EVALUATION OF THE EFFICACY OF A COMMERCIAL PURIFIED PHYLOSILICATE TO REDUCE THE TOXICITY OF ZEARALENONE+DEOXYNIVALENOL IN GILTS.

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INTRODUCTION

The natural contamination of grains by *Fusarium* mycotoxins is a global phenomenon to which swine are particularly sensitive. Zearalenone (ZEA) and deoxynivalenol (DON) are produced mainly by *Fusarium graminearum* and frequently found together in a variety of different grains, such as corn, wheat, rice, sorghum, barley and rye.(3,4) The primary effect of ZEA is estrogenic, and prepubertal female pigs are the most affected farm animals. The estrogenic effect is due to a close structural similarity between ZEA and estradiol. (8,11) DON, commonly called vomitoxin, belongs to the group of trichothecenes and causes reduced body weight gain, feed refusal and vomiting in swine. A tendency to reduce and also to increase the size of the liver has been reported in pigs fed natural DON contaminated feed. (7,1) Clinical signs of intoxication in pigs can occur with levels above 0.1 mg of ZEA and 0.5 mg of DON/kg of complete feed (4).

A practical approach to prevent mycotoxicosis consists of using adsorbent materials in the feed that reduce the absorption of mycotoxins from the gastrointestinal tract. Myco-Ad A-Z has been effective in preventing the toxic effect of 1.25 ppm of T-2 when added at 1 kg/mt of broiler feed. The product did not affect performance or bone mineralization of broilers, demonstrating its lack of nutrients absorption. (2) In addition, Myco-Ad A-Z at 1 kg/mt was effective in reducing the estrogenic effects of zearalenone in prepubertal gilts. (5)

There are no reports on the reduction of the bioavailability of a natural combination of *Fusarium* toxins by adsorbents; therefore, the objective of this study was to determine the efficacy of a low inclusion modified phylosilicate, Myco-Ad A-Z, to ameliorate the deleterious effects of natural ZEA plus DON contaminated feed in prepubertal gilts.

MATERIALS AND METHODS

This experiment was conducted at the Experimental Farm of Trilogy Analytical Laboratory. A total of eighteen 19-day-old recently weaned Yorkshire Cross gilts individually housed and reared under uniform management conditions, with feed and water provided *ad libitum*, were used in this experiment. Pigs were randomly distributed into three treatments with 6 replications each. Dietary treatments were as follows: 1) control diet; 2) control diet with the addition of 1200 µg of ZEA + 6000 µg of DON /kg of feed; and 3) control diet with 1200 µg of ZEA + 6000 µg of DON /kg of feed 0.1% Myco-Ad A-Z. Highly contaminated corn was used to provide the ZEA + DON in treatments 2 and 3. Myco-Ad A-Z is a commercial modified phylosilicate, produced in Texas (Special Nutrients, Miami, FL, USA). Feeds were analyzed for mycotoxins, E. coli, salmonella and listeria prior to feeding. Performance, relative liver and internal reproductive organs weights were evaluated at the end of the experiment, and vulva measurements (height x width) recorded at day 7, 9, 12, 14, 16, 19 and 21.

Data were evaluated with ANOVA for a complete randomized design, using the general linear models procedure of SAS software; SAS Institute (9). When the ANOVA showed significance, Duncan’s significant-difference test was applied. Statistical significance was accepted at $P \leq 0.05$.

RESULTS AND DISCUSSION

The control diet resulted negative for 19 different mycotoxins and the contaminated diets were positive only for ZEA (average 1185.2 µg/kg) and DON (average 6.13 µg/kg). All diets were negative for E. coli, salmonella and listeria.

The effects of dietary treatments on pig performance from 19 to 40 days of age are presented in Table 1. Feed waste was noticeable in pigs receiving the ZEA+DON contaminated diet and pigs from the other treatments imitated that behavior; therefore feed disappearance was measured and feed intake estimated. Results indicated a significant reduction in body weight gain, estimated feed intake and poorer feed efficiency when gilts consumed the ZEA+DON contaminated diet. Supplementation of 0.1% Myco-Ad A-Z to the diet with 1.2 ppm ZEA + 6 ppm DON significantly improved gain, estimated feed intake and feed efficiency. Feed conversion was based on feed disappearance. These results are typical from DON intoxication (1,7) and must be exclusively related to this mycotoxin, since it has been demonstrated in several experiments (3,4,5,10,11) that ZEA has no influence on performance. No apparent clinical signs of disease, including vomiting, were observed.

Table 2 and Figure 1 and 2 show the results of relative liver and internal reproductive organs weight at the end of the experiment. Gilts fed 1.2 ppm ZEA + 6 ppm DON contaminated diet had significant heavier internal reproductive organs (94%) and lighter livers (23%) than gilts fed the control diet. The addition of Myco-Ad A-Z to the contaminated diet resulted in gilts with a statistically significant reduction in internal reproductive organs weight (17%) and heavier livers (8%) than those fed ZEA + DON. Starting on day 9 until the end of the experiment there was a significant increase in the vulva size of gilts fed the ZEA+DON contaminated diet compared to gilts fed the control and the Myco-Ad A-Z supplemented diets (Table 3 and Figure 3), demonstrating the beneficial effect of Myco-Ad A-Z in preventing vulvovaginitis.

The typical estrogenic effects of ZEA were evident in gilts consuming the contaminated diet, confirming several reports from the literature (3,4,5,10); and Myco-Ad A-Z was effective in preventing the clinical signs of hyperestrogenism produced by high levels of ZEA, as previously shown by Malone *et al* (5).

This is the first report showing a significant effect of DON in reducing the liver size of prepubertal gilts. Pollman *et al* (7) observed only a trend toward reduction in liver weight when feeding DON levels from 1.2 to 3.6 ppm, which were much lower than the 6 ppm used in this trial. Bergsjo *et al* (1), on the other hand, reported an increase in liver weights of growing pigs fed 3.5 ppm of DON. Discrepancies in results might be due to the presence of additional mycotoxins in that study.

CONCLUSIONS

The deleterious effects of ZEA+DON in prepubertal gilts were completely independent; hyperestrogenism due to ZEA and poor performance with reduced liver size due to DON.

The addition of 1 kg of Myco-Ad A-Z per metric ton of feed was very effective in preventing both the toxic effects of DON and the estrogenic effects of ZEA in prepubertal gilts.

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ABSTRACT

An experiment was conducted to study the efficacy of a very low inclusion commercial purified phylosilicate (Myco-Ad A-Z) in preventing the deleterious effects of natural zearalenone (ZEA) plus deoxynivalenol (DON) contaminated feed in prepubertal gilts. Eighteen 19-day old recently weaned Yorkshire Cross gilts were individually housed and randomly distributed into 3 dietary treatments with 6 replications each. Pigs were fed a corn-soy diet containing or exceeding NRC recommended nutrients levels for 21 days. Treatments were: (1) control diet; (2) control + 1.2 ppm ZEA + 6 ppm DON; and (3) control + 1.2 ppm ZEA + 6 ppm + 1.0 kg/mt Myco-Ad A-Z. Highly contaminated corn was used to provide the ZEA + DON in treatments 2 and 3. Performance, relative liver and internal reproductive organs weights were evaluated at the end of the experiment, and vulva measurements (height x width) recorded at day 7, 9, 12, 14, 16, 19 and 21. Results indicated that gilts fed the ZEA + DON contaminated diet presented significant lower body weight gain and estimated feed intake, poorer feed conversion, heavier internal reproductive organs (94%) and lighter livers (23%) than gilts fed the control diet. The addition of Myco-Ad A-Z to the contaminated diet resulted in gilts with a statistically significant higher body weight gain (2220 vs 1040 g), better feed efficiency (5.53 vs12.82), lighter internal reproductive organs weight (17%) and heavier livers (8%) than those fed ZEA + DON. Starting on day 9 until the end of the experiment there was a significant increase in size of the vulva in gilts fed the contaminated diet compared to gilts fed the control and Myco-Ad A-Z diets (29.1 vs 16.5 and 18.6 at 21 days). These results indicate that Myco-Ad A-Z at 1.0 kg/mt was very effective in preventing both the toxic effects of DON and the estrogenic effects of ZEA in prepubertal gilts.

Key Words: Myco-Ad A-Z, zearalenone, deoxynivalenol, vomitoxin, gilts, pigs.

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Table 1. Effects of Myco-Ad A-Z on body weight gain, total feed intake and feed conversion ratio of 40 day-old gilts exposed to test diets for 21 days.

TREATMENT	BODY WEIGHT GAIN kg	ESTIMATED FEED INTAKE kg	FEED INTAKE + WASTE * kg	FEED + WASTE CONVERSION RATIO
Control	2.94 a	6.76 a	14.06 a	4.77 a
1.2 ppm ZEA + 6 ppm DON	1.04 b	2.39 b	13.33 a	12.82 b
1.2 ppm ZEA + 6 ppm DON + 1 kg/mt MYCO-AD AZ	2.22 a	5.11 a	12.25 a	5.53 a

a, b Means within columns with no common superscripts differ significantly ($P \leq 0.05$)

***** Waste of feed was noticeable in pigs from ZEA+DON treatment. Pigs from other two treatments (Control and ZEA+DON+MYCO-AD A-Z) imitated that behavior.

Table 2. Effects of Myco-Ad A-Z on the relative liver and internal reproductive organs weight of 40 day-old gilts exposed to test diets for 21 days.

TREATMENT	LIVER g/100 g Body Weight	REPRODUCTIVE SYSTEM g/100 g Body Weight x 1000
Control	3.76 a	53.9 a
1.2 ppm ZEA + 6 ppm DON	2.89 b	104.5 b
1.2 ppm ZEA + 6 ppm DON + 1 kg/mt MYCO-AD AZ	3.12 c	89.5 c

a, b, c. Means within columns with no common superscripts differ significantly ($P \le 0.05$)

Figure 1. Representative livers from gilts in each treatment

CONTROL | **1.2 ppm ZEA + 6 ppm DON** | **1.2 ppm ZEA + 6 ppm DON + 1 kg/mt MYCO-AD AZ**

Figure 2. Representative internal reproductive organs from gilts in each treatment

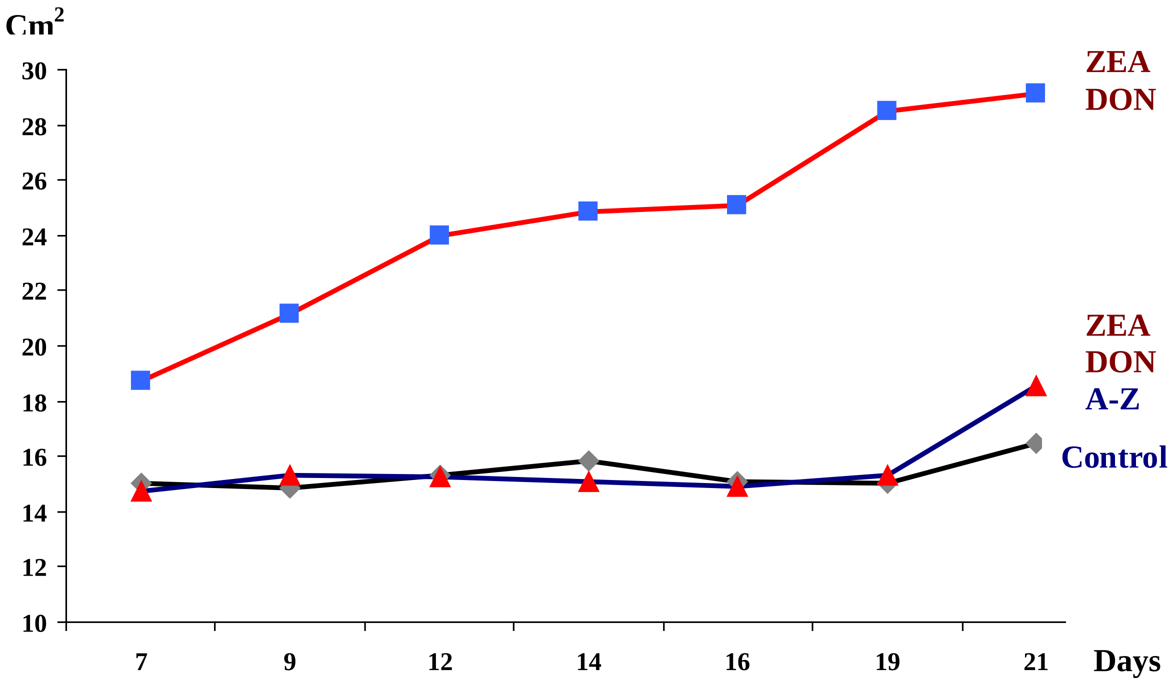
CONTROL | **1.2 ppm ZEA + 6 ppm DON** | **1.2 ppm ZEA + 6 ppm DON + 1 kg/mt MYCO-AD AZ**

Table 3. Effects of Myco-Ad A-Z on the vulva measurements of gilts at different ages and exposed to test diets for 21 days.

TREATMENT	VULVA MEASUREMENT (height x width)						
	DAY 7 cm^2	DAY 9 cm^2	DAY 12 cm^2	DAY 14 cm^2	DAY 16 cm^2	DAY 19 cm^2	DAY 21 cm^2
Control	16.6a	14.8a	15.3a	15.8a	15.1a	15.0a	16.5a
1.2 ppm ZEA + 6 ppm DON	19.4a	21.2b	24.0b	25.8b	25.1b	28.5b	29.1b
1.2 ppm ZEA + 6 ppm DON + 1 kg/mt MYCO-AD AZ	14.8a	15.3a	15.2a	15.1a	14.9a	15.3a	18.6a

a, b Means within columns with no common superscripts differ significantly ($P \le 0.05$)

Figure 3. Effects of Myco-Ad A-Z on the vulva measurements.



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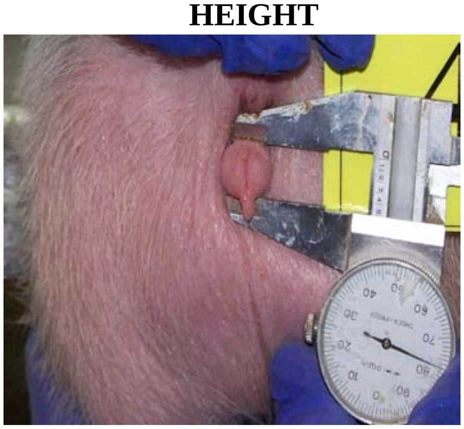

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