

were formulated to meet or exceed NRC (1998) recommendations. Six replicates with a total of 2,448 pigs, housed in mixed-gender pens (barrows and gilts) of 34 were used. The growth evaluation was carried out from weaning (5.9 ± 0.10 kg) to wk 20 post-weaning (107.6 ± 6.86 kg); pigs were sent for harvest when the mean pen BW was 123.8 ± 1.48 kg to a commercial plant where carcass measurements were taken. A subsample of 2 barrows and 1 gilt from each pen were selected for belly and loin quality evaluation. There were treatment interactions ($P \leq 0.05$) for ADG and ADFI. For the 0% HP-DDG diet, there was no effect of DDGS inclusion level on ADG or ADFI, however, for other HP-DDG inclusion levels, ADG and ADFI were linearly reduced with increasing DDGS level with the magnitude of the reduction increasing with HP-DDG inclusion level. There was no effect ($P \geq 0.05$) of either HP-DDG or DDGS inclusion level on G:F. Increasing the dietary level of both HP-DDG and DDGS was associated with linear reductions ($P \leq 0.05$) in carcass yield, *Longissimus* muscle depth and backfat depth, and belly flop distance. These results suggest that DDGS can be included at up to 30% in diets (without HP-DDG) without compromising growth performance of wean-to-finish pigs. However, growth performance was increasingly compromised at higher inclusion levels of both co-products and belly firmness was negatively affected by increasing levels of both DDGS and HP-DDG.

Key Words: DDGS, growth, high protein DDG, pigs

219 Effect of particle size reduction of corn distillers dried grains with solubles (DDGS) on energy digestibility in growing pigs. O. F. Mendoza^{*1}, M. Ellis¹, A. M. Gaines², M. Kocher², T. Sauber³, and D. Jones³, ¹University of Illinois, Urbana, ²The Maschhoffs, Carlyle, IL, ³Pioneer Hi-Bred, Johnston, IA.

Two digestibility studies were carried out to evaluate the effect of particle size (PS) reduction on the digestibility of energy of a range of DDGS samples. Study 1 used one sample of DDGS with an initial mean PS of 1,557 μm that was ground through a hammer mill to PS's of 1,180, 890, 560 and 351 μm . Study 2 used 15 DDGS samples from different sources selected to represent the variation in PS currently available to the industry. The mean PS was 716 ± 264.0 μm (range = 497 to 1,557 μm), and this was reduced by grinding each DDGS source through a hammer mill to an average of 344 ± 36.0 μm (range = 285 to 403 μm). A standard digestibility assay was used in both studies consisting of 4-d adaptation and 3-d collection periods. A corn based control diet (89.5% corn ground to 500 μm PS, 7.9% casein, 1.0% limestone, 0.65 dicalcium phosphate, 0.40 salt, 0.45 vitamins and microminerals, and 0.10% chromic oxide) was used in both studies; experimental diets were created by substituting 50.4% of the corn with the respective DDGS sample. A total of 34 barrows (initial BW 17.2 ± 0.9 kg) were used in an incomplete block design, with a total of 36 and 8 pigs being fed the control and DDGS diets, respectively. In Study 1, there was no effect ($P \geq 0.05$) of reducing PS on either energy digestibility or DE and ME content. In Study 2, reduction of PS increased ($P \leq 0.05$) the digestibility of energy, and DE and ME content by an average of 2.7 percentage units, and 136 and 141 kcal/kg DM, respectively; however, the range in improvement for individual samples varied from 1.0 to 4.8 percentage units for energy digestibility, and between 50 and 240 and 43 and 252 kcal/kg DM for DE and ME, respectively. The results of this research suggest that PS reduction has a variable effect on the digestibility of energy of DDGS. Further research is required to understand the causes of the variable relationship between PS and energy digestibility between and within DDGS samples.

Key Words: DDGS, energy, particle size

220 Evaluation of SID lysine level, replacement of fish meal with crystalline amino acids, and lysine:CP ratio on growth performance of nursery pigs from 6.8 to 11.3 kg. J. E. Nemecek,^{*} M. D. Tokach, S. S. Dritz, R. D. Goodband, J. M. DeRouchey, and J. L. Nelssen, *Kansas State University, Manhattan.*

Three 14-d experiments were used to evaluate SID Lys level, the replacement of fish meal with crystalline AA, and Lys:CP ratio on growth performance of nursery pigs from 6.8 to 11.3 kg. All diets were corn-soybean meal-based containing 10% dried whey and were in meal form. For all trials, on d 3 after weaning, pigs were allotted to 1 of 6 dietary treatments using a completely randomized design. In Exp 1, 294 nursery pigs (PIC TR4 \times 1050, initially 6.8 kg) were allotted with 7 pens per treatment and 7 pigs per pen. Diets were blended to achieve SID Lys levels of 1.15, 1.23, 1.30, 1.38, 1.45, and 1.53%. As SID Lys increased, ADG (290, 306, 342, 328, 330, 284 g) and ADFI (388, 394, 435, 396, 398, 336 g) increased (quadratic; $P < 0.002$) with a plateau at 1.30%. As lysine increased, G:F (0.74, 0.78, 0.79, 0.83, 0.83, 0.85) also improved (linear; $P < 0.0001$). A total of 282 nursery pigs were used in Exp. 2 and 3 each (initially 7.3 and 6.9 kg, respectively) with 7 pens per treatment (5 reps with 7 pigs and 2 reps with 6 pigs). In Exp. 2, all diets contained 1.30% SID lysine, and fish meal was included at 4.50, 3.60, 2.70, 1.80, 0.90, or 0.00%. Crystalline Lys, Met, Thr, Trp, Ile, and Val replaced fish meal while maintaining minimum AA ratios. Glutamine and glycine were also added to diets to maintain a maximum Lys:CP ratio of 7.0 or less. There was no difference ($P > 0.29$) in ADG (376, 372, 389, 378, 380, 380 g), ADFI (528, 517, 537, 525, 531, 546 g), or G:F (0.71, 0.72, 0.73, 0.72, 0.72, 0.70) as fish meal decreased and crystalline AA increased. In Exp. 3, the Lys:CP ratios tested were 6.79, 6.92, 7.06, 7.20, 7.35, and 7.51%. SID lysine was 1.3% and fish meal was adjusted as a source of non-essential N to achieve the Lys:CP ratios. Both ADG (347, 358, 358, 356, 387, 336 g) and G:F (0.73, 0.71, 0.72, 0.73, 0.73, 0.68 g) tended to improve (quadratic, $P < 0.09$) as Lys:CP ratio increased from 6.79 to 7.35% with decreased performance in the pigs fed the highest Lys:CP ratio. These trials indicate that crystalline amino acids can replace fish meal in diets for 6.8 to 11.3 kg pigs and that the diet should contain at least 1.3% SID Lys and a maximum total Lys:CP ratio of 7.35%.

Key Words: amino acid, fish meal, nursery pig

221 Standardized ileal amino acid digestibility of high protein distillers dried grains with or without solubles for laying hens, turkey poults and broiler chicks. P. M. Banks,^{*} T. J. Applegate, and O. Adeola, *Purdue University, West Lafayette, IN.*

Three studies were conducted to determine standardized ileal digestibility (SID) of amino acids (AA) in high protein distillers dried grains (HP-DDG), high protein distillers dried grains with solubles (HP-DDGS) and a freeze-dried blend (FDB) of HP-DDG and condensed distillers' solubles (CDS) in laying hens, turkey poults and broiler chicks. On DM basis, the test ingredients contained 60, 55, 57% CP; 1.9, 3.1, 3.9% Fat; 43, 32, 34% NDF and 27, 18, 25% ADF for HP-DDG, HP-DDGS and FDB, respectively. Semi-purified diets, with test ingredient as the only source of protein, were fed to 16 replicate cages, of 2 birds in the hen study or 12 replicate cages of 8 birds for the poult and broiler studies. In the hen study, 4 replicate cages were pooled ($n = 4$), and SID of Lys was 33, 39 and 40%, SID of Met was 72, 69 and 76%, SID of Trp was 74, 82 and 81% and SID of Thr was 57, 56 and 62% for HP-DDG, HP-DDGS and FDB, respectively. Of the indispensable AA, only Met and Trp SID were significantly different between ingredients. The SID of Met was lower ($P < 0.05$) in