In vivo and in vitro digestibility experiments were conducted to measure the apparent ileal digestibility (AID) and apparent total tract digestibility (ATTD) of dietary fiber by growing pigs fed fibrous feed ingredients. The objective of Exp. 1 was to measure the digestibility of AA, energy, and total dietary fiber (TDF) when 30% distillers dried grains with solubles (DDGS) was added to a corn-soybean meal diet. Results indicated that the AID of Lys (74.1%) was reduced ($P < 0.05$) in the diet with 30% DDGS compared with the control diet (78.6%), but the AID of most other AA was not affected. The AID and ATTD of energy and TDF were less ($P < 0.05$) in the diet with 30% DDGS (81.0 and 55.5%) than in the control diet (86.0 and 60.0%), but there were no differences in rate of passage or VFA concentration in digesta or fecal samples. The objective of Exp. 2 was to measure the AID and ATTD of TDF in 24 sources of DDGS. On average, the ATTD of TDF in DDGS was 47.3% and varied among sources of DDGS. The ATTD of TDF was correlated to the ATTD of NDF and insoluble dietary fiber ($r^2 = 0.90$ and 0.79, respectively; $P < 0.05$). In Exp. 3, 5 Light Yorkshire (LY) pigs, 5 Heavy Yorkshire (HY) pigs, and 5 Meishan pigs were fed 5 diets with increasing concentration of soluble dietary fiber. The ATTD of TDF was different ($P < 0.05$) among groups of pigs fed DDGS (Meishan: 75.3%; LY: 39.0%; HY: 55.7%), but the ATTD of TDF was not different when pigs were fed sugar beet pulp, soybean hulls, or pectin. In Exp. 4, a 3-step in vitro digestibility procedure was used to measure the in vitro ATTD of NDF in DDGS. Results indicated that in vitro AID (28.5%) and ATTD (37.5%) of NDF were lower than the in vivo AID (45.9%) and ATTD (59.3%) and it was not possible to predict in vivo ATTD of NDF from the in vitro values ($r^2 = 0.12$). In conclusion, dietary fibers from DDGS are poorly digested by pigs but do not affect the digestibility of other dietary nutrients. The ability of pigs to digest fiber varies with age and breed and there are interactions between breed of pig and the type of fiber. The in vitro procedure that was used in this experiment did not accurately predict in vivo digestibility of TDF.

Key Words: Dietary fiber, Digestibility, Distillers dried grains with solubles, Pigs

254 The effects of feed-withdrawal time on finishing-pig characteristics in a commercial environment. H. L. Frobose[1], N. W. Shelton*[1], S. S. Dritz[1], L. N. Edwards[1], K. J. Prusa[2], M. D. Tokach[1], J. M. DeRouchey[1], R. D. Goodband[1], and J. L. Nelssen[1], *[1]Kansas State University, Manhattan, KS, USA, [2]Iowa State University, Ames, IA, USA.*

Two studies were conducted to determine the effects of feed-withdrawal on finishing-pig carcass composition. In Exp. 1, a total of 728 pigs (BW = 129.9 kg, 10 to 19 pigs/pen) were marketed after being subjected to feed withdrawal times of 7, 24, 36, or 48 h before harvest. As expected, increased feed withdrawal time decreased (quadratic; $P < 0.001$) feed intake. Withholding feed also decreased (linear; $P < 0.02$) live weight, HCW and backfat depth. Percentage yield increased (quadratic; $P < 0.001$) with longer withdrawal periods, as did percentage lean (linear; $P < 0.02$). In Exp. 2, the prevalence of runny bung and leaking ingesta also were recorded to determine whether a relationship existed between feed withdrawal and the incidence of these processing concerns. 843 pigs (BW = 125.5 kg, 16 to 26 pigs/pen) were assigned to feed withdrawal times 7, 12, 24, or 36 h before harvest. Due to misidentification of pigs by plant personnel, data were analyzed from only 25 of 40 pens. Withholding feed tended to decrease (linear; $P < 0.09$) live weight and decreased (linear; $P < 0.001$) feed intake. There were no differences ($P > 0.22$) in HCW, percentage lean, or backfat depth. However, percentage yield (linear; $P < 0.001$) increased with increasing withdrawal time. Although withholding feed had no effect ($P > 0.31$) on the incidence of runny bung, it did increase (linear; $P < 0.001$) the incidence of leaking ingesta. Overall, withholding feed can be used to avoid weight discounts in heavyweight pigs without negatively impacting carcass composition. However, these advantages come with a potential reduction in carcass weight and increased prevalence of leaking ingesta, resulting in condemned heads at inspection.

Table 1.

	Withdrawal, h					P <	
Exp. 1	7	24	36	48	SEM	Lin	Quad
Wt change, kg	1.2	−1.0	−4.6	−5.4	0.2	0.01	0.01
Feed/pig, kg	6.2	3.7	1.9	1.2	0.2	0.01	0.01
HCW, kg	95.8	95.5	93.8	93.1	0.9	0.02	0.73
Yield, %	74.4	76.1	76.3	76.4	0.23	0.01	0.01
Lean, %	50.7	50.9	51.0	51.0	0.1	0.02	0.31
Exp. 2	7	12	24	36			
Wt change, kg	0.2	−0.1	−2.0	−4.0	0.2	0.01	0.15
Feed/pig, kg	3.5	3.1	1.8	0.6	0.1	0.01	0.93
HCW, kg	91.6	92.9	92.4	91.1	1.3	0.65	0.44
Yield, %	75.3	75.5	76.1	77.0	0.30	0.01	0.77
Runny bung, %	3.3	1.2	6.1	5.1	2.2	0.31	0.78
Leaking ingesta, %	3.3	4.6	9.5	19.5	2.7	0.01	0.36

Key Words: carcass, fasting, feed withdrawal

255 The effects of feeder design and feeder adjustment on the growth performance and carcass characteristics of growing-finishing pigs. J. R. Bergstrom, M. D. Asmus,* M. D. Tokach, S. S. Dritz, J. L. Nelssen, J. M. DeRouchey, and R. D. Goodband, *Kansas State University, Manhattan.*

Two experiments were performed to evaluate the effects of feeder (conventional dry, 5.8 cm trough/pig, CD vs. wet-dry, 2.9 cm trough/pig, WD) and adjustment on grow-finish pig performance. In both experiments, pigs (PIC 337 × 1050) were fed the same corn-soybean meal diets with 15% DDGS. In Exp. 1, 1,296 pigs (initially 20 kg) were used to evaluate 3 feeder settings for each feeder in a 27-d study. The numbered settings (located in each feeder) were 6, 8, and 10 (~1.8, ~2.4, and ~3.1 cm opening) for the CD feeder and 6, 10, and 14 (1.3, 1.9, and 2.5 cm opening) for the WD feeder. From d 0 to 27, pigs using a WD feeder had similar ADG (0.68 vs. 0.68 kg/d), but lower ($P < 0.02$) ADFI (1.23 vs. 1.26 kg/d) and better G:F (0.55 vs. 0.54) than pigs using a CD feeder. Increased feeder setting improved (linear, $P < 0.01$) ADG (0.59, 0.71, and 0.75 kg/d), ADFI (1.07, 1.28, and 1.34 kg/d), and d-27 BW (35.2, 38.5, and 39.7 kg) of pigs using a WD feeder and increased (linear, $P < 0.01$) ADFI (1.22, 1.26, and 1.30 kg/d) of pigs using a CD feeder. In Exp. 2, 1,248 pigs (initially 33 kg) were used to evaluate 3 feeder settings for each feeder in a 93-d study. The feeder setting treatments were the same for the CD feeder (6, 8, and 10) as in Exp. 1; and 10, 14, and 18 (1.9, 2.5, and 3.2 cm opening) for the WD feeder. Overall, pigs using WD feeder had greater ($P < 0.05$) ADG (0.97 vs. 0.91 kg/d), ADFI (2.64 vs. 2.42 kg/d), final BW (122.4 vs. 116.7 kg), HCW (89.9 vs. 86.9 kg), backfat depth (17.4 vs. 16.3 mm), and feed cost/pig ($76.28 vs. $69.87) but reduced ($P < 0.04$) fat-free lean index (FFLI, 49.9 vs. 50.5) compared with pigs using CD feeder. An increased setting of a WD feeder resulted in greater (linear, $P < 0.05$) ADG (0.94 to 1.01 kg/d), ADFI (2.51 to 2.77 kg/d), final BW

(119.3 to 126.1 kg), HCW (87.2 to 92.7 kg), backfat depth (16.9 to 18.3 mm), and feed cost/pig ($71.92 to $80.58). When HCW was used as a covariate, FFLI of pigs using a WD feeder decreased (linear, $P < 0.02$; 50.2 to 49.5) with increased feeder opening. An increased setting of a CD feeder had no effect on growth and carcass characteristics. In conclusion, the growth rate of pigs improved with a WD feeder compared with a CD feeder; however, growth of pigs using a WD feeder was more sensitive to differences in feeder adjustment.

Key Words: dry feeder, feeder adjustment, wet-dry feeder

256 (Invited ASAS Animal Science Young Scholar) The effects of a wet-dry vs. a conventional dry feeder, and feeder management strategies, on the growth performance and carcass characteristics of finishing pigs. J. R. Bergstrom,* M. D. Tokach, S. S. Dritz, J. L. Nelssen, J. M. DeRouchey, and R. D. Goodband, *Kansas State University, Manhattan.*

Research has shown that ADG and ADFI of finishing pigs may be improved with a wet-dry (WD) feeder compared with a conventional dry (CD) feeder. In a factorial experiment, we found ADG of pigs fed a diet with 60% DDGS using a WD feeder was 5% greater than that of pigs fed a diet with 20% DDGS using a CD feeder. Gilts fed with a WD feeder also had 5% greater ADG than that of barrows fed with a CD feeder. Although greater ADG and ADFI have been observed with a WD feeder, differences in G:F and carcass characteristics have been variable when compared with a CD feeder. Earlier experiments have reported that G:F was either similar or improved with a WD feeder, with no change in percent carcass lean. In recent experiments, we have observed variable responses in G:F and similar or greater backfat depth with a WD feeder. Generally, G:F was improved with a WD feeder in the early grow-finish period. When G:F was poorer with a WD feeder, it usually occurred late in the finishing period, particularly when pigs were fed to a heavier BW. In a series of experiments, we identified WD feeder management strategies that sustained improvements in growth over a CD feeder with similar G:F and carcass traits. Reduced settings of the WD feeder opening usually resulted in improvements in G:F, FFLI, and backfat depth, and reductions in ADG and ADFI. Performance of pigs fed with a CD feeder was not as sensitive to different feeder settings. By providing a more open initial setting for the WD feeder and reducing the setting later in the finishing period, backfat depth and FFLI were improved with minimal reductions in overall ADG and ADFI. Although there were no differences in G:F; ADG, ADFI, and final BW remained greater than that obtained with a CD feeder. In another experiment, switching to a source of water separate from the WD feeder at 4 or 8 wk before market resulted in reduced ADG and ADFI. When the water was switched for the final 8 wk, G:F and backfat depth were improved, but overall ADG was reduced to that obtained with a CD feeder. In conclusion, a WD feeder improved ADG and ADFI, and may be especially beneficial when feeding gilts and/or diets known to reduce ADG. However, differences in the management of a WD feeder had a much greater impact on performance and profitability.

Key Words: dry feeder, feeder adjustment, wet-dry feeder

257 Both weaning weight and post-weaning growth performance affect nutrient digestibility and energy utilization in pigs. C. K. Jones,* R. G. Main, N. K. Gabler, and J. F. Patience, *Iowa State University, Ames, IA, USA.*

Little is known about how dietary energy and nutrient availability changes due to variations in piglet weaning weight or its interaction with post-weaning growth performance. This experiment evaluated the effects of both pig weaning weight category (WW) and post-weaning average daily gain (ADG) on nutrient digestibility and energy utilization. A total of 96 PIC barrows were selected from a population of 960 weanling pigs to represent the 10% lightest, median, and heaviest pigs at weaning (n = 24 per WW category; BW = 4.6, 6.2, and 8.1 kg, respectively). Barrows were housed individually and were fed ad libitum quantities of a commercial nursery phase feeding program during a 27-d growth and metabolism study. Total urine and fecal grab samples were collected for 3 d at the end of the experiment for digestibility analyses. At the completion of the study, pigs in each WW category were divided into the slowest, median, or fastest 33% ADG category, yielding a nested design with 9 treatments. The digestibility of dry matter, nitrogen, and gross energy differed ($P \leq 0.01$), resulting in different ($P \leq 0.004$) DE and DE intakes across WW and ADG categories. Pigs with lighter WW and slower ADG within WW category had lower ($P < 0.0001$) energy requirements for maintenance and were more ($P < 0.0001$) efficient at converting energy into gain. Together, these data suggest that both weaning weight and post-weaning growth performance affect nutrient digestibility and nutrient utilization in nursery pigs.

Table 1.

	DM Dig., %	GE Dig., %	N Dig., %	DE, Mcal	DEi, Mcal/d	DEm, Mcal	Energy efficiency for gain, Mcal/kg of gain
Light WW							
–Slow ADG	84.1	85.2	81.3	3.47	1.47	0.76	1.79
–Median ADG	86.4	87.5	84.9	3.56	2.15	0.95	2.34
–Fast ADG	85.9	86.9	84.6	3.54	2.39	1.02	2.40
Median WW							
–Slow ADG	85.1	85.8	81.9	3.50	1.60	0.89	1.18
–Median ADG	86.2	87.4	85.3	3.56	2.49	1.08	2.41
–Fast ADG	84.6	85.8	82.0	3.50	2.96	1.19	2.66
Heavy WW							
–Slow ADG	85.8	86.9	84.1	3.54	2.33	1.05	2.32
–Median ADG	85.9	86.8	84.5	3.54	2.69	1.21	2.34
–Fast ADG	85.4	86.4	84.0	3.52	3.06	1.31	2.39
SEM	0.72	0.70	1.16	0.029	0.135	0.033	0.297

Key Words: Energy, Nutrient digestibility, Pig