

CHOOSING THE RIGHT PHYTASE FOR PHYTATE DESTRUCTION

For the anti-nutrient effects of phytate to be eliminated, phytate needs to be degraded quickly. Given that some phytate is insoluble (unavailable) even in the stomach, rapid and efficient break down of phytate may be necessary as early as the stomach. Optimal phytase activity for superdosing therefore differs from that required to simply release available phosphorus. It relies not only on the activity of the enzyme early in the gastrointestinal tract at low pH, but also on other characteristics such as intrinsic thermostability (to avoid delays to onset of activity caused by thermostabilising coatings), protease resistance (to avoid the degradation of the phytase by endogenous proteases in the stomach), and activity at very low substrate concentrations. **Thus, superdosing is not simply increasing the dose of a phytase, it is increasing the dose to the point that 80-85% of phytate is hydrolysed very quickly.** This may simply not be possible with some of the products on the market, but is well proven to work in several trials with Quantum® Blue.

PHYTASE SUPERDOSING: MORE EFFICIENT PRODUCTION



SUPERDOSING = COMPLETE PHYTATE DESTRUCTION

SUPERDOSING RESULTS IN:

Improved nutrient utilisation including P, Ca, inositol and protein



3 - 4 point improvement in FCR



€4 - 5 / TONNE OF FEED



SAVINGS / EFFICIENCY

Global monogastric feed production: 700 million tonnes per annum



OVER €3 BILLION IN REDUCED FEED COSTS EACH YEAR

IN CONCLUSION

Phytate (IP6) and the low phytate esters are potent chelators of minerals. Understanding the relationship between phytate, phytase and Zn is important in optimising the post-weaning performance of pigs with phytase superdosing and pharmacological Zn levels.



AB Vista, C/Peru, 6. 2ª Planta, Oficina 4
28290, Las Rozas, Madrid, Spain
T + 34 91 859 1787 E emea@abvista.com W www.abvista.com



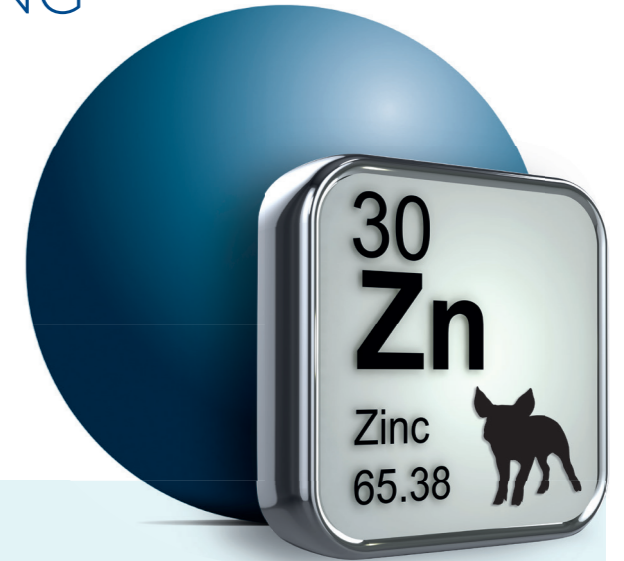
PHYTASE SUPERDOSING AND RELEASE OF ZINC - BENEFITS IN PIGLETS



Gustavo Cordero
Technical Manager EMEA

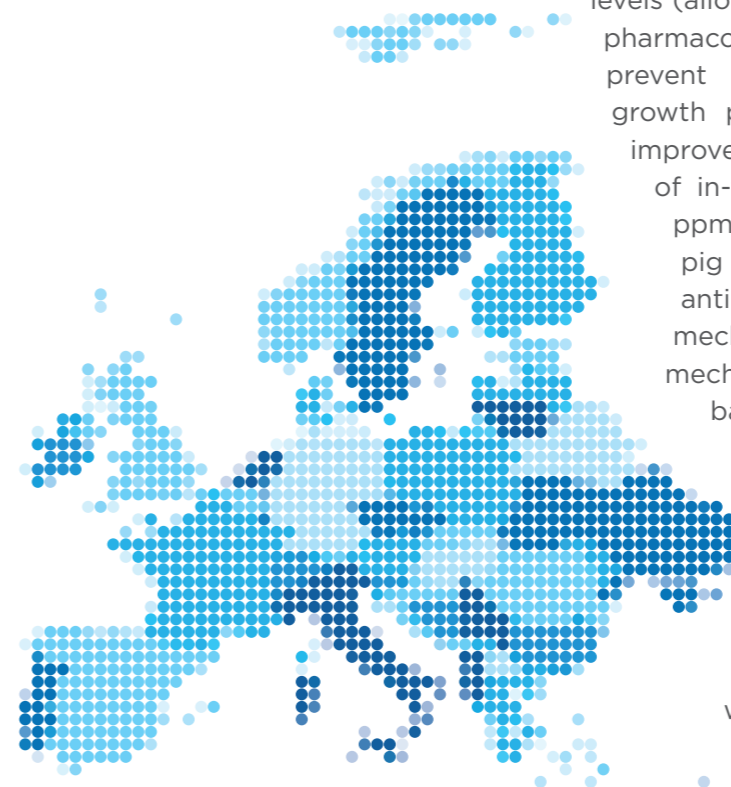


Rob Ten Doeschate
Technical Director EMEA



WHY IS ZINC IMPORTANT FOR PIGLETS?

Zinc (Zn) is an essential trace element in all living systems, from bacteria, plants and animals to humans. Zinc deficiency causes skin lesions in pigs and can result in poor growth. Zinc is limited in EU pig feeds to a total of 150 mg/kg, including background Zn levels although often pharmacological



levels (allowed and defined by veterinary authorities). These pharmacological doses are used in piglet diets to help prevent post-weaning diarrhea and indirectly improve growth performance, with some trials showing a 20% improvement in gain with 2500 ppm of Zn. Hence, use of in-feed pharmacological levels of Zn (2000-2500 ppm) as zinc oxide (ZnO) is widely accepted in the pig industry, especially in some EU countries after the antibiotic growth promoter ban. Although the exact mechanism is unknown, it may involve a number of mechanisms including bacterial modulation, electrolyte balance, and tight junction function or regulating gene expression.

Zinc is a heavy metal which is toxic to living organisms (animals, bacteria, plants) when encountered in high concentrations. Even in pigs, feeding more than 1,000 ppm Zn for more than four weeks can cause toxicity, of which the first symptom is a reduction in feed intake.

THE PROBLEM OF PHYTATE AS AN ANTI-NUTRIENT - REDUCING ABSORPTION OF ZINC

Phytate, the storage form of phosphorus in plant-based ingredients, can bind minerals, including Zn, dependent on pH (Figure 1). **This means that in the presence of phytate (IP6), or the partially degraded phytate esters (IP5, IP4, IP3), Zn is poorly available for absorption in the small intestine of the animal (as pH increases), thus increasing excretion into the environment, which is a potential concern, and thus a balance between piglet welfare, production and the environment is important.**

IP6 & IP5 ARE BAD, BUT IP4 AND IP3 ARE NOT MUCH BETTER

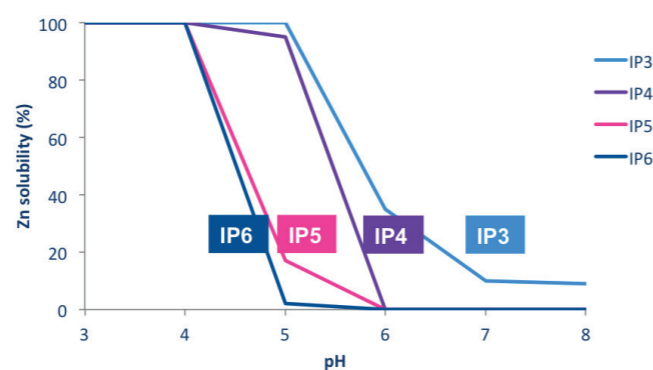
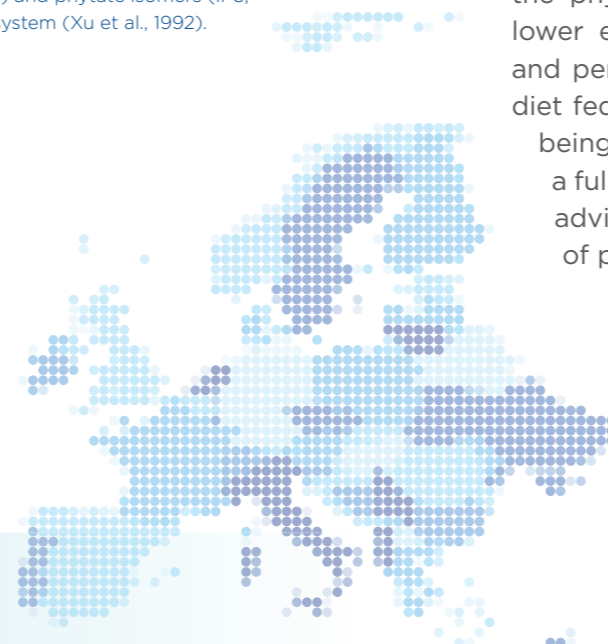
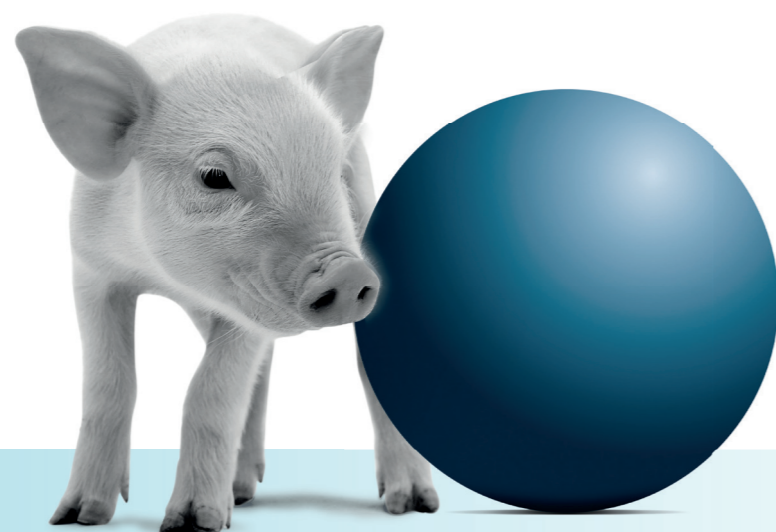


Figure 1. Binding capacity of phytate (IP6) and phytate isomers (IP5, IP4, IP3) for zinc measured in an in-vitro system (Xu et al., 1992).



SITUATION IN EUROPE - ZINC CONTAMINATION AND REGULATION

- In recent years, there has been an increase in the public concern about environmental damage from intensive animal production. The European Union has set maximum permitted levels for mineral concentrations, including zinc, in feed in order to protect livestock, the consumer and the environment.
- Reducing the supplementary Zn level and improving Zn efficacy without negatively impacting post-weaning performance therefore is of significant interest and may be achieved by reducing phytate in the diet through the use of phytase superdosing.

Using a phytase that quickly and efficiently reduces phytate concentration and therefore increases the bioavailability of Zn, may allow reductions in dietary ZnO supplementation, whilst reducing fecal scours and maintaining piglet growth.

DESTROYING PHYTATE WITH PHYTASE SUPERDOSING TO IMPROVE MINERAL ABSORPTION

Superdosing phytase is now a common application in piglet starter feeds. Phytase superdosing typically involves the application of three to five times the standard dose of a highly efficient phytase developed to target near complete phytate destruction, such as Quantum® Blue. It is important to degrade phytate (IP6) and its lower esters such as IP4 and IP3 as quickly as possible. These lower esters have recently been shown to have anti-nutritive properties, as well as IP6, so it is important that the phytase can break down IP6 but also its lower esters for maximum mineral absorption and performance benefits. Due to the types of diet fed immediately post-weaning traditionally being low in phytate P concentration the use of a full mineral matrix from phytase is often not advisable though, especially in the presence of pharmacological levels of ZnO.

The interaction between superdosing with Quantum® Blue and pharmacological ZnO levels has been well studied. A series of 5 trials in different countries with this phytase, dosed at 2500 FTU/kg immediately post-weaning up to 21 days has been analyzed. Three levels of ZnO (low, medium or high) were defined to investigate the impact of phytase and Zn on piglet performance (Figure 2). These results show the importance of Zn supplementation: with the high Zn, non-phytase supplemented diet improving gain by 12-17% when compared to the low zinc, non-phytase supplemented pigs. Furthermore, the addition of superdosing phytase improved performance at all levels of Zn tested by 10-30% with the highest ADG at 30% obtained at medium levels of Zn with superdoses of the adequate phytase, suggesting that the optimum combination would be a medium level of ZnO in the presence of Quantum® Blue superdosing.

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SUPERDOSING

Of course any implementation of this concept should always be done in consultation with the practising vet.

WEANING UP TO 21 D POST-WEANING
(5 trial summary)

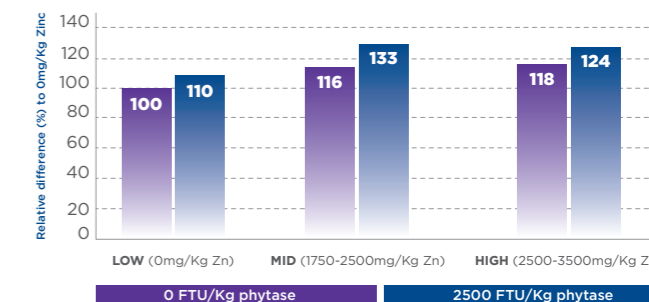


Figure 2. The relative improvement in average daily gain compared to zero zinc supplementation. Note: all diets had a base supplemental zinc; 100ppm (AB Vista, internal 2015).

Furthermore, it was noted that when compared to a non-phytase diet, superdosing phytase at 2500 FTU/kg in post-weaned pig resulted in increased serum Zn (Walk et al., 2013). This indicates an improvement of Zn utilization by the animal with Quantum® Blue superdosing and may in part explain the growth performance benefit as well as the reduction in post-wean scour by 6% in pigs fed superdose phytase supplemented starter feeds. The lower level of scour may also be a component of the overall improved nutrient utilization of the diet with superdosing phytase, thereby limiting nutrient flow into the hind gut and reduced microbial proliferation.