158 Effects of distillers dried grains with solubles (DDGS) on gaseous emissions of finishing pigs. H. J. Kim, S. D. Carter*, M. R. Bible, K. F. Coble, and T. M. Walraven, *Oklahoma State University, Stillwater.*

Two experiments were conducted to determine the effects of feeding DDGS on gaseous emissions by finishing pigs. In each experiment, 80 crossbred pigs were housed in an environmentally-controlled building with 4 identical rooms (20 pigs/room) containing 2 exhaust fans. Airflow and gas concentrations were measured and used to calculate gas emissions. Pigs were stratified by BW, sex, and ancestry, and randomly assigned to 1 of 4 rooms. In Exp. 1, diets were randomly allotted in a 4 × 4 crossover design with 4 rooms and 4 dietary phases. The 4 dietary treatments included corn-soybean meal diets containing 0, 10, 20 or 40% DDGS (88% DM, 27.8% CP, 0.75% S). All diets, within phase, were balanced on standardized ileal digestible Lys and digestible P. Each phase consisted of a 1-wk adjustment period followed by a 3-wk airflow and gas measurement period. Airflow was similar ($P > 0.10$) for all rooms. Increasing DDGS increased (linear, $P < 0.05$) the concentration and emission rates of NH_3, H_2S, CO_2, CH_4, and N_2O in the exhaust air. When calculated on a per pig basis, the emissions of these gases were increased (linear, $P < 0.04$) with increasing DDGS. Emissions of CH_4 and H_2S per pig were increased >200% for pigs fed 40% DDGS. In Exp. 2, pigs were fed either a control diet or a diet containing 25% DDGS (87% DM, 28.6% CP, 0.50% S) for the entire finishing phase. L-Lys HCl, L-Trp, and L-Thr were used to equalize CP content of the DDGS diet with the control diet. Unlike Exp. 1, the concentration and emission of NH_3 was similar ($P > 0.10$) for pigs fed both diets most likely due to the equalization of CP content. However, H_2S concentration and the emission rates of H_2S and CH_4 were increased ($P < 0.06$) by 157% and 188%, respectively, for pigs fed DDGS. The concentration and emissions of CO_2 and N_2O were not affected ($P > 0.10$) by diet. These results suggest that feeding DDGS will markedly increase CH_4 and H_2S emissions; however, NH_3 emissions can be controlled with amino acid use in DDGS diets. This work was partially funded by the National Pork Board.

Key Words: pigs, diet, gaseous emissions

159 Effects of sorghum dried distillers grains with solubles on finishing pig growth performance, carcass characteristics, and fat quality. K. M. Sotak*, T. A. Houser, R. D. Goodband, M. D. Tokach, S. S. Dritz, J. M. DeRouchey, J. L. Nelssen, B. L. Goehring, and G. R. Skaar, *Kansas State University, Manhattan.*

A total of 288 finishing pigs (58.8 kg BW) were used in a 73-d study to determine the effects of sorghum dried distillers grains with solubles (DDGS; 28% CP; 8.0% crude fat) in sorghum- or corn-based diets on growth performance, carcass characteristics, and fat quality. Pigs were allotted to 1 of 6 dietary treatments (6 pens/treatment) which included: sorghum-based diets with 0, 15, 30, or 45% sorghum DDGS (diets 1 to 4 in Table 1.); a sorghum-based diet with 30% corn DDGS (diet 5 28.9% CP, 9.8% crude fat), and a corn-based diet with 30% corn DDGS (diet 6 in Table 1). The diets were formulated to 0.95%, 0.83%, and 0.71% SID lysine in phases 1, 2, and 3, respectively. Overall, increasing sorghum DDGS from 0 to 45% reduced (linear, $P < 0.01$) ADG and increased (linear, $P < 0.01$) backfat iodine value (IV), while fat color became less red (a*; linear, $P < 0.01$) and tended to be less yellow (b*; linear, $P < 0.06$). No differences were observed in growth performance or backfat IV among pigs fed corn- or sorghum-based diets with 30% corn DDGS. However, pigs fed the sorghum-based diet with sorghum DDGS had fat color that was less yellow (b*; $P < 0.03$) than pigs fed the sorghum-based diet with corn DDGS. Pigs fed the sorghum-based diet with 30% sorghum DDGS also had decreased backfat IV ($P < 0.01$) and fat that was whiter (L*; $P < 0.02$) than those fed the sorghum-based diet with corn DDGS. Pigs fed sorghum with 30% sorghum DDGS had decreased ($P < 0.01$) backfat IV than pigs fed corn with 30% corn DDGS. Feeding a sorghum-based diet with 30% sorghum DDGS produces firmer pork fat than those fed corn-based diets with 30% corn DDGS which may have an important role in pork export markets.

Table 1.

	Diet							Linear	Corn DDGS vs. Sorghum
Item	1	2	3	4	5	6	SED	DDGS	DDGS[a]
ADG, kg/d	1.05	1.02	0.99	0.99	1.02	1.02	0.02	0.01	0.88
G:F	0.33	0.33	0.33	0.32	0.34	0.34	0.01	0.26	0.93
Backfat IV	58.7	60.7	64.8	69.2	68.7	68.6	1.23	0.01	0.01
Fat L*[b]	84.8	85.4	85.7	85.4	83.9	84.9	0.70	0.43	0.29

[a]Sorghum grain with 30% sorghum DDGS vs. corn grain with 30% corn DDGS.

[b]L* is on a scale of 0 to 100 (0 = black; 100 = white).

Key Words: corn, DDGS, finishing pigs, sorghum

160 Effects of lowering corn dried distillers grains with solubles (DDGS) and wheat middlings (Midds) with or without the addition of choice white grease (CWG) prior to marketing on finishing pig growth performance, carcass characteristics, carcass fat quality, and intestinal weights. M. D. Asmus*, J. M. DeRouchey, J. L. Nelssen, M. D. Tokach, S. S. Dritz, R. D. Goodband, and T. A. Houser, *Kansas State University, Manhattan.*

A total of 228 pigs (46 kg BW) were used in a 92-d study to determine the effects of withdrawing high fiber diets 19 d before market on growth performance, carcass characteristics, fat quality, and intestinal weights of finishing pigs. Pigs were allotted to 1 of 7 dietary treatments (5 or 6 pens/treatment). Treatments were arranged in a 2 × 3 factorial plus control with main effects of added CWG (0 or 3%) during the withdrawal period (d 73 to 92) and fiber levels of low (corn-soybean meal diet), medium (9.5% Middlings and 15% corn DDGS) or high (19% Middlings and 30% corn DDGS) during the withdrawal period. Pigs were fed high fiber (19% Middlings and 30% corn DDGS) diets from d 0 to 73. Control pigs were fed low fiber corn-soybean meal diets from d 0 to 92. There were no CWG × fiber interactions ($P > 0.13$) except for jowl iodine value (IV) which increased (linear $P < 0.03$) with increasing DDGS and Middlings only when CWG was added to the diet during the withdrawal period. Adding CWG during the withdrawal period increased ($P < 0.02$) ADG (0.82 vs 0.88 kg/d) and G:F (0.29 vs 0.31) leading to an overall (d 0 to 92) improvement ($P < 0.02$) in G:F. Carcass yield and backfat depth increased (linear, $P < 0.05$) when low fiber diets were fed from d 73 to 92. Pigs fed high DDGS and Middlings had increased ($P < 0.001$) jowl IV, with a larger increase when CWG was added. Feeding low levels of DDGS and Middlings during the withdrawal period decreased (linear, $P <$

0.01) whole intestine weights, mainly due to the reduction ($P < 0.02$) in rinsed stomach and full large-intestine weights. Lowering dietary DDGS and Middlings during a 19 d withdrawal period increased yield through reduced large intestine weight and content, improved carcass yield, and jowl IV. The addition of CWG improved G:F; however, CWG did not improve carcass characteristics.

Table 1.

	1	2	3	4	5	6	7	
d 0 to 73:	Low	High	High	High	High	High	High	
					3% Added Fat			
d 73to 92:	Low	Low	Med	High	Low	Med	High	SEM
ADG, kg	0.85	0.84	0.85	0.84	0.86	0.84	0.85	0.013
G:F	0.34	0.33	0.33	0.33	0.34	0.34	0.35	0.004
Final BW, kg	124.5	123.0	123.8	124.0	124.9	124.8	124.5	1.499
Carcass yield, %	72.6	72.6	71.8	71.9	73.0	72.3	71.5	0.305
HCW, kg	90.6	89.4	89.0	89.2	91.2	90.6	88.9	1.332
Lean, %[a]	52.8	53.0	53.3	53.4	53.0	52.6	53.4	0.305
Backfat, mm[a]	18.9	17.5	17.0	17.0	18.6	17.7	16.5	0.603
Jowl IV	69.4	77.8	78.5	79.2	77.3	78.6	81.2	0.502

[a]Adjusted to a common HCW.

Key Words: DDGS, fiber, wheat middlings, pig

161 Effects of feeding diets containing highly oxidized corn dried distillers grains with solubles (DDGS) with increasing vitamin E levels to wean-finish pigs on growth performance, carcass composition, and pork fat quality. R. Song*[1], C. Chen[1], L. J. Johnston[2], B. J. Kerr[3], T. E. Weber[3], and G. C. Shurson[1], *[1]University of Minnesota, St. Paul, [2]West Central Research and Outreach Center, Morris, MN, [3]USDA-ARS-NLAE, Ames, IA.*

Lipid peroxidation in animal feed can reduce growth performance and meat quality. Weanling pigs (n = 432; BW = 6.6 ± 0.4 kg) were used to evaluate the effects of feeding highly oxidized DDGS with 3 levels of vitamin E (α-tocopheryl acetate) on growth performance, carcass composition, and pork fat quality. The DDGS source used in this study contained the highest thiobarbituric acid reactive substances (TBARS) value and peroxide value (5.2 ng/mg oil and 84.1 mEq/kg oil, respectively) among 30 other DDGS sources sampled. Pens within blocks were assigned randomly to 1 of 6 dietary treatments in a 2 × 3 factorial design. Pigs were fed corn-soybean meal (CON) or 30% DDGS diets with 3 levels of vitamin E: none supplemented (No-E), NRC (11 IU/kg, 1X-E), or 10X NRC (110 IU/kg, 10X-E). All diets were formulated on a standardized ileal digestible (SID) AA and available P basis with similar calculated ME content. Compared with CON, inclusion of 30% DDGS in diets reduced ($P < 0.001$) final BW (110 vs. 107 kg), overall ADG (0.76 vs. 0.74 kg/d) and G:F (0.39 vs. 0.37). Increasing dietary vitamin E level increased overall G:F ($P = 0.03$). Hot carcass weight, dressing percentage, backfat depth and loin muscle area were reduced ($P < 0.01$) in pigs fed DDGS compared with CON, but percentage of fat-free carcass lean was not affected. Feeding DDGS increased ($P < 0.001$) PUFA concentration, particularly linoleic acid ($P < 0.001$), and iodine value ($P < 0.001$) in belly fat and backfat compared with pigs fed CON. Dietary vitamin E levels did not affect fatty acid profile in belly or back fat. Alpha-tocopherol concentration in LM was higher ($P < 0.001$) in 10X-E than No-E or 1X-E dietary treatments. Compared with CON, feeding DDGS increased α-tocopherol concentration in LM in pigs fed No-E (1.0 vs. 3.1 μg/g, $P = 0.005$), but not in those fed 1X-E or 10X-E. These results indicate that feeding highly oxidized, 30% DDGS diets to wean-finish pigs may reduce growth performance. However, supplementation of additional vitamin E in the diet did not counteract these effects, but did improve G:F and α-tocopherol level in LM at the 10X NRC level.

Key Words: DDGS, growth performance, pig, vitamin E

162 Effects of dietary L-carnitine and dried distillers grains with solubles (DDGS) on growth, carcass characteristics, and loin and fat quality of finishing pigs. W. Ying*[1], J. M. DeRouchey[1], M. D. Tokach[1], S. S. Dritz[1], T. A. Houser[1], R. D. Goodband[1], J. L. Nelssen[1], and J. C. Woodworth[2], *[1]Kansas State University, Manhattan, [2]Lonza Inc., Allendale, NJ.*

A total of 1,104 barrows and gilts (PIC 337 × 1050, initially 36 kg BW) were used to evaluate the effects of dietary L-carnitine and corn DDGS on growth, carcass traits, and loin and fat quality. Dietary treatments were arranged as a 2 × 3 factorial with main effects of added DDGS (0 or 30% in phases 1, 2, and 3 and 20% in phase 4) and L-carnitine (0, 50, or 100 mg/kg). Each treatment had 7 mixed gender pens with 26 or 27 pigs per pen. Overall (d 0 to 109), pigs fed L-carnitine had increased ($P < 0.02$) ADG and final BW. A DDGS × L-carnitine interaction (quadratic, $P < 0.01$) was observed for G:F. Pigs fed 50 mg/kg L-Carnitine without DDGS had better G:F than pigs fed 0 or 100 mg/kg, but in diets with DDGS, pigs fed 50 mg/kg L-carnitine had poorer G:F compared with those fed 0 or 100 mg/kg. Increasing dietary L-carnitine increased HCW (quadratic, $P < 0.03$), carcass yield (quadratic, $P < 0.07$), and backfat (quadratic, $P < 0.04$), with the maximum response observed at 50 mg/kg. Increasing L-carnitine increased (linear, $P < 0.03$) purge loss of the loin, indicative of decreased water holding capacity. Adding L-carnitine to diets did not affect drip loss, color or marbling score of the loin. Feeding dietary DDGS tended ($P < 0.06$) to decrease visual loin marbling score. Feeding DDGS increased ($P < 0.001$) linoleic acid, PUFA, unsaturated fatty acid:saturated fatty acid ratios, and jowl iodine value; however, feeding L-carnitine did not alter jowl fatty acid profile. In conclusion, feeding L-carnitine improved ADG and HCW, with the maximal response observed at 50 mg/kg, but dietary L-carnitine did not improve loin or fat quality.

Table 1. Effect of L-carnitine and DDGS on growth and carcass traits

DDGS, %:	0	0	0	30	30	30	
L-Carnitine, mg/kg:	0	50	100	0	50	100	SEM
ADG, g	814	853	842	828	845	841	11
ADFI, kg	2.40	2.42	2.47	2.46	2.55	2.41	0.04
G:F	0.34	0.35	0.34	0.34	0.33	0.35	0.01
HCW, kg	92.4	95.4	93.2	92.6	94.2	94.1	0.9
Yield, %	74.7	75.9	75.0	75.0	75.2	75.1	0.3
Loin depth, cm[a]	6.36	6.39	6.34	6.23	6.21	6.23	0.10
Backfat, mm[a]	16.7	17.5	17.2	16.5	17.2	16.5	0.3
Purge loss, %	2.71	3.38	3.47	2.46	2.92	3.45	0.38
Iodine value, g/100g	66.5	66.9	66.9	74.7	73.3	74.0	0.6

[a]Adjusted to a common HCW.

Key Words: DDGS, L-carnitine, pig

163 Effect of replacing soybean meal (SBM) with corn high protein dried distillers grains with solubles (HPDDGS) on growth performance, carcass characteristics, and carcass fat quality in finishing pigs. D. L. Goehring*[1], M. D. Tokach[1], J. M. Nelssen[1], J. M.