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THE UTILIZATION OF ENZYMES IN NON RUMINANT'S ANIMAL NUTRITION AS A WAY FOR REDUCTION OF SOIL AND WATER POLLUTION BY PHOSPHORUS

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Abstract
Albania continues the reforms and developed good institutional and regulatory capacities for managing environmental issues. The roles of the public and private sectors need to be considered according the pollution intensity (solid pollution, the potential collapse of water, water contamination from agricultural or industrial pollutants, energy inefficiency, and threats to natural resources. Groundwater contamination by nitrate-nitrogen and eutrophication of surface waters by phosphorus originating from land application of fertilizers and animal manure are well documented in some most populated areas like, Durres, suburb of Tirana, Lushnja, Fier etc. One of the important reasons of soil and water pollution in Albania is the agricultural techniques and animal manures. Soil and water are compounding parts of it are before the risks of pollution presenting problems for the change of environmental equilibrium. Nevertheless the agricultural is always in front of difficulties from the influence of agronomic techniques and the animal rests. Excessive animal manure and fertilizer inputs do cause various environmental problems, related to the accumulation and elevated leaching, runoff of nutrients (N and P) and heavy metal to ground water and surface water. This is particularly true in areas where animal production has been geographically concentrated. Interest in phytase for non ruminant animals takes place in regions, where soil and groundwater pollution due to animal wastes is a serious problem and phosphorus is a major concern.

Key words*: livestock development, environment, water and soil pollution, animal manure, enzymes.*

INTRODUCTION

It's important to evidence that Albania is a mountainous country and only 16% of its territory is located at elevations of less than 100 m a.s.l. The agricultural land is distributed as follows: 43.3% in the plan or flat areas, 34% in the hilly zones and the remaining 22.7% in the mountainous region.

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Nonpoint source nutrient pollution of ground water and surface water by agriculture is a major, longstanding environmental issue in the United States (Sims, 2005). As comprehensive nutrient management planning has become more widespread in the U.S., it has become increasingly apparent that the primary causative factor for nonpoint nutrient pollution in many regions is nutrient imbalance. Nutrient surpluses, usually due to imports of feed and fertilizer far in excess of exports in crops and animal products, lead to the buildup on nutrients in soils and increase the likelihood of poorly timed applications of manures.

It is now widely accepted that a fundamental tenet of agro-environmental policy must be restoring nutrient balance on farms, especially those referred to as ''Concentrated Animal Feeding Operations" (CAFO-s). To achieve nutrient balance on farms or in watersheds

requires a number of political, social, economic and logistic challenges (Sims, 2005).

Case Study-Durres

Durrës is one of the biggest cities in Albania. Also, there are the most concentrated poultry, pig farms and industries in this area. There are nearly: 1 million broiler chickens, 16.000 cattle and swine industry. Population in this area is nearly 200.000 habitants and arable surface: 16.000 ha.

Table 1. The average quantity of organic fertilizer belongs to the species in Albania (Piu and Locher 2001)

Species	Live weight (kg)	The quantity (ton)/year
Cow	300 400 500	7 8 10
Sow with piglets in maternity	200	2
Pigs	100	1.2
Piglets	30	0.9
Chicken	2	0.07
Sheep	40	0.6
Goat	30	0.4
Horse	500	6

Table 2. N and P amended in the cultivated soil with manure (Sulce and Veizaj, 2006)

	Number of livestock	Annual manure production (in 000/tons)	N (tons)	P (tons)
Cattle	32 000	170 (35% moisture)	1300	380
Chicken	977 000	70 (60% moisture)	1200	300
Pigs	4 000	4 (45% moisture)	150	25
Sheeps/goats	40 000	20	600	100
Total			3250	805

Table 3. The composition of organic fertilizer in Kg/ton, (Piu and Locher 2001)

	N	P_2O_5	K_2O	Mg
Organic manure				
Cow manure	2	3		
Horse manure	2.4	3	6.3	1
Sheep manure	3.2	3.3	8	0.8
Poultry manure	10	28	16	4
Pig manure	3.3	3.2	2.3	0.6
Liquid manure	6	5	5	3

Animal nutrition and environmental problems

As a result of growing concern about the environment, intensification of animal production in many European countries is considered as potential source of air pollution and threat to soil and drinking water quality, (Eeckhout and De. Paepe, 1994).

Cereals composition

Nutritive ration of non ruminant animals (pigs and poultry) contains 90% cereals seed (corn, wheat, barley, rye, and oat). The majority of "P" in cereal grains 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. Indeed, plant phytate is the major form of plant phosphorus and phytate phosphorus itself has low availability (Kirby and Nelson, 1988).

The P-excretion on the pigs and poultry faeces is potential source for soil and water pollution, due to his high level on the subsoil water and destruction of the ecosystem. In such situation the solution is utilization of phytase on pigs and poultry nutritive rations.

MATERIALS AND METHODS

Thirty two piglets (Large White x Landrace) of four litters were transferred after weaning to flat-decks and allocated to 2 groups (A and B) with 16 animals, respectively. Two piglets from different litters (1 male and 1 female), with the same body weight were housed in every box (experimental unit). The control group (A) was feed with a balanced diet, containing mono calcium phosphate. The experimental group (B) was feed with low level of P, 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 diets were offered *ad libitum* and animals had free access to water.

RESULTS AND DISCUSSIONS

The supplementation of microbial phytase preparation (*Aspergillus niger*, NATUPHOS) 750 FTU/kg feed was reduced the P-excretion. The P-excretion was reduced by 20-25%, 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 (Cromwell and Coffey, 1991).

Table 4. Efficacy of supplemented phytase in low phosphorus diet for piglets.

Parameters		Control group	Experimental group
Production	n[1]	X±SE	X±SE
Initial BW,kg	16	12.2 ± 0.90	12.6 ± 0.48
Final BW,kg	16	23.2 ± 1.06	24.5 ± 0.96
DWG,g	16	369 ± 10.0	396 ± 7.33
FCR	16	2.44 ± 0.11	2.43 ± 0.10

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 (Rao et al., 1999, Ravindran et al., 1999).

The efficacy of any enzyme preparation depends not only on the type, inclusion rate and level of activity present, but also on the ability of the enzyme to maintain its activity in the different conditions encountered through the gastrointestinal tract and the conditions used for the pre-treatment of a feedstuff or diet.

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. An original solution is the utilization of microbial phytase on the nutritive rations of non ruminant animals. Nowadays, phytase supplementation is considered as a good way to reduce phosphorus excretion in non ruminant animals.

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REFERENCES

Boriçi J., Canco G., Veizaj E., 2005. Soil and water pollution as a result of agriculture techniques and animal rests. Abstract on the International Conference: Element balances as a Tool for Sustainable Land Management.

Cromwell G. L., Coffey R.D., 1991. Phosphorus -a key essential nutrient, yet a possible major pollutant –its central role in animal nutrition. In: Biotechnology in the Feed Industry. (Edited by T.P. Lyons). Nicholasville, USA; Alltech Technical Publications. Pg 133-145.

Eeckhout W., De Paepe M., 1994. Total phosphorus, phytate–phosphorus and phytase activity in plant feedstuffs. Animal Feed Science and Technology, 47, 19-29.

Kirby L., Nelson T., 1988. Total and phytate phosphorus content of some feed ingredients derived from grains. Nutr. Reports Intl. 37: 277-280.

Sims J.T., 2005. Element balances: A review and critical analysis of their application to United States environmental policy. Abstract on the International Conference: Element balances as a Tool for Sustainable Land Management, 34.

Piu Th., Locher E., 2001. The annual statistical manual of Livestock in Albania, 2: 28-31.

Rao R.S.V., Ravindran V., Reddy V.R., 1999. Enhancement of phytate phosphorus availability in the diets of commercial broiler and layers. Animal Feed Science and Technology, 79:211-222.

Ravindran V., Cabahug S., Ravindran G., Bryden W.L., 1999. Influence of microbial phytase on apparent ileal amino acid digestibility of feedstuffs for broilers. Poultry Science, 78: 699-706.

Sulce S., Veizaj E., 2006. Evaluation of potential pollution from agricultural activities at Durrës region (Albania).