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

533 Effects of space on individual- and group-kept dry sows: behavior and immune status. J. L. Salak-Johnson*, M. A. Sutherland, M. J. Horsman, S. L. Rodriguez-Zas, and S. R. Niekamp, *University of Illinois*, *Urbana*.

The effect of grouping pregnant primiparous and multiparous sows at different space allowances was studied to determine impacts of space on sow behavior and immune status. Six replicates of 5 sows per treatment were allotted to each of 4 experimental treatments: groups 5 at (a) 1.4, (b) 2.3, or (c) 3.3 m2/sow or (d) individual stall (1.3 m2/sow) for two successive parities. Behavior data were collected between gestation d 90 and 110. Blood samples were taken 1-h post-feeding (0800 h) on gestation d 25, 30, 60, 90, 108, and 110. Data were analyzed using PROC MIXED with repeated measures. Gestation environment influenced number of times a sow was observed lying, sitting, and drinking. Frequencies of sitting ($P<0.001$) and drinking ($P<0.05$) were higher among sows kept in stalls than those in groups. Lying was highest ($P<0.05$) among sows grouped at 3.3 m2/sow. Frequencies of walking and oral-nasal-facial behavior (ONF) were influenced by space. As space increased, walking increased among group-kept sows ($P<0.01$). A quadratic trend for frequency of ONF occurred among group-kept sows ($P<0.05$.) such that ONF was higher in sows kept at 2.3 m2/sow. Sow BW influenced lying and standing behaviors; as BW increased the frequency of lying increased ($P<0.05$). Conversely, heavier sows spent less time standing ($P<0.05$). Gestation environment influenced cortisol and immune status. Sows kept in stalls had higher cortisol ($P=0.08$), N:L ratio ($P<0.05$), phagocytosis ($P<0.05$), and B-cell proliferation ($P<0.05$) than did those in groups. Conversely, those kept in groups had higher ($P<0.01$) lymphocytes. Among group-kept sows, space allowance influenced B-cell proliferation and NK cytotoxicity. As space increased, B-cell proliferation increased ($P=0.01$) and NK decreased ($P=0.01$). Several other immune measures (e. g., total WBC, N:L ratio, T-cell proliferation, phagocytosis) were influenced by sow BW ($P<0.05$). Also, immune status was influenced by gestational period. Overall, gestation environment had limited impact on behavior and immune traits studied.

Key Words: Environment, Immune, Behavior

ADSA Production Division Symposium: Forage Analysis: Concept to Application

534 Dairy nutritionist survey on forage carbohydrate analysis: Implications for methodology application. L. Chase*[1], M. Raeth-Knight[2], J. Linn[2], and W. Mahanna[3], [1]*Cornell University*, *Ithaca, NY*, [2]*University of Minnesota*, *St.Paul*, [3]*Pioneer Hi-Bred International*, *Des Moines, IA*.

A survey of field dairy nutritionists was conducted to assess their current use of carbohydrate analysis in feed programming. This survey was specific to NDFD (NDF digestibility), starch and sugar analyses. The information in this abstract is based on about 200 returned surveys. NDFD analysis was never used by 14% of the respondents. Occassional use of NDFD was reported by 52% of respondents and routine use by 33%. Corn silage and haycrop silages were the primary forages analyzed for NDFD (>90% of survey responses). Analytical methods used to obtain NDFD values were wet chemistry (26%), NIR (14%) or both (54%); however, preferences of analytical method for NDFD were wet chemistry (50%), NIR (16%) or no preference (34%). The analytical time points used to determine NDFD were 24 hours (29%), 30 hours (40%) and 48 hours (36%). Respondents indicated a preference for 24 hours (49%) followed by 30 hours (39%) and 48 hours (12%). The most common uses of NDFD results were to make crop feeding decisions (50%), to adjust fiber digestion rates in models (49%) and to compare against similar forages in previous years (46%). The use of a certified lab was indicated as important by 85% of the respondents. The use of either NFC or NSC in ration formulation was indicated by 91% of the respondents. Over half of the respondents (54%) indicated that an NFC (or NSC) value was as good as individual starch or sugar values for ration formulation. The results of this survey have significant implications for forage testing labs. There is a strong preference that forage labs be certified. There are also preferences for the use of wet chemistry methods to obtain NDFD values. This will require forage labs to obtain better standardization of NDFD analytical procedures and measurement time points. These results also indicate that additional education is needed regarding the applicability of NIR for NDFD analysis.

Key Words: NDFD, Forage Analysis, NIR

535 Starches and sugars: conceptual and analytical challenges. M. B. Hall*, *U. S. Dairy Forage Research Center, USDA-ARS*, *Madison, WI*.

For use in diet formulation, partitioning of carbohydrates should reflect differences in digestion and fermentation characteristics and effects on animal performance. Indices of digestibility would be useful. Partitioning of NFC has been problematic in terms of designating fractions based upon nutritional characteristics, and selecting analytical methods to separate them. The relative dearth of information on digestion characteristics of various NFC and their interactions in diets means that fractions will not soon be perfectly established. Starch and sugars are fractions for which there is some consensus. Native starch is an α-(1-4)-linked-glucan with α-(1-6) linked branch points. In feedstuffs, it can be analyzed by specific enzymatic hydrolysis and detection of glucose, or by polarimetry, though sugars can interfere with both analyses. Key challenges with starch analysis include reliability of estimates (varies by lab and method) and description of digestibility; the latter is greatly affected by processing and source. "Sugars" are an ill-defined fraction. They may include mono-. di-, and oligosaccharides (80% ethanol- and water-soluble) and water-soluble polysaccharides such as fructans. The nutritional equivalence of fructans, sucrose, glucose, and fructose has not been well explored. Resolution is needed as to which carbohydrates comprise sugars before a definitive analytical method can be chosen. Another challenge when dealing with carbohydrates that vary greatly in molecular weight is the basis on which to express them to reflect their value to animal and microbes. The greater the degree of polymerization, the greater the proportional content of hexose after accounting for water incorporated for hydrolysis. For example, 1 kg of glucose (monosaccharide) = 1 kg of hexose, whereas 1 kg of sucrose (disaccharide) or starch (polysaccharide) yield 1.05 and 1.11 kg of hexoses released upon hydrolysis, respectively. Expressing carbohydrates on a hexose basis would seem to be more reflective of equivalence than is current practice. Improved methods and nutritionally relevant definitions will improve the utility of these carbohydrate fractions in ruminant nutrition.

Key Words: Sugar, Starch, Analysis

536 Applying starch and sugar analyses in dairy nutrition. S. Emanuele*, *Land O' Lakes Inc.*, *Caledonia, NY*.

The objective is to review why and how starch and sugar analyses are used in routine dairy ration formulation. If one balances dairy diets based on crude protein, NDF and NEl concentration, it is not necessary to analyze feeds for starch and sugar. It has become necessary to utilize these analyses because of the adoption of a metabolizable energy and protein system for balancing dairy diets. Published research indicates that the metabolizable energy and protein yield of a specific diet is influenced by the fermentation of carbohydrates. When feeds are analyzed for starch and sugar we observe the following: 1. Starch and sugar content of corn silage are highly variable and influenced by variety, grow-