

EFFICACY OF WHEAT BASED DIETS FOR EARLY-WEANED PIGS DURING PHASE 2 OF THE NURSERY PERIOD

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Story in Brief

Two growth trials involving 144 pigs (19±2 d of age; 13.7 lb BW) were conducted to evaluate Karl hard red winter wheat as an energy and protein source for early weaned pigs in Phase 2 (day 10 to 38 postweaning) nursery diets. All pigs were fed a common Phase 1 diet containing 1.50% lysine for the first 10 days postweaning. During Phase 2, pigs (18.8 lb BW) were fed one of the following diets: 1) a corn-soybean meal control diet, 2) a diet with wheat replacing 50% of corn, or 3) a diet with wheat replacing 100% corn. Experimental diets were fed for a period of 4 weeks (day 10 to 38 postweaning) and formulated to contain 1.40% lysine, .90% Ca and .76% P. During Week 1 of Phase 2, average daily gain and gain:feed increased with increasing the amount of wheat in the diet. During Week 2, however, no treatment effects were observed. During Week 3, pigs fed the diet containing 50% corn and 50% wheat as the grain source, had higher gains than pigs fed the diet containing only corn or wheat as the grain source. Feed intake, however, decreased as the amount of wheat increased in the diet which resulted in a linear increase in gain:feed as the amount of wheat increased. During Week 4 and during the overall 4-week period, average daily gain and gain:feed increased with increasing the level of wheat in the diet. This study demonstrated that Phase 2 nursery pigs could effectively use hard red winter wheat as a substitute for corn at a level of 50 or 100% of corn in the diet.

(Key Words: Pig, Hard Red Winter Wheat, Performance.)

Introduction

The majority of the swine producers in Oklahoma are practicing early weaning (21 days of age or less) because it shortens the reproductive cycle of the sow and allows the replacement of females back into production sooner. Problems involved in early weaning, however, include meeting the nutrient requirements of the weanling pig in a cost efficient manner. The dietary protein level sufficient to meet the requirement often contains an excess of many dispensable and indispensable amino acids. These excess amino acids have been suggested to depress animal performance (Edmonds et al., 1987; Kerr, 1988) leading to inefficient and uneconomical pork production. One

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method of reducing the amount of excess amino acids normally present and possibly lowering the cost of the diet is the use of synthetic amino acids to replace a portion of the high protein feed ingredients. Another method to reduce the cost and not decrease performance is to replace the cereal grain portion of the diet of early weaned pigs with a grain that is higher in essential amino acids than yellow corn, the cereal grain most often used.

Hard red winter wheat would be a logical replacement for corn in baby pig diets because it contains higher levels of all essential amino acids, with the exception of isoleucine (NRC, 1988). However, research to determine the feasibility of using hard red winter wheat in baby pig diets is very limited. Rodriguez and Young (1981) reported that hard red winter wheat or corn at the rate of 30% of the diet could be effectively used as a substitute for dried whey for pigs weaned at 7 days of age. They did not investigate higher levels. No research could be found on the feeding of hard red winter wheat for pigs weaned at older ages. In addition, Oklahoma is a major producer of hard red winter wheat with an annual yield of 150 to 200 million bushels (Oklahoma Department of Agriculture, 1994) and often wheat is competitively priced with corn. Thus research is needed to determine if hard red winter wheat can be effectively utilized in Phase 2 swine diets.

The objective of this study was to evaluate hard red winter wheat as an energy and protein source for early weaned pigs in Phase 2 nursery diets. Karl variety, a popular wheat grown in Oklahoma, was the source used.

Materials and Methods

Two trials involving a total of 144 Yorkshire, Hampshire, and Yorkshire x Hampshire pigs (72 in each of two trials) were conducted to evaluate Karl hard red winter wheat as an energy and protein source for weanling pigs in Phase 2 (day 10 to 38 postweaning) diets. Pigs weaned at 19 ± 2 days of age and averaging 13.7 lb were divided in two groups based on initial weight in each trial. Pigs within each weight group were allotted into six equal subgroups (six pigs per subgroup) with stratification based on litter and sex. The subgroups from both weight groups were randomly allotted to 12 available pens per trial with two pens in each weight group x diet combination (four pens per diet with six pigs per pen) per trial. During the first 10 days following weaning, all pigs were fed a common Phase 1 diet (Table 1) containing 1.5% lysine, .93 % Ca and .85% P. During Phase 2, pigs (average weight of 18.8 lb) were fed one of the following diets: 1) a corn-soybean meal control diet (Table 1); 2) a diet with wheat replacing 50% of corn, or 3) a diet with wheat replacing 100% corn. These diets were fed for a period of four weeks (day 10 to 38 postweaning) and formulated to contain 1.40% lysine, .90% Ca and .76% P.

Pigs were housed in an environmentally regulated nursery in pens (4'11" x 5') with woven wire flooring. The initial temperature of 86°F (at weaning) was subsequently decreased 2°F per week. Pigs had ad libitum access to one nipple waterer and a four-hole feeder. Pigs body weight and feed intake were determined weekly to evaluate average daily gain (ADG), average daily feed intake (ADFI), and feed efficiency (G/F).

Data were analyzed as a 2x3 factorial with two pens representing each treatment combination in each trial. Pen was the experimental unit. Trial, weight group, diet and the appropriate interactions were evaluated in the statistical model. The weight group x diet interaction was not significant ($P>.3$) and the other two-way interactions were deleted for lack of significance ($P>.35$). Data from both weight groups within diet were combined. Orthogonal polynomials were used to test for linear and quadratic effects.

Results and Discussion

Average daily gain, ADFI and G/F during the 10-day Phase 1 adjustment period following weaning were .51 lb, .62 lb and .82 lb of gain/lb of feed, respectively. During Week 1 of Phase 2, ADG and gain:feed increased linearly ($P<.1$ and $P<.05$, respectively) with increasing the level of wheat in the diet (Table 2). Pigs fed the diet containing only wheat (Diet 3) as the grain source grew 7% faster and gained 8% more per lb of feed than pigs fed the diet containing only corn (Diet 1) as the grain source. During Week 2, however, no treatment effects were observed for ADG, ADFI or G/F. During Week 3, a quadratic effect ($P<.05$) in ADG was observed with increasing the amount of wheat in the diet. Pigs fed the diet containing 50% corn and 50% wheat (Diet 2) as the grain source grew 6.5% faster than those fed the diet containing only corn as the grain source and 7% faster than those fed the diet containing only wheat as the grain source. Feed intake decreased (linear, $P<.01$) as the amount of wheat increased in the diet, which resulted in a linear increase ($P<.05$) in gain:feed with increasing wheat in the diet. During Week 4 and during the overall 4-week Phase 2 period, a linear ($P<.1$) increase in ADG and gain:feed was observed with increasing the level of wheat in the diet. Average daily feed intake was not affected by dietary treatments.

This study suggests that hard red winter wheat, which at times is priced competitively to corn, could be an excellent substitute for corn in Phase 2 nursery swine diets. Similar to our results, Seerley et al. (1988) reported that 28 day-old weaning pigs could utilize soft red winter wheat as effectively as corn. Rodriguez and Young (1981) showed that hard red winter wheat or corn fed at the rate of 30% of the diet could be effectively used as a substitute for dried whey for pigs weaned at seven days of age. However, they did not

investigate the effects of higher levels of wheat or the effects of wheat in pigs weaned at older ages.

In general, the results of this study indicate that Karl hard red winter wheat could be effectively used as a substitute for corn at levels of 50 or 100% of corn in the diet of Phase 2 nursery pigs.

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Table 1. Composition of experimental diets^a.

Ingredient, %	Phase 1	Phase 2		
		Diet ^b		
		1	2	3
Corn, ground	38.81	63.38	32.44	-
Wheat, hard winter	-	-	32.44	66.30
Soybean meal, 48%	10.00	26.50	25.00	23.60
Fishmeal	8.00	4.00	4.00	4.00
AP-301 ^c	1.50	2.75	2.75	2.75
AP-920 ^d	3.50	-	-	-
Whey, dehydrated	10.00	-	-	-
Lactose, 97%	11.36	-	-	-
Steam rolled oats	10.00	-	-	-
Soybean oil	4.00	-	-	-
Mecadox ^e	.25	.25	.25	.25
Salt	.20	.30	.30	.30
Calcium carbonate	-	.52	.52	.52
CuSO ₄	.07	.05	.05	.05
Micro curb	-	.10	.10	.10
Dicalcium phosphate	1.45	1.60	1.60	1.60
Vit. min. premix ^f	.38	.25	.25	.25
Zinc oxide	-	.30	.30	.30
Ethoxyquin	.03	-	-	-
Lysine, HCl	.26	-	-	-
DL-Methionine	.09	-	-	-
Berry flavor	.10	-	-	-

^a As fed basis. Diets were formulated to contain 1.50% lysine, .93% Ca, and .85% P in Phase 1, and 1.40% lysine, .90% Ca, and .76% P in Phase 2, and to exceed the NRC (1988) standards for all nutrients.

^b Diet 1: corn-soybean meal control diet; Diet 2: a diet with wheat replacing 50% of corn; and Diet 3: a diet replacing 100% of corn.

^c Blood meal source, American Protein Corp., Ames, IA.

^d Plasma protein source, American Protein Corp., Ames, IA.

^e Contained 10 g carbadox per lb.

^f Vitamins and minerals met or exceed the NRC (1988) requirements.

Table 2. Effect of replacing corn with Karl hard red winter wheat on performance of weanling pigs during phase 2 of the nursery period^a.

Item	Diet ^b			SEM
	1	2	3	
Week 1				
ADG, lb ^c	.85	.89	.91	.02
ADFI, lb	1.13	1.13	1.13	.03
G/F ^d	.75	.78	.81	.02
Week 2				
ADG, lb	1.21	1.16	1.19	.03
ADFI, lb	1.66	1.58	1.60	.06
G/F	.73	.73	.75	.02
Week 3				
ADG, lb ^f	1.24	1.32	1.23	.03
ADFI, lb ^e	2.23	2.10	2.01	.05
G/F ^d	.56	.63	.62	.02
Week 4				
ADG, lb	1.41	1.52	1.53	.06
ADFI, lb	2.42	2.45	2.39	.08
G/F ^d	.59	.62	.65	.02
Week 1 to 4				
ADG, lb ^c	1.18	1.22	1.22	.01
ADFI, lb	1.86	1.81	1.78	.05
G/F ^c	.65	.69	.71	.02

^a Data are means of eight pens of six pigs each. Pigs averaged 18.8 and 52.7 lb at initiation and termination, respectively.

^b Diet 1: corn-soybean meal control diet, Diet 2: a diet with wheat replacing 50% of corn, and Diet 3: a diet replacing 100% of corn.

^c Linear effect of increasing wheat in the diet (P<.1).

^d Linear effect of increasing wheat in the diet (P<.05).

^e Linear effect of increasing wheat in the diet (P<.01).

^f Quadratic effect of increasing wheat in the diet (P<.05).