12, segment 0-45 cM was significant for average backfat and last rib backfat without significant variance. In conclusion, multiple and segregating QTL were detected for backfat traits on chromosome 7 and QTL was detected on one segment on chromosome 12. The variance component approach is a useful method to detect QTL in crosses between outbred breeds and to identify those that segregate within breeds.

Key Words: QTL, Segregation, Variance Component Analysis

905 PACE: An integrated pig genome database. J. W. M. Merks*[1], T. J. A. van Kampen[2], R. van Wijk[1], B. Harlizius[1], A. Rattink[3], G. Albers[3], and M. A. M. Groenen[2], [1]*IPG, Institute for Pig Genetics BV, Beuningen, The Netherlands,* [2]*Department of Animal Sciences - Animal Breeding and Genetics Group, Wageningen University and Research Centre, Wageningen, The Netherlands,* [3]*Nutreco Breeding Research Centre, Boxmeer, The Netherlands.*

Knowledge of farm animal genomes has increased enormously over the last decade. A large part if this information is publicly available for a variety of species and through specific databases such as for pigs; PiGBASE for mapping data, Pig EST Database, TIGR SsGI for genes and data on their expression patterns and the INRA Comparative and Cytogenetic mapping home pages. Potentially these databases provide comprehensive public repositories for genome research. However, these data are difficult to combine from the different sources or with private data, but also with genome data of model organisms. This strongly hinders comparative mapping and positional fine-mapping. A new pig genome database - PACE was set up in the Netherlands to enable integration of data from the different sources. For this, the widespread database system of AceDB has been adapted and links with existing farm animal databases but also databases like LocusLink, Genbank, MGI, GeneCards are included to facilitate an efficient comparative mapping with human and mouse. In addition published information on porcine QTL has been included. This database with more than 5000 genetic markers and loci and about 500 QTL's will be available publicly from July 2004.

Key Words: Pigs, Genome Map, Database

906 Estimation of genetic parameters for farrowing mortality, litter size and test performance of first parity Large White sows. J. Arango*[1], I. Misztal[1], S. Tsuruta[1], M. Culbertson[2], and W. Herring[2], [1]*University of Georgia, Athens,* [2]*Smithfield Premium Genetics, Roanoke Rapids, NC.*

Selection to increase prolificacy and performance traits may be affecting piglet survivability at different production stages. To investigate this complex of traits, genetic correlations were estimated among total born (TB), number born alive (BA) and number of pigs born dead (PD) from 47,454 first-parity Large White sow records. Data were from 22 pure-line farms. Additional performance data (n=30,832) were available for ultrasound backfat (BF) at end of the test, and days to reach 113.3 kg (AD). Univariate, all pair-wise bivariate, and four sets of trivariate (TB-PD-AD, TB-PD-BF, BA-PD-AD and BA-PD- BF) analyses were carried out using AI-REML. Models included the fixed effects of contemporary group (farm-farrowing year- farrowing month for litter traits and batch-sex-farm-barn for test traits). Analysis of BF included measurement weight as linear and quadratic covariates. Random effects of animal additive genetic and residual error were also included. Estimates of heritability averaged over analyses were 0.09, 0.08, 0.06, 0.37 and 0.31 for TB, BA, PD, AD and BF, respectively, and were similar across individual analyses. Estimates of genetic correlations averaged over analyses were 0.94, 0.39, 0.03, -0.02 for TB-BA, TB-PD, TB-AD and TB-BF; 0.02, 0.08 and 0.06 for BA-PD, BA-AD and BA-BF; -0.13 and -0.21 for PD-AD and PD-BF, and -0.23 for BF-AD, respectively. The genetic relationship of PD with TB was moderate and positive while negative with AD and BF. Response to selection for increasing litter size may increase piglet mortality at birth. Intense selection for faster growth and increased leanness may increase piglet mortality from first parity sows in this population.

Key Words: Swine, Farrowing Mortality, Litter Size

907 Comparison of deposition rates for loin muscle area, backfat, and intramuscular fat percentage among breeds in the 2003 National Barrow Show Sire Progeny Test. B. D. Martin*, T. J. Baas, C. Schwab, D. W. Newcom, J. F. Lampe, and K. J. Stalder, *Iowa State University, Ames.*

Weights and serial ultrasonic measurements of 10^{th} rib loin muscle area (LMA), 10^{th} rib backfat (BF), and intramuscular fat percentage (IMF) were used to assess deposition rates and growth patterns of purebred pigs entered in the National Barrow Show Sire Progeny Test. Yorkshire (30), Duroc (71), Chester White (49), and Berkshire (154) barrows and gilts were weighed and scanned for LMA, BF, and IMF every two weeks beginning at a live weight of approximately 68 kg. Off test ultrasonic measurements were taken at approximately 109 kg. Five scans were taken on each animal. At each scan period, BF, LMA, and IMF were analyzed with a mixed model that included fixed effects of breed, sex, contemporary group, and the interaction of breed by sex. Sire and dam within breed were included as random effects. Weight at each scan period was included as a linear covariate. Deposition rates were calculated for LMA, BF, and IMF using intra-pig linear and quadratic regressions for the independent variable live weight. Intra-pig linear and quadratic regression coefficients and y-intercepts were analyzed as dependent variables in a mixed model that included fixed effects of breed, sex, contemporary group, and the interaction of breed by sex. Across all scans, Yorkshires and Durocs were significantly leaner than Berkshires, and gilts were leaner than barrows. At scans 3, 4, and 5, Durocs were significantly leaner and had more ($P<0.05$) LMA than Chester Whites. Durocs had more ($P < 0.05$) LMA than Yorkshires and Berkshires at all five scan periods. Chester White pigs had the largest linear regression coefficient for LMA and the smallest y-intercept. Mean deposition rates for IMF were not significantly different between breeds. Gilts had more ($P < 0.05$) LMA than barrows at periods 3, 4, and 5. Barrows had more ($P < 0.05$) IMF than gilts at scan intervals 2, 3, 4, and 5. Quadratic regression coefficients for BF were significantly different between barrows (-0.00002) and gilts (-0.00001).

Key Words: Swine, Ultrasound, Regression

Nonruminant Nutrition: Feed Ingredients & Management

908 Effect of whey and lactose source on nursery pig performance. A. M. Gaines*, B. W. Ratliff, P. Srichana, and G. L. Allee, *University of Missouri, Columbia.*

A 25 d growth assay experiment was conducted to determine the effects of whey and lactose source on nursery pig performance. At weaning, a total of 276 pigs (TR-4 × C22; 5.8 ± 0.03 kg) reared in a commercial research facility were fed one of two diets containing spray-dried whey and crystalline lactose or granular whey and Dairy Lac 80®. Pigs were housed 23 pigs per pen and fed in three dietary phases. Each diet contained the same inclusion of whey and other specialty ingredients. Diets were formulated to be lactose equivalent with additional lactose being added from crystalline lactose in the spray dried whey diets or Dairy Lac 80® in the granular whey diets. For the phase 1 period (0-7 d), phase 2 period (7-14 d), and phase 3 period (14-25 d) the level of inclusion of whey in the diets was 20.0%, 10.0%, and 0.0%, respectively. A whey source was not included in phase 3; however, both the spray-dried and granular whey treatments did contain 7% lactose derived from crystalline lactose or Dairy Lac 80®, respectively. During the Phase 1 period there was no effect of whey and lactose source on ADG ($P = 0.91$), ADFI ($P = 0.29$), or G/F ($P = 0.54$). Similarly, there was no effect of whey and lactose source on ADG ($P = 0.57$), ADFI ($P = 0.37$), or G/F ($P = 0.63$) during the Phase 2 period. However, during the Phase 3 period pigs fed Dairy Lac 80® had improved ADG ($P = 0.07$) as compared to pigs fed crystalline lactose. Improvements in ADG were due to improvements in ADFI ($P = 0.08$). There were no differences in G/F ($P = 0.76$) among the lactose sources. For the overall period (d 0-25) pigs fed granular whey and Dairy Lac 80® had improved ADG ($P = 0.05$) and ADFI ($P = 0.04$) as compared to pigs fed spray-dried whey and crystalline lactose. There were no differences in G/F ($P = 0.44$). Based on the results, whey and lactose source did not influence growth performance during the early nursery period. However, growth perfor-

mance in the Phase 3 period was improved when the diets contained Dairy Lac 80®.

Key Words: Pigs, Whey, Lactose

909 Effect of specialty protein supplements on nitrogen balance and digestibility in weanling pigs. J. Zhao*, A. F. Harper, K. E. Webb, Jr., and M. E. Estienne, *Virginia Polytechnic Institute and State University, Blacksburg*.

Inclusion of spray-dried plasma protein (SDPP) in diets for early-weaned pigs improves post-weaning growth. The objective of this experiment was to determine the effects of supplemental SDPP and a marine-based hydrolyzed protein source (Peptiva, VITECH BIOCHEM, San Fernando, CA) in weanling pig diets on N balance and digestibility. At weaning, pigs (n = 48, 5.4 kg BW, and 17 d of age) were placed in metabolism cages with two pigs per cage. There were three dietary treatments (8 cages/treatment): a corn-soy-whey control diet or similar diets containing 6% SDPP or 6% Peptiva. Diets were formulated to be equivalent in energy and essential amino acids. A 7-d adjustment period was followed by two 5-d collection periods, during which total feces, urine, and orts were collected. Pigs were fed their respective diets in two equal portions at 12-h intervals to give daily intake of approximately 3% of BW. Dry matter content of feed and fecal samples was determined by oven drying. Nitrogen concentration of feces, feed and urine was determined by the Kjeldahl method. Analytical data were used to calculate DM and protein digestibility and N balance. Supplementation of 6% SDPP or 6% Peptiva had no impact on protein digestibility, retention, or biological value of the diet. Percent absorbed N ranged from 88.51 to 89.34%, and was not different among treatments (P = 0.55). Similarly, percent N retention ranged from 69.08 to 72.01, and was not different among treatments (P = 0.39). The calculated percent biological value and DM digestibility were: 80.92 and 91.51, 77.62 and 92.01, and 78.03 and 91.28 for the control, SDPP and Peptiva treatments, respectively, with no difference among treatments (P = 0.22 to 0.39). In summary, inclusion of SDPP or Peptiva in the diet of weanling piglets did not alter digestibility, N balance or biological value of protein. Situations in which supplementation of these products improves performance appear unrelated to effects on N digestibility or N balance.

Key Words: Digestibility, Nitrogen Balance, Pigs

910 Use of rice in substitution of corn in diets for young pigs. B. Vicente[1], D. G. Valencia[1], R. Lázaro*[1], M. A. Latorre[2], and G. G. Mateos[1], [1]*Universidad Politécnica de Madrid, Spain,* [2]*Universidad Cardenal H.Oria CEU, Spain*.

We studied the influence of the cereal portion of the diet on performance and total tract nutrient digestibility (TTFD) of young pigs. Control pigs received a practical feeding program based on a complex diet without antibiotics that included 50% of cooked corn (99 C during 50 min and then rolled) from 25 to 39 d of age and a corn-soybean meal diet from 39 to 53 d of age. The experimental groups received the same complex diet as the control group but corn was substituted by rice either raw, cooked, or cooked and rolled from 25 to 53 d of age. The percentage of starch gelatinization was 56% for cooked and rolled corn, 14% for raw rice, 25% for cooked rice, and 48% for cooked and rolled rice. Each treatment was replicated eight times (five piglets penned together). Digestibility of nutrients was determined at 27, 39, and 53 d using 0.6% celite as an indigestible marker. From 25 to 39 d piglets fed rice ate more feed (481 vs 391 g/d; P<0.001), grew faster (357 vs 277 g/d; P<0.001), and tended to have better feed conversion (1.34 vs 1.42 g/g; P<0.10) than piglets fed corn. Similar results were observed at the end of the trial. No significant differences in performance were observed among piglets fed the three rice diets but piglets fed cooked rice grew 6.3% faster and had 6.1% better feed conversion than piglets fed raw rice. At 27 d of age TTFD of DM, OM, and GE was lower for corn (P<0.001) than for rice diets, but nitrogen retention was the same. Piglets fed heat processed rice tended to have better TTFD of nutrients than piglets fed raw rice but the differences disappeared with age. It is concluded that rice improves piglet performance from 25 to 53 d and nutrient digestibility at 27 d. No differences were observed between cooked and cooked and rolled rice in spite of differences in percentage of starch gelatinization, indicating that the beneficial effects of heat processing of rice on piglet performance and nutrient digestibility were independent of starch gelatinization.

Key Words: Rice, Piglet Performance, Heat Processing

911 Growth and carcass characteristics of pigs fed biotechnologically derived and non-biotechnologically derived corn and harvested at different weights. M.G. Custodio*[1], W.J. Powers[1], E. Huff-Lonergan[1], M.A. Faust[2], and J. Stein[3], [1]*Iowa State University, Ames,* [2]*ABS Global, Inc., DeForest, WI,* [3]*Syngenta Biotechnology, Inc., Research Triangle Park, NC*.

To compare growth performance and carcass characteristics, 64 pigs (average initial BW = 62 kg) were fed diets containing biotechnologically derived corn (Bt: Syngenta Bt 11 event) or control corn (C: pooled non-biotechnologically derived inbred lines). Pigs were blocked by sex and weight and allocated to 16 pens. Isocaloric, isonitrogenous diets contained an indigestible marker. Feed and water were provided ad libitum. Feed disappearance and weight gain data, and fecal samples were collected weekly. At slaughter, pigs were divided into two groups based on market weight: 1 (85 kg) and 2 (110 kg). No difference in ADG was observed between pigs fed C and Bt diets for harvest weight groups. Feed efficiency was greater for pigs fed the C diet (P = 0.002) and was not different between groups 1 and 2 pigs. An interaction between corn and harvest weight was observed. No corn effects were observed for hot carcass weight, loin eye area (LEA), and 1st, 10th, last rib, and last lumbar vertebrae fat. Harvest weight differences were observed; lighter weight pigs had smaller LEA (12.4 vs. 15.7 cm^2; P < 0.001) and less backfat. Across both market weight groups, gilts had larger LEA (P < 0.05) and were leaner than barrows. No harvest weight and corn source effects were observed for meat tenderness and drip loss. Hunter color /b/ values were greater for pigs fed C diets (11.71 vs. 11.31; P = 0.02) and group 2 pigs (11.77 vs. 11.26; P = 0.005). There were no significant differences in DM, ether extract or CP content of meat samples. No corn effects were observed for N or P content of fecal samples. There were no differences in apparent digestibility of N between pigs fed Bt and C diets. Pigs fed C diets had greater apparent P digestibility (57.8% vs. 40.2%; P < 0.001). Interactions were observed between treatment and sex; barrows fed Bt corn and gilts fed C corn had lowest apparent P digestibilities. Findings suggest no detrimental effects on growth performance or carcass and excretion characteristics for growing-finishing pigs fed Bt corn. Traits desired by consumers were not different between pigs harvested at light and heavy market weights.

Key Words: Pigs, Biotechnologically Derived Corn, Carcass Characteristics

912 Nutritional value of a corn containing a glutamate dehydrogenase gene for growing pigs. G. A. Apgar*[1], T. A. Guthrie[1], K. E. Griswold[2], M. P. Martin[1], J. S. Radcliffe[3], and M. D. Lindemann[4], [1]*Southern Illinois University, Carbondale,* [2]*Penn State University Extension, Lancaster,* [3]*Purdue University, West Lafayette, IN,* [4]*University of Kentucky, Lexington*.

Eight female PIC pigs (initial body wt. 47.5 ± 1.8 kg) were utilized in a two period switchback design (n = 4 per treatment per period) to evaluate the nutritional difference between a genetically modified corn and a similar non-transgenic corn. The genetically altered corn (*gdhA+*) contained a glutamate dehydrogenase gene isolated from *Escherichia coli*. The non-transgenic corn was the same variety lacking the transgenic cassette, grown at the same locations. Pigs were surgically fitted with steered ileo-cecal valve cannulas for collection of ileal digesta. Diets were comprised primarily of one of the two corn sources. Dietary AA profiles were adjusted using crystalline AA to match Illinois Ideal Protein Ratios. Pigs were limit fed at 8% of metabolic body weight ($BW^{0.75}$), in two equal feedings at 0600 and 1800 each day throughout the experiment. The study consisted of two 15-d periods. Each period was comprised of a 7-d acclimation period, a 3-d total collection of feces and urine, two 12-h ileal collections, and a 3-d adjustment period between ileal collections to assure adequate hydration. Crude protein, leucine, methionine, alanine, aspartic acid, glutamic acid and tyrosine concentrations were greater (P < 0.05) in the gdhA+ corn when compared with the non-transgenic variety. The presence of the gene did not alter (P > 0.17) body weight gain, nor (P > 0.32) dry matter digestibility, fecal N excretion (g/d), apparent total tract N digestibility, N balance, net protein utilization, or N retained as % of absorbed. Apparent ileal AA digestibility values did not differ (P > 0.31) between

the two dietary treatments. This study showed corn that contains the E. coli gene for glutamate dehydrogenase was nutritionally equivalent to the non-altered variety.

Key Words: Maize, Transgenics, Pigs

913 The digestive fate of the *gdhA* transgene in corn diets fed to weanling swine. J. M. Beagle*[1], G. A. Apgar[1], K. L. Jones[1], K. E. Griswold[2], X. Qui[1], and M. P. Martin[1], [1]*Southern Illinois University, Carbondale,* [2]*Penn State Extension, Lancaster.*

A transgenic corn containing *E. coli* glutamate dehydrogenase (*gdhA*) was used in diets fed to weanling swine and the digestive fate of the *gdhA* transgene was traced. Eight groups of 8 pigs were fed a commercially available (non-*gdhA*) starter feed for 2 wk. One pig was randomly selected from each pen, sacrificed, and negative control samples were collected. The remaining 56 pigs were fed a diet containing 57.97% *gdhA* corn for 2 wk. All pigs were then sacrificed and treatment samples were collected. Samples from both control and treatment pigs included digesta from the stomach, distal ileum, and distal colon, liver, 10th rib muscle, and white blood cells and plasma from the hepatic portal vein. Total genomic DNA was extracted and concentration determined via spectrophotometry. Polymerase chain reaction (PCR) was performed with primers designed to amplify a 456 bp region of the *gdhA* gene, and PCR products were analyzed using gel electrophoresis. DNA extracted from the *gdhA* positive corn acted as a positive control for the PCR and gel electrophoresis while DNA extracted from a commercially available non-*gdhA* corn and an equivalent volume of distilled water acted as negative controls. DNA extracted from the *gdhA* positive diet ensured the transgene was detectable in the diet. The level of detection allowed as little as 0.3 ng transgenic corn DNA per each 20 ul reaction to be detected even when confounded with 6.4 ug of SBM or 1.5 ug non-gdhA corn. The 456 bp region of the *gdhA* transgene was detected in 71% of the stomach digesta samples from treatment animals, but was not detected in the small and large intestine, WBC, plasma, liver, or muscle samples. No transgenic DNA was detected in any sample from control animals. These data suggest that degradation of this transgene began in the stomach and that the transgene was degraded beyond detection by the time the digesta reached the distal ileum.

Key Words: Glutamate Dehydrogenase, Transgenic, Corn

914 Effects of increasing pantothenic acid on growth performance and carcass characteristics of finishing pigs reared in a commercial environment. C. N. Groesbeck*, R. D. Goodband, M. D. Tokach, S. S. Dritz, J. L. Nelssen, and J. M. DeRouchey, *Kansas State University, Manhattan.*

An experiment using 1,080 pigs (PIC, initially 40.3 kg) was conducted to evaluate added pantothenic acid (PA) on growth performance and carcass characteristics. Pigs were blocked by weight and gender, and were randomly allotted to one of four dietary treatments. There were 10 pens per treatment with a mean of 27 pigs per pen. Pigs were fed the experimental corn-soybean meal, 5% added fat diets in four phases. Pigs were fed the control diet (no added PA) or the control diet with 22.5, 45 or 90 ppm of added PA from d-calcium pantothenate. Pigs were fed the assigned dietary treatments from 40.3 to 123.6 kg (d 0 to 98), and transported to a commercial packing facility to collect carcass measurements. Pigs were weighed and feed intake was determined every 14 d. There were no PA gender interactions ($P > 0.05$) observed. Increasing dietary PA had no effect ($P > 0.05$) on ADG, ADFI, or feed efficiency (G/F) from d 0 to 98. Barrows had greater ($P < 0.01$) ADG and ADFI than gilts. Increasing pantothenic acid has no effect ($P > 0.05$) on hot carcass weight, dressing percent, fat free lean index (FFLI), average backfat, and loin depth. Gilts had less ($P < 0.001$) backfat and a greater ($P < 0.001$) FFLI than barrows. There were no ($P > 0.05$) gender differences in dressing percent or loin depth. Increasing dietary pantothenic acid during the grow-finish phase does not appear to provide any advantage in growth performance or carcass composition of commercially reared finishing pigs.

Item[a]	0.0	22.5	45.0	90.0	SE
Average wt, d 98	123.11	123.12	122.36	123.76	1.05
ADG, kg	0.85	0.84	0.85	0.87	0.01
Gain/Feed	0.37	0.36	0.36	0.37	0.01
Fat free lean index	50.42	50.36	50.05	50.29	0.19
Average backfat, mm	17.22	17.12	17.65	17.50	0.40

[a]No differences ($P > 0.05$)

Key Words: Pigs, Growth, Pantothenic Acid

915 Effects of reduced crude protein and fiber supplementation on nitrogen and phosphorus digestibility and manure generation. D. M. Sholly*, S. L. Hankins, M. C. Walsh, A. L. Sutton, and B. T. Richert, *Purdue University, West Lafayette, IN.*

Sixteen crossbred barrows (avg initial BW = 32.6 kg) were allotted by weight to 4 experimental diets (4 pigs/diet) in a 2 x 2 factorial design comparing two crude protein (CP) levels and 0 or 10% wheat bran (WB). Dietary trts were: 1) Control (CTL), 17.7% CP; 2) CTL + 10% WB; 3) Low Nutrient Excretion diet (LNE), 13.9% CP, HAP corn, phytase, and synthetic amino acids; and 4) LNE + 10% WB. A 28 d experiment included a 5 d adjustment period to metabolism pens, a 20 d collection of total feces and urine (3 times/wk) for storage in 16 individual PVC columns (122 x 38 cm), and a 3 d total collection to determine nutrient digestibility. There were no differences in initial and final BW among dietary trts. Inclusion of WB decreased ADFI (4.00 vs. 3.66 kg/d; $P<.007$) by 8.5%. Manure generation (as-is basis) was not different among dietary trts. LNE diets reduced manure DM (kg/d) ($P<.004$) by 18.2%, however, WB inclusion increased manure DM (kg/d) by 12.5% ($P<.02$). Manure pH (avg 6.91) was not affected by dietary CP or WB. LNE diets tended to decrease total N (TN) concentration (as-is basis) in the stored manure by 20% ($P<.09$). Manure TN concentration (DMB) was decreased ($P<.0001$) by 14.6% and 21% for the LNE diets and 10% WB inclusion, respectively. Manure ammonium N (AmmN; DMB) concentration was decreased by 22.4% with WB ($P<.003$). The LNE diets decreased ($P<.003$) stored manure total P (TP) concentration (as-is basis) by 38% and TP excreted by 48.2% (4.25 vs. 2.2 g/d; $P<.0001$) when compared to CTL diets. Dietary trts did not affect N and P digestibility. LNE diets reduced total AmmN excreted by 35.5% (3.03 vs. 1.96 g/d; $P<.002$), fecal TP (5.61 vs. 3.67 g/d; $P<.002$) by 34.6%, and total WSP (3.76 vs. 1.74 g/d; $P<.0005$) by 54%. The use of reduced dietary CP and P diets can significantly reduce the amount of N and P excreted by growing pigs. The inclusion of 10% WB did decrease N and AmmN excretion, but also decreased pig ADFI which may hinder growth performance.

Key Words: Pigs, Crude Protein, Fiber

916 Comparison of models fitted to electronically recorded swine growth data over a limited test period. G. Vander Voort* and C. F. M de Lange, *University of Guelph, Guelph, ON, Canada.*

The evaluation of alternative management, marketing and breeding strategies in pork production systems requires knowledge of variation in pig growth patterns. The objective of this research was to evaluate alternative mathematical functions and statistical procedures to represent growth patterns (BW vs time) of individual pigs between about 25 to 120 kg BW. Electronically recorded daily BW data from an 84 d period for 40 group-housed pigs was analyzed. Data was filtered to identify and edit outliers. Three functions (modified Bridges, Gompertz, and exponential second order polynomial) were fit for each individual pig using the non-linear procedure of SAS. A second order polynomial was also fit for each individual pig using a random regression procedure. Least square means of residuals (RESlsm) for daily BW were calculated for each function and 21 d interval of the test period. Across intervals, the smallest RESlsm were observed for the random regression derived second order polynomial (-0.16 to -0.01 kg; SE 0.11), these values did not differ from zero and across 21 d interval ($P > 0.10$). For the other functions, RESlsm differed from zero ($P < 0.05$) for at least one 21 day interval. For the Gompertz function and d 63 to 84 of the test period, the absolute RESlsm was largest (-1.04 kg; SE 0.12), indicating a systematic bias in the prediction of BW during the last 21 d of the

test period when using this function. Based on analysis of residual patterns, the Bridges, Gompertz, and exponential second order polynomial functions were more sensitive to violation of the assumption of constant residual variance across time. The least amount of bias in the representation of the growth patterns of pigs was observed when using a random regression procedure and a second order polynomial function.

Key Words: Swine, Growth, Function

917 Processing of western Canadian feed ingredients improves their digestibility in Nile tilapia *(Oreochromis niloticus)*. T. L. Borgeson*, D. L. Thiessen, V. J. Racz, and M. D. Drew, *University of Saskatchewan, Saskatoon, SK, Canada*.

The apparent digestibility coefficients (ADC) of unprocessed and processed pea, canola and flax products were determined on diets, in which 30% of a reference diet was replaced by each test ingredient. Celite was used as an indigestible marker for measuring apparent digestibility coefficients indirectly. The trial was conducted in a semi-closed recirculating system using 5 tanks per diet with 40 fish per tank, and feces were collected using a settling column. The processed ingredients included dehulled flax produced by abrasive dehulling, canola protein concentrate and pea protein concentrate, which were produced by aqueous extraction of peas and canola meal, respectively. Coextrudates of canola and peas (C:P) or flax and peas (F:P) were also tested. Processing had no significant effect on the ADC of crude protein except for flax. Whole flax had negative ADC for crude protein, energy and dry matter probably due to the high viscosity of this diet. Processing significantly improved the ADC of energy and dry matter for pea, canola meal and flax ($P < 0.05$). The ADC for crude protein for C:P was not significantly different than pea or canola meal while the ADC for crude protein for F:P was intermediate between flax and pea. The coextruded products had ADC for energy and dry matter that were significantly higher than those of the component ingredients ($P < 0.05$). The results suggest that these processing methods can significantly improve energy and dry matter ADC of pea, canola and flax by tilapia but have less effect on protein digestibility.

Ingredient	Crude protein	Energy	Dry Matter
Pea	0.86^{a}	0.58^{cd}	0.59^{cde}
Pea protein concentrate	0.95^{a}	0.95^{a}	0.93^{a}
Canola meal	0.82^{a}	0.68^{bc}	0.54^{de}
Canola protein concentrate	0.86^{a}	0.84^{ab}	0.78^{abc}
Extruded canola:pea	0.76^{ab}	0.84^{a}	0.69^{bcd}
Whole flax	-0.38^{d}	-0.27^{e}	-0.45^{f}
Dehulled flax	0.46^{c}	0.48^{d}	0.41^{e}
Extruded flax:pea	0.61^{b}	0.53^{cd}	0.41^{e}

$^{a\text{-}f}P < 0.05$ within columns.

Key Words: Feed processing, Digestibility, Tilapia

Physiology and Endocrinology: Stress and Inflammation: Effects on Animal Performance

918 Performance of gilts housed individually in stalls or in groups in pens during the first 30 d post-mating. M. J. Estienne*, A. F. Harper, and J. W. Knight, *Virginia Polytechnic Institute and State University, Blacksburg*.

In the U.S. most sows are individually housed throughout gestation in stalls that allow only standing, sitting and lying. Use of gestation stalls is a contentious welfare issue that may lead to legislation limiting the housing of sows in stalls to a defined interval that is less than the total gestation period. The objective was to assess performance of gilts housed individually in stalls or in groups in pens for the first 30 d after mating. Gilts (n = 56; 159.5 ± 1.5 kg BW; 15.0 ± 0.5 mm backfat) were mated via AI twice during estrus. After the second AI, gilts were placed in stalls (0.6 × 2.0 m) (n = 14) or pens (1.7 × 3.1 m) containing three gilts each (n = 14), and were fed at a rate of 2 kg/gilt/d. Gilts housed in pens gained more BW than gilts housed in stalls (11.0 vs. 6.7 kg; SE = 0.8; P < 0.01), but change in backfat was similar between treatments (-0.3 vs. -0.4 mm; SE = 0.5; P = 0.80). The proportion of gilts exhibiting stereotypies on d 28 was not affected by treatment (81 for groups vs. 93% for stalls; SE = 7.2; P = 0.26). Wound scores (0 to 5; 5 = severe) were greater for group-housed gilts and were greatest during the first 7 d post-mating. For example, wound scores for the head, face and ears (2.5 vs. 1.3; SE = 0.2) and neck and shoulders (2.6 vs. 0.3; SE = 0.2) on d 3 were greater (P < 0.01) for group- vs. stall-housed gilts. Lameness scores (0 to 5; 5 = severe) on d 30 were greater in group- compared to stall-housed gilts (0.6 vs. 0.2; SE = 0.1; P = 0.06). Pregnancy rate at d 30 was lower (P < 0.01) for group- compared to stall-housed gilts (85.7 vs. 100%; SE = 3.2). Following slaughter at d 30 of gestation, the number of embryos (13.8 vs. 15.5; SE = 1.8; P = 0.51), embryo weight (1.59 vs. 1.58 g; SE = 0.07; P = 0.89) and crown-rump length (27.2 vs. 27.1 mm; SE = 0.46; P = 0.92) were similar for group- and stall-housed gilts, respectively. Indicators of welfare were differentially affected by type of gestation housing and pregnancy rate was maximized in gilts housed individually in stalls.

Key Words: Gestation, Housing, Gilt

919 Effects of stress and genotype on immune and cortisol measures in pigs. M. A. Sutherland*, S. R. Niekamp, S. L. Rodriguez-Zas, and J. L. Salak-Johnson, *University of Illinois, Urbana*.

Pigs are exposed to many stressors during common management and production practices. Genotypic differences in immune measures and cortisol concentration in pigs have been reported but the influence of genotype on stress responsiveness is limited. The objective of this experiment was to determine the effect of "breed" and commercial genotypes on immune and cortisol responses in pigs subjected to multiple stressors over 14 d. Piglets from Landrace Cross (n=36), Meishan (n=30), Yorkshire (n=32) and two commercial lines (LineA and LineB; n=36) were weaned at 17 to 21 d and kept in a common nursery environment. At 6 wk of age pigs were assigned either no stress (control) or stress (heat, crowding, mixing) treatment. Blood samples were obtained via veni-puncture at d 0 (baseline), 1, 7 and 14 post-stress to determine white blood cell counts, differentials, cortisol (CORT), IgG, lymphocyte proliferation (LPA), natural killer cytotoxicity (NK), phagocytosis and antibody response to sheep red blood cells. There were significant genotype and genotype x day interaction effects for CORT and numerous immune measures. CORT levels were lower (P < 0.0001) in stressed pigs compared to controls. At d 7, CORT levels were lower (P < 0.05) in stressed Meishans and Yorkshires compared to controls and remained suppressed in Meishans until d 14 (P < 0.01). LPA response was higher (P < 0.05) in stressed Meishans at d 1, and remained elevated until d 14, compared to control pigs (P < 0.05). NK, at E:T ratio of 25:1, was higher (P < 0.05) in Landraces and Yorkshires at d 14 compared to control pigs. In commercial lines, CORT levels were lower (P < 0.05) in stressed pigs compared to their controls at d 7. LPA response was higher (P < 0.01) in stressed LineA pigs at d 1 compared to control pigs. These results indicate a genotype effect on immune and cortisol concentrations in response to stress and that these effects change over time.

Key Words: Immune, Pigs, Genotype

920 The use of a Hens' Odorant Analogue to control stress consequences in Broilers. I. Madec*[1], J. F. Gabarrou[2], A. Bruneau[1], L. Bougrat[1], D. Saffray[1], B. Silliart[3], and P. Pageat[1], [1]*Pherosynthese, Saint Saturnin Apt, France,* [2]*Esa Purpan, Toulouse, France,* [3]*Env Nantes, Nantes, France*.

In poultry, stress has consequences such as pecking behavior, increased feed to gain ratio, high mortality or bad carcass quality. Indicators of stress include: high H/L (Heterophil/Lymphocyte) ratio and elevated corticosterone secretion. We have identified in the uropygial glands in laying hens a secretion (named HOA: Hens Odorant Analogue, under patent). To test the hypothesis that HOA has stress-preventive actions and improves general performance, a trial was conducted (HOA vs control) using two similar buildings, each housing 24,000 chickens. Chickens were maintained on the ground floor under similar conditions. Males were separated from females. The HOA was administered by passive diffusion in the building atmosphere (one diffuser for 1000 chickens). After treatment, HOA-treated animals were heavier than controls: 2.22