

replacing normal corn on a lb-for-lb basis. In the grower phase, pigs fed HOC tended to gain faster ($P < .07$) and were more efficient ($P < .04$) than pigs fed the C diet. There were no differences in performance in the finisher 1, finisher 2, or overall periods, nor were there differences in BF. However, there was a tendency ($P < .075$) for pigs fed HOC diets to have smaller LMA. The mean dust concentrations in the HOC room was 40% less than the levels in the C room. In trial 2, the treatments were the same as in trial 1 plus a third treatment in which HOC replaced corn on a constant lysine:calorie ratio (L:C). The ratios for the 3 phases were 3.05, 2.60, and 2.27 g lysine/mcal ME, respectively. In the grower phase, L:C pigs gained faster ($P < .05$) than pigs consuming LB diets, and were more efficient ($P < .01$) than pigs fed the other 2 diets. No differences were observed in the finisher 1 or 2 phases. In the overall period, pigs fed L:C ate less feed ($P < .08$) than C pigs, and pigs fed wither of the HOC diets were more efficient ($P < .05$) than pigs were C diets. No differences were observed in BF, but feeding L:C diets tended to result in larger LMA when compared to LB diets ($P < .16$). Mean dust levels were reduced 37% in the HOC room. Thus, HOC results in a 40% reduction in dust levels, and needs to be incorporated into diets on a constant lysine:calorie basis.

Key Words: Pigs, High Oil Corn, Dust

823 Nutrient digestibilities of intact and insect damaged high oil corn and commercial corn fed to growing pigs. R. F. Gilliam*, C. S. Darroch, and K. R. Robbins, *University of Tennessee, Knoxville.*

The objective of the trial was to determine the nutritive values of damaged high oil corn (DHOC), undamaged high oil corn (UHO) and commercial corn (NC). Two groups of 12 crossbred barrows, average BW of 32.1 kg, were placed in metabolism crates in a RCBD to determine energy and protein digestibilities. In each 10-d feeding period (5 d adaptation, 5 d total collection), pigs were fed the test grain as the only source of protein and energy in the diet. Vitamins and minerals were supplied to meet NRC (1998) requirements. Insect damaged HOC had lower ($P < .0001$) 1000 kernel weights, 238.1 g (± 3.32 ; $n=5$) when compared to UHO (355.4 g) and NC (272.0 g). Compared to UHO, insect damaged HOC had fewer intact kernels (50.8% vs 77.0%, $P < .0001$), more insect damaged whole kernels (15.9% vs 5.0%, $P < .0001$), more fragmented kernels (32.3% vs 17.6%, $P < .0001$) and more chaff (0.9% vs 0.4%, $P = .0028$). NC had the greatest percentage of intact kernels (87.9%), and the lowest percentages of damaged whole kernels (1.5%) and fragmented kernels (10.2%). Despite differences in quality, UHO and DHOC had higher GE values (3866 kcal/kg and 4081 kcal/kg, respectively) than NC which averaged 3562 kcal/kg. UHO had the highest level of crude protein (9.1%), DHOC was intermediate (8.9%) and NC had the lowest crude protein level (7.6%). Final pig live BW, adjusted for initial BW were not different among treatments ($P = .8692$) but pigs in the second replication were heavier ($P = .0168$) than those in the first replication. The coefficient for apparent fecal protein digestibility was highest (85.2%) for UHO. DHOC had a lower ($P = .0464$) coefficient for protein digestibility (81.3%, ± 1.10). The apparent fecal protein digestibility of NC was intermediate to those of UHO and DHOC. Digestible energy differed among treatments ($P = .0001$) and averaged 3658.42 kcal DE/kg, 3788.72 kcal DE/kg and 3314.21 kcal DE/kg for UHO, DHOC and NC respectively. The results of this experiment suggest that insect damage to HOC lowers protein quality and availability, but has little impact on digestible energy levels. HOC even when damaged may be used as a replacement for commercial corn in diets for growing pigs.

Key Words: High oil corn, Nutrient digestibility, Growing pigs

824 Effect of creatine monohydrate on finishing pig growth performance, carcass characteristics, and meat quality. B. W. James*, R. D. Goodband, J. A. Unruh, M. D. Tokach, J. L. Nelssen, P. R. O'Quinn, and B. S. Andrews, *Kansas State University, Manhattan.*

Growth performance, carcass characteristics, and meat quality were evaluated from 320 pigs (PIC C22 \times L326) fed either a control diet (.75% lysine) or diets containing added creatine monohydrate (CMH). Pigs (initially 53.5 kg) were sorted by weight, gender, and ancestry in a randomized complete block design and allotted to one of four dietary treatments with eight replicates. Pigs were fed a sorghum-soybean meal

diet until 30-d preharvest (87.2 kg) when dietary treatments were initiated. Experimental treatments consisted of: 1) a control diet; 2) control diet with 3 g CMH/pig/d for 30-d (maintenance); 3) 25 g CMH/pig/d for 5-d followed by 3 g CMH/pig/d for the next 25-d (early load); 4) or 25 g CMH/pig/d 5-d before slaughter (late load). Average market weight was 112.4 kg. Feeding CMH did not affect ($P > .10$) ADG, ADFI, or gain:feed ratio (G:F) during the 30-d supplementation period. Average back fat, tenth rib fat depth, longissimus muscle area, and percentage lean were not affected ($P > .25$) by feeding CMH. Visual color and marbling scores were not affected ($P > .20$) at 24-h or 14-d postmortem; however, the mean firmness score of all pigs fed CMH was greater ($P < .05$) at 24-h and 14-d postmortem than pigs fed the control diet. Longissimus muscle percentage moisture, protein, and lipid and 14-d postmortem loin purge loss and Warner-Bratzler shear force values were not affected ($P > .21$) by treatment. Longissimus muscle drip loss percentage at 24-h postmortem was less ($P < .05$) for pigs fed maintenance and late load CMH compared to pigs fed early load CMH (4.06, 4.15, vs 5.76%). Maintenance CMH pigs also tended to have less ($P < .09$) drip loss than control pigs (4.06 vs 5.31%). At 14-d postmortem, the mean of pigs fed CMH had less ($P < .06$) drip loss compared to control pigs. These results suggest that added CMH does not affect finishing pig growth performance but may increase longissimus muscle firmness and decrease drip loss at 14-d postmortem.

Key Words: Pigs, Creatine, Meat Quality

825 Effects of feeding supra-nutritional levels of vitamin E on pork quality in two different genotypes. J. L. Hasty*, E. van Heugten, and M. T. See, *North Carolina State University, Raleigh.*

The objective of this study was to examine the effects of feeding supra-nutritional levels of vitamin E on pork quality of different genotypes. Pigs ($n=240$) with an average initial BW of 87 kg, were blocked by weight and randomly assigned to one of ten treatments (8 pens/trt, 3 pigs per pen) in a 2 \times 5 factorial arrangement. Factors included: 1) genotype, (Berkshire \times PIC as superior meat quality breed and Hampshire \times PIC as poor meat quality breed) and 2) supplemental levels of vitamin E (0, 75, 150, 300 and 600 mg/kg). Animals were fed standard corn and SBM based diets containing 2.5% fat, 0.83% lysine and 15 mg/kg vitamin E for 6 weeks. Biopsies of the longissimus dorsi (LD) were obtained at the initiation of the experiment, d 21, and d 42 of supplementation. Fluid loss and pH of the fluid from biopsy samples were used as indicators of pork quality and were not affected by vitamin E supplementation ($P > .10$). However, fluid loss was greater ($P < .07$) in Hampshire pigs (51.9 vs. 47.7%) and pH of the fluid was greater ($P < .10$) in these pigs compared to Berkshire pigs (6.40 vs. 6.35). Pigs were slaughtered at a commercial facility after the 6 week experimental period and loin samples were obtained 24 hr post-mortem. Drip loss was greater ($P < .001$) in Hampshire pigs compared to Berkshire pigs (92.9 vs. 66.3 mg fluid accumulated on filter paper). Muscle vitamin E concentration increased linearly ($P < .001$) from 2.02 to 5.92 mg/kg for pigs fed 0 to 600 mg/kg of vitamin E. Concentration of vitamin E in muscle was greater in Berkshire pigs compared to Hampshire pigs when 75 mg/kg of vitamin E was fed (4.72 vs. 3.76 mg/kg). In summary, pre-slaughter muscle biopsy fluid loss appeared to be an accurate indicator of post-slaughter drip loss. Results of the study further demonstrate that differences in fresh pork quality exist between genotypes (as measured by drip loss), but did not appear to be improved by vitamin E supplementation.

Key Words: Vitamin E, Genotype, Pork Quality

826 Effects of increasing L-lysine HCl on growth performance and carcass characteristics of gilts from 27 to 120 kg. M. De La Lata*, S.S. Dritz, M.D. Tokach, R.D. Goodband, and J.L. Nelssen, *Kansas State University, Manhattan.*

A total of 1,200 gilts (PIC C22 \times 337) with an initial weight of 29 kg were used in a 116-d growth trial to determine the effect of increasing L-lysine HCl in corn-soybean meal based diets on growth performance and carcass characteristics. Pigs were housed in a fully slatted commercial research facility and allotted to one of 8 dietary treatments in a randomized complete block design with 25 pigs/pen and 6 pens/treatment. The dietary treatments were fed in four phases and consisted of a positive control diet with no added L-lysine HCl and 6 increasing levels of L-lysine HCl (.05, .10, .15, .20, .25, and .30%) replacing the lysine

provided by soybean meal. A negative control treatment with no added L-lysine HCl was formulated to contain .10% less total lysine than the other treatments to ensure dietary lysine was not above required levels. For the overall experiment, ADG and G/F decreased in a quadratic fashion ($P < .05$) by increasing L-lysine HCl in the diet. Treatment did not influence ($P > .70$) ADFI. The response was similar for every phase. Fat depth increased (linear $P < .01$) and loin depth, percent lean, and fat free lean index (FFLI) decreased by increasing L-lysine HCl in the diet. The results of this experiment indicate that no more than .15% L-lysine HCl should replace lysine from soybean meal in a corn-soybean meal based diet to avoid deficiencies of other amino acids.

Item	Neg.	L-Lys HCl, %							P <	CV
		0	.05	.10	.15	.20	.25	.30		
ADG, g	717	798	807	794	798	744	717	708	.01 ^a	3.2
G/F	.353	.387	.390	.388	.391	.361	.356	.356	.01 ^a	2.6
BF, mm	17.8	16.8	16.9	17.2	17.1	17.6	18.2	17.8	.01 ^b	4.7
Lean, %	54.8	55.8	55.6	55.3	55.5	55.3	54.7	54.8	.01 ^b	1.0
FFLI	50.1	50.5	50.5	50.3	50.4	50.1	49.8	50.1	.01 ^b	.78

^aQuadratic effect.

^bLinear effect.

Key Words: Lysine, Corn, Finishing Pigs

827 Growth performance of gilts fed low-crude protein diets supplemented with crystalline amino acids including valine, isoleucine, and histidine. J. L. Figueroa*, A. J. Lewis, P. S. Miller, and R. L. Fischer, *University of Nebraska, Lincoln.*

Two experiments were conducted to determine the fifth-limiting amino acid in a low-crude protein, corn-soybean meal diet. In each experiment, thirty-six gilts (initial weight 19.5 and 21.9 kg, respectively) were individually penned and fed one of six diets in a randomized block design for 35 d. Diets containing 16% CP (positive control), 12% CP (neutral control), and 11% CP (negative control) were used in each experiment. In Exp. 1, the 11% CP diet was supplemented with isoleucine (Ile), valine (Val), or Ile + Val to concentrations equal to those in the 16% CP diet. In Exp. 2, the 11% CP diet was supplemented with histidine (His), His + Val, or His + Val + Ile. All low-CP diets were supplemented with lysine, tryptophan, threonine, and methionine to provide the same concentrations, on a total basis, as those in the 16% CP diet. Gilts were allowed ad libitum access to feed and water. In Exp. 1, Ile supplementation of the 11% CP diet decreased growth performance and backfat thickness ($P < .05$). Valine supplementation did not affect growth performance ($P > .05$). However, the addition of Ile + Val resulted in ADG, ADFI, and longissimus muscle areas that were similar to the 12% CP and 16% CP diets ($P > .05$). Plasma urea nitrogen (PUN) concentrations were reduced as CP concentration was reduced ($P < .01$), but there was no further effect with addition of Ile and/or Val ($P > .05$). In Exp. 2, supplementation of the 11% CP diet with His decreased ADG by 7% and ADG/ADFI by 3%, but the decreases were not significant ($P > .30$). Supplementation of His + Val increased ADG ($P < .05$) and tended to increase ($P < .10$) ADFI and ADG/ADFI. Reduction in CP concentration reduced PUN concentration ($P < .01$). There were no differences among all low-CP diets in PUN concentration ($P > .05$). These data indicate that supplementation of Val in combination with Ile or His improved growth rate of pigs fed an 11% CP corn-soybean meal diet. Neither Ile, Val, nor His alone resulted in beneficial effects.

Key Words: Pigs, Amino Acids, Crude Protein

828 Influence of energy and lysine concentration on performance and carcass yield of heavy weight pigs.

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A total of 192 Pietrain*Large White x Large White*Landrace pigs were used to study the influence of dietary energy and lysine concentration on performance of heavy weight pigs. They were fed a common diet (2,300 kcal NE/kg and 0.97% lysine) from 20 to 80 kg and then their respective experimental diets to 120 kg of live weight. There were six diets arranged as a factorial 2x3 with two levels of dietary net energy (2,300 vs 2,415 kcal/kg) and three levels of total lysine (0.65, 0.70 and 0.75%). Each treatment was replicated 8 times (2 females and 2 castrated males caged together). Pigs fed high energy diets grew faster and transformed feed into gain more efficiently than pigs fed low energy diets (977 vs 927 g/d and 3.26 vs 3.45 g/g; respectively, $P < 0.05$). Feed intake was not affected by the energy concentration of the diet. Increasing the level of lysine up to 0.65% improved growth and feed conversion (979 vs 897 g/d and 3.25 vs 3.55 g/g, respectively; $P < 0.01$) but no additional improvement was detected between 0.70 and 0.75%. Castrated males grew faster (989 vs 928 g/d; $P < 0.01$). Neither energy concentration nor lysine content of the diet influence carcass yield ($P > 0.05$). At 120 kg body weight castrated males and females had similar killing out percentage (76.3 vs 75.9%; $P > 0.05$). It is concluded that growth and feed conversion of pigs of 120 kg were improved when the energy concentration of the diet was increased from 2,300 to 2,415 kcal NE/kg and that 0.70% of lysine was sufficient to optimize performance traits at this weight. Killing out percentage was not modified by any of the treatments studied.

Key Words: Heavy weight pigs, Lysine, Net energy

829 Modeling of dietary lysine requirements for pigs fed Ractopamine.

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Ractopamine (RAC) has been approved to be fed to market pigs at levels (RL) from 5 to 20 ppm. RAC increases empty body protein accretion (PA, 24%), fat-free lean growth rate (34%) and reduces feed intake (FI 5.3%) when fed at 20 ppm for the last 40.8 kg live weight gain. The response to RAC is greatest the first 21 d or 20 kg live weight gain on RAC, after which time, the RAC response decreases. The relative RAC response was modeled as $RR = 1.408 \exp [0.050224 w - (1.09164/w) - (.002607w^2)]$ where w is live weight gain (kg) on RAC. This RR function is based on data in which barrows ($N=142$) and gilts ($N=143$) were individually scale fed two levels of RAC (0 vs. 44.7 mg/d; Williams et al. 1994). The RAC response is affected by RL. The increase in PA (g/d), due to RAC, was modeled as $.24 (RL/20)^{.50}$ times the control PA at each live weight. The reduction in FI (kg/d) was modeled as $.053 (RL/20)^{.66}$ times the control FI at each live weight. The lysine content of empty body protein for pigs fed RAC was modeled as $.068 + (.002 RR \times [RL/20]^{.50})$. Predicted daily lysine requirements increased rapidly as RR increased. Maximum RR was achieved at 11.1 kg weight gain on RAC. After 22 d on test, RR decreased, and control PA decreased, resulting in decreased daily lysine requirements. The predicted percent lysine required (PLY) for the first 21 d or 20 kg live weight gain on RAC are 41.7% greater than required by pigs not fed RAC. The PLY after 21 d or 20 kg live weight gain on RAC is 21.5% greater than that required by pigs not fed RAC. The predicted percent increases in PLY for pigs fed 10 ppm RAC are 28.1 and 14.4% for the two feeding periods. The predicted percent increase in PLY is 19.3 and 9.7% for pigs fed RAC at the 5 ppm level. The results indicate a two-phase feeding strategy: feed higher percent lysine diets for the first 21 d or 20 kg live weight gain on RAC and reduced lysine levels after 21 d or 20 kg of RAC feeding.

Key Words: Ractopamine, Pigs, Lysine