

- 173 **Identifying dietary fiber components that best predict nutrient digestibility and energy content in 9 corn co-products fed to growing pigs.** N. A. Gutierrez^{1,*}, N. V. L.-Serão¹, B. J. Kerr², R. T. Zijlstra³, J. F. Patience¹,
¹Iowa State University, Ames, ²USDA-ARS, Ames, IA,
³University of Alberta, Edmonton, Canada.

An experiment was conducted to determine the best-fitting dietary fiber (DF) assay to estimate the effect of DF concentration and to predict the digestibility of energy, DF, and AA of 9 corn co-products: conventional corn bran, corn bran with solubles, corn distillers dried grains with solubles (DDGS) conventionally produced, reduced oil DDGS, uncooked DDGS, high-protein distillers dried grains, dehulled, degermed corn, corn germ meal, and corn gluten meal. A total of 20 growing pigs (initial BW: 25.9 ± 2.5 kg) were fitted with a T-cannula in the distal ileum and allotted to 10 dietary treatment groups in a 4-period incomplete block design with 8 observations per treatment. Treatments included a corn soybean meal-based basal diet and 9 diets obtained by mixing 70% of the basal diet with 30% of the test ingredient. The 9 ingredients were analyzed for the concentration of NDF, TDF, total nonstarch polysaccharides (NSP), and 5 constituent monosaccharides of NSP, namely, arabinose (Ara), xylose (Xyl), mannose (Man), glucose (Glc), and galactose (Gal). The apparent ileal (AID) and total tract digestibility (ATTD) of GE, DM, and NDF and the AID of AA of ingredients were measured. A single best-fitting DF assay was assessed and ranked for each trait, showing that total NSP concentration best explained the variance of AID of GE ($R^2 = 0.65$; cubic, $P = 0.02$) and DM ($R^2 = 0.67$; cubic, $P = 0.04$). The xylose concentration in NSP best explained the variance in ATTD of GE ($R^2 = 0.80$; cubic, $P < 0.01$), DM ($R^2 = 0.78$; cubic, $P < 0.01$), and NDF ($R^2 = 0.63$; cubic, $P < 0.01$); AID of Met ($R^2 = 0.40$; cubic, $P = 0.02$), Met+Cys ($R^2 = 0.44$; cubic, $P = 0.04$), and Trp ($R^2 = 0.11$; cubic, $P = 0.04$); and DE ($R^2 = 0.66$; linear, $P = 0.02$) and ME ($R^2 = 0.71$; cubic, $P = 0.01$) values. The AID of Lys was not predictable ($P > 0.05$) from the DF concentration. In conclusion, the total NSP or xylose in NSP were the DF assays that best explained variation due to DF concentration and, with the exception of AID of Lys, can be used to explain digestibility traits and energy values in corn co-products.

Key Words: corn co-products, dietary fiber, digestibility, energy, pig

- 174 **Digestible energy, ME, and DM and CP digestibility values of dried distillers grains with solubles (DDGS) estimated from corn-soybean meal or barley-canola meal basal diets and using different collection methods.** Y. S. Li^{1,*}, G. A. Mastromano¹, H. Tran¹, J. W. Bundy¹, T. E. Burkey¹, B. J. Kerr², M. K. Nielsen¹, P. S. Miller¹, ¹University of Nebraska, Lincoln, ²USDA-ARS, Ames, IA.

To determine the effects of collection method and basal diet on

estimating digestibility of DDGS, 24 barrows in 2 replicates (BW = 90.3 and 90.9 kg, respectively) were individually fed 1 of 4 diets: corn-soybean meal (CSBM, basal-1), barley-canola meal (BCM, basal-2), and 20% of basal-1 or basal-2 replaced by DDGS (10% EE; total-1 and total-2). Time-based (Day) and marker-to-marker (MM) collection methods were employed for each pig using separated fecal collections. Diets contained 0.5% titanium dioxide (TiO₂) to estimate digestibility using the index method (IN). Data were analyzed as a 4 × 3 or 2 × 3 factorial in a split-plot design for comparisons of diet or DDGS digestibility, respectively. There were interactions ($P < 0.05$) for estimating dietary digestibility between diet and method for all variables. The apparent total tract digestibility (ATTD) of DM and CP, DE, and ME were not affected ($P > 0.10$) by method in CSBM-based diets. However, for the basal-2 diet, all estimates were greater ($P < 0.05$) when calculated using Day vs. MM or IN. Using the MM method, the ATTD of DM and CP were greater ($P < 0.05$) than IN, and DE and ME tended to be greater ($P < 0.10$) using MM vs. IN. For the total-2 diet, all estimates calculated using Day and MM were not different ($P > 0.10$) and were greater ($P < 0.05$) than those using IN. Digestibility estimates of DDGS were not affected ($P > 0.10$) by basal diet. The ATTD of DM, DE (%), and ME (kcal/kg) of DDGS using MM were greater ($P < 0.05$) than IN, and ATTD of CP tended to be greater ($P < 0.10$) using MM vs. IN, whereas estimates using the Day method were not different ($P > 0.10$) from MM or IN. Digestible energy (kcal/kg) of DDGS was greater ($P < 0.05$) using Day or MM vs. IN. The mean DE and ME (DM basis) of DDGS were 4374 and 4037 and 4215 and 3884 kcal/kg estimated using basal-1 and basal-2 diets, respectively. In conclusion, digestibility estimates of BCM-based diets and DDGS were lower using IN vs. total collection (Day and MM) methods. Except for basal BCM diet, digestibility estimates for DDGS and complete diets were not different using Day and MM methods. Basal diet does not appear to affect digestibility estimates of DDGS.

Key Words: collection method, digestibility, pig

- 175 **Evaluation of different corn oil sources on nursery pig growth performance.** K. E. Jordan^{*}, M. A. Goncalves, M. D. Tokach, R. D. Goodband, S. S. Dritz, J. M. DeRouchey, J. C. Woodworth, Kansas State University, Manhattan.

A total of 350 pigs (PIC 1050; initially 12 ± 0.04 kg and 45 d of age) were used in a 21-d study to compare the effects of soybean oil and 2 sources of corn oil on nursery pig growth performance with 5 pigs per pen and 10 replications per treatment. The 7 dietary treatments consisted of a corn-soybean meal-based control diet with no added oil or with 2.5 or 5% soybean oil (NE = 7545 kcal/kg) or corn oil from 2 sources (NE = 7459 kcal/kg for both sources). Corn oil sources were derived from postfermentation extraction from ethanol production. Diets were formulated to have similar standardized ileal digestible Lys:NE ratios (5.09 g/Mcal). Free fatty acid

Table 175.

Item	Control	Soybean oil		Corn oil source 1		Corn oil source 2		SEM
	0%	2.5%	5%	2.5%	5%	2.5%	5%	
ADG, g	633	682	693	662	673	661	655	12.8
ADFI, g	1011	1026	1008	978	943	981	946	20.5
G:F	0.627	0.666	0.689	0.677	0.714	0.675	0.693	0.01
CE ¹	3837	3776	3806	3708	3666	3723	3778	63.9

¹Caloric efficiency, Mcal NE/kg of gain.

levels were 0.16%, 4.1%, and 11.8% and initial peroxide values were 47.6, 1.0, and 5.6 meq/kg for the soybean oil and corn oils 1 and 2, respectively. Increasing corn or soybean oil increased (linear; $P < 0.02$) ADG, G:F, and final (d 21) BW. However, a source $\times$ level interaction was observed ($P < 0.05$) for ADG, G:F, and caloric efficiency (CE; caloric intake/total BW gain). For ADG, increasing soybean oil or corn oil source 1 from 2.5 to 5% increased ADG, while increasing corn oil source 2 from 2.5 to 5% decreased ADG. Gain:feed increased at a greater rate for pigs fed corn oil source 1 compared to the other oil sources. For CE, pigs fed soybean oil or corn oil source 2 had poorer CE as level increased from 2.5 to 5%, whereas pigs fed source 1 had improved CE as level increased. In conclusion, soybean or corn oil increased ADG and G:F when compared to the control as expected; however, growth performance varied among the 3 oil sources.

Key Words: corn oil, growth performance, nursery pig

176 Digestibility of energy and nitrogen retention of diets with increasing proportions of co-product ingredients and formulated using the NE system. J.

A. Acosta Camargo^{1,*}, R. D. Boyd², J. F. Patience¹,
¹Iowa State University, Ames, ²The Hanor Company, Inc., Franklin, KY.

Rising feed costs demand that our industry pursue strategies to lower the cost of production. One option is the adoption of the net energy system (NE), although many producers are hesitant to proceed without more definitive data. The objective of this experiment was to compare the ATTD of energy and the nitrogen retention (NR) of diets formulated using the NE system with increasing quantities of co-product ingredients. The 5 dietary treatments included a control corn-soy based control diet (CTL), a diet similar to the CTL but containing 6% each of corn DDGS, corn germ meal, and wheat middlings with NE constant relative to CTL (18NE-CON) or allowed to decline (18NE-DEC), or similar diets but with 12% each of the same co-products and NE held constant (36NE-CON) or allowed to decline (36NE-DEC). Constant NE in the CON treatments was achieved by adding fat. Diets were formulated for both growing (40 to 70 kg; GP) and finishing (70 to 110 kg; FP) periods. Forty gilts (PIC 337 sires $\times$ C22 or C29; initial BW = 38.5 ± 0.4 kg) were randomly assigned to treatment, receiving fed and water ad libitum throughout the experiment (69 d). For the last 13 d of the GP and FP, pigs were transferred to metabolism crates, where two total urine and fecal collections

(d 4 to 6; d 11 to 13) were performed. Data were analyzed using the MIXED procedure of SAS. In GP, ATTD of GE decreased in all co-product diets compared to the CTL (85.3 vs. 79.9% for average of 18NE and 36NE; $P < 0.01$). There were no differences between NE-CON and NE-DEC (80.5 vs. 79.3%; $P > 0.05$). In FP, ATTD of GE also decreased in co-product diets compared to the CTL (87.1 vs. 82.6% for average of 18NE and 36NE; $P < 0.01$). Unlike GP, the 18NE diets had a higher ATTD of GE compared to 36NE diets ($P < 0.05$). There were no differences between NE-CON and NE-DEC (82.7 vs. 82.5%; $P > 0.05$). NR declined on all co-product diets in the GP (40.6 vs. 35.5% for average of 18NE and 36NE; $P = 0.01$) and tended to decline in the FP (35.0 vs. 30.2% for average of 18NE and 36NE; $P = 0.08$). There were no differences between CON and DEC diets at 18NE or 36NE ($P > 0.05$). In conclusion, diets containing up to 36% co-products and formulated using NE resulted in poorer NR than a simple corn-soybean meal control diet.

Key Words: corn germ meal, DDGS, net energy, nitrogen retention, pigs, w heat middlings

177 Effects of condensed distillers solubles to wet distillers grains ratio on the growth performance and carcass characteristics of growing-finishing pigs. S. Baidoo, X. Yang*, J. Jendza, D. Hansen,

Southern Research and Outreach Center, University of Minnesota, Waseca.

The objective of this study was to determine the effect of condensed distiller's solubles (CDS) to wet distillers grains (WDG) ratio on growth performance and carcass characteristics of growing-finishing pigs fed by a liquid feeding system. A total of 280 pigs were blocked by initial BW (30.1 ± 5.1 kg) and gender, and pens of pigs (10 pigs/pen) were allocated randomly to 1 of 4 dietary treatments (7 pens/treatment): 1) 30% DDGS, 2) 30% WDG, 3) 25% WDG plus 5% CDS, or 4) 20% WDG plus 10% CDS. The Big Dutchman automated liquid feeding system recorded daily pen feed intake, which was automatically adjusted, based on a reference feed intake curve during the 90-d and three-phase trial. Pen was the experimental unit. Data were analyzed by the MIXED procedure of SAS, with treatment as a fixed effect and block as a random effect. Significant level was set at the level of 0.05. The overall ADG was 0.911, 0.923, 0.968, and 0.971 kg/d, ADFI on a dry matter basis was 2.34, 2.18, 2.38, and 2.31 kg/d, and gain to feed ratio was 0.392, 0.425, 0.408, and