Nonruminant Nutrition: Nursery and Growing-Finishing Nutrition and Management

273P The effects of high-sulfate water and dietary zeolite (clinoptilolite) on nursery pig performance. J. R. Flohr*, M. D. Tokach, J. L. Nelssen, S. S. Dritz, J. M. DeRouchey, R. D. Goodband, and N. W. Shelton, *Kansas State University, Manhattan.*

A total of 320 barrows (PIC 1050, 5.5 kg BW) were used in a 24-d study to determine the effects of high-sulfate water and dietary zeolite on growth performance and fecal consistency of nursery pigs. Eight treatments were arranged as a 2×4 factorial with 2 water treatments (control or water with 3,000 ppm sodium sulfate; NaSO₄), and 4 dietary zeolite levels (0, 0.25, 0.5, and 1.0%). Barrows were transported (623 km) from the sow farm and were weighed and allotted to pens. There were 8 replications/treatment with 5 barrows/pen. Water treatments remained the same from d 0 to 24, and all diets were fed in 2 phases, with the same zeolite inclusion rates in both phases. Phase 1 diets were fed in a pellet form (d 0 to 10), and phase 2 diets fed in meal form (d 10 to 24). Fecal samples were collected on d 5, 9, 16, and 23, visually scored for consistency (1 = firm, 5 = watery), and analyzed for DM. There were no water source × zeolite interactions for any response criteria. Overall (d 0 to 24), pigs drinking high-NaSO₄ water had decreased (P < 0.01) ADG, ADFI, and G:F compared with pigs drinking control water. Pigs drinking high-NaSO₄ water had increased (P < 0.01) fecal scores and lower (P < 0.04) DM on d 5, 9 and 16 compared with pigs drinking control water. Increasing dietary zeolite increased (linear, P < 0.05) ADG and ADFI, but had no effect on G:F. In conclusion, the 3,000 ppm NaSO₄ resulted in decreased pig growth performance that had indicators of less firm fecal consistency with lower DM and higher scores. Supplemental dietary zeolite increased ADG and ADFI but did not affect fecal score or DM.

Table 1. Effects of supplemental dietary zeolite and sodium sulfate water on nursery pig performance (d 0 to 24) and fecal consistency

Item	0%	0.5%	1%	2%	SEM
Control water					
ADG, g	277	284	283	291	12.53
G:F	0.77	0.76	0.78	0.79	0.02
d 9 fecal score	3.4	3.3	3.4	3.3	0.13
d 9 fecal DM, %	23.9	25.0	25.2	26.2	1.0
3,000 ppm NaSO ₄					
ADG, g	229	259	268	265	12.53
G:F	.73	.76	.74	.73	.02
d 9 fecal score	4.0	4.0	4.4	4.0	.13
d 9 fecal DM, %	19.0	18.0	17.0	19.8	1.0

Key Words: nursery pig, sulfate, water, zeolite

274P Evaluation of feed budgeting, complete diet blending, and over and under feeding each phase on finishing pig growth performance and carcass characteristics. H. L. Frobose*¹, J. M. DeR-ouchey¹, D. Ryder², M. D. Tokach¹, S. S. Dritz¹, R. D. Goodband¹, and J. L. Nelssen¹, ¹Kansas State University, Manhattan, ²Feedlogic Corp., Willmar, MN.

A total of 252 mixed sex pigs (PIC 327×1050 ; initial BW = 39.2 ± 0.4 kg) were used in a 103-d growth study to compare feed–budgeting strategies and complete diet blending for finishing pigs on growth per-

formance, carcass characteristics and economics. Feed was delivered to all pens of pigs using a computerized feed delivery system (FEED-Pro, Feedlogic Corp., Willmar, MN) which is capable of delivering and dispensing 2 separate diets concurrently. There were 9 pens/treatment and 7 pigs/pen in a randomized complete block design. There were 4 experimental treatments: 1) standard 4-phase (0.91, 0.77, 0.67, 0.61% SID, respectively) complete feed program (Standard); 2) Blending a high- and low-lysine complete diet to meet the estimated daily SID lysine requirement from d 0 to d 103 (Curve); 3) Treatment 1 diets with 20% greater feed budget per phase (Over), and 4) Treatment 1 diets with 20% lower feed budget per phase (Under). Diets were cornsoybean meal based with no added fat. The Standard diet was budgeted 53.1, 62.6, 71.7 and 79.4 kg for phases 1 to 4, respectively. Overall (d 0 to 103), there were no differences ($P \ge 0.12$) in ADG, ADFI or G:F or final BW. Pigs phase-fed a standard budget tended to have heavier (P ≤ 0.10) carcasses (HCW) than pigs fed the curve and tended to have (P ≤ 0.10) greater percentage yield than those fed the curve or the overbudget. However, there were no differences $(P \ge 0.14)$ in percentage lean, fat depth, or loin depth. Because of heavier HCW, pigs fed the standard feed budget had greater ($P \le 0.05$) revenue per pig and tended to have greater ($P \le 0.10$) income over feed cost (IOFC) than pigs fed via the curve with pigs over- and under-budgeted being intermediate.

Table 1. Effects of feeding method using FEEDPRO on overall performance

Criteria	Standard	Curve	Over	Under	SEM
ADG, kg	0.94	0.91	0.92	0.93	0.011
ADFI, kg	2.51	2.48	2.46	2.50	0.03
G:F	0.37	0.37	0.37	0.37	0.004
HCW, kg	99.7 ^y	97.6 ^x	97.9 ^{xy}	98.5 ^{xy}	0.97
Yield, %	75.1 ^y	74.5 ^x	74.4 ^x	74.6 ^{xy}	0.24
Feed cost, \$/pig	73.87	72.47	72.70	72.92	0.934
Revenue, \$/pig	185.49 ^b	179.73 ^a	181.74 ^{ab}	183.75 ^{ab}	2.036
IOFC, \$/pig	111.62 ^y	107.26 ^x	109.04 ^{xy}	110.83 ^{xy}	1.868

^{a,b} $P \le 0.05$; ^{x,y} $P \le 0.10$.

Key Words: feed blending, feed budgeting, finishing pig, growth

275P Effects of increasing NDF from corn dried distillers grains with solubles (DDGS) or wheat middlings (Midds), individually or in combination, on growth performance, carcass characteristics, and fat quality in finishing pigs. M. D. Asmus*, J. M. DeRouchey, J. L. Nelssen, M. D. Tokach, S. S. Dritz, and R. D. Goodband, *Kansas State University, Manhattan.*

A total of 288 pigs (38.0 kg BW) were used in an 87-d study to determine the effects of increasing dietary NDF from middlings (14.1% CP, 42.1% NDF, and 9.6% CF) and DDGS (24.9% CP, 30.4% NDF, and 12.2% fat) on growth performance, carcass characteristics, and fat quality. Pigs were allotted to 1 of 6 dietary treatments (6 pens/ treatment; 8 pigs/pen) with varying levels of DDGS and middlings added to corn-soybean meal-based diets to achieve NDF concentrations ranging from 9.2 to 18.8% (Table 1). Choice white grease (CWG) was added to maintain similar dietary SID lysine to ME within phase. The only DDGS × middlings interaction was a trend for carcass yield (P = 0.09). Adding middlings or DDGS to the diet reduced carcass yield, but the effect was not additive. Overall, adding middlings to the diet decreased (linear, P < 0.01) ADG, G:F, final BW, and HCW, and increased (linear, P < 0.001) jowl fat iodine value (IV). Increasing DDGS did not influence growth or carcass traits except for an increase (linear, P < 0.001) in IV. Pigs fed increasing NDF had decreased (linear, P < 0.05) ADG, G:F, and HCW; however, these effects were driven by the pigs fed diets containing middlings and does not appear to be attributed solely to increased NDF levels. Increasing NDF also increased IV, but DDGS had a greater negative effect than middlings (due to the higher oil content of DDGS). In summary, increasing NDF has negative effects on growth, carcass yield, and IV, but the effects appear to be more closely related to individual ingredients.

Table 1.

	1	2	3	4	5	6			
NDF, %:	9.2	14	14	16.4	16.4	18.8	-		
Midds, %:	0	19	0	9.5	19	19	-		
DDGS, %:	0	0	30	30	15	30	SEM	l Midds ^a	$\mathrm{DDGS}^{\mathrm{b}}$
ADG, kg	1.07	1.02	1.11	1.08	1.03	1.01	0.01	< 0.001	0.16
G:F	0.37	0.35	0.37	0.37	0.36	0.34	0.01	< 0.001	0.72
Final BW, kg	130.1	126.3	133.2	132.7	126.6	125.8	1.30	< 0.001	0.32
Carcass yield, %	73.8	72.2	71.9	71.5	72.2	72.4	0.69	0.37	0.17
HCW, kg	95.1	91.4	95.9	95.2	91.9	91.1	1.15	< 0.001	0.82
Jowl IV	68.2	70.3	74.6	77.0	73.4	76.6	0.42	< 0.001	< 0.001

^aTreatments 1 and 3 vs. 2 and 6; ^bTreatments 1 and 2 vs. 3 and 6.

Key Words: DDGS, NDF, wheat middlings, pig

276P Inclusion of corn germ and corn distillers dried grains with solubles in diets fed to growing-finishing pigs. J. W. Lee and H. H. Stein*, *University of Illinois, Urbana.*

A total of 280 pigs (initial BW: 42.5 ± 4.6 kg) were used to determine effects of adding corn germ (15.6% CP; 16.6% crude fat; 21.7% NDF) to diets fed to growing-finishing pigs. Pigs were randomly allotted to 1 of 8 dietary treatments in a 2×4 factorial design with 2 levels of corn distillers dried grains with solubles (DDGS; 0 or 30%) and 4 levels of corn germ (0, 10, 20, or 30%). The calculated ME was constant among all diets. Each diet was fed to 10 pens with either 3 or 4 pigs per pen. Pigs were fed phase 1, 2, and 3 diets for 28, 28, and 27 d, respectively. At the conclusion of the experiment, the pig that had a BW that was closest to the average BW of the pen was harvested. Results indicated that for the overall experimental period, there were no effects on pig growth performance of including corn germ in the diet regardless of the level of DDGS, but inclusion of 30% DDGS in the diet reduced (P < 0.001) ADG, ADFI, and final BW. There were no effects of corn germ on dressing percentage, carcass composition, muscle quality, or fat quality, but longissimus muscle (LM) marbling and firmness were reduced (P < 0.05) by inclusion of DDGS in the diet. The L* value of LM decreased (linear and quadratic, P < 0.05) as corn germ was included in diets containing no DDGS, but that was not the case in diets containing 30% DDGS (interaction, P < 0.05). Inclusion of corn germ in diets containing no DDGS increased belly length (quadratic, P < 0.05), but that was not the case in diets containing 30% DDGS. There was also a decrease in belly flop distance as corn germ was added to diets containing no DDGS (linear, P < 0.001), but no effects of corn germ were observed in diets containing 30% DDGS. However, inclusion of DDGS in the diet reduced (P < 0.001) the belly flop distance. In conclusion, addition of up to 30% corn germ in diets containing 0 or 30% DDGS did not negatively affect pig growth performance, carcass composition, or muscle quality, but belly firmness was reduced if no DDGS was included in the diet.

Key Words: corn germ, distillers dried grains with solubles, growth performance, pigs

277P Effects of dietary supplementation of emulsifier on growth performance, nutrient digestibility and blood characteristics in growing-finishing pigs. J. P. Wang*, S. M. Hong, and I. H. Kim, Department of Animal Resource & Science, Dankook University, Cheonan, Choongnam, South Korea.

The objective of this research was to evaluate the effect of exogenous emulsifier on growth performance, nutrient digestibility and blood characteristics in finishing pigs. A total of 160 crossbred barrows (initial body weight = 49.2 ± 1.3 kg) were randomly allotted to 1 of 4 treatments by their BW and litters (10 replicate pens per treatment, 4 pigs per pen). This experiment lasted for 10 weeks and there were 2 phases, growing phase (1 to 4 week) and finishing phase (5 to 10 wk). The experimental diets were based on corn and soybean meal. Treatments included: 1) PC (control diet with 5% added beef tallow and 3% soybean oil, ME = 3410 kcal/kg), 2) NC (control diet with 5% added tallow, ME = 3310 kcal/kg), 3) EA (NC diet with 0.07% lysophospholipids), and 4) EB (NC diet with 0.10% lysolecithins). Through all the experimental period, pigs in NC treatments had higher (P <0.05) ADFI than PC treatment, and there was no difference in feed take among EA, EB, and PC treatments. The ADG was not affected by any dietary treatment. Those pigs fed PC and EA diets had better (P < 0.05) G:F than NC treatments from 1 to 4 weeks and the overall phase, but the EB treatments only improved (P < 0.05) the feed efficiency during 1 to 4 weeks. Apparent total tract nutrient digestibility (ATTD) of DM, nitrogen, fat and gross energy were increased by the EA and EB treatments as compared with the PC and NC diet (P < 0.05) at the end of 4 week. Gross energy and fat digestibility were improved in EA and EB treatments in 10 week. After the feeding period, meat samples from pigs which reached marketing BW were collected from the slaughter house. No numerical differences were observed in backfat thickness, meat color, pH value and water holding capacity (WHC) among 4 treatments. In conclusion, the addition of emulsifier can improve feed efficiency and nutrient digestibility in diet containing 5% tallow of finishing pigs.

Key Words: emulsifier, fat digestibility, growing-finishing pigs

278P Effect of altering the dietary n-6 to n-3 fatty acid ratio on the pro-inflammatory responses of newly weaned pigs when challenged with *E. coli* lipopolysaccharide. U. Damdinsuren¹, L. Eastwood^{*1,2}, and A. D. Beaulieu^{1,2}, ¹Prairie Swine Centre Inc, Saskatoon, SK, Canada, ²Animal and Poultry Science, University of Saskatchewan, Saskatoon, SK, Canada.

The objective of this experiment was to determine the effect of altering the n-6 (ω 6) to n-3 (ω 3) fatty acid (FA) ratio in diets of newly weaned pigs on their pro-inflammatory responses. Piglets (n = 120) were weaned on d 28 (\pm 2) of lactation and were randomly assigned to 1 of 5 diets (5% crude fat); a tallow based control (low unsaturated fat) or plant based ω 6: ω 3 ratios of 10:1, 5:1, 1:1 (oil sources: canola, corn, flax) or a fish based (herring oil) 1:1 ratio. Individually housed piglets were fed diets for 6 d and then subjected to a 24 h *E. coli* lipopolysaccharide (LPS) challenge. Within each diet group pigs were randomized to a control group (saline) or to an LPS (15 ug/kg BW) injected group (n = 12/(challenge·diet). Rectal temperatures (temp) were recorded at