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J A. Hansen

R C. Thaler

Robert D. Goodband

*See next page for additional authors*

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## Low test-weight sorghum for growing-finishing swine

### Abstract

Two growth studies were conducted to determine the effects of substituting lower test-weight sorghum (35 lb/bu as LOW or 45 lb/bu as MED) for normal test-weight sorghum (55 lb/bu NORM), in growing and finishing swine diets. One-hundred twelve pigs (50 lb initial wt) were fed for 28 d in the grower study and 80 pigs (120 lb initial wt) were fed for 51 d in the finisher study. Diets were formulated to contain .80 and .65% lysine for the grower and finisher trials, respectively, using NORM and soybean meal; LOW and MED were substituted on a wt/wt basis for NORM. The fourth treatment evaluated was a 50:50 (wt:wt) blend of LOW/NORM. Apparent dry matter and nitrogen digestibility were determined on d 14 of the grower trial using chromic oxide as a nondigestible marker. In the grower study, pigs fed the NORM or MED had similar growth rates, daily feed intakes, and feed conversions. However, pigs fed the LOW diet tended to grow slower and convert feed to gain less efficiently than pigs fed either the NORM or MED diets. Similarly, pigs fed the LOW/NORM blend tended to perform at a level intermediate to pigs fed the MED and LOW diets. Dry matter and N digestibilities paralleled the numeric trends noticed in the performance data, and significant differences were detected between NORM or MED and the LOW or LOW/NORM. In the finishing trial, pigs fed the NORM or MED gained at similar rates and had similar feed efficiencies, but pigs fed the LOW or blend had poorer feed/gain and slightly poorer growth rates. In a companion study, chicks fed the sorghums had linear reductions in growth rate and feed conversions when fed diets containing reduced test-weight sorghum. Overall, LOW sorghum can be expected to cause a 5 to 7% reduction in gains and a 7 to 12% reduction in feed/gain when fed to growing and finishing pigs. Similar reductions are observed for chicks (6 to 7% reduction in growth rate; 4 to 5% reduction in feed/gain). Medium sorghum has an equal feeding value to NORM sorghum for both growing and finishing swine and a slightly lower feeding value for chicks.; Swine Day, Manhattan, KS, November 15, 1990

### Keywords

Swine day, 1990; Kansas Agricultural Experiment Station contribution; no. 91-189-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 610; Swine; Sorghum; Test weight; Damaged; GF; Performance

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### Authors

J A. Hansen, R C. Thaler, Robert D. Goodband, Jim L. Nelssen, Robert H. Hines, and Joe D. Hancock

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**K****S****U****LOW TEST-WEIGHT SORGHUM FOR  
GROWING-FINISHING SWINE****J. A. Hansen, R. D. Goodband, R. C. Thaler<sup>1</sup>,  
J. D. Hancock, J. L. Nelssen, and R. H. Hines**

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**Summary**

Two growth studies were conducted to determine the effects of substituting lower test-weight sorghum (35 lb/bu as LOW or 45 lb/bu as MED) for normal test-weight sorghum (55 lb/bu NORM), in growing and finishing swine diets. One-hundred twelve pigs (50 lb initial wt) were fed for 28 d in the grower study and 80 pigs (120 lb initial wt) were fed for 51 d in the finisher study. Diets were formulated to contain .80 and .65% lysine for the grower and finisher trials, respectively, using NORM and soybean meal; LOW and MED were substituted on a wt/wt basis for NORM. The fourth treatment evaluated was a 50:50 (wt:wt) blend of LOW/NORM. Apparent dry matter and nitrogen digestibility were determined on d 14 of the grower trial using chromic oxide as a nondigestible marker. In the grower study, pigs fed the NORM or MED had similar growth rates, daily feed intakes, and feed conversions. However, pigs fed the LOW diet tended to grow slower and convert feed to gain less efficiently than pigs fed either the NORM or MED diets. Similarly, pigs fed the LOW/NORM blend tended to perform at a level intermediate to pigs fed the MED and LOW diets. Dry matter and N digestibilities paralleled the numeric trends noticed in the performance data, and significant differences were detected between NORM or MED and the LOW or LOW/NORM. In the finishing trial, pigs fed the NORM or MED gained at similar rates and had similar feed efficiencies, but pigs fed the LOW or blend had poorer feed/gain and slightly poorer growth rates. In a companion study, chicks fed the sorghums had linear reductions in growth rate and feed conversions when fed diets containing reduced test-weight sorghum. Overall, LOW sorghum can be expected to cause a 5 to 7% reduction in gains and a 7 to 12% reduction in feed/gain when fed to growing and finishing pigs. Similar reductions are observed for chicks (6 to 7% reduction in growth rate; 4 to 5% reduction in feed/gain). Medium sorghum has an equal feeding value to NORM sorghum for both growing and finishing swine and a slightly lower feeding value for chicks.

(Key Words: Sorghum, Test Weight, Damaged, GF, Performance.)

**Introduction**

Sorghum grains grown under normal agronomic conditions should obtain test weights of greater than 50 lb/bu. In general, test weights can be affected by several factors including a late seeding, early frost, or drought. Unfortunately, drought conditions over the past few years have resulted in less than optimal test weights for sorghum. The sorghum generally contains a slightly higher percentage crude protein, however, smaller seed size indicates a

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<sup>1</sup>In cooperation with South Dakota State University, Brookings, SD.

significantly reduced starch content, resulting in a larger fraction of protein. This would seem beneficial from a nutritional standpoint, but the opposite is generally the case. Therefore, the present research was needed to further evaluate the use of reduced test-weight sorghum in growing and finishing swine diets.

### Procedures

A total of 112 crossbred (Hampshire x Yorkshire x Duroc) pigs (initial wt 50 lb; 28 d trial) and 80 crossbred (Large White x Landrace x Duroc x Hampshire) pigs (initial wt 120 lb; 51 d trial) were utilized in grower and finisher trials, respectively, to determine the efficacy of substituting MED or LOW sorghum for NORM sorghum in standard growing and finishing swine diets. Pigs were blocked by weight and randomly allotted to dietary treatments within each block to obtain four replicate pens per treatment. Sexes were represented equally across treatments. There were five or seven (finisher and grower, respectively) pigs per pen. Apparent digestibility of dry matter (DMD) and nitrogen (ND) were determined on d 14 using a non-digestible marker ( $Cr_2O_3$ ).

The chemical composition of the sorghum is presented in Table 1. It is important to note that the sorghums were not cleaned before use in the studies. Basal diets (Table 2) were formulated to contain .80 and .65% lysine, .75 and .65% calcium, and .65 and .55% phosphorus in the grower and finisher studies, respectively. Experimental treatments were: 1) basal diet, 2) MED substituted for NORM (wt/wt basis), 3) LOW substituted for NORM (wt/wt basis), 4) 50:50 blend of LOW/NORM substituted for NORM (wt/wt basis). Pigs were allowed feed and water ad libitum.

**Table 1. As Fed Composition of Sorghum**

Nutrient, %	Norm	Med	Low
Protein	9.7	10.2	11.5
Ca	.02	.04	.07
P	.28	.30	.37
Fiber <sup>a</sup>	3.20	6.00	10.40
Lysine	.20	.26	.31
Methionine	.15	.15	.16
Threonine	.35	.39	.44
Tryptophan	.10	.13	.12

<sup>a</sup>Acid detergent fiber analysis.

In a companion study, a 14-d assay was conducted using 7-d-old chicks to further evaluate the reduced test-weight sorghum for monogastric animals. Diets were evaluated using six cages (four birds per cage) per treatment. The basal diet was formulated to contain 24% crude protein, 1.1% calcium, and .9% phosphorus and fortified to meet or exceed the chicks estimated requirements. Chick wt and feed intakes were measured weekly, and feed efficiency was calculated.

### Results and Discussion

Pigs grew at similar rates (Table 3) when fed diets containing NORM, MED, or LOW/NORM in the grower trial. There was a numerical difference between gains for pigs fed the LOW diet as compared to all other treatments. Most notably, there was a tendency for reduced efficiency of feed utilization by pigs fed diets containing LOW (including the

blend). There was a significant reduction ( $P < .05$ ) in DMD for pigs fed the LOW diet as compared to all other diets. Similarly, ND was reduced for both LOW and LOW/NORM diets when fed to grower pigs, indicating that the availability of amino acids in the low test-weight sorghum is reduced. In the finishing trial, no differences were detected in ADG or in feed intake (Table 3). There was a tendency for pigs fed the LOW or LOW/NORM diets to have poorer feed conversions; however, these differences were not statistically significant.

Chick performance (Table 4) followed a similar trend to the pig performance, with chicks fed LOW growing slowest. Blending the LOW with NORM resulted in growth and feed/gain similar to LOW. Chicks fed MED had intermediate performance to chicks fed NORM and LOW. Feed conversion ratios

were similar to those observed in the swine trials, with respect to dietary treatment. Linear reductions in the efficiency of feed utilization were observed with reducing test weight.

In summary, these data indicate that monogastric animals, pigs and chicks, utilize reduced test-weight (45 lb/bu or 35 lb/bu) sorghum less efficiently for gain than normal test-weight sorghum. Although feed intake patterns are not altered significantly, the reduced ability to utilize the grain results in reduced growth rates. It appears that the reduced test-weight sorghums have a lower availability of total dry matter as well as amino acids, as indicated by nitrogen digestibility. Overall, one can expect to observe a 5 to 7% reduction in growth rate in both species and a 7 to 12% (swine) or 4 to 5% (chicks) reduction in feed/gain. Thus, when considering the use of low test-weight sorghum in swine or poultry diets, one should weigh the expected reductions in performance against the price of the sorghum. Simply stated, a producer should not pay more than 90 to 93% the present value of normal test-weight sorghum for sorghums testing less than 45 lb/bu.

**Table 2. Composition of Basal Diets**

Ingredient	Amount, %		
	Grower	Finisher	Chick
Sorghum	75.00	81.15	53.28
Soybean meal (44% CP)	21.65	16.20	
Soybean meal (48% CP)			38.12
Soybean oil			3.50
Monocal phos (21% P)	1.45	1.05	2.45
Limestone	1.05	1.00	1.40
Salt	.25	.25	.40
Vitamin premix	.25	.25	.50
Trace mineral mix	.10	.10	.05
DL-methionine			.25
Chromium oxide	.25		
Antibiotic <sup>a</sup>			.05
Total	100	100	100

<sup>a</sup>Provided .025% amprolium.

**Table 3. Effect of Sorghum Test Weight on Growing and Finishing Pig Performance<sup>a</sup>**

Item	NORM	MED	LOW	LOW/NORM	CV
Grower trial					
ADG, lb	1.30	1.30	1.22	1.30	10.1
ADFI, lb	3.73	3.55	3.70	3.73	5.0
Feed/gain	2.75	2.72	3.14	2.88	12.7
<u>Apparent digestibility, %</u>					
DM <sup>b</sup>	71.7	71.7	65.2	68.8	2.7
N <sup>c</sup>	82.2	81.0	72.0	78.8	1.9
Finisher trial					
ADG, lb	2.10	2.05	2.02	2.01	7.0
ADFI, lb	7.30	7.07	7.45	7.45	6.6
Feed/gain	3.50	3.46	3.71	3.73	4.5

<sup>a</sup>Values are means of four replicate pens containing seven (grower; initial wt 50 lb) or five (finisher; initial wt 120 lb) pigs per pen.

<sup>b</sup>LOW vs others (P<.06).

<sup>c</sup>LOW vs others (P<.01), NORM or MED vs blend (P<.05).

**Table 4. Effect of Sorghum Test Weight on Chick Performance**

Item	NORM	MED	LOW	LOW/NORM	CV
Total gain, lb <sup>a</sup>	1.07	1.00	1.00	1.01	4.8
Total feed, lb	1.50	1.44	1.45	1.48	3.7
Feed/gain <sup>a</sup>	1.40	1.44	1.46	1.47	3.1

<sup>a</sup>Linear effect of test weight (P<.05).