The objective was to determine the effectiveness of dietary molybdenum/sulfur (**MS**) in returning lambs to a normocupremic state after COWP use and whether MS inhibited anthelmintic properties of COWP. Male hair breed lambs that were naturally infected with *H. contortus* were administered 0 or 2 g COWP on D 0 and 49 and fed a TMR (DM: 37% corn, 16% wheat mids, 14% soybean meal, 13% cottonseed hulls, 10% alfalfa pellets, 4% molasses, 4% soybean hulls, 1% calcium carbonate, 0.5% salt, 0.5% ammonium chloride, 0.15% vitamin premix, and 27.5 mg/kg lasalocid) with additional calcium carbonate (0.25%; **C**) or MS mineral (74.9 mg/kg sodium molybdate, 0.21% sodium sulfate, and 0.25% calcium carbonate). Lambs were randomly assigned to one of four treatments (2 × 2 factorial; n = 7/treatment). Fecal egg counts (FEC) and packed cell volume (PCV) were determined every 7 d between D 0 and 70. Plasma was collected on D 42 and 70 for determination of aspartate aminotransferase (AST) activity. To simulate a pasture nematode infection, lambs were inoculated between D 21 and 49 with 1500 L3 larvae weekly. FEC were reduced in COWP-treated lambs (COWP × day, $P < 0.03$). By D 21 FEC were reduced from more than 2500 eggs/g (epg) to less than 500 epg in COWP-treated and C-fed lambs and inoculation with L3 larvae failed to increase FEC in these three groups. FEC remained higher in the MS/no COWP group. PCV was reduced in MS-fed lambs (diet × day, $P < 0.001$). Plasma AST activity was similar among all groups on D 42, but 21 d after the second COWP treatment, AST activity was elevated in COWP-treated C-fed lambs (diet, $P < 0.03$; COWP × diet, $P = 0.10$). The MS diet alleviated potential copper toxicity and did not inhibit COWP from depressing *H. contortus* infection. However, the MS diet may have led to copper deficiency, perhaps decreasing natural immunity against gastrointestinal parasites. The complete ration fed to lambs appeared to have a protective effect against *H. contortus* as FEC remained low in C-fed lambs.

Key Words: Copper Oxide, *Haemonchus contortus*, Molybdenum

Swine Species: Swine Nutrition and Management

523 Studies on causes of sow disposal at different parities of 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*.

Different reasons of sow removal (RR) at consecutive parities were analyzed with 13,838 records of Large White sows. Data were from seven pure-line farms having, on average, 5.9% unknown RR. Three traits were defined, each corresponding to a classification of RR (reproductive, no reproductive and others) as a five-category trait, according to parity of removal (0 to 4 or later). Univariate and multivariate linear and threshold models were implemented via animal or sire models. Additional analyses used pooled RR across parities as trait definition. Models included the effects of year, region, season, contemporary group and animal additive genetic effects. The most common RR was related to reproduction (48.5 %). Illnesses of different origin and cause, old age/parity, and sow death or loss accounted for about 18, 7 and 4 % of total culls, respectively. Analyses were by single trait censored model for each reason separately, and by three-trait threshold models where only one trait was observed and the other two censored. Genetic correlations from the last analyses could suggest whether all the reasons could be described collectively as fitness, or whether they need to be addressed separately. Estimates of variance components were consistent across models and methods of analysis, showing unrealistically small estimates of residual variance. The apparent model saturation led to large estimates of heritability, except when an additional uncorrelated random effect of sire was fitted in the model. With that model, estimate of heritability for reproductive RR in different parities was 0.09 and 0.07 using linear and threshold model, respectively. Data structure and volume are major limitations in studies of sow survival.

Key Words: Sow Removal, Sow Disposal, Sow Culling

524 Relations between lactation-, and slaughter/carcass traits in pigs. E. F. Knol*, D. T. Prins, and R. Bergsma, *Institute for Pig Genetics (IPG), Beuningen, The Netherlands*.

Pork industry benefits from uniformity. Meat companies start to tighten weight grids and implement bonus/malus systems for carcass grading. We were interested in the relation between early development and final slaughter traits in pigs.

Data came from a 180 (3 week batch) farrow to finish experimental farm testing 6 sire lines on 3 dam crosses. 14.500 piglets, including stillborns, with birth-, and weaning weights, foster and mortality data were available. Resulting in 6700 slaughter records and 1688 dissected carcasses. Birth deviation is the difference between individual birth weight and litter average to give indication of competition challenge.

Within litter variation in weight at birth and at weaning was not related to any of the slaughter and carcass traits (not in the table). Absolute birth weight was equally or more important than relative birth weight. High carcass gain started already at birth and (auto) correlated with all youth stages. Fat accretion appeared to start during nursery. Ham, but not loin, deboned weight was positively correlated with birth-, and weaning weight.

In a subset of the data (crossfostered (22%) piglets; n=1541), we added biological mother (sow) and nurse sow to model 1. Both HGP-fat and HGP-loin were significantly related (***) to sow, and not to nurse, suggesting a genetic influence and no milk quality or quantity effect. In contrast, lactation gain related only to nurse (***). Variation in carcass gain was related (***) equally to both sow and nurse, as was nursery gain (***).

Residual correlations between lactation-, and slaughter- traits. Corrected for batch, sire line, dam cross, sexe (model 1) and carcass weight (2).

	Birth weight	Birth deviation	Lactation gain	Weaning weight	Nursery gain
Carcassgain 1	0.33 ***	0.26 ***	0.36 ***	0.38 ***	0.43 ***
HGP fat 2	-0.06 ***	-0.08 ***	-0.04 *	-0.04 **	0.07 ***
HGP loin 2	-0.05 ***	ns	ns	ns	ns
Loinweight 2	ns	ns	ns	ns	ns
Ham weight 2	0.14 ***	0.09 **	0.06 *	0.10 ***	ns

ns non significant; * P<0.01; ** P<0.001; *** P<0.0001

Key Words: Pigs, Lactation, Carcass Quality

525 Estimation of variance components including competitive effects of Large White growing gilts. J. Arango*[1], I. Misztal[1], S. Tsuruta[1], W. Herring[2], and M. Culbertson[2], [1]*University of Georgia*, *Athens*, [2]*Smithfield Premuim Genetics*, *Roanoke Rapids, NC*.

Records of on-test average daily gain (g) of Large White gilts were used to estimate variance components of direct and associative genetic effects. Models included the effects of contemporary group (farm-barn-batch), birth litter, pen-group and two additive genetic effects: direct and associative. The total genetic variance was a function of the number of competitors in a group, the additive relationships between the animal performing the record and its pen mates, and the additive relationships between pen mates. To partially account for differences in pen size and in relationships among members of the pen a covariable ($qi = 1, 1/n$ or $1/n^{½}$) was added to the associative genetic effect. There were 4,946 records from 2,409 litters and 362 pen-groups. Pen size ranged from 12 to 16. There were, on average, 1.2 and 2.6 full and half sibs per pen. Within the BLUPF90 family of programs, the mixed model equations can be set up directly. For variance component estimation, simple programs (REMLF90 and GIBBSF90) worked without modifications, but the more optimized programs

did not. Analyses by restricted maximum likelihood converged slowly. Estimates obtained using the three values of qi were similar. Estimates of direct and associative heritability were 0.15 and 0.03, respectively, and their correlation was 0.1. A grid search showed that the likelihood function was almost flat when the additive genetic associative effect was fitted. Estimation of the competitive effects may be more reliable with more relationships across and within pens, when pen sizes are lower, and when the environment forces higher expression of competitive effects. The last condition may be particularly relevant in commercial populations, where housing is denser and food limited.

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Key Words: Genetic Effects, Associative Effects, Growth

526 The effect of different grinding grades of soybean hulls on nutrient digestibility and performance in starting pigs (15-30kg). I. Moreira*[1], M. Kutschenko[1], D. Paiano[1], C. Scapinello[1], A. E. Murakami[1], and A. R. B. Qradros[1,2], [1]*Universidade Estadual de Maringá*, *Maringá, Paraná, Brazil*, [2]*Universidade Federal de Santa Maria*, *Santa Maria, Rio Grande do Sul, Brazil*.

The effects of ground soybean hulls (SH) on the nutritional value of SH for starting pigs were studied in two experiments. Soybean hulls were ground in different screen-opening diameters (2.0, 2.5, 3.0 and 3.5mm). Experiment I consisted of a digestibility trial using 12 barrows (21.9 ± 1.29kg of BW). On a feed basis, SH values were: DM= 92.22%; GE= 3,850 kcal/kg; CP= 15.76%; Ca=0.44%; P= 0.26%; ADF= 40.48%; NDF= 55.22%; KOH protein solubility= 28.96%; and urease activity= 0.324. Values for geometric mean particle size (GMP) were: S2.0 (2.0mm)= 436µm; S2.5 (2.5mm)= 439µm; S3.0 (3.0mm)= 545µm; S3.5 (3.5mm)= 751µm; and WSH (whole SH)= 2,043µm. Energy values of SH were 2,207kcal of ME/kg for S2.0; 2,278kcal of ME/kg for S2.5; 1,932kcal of ME/kg for S3.0; 1,775kcal of ME/kg for S3.5; and 1,325kcal of ME/kg for WSH. Comparison between SH and WSH indicated better digestibility coefficient (DC) of DM and GE for S2.0 and S2.5 and worse DC of CP for S3.5. The DE of S2.0 and S2.5 were higher for WSH. Results suggest that grinding SH in a screen up to 2.5mm improves DM and GE digestibility, whereas digestibility of CP is improved in screen up to 3.0mm. In Experiment II the nutritional and economic feasibility of SH (S2.5) for starting pigs was evaluated. Diets with increasing levels of SH (0, 3, 6, 9 and 12%) were formulated. Forty piglets (15-30 kg) were allotted into a RCB, with two piglets per experimental unit. There was a quadratic effect on daily weight gain (DWG) due to SH inclusion, with the worst DWG at 7.75% inclusion. Daily feed intake (DFI), feed: gain ratio (FGR) and plasma urea nitrogen (PUN) were not affected by SH inclusion. Comparison between inclusion levels against 0% level indicated the worst DWG at 6% inclusion level. There were no economic advantages in using SH on starting pig diets. The inclusio of SH affects the individual feed intake of piglet and leads to high CV of variables, which impede detection of difference in the treatment effects of SH. Results suggest that the utilization of SH on starting pigs diet is economically unfeasible.

Acknowledgements: CNPq, UEM

Key Words: Alternative Feedstuffs, Nutritional Evaluation, Piglets

527 Reduced crude protein effects on aerial emissions from swine. W. Powers*[1], S. Bastyr[1], and B. Kerr[2], [1]*Iowa State University*, *Ames*, [2]*USDA-ARS*, *Ames, IA*.

The effects of feeding reduced protein diets on air emissions was evaluated using groups of barrows housed in rooms with continuously measured gas concentrations and airflows. Pig weights and feed intake were recorded weekly over the course of four feeding phases: G1 (beginning at 24.5 kg BW), G2 (55.3 kg BW), F1 (87.2 kg BW), and F2 (111.4 kg BW). Pigs were offered one of three isocaloric, isolysinic diets: a control diet (C), a low crude protein diet (LCP) and an ultra low crude protein diet (ULCP), each supplemented with varying amounts of amino acids. Formulated CP of G1 was 22.5, 20.0, and 18.4% for the C, LCP, and ULCP diets. As feeding phases progressed there was a decrease in the formulated CP such that F2 was formulated to contain 16.6, 15.4, and 13.8% CP in the C, LCP and ULCP diet. Dietary treatment had no effect on ADG, ADFI or F:G (P<0.05). Pigs fed the LCP diet had greater intakes than pigs fed the C or ULCP diets during the grower phases but reduced intake during the finisher phases (P=0.0287). A diet effect was observed for average daily NH_3 concentrations (P<0.0001) with concentrations from the LCP diet-fed rooms 16% less than the C diet (3.86 vs. 4.57 ppm). Ammonia concentrations were reduced 25% (2.93 ppm) in the ULCP diets compared to the LCP diet and 36% compared to the C. Airflow-corrected NH_3 emission rates were 26.8, 21.0, and 14.5 mg min^{-1} for the C, LCP, and ULCP diets, corresponding to a daily mass of NH_3 emitted per kg of animal liveweight, of 88.0, 68.9, and 46.0 mg kg^{-1}. Feeding phase effects were observed for NH_3 concentration, NH_3 emission rate, daily mass emitted and daily mass per unit of liveweight with increases from G1 to G2 followed by a decrease from F1 to F2. Similarly, feeding phase effects were observed for hydrogen sulfide concentration and daily emitted mass of hydrogen sulfide per unit of liveweight. Hydrogen sulfide concentration and emissions were not different between rooms offered the different dietary treatments. Diet had no effect on mass of manure produced however TKN and NH_3-N concentration decreased with decreasing diet CP (7.9, 6.7, 5.7% and 5.4, 4.4, and 3.5%, respectively for C, LCP and ULCP diets).

Key Words: Emissions, Swine, Diet Modification

528 Effects of albuterol on the growth and carcass characteristics of finishing pigs. B. Richert*[1], R. Hinson[1], R. Marchant-Forde[2], D. Lay, Jr.[2], K. McMunn[2], and J. Marchant-Forde[2], [1]*Purdue University*, *West Lafayette, IN*, [2]*USDA-ARS, Livestock Behavior Research Unit*, *West Lafayette, IN*.

The use of ractopamine as a repartitioning agent has become increasingly popular in US pig production. This experiment examined the effects in finishing pigs of a pure form of albuterol, a beta agonist proposed to deliver positive production effects without negative behavioral effects. The study used 192 pigs (88.8±.9 kg BW) housed in groups of six in 32 pens (1.4 m x 4.1 m) and assigned to one of four treatments: 1) Control - 0 ppm albuterol, 2) ALB-2R - diet 1 with 2 ppm of the pure R-enantiomer of albuterol, 3) ALB-4R - diet 1 with 4 ppm of pure R-albuterol, or 4) ALB-8RS - diet 1 with 8 ppm of a racemic mixture of R- and S-enantiomers. All diets supplied 18.3% CP, 1.1% lysine and 3534 kcal ME/kg and were offered ad libitum for 4-wk. All pigs were weighed and pen feed intakes recorded weekly. At slaughter, individual hot carcass weights (HCW) and measurements of 10th rib loin eye area (LEA), color, marbling, firmness, and backfat, last lumbar and midline backfat depths were collected. Data were analyzed using Proc GLM of SAS, with pen as the experimental unit. Overall, ALB-2R and ALB-4R pigs had greater ADG than control pigs (1.30 and 1.26 vs 1.13 kg/d; P<0.01 and P<0.05, respectively) and at slaughter, were heavier than control pigs (124.6 and 124.7 vs 120.1 kg, respectively; P<0.01). Overall, ALB-8RS pigs had lower ADFI (P<0.05) and control pigs had poorer G:F (P<0.001) than the other three treatments, respectively. Control pigs had 5-6 kg lighter HCW (P<0.001), 2-3% less carcass yield (P<0.001), 5.6 cm^2 smaller LEA (P<0.01), greater 10th rib (3-4 mm, P<0.01) and last lumbar backfats (2 mm, P<0.05) than all albuterol fed pigs. However, control pigs had higher loin eye color (P<0.05) and marbling (P<0.001) scores than all albuterol-treated pigs and higher firmness scores (P<0.05) than the R-albuterol treated pigs. As little as 2 ppm R-albuterol has a positive effect on pig growth and carcass composition. However, negative effects of albuterol on meat quality requires further research.

Key Words: Albuterol, Pigs, Growth

529 Effect of diet supplementation with grass-meal and antioxidant supplementation on performance and carcass composition of Duroc and Landrace cross- bred pigs. P. G. Lawlor*[1], P. B. Lynch[1], J. Kerry[2], and S. Hogan[2], [1]*Moorepark Research Centre*, *Fermoy, Co. Cork, Ireland*, [2]*University College*, *Cork, Ireland.*

The objectives of this study were to assess (1) the effect of diet dilution with grass-meal and (2) the effect of supplemental antioxidant on pig performance. Pigs (n = 1080) from Duroc (D) or Landrace (D) boars mated to crossbred sows were weaned (mean 26 d; 8.2kg), into same-breed, single-sex groups of 15 (n = 72). At 21 days post-weaning, pigs were allocated at random to the following treatments: (1) High density diets (HD) to slaughter, (2) Diets with grass-meal (GM) to slaughter, (3) Diets with GM to 50kg followed by HD. (4) Diets with GM to 80kg followed by HD. (5) Diets with GM to 80kg followed by a vitamin E enriched (200 mg alpha-tocopherol/kg) diet with 50g/kg of 00-rapeseed oil, (6) As 5 with tea extract instead of alpha-tocopherol. Pigs were slaughtered at approximately 105kg liveweight. Interaction effects were not significant. Males were more efficient than females (G:F: 0.41 v 0.38; $P < 0.01$) but had similar growth rates. Pigs from L boars grew at the same rate (707 v. 694g/d; NS) but more efficiently (G:F 0.39 v. 0.38; $P < 0.01$) from weaning to slaughter and had leaner carcasses than pigs from Duroc sires (596 v. 592 g/kg; $P < 0.01$). Feeding GM depressed pig performance (growth rate and G:F). Growth rates from weaning to slaughter were 730, 675, 710, 686, 698 and 704g/d; $P < 0.05$ for treatments 1 to 6 respectively while G:F values were 0.41, 0.36, 0.40, 0.37, 0.38 and 0.39; $P < 0.01$. Supplementation of the diet in the final stages of finishing with vitamin E or tea extract had little effect on pig performance.

Key Words: Grass Meal, Fiber, Antioxidant

530 Evaluation of low-phytate soybeans on swine performance and phosphorus excretion. W. Powers*, E. Fritz, W. Fehr, and S. Bastyr, *Iowa State University*, *Ames*.

A study was conducted to evaluate the impacts of feeding full-fat extruded low-phytate (LP) soybeans on performance and P excretions from growing swine. Ninety-six crossbred barrows (initail BW = 18 kg, end BW = 70 kg) were allocated to 24 pens and fed one of four treatment diets: normal phytate soybeans without supplemental phytase (NP-np), normal phytate soybeans plus 500 FTU kg^{-1} phytase (Ronozyme P (CT) 2500; DSM Nutritional Products; Basel, Switzerland; NP-p); LP soybeans (USDA-ARS line CX1834-1) without supplemental phytase (LP-np) and LP soybeans plus phytase (LP-p). Four feeding phases occurred that were 2, 3, 3, and 2 wk in duration. All diets within a feeding phase were formulated to be isocaloric, isolysinic and similar in non-phytin phosphorus content; allowing P content to vary. Non-phytin P content was 0.45, 0.36, 0.32, and 0.32% for phase 1-4, respectively. Pens were randomly assigned to treatments at the start of each feeding phase. Individual pig weights and pen fecal samples were collected and feed disappearance recorded weekly. No phytase inclusion nor soybean source effects were observed for pen ADG, ADFI and F:G. Apparent digestibility of DM and OM were not different among treatment groups. Apparent digestibility of P was greater when pigs were offered diets containing the LP soybeans (49.1% vs. 42.3%; $P<0.0001$) and less when diets included phytase (44.1% vs. 47.3%; $P<0.0001$). Total P (TP) and water-soluble P (WSP) excreted were affected by diet (TP: 19.7, 18.1, 16.7, 13.9 g kg^{-1}; $P<0.0001$ and WSP: 10.9, 10.2, 8.9, 8.2 g kg^{-1}; $P<0.0001$ for NP-np, NP-p, LP-np, and LP-p diets, respectively). Inclusion of phytase decreased TP and WSP excreted ($P<0.0001$) as did use of LP soybeans ($P<0.0001$). Diet effects on the fraction of excreted TP that was WSP were observed ($P<0.0001$) however, source of soybeans did not result in a significant difference (57%; $P>0.10$). However, inclusion of exogenous phytase in diets did increase the proportion of TP that was excreted as WSP (59% vs. 55%; $P<0.0001$ for diets with and without phytase, respectively). The findings suggest that there is a viable need for LP soybeans to minimize farm environmental impact.

Key Words: Swine, Low-Phytate, Phosphorus

Animal Behavior and Well-being: Sow and Boar Behavior and Housing

531 Sexual behaviors in boars treated with an inhibitor of prostaglandin synthesis. M. Estienne*, A. Harper, and W. Beal, *Virginia Polytechnic Institute and State University*, *Blacksburg*.

Previous work from our laboratory demonstrated that a single i.m. injection of PG (Lutalyse; Pfizer Inc., New York, NY) acutely enhanced sexual behaviors in boars via some undetermined mechanism. The objective of this experiment was to test the hypothesis that an acute, endogenous release of PG is necessary for the expression of normal sexual behaviors. Landrace x Yorkshire boars, trained to mount an artificial sow and allow semen collection, were moved to a semen collection pen 30 min after i.m. treatment with 500 mg flunixin meglumine (Flunixamine; Fort Dodge Animal Health, Fort Dodge, IA) (n = 6), a potent inhibitor of PG synthesis, or 10 mL 0.9% saline (n = 6). One wk later, the experiment was repeated, but boars that previously received Flunixamine were treated with saline and vice versa. The interval between entering the collection pen and first interaction with the artificial sow (18.5 vs. 13.3 s; SE = 2.7; P = 0.21), the interval between entering the collection pen and start of ejaculation (225.5 vs. 294.0 s; SE = 73.5; P = 0.52), duration of ejaculation (393.7 vs. 350.9 s; SE = 34.1; P = 0.40), false mounts (mounting artificial sow but dismounting before allowing a complete collection of semen) (1.5 vs. 1.0; SE = 0.6; P = 0.58), and libido score (1 to 5; 1 = displayed no interest in artificial sow, 5 = mounted artificial sow and allowed semen collection) (4.3 vs. 4.5; SE = 0.1; P = 0.34) were similar for Flunixamine-treated and control boars, respectively. We suggest that an acute, endogenous increase in PG synthesis and release is not a necessary antecedent for the display of normal sexual behaviors in boars exposed to an artificial sow for semen collection.

Key Words: Boar, Prostaglandin, Sexual Behavior

532 The effects of boar presence on the frequency of agonistic behaviour, occurrence of shoulder scratches and stress response of group-housed bred sows. M. J. Séguin*[1], R. M. Friendship[1], R. N. Kirkwood[2], A. J. Zanella[2], and T. M. Widowski[1], [1]*University of Guelph*, *Guelph, ON*, [2]*Michigan State University*, *East Lansing*.

The effects of boar presence on the expression and consequences of aggression among newly mixed bred sows were investigated. Groups of fifteen sows were exposed to one of three levels of boar presence in an incomplete block design (N=5 per treatment): PHYSICAL (boar in pen with sows, 2.15m^2/sow), FENCELINE (boar housed in pen opposite sows, 2.3m^2/sow) or CONTROL (no boar present in room, 2.3m^2/sow). The boar was removed six days after mixing. During the 24h pre- and 24h post-mixing periods the number of shoulder scratches were assessed and saliva samples were collected twice daily. All incidences of sow-to-sow physical contact (bite, body knocks, fights, head knocks and levering) or non-physical (threat) interactions and the duration of fights were collected from video-recordings from the point of mixing to 24h post-mixing (avg. 22h). Data were analyzed using PROC MIXED with group as the experimental unit and boar and block as random effects. Means were compared using a Tukey test. During the 24h post-mixing period, treatment had no effect on the frequency of physical (Control, 5.3 ± 0.9; Fenceline, 8.9 ± 1.0; Physical, 7.5 ± 1.2; $P> 0.1$) and non-physical interactions (Control, 4.9 ± 0.4; Fenceline, 6.5 ± 0.9; Physical, 6.2 ± 2.4, $P> 0.1$) occurring per group per hour. The duration of fighting (s/group/h) was also unaffected by treatment (Control, 58.9 ± 16.8; Fenceline, 39.1 ± 4.4; Physical, 37.1 ± 6.5, $P> 0.1$). The mean scratch score was significantly lower for PHYSICAL versus CONTROL (2.0 ± 0.1 vs. 2.6 ± 0.3; $P <0.05$) 24h post-mixing. Salivary cortisol (ng/mL) was higher for PHYSICAL versus FENCELINE treatments 24hr post-mixing (0.41 ± 0.12 and 0.19 ± 0.04, $P<0.05$). There is no clear advantage of boar presence on reducing aggression and stress among newly mixed bred sows.

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Key Words: Sow, Aggression, Boar