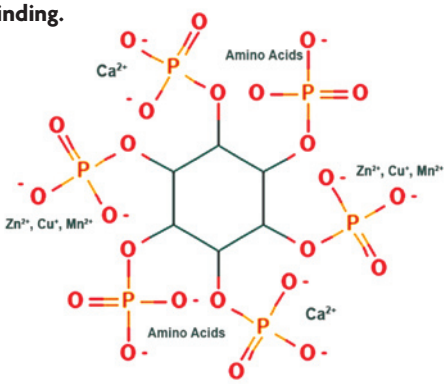
Table 1. Improvement in protein digestibility by increasing the dose of OptiPhos Plus.

		Positive control	Negative control	NC + 250 FTU	NC + 500 FTU	NC + 1,000 FTU	NC + 1,500 FTU	NC + 2,000 FTU
Indonesia	P	46.3	48.7	71.3	76.9	78.4	ND	ND
	Crude protein	73.3	73.4	75.5	76.4	76.3	ND	ND
The Netherlands	P	52.7	51.4	60.0	61.3	67.3	ND	75.9
	Crude protein	76.1	76.1	77.6	77.0	78.5	ND	78.8
Belgium	P	61.3	31.5	64.8	69.7	75.1	82.8	ND
	Crude protein	77.4	77.4	77.3	77.8	80.7	79.5	ND

*ND: not determined

Fig. 1. Phytate structure and its antinutritional effect linked to nutrient binding.



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These feeds would not be commercially viable and would deliver very poor technical results.

In other trials, excess protein is provided in the feed, making it easy to prove the claimed amino acid matrix values for a phytase – you are simply removing the excess protein which is not contributing to performance anyway. The golden rule regarding expectations of the improved protein digestibility by superdosing phytase in commercial feeds which are adequate and well balanced in digestible amino acids, can be stated as such:

- 1% improvement: sure.
- 2% improvement: maybe.
- 3% improvement: do not count on it.

Similarly, the enhancement of performance in trials sometimes shows very positive results, but in many of these trials this can easily be linked to below standard feed formulations (for example excess Ca combined with borderline P in the control feed which is not supplemented with phytase). However, a more moderate expectation (and reference) is what has recently been observed in a very large research study in Indonesia. In this trial, a high-quality corn/soy feed was reformulated with the Ca and P matrix values of OptiPhos Plus at 2,000 FTU/kg.

The performance of the birds reached the intended objectives of performance (according to the guidelines), while the addition of 2,000 FTU/kg of OptiPhos Plus delivered extra growth of 25g and a feed conversion reduction of approximately 0.02 (Fig. 2). This yielded an extra financial benefit of €0.05 per broiler.

The economics of superdosing: it pays for itself and more

To estimate how much performance needs to increase to be economically beneficial when shifting from a dose of 500 FTU/kg to 1,000 or 2,000 FTU/kg is shown in Table 2. To simplify things, it is assumed that there is no feed price reduction due to reformulation at 1,000 or 2,000 FTU/kg (which is generally not the case).

Assuming broiler weight at 35 days and a feed conversion of 1.5, only a 2.5 to 7.5g higher end weight, or a 0.003 to 0.008 improvement in feed conversion (or any combination) at 1,000 and 2,000 FTU/kg is needed to reach financial break even. The improvement is much higher than this (as seen above in Fig. 2), thus the phytase pays for itself and more. ■

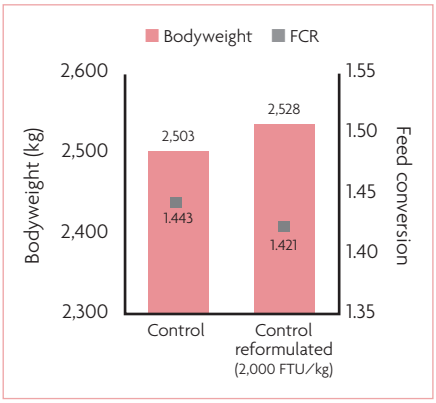

Fig. 2. Response in performance when superdosing OptiPhos Plus at 2,000 FTU/kg (35 days).

Table 2. Required performance improvement to obtain break even (cost improvement).

	1,000 FTU/kg	2,000 FTU/kg
Extra income needed (€/1,000 birds)	2.5	7.5
Extra end liveweight (g) needed per bird (at €1/kg)	2.5	7.5
Improvement in FCR needed	0.003	0.008