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Effects of Endosperm Type on Nutritional Value of Sorghum Grain for Swine

Gary L. Allee and Kent Smith

Summary

Two feeding trials, a digestion trial, and a preference trial were conducted to evaluate the effects of endosperm type on the nutritional value of sorghum grain in swine diets. Endosperm types evaluated were: (1) white endosperm--red seed coat; (2) Heterozygous yellow endosperm--bronze seed coat; (3) homozygous yellow endosperm--yellow seed coat.

In trial I, 63 pigs averaging 47 pounds were used in a 28-day experiment. Performance of pigs in trial I was not influenced by endosperm type. A digestion study using 51 pound pigs showed endosperm type making no significant difference in protein digestibility or nitrogen retention. Trial II involved 81 finishing pigs averaging 125 pounds. Pig performance as measured by daily gain, feed per pound of gain, and carcass measurements was not influenced by endosperm type. The results indicate that the endosperm types studied did not effect pig performance.

Introduction

Sorghum grain is the basic feed grain in many swine rations in the Midwest and Southwest. The rapidly expanding swine production in Kansas is based largely on the use of sorghum grain. In recent years, we have seen a great increase in the production of a homozygous yellow endosperm sorghum. However, little information is available regarding endosperm types on the nutritional value of sorghum grain as a feed for swine.

Procedures

General. The amino acid analyses of the sorghum grain used are shown in table 5.1. All diets were fed in pellet form.

Trial I. Sixty-three pigs averaging 47 pounds were assigned from outcome groups based on litter, sex, and initial weight to nine pens representing three replications of the three dietary treatments. Composition of the diets are shown in table 5.2.

Each grain was mixed with the same amount of soybean meal. Sufficient soybean meal was added so that the amino acid needs of the pig would be met on all sorghum grains. Pigs were fed the experimental diets for 28 days.

Table 5.1. Amino Acid Analyses, %^a

Endosperm type	White	Hetero-yellow	Yellow
Arginine	0.48	0.32	0.42
Histidine	0.29	0.18	0.23
Isoleucine	0.47	0.29	0.36
Leucine	1.69	0.91	1.25
Lysine	0.26	0.23	0.22
Methionine	0.13	0.08	0.12
Phenylalanine	0.60	0.45	0.48
Threonine	0.39	0.27	0.32
Valine	0.59	0.29	0.45
Crude protein	12.73	8.14	10.41

^a Values expressed on a moisture-free basis.

Table 5.2. Composition of Diets (Trial I)^a

Ingredient	%
Sorghum grain	68.9
Soybean meal (44%)	27.0
Dicalcium phosphate	1.6
Limestone	1.0
Salt	0.5
Vitamin, trace mineral and antibiotic premix	1.0
	100.0

^aAll diets were pelleted.

Digestion trial. A replicated 3x3 Latin square digestion trial was conducted with two groups of three littermate barrows averaging 51 pounds. Pigs were housed individually in metal metabolism crates allowing for separate collection of urine and feces. Daily feed intake was constant and fed in two equal portions at approximately 8:00 a.m and 5:00 p.m. Water was available at all times. A five day pre-test period preceded a five-day collection period. The diets used in the digestion trial were identical to those used in trial I.

Preference trial. Twenty pigs averaging 32 pounds were randomly assigned to two pens. Each pen contained three feeders. Feeders were rotated daily to prevent habit or proximity to waterers from influencing the results.

Trial II. Eighty-one pigs averaging 125 pounds were assigned from outcome groups formed on the basis of breed, sex, and initial weight to nine pens representing three replications of the three dietary treatments. Composition of the diets are shown in table 5.3. The same quantity of soybean meal was added to all diets. Carcass measurements were obtained from eight barrows per treatment at approximately 220 pounds.

Table 5.3. Composition of Diets (Trial II)^a

Ingredient	%
Sorghum grain	80.9
Soybean meal (44%)	15.5
Dicalcium phosphate	1.0
Limestone	1.1
Salt	0.5
Vitamin, trace mineral and antibiotic premix	1.0
	<u>100.0</u>

^aAll diets were pelleted.

Results and Discussion

The effects of endosperm type on the performance of growing pigs is shown in table 5.4. Weight gain and feed efficiency of pigs were similar on all three sorghum endosperm types. Results of the digestion study are shown in table 5.5. Neither nitrogen digestibility or nitrogen retention were significantly influenced by sorghum endosperm type.

Table 5.4. Influence of Endosperm Type on Performance of Growing Pigs (Trial I)^a

Endosperm type	White	Hetero-yellow	Yellow
Daily gain, lbs.	1.56 ^b	1.58 ^b	1.61 ^b
Feed intake, lbs.	3.59 ^b	3.63 ^b	3.65 ^b
Feed/gain	2.30 ^b	2.29 ^b	2.27 ^b

^aEach value is the mean of 21 pigs with an initial weight of 47 pounds. Duration of the trial was 28 days.

^bMeans are not significantly ($p < .05$) different.

Table 5.5. Effects of Endosperm Type on Nitrogen Digestibility and Retention^a

Endosperm type	N retained %	N digestibility %
White	51.55	84.63
Hetero-yellow	49.84	83.55
Yellow	51.89	84.99

^aEach value is the mean of six pigs with an initial weight of 51 pounds.

The results of the preference trial conducted with growing pigs are shown in table 5.6. When offered a choice, pigs exhibited a marked preference for the diet containing the heterozygous yellow endosperm sorghum grain. The reason for the difference in preference consumption is not apparent. However, when not given a choice (Trial I) pig performance was identical on all three endosperm types.

Table 5.6. Effects of Endosperm Type on Preference Consumption of Growing Pigs^a

Endosperm type	White	Hetero-yellow	Yellow
Pen I (pounds/pen)	174	647	77
Pen II (pounds/pen)	53	638	101

^aEach pen contained ten pigs and three feeders. Feeders were rotated daily.

Performance and carcass characteristics of finishing pigs fed different sorghum grain endosperm types are shown in table 5.7. There were no significant differences between pigs fed the endosperm types as measured by daily gain or feed efficiency. Similarly, carcass measurements were not affected by the endosperm types.

Table 5.7. Performance and Carcass Characteristics of Finishing Pigs Fed Different Sorghum Grain Endosperm Types (Trial II)^a

Endosperm type	White	Hetero-yellow	Yellow
Daily gain, lbs.	1.76 ^b	1.72 ^b	1.83 ^b
Feed intake, lbs.	6.20 ^b	6.12 ^b	6.42 ^b
Feed/gain	3.52 ^b	3.56 ^b	3.52 ^b
Slaughter wt., lbs.	218	216	218
Backfat thickness, in.	1.15 ^b	1.18 ^b	1.25 ^b
Loin-eye area, sq. in.	5.19 ^b	4.96 ^b	5.02 ^b
Ham and loin, %	42.56 ^b	42.25 ^b	41.35 ^b

^aFor the performance data each value is the mean of 18 pigs with an initial weight of 125 pounds. For the carcass data each value represents the mean of eight barrows.

^bMeans do not differ significantly ($P < .05$).