

formance. In spite of the reduction in ATTD of energy with fiber level, growth performance was not affected with constant NE of the diet.

Key Words: corn co-products, dietary fiber, pigs

166 The effects of sorghum dried distillers grains with solubles on nursery pig performance. K. M. Sotak*, R. D. Goodband, M. D. Tokach, S. S. Dritz, J. M. DeRouchey, and J. L. Nelssen, *Kansas State University, Manhattan*.

Two experiments were conducted to determine the effects of sorghum dried distillers grains with solubles (DDGS; 32.4% CP; 8.0% crude fat) on nursery pig growth performance. In both experiments, sorghum DDGS were added to corn- or sorghum-based diets. In Exp. 1, 360 nursery barrows (6.8 kg and 26 d of age) were allotted to 1 of 8 dietary treatments (9 pens per treatment) in a 34-d study. Treatments were arranged in a 2 × 4 factorial with main effects of grain source (corn vs. sorghum) and 0, 15, 30, or 45% sorghum DDGS. The diets were formulated to 1.30% and 1.25% SID lysine in phases 2 and 3, respectively and were not balanced for energy. There were no differences among pigs fed sorghum- or corn based diets for ADG and ADFI; however, as sorghum DDGS increased from 0 to 45% of the diet, ADG decreased (linear, $P < 0.01$). A DDGS × grain source interaction (quadratic, $P = 0.03$) was observed for G:F. As sorghum DDGS increased in corn-based diets, G:F was identical for pigs fed 0, 15, and 30% DDGS, but worsened for those fed 45% DDGS. In sorghum-based diets, G:F was best for those fed 0% DDGS, but worsened in pigs fed 15, 30, or 45% DDGS. In Exp. 2, 180 nursery pigs (10.8 kg and 38 d of age) were used in a 21-d study with 5 pens per treatment. Treatments were arranged in a 2 × 3 factorial with main effects of grain source (corn vs. sorghum) and DDGS (0%, 30% corn DDGS; 28.9% CP; 9.8% crude fat, or 30% sorghum DDGS; 32.4% CP; 8.0% crude fat). Diets were formulated to 1.27% SID lysine and were not balanced for energy. Overall, pigs fed sorghum- or corn-based diets had similar ADG (main effect, 520 vs. 513 g/d, respectively). Pigs fed sorghum or corn DDGS had similar ADG, (main effect, 508 vs. 506 g/d, respectively). Pigs fed diets with 30% DDGS gained less ($P < 0.03$) than pigs fed basal diets (507 vs. 535 g/d ADG, respectively). These results suggest sorghum can be a suitable replacement for corn in nursery pig diets, however increasing sorghum DDGS decreased ADG.

Table 1. Exp. 1, evaluating 8 treatments consisting of two grain sources (corn and sorghum) and 4 levels of sorghum DDGS (0, 15, 30, and 45%)

Item	Corn-based				Sorghum-based				SED
	0	15	30	45	0	15	30	45	
d 0 to 14									
ADG, g ^d	313 ^{ab}	302 ^{ab}	294 ^a	282 ^a	336 ^b	308 ^{ab}	286 ^a	288 ^a	20.9
ADFI, g	465	464	441	412	442	469	440	433	28.7
G:F ^c	0.67 ^a	0.66 ^a	0.67 ^a	0.69 ^a	0.76 ^b	0.66 ^a	0.65 ^a	0.67 ^a	0.04
d 0 to 34									
ADG, g ^d	488 ^{ac}	478 ^{ac}	466 ^{abc}	430 ^b	491 ^c	471 ^{ac}	472 ^{ac}	449 ^{ab}	20.4
ADFI, g	757	748	728	694	749	772	765	736	31.5
G:F ^c	0.64 ^{ab}	0.64 ^{ab}	0.64 ^{ab}	0.62 ^{bc}	0.66 ^a	0.61 ^c	0.62 ^c	0.61 ^c	0.01

^{abc}Means on the same row with different superscripts differ $P < 0.05$.

^dIncreasing DDGS; linear, $P < 0.01$.

^cGrain source × DDGS interaction $P < 0.05$.

Key Words: corn DDGS, nursery pigs, sorghum, sorghum DDGS

167 Effect of increasing levels of corn distillers dried grains with solubles (DDGS) on growth performance of nursery pigs. T. C. Tsai, C. R. Dove, P. M. Cline, and M. Azain*, *University of Georgia, Athens*.

Two experiments were conducted to evaluate the effect of increasing DDGS (25.9% CP, 10.4% Fat, 7.1% Fiber) in phase 2 and 3 nursery diets on growth performance. The objective was to determine if there was an upper limit of the level of DDGS that could be included in nursery diets. In both experiments, pigs were weaned at 21 d and fed a common phase 1 starter diet (ME: 3.30 Mcal/kg, CP: 21.68%, Lys: 1.5%) for d 0–7 post-weaning. In Exp 1, a total of 160 pigs (2 trials, 80 pigs per trial, 5 pigs per pen) with initial body weight 6.61 ± 0.5 kg were randomly assigned to one of 4 diets: 0% DDGS, 10% DDGS, 20% DDGS, 30% DDGS formulated on a total lysine basis. Test diets were fed in 2 phases (Phase 2: 7–21 d, 3.30 Mcal/kg ME, 1.38% lysine; phase 3: 21–35 d, 3.40 Mcal/kg ME, 1.25% Lysine). In Exp 2, 65 pigs (5 reps per diet, 2–3 pigs per pen, initial BW = 6.77 ± 0.5 kg) were assigned to one of 5 diets: 0% DDGS, 10% DDGS, 20% DDGS, 30% DDGS, 37.5% DDGS, and 45% DDGS, that were formulated on a standardized ileal digestible lysine basis and fed in 2 phases (phase 2: 7–21 d; 3.30 Mcal/kg ME, 1.20% SID lysine; phase 3: 21–35 d, 3.40 Mcal/kg ME, 1.01% SID lysine). Energy, protein and phosphorus digestibility were also determined in Exp 2 using TiO₂ as a marker. In Exp 1, there was no change in ADG in phase 2 as DDGS increased from 0 to 30% (274, 286, 269, 242 g/d, NS), however, ADG decreased linearly in phase 3 (559, 545, 525, 480, g/d, $P < 0.001$) and overall (D 7–35: 416, 415, 398, 316, g/d, $P < 0.001$). Intake (ADFI) increased with increasing DDGS in phase 2 (468, 533, 555, 557 g/d $P < 0.05$), but was not changed ($P > 0.2$) in phase 3 (average = 883 g/d) or overall (average 705 g/d). In Exp 2, increasing DDGS up to 45% had no significant effect in ADG or ADFI ($P > 0.20$). Apparent digestibility of energy ($P < 0.001$) and protein ($P < 0.01$) decreased in both phase 2 and 3 as DDGS increased. Phosphorus digestibility improved ($P < 0.001$) with increasing DDGS. The results indicate that high levels of DDGS can be used in nursery diets and are well tolerated if the diets are formulated on a constant SID lysine basis with a balanced amino acid pattern.

Key Words: DDGS, growth performance, nursery pigs, nutrient digestibility

168 Effects of increasing dietary wheat middlings and corn dried distillers grains with solubles in diets for 7- to 23-kg nursery pigs. J. A. De Jong*, J. M. DeRouchey, M. D. Tokach, R. D. Goodband, S. S. Dritz, and J. L. Nelssen, *Kansas State University, Manhattan*.

Three experiments were conducted to determine the effects of dietary wheat middlings (middlings) and corn dried distillers grains with solubles (DDGS; 29.5% CP; 9.5% fat) on nursery pig performance. For all experiments, pigs were allotted to pens based on BW at weaning (21 d of age) with pens allotted to treatments based on pen weight on d 0 of the experiment. Composition of middlings ranged from; 16.0 to 16.5% CP, 9.8 to 11.0% ADF, 30.6 to 33.7% NDF, and 7.9 to 8.5% CF. Diets had constant SID Lys, but were not isocaloric. In Exp. 1, 180 pigs (12 kg BW) were used in a 21-d trial and fed diets containing wheat middlings. Increasing wheat middlings decreased ADG (linear; $P < 0.05$; 578, 568, 565, 566, 547 g/d) and ADFI (linear; $P < 0.005$; 945, 941, 903, 916, 892 g/d) with no change in G:F. In Exp. 2, 180 pigs (12 kg BW) were fed 1 of 6 experimental diets arranged in a 2 × 3 factorial with main effects of DDGS (0 or 20%) and middlings (0, 10, or 20%)

for 21-d. There were no DDGS $\times$ middlings interactions and adding DDGS to the diet did not influence ADG (577 vs. 571 g/d), ADFI (942 vs. 939 g/d), or G:F (0.61 vs. 0.61). Increasing wheat middlings decreased (linear, $P < 0.03$) ADG (589, 573, 556 g/d), G:F (0.63, 0.61, 0.60), and final BW (24.6, 24.3, 24.0 kg) with no difference in ADFI. In Exp. 3, 210 pigs (7 kg BW) were used in a 35-d trial to evaluate the effects of increasing wheat middlings (0, 5, 10, 15, and 20%) on 7- to 23-kg pig performance. From d 0 to 14, increasing middlings did not affect ADG (205, 210, 213, 200, 209 g/d) or G:F (0.62, 0.67, 0.67, 0.63, 0.63). From d 14 to 35, increasing middlings decreased (linear; $P < 0.02$) ADG (585, 585, 578, 569, 543 g/d) and G:F (0.67, 0.68, 0.66,

0.66, 0.63). Overall increasing middlings tended (linear; $P < 0.11$) to decrease ADG (433, 435, 432, 422, 408 g/d) and decreased (quadratic; $P < 0.01$) G:F (0.66, 0.68, 0.66, 0.66, 0.63) with no difference in ADFI. The greatest reductions in ADG and G:F were observed when wheat middlings exceeded 10 and 15% of the diet, respectively. In conclusion, feeding increasing middlings to 7- to 23-kg pigs decreased growth performance; however, effects were minimal until over 10% middlings were added to the diet.

Key Words: DDGS, growth, nursery pig, wheat middlings