442 Comparison of TAI at GnRH injection and delayed insemination of non-estrus beef heifers. Hazy R. Nielson*[1], Dan J. Kelly[2], and Rick N. Funston[1], *[1]University of Nebraska, West Central Research and Extension Center, North Platte, NE, [2]Kelly Ranch, Sutherland, NE.*

A study evaluated the effect of a 16-h delayed AI following GnRH administration in a hybrid estrus detection and time AI protocol in heifers not in estrus at the time of scheduled AI. Angus-based, crossbred heifers (n = 453) of the same origin were managed at the Kelly Ranch (Sutherland, NE) or the University of Nebraska West Central Research and Extension Center (North Platte, NE). Estrus was synchronized utilizing the melengestrol acetate (MGA)-PG protocol; heifers received MGA for 14 d. Nineteen d later, on d 33 of the protocol, heifers received a PG injection and estrus detection aids (Estrotect) were applied. Heifers were considered to have expressed estrus when greater than 50% of the rub off coating was removed from the Estrotect. Heifers (n = 319) were then removed from the herd and AI 12 h later (ESTRUS). Seventy-two hours following the PG injection, heifers whose Estrotect were less than 50% activated were administered GnRH, and randomly assigned to 1 of 2 treatment groups; 1) immediately AI (n = 70, GNRH1) or 2) AI 16 ± 1 h following GnRH injection (n = 64, GNRH2). Data were analyzed using the GLIMMIX procedure of SAS (SAS Inst. Inc., Cary, NC) and the proportion of pregnant heifers was found using an odds ratio utilizing the ILINK function. Pre-breeding BW was similar (P = 0.58) between ESTRUS, GNRH1, and GNRH2 (351, 346, and 349 ± 6 kg, respectively). Furthermore, pregnancy diagnosis BW among the treatments was similar (P = 0.48; 376, 380, and 377 ± 6 kg; ESTRUS, GNRH1, and GNRH2, respectively). Heifers who were AI on their estrus, as determined by an activated Estrotect, had significantly higher (P < 0.01) pregnancy rate compared with heifers in both GNRH1 and GNRH2 groups (70 vs. 56, 47 ± 6%). Pregnancy rates did not differ (P = 0.56) between GNRH1 and GNRH2 (56 vs. 47 ± 6%). Heifers in all groups reached a similar (P = 0.59) percentage of mature BW before the breeding season (63 ± 1%). Final pregnancy rate was not different (P = 0.54) for ESTRUS, GNRH1, and GNRH2 heifers (92, 89, 91 ± 4%). There was no significant benefit to delayed AI of non-estrus beef heifers compared with traditional timed AI at the time of GnRH injection.

Key Words: beef heifer, delayed insemination, estrus synchronization

443 Bee Synch for synchronization and fixed-time AI of *Bos indicus*-influenced cows: An update. Gary L. Williams*1,3, Randy L. Stanko[2], and Marcel Amstalden[3], *[1]Texas A&M AgriLife Research, Beeville, TX, [2]Texas A&M University-Kingsville, Kingsville, TX, [3]Texas A&M University, College Station, TX.*

Synchronization methodologies that are successful in straight-bred English and Continental breeds have proven less successful in *Bos indicus*-influenced cattle, with fixed-time AI (FTAI) pregnancy rates of 35 to 40%. Because of these poor outcomes, few commercial cattlemen who utilize these types of cattle employ synchronization technologies and FTAI. Research has indicated that variation in the rate of maturation of the dominant follicle after CIDR removal in *Bos indicus*-influenced females is a major contributor to reduced pregnancy potential at FTAI. Herein, we provide an updated report on the use of a modification of the standard 5-day CO-Synch + CIDR protocol, the 5-day Bee Synch + CIDR (Bee Synch) which has been termed PG-5-Day + CIDR by the Beef Reproduction Task Force. The protocol was designed to eliminate mature corpora lutea at the onset of synchronization, thus reducing circulating concentrations of progesterone, minimize variation in the rate of follicle maturation, and improve FTAI pregnancy rates. Initial studies evaluated the 5-Day CO-Synch + CIDR protocol alone (n = 100; Trial 1) or in comparison with Bee Synch (Bee Synch, n = 133; 5-Day CO-Synch, n = 136; Trial 2) at one location with mature cows. Subsequently, Bee Synch was evaluated at 4 additional locations utilizing Braford, Brangus, and Nelore crossbred cows. The 5-d protocol involved insertion of a controlled internal drug releasing device (CIDR) and i.m. injection of GnRH (100 μg; Factrel) on d 0. On d 5, the CIDR was removed and cows were treated i.m. with prostaglandin $F_{2\alpha}$ (PGF; Lutalyse, 50 mg). Cows were inseminated at 66–72 h after CIDR removal and treated with 100 μg GnRH. Bee Synch employed a similar sequence except that all cows were treated with 25 mg PGF at the time of CIDR insertion. Pregnancy rate to FTAI in Trial 1 (5-Day CO-Synch + CIDR) was 33%. In trial 2, Bee Synch markedly improved FTAI pregnancy rates compared with the standard 5-day protocol (51.8 ± 0.9 vs 40.9 ± 5.7%; P < 0.04). Cumulative FTAI pregnancy rates in cows (n = 702) treated with Bee Synch at 5 locations averaged 51.9 ± 3.1% (range = 40 to 59.3). Bee Synch appears to improve FTAI feasibility in *Bos indicus*-influenced cows.

Key Words: synchronization, *Bos indicus*-influenced, Bee Synch

444 Effect of MGA versus CIDR estrus synchronization on estrus response and pregnancy rates in 311-d-old beef heifers. Hazy R. Nielson*[1], Rosemary V. Anderson[2], and Rick N. Funston[1], *[1]University of Nebraska, West Central Research and Extension Center, North Platte, NE, [2]Anderson Ranch, Whitman, NE.*

A study compared the effect of melengestrol acetate (MGA)-PG and 14-d controlled internal drug release (CIDR)-PG estrus synchronization protocols on estrus response and pregnancy rates of 311-d-old Angus-based, crossbred heifers (n = 153). Fall-born heifers, at 10 mo of age, were randomly assigned to 1 of 2 estrus synchronization protocols in the spring (2 replications/treatment). Heifers in the MGA protocol received MGA for 14 d fed through the diet beginning on d 0 of the synchronization treatment period. Heifers in the CIDR treatment received the same diet as MGA heifers and were implanted with a CIDR (Eazi-breed CIDR) on d 2 of the treatment period and removed on d 16. Following estrus synchronization, heifers from both treatments were combined and received a single PG (Lutalyse) injection on d 32. Heifers with activated heat detection aids (Estrotect) were AI 12 h following observation. All data were analyzed with the GLIMMIX procedure of SAS (SAS Inst. Inc., Cary, NC). Group BW was measured at weaning (198 kg) and before breeding (273 kg). Pre-breeding BW was 50.1% of predicted mature BW. Heifer age at breeding was not different (P = 0.12) between MGA and CIDR treatment groups. Percentage of heifers demonstrating signs of estrus was similar (P = 0.42) between synchronization treatment groups (CIDR vs. MGA, 71.5 vs. 77.4 ± 1.0%). Heifers not expressing estrus were not given an opportunity to become pregnant and removed from the herd. Pregnancy rates to AI of heifers expressing estrus (n = 115) were similar (P = 0.27) between CIDR and MGA synchronization treatment (46.3 vs. 36.1 ± 6.8%). Bulls were placed with heifers at a 1:25 ratio 10 d following AI. Final pregnancy rate was also similar (P = 0.96) between CIDR and MGA treatment groups (51.0 vs. 51.5 ± 7.4%). Heifer BW at pregnancy diagnosis was not different (P = 0.45) between CIDR and MGA treatment groups (325 vs. 321 ± 3.4 kg). The

numerical 10% decrease in AI pregnancy rate in MGA compared with CIDR synchronization is not significant but is of interest. Approximately half of these 311 d old heifers exposed to AI and bulls became pregnant.

Key Words: beef heifers, estrus synchronization, heifer development

445 Variation in timed-AI pregnancy rates in beef sires. Bo R. Harstine*[1], Rodrigo A. C. Martins[2], Adnan D. P. Rodrigues[4], Leandro H. Cruppe[1,3], Matthew D. Utt[3], Lon D. Peters[3], José L. M. Vasconcelos[4], Mel DeJarnette[3], and Michael L. Day[1], *[1]The Ohio State University, Department of Animal Sciences, Columbus, OH, [2]RM Reprodução Animal, Brasilia, Brazil, [3]Select Sires Inc., Plain City, OH, [4]Faculdade de Medicina Veterinária e Zootecnia, UNESP, Botucatu, SP, Brazil.*

Differences between timed-AI (TAI) pregnancy rates (PR) of beef bulls and collections within bull are difficult to determine due to limited number of females per breeding group. PR to TAI between 6 Angus bulls and between collections (combined 2 ejaculates) within bull were examined in large Brazilian beef herds. In 4 bulls, 3 collections obtained in a 2-week period were packaged in different colored straws. In 2 bulls, a single collection was packaged in 3 straw colors as controls. Straws contained 20 million total spermatozoa (0.5 ml). Nelore females (n = 6003) in 75 groups on 4 farms were synchronized for TAI. Every bull was represented in each group, and collection within bull was randomized across groups. Parity and body condition score (BCS) were recorded at TAI. Pregnancy was diagnosed approximately 35 d post-TAI (5614 complete records). Data were analyzed using GLIMMIX procedure of SAS with main effects of sire, collection(sire), farm, parity(farm), and BCS (≤2.75 or ≥3 on a scale of 5). Estrotect patches were used on a subset of cows (n = 3334; 2 farms) to assess estrus activity. PR was greater ($P < 0.05$) when BCS was ≥3 and if females displayed estrus. PR differed ($P < 0.05$) between sires and tended to differ between collections within sire ($P = 0.09$; Table 1). The numeric range in PR was similar among straw colors for both individual collections and a control (Sire 3), illustrating that the impact of binomial variation, even within large sample sizes such as these, cannot be ignored. In conclusion, large and economically significant differences in fertility exist between bulls used for TAI, and knowledge of bull fertility is crucial for the consistency and success of beef TAI programs.

Table 1 (Abstr. 445). Pregnancy rates (PR; %) to timed-AI (TAI) for bulls and individual collections within bull

	TAI PR per bull		SEM	TAI PR by straw color		
Bull	n	TAI PR	(%)	Purple	Red	Yellow
1	828	46.1[a]	2.7	47.7	44.8	45.8
2	1,109	44.7[a]	2.4	47.3	40.4	46.6
3[1]	735	41.3[ab]	2.9	42.3	44.7	36.8
4	1,026	39.2[ab]	2.6	31.8	42.3	43.7
5[1]	841	35.7[bc]	2.6	35.5	35.8	35.7
6	1,075	30.6[c]	2.1	26.5	34.5	30.7

[a–c]Means within the same column not sharing a common superscript differ significantly, $P < 0.05$.
[1]All straws from sire are from the same collection.

Key Words: fertility, AI, bull

446 Effect of decreasing the duration of a PRID-synch protocol and addition of a second prostaglandin $F_{2\alpha}$ treatment on fertility after resynchronization of ovulation in lactating Holstein cows. V. G. Santos*[1,2], P. D. Carvalho[1], C. Maia[3], B. C. Carneiro[3], A. Valenza[4], E. M. Bettencourt[2], and P. M. Fricke[1], *[1]Department of Dairy Science, University of Wisconsin-Madison, Madison, WI, [2]Departamento de Medicina Veterinária, Escola de Ciências e Tecnologia, Instituto de Ciências Agrárias e Ambientais Mediterrânicas, Instituto de Investigação e Formação Avançada, Universidade de Évora, Núcleo da Mitra, Évora, Portugal, [3]Diessen Servicos Veterinarios Lda, Évora, Portugal, [4]CEVA Sante Animale, Libourne, France.*

Our objective was to evaluate the effects of (1) decreasing the interval between the first GnRH treatment (G1) and the $PGF_{2\alpha}$ (PGF) treatment and (2) a second PGF treatment 24 h after the first during hormonal protocols for resynchronization of ovulation and timed artificial insemination (TAI). Lactating Holstein cows (n = 249) from 3 commercial dairy farms were randomly assigned at a nonpregnancy diagnosis to 1 of 3 hormonal protocols for resynchronization of ovulation: (1) a 7-d PRID-synch protocol with 1 PGF injection (7D1P: d 0; GnRH +PRID; d 7, PGF -PRID; 56 h, GnRH; 16 h, TAI); (2) a 7-d PRID-synch protocol with 2 PGF injections (7D2P: d 0, GnRH +PRID; d 7, PGF -PRID; 24 h, PGF; 32 h, GnRH; 16 h TAI); and (3) a 5-d PRID-synch protocol with 2 PGF injections (5D2P: d 0, GnRH +PRID; d 5, PGF -PRID; 24 h, PGF; 32 h, GnRH; 16 h, TAI). Ovaries of all cows were examined at G1 using transrectal ultrasonography, and cows were classified as either having or lacking a CL. Data were analyzed by logistic regression using PROC GLIMMIX of SAS. Pregnancy diagnosis was conducted 32 d after TAI using transrectal ultrasonography. Overall, P/AI 32 d after TAI did not differ ($P = 0.83$) between primiparous and multiparous cows [47% (35/75) vs. 44% (77/174), respectively]. At 32 d after TAI, P/AI tended to differ ($P = 0.09$) among treatments and was least for 7D1P cows, intermediate for 5D2P cows, and greatest for 7D2P cows [39% (35/89) vs. 44% (34/77) vs. 52% (43/83), respectively]. Furthermore, P/AI did not differ ($P = 0.20$) between cows classified as having or lacking a CL at G1 of the resynchronization protocols [48% (83/174) vs. 39% (22/56), respectively]. Based on these preliminary data, addition of a second PGF injection to a 7-d PRID-synch protocol increased ($P = 0.03$) P/AI 32 d after TAI by 13 percentage points (7D2P vs. 7D1P cows), whereas decreasing the interval between G1 and the PGF injection (5D2P vs. 7D2P cows) did not increase ($P = 0.62$) P/AI 32 d after TAI in resynchronized Holstein cows. Supported by CEVA Sante Animale.

Key Words: timed AI, dairy cow, resynchronization

447 Evaluating blood perfusion of the corpus luteum in beef cows during fescue toxicosis. Garrett F. Cline*[1], Ashleigh M. Muth-Spurlock[1], Benjamin E. Voelz[2], Caleb O. Lemley[1], and Jamie E. Larson[1], *[1]Mississippi State University, Mississippi State, MS, [2]Kansas State University, Manhattan, KS.*

The aim of this study was to determine if fescue toxicosis altered blood perfusion in the corpus luteum (CL), and peripheral concentrations of progesterone (P4) in cattle. In 2 replicates, the estrous cycles of 36, non-pregnant Angus or Charolais cows were synchronized using the CO-Synch+CIDR protocol. Seven d after initiation of the protocol, cows were assigned (d 0) to 1 of 2 treatments: 2.5 kg of (1) Kentucky-31 endophyte-infected (E+; n = 14), or (2) MaxQ novel endophyte (NE; n = 12) tall fescue seed. On d 7 ovaries were examined using ultrasonography and only cows that had 1 CL present remained on the study (n = 26). Images of blood perfusion of CL, blood samples, rectal temperatures, and blood pressure of tails were collected on d 10, 13, 15 and 18. Images

of CL blood perfusion were analyzed using ImageJ software for pixel density, and scored visually (0 to 9 with 0 = no perfusion, 9 = complete perfusion) by 2 independent technicians. The MIXED procedure of SAS was used with day as a repeated measure. LSMeans and pooled SEM are reported. Cows receiving E+ had greater rectal temperatures ($P = 0.02$; 38.73 ± 0.08°C) than those receiving NE (38.46 ± 0.08°C), providing evidence the cows treated with E+ were influenced by fescue toxicosis. Pulse pressure and mean arterial pressure were decreased ($P < 0.01$) in cows receiving E+ (54.08 ± 3.21 and 80.06 ± 2.71 mmHg, respectively) than NE (67.12 ± 3.11 and 91.37 ± 2.93 mmHg, respectively). Concentrations of P4 were similar ($P = 0.54$) between cows receiving E+ (6.04 ± 0.53 ng/mL) or NE (6.36 ± 0.63 ng/mL). Pixel densities ($P = 0.14$) and visual perfusion scores were similar ($P = 0.11$) between cows receiving E+ (1,477.20 ± 655.62 pixels and 2.23 ± 0.34, respectively) or NE (2,934.70 ± 718.20 pixels and 3.00 ± 0.36, respectively). Mean CL volume was similar ($P = 0.39$) between treatments. In conclusion, blood perfusion of CL or peripheral concentrations of P4 were not altered at the onset of fescue toxicosis, indicating that a decrease in blood perfusion of the CL may not be a primary mechanism involved in decreased reproductive efficiency of cattle during fescue toxicosis.

Key Words: blood perfusion, corpus luteum, fescue toxicosis

448 Improved fertility of cows failing to respond to resynchronization of ovulation through presynchronization of ovulation or progesterone supplementation. Julio O. Giordano*[1], Mark J. Thomas[2], Grace Cuatucuamba[2], Mathew D. Curler[2], Robert Wijma[1], and Matias L. Stangaferro[1], *[1]Department of Animal Science, Cornell University, Ithaca, NY, [2]Dairy Health & Management Services, Lowville, NY.*

Our objective was to evaluate treatments to increase fertility of timed-AI (TAI) services of lactating dairy cows without a corpus luteum (CL) at the time of the PGF injection of Resynch initiated 32 ± 3 d after AI (RD32; GnRH-7d-PGF-56h-GnRH-16h-TAI). In Exp1, blood collection and ovarian ultrasound was conducted (n = 555) at the PGF of RD32 to define a cutoff value for CL size that allows creating groups of cows with low and high fertility after TAI. P/AI were analyzed by logistical regression using PROC GLIMMIX of SAS. Based on P/AI, the CL size selected was 15 mm [CL ≥ 15 mm = 33.2%; (165/497) vs. NoCL or CL < 15 mm = 10.3% (6/58); $P < 0.01$]. In Exp2, cows without a CL or a CL < 15 mm (NoCL) were randomly assigned to (1) Ovsynch plus progesterone (P4) [OvP4; GnRH (G1) and CIDR-7d-PGF and CIDR removal-56h-GnRH-16h-TAI; n = 212] or (2) presynchronization with GnRH (PreG) 7 d before Ovsynch [PreGOv; GnRH-7d-GnRH(G1)-7d-PGF(P)-56h-GnRH-16h-TAI; n = 192]. Cows with a CL > 15mm (CLPG) at PGF of RD32 (n = 1,797) completed RD32 to receive TAI. Binary data were analyzed by logistical regression using PROC GLIMMIX whereas quantitative data were analyzed by ANOVA using PROC MIXED of SAS. At 39 d after AI, overall P/AI were similar ($P = 0.13$) for cows in OvP4 (34.4%), PreGOv (35.9%), and CLPG (31.1%). Cows inseminated in estrus had similar ($P = 0.32$) P/AI [41.4% (n = 29) OvP4, 24.4% (n = 41) PreGOv, and 34.1% (n = 173) CLPG] but P/AI tended ($P = 0.06$) to differ for TAI cows (33.3% OvP4, 39.1% PreGOv, and 30.8% CLPG). Pregnancy losses were similar ($P = 0.29$) for cows in OvP4 (2.9%), PreGOv (8.7%), and CLPG (11.6%). Ovulatory response to PreG was 86.0%. At G1, cows with a CL (86.6 vs. 16.4%; $P < 0.01$), cows with P4 > 1ng/mL (82.8 vs. 31.8%; $P < 0.01$), P4 concentrations (3.7 vs. 1.1 ng/mL; $P < 0.01$), and cows with a follicle > 10 mm (94.9 vs. 80.9%; $P < 0.01$) was greater in PreGOv than OvP4 group. Ovulatory response to G1 was 71.9 vs 58.3% for OvP4 and PreGOv ($P = 0.03$). At the PGF before TAI, more cows had a CL in PreGOv than OvP4 (92.1 vs. 77%; $P < 0.01$), cows with P4 > 1 ng/mL was similar (79.1 vs. 82.7%; $P = 0.50$), but P4 concentrations were greater in PreGOv than in OvP4 (4.1 vs. 2.6 ng/mL;$P < 0.01$). We conclude that presynchronization with GnRH 7 d before Ovsynch or Ovsynch plus P4 are 2 feasible alternatives to increase P/AI of cows without a CL at the PGF injection of RD32. Supported by New York Farm Viability Institute project AOR12–012.

Key Words: corpus luteum, resynchronization, dairy cow

449 Interferon-tau and progesterone down-regulate cytochrome P450 1A and 2C in bovine endometrial epithelial cells. Caleb O. Lemley* and Christa L. Gilfeather, *Mississippi State University, Mississippi State, MS.*

The objective of the current study was to examine cytochrome P450 1A (CYP1A) and 2C (CYP2C) activity in bovine endometrial cell cultures following exposure to oxytocin (OT), interferon-tau (IFN), estradiol (E2), and/or progesterone (P4). Bovine endometrial epithelial cells were cultured to 80% confluence in 6-well plates. For experiment 1, cells were treated with 1 µg/mL OT, 10 ng/mL IFN, a combination of OT+IFN, or control (CON) media for 24 h. For the second experiment, cells were treated with 1 ng/mL E2, 15 ng/mL P4, a combination of E2+P4, or CON media for 24 h. Following the hormone treatment, endometrial cells were harvested in lysis buffer containing protease and phosphatase inhibitors and frozen at −80°C until further analysis. Treatments were performed in triplicate and the experiment was repeated 4 times (n = 12 per treatment). The activity of CYP1A and CYP2C were determined using specific luminogenic substrates and expressed relative to mg of cellular protein. Data were analyzed using MIXED procedure of SAS and the model statement included hormone and replicate. Treatment with OT alone did not alter activity of CYP1A ($P = 0.55$) or CYP2C ($P = 0.46$) compared with CON cells. Activity of CYP1A was decreased in cells exposed to IFN ($P < 0.01$) or OT+IFN ($P < 0.01$) compared with CON. Similarly, activity of CYP2C was decreased in cells exposed to IFN ($P < 0.01$) or OT+IFN ($P < 0.01$) compared with CON. Treatment with E2 alone did not alter activity of CYP1A ($P = 0.64$) or CYP2C ($P = 0.06$) compared with CON cells. Activity of CYP1A was decreased ($P < 0.01$) in P4 versus CON, while E2+P4 was not different ($P = 0.38$) from CON. Activity of CYP2C was decreased in cells exposed to P4 ($P < 0.01$) or E2+P4 ($P < 0.01$) compared with CON cells. In summary, both interferon-tau and progesterone exposure decreased CYP1A and CYP2C activity. The mixed function monooxygenase enzymes, CYP1A and CYP2C, have been implicated in synthesizing embryotoxic compounds; therefore, down-regulation in the endometrium may be necessary during maternal recognition of pregnancy.

Key Words: cytochrome P450, endometrium, interferon-tau

450 Epidermal growth factor promotes interferon-tau expression in bovine trophectoderm. Sarah R. McCoski* and Alan D. Ealy, *Virginia Tech, Blacksburg, VA.*

Significant pregnancy loss occurs in cattle during the early stages of embryogenesis and placentation. Several critical events occur in the first 3 to 4 weeks of gestation, and aberrations in any one of these events will prompt pregnancy loss. One such event is maternal recognition of pregnancy, when interferon-tau (IFNT) must be produced in sufficient quantities from the conceptus to prevent luteolysis and modify uterine function to favor pregnancy. Epidermal growth factor (EGF) is produced by the uterus and is a recognized embryotrophic factor. Specific activities in bovine embryos include improving rates of bovine embryo development and increasing trophectoderm (TE) proliferation. This

study examined whether EGF affects *IFNT* expression. A stable bovine TE cell line (CT1) was maintained in Dulbecco's Modified Eagle's Medium (DMEM). Cells were serum-starved and then exposed to various concentrations of human recombinant EGF. Total cellular RNA was extracted, and quantitative reverse transcription PCR was completed using *IFNT*-specific primers and ribosomal protein S9 (*RPS9*; internal control). Data were analyzed by ANOVA. In the first study, a 6 h dose response was completed (n = 3 replicate studies). Supplementation with 100 ng/mL EGF increased ($P < 0.05$) *IFNT* transcript abundance when compared with controls (2.3 ± 0.8 fold effect). Exposure to 1 or 10 ng/mL EGF did not affect *IFNT* transcript abundance. In the second study, a 24 h dose-response was completed (n = 3 replicate studies). A trend in increased *IFNT* mRNA abundance was evident ($P = 0.07$) when CT1 cells were supplemented with 1 ng/mL EGF (2.0 ± 1.5 fold vs. controls). Incubation with either 10 or 100 ng/mL EGF increased ($P < 0.05$) *IFNT* transcript abundance when compared with controls (2.6 ± 0.8 and 3.6 ± 1.4 fold effect, respectively). Moreover, the 100 ng/mL effect was more pronounced than the 1 ng/mL effect ($P = 0.06$; 1.75 ± 0.7 fold). These outcomes implicate EGF as a mediator of *IFNT* expression, and provide further evidence of how the maternal system may control IFNT production and other developmental events during early pregnancy in ways that dictate pregnancy retention or failure.

Key Words: interferon-tau, embryo, trophectoderm

451 Effects of label-dose permethrin administration on reproductive function in superstimulated beef heifers. Tyler M. Dohlman*[1,2], Marianna M. Jahnke[1], James K. West[1], Patrick E. Phillips[1], and Patrick J. Gunn[2], *[1]Veterinary and Diagnostic Production Animal Medicine, Iowa State University, Ames, IA, [2]Department of Animal Science, Iowa State University, Ames, IA.*

The objective was to study the effects of a commercial pyrethroid-based pour-on product, permethrin, on reproductive performance in superovulated beef heifers by assessing steroid biosynthesis and embryo quality. Nonpregnant, yearling beef heifers (n = 10; 417 ± 33 kg; 5.5 ± 0.2 BCS) were assigned by BW and breed to either 1) saline control (CON) or 2) permethrin pour-on administered at label dose (PYR). Superstimulation was achieved on all heifers utilizing a timed, 17-d, CIDR-based protocol with GnRH and PGF_{2a} and decreasing total dosage of 240mg FSH administered twice daily for 4 d. Heifers were AI twice (at onset of estrus and 12 h later) by the same technician with frozen semen from single bull collection. To determine short and long-term effects of permethrin on embryo quality and steroid biosynthesis, superstimulation was initiated twice with collection of embryos occurring at 17 and 51 d post-treatment. Embryos were recovered 6.5 d after first AI via non-surgical flush and were evaluated by International Embryo Transfer Society standards. Blood was collected at standing estrus and d of embryo recovery. Estrogen (E_2) and progesterone (P_4) concentrations were analyzed via RIA. MIXED and GLIMMIX procedures of SAS were used to analyze continuous and categorical data, respectively. Heifer per flush was the experimental unit. Total embryos recovered did not differ due to treatment ($P = 0.30$), but did decrease in flush 2 compared with flush 1 ($P = 0.02$). Quality grade, total transferrable quality embryos (TQE), and overall flush success did not differ due to treatment ($P = 0.16$). However, TQE was decreased in flush 2 compared with flush 1 ($P = 0.05$). Total unfertilized oocytes was greater in CON ($P = 0.04$). The PYR heifers tended to have less total P_4 ($P = 0.15$) and P_4 per corpus luteum ($P = 0.06$) at recovery. E_2 per ovulated follicle and E_2 per total ovarian structure was greater in flush 2 ($P = 0.03$) but did not differ due to treatment ($P = 0.23$). In summary, these data indicate that permethrin administration at label dose in superstimulated beef heifers has a tendency to reduce P_4, but embryo quality is not affected.

Key Words: permethrin, embryo, progesterone

452 Effects of tamoxifen on pre-pubertal heifer reproductive tissues: Potential for disruption of tract development through alteration of related signaling pathways. Abdullah Al Naib*[1], Ali.Y. Wood[1], Hannah.L. M. Tucker[1], Catherine.L. M. Parsons[1], Victoria.L. McCracken[1], Abigail.L. Zezeski[1], Stacie.E. Deaver[2], Britni.M. Brown[1], Mike.M. Akers[1], and Michelle.L. Rhoads[1], *[1]Virginia Polytechnic Institute and State University, Blacksburg, Virginia, [2]Virginia Western Community College, Roanoke, Virginia.*

Pre-pubertal exposure of the developing reproductive tract (RT) to estrogen or xenoestrogens can have long-term consequences that compromise the reproductive performance of dairy cattle. This research examined the effects of the selective estrogen receptor modulator, tamoxifen (TAM), on gene and protein expression in the pre-pubertal RT with particular focus on signaling pathways that affect RT morphology. Tamoxifen was administered to heifer calves (n = 7) daily (0.3 mg/kg subcutaneously) from 28 to 120 d of age. Control calves (CON; n = 7) received an equal volume of excipient. Weight, gross measurements and samples of RT tissues were collected upon sacrifice at 120.7 ± 0.3 d of age. Protein and mRNA were extracted from snap frozen samples of vagina, cervix, uterine body, ovary and oviduct. Data were analyzed using the proc mixed procedure of SAS version 9.1.3 (SAS Institute Inc., Cary, NC) followed by the Tukey-Kramer test as a multiple comparison test. As we previously reported, overall weight of the RT was dramatically decreased following TAM treatment ($P = 0.01$). Both estrogen receptor α (ERα) protein and gene expression were dramatically reduced in the uterus, cervix and vagina ($P < 0.01$). In oviduct, ERα protein was reduced in the TAM treated animals ($P < 0.01$) while ERα gene expression was not affected. Similarly, the phosphorylated form of ERα protein was reduced in the cervix and vagina ($P < 0.01$) and tended to be reduced in the uterus ($P = 0.09$) of the TAM group. In contrast to other RT tissues, phosphorylated ERα protein abundance was greater in the ovaries of the TAM animals ($P < 0.05$). Even though insulin-like growth factor-I (IGFI) gene expression was higher in the uterus, oviduct and vagina of the TAM group ($P < 0.01$), IGFI receptor protein and gene expression did not differ. Total mitogen-activated protein kinases (MAPK) protein was higher in the oviduct, vagina and ovary ($P < 0.01$) but was lower in the uterus of TAM treated heifers ($P < 0.01$). The phosphorylated form of MAPK protein was similarly increased in the ovary but was decreased in the cervix of the TAM group ($P < 0.05$). In conclusion, the bovine pre-pubertal RT is affected by TAM treatment. Further research is needed to determine if these effects have long-term consequences for reproductive performance.

Key Words: reproductive tract, tamoxifen, estrogen

453 Effects of label-dose permethrin administration on reproductive function and testicular histopathology in yearling bulls. Tyler M. Dohlman*[1,2], Darin M. Madson[1], Patrick E. Phillips[1], Chris A. Clark[3], and Patrick J. Gunn[2], *[1]Veterinary and Diagnostic Production Animal Medicine, Iowa State University, Ames, IA, [2]Department of Animal Science, Iowa State University, Ames, IA, [3]Armstrong Research and Demonstration Farm, Iowa State University, Lewis, IA.*

The objective of this experiment was to study the effects of a commercial, pyrethroid-based pour-on product, permethrin, on reproductive

parameters and testicular histopathology of yearling beef bulls. Black Angus bulls (n = 60; 369 ± 17 d of age; 509 ± 33 kg; 6.2 ± 0.5 BCS) were assigned to either (1) saline control (CON) or (2) permethrin pour-on administered at label dose (PYR). All bulls had blood samples collected and were subjected to an industry standard breeding soundness exam (BSE) via electroejaculation at both 5 d before and 14 d post-treatment. Progressive motility and Eosin-Nigrosin stained morphology were analyzed using high power magnification with phase contrast microscopy. Plasma testosterone concentrations were analyzed via RIA. At 34 d post-treatment, bulls were slaughtered and one testicle per bull was collected for histopathological examination. Categorical and continuous data were analyzed with the GLIMMIX and MIXED procedures of SAS, respectively. Change in motility between BSEs was not different due to treatment ($P = 0.69$). Although morphology improved across treatments between BSEs, PYR bulls had less improvement in percent of head ($P < 0.001$) and tailless sperm ($P = 0.05$) abnormalities compared with CON, resulting in less improvement of primary abnormalities ($P = 0.04$). Nonetheless, morphological differences did not change the overall outcome for satisfactory breeder status ($P = 0.82$). Change in testosterone concentration did not differ due to treatment ($P = 0.22$). Histopathological examination determined that testicular degeneration and tubule diameter did not differ as a result of treatment ($P \geq 0.19$). It should be noted, however, that degeneration score (higher score having more degeneration) was positively correlated with primary abnormalities ($P < 0.01$; $r = 0.35$) and negatively correlated with normal sperm cells ($P < 0.001$; $r = -0.43$). In summary, these data indicate that a single use of permethrin at label dose in yearling Angus bulls results in minimal detrimental effects on semen morphology, but not to a degree that affects the ability of bulls to pass a standard BSE.

Key Words: permethrin, breeding soundness exam (BSE), sperm