Kansas Agricultural Experiment Station Research Reports

Volume 0
Issue 10 *Swine Day (1968-2014)*

Article 834

2000

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Recommended Citation

Jones, C L.; Hancock, Joe D.; Behnke, Keith C.; Sowder, C M.; and McKinney, Leland J. (2000) "Effects of sorghum genotype on milling characteristics and growth performance of nursery pigs," *Kansas Agricultural Experiment Station Research Reports*: Vol. 0: Iss. 10. https://doi.org/10.4148/2378-5977.6674

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Abstract

The sorghums used in our experiment (mill-run, red feed-quality, and white food-quality) had greater true grinding efficiency than corn. Mill-run sorghum also ground easier and with greater true efficiency than the red and food quality (white seed/tan plant) experimental sorghums. Diets with the red sorghum had greater pellet production rate and pellet durability index than diets with the food-quality sorghum. In a nursery pig growth assay, corn-based diets had greater digestibility of gross energy than the sorghum diets, and the white sorghum had greater digestibilities of dry matter, nitrogen, and gross energy than the red sorghum. However, ADG, ADFI, and G/F were not different among pigs fed the various cereal grains.; Swine Day, Manhattan, KS, November 16, 2000

Keywords

Swine day, 2000; Kansas Agricultural Experiment Station contribution; no. 01-138-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 858; Swine; Nursery pigs; Sorghum; Food quality

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EFFECTS OF SORGHUM GENOTYPE ON MILLING CHARACTERISTICS AND GROWTH PERFORMANCE OF NURSERY PIGS

C. L. Jones, J. D. Hancock, K. C. Behnke[1], C. M. Sowder[2], and L. J. McKinney[1]

Summary

The sorghums used in our experiment (mill-run, red feed-quality, and white food-quality) had greater true grinding efficiency than corn. Mill-run sorghum also ground easier and with greater true efficiency than the red and food quality (white seed/tan plant) experimental sorghums. Diets with the red sorghum had greater pellet production rate and pellet durability index than diets with the food-quality sorghum. In a nursery pig growth assay, corn-based diets had greater digestibility of gross energy than the sorghum diets, and the white sorghum had greater digestibilities of dry matter, nitrogen, and gross energy than the red sorghum. However, ADG, ADFI, and G/F were not different among pigs fed the various cereal grains.

(Key Words: Nursery Pigs, Sorghum, Food Quality.)

Introduction

Worldwide, more than 50% of the sorghum produced is used for human food. However, less than 2% of domestic sorghum produced is used for human food. Consequently, there is interest in developing food-quality sorghums for production in the United States to increase sorghum's value in the export market. Food-quality sorghums traditionally have been selected for color (white seed/tan plant) and milling characteristics with little regard given to their nutritional value. With the increased production of food-quality sorghum, it will find its way into the livestock feeding industry. Thus, we designed an experiment to determine the milling characteristics and feeding value of a food-quality sorghum adapted for production in Kansas.

Procedures

A total of 192 weanling pigs, averaging 21 days of age and 15 lb BW, was used in a 35-d growth assay. The pigs were blocked by weight and allotted to pens based on sex and ancestry. There were eight pens/ treatment with six pigs/pen. The pigs were housed in 3.5-ft x 5-ft pens having a self-feeder and nipple waterer to allow ad libitum consumption of food and water. Treatments were: 1) mill-run corn (control); 2) mill-run sorghum (control); 3) Asgrow A570 (red seed/purple plant); 4) Asgrow 6126 (white seed/tan plant). The diets (Table 1) were formulated to 1.7% lysine for d 0 to 7, 1.55% lysine for d 7 to 21, and 1.4% lysine for d 21 to 35. At the end of each phase, pigs and feeders were weighed to allow calculation of ADG, ADFI, and F/G.

The cereals were ground through a Jacobson Hammermill using a 6/64" screen. A volt/amp meter was used to determine grinding efficiency and particle size was determined by sieving. Pelleting was accomplished using a CPM Master Model HD pellet mill equipped with a 5/32" by 1 ¼" die. Phase 1 diets were pelleted at 140°F, and phase 2 and 3 diets were pelleted at 180°F.

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Results and Discussion

Grinding data (Table 2) indicated no differences in energy consumption or production rate among corn and the sorghums ($P>.38$). However, the sorghums had greater true grinding efficiency than corn ($P<.04$), and this difference resulted primarily from the greater true grinding efficiency of the mill-run sorghum. Indeed, mill-run sorghum required less net energy to grind ($P<.02$) and had greater true grinding efficiency ($P<.001$) than the two Asgrow hybrids. Finally, the food-quality sorghum required more total energy to grind ($P<.01$) and had a lower production rate ($P<.001$) compared to the red sorghum.

In the pelleting experiment, no differences in energy consumption occurred among diets based on the four cereals ($P>.39$). However, corn did show a trend for greater production rate ($P<.10$) vs the sorghums and the red feed-quality sorghum had a greater production rate ($P<.04$) than the white food-quality sorghum. Diets pelleted with the red sorghum also had greater standard and modified pellet durability indexes than diets with food-quality sorghum ($P<.04$).

During d 0 to 7 of the growth assay with nursery pigs, corn supported greater ADG ($P<.02$) and lower F/G ($P<.04$) than the sorghum diets. However, for d 7 to 21, the pigs fed sorghum-based diets had greater ADG ($P<.05$) than pigs fed the corn-based diet. Thus, for the overall period (i.e., d 0 to 35), no differences in growth performance ($P>.13$) occurred among pigs fed the corn- and sorghum-based diets. As for pigs fed the various sorghums, the red sorghum supported greater ADG than the white sorghum ($P<.03$) for d 0 to 7, and pigs fed the red and white sorghums had better F/G ($P < .05$) than pigs fed the mill-run sorghum for d 7 to 21. These were the only significant effects on growth performance. Thus, there is little reason to suggest that any of the sorghums had superior feeding value.

Digestibilities of nitrogen (N) ($P<.06$) and gross energy (GE) ($P<.04$) were greater for the corn-based diet than the sorghum-based diets. However, diets with the white sorghum had greater digestibilities ($P < .01$) of dry matter, N, and GE than diets with the red sorghum, and digestibility of nutrients in the white sorghum compared nicely to those for corn-based diets.

In conclusion, our results demonstrated that sorghum can be substituted for corn in nursery diets with no effect on growth performance. Also, the white food-quality sorghum supported growth performance and nutrient digestibilities equal to those of corn.

Table 1. Compositions of Diets[a]

	d 0 to 7		d 7 to 21		d 21 to 35	
Item, %	Corn	Sorghum	Corn	Sorghum	Corn	Sorghum
Corn	29.71	—	52.39	—	63.35	—
Sorghum	—	29.73	—	52.39	—	63.35
Soybean meal	24.70	24.70	28.48	28.49	30.39	30.42
Whey	20.00	20.00	10.00	10.00	—	—
Lactose	10.00	10.00	—	—	—	—
Plasma protein	4.00	4.00	—	—	—	—
Wheat gluten	4.00	4.00	—	—	—	—
Fishmeal	2.00	2.00	4.00	4.00	—	—
Soy oil	1.00	1.00	1.00	1.00	1.00	1.00
Monocalcium phosphate	1.26	1.24	.79	.76	1.50	1.47
Limestone	.85	.86	.72	.73	1.11	1.13
Lysine	.36	.38	.36	.40	.42	.45
Methionine	.15	.15	.15	.16	.15	.16
Threonine	.09	.09	.15	.14	.16	.15
Valine	.02	—	.04	—	.05	—
Tryptophan	.01	—	.02	—	.02	—
Salt	.20	.20	.25	.25	.36	.38
Vitamin premix	.15	.15	.25	.25	.25	.25
Mineral premix	.10	.10	.15	.19	.15	.15
Copper sulfate	—	—	—	—	.09	.09
Zinc oxide	.40	.40	.25	.24	—	—
Antibiotic[b]	1.00	1.00	1.00	1.00	1.00	1.00

[a]Diets were formulated to 1.7% lysine, .9% Ca, and .8% P for d 0 to 7; 1.55% lysine, .8% Ca and .7% P for d 7 to 21; and 1.4% lysine, .8% Ca and .7% P for d 21 to 35.
[b]Supplied 150 g/ton apramycin for d 0 to 7 and 7 to 21 and 50 g/ton mecadox for d 21 to 35.

Table 2. Production Characteristics for Phase 3 Diets

Item	Treatments				SE	Contrast[c]		
	Corn	Mill-Run Sorg	Red Sorg	White Sorg		1	2	3
Hammermill data								
Production rate, lb/h	2,783	2,547	3,123	2,497	55	—[d]	.008	.001
Energy consumption, kWh/t								
Total	13.7	13.8	13.1	15.2	.4	—	—	.01
Net	7.2	6.6	7.3	8.0	.3	—	.02	—
True efficiency, ft^2/Wh	15.5	22.4	14.7	14.3	.7	.04	.001	—
Pelleting data								
Production rate, lb/h	4,635	4,343	4,610	4,166	118	.11	—	.04
Energy consumption, kWh/t								
Net[a]	3.9	4.2	4.0	4.1	.2	—	—	—
Pellet durability index, %								
Standard	83.5	84.1	84.0	82.1	.5	—	.11	.03
Modified[b]	78	79.4	79.4	77.0	.6	—	—	.04
Fines, %	9.9	8.6	9.2	11.0	.85	—	—	—

[a]Expressed as the difference between full load and empty load.
[b]Am. Society of Ag. Eng. S269.3 with the addition of five ½ in. hexagonal nuts.
[c]Contrast were: 1) corn vs sorghums; 2) mill-run sorghum vs red and white; 3) red vs white.
[d]Dashes indicate P>.15.

Table 3. Effects of Different Sorghum Varieties on Growth Performance in Nursery Pigs[a]

Item	Treatment				SE	Contrast[b]		
	Corn	Mill-Run Sorg	Red Sorg	White Sorg		1	2	3
d 0 to 7								
ADG, lb	.61	.55	.60	.54	.02	.02	—[c]	.03
ADFI, lb	.57	.56	.59	.55	.02	—	—	.13
F/G	.93	1.02	.98	1.02	.06	.04	—	—
d 7 to 21								
ADG, lb	.98	1.03	1.07	1.09	.03	.05	—	—
ADFI, lb	1.21	1.28	1.29	1.26	.04	—	—	—
F/G	1.23	1.24	1.21	1.16	.04	—	.05	—
d 21 to 35								
ADG, lb	1.39	1.46	1.43	1.40	.03	—	—	—
ADFI, lb	1.81	1.88	1.87	1.79	.06	—	—	—
F/G	1.30	1.29	1.31	1.28	.05	—	—	—
d 0 to 35								
ADG, lb	1.07	1.11	1.12	1.10	.02	.13	—	—
ADFI, lb	1.32	1.38	1.38	1.33	.03	—	—	—
F/G	1.23	1.24	1.23	1.21	.03	—	—	—
Digestibility, %								
Dry matter	86.3	80.8	85.3	86.9	.2	—	—	.001
Nitrogen	81.7	80.8	78.0	82.9	.5	.06	—	.001
Gross energy	88.5	88.2	87.2	88.6	.2	.04	—	.001

[a]A total of 192 pigs (6 pigs/pen and 8 pens/treatment) with an average initial BW of 15 lb and an average age of 21 d.
[b]Contrasts were: 1) corn vs sorghums; 2) mill-run sorghum vs red and white sorghums; 3) red vs white sorghum.
[c]Dashes indicate P>.15.