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D S. Pollmann

B A. Koch

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Effect of scabby wheat in starter pig diets

Abstract

Two studies using a total of 64 starter pigs (averaging 16-18 lbs initial weight) to evaluate the influence of varying levels of vomitoxin-contaminated wheat on performance was conducted. In both trials it appears that when vomitoxin levels exceed 1 ppm, a reduction in performance was evident. Feed refusal was evident particularly the first week on the vomitoxin-contaminated wheat. No symptoms of sickness, nor an influence on tissue size and function, were observed. The pigs were unable to compensate for depression in gains after withdrawal of vomitoxin-contaminated wheat.; Swine Day, Manhattan, KS, November 11, 1982

Keywords

Swine day, 1982; Kansas Agricultural Experiment Station contribution; no. 82-614-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 422; Swine; Scabby wheat; Starter pig diets

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Effect of Scabby Wheat in Starter Pig Diets

D.S. Pollmann and B.A. Koch^aSummary

Two studies using a total of 64 starter pigs (averaging 16-18 lbs initial weight) to evaluate the influence of varying levels of vomitoxin-contaminated wheat on performance was conducted. In both trials it appears that when vomitoxin levels exceed 1 ppm, a reduction in performance was evident. Feed refusal was evident particularly the first week on the vomitoxin-contaminated wheat. No symptoms of sickness, nor an influence on tissue size and function, were observed. The pigs were unable to compensate for depression in gains after withdrawal of vomitoxin-contaminated wheat.

Introduction

Wheat scab or head blight disease has caused losses to Kansas farmers in eastern and north central parts of the state the past year. The USDA estimated that less than 3.5% of the national 1982 hard red winter wheat crop had been scab damaged. The disease is caused by a fungus, Fusarium, which attacks all or parts of the heads and kills them before maturity. Wet weather provided ideal conditions for disease development. Infected kernels tended to be chalky white, shriveled and some were pink. The scab fungus can produce vomitoxin. This toxin has been studied in corn, but very little research has been done with vomitoxin levels in wheat. Therefore, the objective of this study was to evaluate the effect of varying levels of vomitoxin-contaminated wheat in young pig diets.

Experimental Procedures

Two growth trials were conducted with 32 pigs (4 pigs per pen; two pens per treatment) in each experiment. In both trials, wheat containing 6.8 ppm was used to formulate diets. In the first trial, four levels (0, 1.2, 2.4 and 3.6 ppm) of vomitoxin was added to a starter pig (average initial weight, 16.3 lbs) diet (1.2% lysine). The contaminated wheat was substituted for normal wheat (1981 crop) containing no detectable levels of vomitoxin (Table 1). Analyzed levels of vomitoxin were slightly lower than the initial calculated concentration.

All pigs received the treatments for three weeks. At the end of three weeks, half of the pigs (16) were killed via electrocution to evaluate the influence of vomitoxin on a tissue size and tissue and histological evaluation. Liver, spleen, heart and kidneys were weighed and tissue weights were expressed on percent of the body weight. The other pigs (16) were removed from the treatments to evaluate the influence of the levels of vomitoxin on compensatory gain. Pigs received a corn-soybean meal diet containing 20% dried whey for four weeks.

^aWe wish to acknowledge the assistance of Dr. Bill Willis, Dept. of Plant Pathology, for assistance in wheat procurement and Dr. Larry Seitz, USDA Grain Marketing, for vomitoxin analyses.

Trial II was conducted to further evaluate the level of vomitoxin on performance of starter pigs (average initial weight, 18.3 lbs). The calculated levels of vomitoxin in the complete feed (Table 2) were 1.2, 1.6, 2.0 and 2.4 ppm. Pigs were observed in a two-week growth trial.

Results and Discussion

Gain and feed intake were depressed by the addition of the vomitoxin levels in Trial I (Table 3). It appears that in pigs consuming excess of 1 ppm of vomitoxin, a reduction in performance will be evident. Gain and feed efficiency were influenced most greatly the first week. No outward signs of sickness or vomiting were observed in either trial.

Since pigs on the upper levels of vomitoxin were lighter when killed, tissue weights were significantly lighter ($P < .01$). The levels of vomitoxin did not appear to affect tissue size when the data are expressed on percent of body weight (Table 4).

After the treatments were discontinued, an approximate 8-pound difference was observed between the upper level of vomitoxin and the control (0 ppm) diet at the end of the three-week trial. It appears that no compensatory gain was prevalent (Table 5). At the end of 4 weeks post-treatment, pigs were still approximately 8 pounds lighter on the upper level of vomitoxin. Average daily gain, after withdrawal of the varying levels of the vomitoxin, was not different. Feed efficiency was slightly worse for the pigs that were on the higher levels of vomitoxin.

In Trial II, when vomitoxin levels exceeded 1.2 ppm, a tendency for reduction in average daily gain was observed the first week (Table 6). Also, a slight reduction in feed intake was observed for higher levels the first week. At the end of the two week period, no real differences in overall gain, feed intake, or feed efficiency were observed.

These results suggest that when vomitoxin-contaminated wheat is added to starter pig diets in excess of 1 ppm, a reduction in gain and feed intake can be expected. Feed refusal, particularly the first week, will be prevalent but no noticeable sickness will be observed.

Table 1. Composition of Starter Pig Diets (Trial I)

	<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>
Normal wheat	54.00	36.00	18.00	0.0
Contaminated wheat ^a	--	18.00	36.00	54.00
Soybean meal, 44%	22.50	22.50	22.50	22.50
Dried whey	20.00	20.00	20.00	20.00
Limestone	.75	.75	.75	.75
Dical	1.70	1.70	1.70	1.70
Trace mineral mix	.10	.10	.10	.10
KSU Vitamin mix	.50	.50	.50	.50
Salt	.20	.20	.20	.20
L-Lysine HCl	.25	.25	.25	.25
ASP-250	+	+	+	+
	<u>100.00</u>	<u>100.00</u>	<u>100.00</u>	<u>100.00</u>
Vomitoxin concentration, ppm				
Calculated level	0.0	1.20	2.40	3.60
Analyzed level	0.0	1.20	2.40	3.60

^aAnalyzed vomitoxin concentration of 6.8 ppm

Table 2. Diet Composition (Trial II)

	<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>
Normal wheat	35.75	29.75	23.75	17.75
Contaminated wheat ^a	18.00	24.00	30.00	36.00
Soybean meal, 44%	22.50	22.50	22.50	22.50
Dried whey	20.00	20.00	20.00	20.00
Limestone	.75	.75	.75	.75
Dical	1.70	1.70	1.70	1.70
Trace mineral	.10	.10	.10	.10
KSU Vitamin mix	.50	.50	.50	.50
Salt	.20	.20	.20	.20
L-Lysine HCl	.25	.25	.25	.25
ASP-250	+	+	+	+
	<u>100.00</u>	<u>100.00</u>	<u>100.00</u>	<u>100.00</u>
Vomitoxin, ppm				
Calculated level	1.20	1.60	2.00	2.40

^aAnalyzed vomitoxin concentration of 6.8 ppm

Table 3. Effect of Vomitoxin Contaminated Whet on Performance of Starter Pigs (Trial I)^a

	Vomitoxin, ppm ^b			
	0	1.2	2.4	3.6
Avg. daily gain, lbs				
Week 1	.69	.57	.36	.13
Week 2	.64	.83	.61	.34
Week 3	.99	1.01	.87	.74
Overall	.77	.88	.63	.40
Avg. daily feed intake, lbs				
Week 1 ^c	.89	.84	.63	.56
Week 2	1.29	1.51	1.08	.95
Week 3 ^c	1.99	2.09	1.47	1.23
Overall ^c	1.39	1.48	1.06	.91
Feed/gain				
Week 1 ^c	1.27	1.48	1.76	4.55
Week 2 ^{cd}	2.02	1.81	1.78	2.81
Week 3	2.02	2.07	1.68	1.70
Overall ^c	1.80	1.84	1.72	2.29

^a4 pigs/pen; 2 pens/treatment.^bActual concentration 0, .89, 2.00, and 2.79 ppm, respectively.^cLinear effect (P<.05).^dQuadratic effect (P<.05).Table 4. Effect of Vomitoxin Contaminated Wheat on Tissue Size in Starter Pigs^a (Trial I)

	Vomitoxin, ppm			
	0	1.2	2.4	3.6
Avg. slaughter wt., lbs ^b	32.2	34.2	29.4	22.9
Liver wt., g ^b	455	496	403	305
Liver % of body wt.	3.12	3.17	3.03	2.94
Spleen wt., g	23	27	24	21
Spleen % of body wt.	.16	.18	.18	.20
Heart wt., g ^{bc}	68	69	61	48
Heart % of body wt.	.49	.44	.46	.46
Kidney wt., g ^b	88	75	70	56
Kidney % of body wt. ^d	.60	.55	.52	.53

^aFour pigs/treatment; slaughtered 3-weeks post-treatment.^bLinear effect (P<.01).^cQuadratic effect (P<.05).^dLinear effect (P<.10).

Table 5. Effect of Vomitoxin Contaminated Wheat on Post-treatment Performance of Young Pigs (Trial I)^a

	Vomitoxin, ppm			
	0	1.2	2.4	3.6
Avg. weight, lbs				
Initial wt. ^b	16.3	16.4	16.5	16.7
3 - week ^b	32.5	33.1	29.4	25.1
<u>Post-treatment^c</u>				
Avg. weight, lbs				
Week 1	44.0	45.5	40.4	37.9
Week 4	74.7	77.3	66.8	67.7
Avg. daily gain, lbs	1.50	1.53	1.34	1.44
Avg. daily feed intake, lbs	2.93	2.84	3.02	3.25
Feed/gain	1.87	1.79	2.07	2.17

^a4 pigs/treatment.^bLinear effect (P<.05).^cAt 3 weeks all pigs received a corn-soybean meal + 20% dried whey diet for 4 weeks.Table 6. Effect of Vomitoxin Contaminated Wheat on Performance of Starter Pigs (Trial II)^a

	Vomitoxin, ppm			
	1.2	1.6	2.0	2.4
Avg. daily gain, lbs				
Week 1 ^b	.75	.63	.61	.66
Week 2	<u>.90</u>	<u>.87</u>	<u>.93</u>	<u>.82</u>
Overall	.82	.75	.77	.74
Avg. daily feed intake, lbs				
Week 1 ^b	1.07	.79	.92	.88
Week 2	<u>1.65</u>	<u>1.59</u>	<u>1.56</u>	<u>1.58</u>
Overall	1.66	1.58	1.61	1.66
Feed/gain				
Week 1	1.43	1.25	1.51	1.33
Week 2	<u>1.83</u>	<u>1.83</u>	<u>1.68</u>	<u>1.92</u>
Overall	1.66	1.58	1.61	1.66

^a4 pigs/pen; 2 pens/treatment; average initial wt., 18.3 lbs.^bLevel difference (P<.08).