

five animal industry organizations with extensive expertise on best management practices and current science in animal agriculture. The organization's purpose is to promote the humane treatment of animals through education and certification of animal auditors and to promote the profession of animal auditors. Founding and current organizations are the Federation of Animal Science Societies (FASS), American Registry of Professional Animal Scientists (ARPAS), American Association of Swine Veterinarians (AASV), American Association of Bovine Practitioners (AABP) and American Association of Avian Pathologists (AAAP). Website: www.animalauditor.org. PAACO does not create audits nor determine protocols within animal agriculture. Its role is to work with the species organization to train and certify auditors to the industry determined standards.

PAACO, Inc. Background

Successful livestock, dairy and poultry producers and their related industry partners provide sound animal care on commercial farms and

harvest plants. Most animal and meat producer organizations have guidelines that are consistent with sound science and a consideration of economic realities. The process by which auditors are qualified, trained and certified continues to be developed by PAACO. Many groups require auditors and audit firms to have specific qualifications, experience and abilities. FASS, ARPAS, AABP, AAAP and AASV are professional, independent, science-based groups that have come together to initiate training and certification for on-farm and harvest plant auditors. PAACO has anticipated the need to evaluate, train and qualify candidates that want to pursue animal auditing as a career. Animal welfare is only the first of many aspects of livestock production to be audited at the farm level. It is in agriculture's best interest to verify the qualifications of the potential auditors.

Key Words: PAACO, Audit, Welfare

Breeding and Genetics - Livestock and Poultry: Dairy Cattle III

723 Analysis of calving ease trait in Canadian Holsteins. A. Sewalem^{*1,2}, F. Miglior^{1,2}, G. Kistemaker², P. Sullivan², and B. Doormaal², ¹*Agriculture and Agri-Food Canada, Guelph, Ontario, Canada*, ²*Canadian Dairy Network, Guelph, Ontario, Canada*.

The aim of this study was to examine the level of calving ease trait across parities and to estimate genetic parameters in Canadian Holsteins. Data consisted of 271,789 cows from 11,283 herds sired by 2,276 sires. At time of calving the calving ease was recorded as unassisted or unobserved, easy pull, hard pull and surgery. The distribution of each score across parities was 61.38, 31.15, 7.21 and 0.26% for unassisted or unobserved, easy pull, hard pull and surgery, respectively. The statistical model included the fixed effects of herd-year-season, age at calving, sex of calf and the random effects of service sire and animal. A single trait animal model was used. The distribution of each category in the first parity were 49.16, 37.70, 12.84 and 0.30 % for unassisted or unobserved, easy pull, hard pull and surgery, respectively. The corresponding figures in the second parity are 64.53, 30.54, 4.81 and 0.13% and in the third parity 65.18, 29.92, 4.74 and 0.17%. The phenotypic correlations of calving ease trait for parity 1 and 2 was 0.21, for parity 1 and 3 0.17 and for parity 2 and 3 is 0.24. Heritability values from a single trait analysis (as trait of the dam) for parity 1, 2 and 3 were 0.096, 0.132 and 0.129, respectively. Estimation of genetic parameters using a multiple trait animal model is under progress.

Key Words: Calving Ease, Genetic Parameters, Canadian Dairy Breeds

724 Genetics of grass dry matter intake, energy balance and digestibility in Irish grazing dairy cows. D. P. Berry^{*}, M. O'Donovan, and P. Dillon, *Moorepark Dairy Production Research Center, Fermoy, Co. Cork, Ireland*.

The objective of this study was to estimate genetic parameters for grass dry matter intake (DMI), energy balance (EB) and cow internal digestibility (ID) in grazing Holstein-Friesian dairy cows. Grass DMI was estimated up to four times per lactation on 1,588 lactations from 755 cows on two research farms in southern Ireland. Simultaneously measured milk production and body weight records were used to

calculate EB. Cow ID, measured as the ratio of feed and faecal concentrations of the natural odd carbon-chain n-alkane pentatriacontane, was available on 583 lactations from 238 cows. Random regression and multi-trait animal models were used to estimate residual, additive genetic and permanent environmental (co)variances across lactation. Results were similar for both models. Heritability for DMI, EB, and ID across lactation varied from 0.10 (8 days in milk; DIM) to 0.30 (169 DIM), from 0.06 (29 DIM) to 0.29 (305 DIM), and from 0.08 (50 DIM) to 0.45 (305 DIM), respectively when estimated using the random regression model. Genetic correlations within each trait tended to decrease as the interval between time periods compared increased for DMI and EB while the correlations with ID in early lactation were weakest when measured mid-lactation. The lowest correlation between any two time periods was 0.10, -0.36 and -0.04 for DMI, EB and ID, respectively suggesting the impact of different genes at different stages of lactations which has repercussions for genetic selection. Eigenvalues and associated eigenfunctions of the additive genetic covariance matrix revealed considerable genetic variation among animals in the shape of the lactation profiles for DMI, EB and ID which may be exploited in breeding programs. Genetic parameters presented are the first estimates from dairy cows fed predominantly grazed grass and imply that genetic improvement in DMI, EB and ID in Holstein-Friesian cows fed predominantly grazed grass is possible.

Key Words: Grass Dry Matter Intake, Energy Balance, Genetics

725 Principal components approach for estimating heritability of mid-infrared spectrum in bovine milk. H. Soyeurt^{*1,2}, S. Tsuruta³, I. Misztal³, and N. Gengler^{1,4}, ¹*Gembloux Agricultural University, Gembloux, Belgium*, ²*FRIA, Brussels, Belgium*, ³*University of Georgia, Athens*, ⁴*FNRS, Brussels, Belgium*.

Mid-Infrared spectrometry predicts the milk components (e.g., %fat, %protein) from spectral data reflecting the milk composition. The data included 9,663 test days on 1,937 cows in 1 to 12 parity recorded from April 2005 to May 2006. Each sample was scanned by MilkoScan FT6000 into 1,060 points. Due to the high dimension, principal components approach (PCA) was done to reduce the traits and indicated

that 48 principal components (PC) described 99.02% of information. These PC were analyzed by multi-trait REML using the canonical transformation. This analysis considered 2,850 first lactation records for 738 cows in 7 breeds from 26 herds. Effects included in the multi-trait model were herd*test date, lactation stage, permanent environmental and animal random effects. The estimates of the variances were back transformed to the initial scales. Heritabilities varied from 0.005% to 57.20% for the different pin numbers. Spectral regions with heritability greater than 5% were located between 1 to 181; 194 to 558 and 709 to 1,060 pin numbers. PCA involving points in those regions demonstrated that only 9 PC explained 99.23% of information. Mid-Infrared spectrum contains specific regions with substantial genetic information potentially useful for selecting improved milk quality directly on spectral data.

Key Words: Mid-Infrared, Milk, Heritability

726 Associations between body size, body condition score and fertility parameters in pasture-based seasonally calving commercial dairy herds in Australia. T. E. Stirling^{*1}, C. R. Stockdale², and K. L. Macmillan¹, ¹The University of Melbourne, Werribee, Victoria, Australia, ²Primary Industries Research Victoria, Kyabram, Victoria, Australia.

The objective of this study was to evaluate the associations between body size parameters (hip height and hip width) with changes in body condition score (BCS), and the association with fertility parameters. A total of 1850 cows from 5 commercial pasture-based seasonally calving herds were monitored over a 12-month production cycle, with BCS assessed pre-calving, start of the artificial insemination period (SAIP), mid lactation and late lactation. Little variation was observed in height and width parameters; 140.0 ± 0.11 cm and 43.0 ± 0.09 cm respectively (mean \pm standard error); but associations with BCS and fertility could be drawn. Taller cows tended to be thinner throughout the production cycle ($P < 0.05$ pre-calving, SAIP and late lactation) while wider cows were fatter ($P < 0.05$). Height was not related to the likelihood to become pregnant nor the interval between SAIP and conception (INT); however, width was positively correlated to the INT ($P < 0.01$) meaning wider cows took longer to conceive. Body frame size (HxW) was not significantly related to BCS per se, apart from at SAIP when larger cows were fatter ($P < 0.01$). Despite this, larger cows lost more condition in early lactation, were less likely to become pregnant, and those that did become pregnant had a longer INT. Cows with a greater height to width ratio (H:W) were thinner throughout the production cycle and did not have significant losses in condition in early lactation. These cows were more likely to become pregnant and those that did become pregnant had a shorter INT. The experiment was conducted during drought conditions when nutritional intake was limited and fertility compromised. Under these conditions, large cows were unable to maintain enough condition to optimise fertility. Despite being thinner overall, cows with greater H:W were able to maintain a more consistent BCS and had a better reproductive performance.

Key Words: Body Size, Body Condition Score, Fertility

727 Comparison of yield in Holsteins, Jerseys, and reciprocal crosses in the Virginia Polytechnic Institute and State University - Kentucky crossbreeding trial. B. G. Cassell^{*1}, K. M. Olson¹, and

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Purebred Holstein and Jersey cows at Virginia Polytechnic Institute and State University and Kentucky were bred to four Holstein and four Jersey bulls in AI in a diallele scheme. First calvings to project animals were in June 2005 at Virginia Polytechnic Institute and State University and January 2006 at Kentucky. Here we summarize summit and peak yields and projected 305 day actual production from animals with at least 150 days in milk in first parity. Data include 33 HH (breed of sire first), 19 HJ, 17 JH, and 12 JJ animals. Breed comparisons were from a fixed model including four breed groups, seven herd-seasons of calving groups (five four-mo groups at Virginia Polytechnic Institute and State University and two at Kentucky), and regression of response variable on age at calving in mo. The three degrees of freedom for breed groups were also partitioned into additive effects of Holstein versus Jersey genes, maternal effects, and heterosis and fit with herd-season and regression on age at freshening. Limited JJ animals and unequal sire progeny distribution may affect results. We found significant ($P < 0.05$ for all comparisons) effects for additive gene action and heterosis for summit milk, peak milk, and projected actual 305 day yields of milk, protein, and fat, but no significant maternal effects for any trait. Heterosis ranged from 8% for summit to 13% for peak yields, and exceeded 10% for 305d projected yields. Fixed effects were significant for all traits except age for summit yield and herd-season for protein yield. Summit yield differed only for Jerseys, while peak yield differed for Jerseys and JH vs. HH. Milk yields were higher for HH than HJ, JH, or JJ, but were not different from HJ or JH for protein. Milk, protein, and fat yields for Jerseys were lower than other breed groups, while HJ fat was higher than HH or JH. Entries in the table are in kg. Summit and peak refer to milk production while milk, protein, and fat refer projected 305d yields in kg.

Table 1. Breed group least squares means (kg) for summit and peak milk and for projected 305d yields of milk, protein, and fat

Breed	Summit	Peak	Milk	Protein	Fat
HH	34	37	9642	291	350
HJ	31	36	8915	293	383
JH	32	34	8963	288	360
JJ	24	25	6596	228	322

Key Words: Crossbreeding, Heterosis, Production

728 Quantitative Trait Loci affecting IgG serum protein levels, birth weight and gestation length in a Holstein x (Holstein x Jersey) backcross population. C. Maltecca^{*}, K. A. Weigel, H. Khatib, and V. R. Schutzkus, University of Wisconsin, Madison.

Aim of the study was to identify QTL associated with stillbirth and calf survival, using data from a crossbred HOL x JER. experimental population consisting of 172 backcross calves created via backcross matings. Stillbirth is defined as a calf that dies just prior to, during, or within 24 to 48 h of parturition. The cost of stillbirths to the US dairy industry has been estimated to be ~\$132 million per year. Nonetheless its binary nature and low frequency make it difficult to investigate. In the study three indicators of general health were utilized instead. The first, calf birth size, was considered in relation with the ability of the calf to survive and later perform. The second, Calf IgG absorption during the first 72h of life, is a strong indicator of passive immunization

attainment and it's associated with long-term calf performance. Finally, studies by Meyer et al. ranked gestation length as the third most important factor affecting stillbirth rates in primiparous cows with dystocia scores of 3+ and third for multiparous cows for any level of dystocia. The same author also reported a significant decrease in stillbirth for longer gestations. This trait was then chosen in connection with its influence on newborn survival. Calves were measured for weight after birth. Immune function was evaluated through serum IgG levels between 24 and 78h of age. Serum IgG levels were determined by radial immuno-diffusion assay. Gestation lengths were recorded as part of the routine data collection. Results from a genome scan, are discussed. 182 microsatellites were chosen among 270 after sires genotyping. Spacing between markers ranged from 3.4 to 32.85 cM with an average of 15.93 cM. Interval mapping analysis was performed for all traits considered. Evidences for suggestive QTL ($P < 0.05$) for IgG levels were found in at least one of the families at CHR2 (~72 cM) and CHR5 (~88 cM). Evidence for a significant QTL ($P < 0.01$) for IgG level were found in CHR6 (~68 cM) in one family. Evidence for suggestive QTL ($P < 0.05$) for birth weight were found in CHR2 (~24 cM) and CHR6 (~90 cM) in at least one family. Evidences for a suggestive QTL ($P < 0.05$) affecting gestation length, were found in CHR9 (~100cM).

Key Words: QTL, Cattle, Health

729 Stearoyl-CoA desaturase gene polymorphism and milk production traits in Italian Holsteins. N. P. P. Macciotta^{*1}, M. Mele², G. Pagnacco³, M. Cassandro⁴, G. Conte², A. Cappio-Borlino¹, and P. L. Secchiari², ¹Dipartimento di Scienze Zootecniche, Università di Sassari, Sassari, Italia, ²Dipartimento di Agronomia e Gestione dell'Agro-Ecosistema, Università di Pisa, Pisa, Italia, ³Dipartimento di Scienze e Tecnologie Veterinarie per la Sicurezza Alimentare, Università di Milano, Milano, Italia, ⁴Dipartimento di Scienze Animali, Università di Padova, Padova, Italia.

The Stearoyl-CoA desaturase (SCD) is a key enzyme for the lipid metabolism of ruminants, being able to introduce a double bond at the Δ^9 -position in a large spectrum of fatty acids. A polymorphism with two alleles (A and V) has been reported for the SCD locus in cattle, due to three single nucleotide polymorphisms that are in linkage disequilibrium. In this work, possible associations between SCD genotype and milk production traits in Italian Holsteins are investigated. Data were 5,097 test day records for milk, fat and protein yields, fat and protein contents, measured on 313 Italian Holsteins (2,2 lactations per cow). Data were analysed with a mixed linear model that included the fixed effects of herd, test date, genotype at the SCD locus, parity, lactation stage nested within SCD genotype

and the random effect of the animal plus the random residual. Parity, test date, herd and lactation stage affected significantly milk production traits, except for parity on fat content. A statistically significant effect of the SCD genotype was observed for milk yield, fat content and protein yield. In particular, VV cows had an average daily milk yield higher than AV and AA cows (kg/day 35.95, 34.59, 33.71, respectively; $P < 0.01$), a lower fat content (gr. fat/100 gr milk 3.39, 3.51, 3.55, respectively; $P < 0.05$) and a higher protein yield (kg/day 35.95, 34.59, 33.71, respectively; $P < 0.01$). Differences observed among the three different genotypes tend to remain constant throughout the whole lactation. Although observed in a limited sample of cows, these results, together with the recently reported influence of the SCD polymorphism on fatty acid composition of carcass and milk fat in cattle, seem to suggest a possible role of the SCD locus as a candidate gene to be used in the genetic improvement of milk production traits in cattle via schemes of Marker Assisted Selection.

Key Words: Stearoyl-CoA Desaturase, Polymorphism, Milk Production Traits

730 Effect of pregnancy on milk yield of Canadian dairy cattle. S. Loker^{*1}, J. Bohmanova¹, F. Miglior^{2,3}, M. Kelly¹, and G. Kistemaker³, ¹University of Guelph, Guelph, ON, Canada, ²Agriculture and Agri-Food Canada, Sherbrooke, QC, Canada, ³Canadian Dairy Network, Guelph, ON, Canada.

Pregnancy has been reported to have a negative impact on milk production in dairy cattle. A suitable method for estimating the effects of pregnancy is required before pregnancy can be properly accounted for in genetic evaluations. In this study, two models were used to account for pregnancy in seven Canadian dairy breeds. The first model represented pregnancy effects with days open, studying the impact of increased days open on the shape of the lactation curve. The second model measured the impact of the stage of pregnancy on milk production. Milk production for cows with short days open tended to drop significantly in the last part of lactation, while cows with longer days open had proportionally higher milk yield. Using the second model, milk yield declined in all breeds in the study after 4 months of pregnancy (from -0.5 kg/d in first parity Jerseys to -1.3 kg/d in third parity Holsteins). While the pattern of decline in milk yield using both models generally followed the results of other studies, the effect of days open from the first model seemed to be confounded with the production level of the cows. Stage of pregnancy provided a more realistic estimate of the effect of pregnancy on milk production, especially when adjusted for stage of lactation.

Key Words: Pregnancy, Days Open, Genetic Evaluation

Dairy Foods: Products and Processing

731 Kinetics and properties of plant β -galactosidase extracted from durian seeds (*Durio zibethinus*) and its utilization on ice milk production. E. E. El Tanboly*, National Research Center, Dokki, Cairo, Egypt.

β -galactosidase (β -gal) was partially purified 2.16-fold with a total yield of 21.32% of the original activity by sequential use of ammonium sulfate precipitation and gel filtration through Sephadex G-200 from durian seeds (*Durio zibethinus*). The β -gal activity was linear with time up to 20 min and still constant thereafter. A progressive increase

in activity of the purified β -gal was observed up to 60°C accompanied by a decrease thereafter. An energy of activation of 3.04 Kcal/mole for the enzyme activity was derived from the Arrhenius plot. The purified β -gal started losing activity above 40°C when incubated at different temperatures for 10 min and became completely inactivated at 80°C. The optimum pH was 3.0. Michaelis-constant (K_m) value of 1.42 mM and a maximum velocity (V_{max}) of 3.3 μ moles/ml/min. Fe^{+++} , Zn^{++} and Cu^{++} strongly inhibited the enzyme. However, the enzyme was partially inhibited by Mg^{++} , Ca^{++} and Mn^{++} . The use of a plant β -gal in ice milk production was studied. Different concentrations of β -gal;