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Feed additives (enzymes), as a way for improving performance parameters of gilt and weaned piglets.

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Abstract

The major part of phosphorus (P) in cereals and seeds is stored as phytate (myo-inositol hekxakisphosphate), that is hard to digest for pigs. Phytate P in plants is a mixed calcium-magnesium-potassium salt of phytic acid that is present as chelate and solubility is very low. Phosphorus in this form is poorly digestible/available for simple-stomached animals. However, the enzyme phytase catalyses the hydrolysis of phytate rendering phosphate available for absorption. The reported effects of phytase addition on the improvement of P digestibility show great variation.

The aim of this study was to test the effects of the microbial phytase (NATUPHOS) on the performance parameters of gilt and weaned piglets.

The microbial phytase preparation (*Aspergillus niger*, NATUPHOS) was supplemented to a basal ration 750 FTU/kg feed and the effects on growth performance of gilt and weaned piglets were studied weekly.

The supplementation of microbial phytase improved slightly daily weight gain, feed intake and feed conversion ratio. Overall a positive effect of the microbial phytase on performance parameters was observed. The P-excretion in the faeces was reduced also.

Keywords: Microbial phytase, Gilt piglets, Weaned piglets, Performance parameters.

Introduction

Interest in phytase for non ruminant animals take place in regions, where soil and groundwater pollution due to animal wastes is a serious problem and phosphorus is a major concern. Indeed, plant phytate is the major form of plant phosphorus [2] and phytate phosphorus itself has low availability. The majority of the P in cereal grains and oilseed meals is organically bound as phytic acid or phytate. This form of P is nutritionally unavailable to non ruminant animals due to the lack of phytase in their digestive tract. As a result swine and poultry diets must be supplemented with highly available, inorganic sources of P to meet their P requirements. The poor bioavailability of P in the natural feedstuffs along with high dietary levels of supplemental P result in higher levels of fecal P compared with ruminant animals.

Studies in the early 1990s at Kentucky and Michigan showed that feeding pigs a low-P, corn-soy diet supplemented with phytase from a mutant strain of *Aspergillus niger* improved the bioavailability of P. At about the same time, research in the Netherlands also demonstrated the efficacy of phytase produced by recombinant *Aspergillus niger* in studies with pigs and chicks. In November, 1995 a commercial source of recombinant-produced phytase (Natuphos) was approved for use in the USA. Since then, other sources and forms of phytase have been developed and evaluated. From 1992 to 2001, 82 papers involving phytase were published in Poultry Science (N=55) and the Journal of Animal Science (N=27) with 48 of these published in the last 4 years. The studies clearly show that phytase increases the digestibility and bioavailability of P from phytate, reduces the amount of inorganic P needed to maximize growth and bone mineralization, and markedly reduces fecal excretion of P. Phytase seems to increase the bioavailability of Ca, Z, and other

divalent cations that otherwise bind to phytate. Some studies suggest that phytase may improve ideal digestibility of amino acids slightly, but other studies have not shown this response. This new technology offer substantial benefits to swine and poultry production by reducing the potential for environmental problems associated with excess P excretion.

The effect of microbial phytase use as a partial replacer of the bicalcium phosphate in the layers and weaned piglets, aiming a better utilization of the phytic phosphorus and decrease of the environment pollution was documented [3]. Utilization of microbial phytase (Natuphos) on the nutritive ration of weaned piglets (28 days old), was accompanied with improved performance parameters. In the experimental group, treated with Natuphos (750 FTU/kg), the excreted phosphorus amount in the dropping is decreased by 6,8%, while the excreted nitrogen amount is decreased by 5,2%. So, there is a positive output towards the minimizing of the environmental pollution with non degradable Phosphorus and Nitrogen. [1] concluded that a 50% reduction of excreted phosphorus would mean that 100.000 fewer tons of phosphorus would be excreted into the environment annually in the United States [6]. Obviously, this could have a major impact and would be especially significant in countries, where livestock production is restricted because of environment pollution.

With the industrial production of phytase, application of this enzyme to pig's diet to increase P availability and improve animal performance, as well as reducing environmental pollution has gained widespread attention. The beneficial effects of supplementary phytases on P digestibility and animal performance have been well documented [4,5].

2. Material and Methods

Twenty piglets (Large White x Landras) of three litters were transferred to flat-decks and allocated to 2 groups (A and B) with 10 animals (5 male and 5 female), respectively. Two piglets from different litters (1 male and 1 female), with the same body weight were housed in every box (experimental unit). The litter origin was taken into account, avoiding that piglets from the same litter were allocated in the same treatment. There were five replications per control group and five also per treated group. The control group (A) was feed with a balanced diet, containing mono calcium phosphate. The experimental group (B) was feed with low level of phosphorus, without inorganic phosphorus. All the phosphorus in this group originates from soybean meal. This group was supplemented with NATUPHOS phytase 750 FTU/kg feed.

The basal diet mainly contained maize and soybean meal and the nutrient contents met or exceeded nutrient requirements recommended by NRC. The diets were offered ad-libitum and animals had free access to water.

Table 1. The calculated nutrient concentration of diet.

Nutrient concentration (g/kg feed)		
	Control group (A)	**Experimental group (B)**
ME (MJ/kg)	12.75	12.80
Crude protein	190.1	191.1
Crude fibre	38.4	38.1
Calcium	6.90	6.45
Phosphorus	6.0	4.2
Lysine	2.1	1.9
Metionine+Cystine	6.4	6.5

During six weeks experimental period Body Weight (BW), Daily Weight Gain (DWG) and Feed Conversion Ratio (FCR, kg feed/kg Body Weight Gain were measured weekly. Data are presented as arithmetic means with standard deviation of the mean (Mean ± SD). One-way analysis of variance and Student's *t*-test ($P<0.05$) were performed to test the differences between two groups.

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3. Results and Discussion

Feeding phytase NATUPHOS was slightly improved the production parameters respectively: Final Body Weight (FBW) by 1.65% and Daily Weight Gain (DWG) by 2.7%, compare with control group

Table 2. The effect of phytase on production parameters of gilt and weaned piglets.

Parameters		*Control group*	*Experimental group*
Production	n[1]	X ± SD	X ± SD
-Initial BW, kg	10	7.5 ± 0.31	7.51 ± 0.34
-BW 6th week [2]		18.7± 1.2	19.01 ± 1.3
DWG, g [3]		266.6 ± 3.4	273.8 ± 3.7
FCR [4]		1.92 ± 0.30	1.87 ± 0.32

[1] Number of animals, (10 piglets/ every group, at the beginning of the experiment)
[2] BW at the end of the trial.
[3]DWG for whole experimental period.
[4]FCR for whole experimental period.

Feed Conversion Ratio (FCR) was reduced (-2.67%) to compare with control group, but the differences were not significant. The P-excretion was reduced by 25-30%, provided that pig's diets can be supplemented with an economical and efficacious level of phytase that will allow all of the supplemental inorganic P to be removed from the diet.

4. Conclusions

Agricultural techniques and animal rest is a serious problem for soil and water pollution, especially in the areas with a big concentration of livestock farms. The situation is more problematic, when we add the fact that there is not government law to not allow the distribution of animal manure in everywhere. In such situation, It's difficult to have control on the quantity of phosphorus and nitrogen in the arable soil and ground water.

An original solution is the utilization of microbial phytase on the nutritive rations of non ruminant animals. This could have a major impact in countries, where livestock production is restricted because of environment pollution. Nowadays, Phytase supplementation is considered as a good way to reduce phosphorus excretion in non ruminant animals.

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6. References

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