56 Peak and persistency: The mathematics of the lactation curve. I. Vetharaniam*[1], S. R. Davis[2], and E. S. Kolver[3], [1]*AgResearch Limited*, *Hamilton, New Zealand*, [2]*ViaLactia Biosciences (NZ) Limited*, *Newmarket, Auckland, NewZealand*, [3]*Dexcel Limited*, *Hamilton, New Zealand*.

Underlying the concept of lactational persistency is a complex of interactions which influence mammary secretory cell number and activity over the course of the lactation. The secretory cell population in the bovine mammary gland consists of alveoli in both active (secreting) and quiescent (engorged) states. We hypothesize that prolonged engorgement is a key regulator of changes in gene expression that lead to de-differentiation and secretory cell death. The number of active alveoli, modulated post partum primarily by nutrition and milking frequency, governs the capacity for milk production. Quiescent alveoli provide a latent secretory potential which can be unlocked through disgorgement of milk. Early in lactation, proliferation of progenitor cells provides new alveoli, resulting in growth of the mammary gland. After peak lactation, the size of the quiescent pool and the rate of cell death, driven from that pool, govern the rate of regression of the gland, and thus the persistency of the lactation. These biological dynamics have recently been incorporated into mathematical models which predict the active and quiescent secretory cell pools through time. This has allowed mechanistic description as to how milking frequency and nutrition might interact with persistency. In particular, chronic effects of nutrition are proposed to regulate the induction phase of apoptosis, while the influence of milking frequency is at the initiation of quiescence (and the size of the quiescent pool of secretory cells). This paper presents these models and discusses their results and their biological implications. Key experiments are identified which could be performed to either strengthen or refute key assumptions in the model. The sensitivity of the lactation curve to up- and down-regulation of pathways in the mammary gland are examined in considering strategies for improving production and its persistency. Differences between New Zealand and North American Holsteins in the way that nutrition modulates udder regression through apoptosis of mammary cells are considered in light of modelling predictions.

Key Words: Mathematical Modelling, Milking Frequency, Nutrition

Nonruminant Nutrition: Dietary Supplements and Additives

57 Growth performance and intestinal morphology responses to diet supplementation with spray-dried plasma protein and organic complex copper in weanling pigs housed under sanitary and sub-sanitary conditions. A. Harper*, J. Zhao, M. Estienne, K. Webb, Jr., and A. McElroy, *Virginia Polytechnic Institute and State University*, *Blacksburg*.

Weanling pigs (n = 192, 18 ± 2 d of age, 6.0 ± 0.2 kg BW) were used to investigate effects of dietary addition of spray-dried plasma protein (SDPP, 0 or 6% for 10 d) and copper from an organic copper complex (0 or 200 ppm for 35 d) on growth performance and intestinal morphology under sanitary or sub-sanitary conditions. The sub-sanitary condition was created by applying swine manure slurry to all surfaces of the sub-sanitary pens during the wk prior to weaning with the understanding that pen sanitation and nursery room would be confounded. There were four pigs per pen; feed and water were available ad libitum. On d 10, one pig per pen was killed and sections of duodenum, jejunum and ileum were fixed, stained and prepared for microscopic assessment of mucosal morphology. By d 10 post-weaning, SDPP and copper supplementation improved ADG and ADFI ($P < 0.001$), while pigs reared in the sub-sanitary pens had lower ADG ($P < 0.05$) than those from sanitary pens. Trends for interaction of diet and pen sanitation were observed for G:F with more pronounced response to SDPP ($P < 0.07$) or copper ($P < 0.11$) supplementation in the sub-sanitary pens. By d 35, there were no main or interactive effects of treatment on performance ($P = 0.19$). In each intestinal segment, shorter villus length and less crypt depth were observed in pigs housed in the sub-sanitary pens ($P < 0.05$). In the duodenum, reduced crypt depth with copper supplementation ($P < 0.01$) and a trend for greater villus length with SDPP supplementation ($P < 0.09$) were observed. Under these experimental conditions, SDPP and copper supplementation improved pig growth performance during the initial 10 d post-weaning and responses for G:F tended to be greater under sub-sanitary conditions. Poor sanitation conditions in the pig housing environment appear to have a negative impact on mucosal morphology.

Key Words: Pigs, Spray-Dried Plasma, Copper

58 Dietary spray-dried plasma and lactating sow feed intake. J. Crenshaw*[1], J. Mencke[2], R. Boyd[2], J. Campbell[1], B. Allen[1], and L. Russell[1], [1]*APC Incorporated*, *Ankeny, IA*, [2]*The Hanor Company*, *Franklin, KY*.

Segregated-parity PIC sows (n = 894) were fed lactation feed with 0% or 0.5% dietary spray-dried plasma (SDP) to determine the effects of SDP on sow feed intake, wean to estrus interval, and pig survival to weaning. There were 112 first parity sows, 112 second parity sows, and 223 older parity (> 2) sows per treatment in experiment 1. In a second experiment, 2,116 older PIC sows (parity, > 2) were fed lactation feed with 0% or 0.5% SDP to evaluate the effects of SDP on sow feed intake, pig survival to weaning and weaning weight of pigs. Litter weaning weight data were collected on 588 litters. At weaning (average 16 d of age), pigs were weighed and pig quality was recorded (high quality pigs weighed 3.6 or more kilograms at weaning). In both experiments, feed intake data were collected from individual sow feed records with feed additions to feeders recorded daily. Feed data were subjected to repeated measures analysis. In experiment 1, SDP increased feed intake of first parity sows (+0.82 kg/d; $P < 0.001$) and second parity sows (+0.23 kg/d; $P = 0.117$), but reduced feed intake of older parity sows (-0.20 kg/d; $P = 0.023$). First parity sows fed SDP had fewer days (-2.5) to postweaning estrus ($P = 0.001$). Older sows fed spray-dried plasma had improved ($P = 0.025$) pig survival (92.0% vs. 89.3%). In the second experiment, SDP reduced ($P < 0.001$) feed intake (-0.34 kg/d) of older parity sows and had no effect ($P > 0.25$) on pig survival to weaning, but the number of high quality pigs (> 3.6 kg) weaned was increased 0.35 pigs per litter from sows fed SDP ($P = 0.017$). Also pigs from sows fed SDP were 0.25 kg heavier ($P = 0.001$) at weaning than pigs from control sows. In conclusion, SDP increased feed intake in younger sows and reduced days to estrus in first parity sows. Although SDP reduced feed intake in older sows, both heavier pigs at weaning and increased number of high quality pigs at weaning from sows fed spray-dried plasma suggest that metabolic efficiency of the lactating sow was enhanced and milk production was improved.

Key Words: Swine, Lactation, Spray-Dried Plasma

59 Effects of Bio-Mos® and carbadox on gastrointestinal pH, organ weight and morphology of nursery pigs. J. Miguel* and J. Pettigrew, *University of Illinois*, *Urbana*.

A 3-wk experiment was conducted to evaluate the effect of a mannan oligosaccharide product (Bio-Mos®) and antibiotic (carbadox) on gastrointestinal characteristics of pigs. Thirty pigs were weaned at an average of 21.2 d and 5.95 kg BW. At weaning, six pigs were euthanized for gastrointestinal sample collection, while the remaining 24 pigs were randomly allocated to one of four dietary treatments. The experiment was conducted as a 2 x 2 factorial arrangement, with the factors being 0 or 0.2% Bio-Mos® and 0 or 55 ppm carbadox. Twelve pigs, representing three pigs per treatment, were euthanized on each of 2 days, 7 or 21 d post-wean. Gastrointestinal pH and wet empty organ weight measurements were taken as well as tissue samples from the duodenum, jejunum and ileum for morphological measurements. For the entire group of 30 pigs, the wet empty weight of the stomach, small intestine and large intestine (including cecum) as a percentage of body weight, was significantly smaller ($P < 0.001$) for pigs at weaning compared to older pigs. For intestinal morphology, pigs at 7 d post-wean had significantly lower (P < 0.001) villous height, villous height:crypt depth ratios, and villous cross-sectional area than pigs at weaning or 21 d post-wean, while crypt depth was significantly larger (P < 0.001) than in pigs at wean. Bio-Mos® tended (P = 0.08) to decrease the percentage of small intestine weight at 7 d post-wean, while at 21 d it tended (P = 0.09) to have an opposite effect on both the small and large intestine weight. Bio-Mos® significantly lowered (P < 0.05) the pH in various segments of the G.I. tract but the effect depended on the absence or presence of carbadox at 7 and 21 d post-wean. In the absence of carbadox, Bio-Mos® lowered the pH, while in its presence the pH was higher. Carbadox appeared to increase (P = 0.06) the size of the villi in the duodenum at 7 d post-wean, while Bio-Mos® appeared to have the same effect (P = 0.02) at 21 d post-wean. These observations suggest that both Bio-Mos® and carbadox have beneficial effects on the gastrointestinal tract.

Key Words: Pigs, Mannan Oligosaccharide, Carbadox

60 Effect of mannan-oligosaccharides and(or) organic zinc on the intestinal microbiota and immune response of early-weaned pigs. M. Castillo*[1], C. Rodríguez[1], S. M. Martín-Peláez[1], J. Roquet[2], J. A. Taylor-Pickard[3], J. F. Pérez[1], and S. M. Martín-Orúe[1], [1]*Departament de Ciència Animal i dels Aliments, Universitat Autònoma de Barcelona, Bellaterra, Barcelona, Spain*, [2]*Probasa, Barcelona, Spain*, [3]*Alltech Biotechnology Centre, Summerhill, Sarney, Ireland*.

To determine the possible effect of dietary mannan-oligosaccharides (MOS) and organic zinc (Zn) on intestinal microbial populations and immune response, 32 early-weaned (20 ± 2 days) pigs were divided into four dietary treatments: a control diet (CT) to which 0.2 % of a commercial source of MOS (Bio-Mos® Alltech Inc., USA; BM), 0.08% organic Zn (Bioplex-Zn™ Alltech Inc, USA; BP) or both additives (BMP) were added. After two weeks receiving experimental diets, animals were sacrificed and weights of the whole gastrointestinal tract, full and empty stomach and small intestine were recorded. Digesta samples from the stomach, ileum and caecum were taken, pH registered and short-chain fatty acid (SCFA) concentrations determined to evaluate possible changes of fermentation patterns. Microbiological counts for enterobacteria and lactobacilli were determined by quantitative-PCR and immunoglobulin concentration in plasma (IgG, IgM, IgA) and ileal digesta (IgA) were also analysed. Inclusion of organic Zn into the diets (BP and BMP) promoted increased empty ileal weight (containing the continuous Peyer patches) (8.9, 9.5, 11.9 and 10.3 g/kg BW for CT, BM, BP and BMP, respectively; *P* = 0.03). MOS addition promoted a decrease in enterobacteria counts in the jejunum (9.13, 8.05, 8.87, and 7.89 log 16 S rDNA copies/g FM for CT, BM, BP and BMP, respectively; *P* = 0.01) but no changes in lactobacilli populations. No significant differences were registered in pH or SCFA concentrations, or in plasmatic or ileal immunoglobulins. Results suggest that MOS could modulate intestinal microbiota through inhibition of certain microbial groups, whereas the observed increase in ileal weight with organic Zn would suggest a possible immunological effect (longer Peyer patches together with an increase in intestinal wall thickness). The use of both additives together result in complementary actions.

Key Words: Mannan-Oligosaccharides, Organic Zinc, Weaning Pig

61 Effect on nursery pig growth performance from phosphorylated mannan oligosaccharide supplementation to the sow and to pigs during the nursery phase. C. L. Bradley*[1], M. E. Davis[1], D. C. Brown[1], C. V. Maxwell[1], E. A. Halbrook[1], Z. B. Johnson[1], R. Dvorak[2], and B. Lawrence[3], [1]*University of Arkansas, Fayetteville*, [2]*Alltech, Inc., Nicholasville, KY*, [3]*Hubbard Feeds, Inc., Mankato, MN*.

An experiment was conducted to determine the effects of mannan oligosaccharide (MOS) supplementation to sow diets during gestation and lactation on subsequent performance of pigs supplemented with or without MOS in the nursery phases. Diets consisted of a control or the control with 0.3% MOS fed to 36 sows for 3 wk of gestation and throughout lactation. At weaning, 126 pigs from each gestation/lactation treatment were blocked by initial BW, stratified based on sex and litter, and assigned one of two treatments: a complex control diet or the control diet with 0.3% Mos. The nursery diets were fed during Phase 1 (d 0 to 13, 1.50% Lys), Phase 2 (d 14 to 27, 1.35% Lys), and Phase 3 (d 28 to 42, 1.20% Lys). Gestation/lactation data were analyzed as a completely randomized block design and nursery data were analyzed as a randomized complete block design with treatments arranged in a 2 x 2 factorial. The percentage of mummified pigs was reduced (P < 0.05) in sows fed MOS. Piglet performance during lactation was similar (P > 0.10) between the two treatments. Pigs had improved (P < 0.05) performance during Phase 1 (ADG, ADFI, and BW) and for Phase 1 and 2 combined (ADG and BW) from the addition of MOS in the nursery diets in pigs reared by unsupplemented sows, whereas pigs from sows fed MOS had similar performance (gestation/lactation treatment x nursery treatment interaction, P < 0.05). Pigs from sows fed Mos and not receiving MOS in the nursery phase had improved (P < 0.05) ADG, ADFI and BW compared to pigs from unsupplemented sows and fed diets devoid of MOS in Phase 1 and for Phase 1 and 2 combined. Addition of MOS in Phase 1 improved (P < 0.01) G:F, but G:F was similar among treatments in Phase 2. Performance among the treatments during Phase 3 was similar. These data suggest that the benefits to nursery pig performance from MOS supplementation can be realized when administered to the dam or to the pig during the nursery phase.

Key Words: Mannan Oligosaccharide, Growth Performance, Swine

62 Holo-analysis of the effects of genetic, managemental, chronological and dietary variables on the efficacy of a pronutrient mannanoligosaccharide in pigs. G. Rosen*, *Pronutrient Services Ltd., London, England*.

All available pig test data sets from 31 publications on a yeast mannanoligosaccharide, Bio-Mos® (BM) Alltech Inc., have been holo-analysed by multiple regression of start-to-finish feed intake (FDIeff), liveweight gain (LWGeff) and feed conversion ratio (FCReff) effects on 14 independent variables, control performance, year, duration, dosage, factorial data, grower-finisher, male, slatted floor, pellet, soy, animal protein, added oil/fat, antibacterial and non-USA. Average responses from 69 tests are +7.5 g/day (0.99%) for FDIeff, +145 g/day (3.58%) for LWGeff and -0.0526 (-3.07%) for FCReff using BM at 0.12-4.0 g/kg feed (mean, 1.94) in 10-131 day tests (mean, 41.4) on 3,778 pigs in 10 countries in 1996-2002. Respective coefficients of variation of these responses average 511, 163 and 229%. Mean respective beneficial response frequencies for LWGeff and FCReff are 73 and 68% (54% jointly). Preliminary multiple regression analyses (P in, 0.05/P out, 0.10) afforded no LWGeff model; better FCReff in less efficient converters; no BM dosage term for FDIeff or FCReff; better piglet FCReff than grower/finisher; higher FDIeff in oil/fat-supplemented diets; and better FCReffs in animal protein and oil/fat diets. Less stringent (P in, 0.25/P out, 0.34) exploratory models for 64 FDI, 64 LWG and 67 FCR outlier-free tests indicate better FCReff in less efficient converters; maximum FDIeff at 3.5 g BM/kg; no significant LWGeff or FCReff dosage terms; lower LWGeffs in USA and pelleted feed; lower FCReffs with age, factorial data, supplemental oil/fat, step-down BM dosage and slatted floor; and better FCReffs in weaners and in animal protein and main vegetable protein not-soy feeds. Future research when data suffice could include weaner and slaughter pig dose-response functions; continuous and step-up BM dosages; disease, geographic and main diet ingredient and nutrient content effects; and BM interactions with antibiotics/antibacterials (including Cu and Zn compounds), enzymes, acids, other oligosaccharides and limiting nutrients.

Key Words: Holo-Analysis, Mannanoligosaccharide, Pig

63 Effect of an *E. coli* F4 (K88) probiotic, liquid acidifier, dry acidifier, or plant extract on early-weaned pigs challenged with enterotoxigenic *E. coli* F4 (K88). Y. Han*[1], M. Vignola[2], and J. Brennan[1], [1]*Maple Leaf Foods Agresearch, Guelph, Ontario, Canada*, [2]*Shur-Gain Quebec, St-Romuald, Quebec, Canada*.

To evaluate the efficacy of alternatives to antibiotic growth promotants (AGP), 130 piglets were weaned at 14 days of age and used in an *E. coli* F4 (K88) challenge trial. There were six dietary or water treatments, including a nonmedicated control (Non-Med), an AGP control (Tiamulin, 31.2 mg/kg), an avirulent *E. coli* K88 isolate as a probiotic (Probiotic), a liquid acidifier (phosphoric, lactic, and formic acid, 0.5 mL/liter of drinking water), a feed acidifier (phosphoric, lactic, citric, acetic, and formic acid; 1 g/kg), and a plant extract (genus papaveraceae). All treatments commenced on d 7 of the trial except for Probiotic that was orally administered to each piglet at weaning (one dose/pig). On d 15, all piglets were challenged orally with 10^9 (CFU/mL) of an *E. coli* K88 inoculum. The trial ended on d 42. Compared to Non-Med, the dry acidifier and plant extract failed to improve growth or health condition of pigs. By d 42, pigs fed liquid acidifier or AGP were heavier than those fed Non-Med (20.9, 21.3, 18.3 kg BW, respectively; P < 0.01). The liquid acidifier resulted in a non-significant reduction of *E. coli* K88 shedding and diarrhea score. The Probiotic tended to reduce diarrhea severity and *E. coli* K88 shedding but the effects were not significant. On d 42, pigs treated with Probiotic were heavier than those fed Non-Med (20.1, 18.3 kg BW; P = 0.06). In conclusion, both the liquid acidifier and *E. coli* K88 probiotic demonstrated potential as alternatives to AGP for prevention of *E. coli* K88 infection.

Key Words: Early Weaned Pigs, Alternatives, *E. coli* K88 Challenge

64 Effect of L-carnitine on growth performance in segregated early weaned pigs. D. C. Brown*[1], M. E. Davis[1], C. V. Maxwell[1], E. A. Halbrook[1], Z. B. Johnson[1], and J. Woodworth[2], [1]*University of Arkansas*, *Fayetteville*, [2]*Lonza*, *Fairlawn, NJ*.

Two identical experiments were conducted to determine the efficacy of L-carnitine in improving performance of early weaned pigs. A total of 216 barrows (19 ± 3 d of age) per experiment were moved to a wean-to-finish facility, sorted by BW into three weight groups, and allotted into twelve equal subgroups (six pigs/pen) with stratification based on sex and litter. Treatments were randomly assigned to pens within each of the six weight groups (18 pens/treatment). During the first 13 d post-weaning (Phase 1), pigs were fed either a simple diet containing 1.6% lysine with no L-carnitine or the control diet with 0.0050% (50 ppm) L-carnitine. Upon completion of Phase 1, pigs were fed a Phase 2 diet (1.45% lysine) from d 13 to 26, and a Phase 3 diet (1.35% lysine) from d 26 to 40 post-weaning. Treatments remained the same during the Phase 2 and Phase 3 periods. In trial 1, L-carnitine tended (P < 0.10) to increase ADG and ADFI during Phase 3 of the nursery period. In trial 2, L-carnitine supplementation tended to improve (P < 0.10) ADG during Phase 1 of the nursery period and in the combined Phase 1-2 period. In addition, pigs fed diets supplemented with L-carnitine tended to have greater (P < 0.10) BW at the end of Phase 1 compared to pigs fed the control diet, and the average BW of pigs fed L-carnitine was 0.81 kg greater (P < 0.05) than the average BW of pigs fed the control diet at the end of Phase 2. The improvement in ADG and pig BW was likely a result of the increased (P < 0.05) feed intake observed during Phase 1 of the nursery period and during the overall Phase 1-2 and Phase 1-3 periods. Pigs in trial 1 had a poor growth performance compared to pigs in trial 2, which may indicate that pigs were undergoing some type of heath challenge during trial 1. These data suggest that pig health status may influence the ability of L-carnitine to impact growth performance during the nursery period. Further research is needed to determine under which rearing conditions L-carnitine can enhance pig performance.

Key Words: L-Carnitine, Nursery Pigs, Performance

65 Effect of supplemental chromium level and source on fasting plasma nonesterified fatty acid concentrations in growing pigs. E. B. Kegley*[1] and T. M. Fakler[2], [1]*University of Arkansas*, *Fayetteville*, [2]*Zinpro Corp.*, *Eden Prairie, MN*.

Chromium is generally recognized as an essential nutrient; however, a dietary requirement for the pig has not been quantified. The objective of this experiment was to determine the effects of chromium level and source on fasting plasma NEFA concentrations in growing pigs. Two hundred ten pigs (105 barrows and 105 gilts, 23.3 kg, 54 to 62 d of age) were stratified by gender, litter and weight, and were then assigned randomly to one of 35 pens, with three barrows and three gilts in each pen. Pens were assigned randomly to treatment. Treatment diets were available to the pigs on an ad libitum basis for 33 or 34 d. Diets consisted of 72% corn, 23% soybean meal and 2% added fat, and were formulated to provide 1.05% lysine, and recommended levels of other nutrients. Seven dietary treatments were: control (no supplemental Cr); 200 ppb supplemental Cr as chromium picolinate (CrPic), chromium propionate (CrProp) or chromium-L-methionine (CrMet); and 400 ppb supplemental Cr as CrPic, CrProp or CrMet. After a 16 h fast, on d 34 or 35, pigs were bled via the anterior vena cava. Finding through boxplot analyses that the data were not normally distributed, NEFA concentrations were transformed logarithmically. Transformed data were analyzed by ANOVA using the MIXED procedure of SAS, with pen as the experimental unit. The model included dietary treatment. A random statement included block (the day of bleeding). Supplemental Cr as CrMet resulted in the greatest decrease in fasting plasma NEFA concentrations (control vs. CrMet, $P = 0.06$). Supplementation with CrProp or CrPic also tended to decrease fasting plasma NEFA concentrations (control vs. CrProp, $P = 0.09$; control vs. CrPic, $P = 0.11$). There was a linear effect of CrMet supplementation on decreasing NEFA concentrations ($P = 0.07$). This linear effect was not significant for the other two supplemental Cr sources (linear CrPic, $P = 0.12$; or linear CrProp $P = 0.22$). Chromium-L-methionine decreases fasting NEFA concentrations in growing pigs.

Key Words: Chromium, NEFA, Pigs

66 The effects of feeding inorganic zinc or zinc amino acid complex to sows during gestation and lactation, and the subsequent effects on the progeny during lactation and the nursery period. R. Payne[1], T. Bidner[1], L. Southern*[1], and T. Fakler[2], [1]*Louisiana State University Agricultural Center*, *Baton Rouge*, [2]*Zinpro Corp.*, *Eden Prairie, MN*.

An experiment was conducted to determine the effects of feeding inorganic Zn or a zinc AA complex (AvailaZn^®^) to sows during gestation and lactation and the subsequent effects on the progeny during the nursery period. Three diets were fed to sows (nine, seven, and nine for Diets 1, 2, and 3) starting from d 15 after breeding through lactation, and also to the offspring in the nursery. The diets were: 1) corn-soybean meal diet with 100 ppm Zn from $ZnSO_4$ (Control); 2) Control + 100 ppm Zn from $ZnSO_4$ (ZS); and 3) Control + 100 ppm Zn from AvailaZn (ZnAA). After weaning, pigs (63, 55, and 84 pigs; and nine, eight, and 12 pens/treatment for Diets 1, 2, and 3) were maintained on the same diet as the dam. At weaning and at the end of the nursery phase, one pig per replicate was killed for tissue analyses. Diet did not affect sow weight change during gestation (P > 0.10). During lactation, sows fed ZnAA had increased (P < 0.10) litter birth weight and pigs nursed and weaned compared with those fed the control or ZS diet. Jejunal villi height of the weaned pigs from sows fed ZS or ZnAA was increased (P < 0.10) compared with pigs from sows fed the control diet. During the nursery period, growth performance was not affected (P > 0.10) by diet. At weaning, pigs fed ZS had wider duodenal and ileal villi (P < 0.10) than those fed ZnAA. Pigs fed either ZS or ZnAA had increased (P < 0.10) bone Zn than pigs fed the control diet. Liver Zn was highest in pigs fed ZS, followed by those fed ZnAA, and then those fed the control diet (P < 0.10). Pancreas Zn was increased (P < 0.10) in pigs fed ZS compared with those fed the control diet. In this study, supplemental Zn from ZS or ZnAA, above typical trace mineral premix levels did not affect the sow during gestation or pigs during the nursery period. However, sows fed ZnAA had two more pigs per litter and nursed and weaned more pigs than sows fed ZS or the control diet.

Key Words: Lactation, Pig, Zinc

67 Effect of fat level in late finishing barrows fed ractopamine HCl (Paylean®). A. M. Gaines*[1], B. W. Ratliff[1], P. Srichana[1], G. L. Allee[1], and J. L. Usry[2], [1]*University of Missouri*, *Columbia*, [2]*Ajinimoto Heartland LLC*, *Chicago, IL*.

This experiment was conducted at a commercial research site in order to evaluate the effect of fat level in barrows fed ractopamine HCl (Paylean). A total of 588 pigs (TR-4 × C22; 106.2 ± 0.39 kg) were used in a completely randomized block design with seven replicate pens/treatment and 21 pigs/pen. Pigs were allotted to one of four dietary treatments containing 0.0, 2.0, 4.0 and 6.0% supplemental fat (choice white grease), respectively. All diets contained the same inclusion of Paylean (7.2 ppm) and were formulated at a lysine:calorie ratio of 2.72 g true ileal digestible lysine/Mcal ME. The level of soybean meal (25.0%) was also held constant across the diet formulations and dietary lysine content was adjusted by adding L-lysine•HCl (0.10, 0.13, 0.17, and 0.20%, respectively) with additional synthetic amino acids supplied as necessary in order to meet the minimum amino acid profile. Growth performance was evaluated for 21 d. At d 21, pigs were transported to a commercial processing facility for carcass data collection. Fat supplementation increased (linear, P = 0.01) ADG (1,061, 1,093, 1,134, and 1,139 g/d, respectively) and improved (linear, P < 0.001) G/F (0.328, 0.341, 0.355, and 0.361, respectively). There was no effect on ADFI (P > 0.20). Based on linear regression analysis, for each one percentage unit increase in supplemental fat addition there were 1.30% and 1.72% improvements in ADG (r^2 = 0.93) and G/F (r^2 = 0.98), respectively. Fat supplementation slightly increased 10th rib backfat (20.0, 19.3, 20.8, 20.6 mm, respectively) and decreased carcass percent lean (54.1, 54.5, 53.5, and 53.7%, respectively). There was no effect on loin depth (P > 0.74) or carcass yield (P > 0.45). Based on the economic analysis, the optimum level of fat when feeding 7.2 ppm Paylean is 4.0%.

Key Words: Pigs, Ractopamine HCl, Growth

68 The effects of a carbohydrate- and protein-based feed supplement on sow and litter performance. W. Browning*, C. Fontenot, R. Guillory, M. Leger, and F. LeMieux, *McNeese State University*, *Lake Charles, LA*.

An experiment was conducted to determine the effects of a carbohydrate-and protein-based feed supplement on sow and litter performance. Fifty-two first parity and multiparous sows and their pigs were used to evaluate the effects of a novel carbohydrate-and protein-based feed ingredient (Nutri-Pal) on sow and litter performance during lactation. The dietary treatments were a corn-soybean meal control and a corn-soybean meal plus Nutri-Pal top-dress fed from farrowing to weaning. Top-dress was fed at a rate of 113 g per feeding, and sows were fed twice daily during lactation. Sows were allotted to treatment at random. There were 24 and 28 sows for the corn-soybean meal and corn-soybean meal plus Nutri-Pal treatments, respectively, over two farrowing groups. Farrowing months were March, April, July, August, and September, 2004. Within the first 3 d after birth, pigs were cross-fostered to equalize litter size. Pigs were cross-fostered only among litters of the same diet. Pigs were weighed within 1 d of farrowing and pigs were weaned at an average age of 20 d. Sow response variables (pigs born alive, and litter and average pig birth weight) were not affected (P > 0.10) by the diet. There were no effects (P > 0.10) of the diet on litter performance response variables (pigs weaned, litter and average pig weaning weight and gain, and percentage survival). The Nutri-Pal feed ingredient did not affect sow or litter productivity.

Key Words: Lactation, Litter Traits, Sows

Physiology and Endocrinology I

69 A comparison of progestin-based protocols to synchronize ovulation prior to fixed-time artificial insemination in postpartum beef cows. D. J. Schafer*[1], J. F. Bader[1], J. P. Meyer[1], J. K. Haden[2], M. R. Ellersieck[1], M. F. Smith[1], and D. J. Patterson[1], [1]*University of Missouri*, *Columbia*, [2]*MFA Inc.*, *Columbia, MO*.

The experimental objective was to compare pregnancy rates after fixed-time AI in postpartum beef cows following administration of two protocols to synchronize ovulation. Cows (n = 650) at four locations (n = 210, 158, 88, 194) were stratified by age, BCS and days postpartum (DPP) to one of two treatment protocols. The MGA Select treated cows (MGA Select; n = 327) were fed melengestrol acetate (MGA; 0.5mg•hd^{-1}•d^{-1}) for 14 d, GnRH was injected 12 d after MGA withdrawal (100 µg, i.m. Cystorelin; d 26), and PG was administered 7 d after GnRH (25 mg i.m. Lutalyse; d 33). Cows assigned to the CO-Synch + CIDR protocol (CO-Synch + CIDR; n = 323) were fed carrier for 14 d, were injected with GnRH (100 µg, i.m. Cystorelin) and equipped with a CIDR insert (1.38g progesterone) 12 d after carrier removal (d 26), and CIDRs were removed 7 d later at the time PG (25 mg i.m. Lutalyse) was administered (d 33). Artificial insemination was performed at fixed-times (72 or 66 h after PG for MGA Select and CO-Synch + CIDR groups, respectively), and all cows were injected with GnRH (100 µg, i.m. Cystorelin) at AI. Blood samples were collected 8 d and 1 d prior to MGA or carrier to determine pre-treatment estrous cyclicity [progesterone ≥ 0.5 ng/ml; (MGA Select, 185/327, 57%; CO-Synch + CIDR, 177/323, 55%); P = 0.65]. There was no treatment by location interaction (P > 0.10) for age, DPP, or BCS, and the results were therefore pooled for the respective treatments. Pregnancy rates resulting from fixed-time AI did not differ between treatments [P = 0.20; (MGA Select, 201/327, 61%; CO-Synch + CIDR, 214/323, 66%)], among sires (P = 0.11) or technicians (P = 0.20). There was no difference (P = 0.36) between treatments in pregnancy rate resulting from fixed-time AI based on pretreatment estrous cyclicity status, and no difference (P = 0.25) between treatments in final pregnancy rate. Both protocols provide opportunities for beef producers to use AI and eliminate the need to detect estrus.

Key Words: Estrus Synchronization, Beef Cow, Progestin

70 Resynchronizing estrus with a progesterone (P4) insert and estradiol cypionate (ECP) in cows of unknown pregnancy status. K. N. Galvao*[1], R. L. A. Cerri[1], H. M. Rutigliano[1], R. G. S. Bruno[1], R. C. Chebel[1,2], and J. E. P. Santos[1], [1]*University of California*, *Tulare*, [2]*University of Idaho*, *Caldwell*.

Holstein cows, 488, were randomly assigned to one of three treatments: Control, enrollment on the Heatsynch protocol (d0 GnRH, d7 PGF2a, d 8 ECP, and d10 timed AI) upon diagnosis of nonpregnancy on d 32 after AI; CG, intravaginal P4 (CIDR) inserted from d 14 (12 to 15) to d 21 (19 to 22) after AI, with cows observed for estrus from d 21 to 25 after AI and initiation of the timed AI on d 25 in those not in estrus, followed by pregnancy diagnosis on d 32 and completion of the timed AI in nonpregnant cows; CEG, same treatment as CG but with the an injection of 1.0 mg of ECP at the time of CIDR removal. Cows were continuously re-enrolled in the same treatment until diagnosed pregnant, which resulted in a total of 1001 AI. Blood was sampled on d 14, 21, and 25 after AI for P4 determination. Ovaries were scanned on d 21, 25 and 32 to monitor responses to treatments. Pregnancy was presumed based on P4 > 1.0 ng/mL on d 14, 21, and 25 and diagnosed by ultrasonography on d 32 and 60 after AI. The pregnancy rate (PR) was similar for Control, CG, and CEG on d 32 (34.6 vs 32.8 vs 34.2%; P = 0.93) and 60 (30.2 vs 30.7 vs 30.3%; P=0.96). The pregnancy loss (PL) based on a drop in P4 below 1 ng/mL was not affected by treatment between d 14 and 21 or between d 25 to 32, but was greater for CEG compared to Control or CG between d 21 and 25 (32.4 vs 25.4 vs 23.9%; P=0.02). Nevertheless, PL from d 32 to 60 was not affected by treatment (Control = 10.3%, CG = 5.5% and CEG = 9.9%; P=0.43). Survival analysis of the cows remaining pregnant from 14 to 60 d after AI showed no effect of treatment on embryonic and fetal survival. Re-insemination interval for nonpregnant cows was similar for the Control compared to CG and CEG groups (29.3 vs 29.6 vs 28.1 d; P=0.13), but for cows receiving CIDR, ECP tended to reduce the interval (P = 0.06) because of increased estrous detection after insert removal (56.4 vs 47.1%; P=0.01). Treatment did not affect interval from study enrollment to pregnancy. Resynchronization of non-pregnant cows with CIDR or CIDR and ECP did not affect reproductive performance of dairy cows.

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Key Words: Resynchronization, CIDR, Dairy Cows