273 Antimicrobial resistance and prevalence of virulence factor genes in fecal *Escherichia coli* of Holstein calves fed milk with and without antimicrobials. R. V. V. Pereira*, T. M. A. Santos, M. L. Bicalho, V. S. Machado, R. C. Bicalho, and L. S. Caixeta, *Department of Population Medicine and Diagnostic Science, College of Veterinary Medicine, Cornell University, Ithaca, NY.*

Diarrhea in calves has a significant impact on the dairy industry. A common management practice for preventing and reducing diarrhea in preweaned calves is by adding antimicrobials in the milk. In this study, *Escherichia coli* antimicrobial resistance in fecal samples collected from calves 2 to 8 d of age that had received or not received antimicrobials in the milk and that presented or did not present signs of diarrhea were investigated. Resistance of *E. coli* isolates to individual antimicrobials, multiresistance patterns, and presence of virulence factors were analyzed. *E. coli* isolates were tested for 12 antibiotics, by use of a Kirby-Bauer disk diffusion assay, and categorized as susceptible, intermediate or resistant according to interpretive breakpoints described previously. The study was conducted at 3 farms, one administering antimicrobials (GPA) in the milk (n = 154) and 2 not adding antimicrobials in the milk (NGPA) (n = 97). To analyze the effect of GPA on the inhibition zone diameter a general linear model was fitted to the data using the MIXED procedure of SAS (SAS Inst., Cary,NC). Ordinal logistic regression models, one for each antibiotic, were fitted to the data using the ologit procedure of STATA (STATA 9.2, Statacorp, TX).Chi-squared tests were performed in Jump® (SAS Inst., Cary,NC) to assess the difference in the presence of genes encoding virulence factors between isolates. For all statistical models and tests, variables were considered statistically significant when a $P < 0.05$ was observed. All isolates were susceptible to ciprofloxacin and cefepime. From the total isolates tested, 84% (n = 251) were resistant to at least 2 antimicrobials and 81% (n = 251) were resistant to 3 or more antimicrobials. When antimicrobial resistance was compared between GPA and NGPA, it was observed that the GPA group had higher odds of antimicrobial resistance for most of individual antimicrobial tested. No significant correlation of virulence factors in GPA or NGPA and diarrheic or non-diarrheic fecal samples was found.

Key words: antibiotic resistance, dairy calves, *E. coli*

274 Somatic cell count and management benchmarks in Minnesota dairy herds. R. F. Leuer* and J. K. Reneau, *University of Minnesota, St. Paul.*

Dairy Herd Improvement Association (DHIA) tests provide a large amount of information about herd milk production and milk quality. Many guidelines have been given about farm SCC performance and its relationship to mastitis and milk quality, however, statistics quantifying that association is lacking. The objective of this study was to investigate the relationship between herd SCC level and performance rank for mastitis and milk quality benchmarking on dairy farms. Minnesota DHIA monthly average herd records were collected from January 2007 to November 2010. Herd tests without SCC information were removed and only herds with an average of 10 tests per year were included. Herds were divided into 4 categories based on average herd SCC over the collection period. Low herds (L) with less than 200,000 SCC (n = 325), medium low (ML) herds between 200,000 and 300,000 SCC (n = 547), medium high herds (MH) herds between 300,000 and 400,000 SCC (n = 470), and high herds (H) above 400,000 SCC (n = 438). Monthly records (n = 66,296) were analyzed using PROC GLM with significant differences determined at $P < 0.05$ using Tukey's multiple comparisons test. The 4 categories were all significantly different in average SCC (L = 157,000, ML = 251,000, MH = 350,000, H = 513,000), average of total cows on test day (L = 116, ML = 141, MH = 110, H = 86), percent infected (L = 16.4, ML = 24.7, MH = 32.9, H = 43.4), percent of current cows with new infections (L = 8.1, ML = 10.5, MH = 12.5, H = 14.2), percent of fresh cows with chronic infections (L = 6, ML = 11.2, MH = 17.6, H = 27.4), percent of current cows with chronic infections (L = 8.3, ML = 14.2, MH = 20.4, H = 29.2), percent infected <30 d in milk (L = 1.7, ML = 2.3, MH = 2.8, H = 3.3), percent infected between 30 and 220 d in milk (L = 7.7, ML = 11.7, MH = 15.4, H = 20), percent infected >220 d in milk (L = 7, ML = 10.7, MH = 14.7, H = 20.1), percent of herd >220 d in milk (L = 35.4, ML = 36.7, MH = 38.5, H = 40.5), rolling herd average (RHA) milk production (L = 10,351, ML = 9,944, MH = 9,201, H = 8,440 kg), RHA protein production (L = 315, ML = 304, MH = 284, H = 263 kg), and RHA fat production (L = 386, ML = 371, MH = 348, H = 325 kg). The 4 categories demonstrated differences that contribute to herd SCC.

Key words: benchmarking, DHIA, SCC

275 Heritability of rectal temperature and genetic correlations with production and reproduction traits in dairy cattle. S. Dikmen*[1], J. B. Cole[2], D. J. Null[2], and P. J. Hansen[3], *[1]Department of Animal Science, Faculty of Veterinary Medicine, Uludag University, Bursa, Turkey, [2]Animal Improvement Programs Laboratory Agricultural Research Service, USDA, Beltsville, MD [3]Department of Animal Sciences, University of Florida, Gainesville.*

Heat stress affects production and reproduction in dairy cattle. Genetic selection for body temperature might help to decrease the effects of heat stress on those traits. Objectives of the current study were a) to estimate genetic parameters of rectal temperature in dairy cows under heat stress conditions, and b) to determine genetic and phenotypic correlations of rectal temperature with production and fitness traits. Rectal temperature was measured between 1500 and 1700 h in 1,695 lactating Holstein cows sired by 509 bulls during the summer in north central Florida. Genetic parameters were estimated with GIBBS1F90 and breeding values were estimated with MTDFREML. The heritability of rectal temperature was estimated as 0.21. Annual genetic trend for rectal temperature was positive and increased 0.000068 oC/year from birth year 2002 to 2008. Genetic correlations of rectal temperature with other traits were close to zero. However, 305-d actual somatic cell score (SCS) was positively correlated ($r = 0.056 \pm 0.024$, $P < 0.05$) with rectal temperature. On the other hand, productive life ($r = -0.058 \pm 0.024$, $P < 0.05$), daughter pregnancy rate ($r = -0.036 \pm 0.024$, $P < 0.05$) and net merit ($r = -0.030 \pm 0.024$, $P < 0.05$) were negatively correlated with rectal temperature. Phenotypic correlations among rectal temperature and production traits were positive and often significant. In conclusion, rectal temperature during heat stress is moderately heritable and generally does not have strong genetic correlations with economically important traits. Selection for rectal temperature would result an increase in health and fitness traits without adversely affecting production traits.

Key words: heritability, dairy cattle, rectal temperature

276 Analysis of twinning, abortion and calf mortality in Irish Holstein and Friesian populations. A. M. Doyle[1], R. D. Evans[2], and

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Twinning is associated with unfavorable effects such as lower calf survival, dystocia, increased incidence of retained placentas, occurrence of freemartins and longer calving intervals. However twinning in dairy animals is also associated with increased milk production and the potential for obtaining more progeny from genetically superior females. The objective of this study was to determine the factors associated with twin births, stillbirths, abortion, and calf death before 28 d of age in the Irish Holstein and Friesian populations. Data were obtained from the Irish Cattle Breeding Federation and consisted of calving and mortality records from Holstein (n = 1,388,840) and Friesian animals (n = 217,786) in Ireland from 2004 to 2009. Logistical regression was used to determine factors associated with twinning, stillbirths, abortions and calf death before 28 d of age. The twinning rate was 2.1% for Holsteins and 2.4% for Friesians. Twinning increased as the parity of the dam increased (odds ration (OR) = 2.13 for Holstein parity 5 vs. Parity 1; OR = 2.24 for Friesian parity 5 vs. Parity 1). Season affected twinning rate, with an increase in the rate of twins born in summer for both Holstein (OR = 1.45 summer vs. winter) and Friesian animals (OR = 1.32 summer vs. winter). Calf stillbirth was higher for twins births than for single births in Holstein (OR = 5.33 twin vs. single birth) and Friesian animals (OR = 4.63 twin vs. single birth). Calving difficulty greatly influenced the odds of stillbirth occurring, particularly in twins births, where Holstein (OR = 10.33 calving score 4 vs. calving score 1) and Friesian (OR = 12.44 calving score 4 vs. calving score 1). Abortion is also more likely for twin births than single births for in Holstein animals (OR = 2.72 twin vs. single birth). Season of birth, year or birth and dam parity also effected the odds of abortion occurring. The odds of calf death before 28 d was increased for twin births when compared with singles and were also affected by dam parity, season, sex of calf and year of calving. These results could be used in herd management to minimize the incidence of twins and calf mortality in the dairy herd.

Key words: twinning, mortality, abortion

277 Nation-wide evaluation of quality and composition of colostrum fed to dairy calves in the United States K. M. Morrill*[1], E. Conrad[1], A. Lago[2], J. D. Quigley[2], and H. D. Tyler[1], [1]*Iowa State University, Ames,* [2]*APC Inc., Ankeny, IA.*

The objective of this study was to characterize the quality (IgG and nutrient content) of maternal colostrum (MC) fed to newborn dairy calves in the United States. Samples of MC (n = 827) were collected immediately before feeding from 67 farms in 12 states between June and October, 2010. Samples were collected from Holsteins (n = 494), Jerseys (n = 87), crossbred (n = 7) and unidentified cattle (n = 239) from 1st (n = 49), 2nd (n = 174), 3rd and later (n = 128) and unknown (n = 476) lactations. Samples were identified as fresh (n = 196), refrigerated (n = 152) or frozen (n = 479) before feeding. Samples of MC were analyzed for IgG by radial immunodiffusion (Triple J Farm; Bellingham, WA), protein, fat, lactose, other solids, total solids and somatic cell count (Dairy Laboratory Service; Dubuque, IA). IgG in MC ranged from <1 to 200 mg/ml, with a mean IgG concentration of 68.8 mg/ml (SD = 32.8). Thirty percent of MC was < 50 mg of IgG/ml. IgG concentration increased ($P < 0.05$) with parity (42.4, 68.6, 95.9 mg/ml in 1st, 2nd, and 3rd and later lactations, respectively). No differences in IgG were observed across breeds or storage method. Fat content ranged from 1.0 to 21.7% with a mean content of 5.6% (SD = 3.2). Protein ranged from 2.6 to 20.5%, with a mean content of 12.7% (SD = 3.3). Lactose content ranged from 1.2 to 4.5%, with a mean content of 2.9% (SD = 0.5). No nutritional differences were observed across breed; however fat content was greater ($P < 0.05$) in MC from 1st lactation compared with other lactations (6.6, 4.2 and 5.1%, respectively). Lactose and total solids were greater ($P < 0.05$) in MC from 1st and 3rd+ lactation cows compared with 2nd lactation cows. Somatic cell count (SCC) ranged from 6,000 to 20,901,000 cells/ml with a mean of 2,531,655 cells/ml. Log SCC decreased ($P < 0.05$) from 1st to 2nd and 2nd to 3rd+ lactation MC (5.9, 5.6 and 5.3, respectively). These data suggest that a minimum of 30% of dairy calves are currently being fed colostrum classified below industry standards for IgG content (<50 mg/ml), and are at a greater risk of failure of passive transfer, mortality and morbidity.

Key words: colostrum, calves, passive transfer

278 Milk production and somatic cell counts: A cow level analysis. K. J. Hand*[1], A. Godkin[2], and D. F. Kelton[3], [1]*Strategic Solutions Group, Puslinch, ON, Canada,* [2]*Ontario Ministry of Agriculture, Food and Rural Affairs, Elora, ON, Canada,* [3]*University of Guelph, Guelph, ON, Canada.*

The objectives of this study were to determine milk loss at the lactation and 24 h level due to subclinical and clinical mastitis. Milk loss was determined by quantifying the relationship between 24 h milk yield (kg) and somatic cell count (SCC, 103 cells / ml) in a cow level analysis. Milk production as a risk factor was also examined. The study data consisted of test day records for the year 2009 from 2835 Holstein herds in Ontario, Canada. The average herd size was 73 animals. Data were model in 2 stages, beginning with a general linear model to estimate the change in 24 h milk (kg) per unit change in ln(SCC), (b1LSCC), accounting for the effects of 24 h fat production (kg), days in milk (DIM) and the quadratic effect of DIM for every animal in the study. In stage 2, the estimated b1LSCC's were analyzed in a mix model that included the covariates within herd milk production quartile (MQ), parity (P, for parities 1, 2 and 3 to 5) and a random effect of herd. The estimated slopes from the mixed model analysis were used to estimate milk loss (kg) by comparing to a referent animal with an SCC value of 100. Lactation milk loss (kg) for all completed lactations was calculated using the estimates of 24 h milk loss (kg) and by accounting for the intervals between test days. As expected, 24 h milk loss increased with increased in SCC. In general first parity animals were found to exhibit less milk loss than multiparous animals. Furthermore, higher producing animals within the herd exhibited greater milk loss. Lactation milk loss (kg) increased as lactation average SCC increased. Lactation milk loss (kg) is approximately 50% more in older animals than compared with first parity animals.

Key words: SCC, production, dairy

279 Daily Markov-chain simulation model for selection of reproductive management programs in dairy herds. J. O. Giordano*, P. M. Fricke, M. C. Wiltbank, and V. E. Cabrera, *Department of Dairy Science, University of Wisconsin-Madison, Madison.*

Our objectives were to: (1) present a daily Markov-chain model that simulated dairy herd dynamics and economic performance, and (2) compare the economic value of 2 reproductive programs. A dairy herd was represented by Markov-chains simulation of events with every cow following daily probabilistic events of aging, culling, mortality, pregnancy, abortion, calving, and starting a new lactation. Daily milk yield was determined based on parity (1 to 9), DIM (1 to 1020 d), and reproductive status (open vs. 1 to 282 d pregnant). Cows culled and

dying were replaced to maintain herd size constant. The probability of pregnancy depended on the combination of insemination risk (IR) and conception risk (CR) for each program. All open cows had a probability of pregnancy between the end of the VWP and a cut-off for breeding at 330 DIM. After the cut-off, cows were labeled as "do not breed" until their milk production was below 27 kg/d when they were culled. A large algorithm containing > 2.5 million equations was iterated until the number of cows in each specific state remained unchanged (steady state). The value of a program was calculated daily for each cow as the sum of 5 factors: milk income over feed cost (IOFC), culling and mortality cost, income from newborns, and AI costs. The model compared the economic value of a program performing AI after estrus detection (ED; A) vs. another combining timed AI (TAI) with ED (B). Program A had a 21 d IR of 50% and CR of 30% for 1st postpartum AI and 28% for subsequent AI. Program B combined AI after ED for all AI (60% of cows bred on ED with 28% CR) with Presynch-Ovsynch for 1st AI postpartum (42% CR) and Ovsynch initiated 32 d after a previous AI for subsequent AI (30%). Economically Program B outperformed A by 14.5 $/cow/y. Program B had slightly lower IOFC (-$3.9), and higher AI costs ($3.5), but lower culling cost (-$7.9) and greater income from newborns ($13.9). Program B had more pregnant cows (3.7%) and fewer days open (13 d). Under the conditions of the case study the model indicated that the program combining ED with TAI (B) was economically and reproductively superior to the program with ED only.

Key words: economics, reproduction, dairy

280 Timing to reach the new level of pregnancy and milk yield after an improvement in reproductive management in dairy herds. G. M. Schuenemann*[1], P. Federico[2], A. De Vries[3], and K. N. Galvão[3], *[1]The Ohio State University, Columbus, [2]Capital University, Columbus, [3]University of Florida, Gainesville.*

The objective of this study was to assess the impact of improving 10% in both compliance (COM) and the accuracy of estrous detection (ED) on the timing to reach the new level of pregnancy and milk yield using an individual cow-based stochastic model for a dairy herd. Programs evaluated were: 1) ED: ED only; 2) Pre-Ov: Ovsynch preceded by Presynch with 2 injections of PGF 14 d apart, and Ovsynch for resynchronization of open cows at 32 d after AI; 3) Pre-Ov-ED: same as Pre-Ov for first AI, but cows undergo ED and AI after first AI, and cows diagnosed open 32 d after AI are resynchronized using Ovsynch. Cows were not inseminated after 365 DIM and open cows were culled after 450 DIM. Culled cows were immediately replaced with a primiparous cow. Herd was maintained at 1,000 cows. Mortality was set at 6% and abortion at 11.3%. The dry period and VWP was 60 d. Conception rate to first service was set to 30% (decreased by 2.5% for every subsequent service), and ED was set to 60%. Accuracy of ED (85% or 95%), and COM with each injection (85% or 95%) were evaluated. Simulations were performed at 85% (for COM and accuracy of ED) for 3,000 d, then the model was set at 95% for the subsequent 2,000 d to calculate the new values for pregnancy and milk yield. The first day the new mean was reached was taken as the time since the change was made. Average values from 10 runs were used. At 95% COM and 95% accuracy of ED, the time length to reach the new level of pregnancy for ED, Pre-Ov, and Pre-Ov-ED was 3.4 mo, 6.7 mo, and 4.1 mo, respectively. The time length to reach the new level of milk yield for ED, Pre-Ov, and Pre-Ov-ED took an additional 5.4 mo, 8.8 mo, and 7.5 mo from pregnancy, respectively. According to the model, the new level of pregnancy should be evident around 3 to 6 mo post-change with an additional 5 to 8 mo for milk yield. Assuming that the herd size remains constant, the timing to event (new level of pregnancy and milk yield) provides a timeline to monitor the expected true benefits when an improvement in reproductive management is made (to improve COM and accuracy of ED) at the farm level.

Key words: compliance, dairy cow, estrous detection

281 Economic comparison of reproductive programs for dairy herds using estrus detection (ED), Ovsynch, or a combination of both. K. N. Galvao*[1], P. Federico[3], A. De Vries[1], and G. M. Schuenemann[2], *[1]University of Florida, Gainesville, [2]The Ohio State University, Columbus, [3]Capital University, Columbus, OH.*

Objective was to compare the economic outcome of reproductive programs using ED, Ovsynch, or a combination of both using a stochastic dynamic model. Programs evaluated: 1) ED: ED only; 2) Pre-Ov: Presynch-Ovsynch for first AI, and Ovsynch for resynchronization of open cows at 32 d after AI; 3) Pre-Ov-ED: same as Pre-Ov for first AI, but cows undergo ED and AI after first AI, and cows diagnosed open 32 d after AI are resynchronized using Ovsynch. Cows were not AI after 365 DIM and open cows were culled after 450 DIM. Culled cows were immediately replaced. Herd was maintained at 1000 cows. Death losses were set at 6% and abortion at 11.3%. Dry period of 60 d. Net daily value was calculated by subtracting the costs with replacement heifers ($1,800/heifer), feeding costs ($0.25/Kg of lactating cow diet; $0.25/Kg of dry cow diet), breeding costs ($0.1/cow/d for ED; $2.5/dose PGF; $3.0/dose GnRH; $0.17/injection administration), and other costs ($3.5/d) from the daily income with milk sales ($0.31/Kg milk), cow sales ($0.75/Kg live weight), and calf sales ($200/calf). Simulation was performed until steady-state was reached (3000 d), then average daily values for the subsequent 2000 d was used to calculate profit/cow/yr. first AI CR was set to 30% (decreased by 2.5% for every subsequent AI), and ED was set to 60%. Accuracy of ED (95 or 85%), and compliance with each injection (95 or 85%) were evaluated. Inaccurate ED resulted in 0% CR. Missing a Presynch injection resulted in loss of 50% of the benefit (40% increase to first AI), and missing an Ovsynch injection resulted in decrease in CR by 70%. At 95% accuracy of ED and 95% compliance, the profits for ED, Pre-Ov, and Pre-Ov-ED were $410, $379, and $485, respectively. At 85% accuracy of ED and 85% compliance, the profits were $347, $260, and $421, respectively. ED only is better than Ovsynch, but Ovsynch with good compliance is better than ED with poor accuracy. Combination of Ovsynch with ED resulted in the greatest profit even with low accuracy and low compliance. Dairies should consider their accuracy of ED and compliance before implementing a program.

Key words: economics, reproductive programs, dairy cows