486 Effects of menhaden fish meal or oil on the performance and immune response of nursery pigs. A. Gaines*[1], J. Carroll[2], R. Fent[1], and G. Allee[1], [1]*University of Missouri, Columbia*, [2]*Livestock Issues Research Unit, ARS-USDA, Lubbock, TX.*

A trial using 210 pigs (TR-4 X PIC C22) was conducted to determine the effects of menhaden fish meal (MFM) or oil (MFO) on the performance and immune response of nursery pigs. Pigs (17 d; 5.31 ± 0.16 kg) were weaned into a nursery facility and allotted to one of six dietary treatments (Trt; seven replicate pens/Trt): Trt 1, 0% MFM/MFO; Trt 2, 5% MFM; Trt 3, 10% MFM; Trt 4, 2.5% MFO; Trt 5, 5% MFO; and Trt 6, 5% pet food grade poultry-byproduct meal (PBM). Experimental diets were fed for 21 d. On d 13, a subset of pigs (six pigs/Trt) were fitted with a jugular catheter for blood collection (30-min intervals for 6 h). On d 14, all pigs (n = 210) were injected i.m. with LPS (15 µg/kg BW). On d 21, pigs were placed onto a common corn-soybean meal fortified diet and growth performance was evaluated until d 28. Prior to LPS challenge (d 0-14) there were no Trt differences for ADG ($P > 0.21$) or G/F ($P > 0.80$). However, there was a Trt effect ($P < 0.01$) for ADFI. Pigs fed 5.0% PBM had lower ADFI ($P \leq 0.05$) compared to pigs fed 0% MFM/MFO, 5% MFM, and 10% MFM. Post-LPS (d 14-28), there was a Trt effect for ADG ($P < 0.02$). Pigs fed 10% MFM had increased ($P \leq 0.10$) ADG compared to pigs fed 0% MFM/MFO, 2.5% MFO, 5% MFO, and 5% PBM. Furthermore, ADG was higher ($P \leq 0.10$) in pigs fed 5% MFM compared to pigs fed 0% MFM/MFO, 5% MFO, and 5% PBM. There were no Trt differences for ADFI ($P > 0.27$) or G/F ($P > 0.60$). There was no Trt effect ($P > 0.74$) for basal serum cortisol (-1.0, -0.5, and 0 h) prior to LPS challenge. However, post-challenge, there was an overall Trt effect ($P < 0.04$) on serum cortisol. Serum cortisol was lower in pigs fed 5% MFO compared to pigs fed 0% MFM/MFO ($P = 0.09$), 5% MFM ($P < 0.01$), 10% MFM ($P < 0.01$), and 5% PBM ($P < 0.05$). Additionally, serum cortisol was lower in pigs fed 2.5% MFO compared to pigs fed 5% MFM ($P = 0.06$) and 10% MFM ($P < 0.04$). This research demonstrated that feeding MFM or MFO altered the acute phase immune response, which, in the case of MFM, may have led to improved growth performance.

Key Words: Fish Meal, Fish Oil, Pigs

487 Evaluation of canola meal as an alternative plant protein source in nursery pig diets. J. Ele, S. Meers, M. Azain, and R. Dove*, *University of Georgia, Athens*.

Two experiments were conducted to evaluate the inclusion rate of canola meal (CM) on nursery pig performance, thyroid hormone status and nutrient digestibility. Experiment 1 used 384 nursery pigs (6.16 kg at 18 d) in three trials to determine the effects of CM as a replacement for dietary soybean meal (SBM) on a protein basis. Canola meal was used to replace 0%, 33%, 66% and 100% of the SBM in phase I (d 0 to d 11; 0, 11.5, 22.9, and 34.4% dietary CM, respectively) and phase II (d 11 to 35; 0, 13.3, 26.6, and 39.9% dietary CM, respectively) nursery pig diets. During phase I, pigs fed 33% or 66% CM were not significantly different ($P > 0.10$) from pigs fed the control diet. Pigs fed 100% CM gained less than other treatments ($P < 0.001$). Significant differences for gain ($P < 0.01$) and feed intake ($P < 0.01$) were seen from the phase II diet. The 33% CM was numerically higher but not different from the control diet. As CM increased beyond 33%, gain and feed intake decreased however, no significant difference ($P > 0.10$) was observed for feed efficiency. No differences ($P > 0.10$) were observed in the levels of triiodothyronine (T3) and thyroxine (T4) across all diet treatments. In Exp. 2, 16 barrows (8.83 kg at 37 d) were used to determine nutrient utilization. Dietary treatments were the same as in Exp. 1. Diets were fed in a 4 x 4 latin square design with a 5 d adjustment period and a 3 d total collection period. Digestibility parameters showed statistical differences in energy, CP and nitrogen, ash, DM ($P < 0.001$), and NDF ($P < 0.05$) digestibility among treatments. The control and 33% CM diets were significantly better in nutrient utilization of energy, CP and nitrogen, ash, and DM when compared to the 66% and 100% diets. NDF digestibility in the 33% CM diet was significantly increased ($P < 0.05$) compared to the 66% CM diet, but not significantly different ($P > 0.10$) from the control or 100% CM diets. In conclusion, these studies demonstrated that canola meal can replace up 33% of the SBM (13% dietary CM) in nursery pig diets without adverse effects on pig performance or thyroid function.

Key Words: Canola Meal, Nursery Pigs, Thyroid Hormone Status

488 Near infra-red reflectance spectroscopy for prediction of amino acids in feed ingredients leads to important cost savings in diet formulation. J. Goodson*[1], D. Hoehler[1], J. Fontaine[2], B. Schirmer[2], and A. Jaeger[2], [1]*Degussa Corporation, Kennesaw, GA*, [2]*Degussa AG, Hanau, Germany*.

Near infra-red reflectance spectroscopy calibrations used to predict amino acid levels in feed ingredients can be used to allow swine feed formulators to reduce safety margins in formulation programs. Reduction of these safety margins for amino acids allows the production of feeds which meet animal requirements for protein and amino acids without supplying excessive levels of either. These calibrations also enable formulators to take advantage of alternative feed ingredients when traditional ingredients become high priced compared to other sources of nutrients. Currently calibrations are available to predict DM, CP, Met, Cys, Met+Cys, Lys, Thr, Trp, Arg, Ile, Leu, Val, His and Phe. Ingredients including barley, corn, corn gluten meal, feather meal, fish meal, lupine, meat meal, meat and bone meal, peas, poultry meal, canola meal, rice bran and hulls, sorghum, soybean meal, full fat soybeans, sunflower meal, tritcale and rye, wheat, wheat bran and middlings have calibrations. These calibrations are being used to assess seasonal variation and regional variation in nutrients provided by these ingredients. A large data base of new crop soybean meal samples (n = 81) collected in the fall of 2004 show that there are important variations in CP as well as many important amino acid levels. A similar data set for new crop corn (n = 123) demonstrates amino acid variation also. Application of this technology to soybean meal and corn enables formulators to use very precise amino acids values. Several example formulations have been prepared showing that savings can range up to $1.50 per ton in a swine grower feed when precise data on amino acid levels in corn and soybean meal are available. These savings represent the extremes, since in this case the highest and lowest levels of Met and Lys found were used. In a more practical example, formulation cost was reduced by $0.29 per ton by changing the safety margin of Met and Lys by 0.5 standard deviations in soybean meal alone.

Key Words: Near Infra-Red Reflectance Spectroscopy, Amino Acids, Diets

489 Use of rice in substitution of corn in diets for young pigs. B. Vicente, D. G. Valencia, R. Lázaro, M. P. Serrano, and G. G. Mateos*, *Universidad Politácnica de Madrid, Spain*.

We studied the influence of feeding rice on the ileal digestibility (ID) of dry matter (DM), organic matter (OM), gross energy (GE) and starch and the morphology of the ileum of piglets at 37 d of age. The control diet was a complex diet without in-feed growth promoters and included 50% cooked corn (99°C for 50 min and then rolled). The experimental diets were similar but corn was substituted for rice either raw or cooked (mild and severe temperature). Each treatment was replicated seven times (one pig). Replicates were fed their respective diets from 25 to 37 d of age. Starch gelatinization of the cereal was 84% for corn, 11% for raw rice and 52% and 76% for the mild and severe cooked rice, respectively. Ileal digestibility of nutrients was higher for piglets fed rice than for piglets fed corn (88.0 vs. 87.1% for DM; 88.1 vs. 86.8% for OM; 86.5 vs. 85.2% for GE and 98.8 vs. 97.3% for starch; $P \leq 0.01$). Rice cooking improved DM (88.4 vs. 87.2%; $P \leq 0.01$), OM (88.4 vs. 87.5%; $P \leq 0.05$), GE (86.8 vs. 85.9%; $P \leq 0.05$), and starch (99.1 vs. 98.3%; $P \leq 0.05$) digestibilities but no differences were observed between mild and severe heat processing conditions of the rice ($P \geq 0.10$). Villus height was higher (413 vs. 336 µm; $P \leq 0.05$) and crypt depth was lower (110 vs. 152 µm; $P \leq 0.01$) for

piglets fed mild cooked rice than for piglet fed cooked corn. As a result, villous height: crypt depth ratio was higher for piglets fed mild cooked rice (4.0 vs. 2.3; P ≤ 0.001). The morphological values of the ileum obtained from piglets fed raw rice were intermediate between those of piglets fed cooked corn and mild cooked rice. A more severe processing of rice increased starch gelatinization but tended to impair intestinal morphology as compared to mild cooked rice. The results indicate that the benefits on productivity previously observed with rice feeding of weanling pigs might be due, at least in part, to improvements in ileal morphology that results in better digestibility of nutrients.

Key Words: Rice, Ileal Digestibility and Morphology, Starch Gelatinization

490 Effect of dietary level of distillers dried grains with solubles (DDGS) on growth performance, mortality, and carcass characteristics of grow-finish barrows and gilts. D. Cook*[1], N. Paton[1], and M. Gibson[2], [1]*Akey, Lewisburg, OH*, [2]*Dakota Gold Research Association*, *Sioux Falls, SD*.

The objective of this trial was to determine the effect of feeding 0, 10, 20, or 30% DDGS from a new generation ethanol plant on growth performance and carcass characteristics of grow-finish barrows and gilts (42 kg initial body weight) reared in a commercial environment. Pigs were split-sexed housed (26 pigs/pen) in a commercial grow-finish barn (1,040 pigs per barn) and randomly allotted within sex and weight block (five blocks) to one of four DDGS levels. Diets were formulated on a digestible amino acid basis with the 1998 NRC values for corn and soybean meal. Key nutrient values used for DDGS were 3,420 Kcal ME/kg, 0.67, 0.62, and 0.31% digestible lysine, threonine, and methionine, respectively. Diets were formulated to be isocaloric by adjusting the dietary percentage of liquid fat. Pigs had ad libitum access to diets and water throughout the trial. There was no effect of DDGS inclusion on final pig bodyweight (116 kg), ADG, ADFI or gain to feed ratio, suggesting the nutrient values used for DDGS were appropriate. There was a linear decrease in mortality percentage (6.0, 2.8, 2.4, and 1.6%, respectively) as DDGS inclusion increased (P < 0.05). Carcass yield decreased linearly (77.3, 76.6, 76.2, and 75.6%, respectively) as dietary DDGS inclusion increased (P < 0.01). Back fat level and carcass lean percentage were not affected by the dietary DDGS level fed. The data suggest that up to 30% DDGS from this source can be included in the diet without affecting growth performance or carcass lean percentage and that DDGS may have value in a health challenged system for reducing mortality. The negative effect of feeding DDGS on carcass yield should be accounted for in evaluations of its economic value.

Key Words: DDGS, Pig, Carcass

491 Influence of feed soaking and feed fermentation on amino acid digestibility by growing pigs. C. Pedersen*, K. E. Strom, M. G. Boersma, and H. H. Stein, *South Dakota State University*, *Brookings*.

Two experiments were conducted to study the influence of feed soaking and feed fermentation on the apparent ileal digestibility (AID) of AA by growing pigs. Each experiment utilized six barrows that were equipped with a T-cannula in the distal ileum (initial BW: 77.2 ± 5.9 and 91.2 ± 5.9 kg for Exp. 1 and 2, respectively). Within each experiment, pigs were allotted to a repeated 3 x 3 Latin square design. A corn-soybean meal based diet (16.6% CP) was formulated and used in both experiments. In Exp. 1, this diet was fed in a dry form or after having been mixed with water in a 1:1 ratio or in a 1:3 ratio. In Exp. 2, the diet was fed to the pigs in a dry form or after having been fermented for 24 h using either 10% residual feed or 50% residual feed to initiate the fermentation. Feed was provided to the pigs in two equal meals in a daily amount that was equal to three times the maintenance requirement for energy. Each experiment consisted of three 7-d periods and ileal digesta were collected from the cannulas during the last 2 d of each period. Results from Exp. 1 indicated that there were no differences in the AID for any of the AA between the diet fed in the dry form and the diet mixed with water in a 1:1 ratio. However, the AID for all indispensable AA except His tended ($P \leq 0.08$) to be lower for the pigs fed the feed that was mixed with water in a 1:3 ratio compared to the AID from the other two groups. In Exp. 2, there were no differences in the AID for Arg, Met, and Thr between the three groups. However, for the remaining indispensable AA, higher ($P \leq 0.05$) AID were found for the dry feed compared to the feed that was fermented with 10% residual. The AID for the dry feed were also higher ($P \leq 0.05$) than for the fermented feed with 50% residual for Ile, Leu, Lys, Phe, and Val. Fermentation of the feed with either 10 or 50% residual feed also reduced the concentrations of all AA (on a DM basis) by approximately 7%. It is concluded that the mixing of feed with water in a 1:3 ratio and fermentation of feed prior to feeding may reduce the quantities of digestible AA that are absorbed by the pigs.

Key Words: AA Digestibility, Feed Fermentation, Feed Soaking

492 Relative bioavailability of phosphorus and true amino acid digestibility by poultry as affected by soybean extraction time and use of low-phytate soybeans. L. Karr-Lilienthal*, P. Utterback, C. Martinez Amezcua, C. Parsons, N. Merchen, and G. Fahey, *University of Illinois*, *Urbana*.

The objectives of this study were to determine if lengthening the time that soybeans (SB) spend in the extractor during preparation of soybean meal (SBM) result in increased relative bioavailability of phosphorus without negatively impacting true amino acid digestibilities, and to compare those modified SBM to that produced from a low-phytate SB. Three SBM were prepared under uniform conditions with the exception of the length of time SB spent in the extractor (45 min [300 rpm], 60 min [225 rpm], or 90 min [150 rpm]). A SBM prepared from low-phytate SB was obtained for comparison. Relative phosphorus bioavailability in chicks and true amino acid digestibilities in cecetomized roosters were determined. Data were analyzed as a completely randomized design using the mixed models procedure of SAS. Increasing the length of time that SB spent in the extractor from 45 to 90 min resulted in lower (P < 0.05) phytate phosphorus and increased phosphorus bioavailability from 34 to 56%. However, this increase came at the expense of available lysine status, with the SBM extracted for 90 min containing less total lysine and less digestible lysine (P < 0.05) than the SBM extracted for 45 min (traditional extraction time). Total essential, total nonessential, and total amino acid digestibilities were highest (P < 0.05) for roosters fed the SBM extracted for 45 min and lowest (P < 0.05) for the SBM extracted for 60 min. Phosphorus bioavailability from SBM prepared from low phytate SB was 1.5 times higher (P < 0.05) than for SBM extracted for 45 min. Increasing the length of time that SB spend in the extractor led to an increase in bioavailable phosphorus but a decrease in bioavailable lysine, potentially negating the positive effect on phosphorus.

Key Words: Phytate, Soybean Meal, Processing

493 The effect of particle size and feed form on laying hen performance. M. Scott*[1] and M. McCann[1,2], [1]*The Queen's University of Belfast, Belfast, County Antrim, Northern Ireland*, [2]*Agriculture, Food and Environmental Division*, *Belfast, County Antrim, Northern Ireland.*

Particle size in poultry diets has been reported to affect many characteristics, including feed consumption, body weight gain, egg size, egg production rate and nutrient digestibility. The effect of feed form, pellets, crumbs, mash or whole grain cereals on laying hen performance is less well established and inconsistent results have been published. The aim of the study was to determine the optimum particle size and feed form for laying hen performance. A total of 100 hens were offered a diet containing 600 g/kg wheat. Three particle sizes (2, 5 and 8 mm) were examined, and four feed forms (whole wheat plus balancer, pellets, crumbs and mash) were investigated. The experiment was a 3 x 3 + 1 factorial arrangement carried out for six weeks on individually caged hens. Particle size significantly affected many performance traits, including gizzard weight, eggs produced, total egg weight, average egg weight, dry matter intake (DMI), yolk diameter, yolk height and shell surface area. The optimum particle size for egg production, in terms of both number and weight, was 5 mm; the total number of eggs produced by the hens fed the 5 mm diet (39.00) was significantly higher (P < 0.05) than the total number of eggs produced by the hens

offered the 8 mm diet (35.18). Feeding whole wheat cereal grain significantly increased egg production, total egg weight, average egg weight and shell surface area. Gizzard weight was significantly increased with the inclusion of whole wheat grains in comparison to both the particle size and feed form treatments. The high grinding pressure and abrasive action generated in the gizzard to effectively crush whole grain cereals have resulted in muscle mass increase, therefore, significantly increasing the weight. Whole wheat grains plus balancer gave the best overall performance in terms of egg production and egg weight. In addition, DMI was significantly lower for the whole wheat plus balancer treatment than for the other treatments. It is concluded, in terms of particle size, 5 mm is optimal for egg production. Whole cereal grain plus balancer resulted in significantly better egg production, egg weight and DMI in comparison to the other feed forms investigated.

Key Words: Particle Size, Feed Form, Laying Hen

Production, Management and the Environment: Dairy and Livestock Management

494 Influence of rearing environment and season on growth performance of growing-finishing pigs. R. Myer* and R. Bucklin, *University of Florida*, *Gainesville*.

An eight year study was conducted to determine the effects of three different rearing environments on growth performance of growing and finishing pigs (from 28 to 107 kg avg. body wt.) reared during the summer or winter in north Florida USA (31°N latitude). The three rearing environments were 1) concrete-floored pens in a semi-confinement building or outside dirt lot pens with minimal shelter that 2) have ("old") or 3) have not ("new") been occupied previously by pigs. Two trials were conducted each year (summer and winter) and each involved 36 crossbred pigs. All pigs were routinely dewormed. Overall, pigs reared during the summer on average grew 3% slower (0.83 vs. 0.86 kg/d; P<0.001) but required 3% less fed (3.32 vs. 3.41 kg; P<0.001) per kg of weight gain than pigs reared during the winter. Rearing environment influenced ADG (P<0.001; 0.82, 0.85, and 0.86 kg/d for "old", "new", and concrete pens, respectively) and F/G (P<0.001; 3.48, 3.35, and 3.26). A pen x season interaction (P<0.01) was noted for F/G in that pigs reared on dirt had poorer F/G compared to pigs reared on concrete during winter but during summer, F/G was similar. Average backfat thickness (mean = 2.5 cm) was influenced by rearing environment (P = 0.01) and somewhat by season (P = 0.08). Results indicate that growing-finishing pigs can be effectively reared in outside dirt lots under the environmental conditions of the southeastern USA, in particular if the lots are periodically rotated to "new" ground. However, pigs reared outside will require slightly more feed per unit of weight gain than pigs reared in confinement, especially during the winter.

Key Words: Pigs, Housing, Season

495 Repeatability of measures of Brahman bull temperament and their association with serum cortisol concentrations. K. Curley, Jr.*[1,2], J. Paschal[3], T. Welsh, Jr.[1], and R. Randel[2], [1]*Texas Agricultural Experiment Station, College Station*, [2]*Texas Agricultural Experiment Station, Overton*, [3]*3Texas Cooperative Extension, Corpus Christi*.

The objectives of this study were (1) to compare temperament assessments, using multiple techniques, over repeated observations to gauge temperament over the long-term and (2) to evaluate the relationship of the temperament appraisals with serum concentrations of cortisol (CS). Measures of temperament were gathered over 3 repeated observations (60-d interval) of yearling, fall-born Brahman bulls (initial BW=320 ±4 kg; n=66). Temperament assessments included exit velocity (EV), the rate at which the bulls exited the squeeze chute and traversed a fixed distance (1.83 m); pen scores (PEN; 1=quiet to 5=excited), ascertained from animal behavior while penned in small groups (n=5); and chute scores (CHUTE; 1=quiet to 5=excited), determined from behavioral responses to restraint on the scale. All serial EV measures were positively correlated ($r \geq 0.31$, $P < 0.02$). All PEN were positively correlated ($r \geq 0.31$, $P < 0.01$), while serial measures of CHUTE were not ($P > 0.3$). EV was positively correlated with CS within times 1 and 3; EV1 to CS1 (r=0.26, P=0.04), and EV3 to CS3 (r=0.44, $P < 0.01$). The EV data obtained at Time 1 were transformed into a discrete variable, exit velocity ranking (EV RANK; 1 to 3 scale) where 1 equated to < 1 SD below the mean, and 3 equated to > 1 SD above the mean). Repeated measures ANOVA was conducted using the MIXED procedure of SAS for a factorial analysis of time and EV RANK effects on EV and CS. EV was influenced ($P < 0.01$) by time as mean EV decreased from Time 1 (2.82 ± 0.07 m/sec) to Time 3 (2.11 ± 0.10 m/sec). Time also influenced ($P < 0.01$) CS, as mean CS dropped between Time 1 (14.56 ± 0.65 ng/mL) and Time 3 (11.12 ± 0.82 ng/mL). A time by EV RANK interaction ($P < 0.01$) was also observed. Measures of EV can be a valuable tool for both the assessment of cattle temperament and a possible predictor of both temperament and stress responsiveness to future animal handling events.

Key Words: Exit Velocity, Temperament, Cortisol

496 Postpartum productivity of suckled beef cows supplemented with the fibrolytic enzyme Cattle-Ase™. L. Jonovich*[1,2], D. Neuendorff[2], A. Lewis[2], T. Welsh, Jr[1], and R. Randel[2], [1]*Texas Agricultural Experiment Station*, *College Station*, [2]*Texas Agricultural Experiment Station*, *Overton*.

The effect of Cattle-Ase™ (Loveland Industries Inc., Greeley, CO) supplementation on postpartum productivity was studied in suckled multiparous Brahman (B, n=44) and Romosinuano crossbred (R, n=39) cows. Within 24 hours after calving cows were weighed, body condition scored, calves identified and weighed and the cow-calf pair randomly allotted to either a control (C) or Cattle-Ase™ (A) ration. The pairs were maintained in a dry-lot 7d after calving and then moved to pasture for the remainder of the trial. While in pens the diet consisted of free choice Coastal bermudagrass hay and 3:1 corn:soybean meal supplement (1.8 kg/hd/d). Once moved to rye-ryegrass pasture the diets included 4:1 corn:soybean meal supplement (0.9 kg/hd/d). Cattle-Ase™ was supplemented at a rate of 2.5 g/hd/d. Data were analyzed using SAS's ANOVA procedures. Cow ADG to the end of supplementation was affected by treatment (C=4.8±38.4g, A=150.7±36.5g, P<0.01), though ADG until weaning was not affected (P=0.61). Calf ADG to weaning was affected by breed of calf (BXAngus=952.3±35.3g, B=861.8±12.5g, R=845.8±15.7g, P<0.01) and sex of calf (M=889.2±16.0g, F=844.9±12.7g, P<0.01) but not treatment (P=0.95). Calf ADG to the end of supplementation was also affected by sex of calf (M=1027.3±23.1g, F=953.8±16.8g, P=0.04) but not treatment (P=0.13). Cow BCS change to the end of the trial was not affected by treatment (P=0.82) but was affected by breed (B=-0.07±0.10, R=0.51±0.15, P<0.01). Cow BCS through the end of supplementation was also affected by breed (B=0.32±0.08, R=0.89±0.12, P<0.01) but not treatment (P=0.37). Calf weaning weight was not affected by treatment (P=0.89) but was affected by calf breed (BXAngus=203.4±6.9kg, B=189.7 ±3.2kg, R=214.4±4.5kg, P<0.01). Postpartum interval was not affected by treatment (P=0.30) but was affected by breed (B=62.3±3.5d, R=80.2±3.5d, P<0.01). Number of days to conception was also affected by breed (B=78.5±3.2, R=100.6±3.5, P<0.01) but not treatment (P=0.52). It was determined that Cattle-Ase™ supplementation only affected cow ADG during the supplemental feeding portion of the trial while all other parameters were unaffected.

Key Words: Fibrolytic Enzyme, Postpartum, Cattle