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Varying Amounts of Scabby Wheat Added to Growing-Finishing Rations

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Summary

Scabby wheat, infected with the fungus, Fusarium graminearum and grading No. 4, replaced varying percentages of grain in a typical sorghum grain-soybean meal growing-finishing ration. Four pigs eating the control ration made an average daily gain of 1.91 pounds per day and a feed efficiency of 3.44. When 25% of the sorghum grain was replaced by scabby wheat, average daily gain dropped to 1.71 pounds per day and feed efficiency was 3.29. Replacing 50% of the sorghum grain with scabby wheat reduced average daily gain to 1.56 pounds with a feed efficiency of 2.99. Higher percentages of scabby wheat reduced feed intake drastically. The 25% scabby wheat ration contained 0.75 ppm of vomitoxin and the 50% ration contained 2.07 ppm (ration analysis values). All pigs eating rations containing scabby wheat appeared to drink excessive amounts of water.

Introduction

Cool wet weather during early summer provided ideal conditions for development of wheat scab or head blight disease in the 1982 wheat crop in eastern Kansas, southwestern Nebraska and western Missouri. The disease is actually caused by the fungus, Fusarium graminearum (Gibberella zeae).

The fungus also may produce several mycotoxins which are toxic to warmblooded animals. Analysis of wheat samples from all three states in mid-July showed the presence of two such mycotoxins, zearalenone and deoxynivalenol (vomitoxin). Vomitoxin is of special interest to producers because it is known as the "feed refusal factor". It can also cause emisis (vomiting) in swine. Infected grains are generally shrunken or shriveled, sometimes pinkish in color and light in weight. Such wheat will be graded low and will end up as animal feed.

A quantity of infected wheat was purchased at a local elevator for use in a feeding trial. A sample of the wheat was officially graded as number 4 in Topeka. It contained 3% shrunken and broken kernels and 5.6% of tombstone kernels. A similar sample analyzed at the U.S. Grain Marketing Laboratory contained 7.8 ppm of vomitoxin.

Experimental Procedure

Twenty growing pigs (10 barrows and 10 gilts) averaging 133 pounds weight were allotted to 5 treatments by sex and weight. Pigs were housed, two per pen (barrow and gilt), on solid concrete floors in pens measuring 16 feet by 3 feet. Automatic waterers, one-hole self feeders and overhead foggers were used. Pigs were weighed and feed intake was measured weekly during a 42 day feeding period.

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The control ration was a typical, 15% crude protein, sorghum grain-soybean meal ration with proper fortification. Contaminated wheat replaced sorghum grain pound for pound in the various test rations at levels of 25%, 50%, 75% and 100% of the sorghum grain. Ration formulations are detailed in table 1. After 2 weeks the 75% ration was replaced by a 12½% ration and the 100% ration was replaced by the control ration. At the end of the 42 day feeding period, the 4 pigs eating the control ration and the 4 pigs eating the 50% ration were slaughtered in the department meat laboratory. Dr. George Kennedy of the School of Veterinary Medicine assisted in collection of organ and tissue samples.

Results and Discussion

All pigs were offered control ration in a preliminary period. Measured amounts of treatment rations were placed in designated feeders on day 1 of the feeding trial. One pig was seen frothing at the mouth on day two (50% ration) and there was slight evidence of vomit in one pen (75% ration) on the same day. Neither symptom was observed at any other time throughout the trial. All pigs receiving diets containing wheat appeared to consume extra amounts of water throughout the feeding period.

Feed intake, feed efficiency and body weight gain data are summarized in table 2 by weekly interval. During week 1 pigs consuming 25% of their grain as wheat ate as much as those pigs consuming control ration. Consumption of other rations containing wheat was reduced by 50% or more. Pigs eating the 25% ration continued to eat well but they did lag behind those eating control ration and over the entire period control pigs consumed about 15% more feed than those consuming the 25% ration.

Differences in feed intake were reflected in body weight gains made during the 42 day feeding period. The four control pigs made an average daily gain of 1.91 pounds while those on the 25% ration made an average daily gain of 1.71 pounds.

Pigs consuming 50% of their grain as wheat ate only 56% as much feed in week 1 as did those eating control ration. However, after week 1 their intake did increase as they apparently became more accustomed to the ration and over the entire period they ate approximately 85% as much feed as those on the 25% ration. Weight gains reflected the reduced feed intake.

Those pigs on the 75% wheat and 100% wheat rations had very poor feed intakes in the first week. Intake continued to be poor in the second week although pigs eating the 75% ration did show increased intake. After 2 weeks those two rations were changed. The 75% ration was replaced with a ration containing 12½% wheat in the grain portion and the 100% ration was replaced with control ration. Both groups of pigs responded immediately by increasing feed intake. Throughout the remaining 4 weeks of the trial, the pigs on the 12½% ration ate at about the same rate of intake as those eating the 25% ration and those changed from 100% wheat to control diet ate at about the same level as the original controls. Both groups showed a dramatic increase in weight gain after the rations were changed.

At the end of the feeding period, the four pigs eating control ration and the four pigs eating the 50% ration were slaughtered in the department meats laboratory.

Table 3 summarizes observations made at slaughter. Tissue samples were collected as indicated.

Stomach wall tissues from pigs eating the 50% wheat ration did show some evidence of inflammation or irritation. By calculation, the 4 pigs on the 50% ration had consumed a total of 735 mg of vomitoxin during the 42 day feeding period. No other differences were noted from gross observation. Data from tissue studies are not yet available.

Observations should be converted to conclusions very cautiously with only 4 pigs per feeding treatment. Pigs eating control rations (sorghum grain-soybean meal) performed very well. Similar pigs eating a ration in which 25% of the sorghum grain was replaced by scabby wheat had a slightly lower feed intake and average daily gain but a somewhat better feed efficiency. When 50% of the sorghum grain was replaced by scabby wheat, feed intake and daily gain were decreased still more but feed efficiency improved. The 25% ration contained 0.75 ppm of vomitoxin (by analysis) and the 50% ration contained 2.07 ppm of vomitoxin. More than 50% inclusion of the scabby wheat reduced feed intake severely. All of the pigs eating rations containing scabby wheat appeared to drink excessive amounts of water.

Table 1. Composition of Growing-Finishing Diets

Ingredient[2]	Sorghum control	25%[1] Wheat	50%[1] Wheat	75%[1] Wheat	100%[1] Wheat
Sorghum grain[3,4]	76.35	57.27	38.17	19.09	00.00
Scabby wheat	00.00	19.08	38.18	57.26	76.35
SBM,44%	20.00	20.00	20.00	20.00	20.00
Dical. phos.	1.40	1.40	1.40	1.40	1.40
Gr. limestone	1.00	1.00	1.00	1.00	1.00
Salt	0.50	0.50	0.50	0.50	0.50
T.M.	0.10	0.10	0.10	0.10	0.10
KSU Vit.mix	0.50	0.50	0.50	0.50	0.50
Tylan 10	0.15	0.15	0.15	0.15	0.15
	100.00%	100.00%	100.00	100.00	100.00
Calculated vomitoxin	0.00	1.50 ppm	3.00 ppm	4.50 ppm	6.00 ppm
Analyzed vomitoxin[5]	00.00	0.75 ppm	2.07 ppm	2.66 ppm	3.97 ppm
Analyzed % protein	14.53	16.85	18.50	18.98	20.68

[1] % of grain portion of the ration.
[2] Grains were rolled--Rations were fed in meal form.
[3] 7.8 ppm vomitoxin--Analyzed at the U.S. Grain Marketing Laboratory.
[4] Wheat analyzed--16.54% crude protein on dry matter basis.
[5] Complete rations analyzed for vomitoxin at the U.S. Grain Marketing Laboratory.

Table 2. Performance of Growing-Finishing Pigs

	Vomitoxin, ppm				
	0.00	0.75	2.07	2.66	3.97
No. Pigs	4	4	4	4	4
Avg.Initial wt., lbs.	139	134	132	132	130
Avg. weekly gain, lbs					
Week 1	12.25	12.25	7.75	(-2.25)	0.25
Week 2	11.75	11.00	14.00	11.50	0.25
				---Changed Diet---	
				(0.375ppm)	(0.00ppm)
Week 3	15.25	13.75	12.25	23.00	21.00
Week 4	13.50	14.25	7.50	8.75	9.75
Week 5	14.50	13.25	10.00	14.25	19.25
Week 6	13.00	7.25	14.00	13.75	9.75
Overall	13.38	11.96	10.91	11.50	10.00
A.D.G. overall, lbs	1.91	1.71	1.56	1.64	1.44
Overall F/G	3.44	3.29	2.99	3.19	3.95
Avg. daily feed, lbs					
Week 1	5.18	5.36	2.93	2.32	2.29
Week 2	6.18	5.11	4.89	4.00	2.25
Week 3	6.50	4.71	4.61	6.14	6.54
Week 4	6.11	6.21	5.00	5.36	6.43
Week 5	7.11	6.89	4.96	7.11	7.43
Week 6	8.36	5.46	5.57	6.71	8.58
Overall	6.57	5.62	4.66	5.27	5.58
Mg total vomitoxin	0.00[1]	321	735[1]	331	238

[1]All pigs in group slaughtered for organ and tissue observations.

Table 3. Effect of Vomitoxin Contaminated Wheat on Tissue Size in Growing-Finishing Pigs[1]

	Vomitoxin, ppm	
	0.00	2.07[2]
No. Pigs	4[3]	4[3,4]
Avg. hot carcass wt., kg	68.82	61.45
Avg. liver wt., kg	1.461	1.503
Liver as % hot carcass wt.	2.12	2.45
Kidney wt., kg	0.287	0.276
Kidney as % hot carcass wt.	0.42	0.45
Heart wt., kg	0.273	0.277
Heart as % hot carcass wt.	0.40	0.45

[1]Fresh tissue samples were collected from the liver, heart, kidney, and belly for vomitoxin analysis and histological evaluation.

[2]Four pigs consumed 735 mg vomitoxin during 42-day feeding trial.

[3]Slaughtered at end of 42-day feeding trial.

[4]Stomach-wall tissues from every pig in the group showed definite evidence of inflammation and irritation.