

**1035 Estradiol Enhances Synchrony and Fertility to Artificial Insemination (AI) or Embryo Transfer (ET) in Brangus Females.** J.A. Meyer<sup>\*1</sup>, C.R. Looney<sup>2</sup>, C.R. Long<sup>2</sup>, J.A. Thompson<sup>1</sup>, M.L. Day<sup>3</sup>, H.D. Hafs<sup>4</sup>, and D.W. Forrest<sup>1</sup>, <sup>1</sup>Texas A&M University, College Station, TX, <sup>2</sup>Ovagenix, Bryan, TX, <sup>3</sup>The Ohio State University, Columbus, OH, <sup>4</sup>Rutgers University, New Brunswick, NJ.

Two trials were conducted to quantify effects of estradiol benzoate (EB) administration on fertility after removal of a controlled internal drug release (CIDR)<sup>®</sup> insert. Lactating, primi- and multiparous Brangus females were administered a CIDR (1.38g Progesterone) for 7 or 8 d with prostaglandin F<sub>2α</sub> (25 mg, im) administered upon removal of the CIDR (control group). Females allotted to the treatment group were administered estradiol benzoate (EB, 1 mg,im) at 24 h post-CIDR removal. Females were observed twice daily for signs of estrus behavior for 5 d after CIDR removal. In Trial 1, females were inseminated 12 h post-onset of estrus. The synchrony rate (SR; 93.9%) in EB treated (n = 82)

females was higher (P < 0.01) than the SR (80.0%) in the control group (n = 230). First service conception rate (FSCR) was not affected (P > 0.1) by EB treatment (50.6 and 46.4% for treatment and control groups, respectively). However, females in the treatment group had a higher (P = 0.08) first service pregnancy rate (FSPR) than females in the control group (47.6 vs. 36.7%, respectively). In Trial 2, recipient cows received a single embryo 6.5 to 7.5 d post-onset of estrus. SR was higher (P < 0.01) in EB treated (n = 886) females compared to control (n = 457) females (93.0 and 73.5%, respectively). FSCR did not differ (P > 0.1) between control and treatment groups (54.4 and 55.7%, respectively). FSPR was higher (P < 0.01) in EB females (46.1%) compared to females in the control group (38.1%). In conclusion, the addition of an injection of 1 mg EB administered 24 h after a conventional CIDR synchronization treatment regimen increased both SR and FSPR following either AI or ET, in Brangus females.

**Key Words:** Progesterone, Estradiol, Synchronization

**ASAS/ADSA Production, Management, and Environment: Waste Management for Beef and Swine; Reproductive Practices and Measures**

**1036 Decreasing nitrogen losses from open-dirt feedlot pens by manipulation of organic matter excretion.** G. E. Erickson<sup>\*</sup>, T. J. Klopfenstein, and C. T. Milton, <sup>1</sup>University of Nebraska-Lincoln.

Three experiments with yearling steers (404 ± 15 kg) evaluated adding either 15 (15bran) or 30% (30bran) corn bran to a 15% corn silage, corn based diet (0bran). Experiments were conducted from October to February (128 d), February to June (105 d), and June to September (110 d) in eastern Nebraska. Performance and mass-balance of nitrogen were assessed for each pen (8 steers/pen; 4 pens/treatment) in each experiment. No experiment by treatment interactions were detected (P > .10), so performance data were pooled. Increasing dietary corn bran from 0 to 30% increased (P < .01) DM intake and decreased (P < .05) ADG, leading to depressed (P < .01) feed efficiency. Compared to the 0bran diet, feed efficiency was depressed by 7.8 and 10.4% for 15bran and 30bran, respectively, suggesting that organic matter (OM) excretion was increased. For the winter/spring months, increasing dietary corn bran increased manure N and decreased N losses (primarily volatilization) expressed as either kg/steer or percentage of N excretion. During the summer experiment, increasing dietary corn bran did not significantly influence either manure N or N losses. Increasing OM excretion of feedlot cattle may increase manure N thereby decreasing volatilization losses but will also depress feed efficiency.

| Item                    | 0bran | 15bran | 30bran | SE   | Linear | Quadratic |
|-------------------------|-------|--------|--------|------|--------|-----------|
| ADG, kg/d               | 1.82  | 1.81   | 1.74   | .03  | .05    | .58       |
| ADG/DM intake           | .154  | .142   | .138   | .002 | .01    | .09       |
| Winter/spring, kg/steer |       |        |        |      |        |           |
| N manure                | 12.6  | 21.1   | 25.0   | 1.6  | .01    | .29       |
| N losses                | 36.9  | 31.6   | 29.3   | 1.8  | .02    | .51       |
| %N lost <sup>a</sup>    | 74.5  | 59.9   | 53.9   | 3.2  | .01    | .32       |
| Summer, kg/steer        |       |        |        |      |        |           |
| N manure                | 6.5   | 6.2    | 7.1    | 1.3  | .76    | .70       |
| N losses                | 16.0  | 17.3   | 16.6   | 1.5  | .78    | .60       |
| %N lost <sup>a</sup>    | 70.9  | 73.6   | 69.6   | 5.9  | .88    | .66       |

<sup>a</sup>Percentage of N excreted.

**Key Words:** Nitrogen, Nutrient management, Manure

**1037 Validation of the nitrogen balance in a whole system feedlot model.** H. Fairweather, K. A. Beauchemin, and K. M. Koenig, *Agriculture and Agri-Food Canada, Research Centre, Lethbridge, AB, Canada.*

FeedNuts is a stochastic daily time step simulation of a feedlot system model and predicts the nutrient flow (N, P) from feed inputs to the manure and effluent storage systems. Inputs (CP, P, UIP, DM and TDN, % dietary DM) into the FeedNuts model are stochastic and the mass balance is calculated initially for a single animal, which is then aggregated

to the whole system. Data from Bierman et al. (1999; J. Anim. Sci. 77:1295-1305), which evaluated the N balance in a feedlot, were used to verify the model calculations and validate the N balance predicted by the FeedNuts model. The N balance experiments consisted of a digestibility trial and a feedlot trial (87 d) in which cattle were fed one of three corn grain based diets. The diets were: wet corn gluten feed (WCGF, 41.5% of DM), 10% forage (10F) and all concentrate (CONC). Total tract N digestibility of the diets was 65.2, 74.7 and 76.9% for the WCGF, 10F and CONC diets, respectively. The FeedNuts model predicts the total N excreted as the difference between N intake and N retained (calculated using the net protein gain equation, NRC (1996)). A rumen sub-model that accounts for microbial protein synthesis and the degradability of feed protein sources is used to determine N output in urine and feces. Using a daily time step to predict N retention predicted a higher amount of N retained (approximately 0.5 kg over the 87 d) compared with the estimated retention in the feedlot study. However, that calculation used only the final weight. The N digestibility and predicted fecal and urinary N, as a percentage of N intake, were within 10% of the measured values for each diet. Furthermore the predicted relative ranking of diets in terms of fecal and urinary N agreed with the observed. This verification and validation exercise demonstrates the capability of the FeedNuts model for predicting the N balance in the feedlot system at any point in time as a function of ration inputs.

**Key Words:** Nitrogen balance, System model, Validation and verification

**1038 Digestibility of several known dietary manipulations used in combination to reduce nutrient excretion in pigs.** S.L. Hankins<sup>\*</sup>, D.C. Kendall, B.E. Hill, and B.T. Richert, *Purdue University, West Lafayette, IN.*

Twelve crossbred barrows (Initial BW=96kg) were blocked by weight and randomly assigned to one of three diets. All diets were formulated to provide 0.48% digestible Lys and were: 1) Standard 13.1% CP corn-soy diet, 0.23% available P (0.50% total P) (STD), 2) 11.5% CP corn-soy diet, 0.15% Lys-HCl, 0.26% available P (0.50% total P) (RCP), and 3) 8.25% CP diet with 5% soybean hulls, high-available P corn, 0.05% phytase and reduced mineral sulfates, 0.40% Lys-HCl, 0.16% available P (0.26% total P) (HRP) to evaluate the effect of several known dietary manipulations in combination on nutrient excretion compared to standard diets. Pigs were adapted to metabolism stalls and dietary treatments for 7 d followed by a 3 d total feces and urine collection. Feces and acidified urine were collected twice daily and frozen until analysis. Pigs were fed at 3X maintenance levels (NRC, 1988) with ad-libitum access to water. Feces and urine were analyzed for DM, nitrogen (N), ammonium N (AMM) and total P (TP). DM digestibility was 88.8%, 88.3% and 87.9% for the STD, RCP and HRP diets, respectively. N and P digestibility were 82.8%, 81.4%, 75.2% and 45.9%, 48.3%, 56.1% for the STD, RCP and HRP diets, respectively. Urine N was 41% and 66% lower (P<.05) from pigs fed the RCP and HRP diets, respectively, compared to the STD diet. Total N excretion was reduced (P<.05) 37% and 55% when the RCP (20.3 g/d) and HRP (14.6 g/d) diets were fed respectively when compared to the STD (32.2 g/d) diet. N retention as a percent of total N absorbed was 30% higher (P<.05) for pigs on

the HRP diet and 16% higher for pigs fed the RCP diet compared to the STD diet. Pigs fed the HRP diet had 55% and 62% lower ( $P<.05$ ) total P excretion (4.0 g/d) than pigs fed the RCP (8.8 g/d) and STD (10.7 g/d) diets, respectively. P retention as a percent of that absorbed tended to be higher for pigs fed the HRP diet compared to the STD diet. Nitrogen and P excretion can be effectively reduced when a combination of synthetic amino acids, high-available P corn, phytase and 5% soybean hulls are fed to finishing pigs.

**Key Words:** Pigs, Digestibility, Excretion

**1039 Effects of soybean hulls in a commercial diet on pig performance, manure composition, and selected air quality parameters in swine facilities.** S.A. DeCamp<sup>1</sup>, B.E. Hill<sup>\*1</sup>, S.L. Hankins<sup>1</sup>, D.C. Kendall<sup>1</sup>, B.T. Richert<sup>1</sup>, A.L. Sutton<sup>1</sup>, D.T. Kelly<sup>1</sup>, M.L. Cobb<sup>1</sup>, D.W. Bundy<sup>2</sup>, and W.J. Powers<sup>2</sup>, <sup>1</sup>Purdue University, Lafayette, IN, <sup>2</sup>Iowa State University, Ames, IA.

Grow-finish pigs ( $n=150$ ) were used to evaluate the inclusion of soybean hulls in swine diets to reduce aerial pollutants and alter manure composition. The pigs (initial BW=85.3 kg) were placed in two identical, environmentally controlled rooms (5 pigs/pen, 5 pens/room; 50 pigs/rep) with 3 replications and treatments rotating between rooms. Diets were split-sex fed and consisted of either a corn-soybean meal based control (C) or the control diet with the addition of 10% soybean hulls and 3.4% supplemental fat (SH) (all diets=3370 Kcal ME/kg; barrows 12.0% CP, 0.53% dLys; gilts 12.7% CP, 0.57% dLys). Pigs and feeders were weighed at 0, 3, and 6 wks to calculate ADG, ADFI, and G:F. Aerial ammonia concentration (AAC), hydrogen sulfide (HS), detection threshold (DT) of odor samples, and pit manure samples were taken at wk 0, 3, and 6. Pigs fed SH diets had greater overall ADG (905 vs 859 g/d;  $P<.03$ ) and tended to have higher G:F (0.326 vs 0.310;  $P<.09$ ) with no difference in ADFI. Pigs fed SH had greater adjusted backfat (113 kg BW) at wk 6 (15.8 vs 14.7 mm;  $P<.001$ ) than C pigs. At wk 6, there was a 20% reduction in AAC ( $P<.02$ ), a 32% reduction in HS ( $P<.003$ ) and an 11% reduction in DT when pigs were fed SH diets. There was a decrease in wk 6 manure pH (7.12 vs 7.26;  $P<.03$ ) and an increase in all individual manure VFA concentrations, with total manure VFA concentrations increasing by 32% ( $P<.001$ ) when pigs were fed SH. At wk 6, the stored manure from pigs fed SH diets had 21% greater total nitrogen accumulation (22.5 vs 18.6 kg;  $P<.02$ ) and an 8% increase in ammonium N accumulation (18.3 vs 16.9 kg;  $P<.05$ ), with no difference in phosphorus. The addition of 10% SH to a commercial type diet can enhance environmental stewardship, without hindering pig growth performance and carcass characteristics. The addition of SH lowered AAC and HS in room air and increased manure N content, indicating greater retention of N in the manure and less N volatilization. This increased manure N reflects a more stable microbial protein form and provides a reduced environmental runoff potential.

**Key Words:** pigs, odor, manure composition

**1040 Effects of dietary phytase and aluminum chloride manure amendments on phosphorus in swine manure.** D.R. Smith<sup>\*1</sup>, P.A. Moore, Jr.<sup>2</sup>, C.V. Maxwell<sup>1</sup>, and T.C. Daniel<sup>1</sup>, <sup>1</sup>University of Arkansas, Fayetteville, <sup>2</sup>USDA-ARS, Fayetteville.

Phosphorus (P) runoff from animal manure applied to pastures has been implicated in eutrophication of lakes and rivers. Two technologies that have been proposed to reduce P in manure are the addition of dietary phytase, which allows lower total P to be fed, or addition of aluminum compounds to the manure, which precipitates soluble P. The objectives of this study were (1) to evaluate the effects of dietary phytase, and aluminum chloride ( $AlCl_3$ ) added to swine (*Sus scrofa domestica*) manure, on P in manure and runoff, and (2) to study the effects of  $AlCl_3$  amended manure on ammonia volatilization from swine manure. A 2 X 4 factorial design was applied to twenty-four pens of nursery pigs, using two levels of phytase (500 IU phytase  $kg^{-1}$  and no phytase), and four levels of  $AlCl_3$  (0, 0.25, 0.50 and 0.75% of final manure volume). Each pen was fitted with an individual manure collection pit. A pull/plug manure management system was simulated by flushing pits bi-weekly and recharging with simulated lagoon water, at which time  $AlCl_3$  amendments were made. A three phase diet was used with the control diet based on NRC available P (aP) and phytase diets based on NRC -0.1% aP. Ammonia fluxes were measured in-situ twice weekly. Manure was collected at the end of each phase, and analyzed for total and soluble reactive P (SRP). Manure was also collected and applied to 1.96 X 5.96

m plots cropped to tall fescue (*Festuca arundinacea* Shreb.) at a rate of 150 kg N  $ha^{-1}$  for rainfall simulations. A simulated 5 cm  $hr^{-1}$  rainfall event was conducted on each plot, and runoff samples collected. Phytase reduced SRP in manure by 15% (89.6 mg P  $L^{-1}$  for no phytase and 76 mg P  $L^{-1}$  for phytase diet,  $P<.001$ ). A 78% reduction in SRP ( $P<.001$ ) in manure was noted in high  $AlCl_3$  (34 mg P  $L^{-1}$ ) pits compared to controls (154 mg P  $L^{-1}$ ). Ammonia fluxes were reduced ( $P<.001$ ) by 51% for high  $AlCl_3$  treatments compared to controls. These two technologies could be employed by production facilities to reduce risk of P losses from swine manure.

**Key Words:** Phosphorus, Phytase, Aluminum Chloride

**1041 Effects of monensin on microbial activity in in vitro swine manure slurries.** M.A. Cotta<sup>\*</sup>, R.L. Zeltwanger, and T.R. Whitehead, USDA/ARS/Natl. Cent. for Agric. Utilizn. Res..

Storage of swine waste is associated with the microbiological production of a variety of odorous compounds, including ammonia, organic acids and alcohols, and sulfides. These compounds can contribute to health problems for swine facility workers and animals, as well as odors that affect local human populations. Previous research in our laboratories has demonstrated that the primary microbial populations in stored swine waste are low (G+C), Gram-positive anaerobic bacteria. Monensin has been used to alter the bacterial population and metabolic end-products in the rumen of domestic animals for improved animal performance, largely through its effect on Gram-positive bacteria. Therefore, it was decided to test the effects of monensin on stored swine waste slurry. Fecal and manure storage pit slurry were collected from a local swine production facility. Manure slurry was combined with 20%(w/v) feces and mixed under gas. The mixture was aliquoted into glass bottles under gas, stoppered and maintained under anaerobic conditions. Monensin (10  $\mu M$ ) was added to two bottles, and two bottles without monensin were used as controls. Gas production was measured over time, and aliquots were removed for chemical analyses and determination of viable bacterial numbers. Gas production in the monensin samples were greatly reduced within 24 hr ( $<10\%$  of controls), and this reduction was maintained over a 28 day test period. Methane production was also reduced ( $<5\%$  of controls). However, no detectable hydrogen was observed in any sample. Volatile fatty acid production was only slightly decreased in the monensin samples, while butyrate production increased 3-fold. These results are quite different from those observed in the rumen. Viable bacterial levels as determined by anaerobic agar plating were consistent between the treatments over the test period. Since a shift in bacterial populations was probably occurring during incubations with monensin, total DNA was isolated from the samples. The DNA will be used to assess changes in bacterial populations by 16S rDNA Amplified Ribosomal DNA Restriction Analysis (ARDRA). The results of this study suggests that addition of antimicrobial compounds may prove useful for reducing gaseous, odorous emissions from swine facilities, although monensin may not be the correct one.

**Key Words:** Swine, Manure, Monensin

**1042 Factors influencing estrus and ovulation in weaned sows as determined by transrectal ultrasound.** R. Knox<sup>\*1</sup> and S. Rodriguez-Zas, <sup>1</sup>University of Illinois, Urbana IL.

Characterization of factors influencing estrus and ovulation in sows may facilitate development of procedures for improving reproductive performance. The experiment was conducted in confinement during 1997-1999 using 174 Large White x Landrace sows. After weaning, sows were checked for estrus twice daily. In the first year transrectal ultrasound was performed once daily and in the second year twice daily at estrus, and on every day until ovulation. The effects of lactation length ( $\leq 16$  d, 17-24 d, 25-31 d or  $\geq 32$  d), parity (1, 2 or  $\geq 3$ ), season (winter, spring, summer or fall) and weaning to estrus interval (3 d, 4 d, 5 d, or 6-8 d) and their interactions on estrual and ovulatory responses were studied. There was no effect of frequency of ultrasound on any measures so data across years were pooled. Estrus was influenced by lactation length ( $P<.001$ ), with sows lactating  $\leq 16$  d (35.2%) less likely to express estrus than sows lactating  $\geq 17$  d (94%). A parity by season interaction effect was observed ( $P<.001$ ) for estrus with lowest expression in parity 1 sows in fall (73.0%) and winter (86.4%), parity 2 sows in fall (67.2%), and  $\geq$  parity 3 sows in summer (84.6%). No explanatory variable had a significant effect on wean to estrus interval (4.4 d) or on follicle size at estrus (8.1 mm). Ovulation hour after onset of estrus was affected by

wean to estrus interval ( $P < .01$ ) with sows returning in 3 d ovulating at 46.2 h, and between 6-8 d at 30.2 h. The percentage of sows ovulating was influenced by lactation length ( $P < .001$ ) and wean to estrus interval ( $P < .001$ ). Sows that lactated  $\leq 16$  d were less likely to ovulate (78.0%) than those lactating  $\geq 17$  d ( $> 92\%$ ). Sows that returned to estrus in 3 d were also less likely to ovulate (79.5%) than sows returning  $\geq 4$  d after weaning ( $> 92\%$ ). A parity by season interaction effect was also observed on ovulation ( $P < .001$ ). The data suggest that parity, lactation length and early return to estrus and parity by season effects are associated with risk of failure to express estrus and ovulate.

**Key Words:** sows, estrus, ovulation

**1043 Use of CowTemp<sup>TM</sup> temperature monitoring system for prediction of calving onset in beef cows.** J. N. Nielsen<sup>\*1</sup>, S. S. Donkin<sup>1</sup>, K. Vanzant<sup>1</sup>, P. A. McAfee<sup>2</sup>, and S. A. Brune<sup>2</sup>, <sup>1</sup>Purdue University, West Lafayette, IN, <sup>2</sup>Innotek, Inc., Garrett, IN.

The ability to identify cows that will calve within 24 hours would enhance the herd manager's provision of appropriate peripartum care. Previous studies using surgically implanted temperature monitors identified a drop in body temperature from 48-8 hours prior to calving. This study tested the calving predictive value of the CowTemp<sup>TM</sup>, a telemetric system in development that measures and transmits the temperature within the reticulum on a periodic basis. Nine pregnant multiparous beef cows were orally administered a reticular bolus containing a temperature sensor, microprocessor and transmitter 7-41 days prior to calving. Each bolus was programmed with a unique ID number, which was transmitted with temperature via a receiver to a computer that averaged the temperature over a 24-hour period and graphically displayed the results. A computer program was designed to compare the rolling 24-hour temperature average with the previous 5 days' average. The mean temperature nadir and standard deviation (SD) prior to calving was  $-0.69 \pm 0.18^\circ\text{C}$  (reduction from rolling average). The nadir temperature was recorded  $3.1 \pm 2.4$  hours prior to parturition. Using a critical temperature from 1 to 2 standard deviations above the nadir ( $0.39^\circ\text{C}$ ), all cows were identified 9-23 hours prior to calving. At 1 SD above the nadir, one of the 9 cows would have been missed, since her temperature drop was not great enough to trigger the alarm. At 2 SD above the nadir this same cow had multiple false alarms for impending calving. Although this is a small sampling of animals, it demonstrates the value of remotely monitoring temperature within the reticulum to predict calving within a 9-23 hour window.

**Key Words:** Temperature, Calving, Radiotelemetry

**1044 Optimal days in period to detect a change in estrus detection.** A. de Vries<sup>\*</sup> and B.J. Conlin, University of Minnesota, St. Paul, Minnesota.

The objective was to determine the optimal number of days in a period (DIP) to detect a change in average estrus detection index (EDI) with a Shewhart control chart. EDI is defined as the number of observed estruses over the number of expected estruses in a period. Shewhart charts are tools in statistical process control and distinguish between true changes and normal variation in EDI. A signal is triggered when EDI value falls outside a control limit. Control limits are based on the desired rate of false alarms and a measure of the standard error in EDI from period to period. Typically, EDI is calculated monthly (DIP = 30 or 31). Long periods imply large sample sizes and therefore EDI has more power ( $1 - \beta$ ) to signal a true change. On the other hand, short periods take less time to complete and may signal larger changes faster. Thus, the DIP should be chosen such that the average time to signal (ATS) given a true change is as short as possible. Assuming that the distribution of EDI can be modeled by a normal distribution, then the optimal DIP can be found by minimizing  $\text{DIP} / (1 - \beta) = \text{DIP} / [1 - (\text{Pr}(X < \text{EDI}0 - Z * \sigma / \sqrt{\text{DIP}}) + \text{Pr}(X > \text{EDI}0 + Z * \sigma / \sqrt{\text{DIP}}))]$  where  $X$  is the EDI random variable,  $\text{EDI}0$  is the average EDI before a change,  $\sigma$  is the standard deviation of EDI with periods of 1 day. The constant  $Z$  depends on the desired average days between false alarms (ATS0) and the change of most interest (EDI1):  $Z = \Phi^{-1}(\text{DIP} / \text{ATS}0 / 2) - (\text{EDI}0 - \text{EDI}1) / \sigma * \sqrt{\text{DIP}}$  where  $\Phi^{-1}()$  is the inverse of the standard normal distribution. Then  $\text{ATS}1 = \text{optimal DIP} / (1 - \beta)$  is the average days to signal after the change to EDI1. For example, assume  $\text{ATS}0 = 730$  and  $\sigma = 0.25$  for a 1000 cow herd. A change from  $\text{EDI}0 = 0.6$  to  $\text{EDI}1 = 0.4$  is the fastest

detected with  $\text{DIP} = 12$  ( $\text{ATS}1 = 18.6$ ). A period length of  $\text{DIP} = 31$  would result in  $\text{ATS}1 = 31.2$ . Similarly, a 100 cow herd with  $\sigma = 0.79$  would have optimal  $\text{DIP} = 57$  ( $\text{ATS}1 = 102.0$ ). For  $\text{DIP} = 31$ ,  $\text{ATS}1 = 115.8$ . The conclusion is that optimal period length decreases with larger herd size, larger change of interest, and higher false alarm rate.

**Key Words:** Estrus detection, Statistical process control, Sample size

**1045 The effect of days open on milk produced per day across sequential lactations.** J.D. Ferguson<sup>\*1</sup>, D.T. Galligan<sup>1</sup>, G. Atzaro<sup>2</sup>, S. Ventura<sup>2</sup>, and G. Licita<sup>2</sup>, <sup>1</sup>University of Pennsylvania, <sup>2</sup>Consorzio-Ricerca Filiera Lattiero-Casaria.

The objective of this study was to calculate the effect of days open on milk produced per day across sequential lactations in Holstein-Friesian cows. Records (39,929) were collected from the Ragusa, Italy DHIA organization from 263 herds for the years 1995-1999. Each record included herd ID, cow ID, date of parturition, lactation number, total cumulative milk production, and total days in milk at last test record. Cumulative milk production (CUMMILK) was calculated from monthly test records. Calving interval (CI) was determined by the interval between sequential calvings for each cow. The CI was associated with the next lactation record for that cow, as was previous lactation cumulative milk yield (PREVMILK) and previous total lactation days (PREVDIM). Days open (DOPEN) was calculated as  $\text{CI} - 280$ . Total milk produced (TOTMILK) in sequential lactations was  $\text{CUMMILK} + \text{PREVMILK}$ . Total days (TOTDIM) was  $\text{CI} + \text{DIM}$  in the subsequent lactation. Milk produced per day (MPD) was calculated as  $\text{TOTMILK} / \text{TOTDIM}$ . To index production, the 305 milk yield (M305) was calculated based on production curves for each cow-lactation generated from monthly milk records. Data was edited to exclude extreme PREVDIM and DIM records. Final analysis was on 8331 records. MPD was influenced by M305 of cow, lactation number, month of parturition, and DOPEN. The relationship of MPD to DOPEN was nonlinear and fit the following model ( $\text{SE}$ ):  $\text{MPD} = .00341(.00014) * \text{M305} * \text{DOPEN}^{-.0383(.0111)} * \exp(\text{DOPEN} * -.00014(.0001))$ . Selective culling may have resulted in the nonlinear relationship of MPD and DOPEN.

**Key Words:** days open, milk produced per day, reproductive efficiency

**1046 Conception rates of sequential inseminations after batch-thawing multiple straws of semen: A professional technician case study.** M. J. Sprenger<sup>1</sup>, J. M. DeJarnette<sup>2</sup>, and C. E. Marshall<sup>2</sup>, <sup>1</sup>Paddocks Breeding Service, Warsaw, NY, <sup>2</sup>Select Sires, Inc., Plain City, OH.

Although standard recommendations for thawing cryopreserved bovine semen are to thaw no more straws than can be deposited in the female within 10 to 15 minutes and to maintain thermal homeostasis during this interval, recent studies suggest thawing more than two straws at once results in compromised fertility of the third or greater sequential insemination number (SIN). This study evaluated the effects of SIN on conception rates (CR) after batch-thawing of straws by a professional AI technician (PAIT). The study was conducted in western NY from June 1999 through May 2000. As efficiency dictated that multiple straws should be thawed ( $n = 2$  to 11), the PAIT recorded herd, cow ID, bull ID, AI date, and SIN. Pregnancy data ( $n = 6122$ ) were obtained by cross-referencing the recorded events with each herd's ( $n = 28$ ) reproductive database subsequent to pregnancy diagnosis. To increase sample size for statistical analyses,  $\text{SINs} \geq 7$  were combined and data from 16 small herds ( $n < 80/\text{herd}$ ) were combined as one. Data were evaluated in logistic regression models that included the main effects of herd ( $n=13$ ), SIN, season, service (first or repeat), and all two-way interactions. The herd by SIN interaction tended ( $P = 0.07$ ) to influence CR. In herd E, CR of SIN 5 was lower ( $P < 0.01$ ; 10%, 11/108) than SIN 1 to 4 or 6 and  $\geq 7$  (28% for each). In herd M, CR of SIN 6 (0%, 0/11) and  $\geq 7$  (7%, 1/14) were lower than SIN 1 to 5 (32% for each). SIN had no effect ( $P > 0.10$ ) on CR in the other 11 herds nor across all herds (1 = 32%, 397/1260; 2 = 33%, 411/1250; 3 = 34%, 386/1129; 4 = 33%, 300/917; 5 = 32%, 219/696; 6 = 29%; 133/464;  $\geq 7 = 35\%$ , 142/406). Additionally, CR evaluated by the total number of straws in each thaw revealed no decline in fertility due to batch-thawing. These

data suggest that PAITs and herdsman inseminators who follow recommended semen handling procedures can thaw more than two straws at once without compromising conception rates.

**Key Words:** Cryopreserved bovine semen, AI, Batch-thawing

**1047 Results of Breeding Soundness Evaluations performed on Senepol bulls in the US Virgin Islands.** R.W. Godfrey\* and R.E. Dodson, <sup>1</sup>University of the Virgin Islands, Agricultural Experiment Station, St. Croix.

The Breeding Soundness Evaluation (BSE) was used to evaluate Senepol bulls on 3 farms on St. Croix over a 2-yr period. One set of bulls (SELECT; n = 75) was tested prior to sale or use in the breeding herd. The second group of bulls (UNSELECT; n = 440) was tested at 4-mo intervals without any prior selection. Bulls in the SELECT and UNSELECT groups ranged in age from 12.7 to 89.3 mo and 6.5 to 101 mo, respectively. Bulls were given a rating of satisfactory or unsatisfactory based on the BSE guidelines. Data were analyzed using GLM and chi-squared procedures of SAS. In the UNSELECT group the percentage of bulls passing the BSE increased ( $P < .0001$ ) with age. In the SELECT group the percentage of bulls passing the BSE decreased ( $P < .02$ ) with age. In the UNSELECT group, bulls that passed the BSE had larger SC ( $P < .0001$ ), greater sperm motility ( $P < .0001$ ) and a higher percentage of normal sperm ( $P < .03$ ) than bulls that failed. In the SELECT group, bulls that passed the BSE had a higher percentage of normal sperm ( $P < .0001$ ) but there was no difference ( $P > .10$ ) in SC or sperm motility. Of the SELECT bulls that failed the BSE, a higher percentage ( $P < .0001$ ) received passing scores for sperm motility and SC than they did for sperm morphology (92, 94.4 and 1.1 %, respectively). Of the UNSELECT bulls that failed the BSE, there was no difference ( $P > .10$ ) in the percentage that received passing scores for SC, sperm motility or morphology (7.2, 7.7 and 9.7 %, respectively). In the SELECT and UNSELECT groups, 28 and 197 bulls were tested more than once, respectively. In the UNSELECT bulls that were tested more than once, there were increases in SC ( $P < .0001$ ) and sperm motility ( $P < .01$ ), but not sperm morphology ( $P > .10$ ) over time. In the SELECT bulls that were tested more than once there was no effect of time on SC, sperm motility or morphology ( $P > .10$ ). These results indicate that sperm morphology had a greater impact on the proportion of Senepol bulls passing the BSE than did testicular size or sperm motility.

**Key Words:** Bull, Scrotal Circumference, Semen Quality

**1048 Effects of GnRH-PGF based estrus synchronization with or without short-term progestin exposure on reproductive performance of postpartum suckled beef cows.** J. M. DeJarnette, R. A. Wallace, and C. E. Marshall, *Select Sires, Inc., Plain City, OH.*

This study evaluated the effects of short-term progestin exposure on synchrony of estrus and reproductive performance of postpartum beef cows synchronized to estrus using GnRH and PGF. Postpartum (80 ± 2.2 d) Angus cows were injected (im) with 100 mg of GnRH on d #7 and PGF (0.5 mg cloprostenol) on d 0. Animals were randomly allotted by parity and calving date to receive either: 1) no further treatment (GP; n = 45) or 2) 0.5 mg/hd/d of melengestrol acetate (MGA) from d #6 through d #1 (GMP; n = 54). Unbalanced sample size is due to herd-owner decision (subsequent to treatment allocation) to breed animals to randomly detected natural heats during the 2 week prior to treatment, however, postpartum interval and parity distribution remained balanced across treatments. Twice daily observation for estrus began on d #3 and continued until 72 h post-PGF. Cows detected in estrus were bred by AI 8 to 12 h later (EAI). Cows not detected in estrus by 72 h post-PGF were fixed-time inseminated and concurrently injected (im) with 100 mg of GnRH (TAI). Cows were exposed to herd bulls on d 13 and ultrasonographic pregnancy diagnosis was performed on d 38. Data were analyzed in logistic regression models that included the effects of treatment, parity, postpartum interval, body condition score, and all two-way interactions. Although fewer ( $P = 0.08$ ) GMP than GP-treated cows were detected in estrus (59 vs. 76%, respectively), the numerical difference ( $P = 0.30$ ) in conception rate at TAI (56 vs. 36%, respectively) and the absence of estrus by 24 h post-PGF (0 vs. 9%, respectively) suggests a greater degree of ovulatory synchrony was established by GMP treatment. Conception rates to EAI (GP vs. GMP; 75 vs. 69%) and synchronized AI pregnancy rates (GP vs. GMP; 67 vs. 63%) were not affected ( $P > 0.10$ ) by treatment. These data suggest

MGA can be used to prevent premature estrus in GnRH-PGF treated cows without compromising AI pregnancy rate.

**Key Words:** Estrus synchronization, Melengestrol acetate, Progestin

**1049 Effectiveness of a stand-alone electronic estrus detection device - MountCount.** H. K. Baitis\*, J. B. Hall, D. E. Eversole, and D. Cuddy, *Virginia Polytechnic Institute and State University, Blacksburg, Virginia.*

An electronic estrus detection (EED) system, HeatWatch® (DDx, Inc., Boulder, CO), increases estrus detection efficiency in cattle, but requires receivers, repeaters, and a computer. MountCount® (DDx, Inc., Boulder, CO) is a stand-alone EED unit that indicates estrus status by lights. Information on the effectiveness of MountCount® (MC) compared to other estrus detection systems is limited. The objective of this study was to compare the efficiency and accuracy of visual estrus detection (VIS) or MC to HeatWatch® (HW). In trial 1, dry open cows (n=50) were fitted with both MC and HW. Cows were observed for estrus for 10 d and then synchronized with prostaglandin. In trial 2, lactating postpartum cows (n=136) were randomly fitted with either MC or HW. Cattle were synchronized with either 7-11 or CO-Synch protocol. Cattle were observed 2x/d (trial 1; VIS-2) or 5x/d (trial 2; VIS-5) for visual signs of estrus, MC status and condition of MC and HW. In trial 1, either MC or HW detected more ( $P < .001$ ) cows in estrus than VIS-2. VIS-2 and MC agreed with HW 43.0% and 93.3%, respectively, when HW indicated cows were in estrus. MC more often indicated ( $P < .02$ ) that cows were in estrus when HW did not indicate estrus. Agreement with HW was 85.0% and 70.0% for VIS-2 and MC, when HW indicated no estrus activity. In trial 2, for HW cows, VIS-5 identified fewer ( $P < .03$ ) cows in estrus than HW. Estrus detection rates were 86.7% and 100% for VIS-5 and HW, respectively. For MC cows, VIS-5 identified more ( $P < .02$ ) cows in estrus than MC with estrus detection rates of 96.0% and 78.0% for VIS-5 and MC, respectively. Pregnancy rates to artificial insemination were not different ( $P > .15$ ) for MC cows (47.8%) compared to HW cows (30.4%). Observers indicated that MC was difficult to visualize in daylight. We conclude that MC is superior to twice-daily visual estrus detection, but appears less effective than intensive visual estrus detection or HW.

**Key Words:** Estrus Detection, Cows, Electronic

**1050 Lowering dietary P in dairy rations reduces the vulnerable P fraction in manure.** Z. Dou\*, K. Knowlton<sup>2</sup>, G. Zhang<sup>1</sup>, Z. Wu<sup>3</sup>, and R. Kohn<sup>4</sup>, <sup>1</sup>University of Pennsylvania, <sup>2</sup>Virginia Tech, <sup>3</sup>Penn State University, <sup>4</sup>University of Maryland.

Phosphorus (P) accumulation on livestock farms contributes to elevated P runoff loss and accelerated eutrophication of surface waters. Recent studies strongly suggest that the amount and concentration of P in dairy manure can be substantially reduced by lowering dietary P levels in lactating cow rations while maintaining cow performance. Yet, little is known concerning the effect of dietary manipulation on the forms and relative solubility of manure P. The objective of this study was to characterize P in dairy feces collected from several feeding trials, each comparing two or three dietary P concentrations in lactating dairy cows. Fecal samples, collected during various stages of lactation, dried and ground, were measured for readily soluble P by extracting in deionized water with 1 hr shaking. Selected fecal samples were used to determine P fraction distributions using a sequential extraction procedure. Lowering dietary P levels dramatically reduced the amount of readily soluble P in fecal materials. For example, decreasing dietary P from 0.47% to 0.39% of feed DM resulted in a reduction of readily soluble P from 4.33 to 2.82 g/kg fecal DM. In another trial, decreasing dietary P from 0.52% to 0.34% reduced readily soluble P from 4.40 to 1.82 g/kg DM. The same pattern was observed throughout the sampling periods covering up to 11 wks in lactation. Results from the sequential extractions indicate that dietary P levels not only affected the quantities but also the relative proportions of P fractions in feces. For instance, cumulative P released in repeated water extraction accounted for 88%, 84%, and 76% of the total P extracted through the sequential extractions corresponding to dietary P levels of 0.67%, 0.52%, and 0.34% DM. Reducing excessive P in diets may lead to a substantial decrease in the potential runoff loss of manure P from fields.

**Key Words:** Dietary P, Manure, P fraction

**1051 Reducing phosphorus solubility in animal manures using chemical amendments.** J. D. Toth\*<sup>1</sup>, G. Zhang<sup>1</sup>, Z. Dou<sup>1</sup>, and J. D. Ferguson<sup>1</sup>, <sup>1</sup>*University of Pennsylvania*.

Controlling nutrient losses from animal manures when they are land-applied is a critical factor in nutrient management, promoting environmental health and maintaining the sustainability of animal agriculture. Phosphorus is of particular concern due to its implication in eutrophication of surface waters and declines in water quality. We conducted a laboratory experiment to test the effect of several chemical amendments on reducing P solubility of animal manure. Freshly excreted swine or dairy manure samples were treated with aluminum sulfate (alum) or coal combustion byproducts: fluidized bed combustion flyash (FBC), flue gas desulfurization product (FGD), or anthracite refuse flyash (ANT). After incubation at ambient temperature for 3 d, subsamples were dried and ground. Samples were extracted with shaking for 1 hr in deionized water and the pH and inorganic and total P concentrations measured. Selected samples were extracted using a sequential procedure developed in our laboratory to identify the changes in soluble P forms as a function of amendment type and rate. Compared to untreated controls,

alum, FBC and FGD substantially reduced water soluble inorganic P in the 1 hr extract in fresh swine manure (by 80, 60 and 77%, at 250, 400 and 250 g amendment per kg DM manure, respectively). The 1 hr water extractable inorganic and total P in dairy manure were reduced by an average of 65 (alum at the 50 g rate) and 50% (FBC at the 400 g rate). The ANT amendment was ineffective in reducing water soluble P in swine manure, and both ANT and FGD ineffective in dairy manure. In the sequential, repeated extraction trial, addition of the amendments alum, FBC or FGD to swine manure reduced the total water soluble inorganic P concentration and increased the concentrations of bicarbonate, hydroxide and acid-soluble P by 11-21% compared to the control, demonstrating effectiveness in shifting inorganic P from the most vulnerable, water-soluble fraction to less soluble forms. The alum and FBC amendments had a similar effect on the dairy manure samples. Additional trials are planned to examine the amendments for other manure types and to refine effective rates of addition to reduce soluble P.

**Key Words:** Phosphorus Solubility, Nutrient Management, Manure Nutrients

## Beyond pH: Metabolic Factors Affecting Pork Quality

**1052 The Effect of the RN<sup>-</sup> Allele on Meat Quality and how the Gene was Discovered.** K. Lundstrom\* and L. Andersson, *Swedish University of Agricultural Sciences, Uppsala, Sweden*.

The RN<sup>-</sup> allele was first identified in France as causing a reduction in the yield of cured cooked ham from composite lines containing the Hampshire breed. The effect was determined by "Napole yield" (Rendement Napole in France), a standardized method for estimating yield. The dominant allele decreasing the yield was called RN<sup>-</sup> and was due to an increase in muscle glycogen content. The RN locus has been mapped to chromosome 15, and has recently been identified as a mutation in the PRKAG3 gene, which encodes a muscle-specific isoform of the regulatory  $\lambda$  subunit of adenosine monophosphate-activated protein kinase (AMPK).

The RN<sup>-</sup> allele has a great effect on technological meat quality, leading to a decrease in ultimate pH and water holding capacity, and an increase in reflectance value. The chemical composition of meat is also altered with an increase of glycogen and water content and a reduction of pro-

tein content. These changes lead to a reduction in the yield of cooked cured ham. On the other hand, the eating quality is enhanced. In several Swedish studies, pork from animals carrying the gene had higher juiciness, meat taste and acidulous taste and usually a higher tenderness. Also Swedish consumers preferred pork from carriers of the RN<sup>-</sup> allele in comparison with non-carriers. Processed meat from RN<sup>-</sup> carriers also showed a higher juiciness and tenderness in sensory tests with a trained panel. In contrast, French results showed a negative effect on eating quality. Also, the production traits are altered as an effect of the RN<sup>-</sup> allele, leading to a higher growth rate and a higher proportion of lean meat in the carcass.

The gene frequency of the RN<sup>-</sup> allele has been around 0.6 in Swedish Hampshire. Due to the negative effect of the RN<sup>-</sup> allele on technological meat quality, most countries and breeding companies would like to eliminate the mutation. With the mutation identified, this could be easily achieved. However, the positive effects of the RN<sup>-</sup> allele on eating quality should be taken into consideration.

**Key Words:** RN<sup>-</sup> allele, Meat Quality, Napole Yield