

when experiencing MP than all other treatments. LR pigs did not differ in lying time among odor treatments. HR piglets exposed to AA, NB or MF had decreased lying time compared with ISO. MR pigs spent more time PFF (interested in the odor) when exposed to MF or NB compared with ISO. LR pigs showed similar PFF when exposed to each odor. HR piglets showed more PFF when exposed to MF than ISO. MR piglets showed more PAF (avoided the odor) when exposed to MP and AA than ISO-exposed piglets. LR and HR did not differ in their PAF behaviors among odors. These experiments demonstrated that pig behavioral type interacted with piglet behavioral responses to relevant and non-relevant biological odors.

Key Words: Pigs, Odors, Backtest

512 Effects of mixing stress on plasma cortisol, corticosteroid-binding globulin and free cortisol index in prenatally-stressed pigs. D. C. Lay Jr^{*1}, H. G. Kattesh², M. P. Roberts², M. J. Toscano¹, and K. A. McMunn^{1,2} *USDA-ARS Livestock Behavior Research Unit, West Lafayette, IN, ²University of Tennessee, Knoxville.*

Exposing a pregnant sow to stress has been shown to have negative effects on her resulting offspring. However, little knowledge exists regarding the mechanisms of this process or the effects of specific stressful events. Our objective was to determine if exposing a sow to stress altered the response of her offspring to mixing stress at 4 mo of age. Sow

treatments consisted of i.v. injections of adrenocorticotrophin (ACTH, 1 IU/kg BW) (ACTH), exposure to rough handling for a 10-minute duration (ROU), or no treatment (CONT) once a week during d 42 to 77 of gestation. At 4 mo of age, one pig from each litter ($n = 14, 14, 15$) was taken from its home pen and placed in a pen of unfamiliar pigs. Blood samples were collected three times per week for two weeks and then once a week for four more weeks. Blood samples were analyzed for cortisol and corticosteroid-binding globulin (CBG), and a free cortisol index (FCI; total cortisol/CBG) was calculated. In response to treatments, ACTH sows had greater concentrations of cortisol than did ROU sows, which had greater concentrations than CONT sows (77.1, 46.0 and 32.1 ng/mL, $P < .004$). CBG concentrations in pigs from CONT sows tended to be lower ($P < .06$) than pigs from ROU sows and was lower ($P < .008$) than pigs from ACTH sows (4.75 ± .10, 5.2 ± .12, and 5.51 ± .13 mg/L, respectively). An effect of gender was also detected with females having greater ($P < .001$) concentrations of CBG than males. No treatment differences ($P < .10$) were found for either plasma cortisol concentrations or FCI. A treatment by repetition ($P < .02$) and repetition effect ($P < .04$) were noted for both plasma cortisol and FCI. Prenatal stress, induced either artificially with injections of ACTH, or via rough handling, changes CBG responses compared to controls but does not alter either FCI or plasma cortisol concentrations. The degree to which effects of prenatal stress are induced in production livestock needs to be sought.

Key Words: Swine, Prenatal Stress, Corticosteroid Binding Globulin

Animal Health: Dairy Cattle Health – Transition Cows and Mastitis

513 Negative energy balance during the periparturient period is associated with uterine health disorders and fever in Holstein cows. D. S. Hammon^{*1}, I. M. Evjen¹, T. R. Dhiman¹, and J. P. Goff², ¹*Utah State University, Logan, ²USDA, National Animal Disease Center, Ames, IA.*

Eighty-three multiparous Holstein cows were used to investigate the association between periparturient energy balance and uterine health disorders and fever. Blood samples were collected weekly from wk -2 to wk 5 postpartum for serum nonesterified fatty acids (NEFA) and Beta-hydroxybutyrate (BHB). Feed dry matter intake (DMI) was determined daily from wk -2 to wk 5 postpartum. Cows were examined at wk 3 for clinical endometritis (purulent cervical discharge on vaginal examination) and at wk 4 for subclinical (SC) endometritis (presence of neutrophils on endometrial cytological exam). Retained placentae (RP) were determined by visual and vaginal speculum examination on d 1 postpartum. Rectal temperatures were recorded from day 1 -10 postpartum. Fever was defined as a rectal temperature #8805103°F for #88052 d. Differences in measurements were determined using a repeated measures of ANOVA. Of 83 cows total, 14 developed RP, 13 developed clinical endometritis, 61 developed SC endometritis, and 18 developed fever. Cows with RP had significantly ($P < 0.001$) lower DMI beginning 1 wk before calving and for the first 3 wk of lactation compared to cows without RP. Cows with SC endometritis had significantly ($P = 0.01$) lower DMI from wk -1 to wk 5, significantly ($P = 0.01$) higher NEFA from wk -2 to wk 4, and significantly higher ($P < 0.04$) BHBA from wk 1 to wk 4, compared to cows without subclinical endometritis. Cows with fever had significantly ($P = 0.05$) lower DMI from wk 1 to wk 4, significantly ($P = 0.03$) higher NEFA from wk -1 to wk 4, and significantly ($P < 0.03$) higher BHBA wk 1 to wk 4, compared to cows without fever. DMI, NEFA, and BHBA were similar for cows with or without clinical endometritis. From these data, we suggest that some uterine health disorders and fever are preceded by negative energy balance that begins prior to calving and extends into early lactation.

Key Words: Periparturient Dairy Cow, Endometritis, Negative Energy Balance

514 The relationship between the incidence of production-limiting disease and return over feed in Ontario dairy herds. C. McLaren^{*1}, K. Lissemore¹, T. Duffield¹, K. Leslie¹, D. Kelton¹, and B. Grexton², ¹*Department of Population Medicine, University of Guelph, Guelph, ON, Canada, ²Ontario Dairy Herd Improvement Corporation, Ontario, Canada.*

Production-limiting diseases are some of the most prevalent and costly conditions in the dairy industry. Displaced abomasum (DA), retained

placenta (RP), lameness, milk fever, mastitis and ketosis have a large economic impact on the individual animal. However, there are few studies that quantify their effect on herd economics. The objectives of this research were to examine the relationship between profitability as measured by the Ontario Dairy Herd Improvement (DHI) Corporation's Return over Feed herd profit index (ROF), and production-limiting disease. Clinical disease incidence risk of DA, lameness, RP, milk fever, mastitis and ketosis were calculated from participant submissions. For the determination of subclinical mastitis and ketosis cumulative incidence, the California Mastitis Test (>0) and the KetoTest® Beta-hydroxybutyrate (greater than or equal to 100 $\mu\text{mol/l}$) milk test were used weekly in early postpartum cows (1-14 days). Producers were identified through the Ontario DHI Corporation ROF groups. The ROF was calculated from the difference between milk revenue and feed cost each month. Feed cost was determined from herd level dry matter intakes at each operation multiplied by fixed market prices for each feed ingredient. Revenue was calculated based on the Dairy Farmers of Ontario multiple component pricing formula for milk. There were 48 producers that submitted ROF, postpartum monitoring and clinical disease data for the period January 1st, 2002 and January 31st, 2003. Using linear regression modeling, no significant association ($p > 0.05$) was detected for subclinical and clinical mastitis, RP, lameness and milk fever herd incidence with ROF.

Disease	Mean Herd Incidence Risk (%)	Coefficient ¹ (\$/cow/day)	p-value
Subclinical Ketosis	61.0	-0.015	0.0239
Clinical Ketosis	2.1	0.12	0.0030
DA	3.4	0.11	0.0085

¹Baseline ROF (Intercept)=\$13.13/cow/day, $r^2=0.33$

Key Words: Return Over Feed, Production-Limiting Disease

515 An evaluation of rumen-protected choline and monensin controlled release capsule on milk production, health and metabolic function of periparturient dairy cows. L. Zahra^{*1}, S. LeBlanc¹, K. Leslie¹, T. Duffield¹, T. Overton², and D. Putnam³, ¹*Department of Population Medicine, University of Guelph, Guelph, ON, Canada, ²Department of Animal Science, Cornell University, Ithaca, NY, ³Balchem Corporation, New Hampton, NY.*

Three weeks prior calving, 185 Holstein cows were randomly assigned to receive one of the following: a monensin CRC, a daily top-dress of

56g rumen-protected choline (RPC; Reashure choline, Balchem Encapsulates, New Hampton, NY) until 28 days post-calving, both supplements (RPC+CRC), or neither (CON). Blood samples were collected at enrollment, one week pre-calving, and in the first and second weeks post-calving. Daily DMI from enrollment until 30 DIM, and daily milk weights up to 60 DIM were measured. Adjusting for parity and BCS at enrollment, beta-hydroxybutyric acid (BHBA) concentrations in the first week post-calving were lower in the CRC and RPC+CRC groups than controls (990, 1140 and 1553 μ mol/L respectively, ($P<0.05$). NEFA concentrations in the first week post-calving were lower in the CRC group compared to control (0.51 and 0.70 mEq/L, respectively, $P<0.01$). In both the first week pre-calving and the first week post-calving, the concentrations of serum urea were higher in the CRC group (4.03 & 4.54mmol/L, respectively) and RPC+CRC group (4.12 & 4.51 mmol/L, respectively) in comparison to the CON group (3.67 & 4.02 mmol/L, respectively) ($P<0.05$). During the first week post-calving higher serum glucose concentrations were observed in both the CRC and RPC+CRC groups in comparison to the CON group (2.76, 2.72 and 2.43mmol/L, respectively, $P<0.05$). There was no treatment effect on DMI pre or post-calving. There was no interaction between CRC and RPC on milk production, and no significant main effects of CRC on milk production. Data were pooled into two groups, cows receiving RPC and cows not receiving RPC. Adjusting for treatment, parity, BCS at enrollment, week of lactation and average post-calving DMI there was a tendency ($P=0.06$) for the RPC group to produce more milk in the first 60 DIM compared to cows that did not receive RPC (32.6 vs 31.7 kg/d respectively). According to the results from this study thus far, the mechanism by which RPC enhances milk production remains unclear.

Key Words: Dairy, Choline, Monensin

516 Effect of the method of delivery of monensin on serum insulin and cortisol concentrations in transition dairy cows. C. S. Petersson^{*1}, K. E. Leslie², T. F. Duffield², T. M. Osborne², B. W. McBride³, R. Bagg⁴, and P. Dick⁴, ¹Department of Animal Sciences, Ohio State University, Columbus, ²Department of Population Medicine, University of Guelph, Guelph, ON, Canada, ³Department of Animal and Poultry Science, University of Guelph, Guelph, ON, Canada, ⁴Elanco Animal Health, a Division of Eli Lilly, Inc., Research Park Centre, Guelph, ON, Canada.

An investigation was conducted to compare the effects of the monensin controlled-release capsule (CRC), the monensin premix and a negative control group on serum insulin and cortisol concentrations in a randomized and blinded clinical trial. A total of 136 Holstein cows and heifers from the Elora Dairy Research Centre were enrolled at three weeks prior to expected calving date. At enrolment, each animal was randomly assigned to receive a monensin CRC, monensin premix in the TMR or no treatment. Blood samples were obtained at enrolment, at one week prior to expected calving date, at calving, and at one and two weeks postpartum. The serum from these samples was analyzed for insulin and cortisol concentrations. Monensin had no effect on serum insulin concentration over the study period. However, serum insulin concentrations were higher prior to calving as compared to the postpartum period. Additionally, the serum concentration of insulin in heifers was significantly increased compared to multiparous animals. A seasonal effect found that the serum concentration of insulin was lowest in the summer as compared to the spring, winter and fall seasons. Monensin administration had no effect on serum cortisol concentration throughout the study period. However, statistical variation over time was observed; the highest concentrations occurred at calving.

Key Words: Escherichia coli, Mastitis, Vaccination

517 Determination of the test characteristics of a rapid, on-site serum NEFA test. L. Gooijer, K. Leslie*, T. Duffield, S. LeBlanc, N. Perkins, and E. Vernooy, University of Guelph, Guelph, ON, Canada.

Excessive or prolonged periparturient negative energy balance (NEB) may be associated with increased risk of clinical disease and losses from impaired production and reproductive performance. Monitoring the incidence of subclinical ketosis has been the recommended method of surveillance. It has been found that affected cows commonly have elevated circulating levels of non-esterified fatty acids (NEFA) in the prepartum period. However, measuring NEFA has traditionally involved submission of serum to a diagnostic laboratory. The objective of this

study was to determine the test characteristics of a new, rapid, on-site test for NEFA in serum (DVM NEFA, Veterinary Diagnostics LLC, Newburg, Wisconsin, USA). Cows were enrolled between 7 and 4 days prior to their expected calving date. Blood was collected by coccygeal venapuncture and serum was harvested. Cows were re-sampled twice weekly until calving. NEFA concentration was measured using the DVM NEFA test, and an aliquot was submitted to the Animal Health Laboratory (AHL) of the University of Guelph for analysis by a Hitachi 911 automated analyzer (Roche, Laval, Quebec). The AHL NEFA concentration was considered the gold standard for this evaluation. Serum NEFA greater than or equal to 0.4 mEq/L NEFA has been proposed to identify excessive prep partum NEB. A total of 491 samples from 256 different cows on eight farms in the Guelph, Ontario area were utilized in this study. The Pearson correlation coefficient between the DVM NEFA and the AHL NEFA determination was 0.75. Using 350 samples drawn within 14 d prepartum and NEFA greater than or equal to 0.4 mEq/L from the AHL test as the gold standard, the sensitivity and specificity of the DVM NEFA test were 84% and 96%, respectively. It is noteworthy that changing the NEFA cut off level to greater than or equal to 0.5 mEq/L resulted in a similar sensitivity and specificity of 85% and 97%, respectively. It was concluded that the DVM NEFA test characteristics were satisfactory for detection of cows with elevated prep partum NEFA.

Key Words: Non-Esterified Fatty Acid, Negative Energy Balance, Test

518 DCAD affects responsiveness of cows to parathyroid hormone -how anion supplementation prevents milk fever. J. P. Goff* and R. L. Horst, USDA-ARS, National Animal Disease Center, Ames, IA.

How adjusting dietary cation-anion difference (DCAD) reduces milk fever incidence remains debatable. Our hypothesis is that DCAD affects acid-base status of the cow altering the action of parathyroid hormone (PTH) on its target tissues, primarily bone and kidney. PTH normally stimulates renal synthesis of 1,25-dihydroxyvitamin D (1,25-vit D) and the effects of 1,25-vit D on intestine, and PTH on bone, cause a rapid rise in plasma Ca concentration. To test this hypothesis, Jersey cows in late gestation were fed a Low DCAD (N=8) or a High DCAD diet (N=8) for 2 wks. Urine pH averaged 5.7 in Low DCAD and 8.3 in High DCAD cows indicating the diets did affect acid-base status. Baseline blood samples were collected from each cow. Then 0.5 mg PTH 1-34 was administered IM, with additional injections of 3.3 mg PTH given every 3 h for 48 h. Blood samples were obtained every 3 h during PTH treatment and plasma Ca and 1,25-vit D concentrations were determined. Repeated measures ANOVA demonstrated significant time by diet effects on both plasma Ca and 1,25-vit D. Cows fed Low DCAD had a significant increase in plasma Ca from baseline at 6 h of PTH treatment and plasma Ca continued to increase with PTH treatment. In High DCAD cows plasma Ca did not increase from baseline until 21 h and continued to increase with PTH treatment. Plasma 1,25-vit D was above baseline in Low DCAD cows at 6 h of PTH treatment, peaked at 24 h of PTH treatment and remained elevated. In high DCAD cows there was a small but significant spike in plasma 1,25-vit D concentration at 6 h of PTH treatment but values at 9 and 12 h of PTH treatment were not significantly elevated from baseline. Plasma 1,25-vit D concentration rose above baseline at 15, 24, 30 and 33 h of PTH treatment but were similar to baseline at 18, 21 and 27 h of PTH treatment. These data demonstrate that High DCAD causes a pseudohypoparathyroid state in which tissues are less responsive to PTH stimulation, which impairs Ca homeostasis to cause milk fever. Low DCAD diets restore tissue PTH sensitivity, preventing milk fever.

Key Words: DCAD, Milk Fever, Parathyroid Hormone

519 Impact of participation in somatic cell count testing on herd average somatic cell score. H. D. Norman, A. H. Sanders*, R. H. Miller, and R. L. Powell, Animal Improvement Programs Laboratory, Agricultural Research Service, USDA, Beltsville, MD.

Mastitis results in substantial loss for dairy producers through lost milk and cow treatment or replacement. Test day data for somatic cell score (SCS) is stored in the national database at the Animal Improvement Programs Laboratory (AIPL). Since 1995, national herd average SCS has increased slightly. Also in that time, emphasis on SCS in the Net Merit index was increased from 6 to 9%, recognizing the value of improving udder health. To examine the impact of participation in official

somatic cell count (SCC) testing, herd mean SCS for 692,993 test days in 15,869 herds that began SCC testing between July 1995 and February 2004, having at least 6 mo on SCC testing, were analyzed for within herd effects of months on test. Herds were assumed to have stopped testing if no test was reported for >6 mo. Significant seasonal effects were accounted for by including month of test in the model; SCS was highest in August and lowest in November. Herd effect was nested in time of first test (month and year). Overall, mean first SCS test was 2.99; however, herds beginning SCC testing more recently had lower first SCS test (regression of first SCS on time of first test of -0.03). From the first to the second month on testing, SCS decreased by 0.14 ($P = .0804$), but returned to starting level by 6 mo, and continued to increase over the subsequent 42 mo. Conversely, milk production increased significantly from the first to the second month of SCC testing, but decreased as SCC increased. These results were more pronounced in herds not previously on official milk testing. Increasing herd size was associated with a reduction in SCS, but including number of cows on test day produced similar results for effects of time on test. Frequency of testing did not significantly affect results. The national average of herd SCC and percentage of herd SCC exceeding 750,000 cells/ml have been increasing, the results of this study indicate that somatic cell testing can provide information valuable in reducing herd SCC, but producers may not fully utilize this information.

Key Words: Somatic Cell Score, Mastitis, DHIA

520 Dairy herd characteristics, management practices and mastitis prevalence data from farm visits to improve milk quality in New York and surrounding states. D. Wilson*, R. Gonzalez, G. Bennett, H. Schulte, J. Spatz, L. Tikofsky, F. Welcome, and Y. Schukken, Quality Milk Production Services, Cornell University, Ithaca, NY.

From January through November, 2003 the Quality Milk Production Services made 1294 herd visits and collected 76,346 aseptic milk culture samples from those visits in New York, Pennsylvania, Massachusetts, and Vermont. These visits were made either to monitor and maintain milk quality, or because of concerns about elevated bulk tank SCC. Mean SCC for herds monitoring milk quality was 384,000/ml. Herd size averaged 92 lactating plus dry cows, range 5-1648 cows. The smallest 400 herds had fewer cows than the largest 10 herds. Milk production 305-d mean was 14,903 lb with 90th percentile 22,000 lb. 1.5% of herds sold 50,000-710,000 lb/day, 2.5% sold <300 lb/day. Holstein breed was most common, with Holstein crosses also more common than any other breed. Tiestalls were most common housing type but freestalls were increasing. Dry cows were housed with lactating cows (45%) or a variety of other housing types. Milking systems included pipeline (67%), parlor (21%), and bucket (as only milking system, 12%). Parlor usage was increasing. Predip (63%), udder wash (24%), postdip (85%), dry cow therapy (all cows 84%, selected 7%) were practices increasing in adoption. Closed herds (53%) are decreasing. Trends toward fewer larger herds, freestalls, adoption of milk quality practices, and associated improved milk quality are evident. Some effective mastitis control methods still are not adopted by a substantial fraction of dairy farms, including large operations.

Key Words: Mastitis, Milk Quality

521 Efficacy of intramuscular ceftiofur combined with intramammary pirlimycin or cephapirin for treatment of systemically mild clinical mastitis in dairy cattle. J. R. Wenz*, R. Elia, D. Pruna, F. B. Garry, and R. P. Dinsmore, Integrated Livestock Management, Colorado State University, Fort Collins.

The objective of this study was to evaluate the impact of IM ceftiofur on important outcomes of systemically mild clinical mastitis. Cows from a 1500 cow dairy with clinical mastitis were randomly assigned to a treatment group: M1-intramammary (IMM) pirlimycin (n=35), M2-IMM pirlimycin and ceftiofur (n=36), M3-IMM cephapirin (n=40), M4-IMM cephapirin and ceftiofur (n=33). Pirlimycin was administered as labeled. Cephapirin was administered twice a day for three days. Ceftiofur was administered IM (2mg/kg) once a day for 3 days. Milk was cultured at initial identification (0hr), on exit from sick pen and 7 days post-exit. Cows with abnormal milk 3 days after the end of initial IMM treatment were re-treated. Recurrent clinical mastitis was diagnosed in cows with a subsequent clinical mastitis episode in the same quarter within 3 months. Bacteriologic cure was defined as no growth or growth

different from 0 hr culture results on both exit and 7 day post-exit cultures in cows that did not require re-treatment. Effects of treatment (IMM and IM) on outcomes were analyzed by logistic regression accounting for Gram staining characteristics (GRAM) of 0 hr bacterial culture result (SAS, PROC LOGISTIC). Sixty-nine, 22 and 9 % of 0hr cultures were Gram negative, Gram positive and mixed, respectively. There was a significant difference in bacteriologic cure of ceftiofur treated cows (75%) compared to IMM only treated cows (50%) controlling for IMM treatment and GRAM ($P=0.048$). However, there was no difference in re-treatment or recurrence rate comparing treatment group or ceftiofur treatment alone ($P>0.40$). Treatment had no effect on the number of dried quarters, cows sold for or dying from mastitis or sick pen days. The results of this limited study in one herd, with a predominance of Gram negative clinical mastitis, suggest IM ceftiofur treatment has no beneficial effects on the outcome of systemically mild clinical mastitis.

Key Words: Mastitis, Treatment, Ceftiofur

522 The effects of two *Escherichia coli* J5 immunization protocols on milk production, dry matter feed intake, antibody response and intramammary infection in dairy cattle. C. S. Petersson¹, K. E. Leslie², D. F. Kelton², B. A. Mallard³, and S. W. Martin², ¹Department of Animal Sciences, Ohio State University, Columbus, ²Department of Population Medicine, University of Guelph, Guelph, ON, Canada, ³Department of Pathobiology, University of Guelph, Guelph, ON, Canada.

An investigation was conducted to compare the effects of two *Escherichia coli* J5 immunization protocols (Standard and Experimental) in 198 animals from two herds. Each immunization included the *E. coli* J5 bacterin and a naïve marker antigen, ovalbumin (OVA). The Standard Group was immunized at drying-off, three weeks before expected calving and 3-9 days postpartum. The Experimental Group was immunized at two weeks before drying-off, at drying-off and at three weeks before expected calving. Immunization protocol did not effect milk production for 14 days prior to drying-off, or to 60 days in milk. To evaluate the physiologic effects of immunization, dry matter feed intake values were collected for the 24 hours before the third immunization in the Standard Group, as well as the 24, 48 and 72 hours after. The intake values were also collected for the same dates in the non-immunized Experimental Group. Dry matter feed intake was not affected by immunization in the postpartum period. Serum antibody to *E. coli* J5 did not increase following immunization in either group. Animals showed significant response to OVA, however, total peripartum antibody to OVA did not differ between the two groups. The risk of culturing a gram-negative pathogen at calving and the risk of gram-negative clinical mastitis was not different between the two protocols.

Key Words: Insulin, Cortisol, Parturition

523 Tunnel ventilation cooling for lactating dairy cows during hot weather: Comparison to cooling with shade and fans. T. R. Smith¹, A. M. Chapa¹, D. O. Pouge², T. O. Riley², R. J. Williams¹, J. Crouch¹, and H. Wilson¹, ¹The Department of Animal & Dairy Science, Mississippi State University, Mississippi State, ²The Dairy Research Unit, Mississippi Branch Experiment Station, Holly Springs, MS.

The objective of this study was to characterize the ability of tunnel ventilation cooling to alleviate symptoms of heat stress in lactating dairy cows. Fans and evaporative "cooling" cells were used to cool the model, 20-cow tunnel ventilation facility, constructed at the Dairy Research Unit in Holly Springs, MS. The 10-week trial, which began June 2, 2003, compared two groups of 10 cows housed in the tunnel ventilation barn with two similar groups, housed in an adjacent "traditional" freestall barn, which was cooled by shade and fans alone. The effect of tunnel ventilation cooling was to decrease exposure to moderate heat stress conditions by 4.3 ± 0.26 hours/d when compared to conditions in the traditional freestall barns. In response, cows housed in the tunnel barn had dramatically lower peak body temperatures ($0.67 \pm 0.02^\circ\text{C}$) and respiration rates (15.7 ± 0.54 breaths/min) than cows housed in the "outside" freestall barn ($P<.001$). This increment in cooling improved feed consumption within the tunnel barn an average of 1.8 ± 0.81 kg/hd/d over the 10-week study. In addition, over the 10-week trial, cows cooled by tunnel ventilation averaged 2.8 ± 0.7 kg/hd/d greater milk production ($P<.0001$) than cows cooled with shade and fans alone. These results demonstrate that tunnel ventilation cooling can be used

to mitigate the effects of heat stress on lactating dairy cattle in the southeastern US.

Key Words: Tunnel Ventilation, Dairy, Heat Stress

Breeding and Genetics: Dairy Crossbreeding and Breeding Objectives

524 Comparison of first-parity Holstein, Normande-Holstein crossbred, Montbeliarde-Holstein crossbred and Scandinavian-Holstein crossbred cows for dystocia and stillbirths. B. J. Heins*, L. B. Hansen, and A. J. Seykora, University of Minnesota, St. Paul.

First-parity Holstein (H), Normande-Holstein (NxH) crossbred, Montbeliarde-Holstein (MxH) crossbred and Scandinavian-Holstein (SxH) crossbred cows calving from June 2001 to December 2003 were compared for dystocia and stillbirths from seven California herds. Dystocia scores ranging from 1 (no assistance) to 5 (hard pull) and stillbirths (1 for alive and 0 for dead) were recorded for 1695 Holstein cows, 205 Normande-Holstein cows, 157 Montbeliarde-Holstein cows and 110 Scandinavian-Holstein cows. Cows were bred to Brown Swiss, Holstein, Jersey, Normande, Montbeliarde and Scandinavian sires. Investigated were effects of calf sex, breed composition of cow, age at calving, breed of service sire, calving year and herd. For dystocia, sex of calf, calving year, breed of dam, breed of service sire and herd were significantly different ($P < .05$). The least squares mean for calf sex were 1.55 for males and 1.19 for females. Mean scores for dystocia for breed of dam were 1.59 (H), 1.44 (NxH), 1.26 (MxH) and 1.19 (SxH). Holstein sired calves (1.52) differed significantly ($P < .05$) from Jersey sires (1.11), and Holstein sires differed ($P < .01$) from Scandinavian sires (1.30). For stillbirths, sex of calf, calving year, breed of dam, breed of service sire and herd were significantly different ($P < .01$). Male calves (12%) had higher stillbirths than females (2%). Mean scores for stillbirths for breed of dam were 12% (H), 8% (NxH), 3% (MxH) and 5% (SxH). Holstein sires had the highest rate of stillbirths (12%), and rates for the other breeds of sires were 10% for Brown Swiss, 3% for Jersey, 7% for Montbeliarde, 4% for Normande, and 5% for Scandinavian sires. Holstein sires differed significantly from Jersey ($P < .05$) and Scandinavian sires ($P < .01$). Brown Swiss differed significantly from Scandinavian sires ($P < .05$).

Key Words: Crossbreeding, Dystocia, Stillbirths

525 Comparison of the fertility of pure Holstein sires and F1 Jersey x Holstein sires mated to pure Holstein cows in an experimental herd. K. Weigel* and C. Maltecca, Department of Dairy Science, University of Wisconsin, Madison.

The objective of this study was to compare the male fertility of pure Holstein service sires and crossbred F1 Jersey x Holstein service sires in artificial insemination (AI) matings to pure Holstein cows. Approximately 60% of matings involving Holstein cows in the University of Wisconsin Experimental Herd were randomly allocated to F1 Jersey x Holstein young sires ($N=7$) from Alta Genetics, Select Sires, ABS Global, and Accelerated Genetics. The remaining matings were allocated to pure Holstein young sires ($N=52$) from seven commercial AI companies. Our analysis included 429 inseminations (166 cows) to crossbred sires and 288 inseminations (124 cows) to Holstein sires between February 3, 2003 and January 28, 2004. Pregnancy status was determined by ultrasound at 28 to 33 d after breeding. All pregnant cows were re-checked twice, at approximately 63 d and 100 d after breeding. Mean conception rates were 29.2% (84/288) for matings to pure Holstein sires and 30.3% (130/429) for matings to F1 Jersey x Holstein sires. Conception rates for individual crossbred sires were 27.4%, 27.6%, 30.7%, 29.1%, 34.7%, 35.4%, and 0.0% based on 73, 69, 75, 55, 45, 99, and 9 matings, respectively. Abortion rates (after a positive ultrasound at 28-33 d) were 7.1% (6/84) for pregnancies from Holstein sires and 14.6% (19/130) for pregnancies from crossbred sires. Based on Chi-Squared test statistics, corrected for days in milk and year-month of insemination, neither differences in conception rates nor differences in abortion rates between purebred and crossbred sires were statistically significant ($P < 0.05$). Based on the results of this study, it does not appear that crossbred Jersey x Holstein sires can provide a significant improvement in male fertility relative to their pure Holstein contemporaries.

Key Words: Male Fertility, Crossbreeding

526 A comparison of reproductive efficiency in four breeds of dairy cow and two cross breeds under seasonal grass-based production systems in Ireland. F. Buckley*, J. F. Mee, N. Byrne, M. Herlihy, and P. Dillon, Teagasc, Dairy Production Research Centre, Moorepark, Fermoy, Co. Cork, Ireland.

The objective of this study was to compare the reproductive performance of four dairy cow breeds, and two cross breeds; Holstein-Friesian (HF), French Montbeliarde (MB), MBxHF, French Normande (NM), NMxHF, and Norwegian Red (NRF), over a three year period, on two seasonal grass-based milk production systems. The study included a total of 402 cows: 95 HF, 72 MB, 63 MBxHF, 36 NM, 58 NMxHF, and 78 NRF. The mean calving date was February 18. In mid-April each year cows were assigned (within breed) to a low level of concentrate supplementation (LC: 650kg/cow/lactation) or a high level of concentrate supplementation (HC: 1,250kg/cow/lactation) based on calving date and pre-experimental milk yield. Breeding started in late April and lasted 13 weeks (all AI). No difference in the interval to commencement of luteal activity (as determined by thrice weekly milk progesterone measurement), submission rate in the first 24 days of breeding, or number of services per cow were observed between the groups investigated. Significant differences in pregnancy rate to first service (PREG1), pregnancy rate after 42 days of breeding (PR42) and calving to conception interval (CCI) were observed. Overall, the highest reproductive efficiency was observed with the NRF breed (PREG1 = 59%, PR42 = 75% and CCI = 88 days). The lowest reproductive performance was observed with the HF breed (PREG1 = 42%, PR42 = 56% and CCI = 96 days). The reproductive performance of both the MBxHF and the NMxHF was higher than the average of the respective parent breed groups. Feeding system had no influence on any of the fertility traits investigated. In conclusion, the results of the current study highlight the benefit of the NRF breeding program where improved health and fertility have been selection criteria since the early 1970's. The results also suggest that dairy crossbreeding will lead to improved reproductive performance through hybrid vigour.

Key Words: Dairy Breeds, Fertility, Hybdrid Vigour

527 Effect of Holstein females carrying Holstein versus Jersey sired calves on subsequent MEMilk, days open and involuntary culling. A. J. Seykora*, B. J. Heins, L. B. Hansen, J. G. Linn, D. G. Johnson, and W. P. Hansen, University of Minnesota, St. Paul.

From September 2001 to June 2003, 163 Holstein and 180 Jersey-Holstein crossbred calves were born at the University of Minnesota research herds at the St. Paul campus and at the West Central Research and Outreach Center, Morris. Cows and heifers had been randomly assigned to either Holstein or Jersey service sires. Dystocia was scored with a range of 1 (no assistance) to 5 (hard pull). Independent variables for analysis were herd, parity (1st, 2nd and 3rd and greater), sex of calf, and breed of sire. Differences between Holstein and Jersey sires were significant for dystocia score, calf weight, and retained placenta ($P < .05$). Least squares means for Holstein and Jersey sires, respectively, were dystocia score, 1.97 versus 1.36; calf weight, 43.6 kg versus 35.7 kg; and retained placenta, 8.2% versus 3.6%. Stillbirth rate was 7.2% for Holstein sires and 5.2% for Jersey sires, but not significantly different ($P > .05$). There were no significant differences in the subsequent MEMilk, days open or chance of early culling (culled less than 100 days into lactation) for cows having Holstein versus Jersey sired calves. For all cows, cows that had been bred to Holsteins averaged $10,430 \pm 158$ kg MEMilk versus $10,156 \pm 155$ kg for cows bred to Jerseys. Days open also favored the cows that had had Holstein sired calves: 138 ± 8 days versus 143 ± 8 days. Relative to early culling, $16.6 \pm 3.9\%$ of cows having Holstein calves were culled vs. $14.1 \pm 3.7\%$ of cows having Jersey sired calves. The analysis was repeated for just the first lactation cows.