

**89 Effect of selection for residual feed intake on sow reproductive performance and efficiency.** J. M. Young<sup>\*1</sup>, R. Bergsma<sup>2</sup>, E. Knol<sup>2</sup>, J. F. Patience<sup>1</sup>, and J. C. M. Dekkers<sup>1</sup>, <sup>1</sup>*Iowa State University, Ames*, <sup>2</sup>*Institute for Pig Genetics, Beuningen, the Netherlands*.

Feed efficiency is of increasing importance in the swine industry. When developing strategies for genetic improvement of feed efficiency, it is important to evaluate correlated responses to selection. Using unique lines of pigs that have been developed at Iowa State University, the objective of this experiment was to evaluate sow reproductive performance and lactation efficiency in two lines of Yorkshire pigs, one which was selected over 6 generations for decreased RFI (select line) and a control line which was randomly selected for four generations and then for increased RFI. After 6 generations, the select line had two more piglets farrowed ( $P < 0.01$ ), one more piglet born alive ( $P < 0.1$ ), heavier piglets at birth and weaning ( $P < 0.05$ ), and piglets which had greater pre-weaning growth rates ( $P < 0.05$ ), with no difference in number of piglets weaned ( $P = 0.77$ ). However, this increased reproductive performance for the select line was at a cost to the sow; with no differences in body weight or composition at the start of lactation (estimated from ultrasonic backfat), the select line lost more weight and fat mass during lactation ( $P < 0.0001$ ). The select line consumed significantly less feed during lactation only in generation 6 ( $P < 0.001$ ). Energy output in the form of piglets was higher ( $P < 0.05$ ) in the select line when adjusted for energy input above maintenance requirements from feed intake and body mobilization. However, lactation efficiency, a ratio of output to input, did not differ between the two lines. In conclusion, selection for RFI has positively affected litter sizes and pre-weaning growth but has negatively affected sow body condition change during lactation. Funding provided by the National Pork Board, the Iowa Pork Producers Association, and National Needs Fellowship grant no. 2007-38420-17767.

**Key Words:** swine, residual feed intake, reproduction

**90 Comparison of choice white grease and soybean oil for finishing pigs.** Y. Liu<sup>\*</sup>, D. Y. Kil, V. G. Perez-Mendoza, and J. E. Pettigrew, *University of Illinois, Urbana*.

A recent report showed higher swine NE for choice white grease (CWG) than for soybean oil (SBO). The present study was conducted to determine whether practical responses of finishing pigs would verify that difference. Pigs ( $n = 135$ ,  $64.8 \pm 6.2$  kg BW) were randomly assigned to 5 dietary treatments: 1) a corn-soybean meal diet without added fat (C), 2) C + 3% SBO, 3) C + 6% SBO, 4) C + 3% CWG, and 5) C + 6% CWG. The pigs were in 9 replications with 3 pigs/pen. There were 2 diet phases, d 1 – 21 for phase I and d 21 – 49 for phase II. Dietary treatments within each phase were formulated to contain equivalent standardized ileal digestible lysine/Mcal of ME. The ADG, ADFI and G:F were measured during each phase and overall. At the beginning and end of this experiment, ultrasound was used to measure backfat depth at the last rib (BFLR) and 10th rib (BFTR), and muscle depth at the last rib (MDLR) and 10th rib (MDTR). The changes of BFLR, BFTR, MDLR, and MDTR between initial and final measurements were calculated. Pigs fed fats had significantly higher ( $P < 0.05$ ) G:F in phase I (0.41 vs. 0.38), phase II (0.33 vs. 0.30) and overall (0.36 vs. 0.33), lower ( $P = 0.05$ ) ADFI (3.33 vs. 3.54 kg/d) in phase II, and tended ( $P = 0.06$ ) to have more increase in BFLR than pigs fed the control diet. Pigs fed 6% fats had higher ( $P < 0.01$ ) G:F in phase II (0.35 vs. 0.32) and overall (0.38 vs. 0.35) than pigs fed 3% fats. Pigs fed CWG had higher ( $P < 0.05$ ) ADG (1.28 vs. 1.19

kg/d) and G:F (0.42 vs. 0.40) in phase I than pigs fed SBO. Compared to SBO, CWG enhanced ( $P < 0.05$ ) the increase in MDTR. In phase I, increasing CWG from 3% to 6% increased ADG and G:F, but the direction was opposite with SBO (interaction,  $P < 0.05$ ). In conclusion, these results support a greater energy value for CWG than for SBO.

**Key Words:** soybean oil, choice white grease, growing-finishing pigs

**91 Innate immune responses of bovine mammary epithelial cells triggered by toll-like receptor signaling are enhanced by 1,25-dihydroxyvitamin D<sub>3</sub>.** C. D. Nelson<sup>\*1,2</sup>, T. A. Reinhardt<sup>2</sup>, D. C. Beitz<sup>1</sup>, and J. D. Lippolis<sup>2</sup>, <sup>1</sup>*Iowa State University, Ames*, <sup>2</sup>*National Animal Disease Center, USDA, Ames, IA*.

We have recently shown that 1,25-dihydroxyvitamin D<sub>3</sub> (1,25(OH)<sub>2</sub>D<sub>3</sub>) plays an important role in the bovine innate immune response. 1,25(OH)<sub>2</sub>D<sub>3</sub> is the active vitamin D metabolite and is produced from the major circulating metabolite, 25-hydroxyvitamin D<sub>3</sub>, by the enzyme 1 $\alpha$ -hydroxylase (1 $\alpha$ -OHase). Bovine monocytes express 1 $\alpha$ -OHase in response to toll-like receptor (TLR) recognition of bacteria and we have evidence that 1 $\alpha$ -OHase is expressed in mammary tissue during mastitis. Production of 1,25(OH)<sub>2</sub>D<sub>3</sub> by 1 $\alpha$ -OHase in activated monocytes amplifies the expression of inducible nitric oxide synthase (iNOS) and the chemokine RANTES. Mammary epithelial cells (MEC) have been shown to express iNOS and RANTES in response to TLR signaling, but the effects of 1,25(OH)<sub>2</sub>D<sub>3</sub> on expression of iNOS, RANTES, and other vitamin D responsive genes in MEC were not known. The objective of this experiment was to determine the effects of 1,25(OH)<sub>2</sub>D<sub>3</sub> and lipopolysaccharide (LPS) on iNOS, RANTES, and S100 calcium binding protein A12 (S100 A12) gene expression in bovine MEC. Primary cultures of MEC were derived from mammary biopsies of Holstein cows in mid-lactation. To determine the effects of 1,25(OH)<sub>2</sub>D<sub>3</sub> and LPS on MEC, cultures were treated with 0, 0.1, 1, or 10 nM 1,25(OH)<sub>2</sub>D<sub>3</sub> along with 0 or 1  $\mu$ g/mL lipopolysaccharide (LPS) for 16 hours. Gene expression was measured by real-time PCR. In MEC stimulated with LPS, expression of iNOS and S100 A12 increased with 1,25(OH)<sub>2</sub>D<sub>3</sub> dose ( $P < 0.05$ ). In the absence of LPS, the effects of 1,25(OH)<sub>2</sub>D<sub>3</sub> on iNOS and S100 A12 expression were minimal in comparison to the combined effects of LPS and 1,25(OH)<sub>2</sub>D<sub>3</sub>. RANTES gene expression in MEC did not increase with 1,25(OH)<sub>2</sub>D<sub>3</sub> treatment as previously observed in activated monocytes, but did increase significantly with LPS treatment alone ( $P < 0.05$ ). In conclusion, iNOS and S100 A12 expression induced by toll-like receptor signaling in mammary epithelial cells is up-regulated by 1,25(OH)<sub>2</sub>D<sub>3</sub>. Production of 1,25(OH)<sub>2</sub>D<sub>3</sub> by 1 $\alpha$ -OHase in inflamed mammary tissue, then, may increase iNOS and S100 A12 expression in MEC during mastitis.

**Key Words:** vitamin D, immune response, mastitis

**92 Effects of creep diet complexity on individual consumption characteristics and growth performance of neonatal and weanling pigs.** R. C. Sulabo<sup>\*</sup>, M. D. Tokach, J. R. Bergstrom, J. M. DeRouchey, R. D. Goodband, S. S. Dritz, and J. L. Nelssen, *Kansas State University, Manhattan*.

In Exp. 1, 96 sows (PIC C29) and their litters were used to determine the effects of creep diet complexity on preweaning performance and proportion of piglets consuming creep feed. Treatments were: (1) no creep feed ( $n = 26$ ); (2) simple creep diet ( $n = 26$ ); and (3) complex

creep diet ( $n = 44$ ). Creep feed was offered for 3 d prior to weaning. Pigs fed the complex creep diet had greater ( $P < 0.03$ ) preweaning ADG and tended to have greater ( $P < 0.06$ ) total gain than pigs fed the simple creep diet, with no creep pigs intermediate. Litters fed the complex creep diet consumed twice the total ( $1.24$  vs.  $0.62$  kg;  $P < 0.001$ ) and daily ( $412$  vs.  $205$  g;  $P < 0.001$ ) creep feed intake of litters fed the simple creep diet. The high-complexity creep diet improved ( $P < 0.001$ ) the proportion of eaters from 28 to 68%. A greater ( $P < 0.10$ ) proportion of eaters were nursing middle (57%) and posterior teats (52%) than anterior teats (38%). In Exp. 2, 675 pigs from Exp. 1 (initial BW  $6.4$  kg;  $21.2 \pm 0.2$  d) were used to determine whether social facilitation occurs between eaters and non-eaters in commercial nursery groups. Treatments were: Non-eaters (pigs that were not provided any creep feed or non-eaters of creep feed), eaters (pigs that consumed creep feed), and a mixed group (51% non-eaters and 49% eaters). Each treatment had 9 replicate pens with 25 pigs per pen. In the initial 3 d postweaning, eaters had greater ( $P < 0.01$ ) ADG and ADFI than non-eaters, with the mixed group intermediate. Overall (d 0 to 28), ADG of the eater group was higher ( $326$  vs.  $307$  g;  $P < 0.05$ ) than the non-eater group. In conclusion, the high-complexity creep diet improved preweaning ADG, creep feed intake, and the proportion of eaters. Eaters had improved postweaning feed intake, ADG, BW uniformity and reduced postweaning lag. Mixing eaters with non-eaters within pens in large commercial groups did not stimulate feed intake and daily gains of non-eaters, which indicates that social facilitation did not occur.

**Key Words:** creep feeding, complexity, pigs

**93 Effects of wet corn gluten feed and wet distillers grains plus solubles on ruminal pH, feed intake and ruminal hydrogen sulfide during grain adaptation.** J. O. Sarturi\*, J. T. Vasconcelos, G. E. Erickson, T. J. Kloppenstein, K. M. Rolfe, V. R. Bremer, M. G. Dib, and C. D. Buckner, *University of Nebraska, Lincoln*.

A metabolism study was conducted to compare grain adaptation strategies including wet corn gluten feed (WCGF) and wet distiller grains plus solubles (WDGS). Six steers (BW  $= 300 \pm 22$  kg) were assigned randomly to 1 of 2 treatments in a completely randomized design (3 steers per treatment). Cattle were fed once daily for ad libitum intake. Both adaptation strategies started with 0% dry-rolled corn (DRC) and 87.5% byproduct (WCGF or WDGS). Five steps (7 d each) were used to increase DRC levels to 52.5% of dietary DM. All diets contained 7.5% alfalfa hay and 5% supplement. The last 7-d period consisted of a common finishing diet containing a blend of both WCGF and WDGS (17.5% of each), which was used as a covariate for the previous five steps for all variables. Intake and pH (wireless pH probes) measurements were collected daily. Ruminal gas samples were collected 8 h post feeding on the last 2 d of each period, and  $H_2S$  concentration was analyzed. Data were analyzed using the GLIMMIX procedures of SAS. The WCGF step-up strategy resulted in greater ( $P > 0.05$ ) DMI than WDGS on steps 1, 2, and 3 ( $7.84$  vs.  $4.19$ ;  $9.58$  vs.  $6.85$ ;  $9.98$  vs.  $8.73$  kg, respectively). Average pH was lower ( $P > 0.05$ ) for WDGS on steps 2 and 3 ( $5.39$  vs.  $5.69$ ;  $5.57$  vs.  $5.85$ , respectively) compared to WCGF. No differences ( $P < 0.05$ ) in  $H_2S$  concentrations between treatments were observed for steps 1, 2, 3, 4, and 5 ( $3.20$  vs.  $3.80$ ;  $0.65$  vs.  $0.51$ ;  $10.90$  vs.  $25.50$ ;  $2.40$  vs.  $4.60$ ;  $0.40$  vs.  $1.30$   $\mu\text{mol/L}$  gas, for WCGF and WDGS, respectively). Likewise, no differences ( $P < 0.05$ ) were observed for DMI, pH, and  $H_2S$  concentrations during the period in which cattle were fed the finishing diets. Both WCGF and

WDGS adaptation strategies resulted in safe ruminal pH, DMI and  $H_2S$  concentrations, even when S levels were high. Overall, both adaptation strategies effectively adapted cattle to finishing diets.

**Key Words:** adaptation, byproducts, intake

**94 Metabolism characteristics of feedlot diets containing different by-product lipid sources.** V. R. Bremer\*, K. M. Rolfe, C. D. Buckner, G. E. Erickson, and T. J. Kloppenstein, *University of Nebraska, Lincoln*.

A completely randomized, 5-period Latin square design trial was conducted to evaluate the effects of dietary lipid source on the metabolism characteristics of feedlot steers fed 8.5% lipid diets. Treatments included 4 diets with different dietary lipid sources plus a CORN diet containing no added lipid. The OIL and TAL diets contained 4.8% of diet DM as corn oil or beef tallow, respectively. The CCDS diet contained added lipid in the form of condensed corn distillers solubles (CCDS; 25.5% of diet DM). The WDGS diet contained added lipid from corn wet distillers grains plus soluble (WDGS; 56% of diet DM). The four by-product diets were isolipid. Acetate as a proportion of ruminal VFA concentration was greatest for OIL and WDGS and least for CCDS. The acetate to propionate ratio was least for CCDS, although not significantly different ( $P = 0.25$ ; 1.63, 1.62, 1.55, 1.26, and 1.16 for OIL, WDGS, CORN, TAL and CCDS, respectively). The CCDS diet had the lowest average ruminal pH ( $P = 0.01$ ; 5.8, 5.6, 5.6, 5.4, and 5.3 for OIL, TAL, WDGS, CORN, and CCDS, respectively). The CCDS diet had greater DM digestibility than WDGS, OIL, or TAL ( $P = 0.01$ ; 84, 76, 77, 80, and 81% for CCDS, WDGS, OIL, TAL, and CORN, respectively). CCDS had greater fatty acid digestibility than CORN and OIL ( $P = 0.06$ ; 97, 94, and 94%, respectively). WDGS and TAL fatty acid digestibility was intermediate (95 and 95%, respectively). CCDS had greater NDF digestibility than OIL or TAL ( $P = 0.01$ ; 69, 49, 60%, respectively). NDF digestibility was intermediate for WDGS and CORN (65 and 63%, respectively). Although CCDS lipid is similar to corn oil, CCDS had greater DM, fatty acid, and NDF digestibility than OIL. The omasal unsaturated fatty acid to saturated fatty acid ratio of steers fed WDGS was greater than when fed CCDS, CORN, TAL, or OIL ( $P = 0.01$ ; 0.83, 0.52, 0.49, 0.40, 0.39 ratios, respectively). This indicates protection of WDGS fatty acids from ruminal biohydrogenation. Fatty acid absorption was not decreased with 8.5% lipid feedlot diets.

**Key Words:** byproducts, feedlot, lipid

**95 Nutrient restriction from early to late pregnancy decreases circulating insulin like growth factor-1 concentrations in pregnant ewe lambs receiving maintenance or undernourishment.** T. A. Wilmoth\*,<sup>1</sup> A. M. Meyer<sup>2</sup>, M. E. Wilson<sup>1</sup>, J. S. Caton<sup>2</sup>, and K. A. Vonnahme<sup>2</sup>, <sup>1</sup>West Virginia University, Morgantown, <sup>2</sup>North Dakota State University, Fargo.

Ewes administered growth hormone around the time of conception have elevated concentrations of insulin-like growth factor-1 for the first 5 wk of pregnancy, and have heavier lambs at birth compared to vehicle treated ewes. Ewes that are nutrient restricted during mid to late pregnancy have lighter lambs at birth compared to adequately nourished ewes. It is our hypothesis that if nutrient restricted ewes have reduced insulin-like growth factor -1, administration of growth