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# EFFECT OF WHEAT MILL RUN ON FINISHING PIG PERFORMANCE

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## Summary

Finishing pigs were fed diets containing 0, 15, 30, or 45% wheat mill run (WMR) during cold and hot weather. Results indicate that 15% WMR can be included in finishing swine diets without adversely affecting pig performance. Apparent digestibilities of dry matter, gross energy, and crude fiber were lower ($P < .05$) for diets containing WMR than for the control. During cold weather incorporating up to 15% WMR in the diet may be economically justified, because there was no difference in cost of gain for pigs receiving the control or 15% WMR diets. During hot weather, cost of gain increased as the level of WMR in the diet increased.

## Introduction

Wheat mill run is defined as coarse particles of wheat bran, fine particles of wheat bran, wheat shorts, wheat germ, wheat flour, and the offal from the "tail of the mill." The primary site of fiber digestion in simple-stomached animals such as the pig is the hindgut, not the stomach or small intestine. The nutritional value of such feedstuffs is generally considered to be low, since neither the breakdown of the fibrous material nor the absorption of nutrients is very efficient.

The environment has a strong influence on animal performance. Livestock exposed to adverse environments have reduced rate and efficiency of gain. The thermal environment affects both intake and maintenance requirement, which, in turn, alters both rate and efficiency of animal weight gain. During cold stress, maintenance energy requirements generally increase faster than voluntary energy intake, resulting in reduced performance. During heat stress, animals tend to reduce intake while the maintenance requirement increases, therefore reducing performance. Diets containing fibrous feedstuffs have a higher heat increment than more 'energy dense' diets. The nutritional value of fibrous diets should be maximized in animals subjected to cold environments. Conversely, such diets should be detrimental to pigs during hot conditions. The purpose of this study was to determine the level of wheat mill run that could be utilized in finishing pig diets in hot and cold weather. Costs of the diets, including pelleting, were determined using local ingredient prices, and the cost of gain was calculated for finishing pigs in the two adverse environments.

## Procedures

Ingredients were mixed in a double-ribbon, horizontal mixer and pelleted through a 3/16 in X 2 in straight-bore die. Parameters monitored during pelleting included conditioned mash temperature, motor load, production rate, pellet quality, and efficiency.

Two growth studies were conducted to determine the effects of environmental temperature on the utilization of WMR by finishing swine. Pigs were randomly assigned to

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one of four dietary treatments (Table 1) based on initial weight, with littermates being assigned across treatments. Diets were prepared by substituting wheat mill run for grain sorghum on a pound for pound basis, resulting in 0, 15, 30, or 45% WMR in the finished diet. Feed intake (ADF), average daily gain (ADG), and feed efficiency (F/G) were determined biweekly and at the completion of the trial.

Trial 1 was conducted from February through April. One hundred twenty-eight crossbred pigs averaging 95 lb were assigned to four dietary treatments with four replications of 8 pigs per pen. Trial 2 ran from May through July, with 160 crossbred pigs averaging 97 lb assigned to the four dietary treatments. Temperature during each trial was monitored daily at two different locations in the finishing barn.

A digestion trial was conducted in which 16 crossbred barrows averaging 156 lb were randomly assigned to one of the four dietary treatments. Pigs were placed in individual metabolism crates and were acclimated to diets and cages for 7 days. Diets were fed daily in two equal portions at 90% ad libitum intake. A 5-day collection period using a marker to marker technique followed the adaptation period.

Pigs were then reassigned, with one pig remaining on the same diet and the other three receiving different diets. After a 5-day adaptation period, a second collection was made. Samples of the WMR, feed, and feces were analyzed for dry matter, protein, ash, crude fiber, acid detergent fiber, neutral detergent fiber, and gross energy.

## Results

Results of pelleting comparisons appear in Table 2. Although there was no significant difference between the control and 15% WMR diet, as the level of WMR in the diets increased, production rate decreased. There were no significant differences in electrical efficiency between any of the treatments. Although not significant in this study, there was a tendency for the amount of steam required per ton of pellets produced to increase as the amount of WMR in the diet increased. Pellet quality increased ($P < .05$) with increasing levels of WMR.

Trial 1: Results of treatment effects during cold weather (Table 3) show that there were no differences ($P < .05$) in feed intake. Average daily gain was lower ($P < .05$) than the control for all diets containing WMR. Feed efficiency of pigs eating the control and 15% WMR diets did not differ; however, pigs receiving the 30 and 45% WMR diets had poorer feed conversion. Although cost of gain for the 30 and 45% WMR diets was higher than that of the control, cost of gain for the control and 15% WMR diets were nearly the same.

The initial weight of pigs in this study averaged 95 lb. These pigs were consuming more than 3 times the maintenance intake level. The lower critical temperature (LCT) for this size pig would be less than 14°C, and might be as low as 4 or 5°C for some animals. The lowest average daily temperature during the trial was 9°C, and for a good portion of the trial, the temperature was greater than 14°C. Most pigs were not below the LCT for any great length of time during this study and, therefore, were not severely cold stressed.

Trial 2: Results of feeding finishing pigs in hot weather appear in Table 3. There were no differences between treatments in feed intake. Although gain was lower ($P < .05$) than the control for pigs receiving the 30 and 45% WMR diets, there was no difference between the control and 15% WMR diets. Feed conversion and cost of gain increased as the level of WMR in the diets increased.

In a warm weather environment, intake begins to decline and it becomes increasingly

difficult to get enough feed into the animal to maintain rate of gain. The average daily temperature during the trial ranged from 22°C to 30°C or slightly above the 18 C to 21 C range generally considered to be optimum for growing and finishing swine. Pigs were not severely heat stressed until the last 4 weeks of the trial. Heavier pigs are more sensitive to heat than lighter pigs, and the high heat increment of the diets contributed to decreased gain for pigs fed the 30 and 45% WMR diets.

Results of the effect of increasing levels of WMR on apparent nutrient digestibility appear in Table 4. Apparent digestibilities of dry matter, gross energy, crude fiber, and acid detergent fiber were lower ($P < .05$) for diets containing WMR than for the control. There were no differences in NDF digestibility between the control and the 45% WMF diets. Although less digestible than the control, there was no difference ($P < .05$) in NDF digestibility between the 15 and 30% WMF diets, nor was there any difference ($P < .05$) between the 15 and 45% WMF diets.

Table 1. Composition of Swine Finishing Diets Containing Increasing Levels of Wheat Mill Run

| | Percent Wheat Mill Run | | | |
|---|---|---|---|---|
| Ingredient | 0 | 15 | 30 | 45 |
| Soybean meal, 44% | 15.0 | 15.0 | 15.0 | 15.0 |
| Grain sorghum | 81.45 | 66.45 | 51.45 | 36.45 |
| Wheat mill run | 0 | 15.0 | 30.0 | 45.0 |
| Dicalcium phosphate | 1.5 | 1.5 | 1.5 | 1.5 |
| Limestone | 1.0 | 1.0 | 1.0 | 1.0 |
| Salt | .5 | .5 | .5 | .5 |
| Vitamin-mineral premix[a] | .55 | .55 | .55 | .55 |

[a]Contributed the following per kilogram of diet: A, 4400 IU; $D_3$, 330 IU; E, 22 IU; Riboflavin, 5 mg; d-Pantothenic acid, 13.4 mg; Niacin, 27.9 mg; $B_12$, 24.5 g; Menadione sodium bisulfite, 1.7 mg;Zn, 100 mg; Fe, 100 mg; Mn, 100 mg; Cu, 10 mg; I, 3 mg; Ca, 50 mg maximum; Lysine, 0.8 gm as lysine HCl (98%); Tylosin, 44 mg.

Table 2. Production Parameters of Finishing Swine Diets Containing Increasing Levels of Wheat Mill Run

| | Percent Wheat Mill Run | | | |
|---|---|---|---|---|
| Parameter | 0 | 15 | 30 | 45 |
| Production rate, lb/hr | $3023^{b}$ | $2820^{ab}$ | $2690^{b}$ | $2249^{c}$ |
| Electrical efficiency, kWh/ton | $9.56^{a}$ | $9.41^{a}$ | $9.06^{a}$ | $8.84^{a}$ |
| Steam efficiency, kWh/ton | 26.1 | 25.4 | 27.4 | 30.3 |
| Pellet durability, % | $92.2^{a}$ | $94.2^{b}$ | $96.1^{c}$ | $97.3^{d}$ |
| Bulk density, mash, lb/ft$^3$ | 40.7 | 37.7 | 29.6 | 25.8 |
| Bulk density, pellets, lb/ft$^3$ | 43.8 | 43.2 | 42.7 | 42.4 |

[abcd]Means in the same row that do not share a common superscript letter differ ($P < .05$).

Table 3. Finishing Swine Performance with Diets Containing Increasing Levels of Wheat Mill Run

| Parameter | Percent Wheat Mill Run | | | |
|---|---|---|---|---|
| | 0 | 15 | 30 | 45 |
| Trial 1: | | | | |
| Average daily feed, lb | 6.23[a] | 5.90[a] | 6.32[a] | 6.28[a] |
| Average daily gain, lb | 1.98[a] | 1.82[b] | 1.78[b] | 1.76[b] |
| Feed:gain | 3.14[a] | 3.24[a] | 3.55[b] | 3.57[b] |
| Cost of gain, $/lb | .176 | .177 | .188 | .183 |
| Trial 2: | | | | |
| Average daily feed, lb | 5.06[a] | 5.35[a] | 5.28[a] | 5.46[a] |
| Average daily gain, lb | 1.72[a] | 1.69[a] | 1.56[b] | 1.52[b] |
| Feed:gain | 2.95[a] | 3.16[b] | 3.38[c] | 3.60[d] |
| Cost of gain, $/lb | .163 | .168 | .173 | .177 |

[abcd]Means in same row that do not share a common superscript letter differ ($P < .05$).

Table 4. Effect of Increasing Levels of Wheat Mill Run in Swine Finishing Diets on Apparent Digestibilities of Dry Matter, Protein, Energy, Crude Fiber, ADF, and NDF

| Parameter | Percent Wheat Mill Run | | | |
|---|---|---|---|---|
| | 0 | 15 | 30 | 45 |
| Dry matter | 86.7[b] | 82.5[c] | 75.0[d] | 74.4[d] |
| Protein | 8.7[b] | 76.8[c] | 73.4[d] | 78.1[bc] |
| Gross energy | 87.7[b] | 82.3[c] | 76.4[d] | 75.8[d] |
| Crude fiber | 57.4[b] | 44.6[c] | 37.5[c] | 38.1[c] |
| ADF | 5.7[b] | 48.3[c] | 34.7[d] | 43.0[c] |
| NDF | 5.5[b] | 48.8[cd] | 44.8[d] | 52.0[bc] |

[a]Digestibilities calculated on a dry matter basis.
[bcd]Means in the same row that do not share a common superscript letter differ ($P < .05$).