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OMITTING VITAMIN AND TRACE MINERAL PREMIXES, AND(OR) REDUCING INORGANIC PHOSPHORUS DURING LATE FINISHING DID NOT AFFECT GROWTH PERFORMANCE, CARCASS TRAITS, OR MUSCLE QUALITY

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Summary

Omitting the vitamin and trace mineral premixes and(or) adding 2/3 less supplemental inorganic phosphorus source (from .55% down to .40% total P) to diets during late finishing (191 to 265 lb) had no effect on growth performance, carcass characteristics, or muscle quality in high-lean pigs. Thus, this concept can be used to decrease the cost of feeding terminal-cross pigs to heavy weights, while decreasing excretion of minerals from intensive swine operations.

(Key Words: Finishing Pigs, Vitamins, Minerals, Phosphorus, Muscle Quality.)

Introduction

It generally is recognized that as pigs increase in age and weight, nutrient needs (as a percentage of the diet) decrease. It also is well established that nutrients in excess of those needed for maintenance and production are excreted from the body. Thus, feeding diets with excess nutrients does nothing for the pig, increases cost of production, and potentially contributes to environmental pollution. Therefore, nutritionists and producers should take advantage of technologies such as the multiple diets used in phase-feeding regimens to meet nutrient needs with minimum nutrient excesses. This philosophy has special significance in view of the extremely heavy slaughter weights now so common in the U.S.

In last year's KSU Swine Day Report, we presented data from two experiments designed to determine the effects of omitting vitamin and(or) trace mineral premixes and decreasing the supplemental inorganic phosphorus (P) in diets for pigs during late finishing (i.e., from 200 lb to a slaughter weight of 250 lb). In those experiments, we observed no negative effects on growth performance, carcass leanness, or muscle quality from our rather drastic reductions in vitamin and mineral fortification. Thus, we designed a third experiment, reported herein, to verify last year's results and to combine the most favorable treatments from those previous two experiments.

Procedures

A total of 160 pigs, with an average initial body wt of 191 lb, was used in a 30-d experiment. Crossbred pigs of PIC origin (326 boars x C15 sows) were blocked by weight and allocated to dietary treatments based on ancestry. Each treatment used 10 pigs per pen and four pens.

The pigs were housed in 6-ft × 16-ft pens, with concrete (50% solid and 50% slatted) flooring, in a modified open-front barn. Each pen was equipped with a two-hole feeder and nipple waterer to provide ad libitum access to feed and water.

The control diet was corn-soybean meal based and formulated to .70% lysine, .65% Ca, and .55% P (Table 1). Other treatments were achieved by omitting the vitamin and trace mineral premixes, 2/3 of the monocalcium phosphate and vitamin and trace mineral premixes, and 2/3 of the monocalcium phosphate. The diets were fed in meal form.

Pigs and feeders were weighed at the beginning and end of the experiment to allow calculation of ADG, ADFI, and F/G. When pigs in the heaviest pen in a weight block averaged 260 lb, the entire block was slaughtered at a commercial plant. Hot carcass weight, 10th rib backfat thickness, and longissimus muscle depth were recorded. The next day (during fabrication of the carcasses), loins were collected and the longissimus muscle was scored for color, firmness, and marbling according to NPPC (1991) guidelines. Chops from the 10th rib location were cut 1-in. thick; placed on an absorbent pad in a styrofoam tray; wrapped with polyvinylchloride film; and displayed for 15 d (36°F with 150 foot candles deluxe, warm-white, fluorescent lighting). A Minolta CR-200 spectrocolorimeter was used to measure meat lightness (Hunter L value) at d 0, 5, 10, and 15. Water loss was determined after letting 1-in. chops (from the 10th rib location) thaw for 24h at 31°F. After roasting to an internal temperature of 160°F, cooking water loss and Instron™ shear force (tenderness) were determined.

Prior to statistical analyses, dressing percentage, 10th rib fat thickness, fat-free lean index, and longissimus muscle depth and area were adjusted by using slaughter weight as a covariable. All data were analyzed using the GLM procedure of SAS and orthogonal contrasts to separate treatment means.

Results and Discussion

Average daily gain was not affected by treatment ($P > .15$), but pigs fed diets without the vitamin and trace mineral premixes tended to eat more feed ($P < .07$). The similar ADG with greater ADFI resulted in pigs fed the diet without premixes having worse F/G than pigs fed the diet with 2/3 of the monocalcium phosphate omitted ($P < .02$). However, this likely was a chance effect, because omitting both the vitamin/trace mineral premixes and 2/3 of the monocalcium phosphate resulted in a F/G value no different than that for pigs fed the positive control (i.e., 3.29). This is in accordance with results from the previous experiments, where no negative effects on growth performance were observed from omitting the vitamin/trace mineral premixes and most of the monocalcium phosphate.

Carcass characteristics generally were not influenced by the dietary treatment, but there was a trend ($P < .06$) for greater backfat thickness (from .79 to .83 in) when vitamin/trace mineral premixes were omitted. This trend should cause concern, but it should also be remembered that the largest loin eye areas (at least numerically) were for pigs fed the control diet and the diet with the combination of no vitamin/trace mineral premixes and reduced P addition. Also, in last year's experiments, we were unable to detect any differences in carcass leanness when the vitamin and trace mineral premixes were omitted and the inorganic P was reduced by 2/3.

Subjective scores for color and firmness of the longissimus muscle were not affected by treatment ($P > .15$). However, marbling was greatest for pigs fed diets without the vitamin/trace mineral premixes or with reduced addition of monocalcium phosphate. Again, it seems likely that this is chance effect, because omitting the vitamin/trace mineral premixes and 2/3 of the monocalcium phosphate gave the same mean marbling score as for pigs fed the control diet. Objective measurements (Hunter L values) of color were not affected by treatment ($P > .15$). Cooked meat tenderness and thawing loss also were not affected by treatment ($P > .15$). However, water loss during cooking tended ($P < .06$) to be greater in the control treatment.

In conclusion, omitting the vitamin and trace mineral premixes and reducing the inorganic P addition to supply .40% total P can improve profitability of swine operations feeding terminal-market high-lean pigs to heavy slaughter weights. Additionally, the reduced mineral content of these diets will result in less excretion in urine and feces and improve the environmental friendliness of swine production units.

Table 1. Diet Composition

Ingredients, %	Control	Ingredients Omitted[a]: VIT & TM	Ingredients Omitted[a]: 2/3 of MCP	Ingredients Omitted[a]: VIT & TM & 2/3 of MCP
Corn	83.82	84.07	84.77	85.01
Soybean meal (46.5% CP)	12.37	12.37	12.29	12.30
Soybean oil	1.00	1.00	1.00	1.00
Monocalcium phosphate (21% P)	1.12	1.12	.37	.37
Limestone	.94	.94	.82	.82
Salt	.30	.30	.30	.30
Vitamin premix	.15	-	.15	-
Trace mineral premix	.10	-	.10	-
Lysine-HCl	.15	.15	.15	.15
Antibiotic[b]	.05	.05	.05	.05
Total	100.00	100.00	100.00	100.00
Calculated analysis				
Lysine, %	.70	.70	.70	.70
Ca, %	.65	.65	.47	.47
Total P, %	.55	.55	.40	.40
Available P, %	.29	.29	.14	.14

[a]VIT & TM = vitamin and trace mineral premixes; MCP = monocalcium phosphate.
[b]Provided 40 g/ton tylosin.

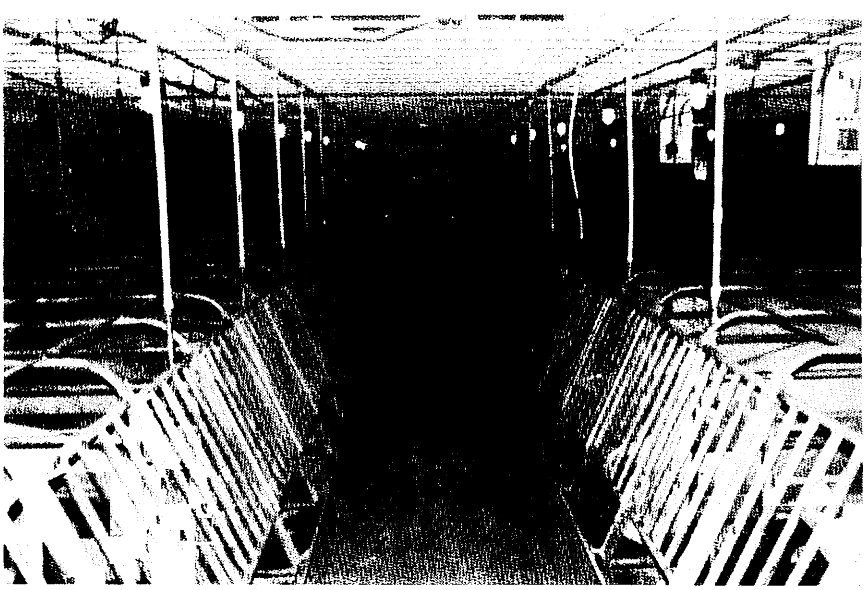

Table 2. **Effects of Omitting the Vitamin and Trace Mineral Premixes (PMXs) and(or) Reducing the Supplemental Monocalcium Phosphate (MCP) Additions for Diets during Late Finishing on Growth Performance, Carcass Characteristics, and Muscle Quality of High-Lean Pigs[a]**

		Ingredients Omitted from Diet				Contrasts[b]		
Item	Control	PMXs	2/3 MCP	PMXs & 2/3 MCP	SEM	1	2	3
ADG, lb	2.29	2.22	2.22	2.22	.10	-[i]	-	-
ADFI, lb	7.54	7.48	7.13	7.30	.16	.13	-	.07
Feed/gain	3.29	3.37	3.21	3.29	.09	-	-	.02
Dressing percentage	74.1	74.7	74.2	74.8	.7	-	-	-
10th rib fat thickness, in.	.79	.85	.83	.83	.03	.06	-	-
10th rib loin eye area, sq. in.	6.9	6.4	6.7	6.9	.2	-	.14	-
Fat-free lean index, %[c]	48.7	48.0	48.4	48.3	.4	.07	-	-
Longissimus muscle color[d]	2.6	2.7	2.6	2.6	.1	-	-	-
Longissimus muscle firmness[e]	2.5	2.5	2.5	2.4	.1	-	-	-
Longissimus muscle marbling[f]	2.2	2.5	2.4	2.2	.2	.07	.02	-
Longissimus muscle lightness[g]								
After 0 d of display	52.2	52.2	52.3	52.2	.9	-	-	-
After 5 d of display	53.4	53.2	52.8	53.3	1.0	-	-	-
After 10 d of display	54.2	52.7	54.1	54.7	1.3	-	-	-
After 15 d of display	52.9	51.1	51.9	52.5	.7	-	-	-
Cooked meat tenderness, lb[h]	2.5	2.5	2.5	2.6	.2	-	-	-
Thawing water loss, %	2.2	2.1	2.1	2.3	.4	-	-	-
Cooking water loss, %	25.6	22.7	22.7	23.3	2.1	.06	-	-

[a]A total of 160 pigs (10 pigs/pen and four pens/treatment) with an avg initial wt of 191 lb and an avg final wt of 265 lb.

[b]Contrasts were: 1) control vs other treatments, 2) PMXs or 2/3 MCP vs PMXs and 2/3 MCP, and 3) PMXs vs 2/3 MCP.

[c]Equation used was (NPPC, 1994): fat-free lean index = 51.537 + (.035 × hot carcass wt) - (12.26 × off-midline backfat thickness).

[d]Scored on a scale of 1 = pale pinkish grey to 5 = dark purplish red (NPPC, 1991).

[e]Scored on a scale of 1 = very soft and watery to 5 = very firm and dry (NPPC, 1991).

[f]Scored on a scale of 1 = practically devoid to 5 = moderately abundant (NPPC, 1991).

[g]Minolta CR-200 spectrocolorimeter values (lightness is Hunter L value). An acceptable range is 50 to 55, which is equal to NPPC scores of 2 to 3 (NPPC, 1991).

[h]Instron™ shear force values, kg.

[i]Dashes indicate $P > .15$.