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Update on the use of phytase in swine

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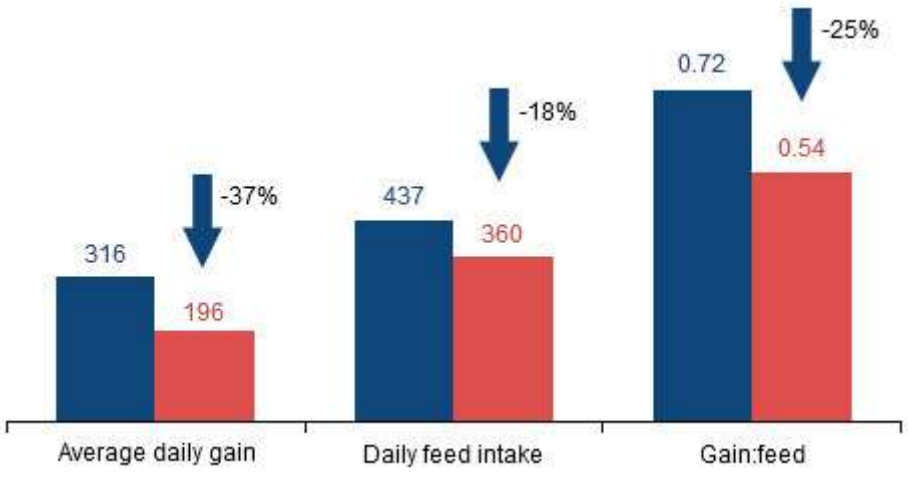
It has been almost thirty years since we started hearing about how profitable it would be to use phytase in animal feeding, specifically for monogastric livestock. Back then, not only was the release of phosphorus contemplated, there were also concerns about the harmful effect of phytate on animal performances. However its use seemed distant, mainly because of its cost. It wasn't until the mid 80s when countries like Holland accepted the possibilities that phytase had to offer in the reduction of phosphorus excreted through manure, that the use was spread throughout the swine industry. In this article we want to briefly highlight some results in the use of phytase in swine.

Use of phytase in swine: a real benefit

While the penetration of phytase in the world market is about 90%, it is estimated that "only" 70% of swine producers use this enzyme. But as data is collected and reported benefits increase, so does this trend. Recent research, carried out with seriousness, has not only shown that the replacement of inorganic sources of phosphorus in pigs for phytase is very possible, but that there is also an effect on other nutrients to take into account. In this article I will try and outline briefly some details in weaned piglets, growing pigs and finishing pigs.

Use of phytase in weaned piglets and growing pigs

Endogenous enzymes cannot digest phytate (from 0.80% -1.2% of the diet, depending on components). This causes endogenous losses, reducing the nutritional value of feed. Recent research (Woyengo et al., 2012) show how weaned piglets (7.4 kg) fed with a highly digestible synthetic diet - based on casein and corn starch -, when supplemented with synthetic phytate (and 0.56% phytic-P), had a decrease in growth (37%), as well as feed intake (18%) and gain:fed ratio (25%). Previous studies show very similar effects; a reduction in the digestibility of energy, protein and amino acids in growth and finishing pigs.



Graph 1: The phytate as an anti-nutritional element,reduces the performance of piglets (7.4 kg).These were fed high digestible diets, without phytate (= blue) and with added phytate (= red) (Woyengo, 2012).

The use of phytases show an improving effect of digestibility not only on calcium and phosphorus. Very recent studies prove it in growing piglets (22.1 and 30.3 kg, with 16 cannulated piglets, divided into 4 groups and fed in two periods; Adedokun et al., 2015). Data from this research with a bacterial 6-phytase in cannulated piglets prove a significant improvement in the ileal digestibility of nutrients and energy. Table 1 shows how the use of this phytase improved the apparent ileal digestibility of DM, N, Ca and P and energy in 4.0, 3.4, 9.1, 15.2 and 3.1%, respectively, in addition to increasing digestible energy available in 152 kcal / kg. According to the authors, this phytase, unlike other studied, was able to significantly improve ileal digestibility of all nutritional parameters studied, obtaining also the highest improvement in P (15.2%) and Ca (9.1 %). Although not shown in the table, the use of such high doses also significantly enhanced apparent ileal digestibility of amino acids measured.

Table 1: Apparent ileal digestibility of DM, other nutrients and digestible energy of piglets (with average initial BW in periods 1 and 2 of 22 and 30 kg, respectively) fed with different levels of a 6-phytase (Adedokun et al, 2015) . The results show the average data for the two periods.

	Phytase levels, FTU/kg				
	0	**500**	**1000**	**2000**	**Prob.**
N. replicas	7	8	7	8	
DM, %	62,9	67,8	67,7	66,2	0,012
N, %	73,8	78,4	76,6	76,6	0,011
Ca, %	62,5	73,9	70,5	70,4	0,002
P, %	46,4	57,8	64,2	62,9	<0,001
Energy, %	66,4	69,5	68,6	70,4	0,068
Ileal digestible energy, kcal/kg	2820	3008	2977	2930	0,053

Use of phytase in finishing pigs

Clearly the effect of phytase on digestibility beyond minerals is an area in which there is growing evidence. But it's the improvement in the release of phosphorus from the phytic-P molecule in the feed that can lead us to feed pigs without using a source of inorganic phosphorus.

A study was carried out at the Agricultural CenterHausDüsse, Germany (DuPont, 2012); using 272 pigs (29-121 kg LW), fed by a liquid feed system in three phases; half of the animals received food with monocalcium phosphate (MCP) and 400FTU / kg base and half without MCP, but adding 1000, 500 and 350 FTU / kg of bacterial 6-phytase in each phase. In Table 2, the results show that:

- The use of a 6-phytase allows feeding pigs from 29-121 kg, without the use of MCP, *maintaining the same results without altering carcass composition.*
- The use of 6-phytase in diets without MCP led to more than *1 € / head* net margin.
- The 6-phytase in animals fed without MCP achieved a *36%* reduction in the excretion of P.

Table 2: Comparison of results of pigs (29-121 kg LW) fed with MCP and without MCP but with a 6-phytase (1000 FTU / kg, 500 FTU / kg and 350 FTU / kg) (DuPont 2012, own documentation)

	Control, MCP + 400 FTU/kg	No MCP + 6-phytase
Average daily gain, g/d	878	873
FCR, g/g	2.58	2.54
Carcass weight, kg	94.6	95.2
Carcass yield, %	78.4	78.8
Lean, %	57.6	57.3
Boneash*, g/kg DM	582	587
Ca in boneash, %	38.2	37.5
P in boneash, %	17.8	17.5
Benefit over feed cost, €/pig	75.5	76.6 (+1,1)
P_2O_5, kg/pig**	1.331	0.857 (-36%)

(*): 16 pigs/treatment; 3rd metacarpal bone, calculation of ash, Ca and P.
(**): Pentoxide P, calculated = P excretion (kg/pig) * 2.29

Conclusions

The use of proven phytases in swine, is recognized to be an extremely useful tool for nutritionists not only in formulating more affordable feed without altering animal performance, but even improving it.