Breeding and Genetics: Dairy Cattle Breeding for Non-Production Traits II

555 Including important traits with low heritability in workable dairy progeny tests in the US. R. Pearson* and B. Cassell, *Virginia Polytechnic Institute and State University*, *Blacksburg*.

Breeding companies make an investment in progeny testing that is recouped by selling semen primarily from these proven bulls. The purpose of progeny testing is to accurately predict the average genetic contribution of a bull to future progeny. Problems accentuated for traits with low heritability include: inaccurate identification, progeny group size, accurate data on progeny groups, and genotype x environment interaction. Accurate animal id is currently emphasized in relation to tracking animals. This will not reduce the problem of incorrect id, but may offer opportunities to obtain samples for parentage verification and keep the id permanent. Increasing progeny group size is mainly a financial question. Current evaluations are focused on increasing the spread of proofs and increased stability through more accurate genetic evaluations. Incentives for use of progeny testing are costly as are the cows bred to progeny test sires that are not candidates for the more profitable proven bull semen. Would this be a place where sexed semen could be a cost effective incentive to the breeder? Because of the added value, the semen may be more judiciously used and thus increase the output of daughters. The potential for sire x environment interactions continues to increase as the variation in the intensity, and/or specificity of the management system increases. Degree of use of BST, approaches to timed AI, variation in the pathogen loads, intensity of rations, and approaches to the dry period are just a few of the possible causes. Genetic evaluations have been from traits that producers were willing to pay for the data collection. AI units will need to find ways to increase the value of data on low heritability traits and recruit herds that already value the needed data. The opportunity of improving the selection of sires for progeny testing through DNA evaluation continues to be a hope for increasing the accuracy of selection. To this point, its overall impact has been minimal.

Key Words: Progeny Test, Low Heritability Traits, Dairy Cattle

556 Effect of herd by sire interaction variance on genetic evaluations. P. M. VanRaden and M. E. Tooker*, *Animal Improvement Programs Laboratory, Agricultural Research Service, USDA*, *Beltsville, MD*.

Records from multiple daughters of a bull in the same herd have had reduced weighting in USDA evaluations since 1967 by adjusting for herd by sire interaction. Interaction variance ($\mathbf{c^2}$) defined as a percentage of phenotypic variance was initially estimated to be 14%. In 1997, c^2 was reduced to 10%, and heritability was increased from 25 to 30% in the animal model. Recent c^2 estimates have been lower, but higher c^2 limits differential management or fraud by individual herd owners. Official November 2004 predicted transmitting abilities (**PTA**) for Holstein protein yield with $c^2 = 10\%$ were compared with PTA computed with reduced c^2. Repeatability of protein yield was held constant at 0.55 by increasing permanent environmental variance as c^2 was decreased to 5 and 1%. Correlations of official PTA with PTA with reduced c^2 were high: 0.999 for $c^2 = 5\%$ and 0.993 for $c^2 = 1\%$ for active artificial-insemination (**AI**) bulls and 0.999 and 0.994, respectively, for cows born since 1998. Calculated reliability of PTA increased as c^2 decreased: 88.6% for $c^2 = 10\%$, 89.2% for $c^2 = 5\%$, and 90.0% for $c^2 = 1\%$ for bulls and 49.3, 49.4, and 49.4% for cows. Mean PTA decreased slightly: 18.4, 18.3, and 18.2 kg for bulls and 8.2, 8.1, and 8.0 kg for cows. Individual PTA changes were small for active bulls and moderate for non-AI bulls. Of the top 100 bulls for protein, 98 had no PTA change; only 2 bulls had changes of 1 kg when c^2 was reduced from 10 to 5%. When c^2 was reduced from 10 to 1%, 92 of the top 100 bulls had no PTA change; changes for the other 8 bulls were 1 or 2 kg. Of 2.3 million recent cows, PTA changed by >4 kg for only 20 cows when $c^2 = 5\%$ and 1256 cows when $c^2 = 1\%$; those cows were sired by non-AI bulls with many daughters in one or a few herds. Use of a relationship matrix among herd by sire or herd by animal interactions could be helpful but was not tested. Reduction of c^2 to 5% would facilitate AI companies obtaining more daughters per herd in large cooperating herds. However, somewhat less protection would be provided against chance or fraud when sampling was limited to a few herds.

Key Words: Herd by Sire Interaction, Environmental Correlation, Animal Model

557 Quantifying the level of heat stress in a southeastern dairy using weather recording on- and off-farm. M. Freitas*[2], I. Misztal[1], J. Bohmanova[1], and J. West[1], [1]*University of Georgia*, *Athens*, [2]*Universidade Federal de Vicosa*, *Vicosa, MG, Brazil*.

The purpose of this study was to compare the effectiveness of on- and off-farm weather recording on capturing the effect of heat stress on production. Daily milk yield for 31 primiparous Holstein cows was collected at Tifton, GA, from June 2 to July 19, 1993. Air temperature and relative humidity were recorded on-farm by a portable unit placed immediately adjacent to the free stalls. Weather information was also available from public weather stations located in Georgia; the closest station was in Tifton, about 3 km from the farm. Maximum temperature-humidity index (THI) was calculated using maximum temperature and minimum relative humidity, and minimum THI was calculated using minimum temperature and maximum relative humidity. Analyses used the average of minimum and maximum THI. Based on on-farm weather information recorded the day of milking, the onset of heat stress was at THI = 74, and afterwards, the rate of decline averaged 0.77 kg of milk per degree of THI. Using a lag of 2 d for weather data increased the rate to 0.96 kg. With the data from the Tifton station, the onset of heat stress was at 71 THI, and the rate was 1.00, (1.14, 1.12, and 0.97) for no lag and (lags of 1 d, 2d, 3d). With data from stations in Macon, (Columbus, Atlanta, and Athens), the onset was at 73, (70, 71, and 71), and the rate was 0.85, (0.76, .88, and 0.89). A separate analysis included 1993-2003 test days from the same farm and the weather information from the Tifton station. The onset of heat stress was at 68 THI and the slope was 0.32. Using only data for 2000-2003 changed the onset to 75 and increased the rate to 0.74; the Tifton station was changed from manual to automatic weather recording in 1999. Records from nearby weather stations may be equal to or superior to those from on-farm recording. The quality of data from weather stations is a function of location and time.

Key Words: Heat Stress, Temperature-Humidity Index, Dairy Cattle

558 Test-day model that accounts for heat stress of Holsteins in the United States. J. Bohmanova*[1], I. Misztal[1], S. Tsuruta[1], D. Norman[2], and T. Lawlor[3], [1]*University of Georgia*, *Athens*, [2]*Animal Improvement Programs Laboratory, Agricultural Research Service, USDA*, *Beltsville, MD*, [3]*Holstein Association*, *Brattleboro, VT*.

Genetic evaluations for heat tolerance of US Holsteins were developed with national data. Hourly temperature and relative humidity records were available from 202 public weather stations across the United States. Production data included 57,315,661 first-parity test-day records from 1993 through 2004 for 6,906,815 Holsteins. Herds were assigned by distance from the nearest weather station. Hourly temperature-humidity indexes (THI) were calculated as [1.8(°C) + 32] - [0.55 - 0.0055(relative humidity percentage)][1.8(°C) - 26]. A daily temperature-humidity index (THI24) was calculated as mean of hourly THI on recording day. The threshold for heat stress was assumed to be a THI of 72. The test-day model contained effects for interaction of herd with test day, days-in-milk classes, calving age, milking frequency, additive genetics, permanent environment, and random regressions on max(0, THI24-72), for additive genetic and permanent environmental effects. Breeding values were calculated by BLUP90IOD in 144 rounds and 8 hr. Breeding values for heat tolerance of sires ranged from -0.48 to 0.38 kg milk per THI unit above a THI24 of 72. Breeding values at higher THI24 would be (THI24 - 72) times greater. On average, the 50 most heat-tolerant bulls were 3 yr older than the 50 least tolerant. Compared to eight worst bulls for heat tolerance, the best eight bulls differed by -5 kg for

milk, -0.08 kg for fat, -0.12 kg for protein, -3.6 for dairy form, +2.2 for udder composite, +2.0 for body composite and +2.2 mo for productive life. Relative drop in protein and fat was lower than in milk. Heat tolerant bulls have daughters with lower milk production, lower water content in milk, larger body reserves, better udders and longer productive life. Heat stress effects may have been underestimated due to unequal quality of weather data. National genetic evaluation for heat tolerance is feasible.

Key Words: Heat Stress, Heat Tolerance, Test-Day Model

559 Reproduction data in USDA database. G. Wiggans*, *Animal Improvement Programs Laboratory, Agricultural Research Service*, *Beltsville, MD*.

The Animal Improvement Programs Laboratory began storing all breedings for cows and heifers in 2003. Some data back to 1997 also were stored. Reproduction data have been acquired for a high proportion of cows in recent years with most herds providing some data. Currently, two record processing centers supply breedings for heifers and up to nine types of reproductive events. The other centers supply the latest breeding each test day and pregnancy confirmation information for cows, but do not supply heifer data and additional reproductive events. Data from 2,336,621 calvings in 2003 and 304,183 heifers born in 2002 were analyzed to determine the portion of data with reproductive events reported. Usable service sire was reported for 89% of the breedings from the two centers with complete reporting, which had 53% of total breeding analyzed. Pregnancy confirmation was reported in 67% of the lactations, of these, 24% were confirmed not pregnant. Of the cows, 86% had at least 1 breeding reported and averaged 2.1 breedings. For heifers, the average number of breedings was 1.5 and breedings were reported for 82% of the heifers. Almost no estrus synchronization and very few cases of embryo transfer, either as a donor or recipient, have been reported. Of herds with 10 or more calvings, 70% had complete reporting and 24% more reported some breedings. Confirmations were reported for 81% of herds with 10 or more calvings. The reproduction data supports daughter pregnancy rate evaluations. For lactations without subsequent calving, pregnancy status is used to improve accuracy of estimates of days open. As pedigree information is added to the database, a calf's sire is checked against its dam's service sire and the provider notified when they differ. The calf's sire is not changed to the service sire because the service sire may be incorrect. This more extensive collection of reproduction information supports improved evaluations of daughter pregnancy rate, planned evaluation of male fertility and further research on fertility.

Key Words: Fertility, Days Open, Reproductive Events

560 Conception rates of Holsteins in New York and Georgia. C. Huang*[1], S. Tsuruta[1], I. Misztal[1], T. J. Lawlor[2], and J. S. Clay[3], [1]*University of Georgia*, *Athens*, [2]*Holstein Association USA Inc.*, *Brattleboro, VT*, [3]*Dairy Records Management Systems*, *Raleigh, NC*.

The objective of this study was to estimate fixed effects that influenced conception rate of Holsteins in NY and GA. Data were obtained from DRMS, Raleigh, NC, and included production and service records on 417,910 cows in NY and 59,784 cows in GA from 2003 to 2004. After removing uncertainty and extreme records (without caving date or birth date, lactation ≥ 1, days to service after calving ≥ 365, service times ≤ 10, and without next calving record), those numbers dropped to 146,821 cows in NY and 11,465 cows in GA, respectively. Using SAS PROC GLM, for each state, the model included the effects of days after calving group, lactation number, milk production level, AI status, caving month, service month, age of cow, herd, calving year and those interactions. In NY (GA), least squares means for conception rate, as a function of days postpartum was 0.51 (0.55) at 50 d and increased to 0.68 (0.74) at 250 d for AI sires. The conception rate was about 0.2 (0.12) higher for natural service sires than for AI sires. The conception rate was the highest at 0.68 (0.82) in March and the lowest at 0.51 (0.53) in June, and decreased by 0.05 (0.07) as milk production increased from 30 to 45 kg/day. The calving and insemination were very seasonal in GA, with 3 times more cows calving in October than in June. Also, the proportion of natural bull services was very seasonal peaking at 25% in summer and dropping to 15% in winter. Conception rate increased with days postpartum and natural service bulls had significantly higher conception rate. Also, it is influenced by season especially in Georgia.

Key Words: Conception Rate, Fertility, Holstein

561 Genetic parameters for conception rate and days open in Holsteins. S. Tsuruta*[1], C. Huang[1], I. Misztal[1], T. J. Lawlor[2], and J. S. Clay[3], [1]*University of Georgia*, *Athens*, [2]*Holstein Association Inc.*, *Brattleboro, VT*, [3]*Dairy Records Management Systems*, *Raleigh, NC*.

The goal of this study was to estimate genetic parameters for conception rate and days open in Holsteins. Data collected in NY from 2001 to 2003 were provided by the DRMS, Raleigh, NC. After editing, it included 89,271 first-parity service records for 43,344 cows. The first mixed linear model (bivariate analysis) was for conception rate at first service and for days open and included fixed effects of herd-year, age class, month of calving, AI status (natural service or AI), days to first service after calving (for conception rate only) and milk yield as a covariate, and random additive genetic and residual effects. Heritability estimates for conception rate at first service and days open were 1.4% and 2.5%, respectively. Genetic correlation between these traits was –0.92. The second model applied to conception rate with repeated records. It included the same fixed effects as the first model plus linear random regression as a function of days to service for the animal additive and permanent environmental effects. Heritability and repeatability estimates were 1.0-1.5% and 3.6-4.2%; they were approximately constant from 50 d to 250 d postpartum. The genetic correlations between the conception at 50 and (150, 250) d were 0.86 and 0.45, respectively. We also estimated genetic parameters for conception rate with threshold models as a binary trait. The heritability and repeatability estimates were about one and a half times higher than those from linear models. Days open is a good measure of fertility in NY. Conception rate may be a different trait at different days postpartum.

Key Words: Conception Rate, Heritability, Holstein

Companion Animals: Nutritional and Health Considerations for Companion Animals II

562 Effects of food and water intake on variation in ileal digesta viscosity among dogs fed a maintenance diet. C. Dikeman* and G. Fahey, Jr., *University of Illinois*, *Urbana*.

A two-period crossover design experiment was conducted to address effects of food and water intake on ileal digesta viscosity among dogs. Six ileal cannulated dogs, average weight of 26.0 kg (range, 19.5 to 29.6 kg), were fed during an initial 6-d adaptation phase up to individual energy requirements (ME = 145 kcal*kg BW $^{0.67}$). This phase preceded a 4-d collection of ileal digesta. The second 10-d period consisted of caloric/intake restriction by decreasing intake by one-half (ME = 72.5 kcal*kg BW $^{0.67}$). Dogs consumed an extruded diet that met or exceeded AAFCO recommendations for dogs at weight maintenance. Water was offered ad lib. Water intake was measured and recorded at 0800 and 2000 daily. Ileal digesta, for both periods, was collected for 1.5 h at 0900, 1300, and 1700 during the collection phase. Ileal digesta viscosity was measured, at multiple shear rates, using a Brookfield RV-DVII+ viscometer adapted with