EFFECTS OF CONDITIONERS (STANDARD, LONG-TERM, AND EXPANDER) ON PELLET QUALITY AND GROWTH PERFORMANCE IN NURSERY PIGS

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Summary

In our first experiment, digestibilities for DM, N, and GE were greater and F/G was better for pigs fed pelleted diets than for pigs fed meal diets. However, we observed no advantages in ADG or F/G with long-term conditioning. In a second experiment, pelleting once again improved nutrient digestibility and F/G. Expander conditioning improved digestibilities of DM, N, and GE but not growth performance compared to standard conditioning.

(Key Words: Nursery Pigs, Pelleting, Expander Conditioning.)

Introduction

Previous research from our laboratory indicated that pelleting improved rate and efficiency of gain in growing pigs. Long-term and expander conditioning have been used to increase pellet quality, but very little research has been done to compare the effects of these conditioning technologies on animal performance. Thus, the experiments reported herein were designed to determine the effects of standard, long-term, and expander conditioning on growth performance and nutrient digestibility in weanling pigs.

Procedures

In Exp. 1, 180 weanling pigs (average age of 21 d) were blocked by weight and allotted to pens based on sex and ancestry. There were six pigs per pen and six pens per treatment. The pigs were housed in an environmentally controlled building and allowed ad libitum access to feed and water.

The pigs were offered the experimental Phase III nursery diets (Table 1) starting on d 16 postweaning (average initial BW of 25.8 lb) and fed for an additional 28 d. Treatments were: 1) meal control; 2) standard-conditioned mash; 3) standard-conditioned pellets; 4) long-term-conditioned mash; and 5) long-term-conditioned pellets. Chromic oxide was added at .2% to the diets, and feces were collected by rectal message for analyses of DM, N, GE, and Cr concentrations.

Table 1. Composition of the Basal Nursery Diet[a]

Ingredient	%
Corn	54.55
Soybean meal (46.5% CP)	37.98
Lysine-HCL	.03
DL-Methionine	.14
Monocalcium phosphate	1.62
Limestone	.89
Soy oil	3.00
Salt	.30
Vitamin premix[b]	.25
Trace mineral premix	.15
Copper sulfate	.09
Antibiotic[c]	1.00
Total	100.00

[a]Formulated to 1.30% lys, .80% Ca, and .70% P.
[b]Expanded diets were fortified at 125% of the vitamins used in the basal diet.
[c]Provided 50 g/ ton carbadox.

Standard diets were steam conditioned to 175°F (California Pellet Mill® conditioner)

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with a retention time of 10 seconds. Long-term conditioning was done in a two-pass conditioner (California Pellet Mill®) with a temperature of 175°F and a retention time of 2 min and 40 seconds.

The diets were pelleted through a 1.5-inch-thick die with 5/32-inch-diameter openings. Pellet durability index (PDI) was determined by tumbling 500 g of cooled pellets in a rotating metal box for 10 min. The percentage of pellets that would not pass through a No. 6 screen was used as the PDI value. Starch damage (i.e., the combined effects of gelatinization and shear) for all diets was determined using a glucoamylase procedure.

Pigs and feeders were weighed at the beginning and end of the experiment to allow calculation of ADG, ADFI, and F/G. The data were analyzed using the GLM procedures of SAS. Contrasts were: 1) unconditioned meal vs all other treatments; 2) mash vs pellets; 3) standard conditioning vs long-term conditioning; and 4) mash vs pellets × standard conditioning vs long-term conditioning. Pen was the experimental unit.

In Exp. 2, 180 weanling pigs (average initial age of 21 d) were blocked by weight and allotted to pens based on sex and ancestry. Facilities management and data collection were the same as for Exp. 1. The Phase III treatments were started at d 14 after weaning (average initial BW of 22.9 lb) and fed for an additional 28 d. Treatments were: 1) meal control; 2) standard-conditioned mash; 3) standard-conditioned pellets; 4) expander-conditioned mash; and 5) expander-conditioned pellets. The data were analyzed as in Exp. 1 with the contrasts: 1) unconditioned meal vs all other treatments; 2) mash vs pellets; 3) standard conditioning vs expander conditioning; and 4) mash vs pellets × standard conditioning vs expander conditioning. Pen was the experimental unit.

Results and Discussion

In Exp. 1, the PDI was increased by 46% with long-term conditioning (Table 2). This improvement is consistent with the greater starch damage (making the starch more sticky) for the long-term processing versus standard steam conditioning. Growth performance of the pigs (Table 3) indicated that pelleting improved F/G by 15% ($P<.004$) compared to conditioned mash. Also, DE of the diet and digestibilities of DM, N, and GE were increased by pelletizing ($P<.009$). However, we observed no advantages in digestibilities of nutrients or growth performance for pigs fed long-term versus standard conditioning treatments ($P>.24$). In Exp. 2, pelleting increased ADG by 5% ($P<.08$) and improved F/G by 12% ($P<.001$) compared to the conditioned mash diets. Expander conditioning improved PDI by 23%. Also, digestibility of nutrients was greater ($P<.05$) with expander processing versus standard conditioning. However, growth performance generally was not affected by type of conditioning.

In conclusion, digestibility of nutrients and F/G were improved with pelleting. Pellet durability index and digestibility of nutrients were improved with long-term and expander conditioning, but growth performance was not affected.

Table 2. Processing Characteristics of Nursery Diets

	Experiment 1		Experiment 2	
Item	Standard pellet	Long-term pellet	Standard pellet	Expander pellet
Pellet durability index, %				
Standard[a]	69.5	92.0	70.6	87.0
Modified[b]	56.5	90.0	57.8	71.0
Starch damage, %[c]	34.9	38.1	34.9	40.5

[a]Am. Soc. Agric. Engin. procedure. [b]Am. Soc. Agric. Engin. procedure modified with the addition of five ½ inch hexagonal nuts prior to tumbling. [c]For Exp. 1, starch damages were 26.1% for the meal control, 25.0% for standard-conditioned mash, and 37.2% for the long-term-conditioned mash. For Exp. 2, starch damages were 26.1% for the meal control, 25.0% for standard-conditioned mash, and 41.9% for the expander-conditioned mash.

Table 3. Effects of Standard and Long-Term Conditioning of Feed on Growth Performance and Nutrient Digestibility in Phase-III Nursery Pigs (Exp. 1)[a]

		Standard		Long-Term			Contrasts[b]			
Item	Meal	Mash	Pellet	Mash	Pellet	SE	1	2	3	4
ADG, lb	1.24	1.24	1.31	1.30	1.26	.02	.10	---[c]	---	.02
ADFI, lb	2.21	2.19	2.16	2.43	1.93	.09	---	.006	---	.02
F/G	1.78	1.77	1.65	1.87	1.53	.71	---	.004	---	.11
Apparent digestiblity, %										
GE	89.9	89.1	91.2	85.6	90.4	.9	---	.002	.04	.002
N	89.3	87.8	90.0	86.8	88.8	.7	---	.009	.13	.009
DM	89.7	88.7	90.9	87.2	90.0	.4	---	.001	.05	.001
DE of the diet, kcal/lb	1,658	1,643	1,682	1,579	1,667	17	---	.002	.04	.002

[a]One hundred-eighty pigs (avg initial BW of 25.8 lb) were used.
[b]Contrasts were: 1) meal vs others; 2) mash vs pellets; 3) standard vs long-term conditioning; and 4) mash vs pellets × standard vs long-term conditioning.
[c]Dashes indicate P>.15.

Table 4. Effects of Standard and Expander Conditioning of Feed on Growth Performance and Nutrient Digestibility in Phase-III Nursery Pigs (Exp. 2)[a]

		Standard		Expander			Contrasts[b]			
Item	Meal	Mash	Pellet	Mash	Pellet	SE	1	2	3	4
ADG, lb	1.24	1.16	1.23	1.15	1.19	.03	.09	.08	---[c]	---
ADFI, lb	2.00	1.97	1.87	1.83	1.73	.05	.03	.07	.09	---
F/G	1.61	1.70	1.52	1.59	1.45	.36	---	.001	---	---
Apparent digestibility, %										
GE	87.2	86.0	88.4	89.1	90.2	.8	---	.05	.008	.05
N	85.2	83.8	85.1	86.6	88.2	.9	---	.14	.006	.14
DM	86.3	85.7	87.5	88.1	89.0	.6	.07	.04	.003	.04
DE of the diet, kcal, lb	1,643	1,620	1,666	1,665	1,699	15	---	.05	.008	.05

[a]One hundred-eighty pigs (avg initial BW of 22.9 lb) were used.
[b]Contrasts were: 1) meal vs others; 2) mash vs pellets; 3) standard vs expander conditioning; and 4) among mash vs pellets × standard vs expander conditioning.
[c]Dashes indicate P>.15.