M216  Impact of estrous expression on progesterone concentrations and its association with fertility. A. M. L. Madureira*, T. A. Burnet1, J. L. M. Vasconcelos2, and R. L. A. Cerri3, 1 University of British Columbia, Vancouver, BC, Canada, 2 Sao Paulo State University, Botucatu, Sao Paulo, Brazil.

The objective of this study was to determine the effect of estrous expression, detected by an automated activity monitor, on progesterone concentrations and its association with fertility. Estrous expression (n = 665 events) from 290 lactating Holstein cows were recorded. Cows were monitored continuously by an activity monitoring system attached to the cow’s neck. The threshold level to be considered an alert on the monitor was set at SCR’s index of 35 or approximately an 80% increase in physical activity. The peak of activity was determined for each event and classified as either high (index ≥80) or low (index 35–79) using the median. Blood sampling was harvested upon detection of estrus (0 d) and analyzed for P4 and E2. A subgroup of 171 events were also sampled at 7, 14, and 21 d post-AI and analyzed for P4. Animals had their ovaries scanned by ultrasound at each collection. Pregnancy was performed at 31 ± 3 d post-AI. Data were analyzed by ANOVA and logistic regression using proc MIXED and GLIMMIX of SAS. Animals that had a higher increase in physical activity had higher P/AI when compared with animals with lower activity (30.7% [48/380] vs 23.6% [64/259], P < 0.05). Animals with low activity had higher concentrations of P4 and lower concentrations of E2 upon detection when compared with animals with high activity (1.0 ± 0.2 mg/mL vs. 0.3 ± 0.2 mg/mL; P < 0.01 and 4.6 ± 0.3 pg/mL vs. 6.7 ± 0.2 pg/mL; P < 0.01). Follicle diameter did not differ between animals with high or low peak of activity (P = 0.41). Higher concentrations of P4 at 7 d, 14 d and 21 d post-AI were found in animals that had high estrus expression detected at the time of alert (7 d – High: 3.4 ± 0.2 pg/mL vs. Low: 2.7 ± 0.2 pg/mL; P < 0.05; 14 d – High: 4.9 ± 0.4 pg/mL vs. Low: 2.9 ± 0.4 pg/mL; P < 0.01 and 21 d – High: 6.8 ± 0.3 pg/mL vs. Low: 5.4 ± 0.3 pg/mL; P < 0.01). Size of corpus luteum on 7, 14, and at 21 d post-AI did not differ between animals that expressed high or low activity. In conclusion, animals that had higher expression of estrus had greater P/AI and a P4 profile at and post-AI normally associated with improved early embryonic development.

Key Words: automated activity monitor, progesterone, estrus intensity

M217  Fertility response to commercially available GnRH products in lactating cows synchronized with the Double-Ovsynch protocol. M. Luchterhand1, C. A. Gamarras1, R. S. Gennari2, J. N. Guenther3, P. D. Carvalho*1, A. H. Souza3, and R. V. Barletta2, 1Elusive Hill dairy, Madison, WI, 2Independent Dairy Consultant, Madison, WI, 3Animal Reproduction Department, VRA-USP University, Sao Paulo, SP, Brazil.

This study was designed to evaluate whether commonly used gonadorelin products that are commercially available in the United States have comparable ovulation and pregnancy per AI (P/AI) results in synchronized lactating dairy cows. A total of 1411 lactating Holstein cows receiving the Double-Ovsynch (DOV) protocol with the addition of a second PGF2α (d 25) treatment (d 1: GnRH, d 7: PGF2α, d 10: GnRH, d 17: GnRH, d 24: PGF2α, d 25: PGF2α, d 26-p.m.: GnRH, d 27: AI 16 h after last GnRH) for first postpartum AI were randomized to receive one of the following GnRH products throughout the Double-Ovsynch protocol: (1) Cystorelin (CYS, gonadorelin diacetate, n = 484); (2) Factrel (FAC, gonadorelin hydrochloride, n = 482); or (3) Fertagyl (FER, gonadorelin diacetate, n = 515). On d 17 and d 24 of DOV, a subgroup of cows (n = 487) were examined by ultrasound to identify whether ovulation had occurred following the 3rd GnRH injection in the DOV protocol (G17). Circulating progesterone concentration was also measured on G17 of DOV (presumably d 7 of the estrous cycle) in a subset of cows (n = 487) to evaluate the impact of circulating P4 on ovulatory responses. Statistical analyses were performed with the procedure Glimmix and Logistic of the SAS software (9.4 version). Proportion of cows ovulating at G17 tended (P = 0.07) to differ among GnRH salts (gonadorelin hydrochloride = 61.5% vs gonadorelin diacetate = 72.7%) but was similar across GnRH products (FER = 74.1% vs FAC = 61.5% vs CYS = 72.2%). In a further analysis, the logistic regression model indicated that predicted ovulation response to FAC was consistently lower than the other 2 GnRH products regardless of circulating P4 levels, although greater circulating P4 had a similar detrimental effect on ovulation across all GnRH products. Results on P/AI at 60 d differed across GnRH salts (P = 0.04), in which P/AI was similar between FER (47.8%3) and CYS (49.8%4), but both were greater than FAC (42.0%5). In conclusion, fertility following Double-Ovsynch was significantly lower for the hydrochloride-based GnRH product likely due to poorer ovulatory responses throughout the synchronization protocol.

Key Words: Double-Ovsynch, GnRH, dairy cow


Our objectives were to evaluate time to pregnancy for dairy cows managed with the Short-Resynch (SR) or Day25-Resynch (D25R) protocol. Lactating Holstein cows not pregnant after first service from 2 farms were stratified by parity (1 vs. >1) and assigned to the SR (n = 1,533) or the D25R (n = 1,555) treatment. Cows in D25R received GnRH 25 ± 3 d after AI. At 32 ± 3 d after AI, nonpregnant cows from SR and D25R with a corpus luteum (CL) ≥ 15 mm and a follicle ≥10 mm received PGF2α (PGF), 24h later PGF, 32 h later GnRH, and 16 h later TAI. Cows without a CL ≥15 mm and/or a follicle ≥10 mm (NoCL cows) received an Ovsynch protocol with 2 PGF treatments and progesterone (P4) supplementation (GnRH CIDR-7 d-CIDR-out+PGF-1 d-PGF-32 h-GnRH-16 h-TAI). Circulating P4 concentration was determined (n = 659 cows) at the GnRH treatment before TAI. Binomial data were analyzed using logistic regression and time to pregnancy [only cows with 210 d at risk after first AI (D25R = 543; SR = 512)] using Cox’s proportional hazards regression. A greater (P < 0.01) proportion of inseminations were conducted at detected estrus in SR (60.4%) than in D25R (49.8%) but, P/AI did not differ (P = 0.14; D25R = 40.4%; n = 1,191 vs. SR = 37.8%; n = 1,489). More cows had a CL at NPD (P < 0.01) in D25R (84.3%; n = 1,139) than SR (78.5%; n = 939). Pregnancy per AI differed for all TAI combined (P = 0.01; D25R = 40.7% vs. SR = 35.4%), for CL cows (P < 0.01; D25R = 40.9% vs. SR = 32.8%), and tended to differ for NoCL cows (P = 0.06; D25R = 39.1% vs. SR = 44.6%). Treatment did not affect pregnancy loss (P > 0.10). The proportion of cows with P4 < 0.5 ng/mL at the GnRH before TAI did not differ (P > 0.10). The hazard of pregnancy was not affected by treatment (P = 0.77; HR = 0.98, 95% CI: 0.85–1.13) or parity (P = 0.71; HR = 1.01,
95% CI: 0.87–1.16). Median days to pregnancy were 75 and 74 for SR and D25R, respectively. The proportion of nonpregnant cows 210 d after first service was similar (P = 0.20) for SR (23.6%) and D25R (20.3%). In conclusion, the Short-Resynch protocol resulted in more inseminations at detected estrus and similar time to pregnancy than the D25-Resynch protocol in spite of a reduction in P/AI for TAI services for CL cows. Supported by NYFVI Project FVII–013 and USDA Hatch NYC127434.

Key Words: Short-Resynch, resynchronization, dairy cow

M219  Effects of intrauterine infusion of seminal plasma at artificial insemination on fertility of lactating Holstein cows. W. G. Ortiz1, J. A. Rizo1, L. R. Carvalheira2, E. C. Estrada3, B. R. Harstine3, J. J. Bromfield1, and P. J. Hansen1, 1Department of Animal Sciences, University of Florida, Gainesville, FL, 2Dept. de Clinica e Cirurgia Veterinárias, Universidade Federal de Minas Gerais, Belo Horizonte, Minas Gerais, Brazil, 3Select Sires Inc., Plain City, OH.

An inflammatory response is induced in the reproductive tract by the deposition of semen during natural mating. It has been proposed that this response could facilitate establishment and maintenance of pregnancy by modifying the microenvironment of the reproductive tract. The best evidence for this idea comes from mice where females mated with males lacking seminal vesicles experience reduced conception rates, embryos with poor development to the blastocyst stage, low implantation rates, and offspring with altered postnatal phenotype. Here we hypothesized that intrauterine infusion of 0.5 mL of seminal plasma at the time of artificial insemination (AI) in first-service lactating Holstein cows will improve pregnancy rate per insemination. The experiment was conducted at a commercial dairy farm in north-central Florida during the winter (November to February); voluntary waiting period was 82 d. Cows were inseminated [multiparous cows (n = 692), conventional semen; primiparous cows (n = 322), X-sorted semen] using the Double Ovsynch protocol. Cows were randomly assigned to receive intrauterine infusion of either 0.5 mL seminal plasma (prepared as a single pool from 44 bulls) or vehicle (saline) immediately after AI. Pregnancy diagnosis was performed at d 32 after AI. Data were analyzed by the GLIMMIX procedure of SAS. Pregnancy rate per AI was affected by parity (P = 0.0030) and treatment (P = 0.0586) but not by the interaction. Least squares means for multiparous cows were 51.7 ± 2.8% for vehicle and 49.0 ± 2.6% for seminal plasma. Least squares means for primiparous cows were 45.3 ± 3.9% for vehicle and 35.4 ± 3.8% for seminal plasma. Results do not support a beneficial effect of seminal plasma on pregnancy rate per AI at first service. Further research to evaluate effects of seminal plasma on pregnancy loss and characteristics of the offspring is warranted. Supported by Select Sires.

Key Words: BCS, prepartum, diseases

M220  Association among calving season, milk yield, and body condition score during the dry period and pregnancy at first artificial insemination in Argentinean dairy herds. P. Melendez1, F. Barigo2, G. Tuñon3, and J. Grigera1, 1College of Veterinary Medicine, University of Missouri, Columbia, MO, 2Universidad de Buenos Aires, Buenos Aires, Argentina, 3INIA, Uruguay, 4Private consultant, Argentina.

The objective was to identify factors for pregnancy at first artificial insemination (P/1AI) in dairy herds from Argentina. A data set of 7,202 lactations from 31 dairies from central Argentina, with records of BCS at dry-off and at calving, type of parturition (normal, or dystocia), calving season (fall-winter vs spring-summer), milk yield up to 90 d (<2,200, ≥ 2,200 kg) and incidence of diseases (milk fever, RFM, metritis, mastitis, and lameness) were analyzed. Data were collected by researchers. For dichotomous variables, logistic regression models were conducted. Models with the best deviance were retained. For continuous variables GLM ANOVA were conducted, testing for interactions. From the total, 60.2% gained or maintained BCS from dry-off to parturition and 39.8% lost BCS. Normal parturitions were 87.9% and dystocia 12.1%. Incidence of milk fever was 6.0%, RFM 8.5%, metritis 4.3%, mastitis 20.8%, and lameness 9.0%. From the total, 63.0% were fall-winter parturitions and 37.0% spring-summer parturitions. Primiparous cows were 32.5% and multiparous 67.5%. Overall, P/1AI was 18.1% and not statistically different between parity (P > 0.05). Within multiparous, those cows that calved in spring-summer had a lower P/1AI than cows calving in fall-winter (P ≤ 0.05). The variable most associated with P/1AI was accumulated milk yield within 90 d. Higher producers (>2,200 kg) had a 23.6% P/1AI and lower producers 8.54%. Milk yield for pregnant cows at first service was 2,737 kg and for non-pregnant 2,313 kg (P ≤ 0.05). This trend was the same within calving season and parity. Cows gaining or maintaining BCS during the dry period had a P/1AI of 20.2% and 2,644 kg of milk yield, while cows losing BCS had a P/1AI of 16.4% and 2,569 kg of milk yield (P ≤ 0.05). Higher producers had 16% of dystocia and lower producers 19.9%. Higher producers had 6.7% of lameness and lower producers 11.1%. It is concluded that lower milk yield was associated with increased incidence of diseases, greater loss of BCS during the prepartum period, more dystocia, and lower P/1AI than those cows with higher milk yield

Key Words: seminal plasma, dairy cattle, Holstein

M221  Maximizing inseminations at detected estrus for second and greater services in lactating dairy cows. M. Masello1, B. Cegłowski2, M. J. Thomas2, and J. O. Giordano1, 1Department of Animal Science, Cornell University, Ithaca, NY, 2Dairy Health and Management Services, Lowville, NY.

Our objective was to compare time to pregnancy after first service for dairy cows managed for second and greater AI services with a program that either promotes insemination at detected estrus (AIE) or timed AI (TAI) after nonpregnancy diagnosis (NPD). After first service, Holstein cows were blocked by parity and randomly assigned to the Day 32 Resynch (D32R; n = 567) or the AIE Resynch (AIER; n = 597) group. Cows in D32R received a GnRH treatment 32 ± 3 d after AI and NPD was conducted 39 ± 3 d after AI by transrectal ultrasonography (TUS). Nonpregnant cows with a corpus luteum (CL) ≥ 15 mm (CL cows) completed the Resynch protocol (PGF2α-56h-GnRH-16h-TAI). Cows without a CL present at NPD (NoCL cows) were enrolled in a PreG-Resynch protocol (GnRH-7d-GnRH-7d-PGF2α-56h-GnRH-16h-TAI) to receive TAI. For the AIE group, nonpregnant cows based on TUS at D32R and a CL ≥ 15 mm (CL cows) completed the Resynch protocol (PGF2α-56h-GnRH-16h-TAI). Cows not AIE at 7 d were enrolled in PreG-Resynch protocol (GnRH-7d-GnRH-7d-PGF2α-56h-GnRH-16h-TAI) to receive TAI. For the AIE group, nonpregnant cows based on TUS at D32R and a CL ≥ 15 mm received a PGF2α (PGF) treatment to induce estrus. Cows not AIE at 7 d were enrolled in PreG-Resynch protocol. Cows remained in AIE and D32R until pregnancy or herd exit. Binomial data were analyzed with logistic regression and time to pregnancy [only cows at risk for 200 d after first AI (D32R = 426; AIER = 475)] with Cox’s proportional regression. At NPD, the proportion of CL cows was greater (P < 0.01) for D32R than for AIE (70.3% vs. 62.7%). A greater (P < 0.01) proportion of CL cows were AIE in AIE than D32R (50.9% vs. 5.7%) and P/AI did not differ (P = 0.79; AIE = 36.0% vs. D32R = 35.1%). A greater (P = 0.05) proportion of NoCL cows were AIE in AIE (16.8%) than D32R (9.6%) and P/AI was greater (P = 0.02) for AIE (41.8%) than D32R (31.0%). Overall, P/AI for all AIE and TAI did not differ (P = 0.13;
A systematic meta-analysis of existing literature was conducted to determine the prevalence of purulent vaginal discharge (PVD) and factors influencing global prevalence estimates. Four databases (PubMed, Google Scholar, Web of Science, and Scopus) were queried with keywords “endometritis,” “PVD,” and “dairy.” Abstracts of initial search results were scanned to ensure dairy cows and one of the 3 most common methods for PVD diagnosis (glowed hand, vaginoscopy, or Metrichock) were used. This resulted in collection of 42 manuscripts, 36 of which reported sufficient information about their methodology and PVD prevalence to be included in the analysis. Reports were from 5 geographic regions: North America, South America, Europe, Asia, and the South Pacific and included 85 observations on PVD prevalence. Proportion of population positively diagnosed with PVD ([0, 1]) was used as the measure of prevalence. The metafor package (Viechtbauer et al., 2010, J Stat. Softw. 36:1–48) in R statistical software was used to fit fixed, random, and mixed effects models to estimate average PVD prevalence and factors influencing this prevalence using a logistic transformation of the original proportion values weighted by the number of animals in the cohort. The fixed effects model estimated a prevalence of 0.23 [95% CI: 0.23–0.23] while the random effects model estimated a slightly higher effect size of 0.24 (95% CI: 0.21 – 0.28). The full mixed effects model included fixed effects for parity, calving strategy (seasonal or continuous), region of the world, method of diagnosis, and days in milk (DIM) at diagnosis. Only DIM at diagnosis had a significant effect ($P = 0.07$) effect on the prevalence of PVD with a decrease of 0.4% per day in lactation. Average PVD prevalence estimated by the mixed-effects model was 0.249 [95% CI: 0.20 – 0.30]. All models included a large degree of heterogeneity indicating factors not included here account for most of the variation in PVD; however, our results show PVD prevalence does not vary with region of the world, parity, or method of diagnosis.

**Key Words:** purulent vaginal discharge (PVD), meta-analysis, dairy cows

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**M222**  
**Association between hoof lesions and fertility of dairy cows.** B. O. Omontese1, R. Bellet-Elias1, A. Molinero1, G. D. Catandi1, R. Casagrande1, Z. Rodriguez1, R. S. Bisinotto2, and G. Cramer1, 1Department of Veterinary Population Medicine, University of Minnesota, St. Paul, MN, 2Department of Large Animal Clinical Sciences, University of Florida, Gainesville, FL.

Objectives were to evaluate associations between hoof lesions (HL), estrous cyclicity, and fertility in dairy cows. Jerseys were enrolled at 20 ± 3 DIM (d20). At d20, cows were evaluated for body condition score (BCS) and presence of claw horn (CLW; sole ulcer, toe ulcer, white line disease), sole hemorrhage (SH), infectious HL (INF; digital dermatitis, foot rot), and injury (INJ). Lesion status at d 20 was categorized into (1) no HL (n = 1197) or with HL (n = 442) and (2) HL category as CLW (n = 113), SH (n = 280), INF (n = 36), and INJ (n = 13). Ovaries were scanned at 27 and 41 ± 3 DIM and cows with corpus luteum >20 mm were considered cyclic. Estrus was synchronized with PGF2α given 14 d apart starting at 27 ± 3 DIM. Cows not inseminated in estrus after 3 PGF2α were subjected to a 5-d Cosynch protocol. Cows were re-inseminated in estrus or via timed AI after a non-pregnancy diagnosis. Pregnancy was diagnosed and 60 ± 3 d after AI. At 120 ± 3 DIM (d120), cows were reevaluated for HL and BCS. To assess the relationship between HL development and fertility, cows were classified as healthy (no HL at d20 and d120; n = 308), cured HL (any HL at d20 and no HL at d120; n = 72), new HL (no HL at d20 and any HL at d120; n = 597), or chronic HL (any HL at d20 and d120; n = 226). Binary variables were analyzed by logistic regression (results presented as odds ratio, 95% CI) and time to pregnancy was analyzed using Cox’s proportional hazard regression (results presented as hazard ratio, 95% CI). Open cows were censored at 150 DIM. Cows with CL (0.60, 0.45–0.81), CLW (0.42, 0.26–0.66), INF (0.32, 0.14–0.70), and INJ (0.04–1.07) at d20 were less likely ($P ≤ 0.06$) to be cyclic compared with healthy cows. Cows with HL at d20 had smaller ($P ≤ 0.01$) hazard of pregnancy (0.83, 0.73–0.96) and more days open (91 vs. 77) compared with healthy cows. Cows with SH had smaller ($P = 0.04$) pregnancy hazard compared with those without HL (0.84, 0.71–0.99). Compared with healthy animals, cows with cured HL tended to have a greater ($P = 0.09$) pregnancy hazard (1.30, 0.96–1.76). In conclusion, HL at d20, but not new HL, were associated with decreased odds of cyclicity and reduced pregnancy hazard in cows.

**Key Words:** lameness, foot trim, pregnancy

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**M223**  
**Prevalence of purulent vaginal discharge in dairy herds depends on timing but not method of diagnosis—A meta-analysis.** A. Ricci1, K. Reed2, and O. Pascolini3, 1DPT Scienze Veterinarie, Università di Torino, Torino, Italy, 2USDA-Agricultural Research Service, US Dairy Forage Research Center, Madison, WI, 3Population Medicine, Ontario Veterinary College, University of Guelph, Guelph, ON, Canada.

D32R = 34.0% vs. AIER = 38.2%). The hazard of pregnancy (HR = 1.00; 0.87–1.16) and the proportion of cows pregnant 200 d after first service was similar ($P > 0.10$) for D32R (88.2%) and AIER (88.0%). In conclusion, a program aimed at increasing the proportion of cows re-inseminated at detected estrus through treatment with PGF at NPD resulted in similar time to pregnancy during lactation than a program that favored TAI after NPD.

**Key Words:** resynchronization, dairy cow, estrus

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**M224**  
**Bellowing and vaginal discharge as secondary symptoms of estrus detection for successful insemination of dairy cattle in tie-stall barns in a tropical environment.** S. Kanwichai1, S. Panasophonkul2, P. L. A. M. Vos3, and W. Surisayasathaporn1, 1Department of Food Animal Clinic, Faculty of Veterinary Medicine, Chiang Mai University, Chiang Mai, Thailand, 2Department of Companion Animal and Wildlife Clinic, Faculty of Veterinary Medicine, Chiang Mai University, Chiang Mai, Thailand, 3Departments of Farm Animal Health, Faculty of Veterinary Medicine, Utrecht University, Utrecht, the Netherlands.

Detection of standing heat is difficult for cattle in tie-stall barns and many farmers use secondary signs of estrus behavior including bellowing and vaginal discharge for AI. The aim of this study was to determine pregnancy success to AI after detection of estrus in cattle in tie-stall barns using by secondary signs. The study was performed using reproductive data from 175 cattle of Thai-Holstein dairy cattle in tie-stall barns in Chiang Mai Province, Thailand, during February to July 2017. After observing secondary signs of estrus, farmers notified the researchers who performed AI within 12, 24, or 36 h after estrus exhibition. Data on season (cool, summer, rainy), signs of estrus (bellowing, vaginal discharge, redness of vulva, swollen vulva), duration between observed estrus and AI time (12, 24, 36 h) were independent variables. Pregnancy checks performed at 60 d after AI was defined as a dependent variable. Multiple logistic regressions were used to determine the factor relating to pregnancy. Results showed that cattle with combination of bellowing and having vaginal discharge had the highest pregnancy rate (68%) and significantly higher than cattle with other signs (OR = 2.02).
The pregnancy rate in cool and summer seasons were higher than rainy season with OR = 3.67 and OR = 1.63, respectively. Cattle inseminated at 24 h after expression had significantly higher pregnancy rate than 12 h (OR = 2.67). Results indicated that highest pregnancy rates were achieved with cattle displaying bellowing and vaginal discharge, with insemination interval of 24 h after signs of estrus, and in the cool season.

Key Words: bellowing, vaginal discharge, pregnancy rate