

ADG and G:F ($P < 0.02$) vs diets with sorghum-DDGS and expander processing improved ADG and G:F ($P < 0.009$) vs standard conditioning. But, pigs fed diets with sorghum-DDGS showed the greatest response in G:F to expander conditioning (DDGS source \times conditioning interaction, $P < 0.02$). For the corn-soy-standard, corn-soy-expander, corn-DDGS-standard, corn-DDGS-expander, sorghum-DDGS-standard, and sorghum-DDGS-expander treatments, ADG was 670, 719, 605, 655, 548, and 632 g/d and G:F was 689, 711, 692, 706, 585, and 672 g/kg. For the finishing experiment, 176 pigs (75 kg avg BW) were assigned to 16 pens. Treatments were arranged as a 2×2 factorial with main effects of diet formulation (corn-soy vs 40% sorghum-based DDGS) and conditioning (standard steam vs expander) prior to pelleting. Pigs fed corn-soy had greater ($P < 0.03$) ADG and G:F vs pigs fed diets with DDGS. Expander conditioning did not affect ADG ($P > 0.8$) but improved G:F and dressing percentage ($P < 0.005$). For corn-soy-standard, corn-soy-expander, DDGS-standard, and DDGS-expander ADG was 1.08, 1.05, 0.98, and 1.01 kg/d, G:F was 334, 349, 328, and 338 g/kg, and dressing percentage was 73.6, 74.3, 72.5, and 73.6%. In conclusion, expanding diets without and with DDGS improved ADG and G:F in nursery pigs and G:F and dressing percentage in finishing pigs.

Key Words: Distillers dried grains, Expander, Pig

157 Effects of feeding increasing levels of distillers dried grains with solubles to grow-finish pigs on growth performance and carcass quality. D. Weimer, J. Stevens*, A. Schinckel, M. Latour, and B. Richert, *Purdue University, West Lafayette, IN*.

Crossbred pigs ($N=140$; initial BW = 52 kg) were assigned to one of 5 dietary treatments (6 pens/trt; pen exp. unit) to evaluate the effect of increasing levels of distillers grains plus solubles (DDGS) on pig growth and carcass traits. Two control diets were used, one with supplemental choice white grease (Cont+Fat) and one without supplemental fat (Cont-NF). The three remaining diets contained 10, 20, or 30% DDGS. Diets were equal in digestible Lys and minimum digestible amino acid ratios along with equal ME for all DDGS and Cont+Fat diets. Growth performance was evaluated on a four phase feeding program. Pigs were fed a grower diet for 28 d and a finisher diet from d28 to 56, a 5 ppm Paylean finisher diet from d56-70, and a 10 ppm Paylean finisher diet from d70 to either 79 or 84 d on test (market; BW=128.2 kg). Overall ADG ($P < 0.10$) and G/F ($P < 0.01$) decreased as DDGS levels increased to 20 and 30%. Hot carcass weight ($P < 0.10$) and dressing percentage ($P < 0.01$) decreased linearly as DDGS inclusion levels increased. Kidney and liver weights increased linearly ($P < 0.06$) as DDGS levels increased. Tenth rib backfat depth and leaf fat ($P < 0.03$) decreased linearly as DDGS inclusion levels increased. Loin muscle (LM) marbling, firmness, color, and 24 hr pH were not affected ($P > 0.40$) by the dietary DDGS level. The percentage of pigs with separation of the backfat layers and inner backfat layer from the LM increased (25.0, 16.7, 66.7, 75.0 and 91.7% for Cont-NF, Cont+Fat, 10, 20 and 30% DDGS, respectively, $P < 0.001$) with increasing dietary DDGS. Belly firmness (measured by suspension over a 2.54 cm rod) decreased ($P < 0.01$) as the DDGS inclusion levels increased. Gilts had greater belly bending and a greater impact of DDGS on belly quality at every level of dietary inclusion. Diets formulated on a digestible lysine basis containing up to 10% DDGS can be fed to grow-finish pigs without decreased growth performance and carcass traits. Utilization of DDGS above 10% of the diet needs to be carefully evaluated before implementing in a grow-finish swine feeding program.

Key Words: Pgs, Distillers dried grains with solubles, Pork quality

158 Effects of adding increasing levels of corn dried distillers grains with solubles (DDGS) to corn-soybean meal diets on pork fat quality of growing-finishing pigs. G. Xu*, S. K. Baidoo¹, L. J. Johnston¹, J. E. Cannon², D. Bibus¹, and G. C. Shurson¹, ¹*University of Minnesota, St. Paul*, ²*Hormel Foods, Austin, MN*.

A total of 512 pigs (22.1 ± 0.54 kg BW; 8 pigs/pen; 64 pens) from 2 groups (each = 256 pigs) were used to evaluate the effects of increasing dietary DDGS levels on pork fat quality. Pigs within group were randomly allotted to one of 4 dietary treatments (16 pens per treatment) which consisted of a corn-soybean meal control (D0), or corn-soybean meal diets containing 10% (D10), 20% (D20), or 30% (D30) DDGS in a 3-phase feeding program to a final BW of about 128.6 ± 3.1 kg. There was a linear increase ($P < 0.01$) in linoleic acid concentration of backfat (9.1, 12.8, 16.2, and 19.5%; $P < 0.01$), belly fat (9.4, 11.7, 14.8, and 17.2%; $P < 0.01$), and loin i.m. fat (6.8, 9.3, 9.5, and 9.5 %; $P < 0.05$) as pigs were fed D0 to D30, respectively. Total polyunsaturated fatty acids content of backfat and belly fat increased linearly ($P < 0.01$), while saturated fatty acids content were reduced linearly ($P < 0.01$) with increasing dietary DDGS levels. As dietary DDGS level was increased from 0 to 30%, iodine value of backfat (58.4, 65.6, 68.4, and 72.4), belly fat (61.4, 65.4, 69.3, and 72.3), and loin fat (54.8, 56.8, 57.1, and 57.7) increased ($P < 0.01$) linearly, respectively. Loin fat oxidation measured on d 1, 14, 21, and 28 of storage was not different among pigs fed increasing levels of DDGS. Loin sensory taste tests revealed no effects of diet on flavor, off-flavor, tenderness, juiciness, and overall acceptability. Similarly, bacon flavor, off-flavor, crispiness, and overall liking were not impacted by DDGS levels, although bacon fattiness ($P < 0.01$) and tenderness ($P < 0.05$) were reduced linearly with increasing dietary DDGS levels. Results from this study suggest that acceptable pork fat quality can be achieved when 20% DDGS is added to grower-finisher swine diets based upon an iodine value standard of 70. Feeding diets containing 30% DDGS may result in acceptable pork fat quality depending on individual pork processors standards for fat quality.

Key Words: DDGS, Pork fat quality, Pigs

159 Effects of dried distiller grain with solubles on fat quality of finishing pigs. J. M. Benz*, S. K. Linneen, J. M. DeRouchey, M. D. Tokach, S. S. Dritz, J. L. Nelssen, and R. D. Goodband, *Kansas State University, Manhattan*.

A total of 1,112 pigs were used in a 78-d growth assay evaluating the effects of increasing dried distillers grains with solubles (DDGS, 0, 5, 10, 15, or 20%) on carcass and fat quality characteristics. Growth performance for this trial was previously published and can be found at J. Anim. Sci. 85 (Supple. 2): (Abstr.). All diets contained 6% choice white grease. The experiment was conducted in a commercial research finishing barn in southwestern Minnesota. There were 9 replicates per treatment with 25 to 28 pigs per pen. Barrows and gilts were distributed equally in each pen. At the end of the trial, jowl fat, belly fat, and backfat samples were collected and analyzed for fatty acid profile and iodine value (IV). Fat quality data was analyzed as a split plot with DDGS treatments as a whole plot and gender as the subplot. Increasing DDGS decreased ($P < 0.04$) carcass weight (89.3, 88.9, 88.7, 87.7, 87.5 kg) and percent yield (75.7, 75.5, 75.4, 75.2, 75.1%). Increasing DDGS level increased (linear, $P < 0.05$) iodine value and percentage C 18:2 fatty acids in backfat (68.3, 70.0, 71.2, 72.4, 72.8 g; 14.0, 14.9, 15.8, 17.1, 17.6%), jowl fat (70.7, 70.8, 71.9, 72.6, 73.8 g; 14.1, 14.0, 14.9, 15.6, 16.5%), and belly fat (70.2, 71.5, 72.4, 73.3, 74.5 g; 14.5,

15.3, 16.3, 16.8, 17.9). Increasing DDGS decreased (linear, $P < 0.05$) percentage saturated fatty acids in jowl fat (36.0, 35.0, 34.5, 34.4, 34.5%), backfat (33.3, 33.1, 32.8, 32.7, 32.3%) and belly fat (34.4, 33.8, 33.7, 33.2, 32.9%). Barrows had decreased ($P < 0.04$) belly fat iodine values (71.8 vs 72.9 g) and percentage 18:2 fatty acids (15.9 vs 16.5) when compared to gilts. Barrows also had increased ($P < 0.05$) percentage of saturated fatty acids in jowl (33.2 vs 32.5 g) and belly fat (33.9 vs 33.3) when compared to gilts. In summary, feeding DDGS linearly increased IV of backfat, jowl fat and belly fat with a similar response in all three fat depots.

Key Words: DDGS, Iodine value, Fat quality

160 Withdrawal of distillers dried grains with solubles (DDGS) prior to slaughter in finishing pigs. G. M. Hill^{*1}, J. E. Link¹, D. O. Liptrap², M. A. Giesemann³, M. J. Dawes¹, J. A. Snedegar¹, N. M. Bello¹, and R. J. Tempelman¹, ¹Michigan State University, E. Lansing, ²Hubbard Feeds, Mankato, MN, ³Dakota Gold Research Association, Sioux Falls, SD.

Use of DDGS in swine finisher diets has raised concern about carcass composition because of its higher unsaturated fat and fiber content. Our study was designed to determine the effect of DDGS in grow-finish diets on growth and carcass fat characteristics when high concentrations of DDGS were withdrawn during late finishing. Pigs (308 pigs; 30 kg) were blocked by wt, allotted to 4 treatments (11/pen; 7 reps) by sex and litter and fed 3 dietary phases. Dietary treatments contained 0, 10, 20, or 30% DDGS until 30 d prior to harvest when DDGS was withdrawn from the 20 and 30% diets and fed the 0% diet. All diets contained Phytase and 4% choice white grease. Wheat midds were added to the 0, 10, and 20% diets to equalize net energy. Overall ADG did not differ between treatments (0.90, 0.91, 0.91, 0.91 kg/d; $P = 0.98$). Overall G:F was greater for pigs fed 10% DDGS than for 0% (0.39, 0.41, 0.39, 0.40; $P = 0.02$). Dressing % did not differ by treatment for 245 pigs killed at a commercial facility (75, 75, 75, 76%, $P = 0.53$). Dressing % ($P = 0.26$) and Standardized Fat Free Lean ($P = 0.39$) did not differ in pigs ($n = 28$, 1/pen) killed at the MSU Meat Lab. The fatty acid (FA) composition of jowl fat showed a linear increase in Arachidic 20:0 and Docosanoic 22:0 acids ($P < 0.0001$), and a linear decrease in Palmitoleic 17:0 ($P = 0.01$), Stearic 18:0 ($P = 0.03$), and Oleic 18:1n9 ($P = 0.02$) acids with increasing DDGS in the diet. Myristoleic 14:1 ($P = 0.001$) and Palmitoleic 16:1 ($P = 0.003$) were lower from pigs fed 30% DDGS than for other treatments. Iodine value (IV) was increased ($P = 0.006$) in fat from pigs fed the 20 and 30% DDGS diets compared with those fed the 0% diet. These data indicate that IV may not be reflective of FA composition. Feeding well balanced commercial swine diets with 20 to 30% DDGS results in acceptable performance and carcasses when DDGS is removed from the diet 30 d prior to harvest.

Key Words: DDGS, Pig, Fatty acids

161 Effects of dietary corn dried distillers grains with solubles (DDGS), and DDGS withdrawal intervals, on pig growth performance, carcass traits, and fat quality. G. Xu^{*1}, S. K. Baidoo¹, L. J. Johnston¹, J. E. Cannon², D. Bibus¹, and G. C. Shurson¹, ¹University of Minnesota, St. Paul, ²Hormel Foods, Austin, MN.

A study was conducted to determine the quantitative effects of feeding level and withdrawal interval of DDGS on growth performance,

carcass, and pork fat quality. A total of 432 pigs (29.8 ± 0.2 kg BW; 9 pigs/pen with total 48 pens) were allotted randomly to one of 9 dietary treatment combinations in a completely randomized design. The nine treatment combinations were: control (D0), 15% DDGS with 0 wk DDGS withdrawal before slaughter (D15-0wk), D15-3wk, D15-6wk, D15-9wk, D30-0wk, D30-3wk, D30-6wk, and D30-9 wk. Each treatment had 5 pens except D0 (8 pens). A 3-phase feeding program was used for pigs to a slaughter weight of 123.5 ± 1.13 kg. Adding 15 or 30% DDGS to the diet, with or without a withdrawal interval, had no effect on ADG, ADFI and G:F except for a reduction (0.87 vs. 0.92 kg/d; $P < 0.05$) in ADG for pigs fed D30-0wk compared to D0. Carcass quality, loin quality, and Japanese fat color score of pigs were not different among treatments. Belly firmness score was reduced ($P < 0.05$) in pigs fed D30-0wk compared to D0, but was not different among pigs assigned to the other treatments. Linoleic acid (C18:2) content and iodine value (IV) of belly fat increased with increasing DDGS level ($P < 0.01$). Withdrawal of DDGS from the diet for 0 wk to 9 wk before slaughter linearly reduced C18:2 content and IV of belly fat in pigs fed 15% DDGS diets (C18:2: 14.6, 13.3, 12.6, and 10.9%; $P < 0.01$; IV: 67.3, 64.4, 64.1, and 62.7; $P < 0.05$; for wk 0, 3, 6, and 9 withdrawal, respectively) and 30% DDGS diets (C18:2: 17.3, 16.1, 14.2, and 12.4%; $P < 0.01$; IV: 71.2, 68.2, 64.5, and 62.7; $P < 0.01$; for wk 0, 3, 6, and 9 withdrawal, respectively). These results indicate that inclusion rate of DDGS up to 30% in grower-finisher diets reduced ADG, and the desired effect of reducing C18:2 content and iodine value of pork fat could be elicited in as little as 3 wk of withdrawing DDGS from the diet prior to slaughter for pigs fed diets containing 30% DDGS based upon an iodine value standard of 70.

Key Words: DDGS withdrawal, Pork quality, Pigs

162 Effects of adding beef tallow and palm oil to diets with sorghum-based distillers dried grains with solubles on growth performance and carcass characteristics in finishing pigs. C. Feoli^{*1}, J. D. Hancock¹, S. Issa¹, T. L. Gugle¹, and S. D. Carter², ¹Kansas State University, Manhattan, ²Oklahoma State University, Stillwater.

A total of 112 barrows (seven pigs/pen and four pens/treatment with an avg BW of 63 kg) was used in a 69-d growth assay to determine the effects of adding sources of saturated fatty acids to diets with sorghum-based distillers dried grains with solubles (DDGS). Treatments were a corn-soybean meal-based control and diets having 40% DDGS (US Energy Partners, Russell, KS) without and with 5% added tallow and palm oil. Feed and water were consumed on an ad libitum basis until the pigs were slaughtered (avg BW of 129 kg) to allow collection of carcass data. Fatty acid composition of jowl samples was used to calculate iodine value (IV). The corn-soy control supported greater ADG and ADFI ($P < 0.001$) with no difference in G:F ($P > 0.9$) compared to the DDGS treatments. Adding 5% fat to diets with DDGS improved G:F by 7% ($P < 0.02$) but there was no difference ($P > 0.12$) in growth performance among pigs fed the tallow vs palm oil treatments. As for carcass data, pigs fed the control diet had greater ($P < 0.004$) hot carcass weights, dressing percentages, and backfat thicknesses than pigs fed the DDGS treatments. Adding fat to the DDGS diets improved hot carcass weights and dressing percentages ($P < 0.06$) but there were no effects of fat source on carcass measurements ($P > 0.16$). Changes in IV indicated softer fat in pigs fed DDGS ($P < 0.001$) even when the saturated fat sources were added to the diets. For the control, DDGS, DDGS + tallow, and DDGS + palm oil treatments, ADG was 1,029, 926, 890, and 934 g/d, ADFI was 3.3, 3.1, 2.9, and 2.9 kg/d, G:F was 312, 299, 307, and 322 g/kg,