Animal performance and carcass traits (HCW, backfat, ribeye area, and marbling scores) were used to compute the BW at 28% empty body fat (EBF) for each animal. The CVDS model with the adjustment of ME efficiency for composition of gain was used to predict individual DMR and to estimate total DMR of the pen. The 90% confidence interval of predicted EBF at the harvest BW was similar between steers and heifers and ranged from 25-36% EBF. The mean bias, calculated as the difference between DMR and feed fed divided by feed fed and weighed by animals per pen, was 4.64% and 1.46% for heifers and steers respectively, with an overall value of 2.43% (P = 0.16). A sensitivity analysis of the dietary ME ($\pm$ 5 and $\pm$ 10%) indicated the accuracy decreased when dietary ME used was lower or higher than the CNCPS predicted value. Our findings suggest the CVDS accurately predicted feed requirements for Santa Gertrudis steers and heifers.

Key Words: Finishing cattle, Feed intake, Modeling

191 Using ultrasound to determine body composition of breeding heifers. M. J. Baker*[1], L. O. Tedeschi[2], D. G. Fox[1], W. R. Henning[3], and D. J. Ketchen[1], [1]*Cornell University*, *Ithaca, NY*, [2]*Texas A&M University*, *College Station*, [3]*Pennsylvania State University*, *College Park*.

Carcass traits and ultrasound have been used to predict empty body fat (EBF) of steers and yearling bulls, which is used to predict their energy and DM requirements for growth. This study was conducted to develop equations to predict EBF from ultrasound measurements in breeding heifers for use in predicting their individual DM requirements when fed in group pens. One hundred eighteen spring-born purebred and crossbred beef heifers (BW=271 kg) were sorted into 3 marketing groups on projected days to USDA low Choice Quality grade and fed a common high energy diet in twelve slatted floor pens (10 hd/pen) until estimated to average the target quality grade. The heifers were evaluated for body composition with ultrasound at approximately one year of age. Ultrasound measurements included backfat (uBF), rump fat (uRmpFt), ribeye area (uREA) and intramuscular fat (IMF); hot carcass weight (HCW) was predicted with an equation (pHCW). Carcass data collected included HCW, backfat over the 12th-13th rib (BF), marbling score (MRB), and ribeye area (REA). The 9-11th rib section was removed and dissected into soft tissue and bone. Chemical fat determined by ether extract was used to compute carcass fat (CF) and EBF. Regression analysis showed that carcass measurements explained 62% of the variation (RMSE = 1.42) in EBF (23.6 + 3.16*BF + 0.0138*HCW + 0.778*MRB - 0.0894*REA). Adding body density (final SBW divided by volume predicted from girth circumference, width, and length) accounted for 70% of the variation in EBF. The equation developed with ultrasound measurements on the live heifers (EBF = 14.7 + 8.73*uRmpFt + 11.4*uBF − 0.0669*uREA + 0.452*IMF + 0.0148*pHCW − 6.267*uRmpFt*uBF), explained 61% of the variation (RMSE = 1.5). The measured EBF was 31.3% and the predicted EBF was 31.6% and 31.5% using the carcass and ultrasound equations, respectively. Ultrasound can be used as effectively as direct measure of carcass traits in predicting EBF in breeding heifers.

Key Words: Beef heifers, Ultrasound, Body composition

Lactation Biology

192 Effects of CLA on bioenergetic and milk production parameters in grazing dairy cows offered ad libitum or restricted pasture. J. K. Kay*[1,2], T. R. Mackle[1], D. E. Bauman[3], N. A. Thomson[1], and L. H. Baumgard[2], [1]*Dexcel, Hamilton, New Zealand*, [2]*University of Arizona*, *Tucson*, [3]*Cornell University*, *Ithaca, NY*.

Conjugated linoleic acid (CLA) reduces milk fat synthesis in grazing and TMR-fed dairy cows and often improves calculated net-energy balance (EBAL). Study objectives were to determine if CLA-induced milk fat depression could be utilized during times of nutrient limitations (i.e. droughts) to improve bioenergetic and milk production parameters. Twelve multiparous mid-lactation rumen-fistulated Holstein cows were offered ad libitum (AL) or restricted (R) pasture allowances and abomasally infused twice daily with 0 (0) or 50 (50) g/d CLA (containing a variety of CLA isomers) in a crossover design. Treatment periods lasted 10 d and were separated by a 10 d washout period. Milk and plasma samples were averaged from d 9 and 10, and EBAL was calculated from d 6-10 of the infusion period. Pasture restriction reduced the yield of milk (P<0.01; 15.7, 15.4, 11.5, 11.9 kg/d for AL0, AL50, R0 and R50, respectively) and milk components. CLA reduced (P<0.01) milk fat yield by 45 and 46% in AL and R, respectively. There was no CLA effect on milk yield nor milk lactose content or yield, however milk protein content increased (P<0.05) in both AL and R, resulting in an increased (P<0.05) protein yield of 6 and 9% in AL and R, respectively. The CLA-induced changes to milk fat and protein increased (P<0.01) the protein:fat ratio by ~2-fold in both AL and R. Milk fat trans-10, cis-12 CLA content increased following CLA infusion (P<0.01; 0.10, 0.64, 0.09, 0.74 % for AL0, AL50, R0, R50, respectively). Calculated net-EBAL improved following CLA infusion (-1.8 vs. 11.2 and 1.6 vs. 13.8 MJ/cow/d for AL and R, respectively; P<0.05), however CLA did not alter plasma bioenergetic markers (including insulin, NEFA, BHBA, urea, glucose and AST). Data indicate that during short periods of nutrient restriction, CLA may provide an alternative management tool to improve the milk protein:fat ratio and calculated EBAL, however further studies are required to determine if CLA is effective at improving bioenergetic parameters during long term feed shortages.

Key Words: CLA, Milk fat, Pasture

193 Variation in milk yield response to once-daily milking in Friesian-Jersey crossbred cattle. S. Davis*, L. McNaughton, G. Bracefield, K. Sanders, and R. Spelman, *Livestock Improvement Corporation*, *Hamilton, New Zealand*.

Once-daily milking (OAD) of cows in New Zealand is an increasingly popular management option. The major constraint to adoption of OAD is the production loss which is variable between individual cows and differs significantly between Friesian and Jersey breeds. The objective of this study was to identify animals consistently showing a minimal loss in production during 7-day periods on OAD in mid and late lactation and to examine the relationship between losses in short (7d) and long-term (70d) OAD challenges. The first study used 306 crossbred cattle (from 6 sires) all in their 2nd lactation and grazing rye-grass/white clover pasture. Mean twice-daily yields in mid-and late-lactation were 16.1 and 10.3 l/d respectively. Mean OAD yield loss after 7d on OAD was 3.6 $\pm$ 1.5 (SD) (22.4%) and 1.3 $\pm$ 1.0 (SD) (12.7%) l/d. at the same stages. Yield loss ranged from 0 to 8.1 l/d at mid and 0-4.3l/d in late-lactation. 20 animals showed a yield loss of

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less than 10% at each lactation stage. However, repeatability of yield loss for the whole herd was relatively poor. Correlation coefficient relating yield loss in mid- and late-lactation was 0.15. Rank correlation coefficient was 0.20. Percentage loss was constant within quartiles ranked on twice-daily yield at mid- but not in late-lactation where %loss was lowest (11.4%) in cows with highest TAD yields. A further study was undertaken in 3rd lactation (mid)with a 70d period on OAD. Yield losses were similar (20%) to 2nd lactation during the first week of the 10 week period on OAD. The correlation of yield loss during week 1 with yield loss in week 5 and week 10 was < 0.10, again indicating that short-term yield responses are not strongly related to long-term yield losses on OAD. In conclusion, yield losses during short-term OAD challenges were not a good predictor of long-term yield loss. The lack of repeatability between mid-and late-lactation indicates an interaction of stage of lactation and/or diet quality with short-term yield loss.

Key Words: Crossbred, Milking, Once-daily

194 Short day photoperiod increases milk yield in cows with a reduced dry period length. J. M. Velasco*, E. D. Reid, K. E. Karvetski, T. F. Gressley, R. L. Wallace, and G. E. Dahl, *University of Illinois*, *Urbana*.

Photoperiod manipulation during the dry period, particularly exposure to short days, increases milk yield in cows in the subsequent lactation. The duration of short day photoperiod (SDPP) exposure necessary to influence milk yield is unknown, but is of interest as reduced dry period length gains industry acceptance. To determine if exposure to SDPP cows could be combined with a reduction in dry period duration, we used 40 multiparous Holstein cows at dry off approximately 42 d before calving and assigned 20 cows each to long day photoperiod (LDPP, 16L:8D) or SDPP (8L:16D). To quantify PRL concentrations during the dry period, weekly blood samples were collected and frequency of collection increased to twice daily around parturition. Dry matter intake (DMI) was recorded during the dry period and for 42 d after calving. Treatments ended at calving when all cows were exposed to an ambient photoperiod and milked twice daily; milk production was recorded until 120 d in milk. SDPP cows calved 4.8 d earlier than LDPP cows (P<0.09) and days dry averaged 37 for SDPP and 42 for LDPP. Cows on SDPP (17 kg/d) had slightly more DMI during the dry period than LDPP cows (16 kg/d; P<0.10) but did not differ after parturition. There was no difference between groups in pre-partum and postpartum BW. The periparturient PRL surge peak was 22.4 and 17.1ng/mL for LDPP and SDPP, respectively (P<0.11). Milk production was inversely related to the periparturient PRL surge. Milk production through 120 d of lactation averaged 38.7 and 35.4 kg/d for SDPP and LDPP cows (P<0.07). Short day photoperiod combined with a reduced length of the dry period increases milk production in the subsequent lactation relative to long days, even when SDPP exposure is limited to 42 d.

Key Words: Photoperiod, Dry period, Prolactin

195 Circulating metabolites from postpartum cows supplemented with POSILAC® and given various lengths of days dry. T. Klusmeyer*, A. Fitzgerald, J. Ballam, and J. Vicini, *Monsanto Co.*, *St. Louis, MO*.

Cumulative net marginal income calculated from milk production and feed consumption has been improved for multiparous cows in which the dry period was eliminated or reduced (Annen et al., 2004; J. Dairy Sci. 87:3746). An additional benefit may be realized from reducing the effects that occur with changing diets at dryoff and parturition. A three-site study was initiated to examine effects of altering the length of the dry period. Treatments were: 1) 60-d Dry/Label POSILAC (60-d L), 30-d Dry/Label POSILAC (30-d L), 0-d Dry/Label POSILAC (0-d L), and 0-d Dry/Continuous POSILAC (0-d C). Cows administered POSILAC according to label were supplemented until dryoff and resumed POSILAC at 57-70 days-in-milk of the subsequent lactation. Blood samples were collected during postpartum weeks 1 and 2. Preliminary data, based on one site in which all the cows have freshened (N=120), are presented here. LSMeans with unlike letters are different at P<0.05. Concentrations of BHBA and NEFA were greatest and P was reduced for cows that were targeted for a 60-d dry period. These data indicate that cows with shortened dry periods may be at a reduced risk for metabolic disease in early lactation.

Table 1. Blood Metabolites

Item	60d-L	30d-L	0d-L	0d-C	SEM
No of Cows	29	26	28	27	
Ca, mg/dl	9.35	9.22	9.53	9.66	0.21
P, mg/dl	4.71a	5.28b	5.39b	5.28b	0.19
BHBH, mmol/L	0.93a	0.73b	0.53c	0.72bc	0.07
NEFA, µEq/L	841a	604b	454b	555b	63

Key Words: Somatotropin, Dry period, Blood metabolites

196 Identification of putative bovine mammary stem cells by their retention of labeled DNA strands. A. V. Capuco*, *Bovine Functional Genomics Lab, USDA-ARS*, *Beltsville, MD*.

Stem cells characteristically retain labeled DNA for extended periods due to their selective segregation of template DNA strands during mitosis. In this study, proliferating cells in the prepubertal bovine mammary gland were labeled using five daily injections of 5-bromo-2-deoxyuridine (BrdU). Five weeks later, BrdU-labeled mammary epithelial cells were still evident. The percentage of BrdU-labeled epithelial cells was greatest in basal regions of the mammary gland and decreased toward the periphery of the parenchymal region, where the ducts were invading the mammary fat pad. Increased numbers of BrdU-labeled epithelial cells in basal regions of the gland are likely a consequence of decreased proliferation rates and increased cell cycle arrest in this area. In peripheral regions of mammary parenchyma, the percentage of heavily labeled epithelial cells averaged 0.24%, a number that is consistent with estimates of the frequency of stem cells in mouse mammary gland. Epithelial, label-retaining cells represent a slowly proliferating population, as 5.4% were positive for the nuclear proliferation antigen, Ki67. Furthermore these putative stem cells can likely respond directly to mitogenic stimulation by estrogen, as 57% of the BrdU-labeled epithelial cells were estrogen receptor-positive. Continuing studies will address the usefulness of this technique to identify bovine mammary stem cells and facilitate studies of stem cell biology.

Key Words: Progenitor cells, Proliferation, Bromodeoxyuridine

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197 Significance of delta-lactoferrin in mammary tissue: Lack of confirmation for expression of human and bovine isoforms. C. R. Baumrucker*, Y. Wang, and D. L. Greger, *The Pennsylvania State University*, *University Park*.

The significance of paracrine, autocrine, and intracrine endocrine signaling for optimal growth and differentiation of mammary tissue is well known. According to previous reports, a unique form of Lf mRNA, termed delta-lactoferrin (Δ-Lf) has been detected in human tissues and cell lines (Δ-hLf). Our objective was to determine if Δ-bovine Lf (Δ-bLf) is expressed in bovine mammary tissue. Our earlier work indicated that bLf appears in the nucleus and affects retinoid signaling in mammary cells *in vitro*. Furthermore, *in vivo* experiments using transgenic mice that over-express mammary hLf indicated a Lf:retinoid interaction that perturbed lactation. Δ-hLf mRNA is reported to be identical to Lf except that exon 1 is modified such that a signal sequence is deleted. Because Lf has a nuclear localization sequence, loss of a signal sequence would direct a cytoplasmic protein and subsequent nuclear location. The presence of Δ-bLf mRNA expression in bovine tissue was explored by using bovine mammary cells; BME-UV and primary bovine mammary cells as well as controls with human mammary cells. While BME-UV and the human cell lines make little or no Lf mRNA, the primary bovine cells exhibit high expression that could be modified by culture with hormones. Primers reported for human Δ-Lf were used for human mammary cell extracts and were used as templates to design bovine-specific primers. No evidence of Δ-Lf mRNA was identified in any of the cell extracts of either species with any primer sets. Bioinformatics searches of TIGR, Ensembl, and NCBI expressed sequence tags (ESTs) for presence of Δ-bLf (bLf with different message length) in the bovine data base were negative. Similar searches of the human EST data base for Δ -hLf produced little evidence for the presence of the message save the submitted Δ-Lf sequence and several rare transcripts that did not indicate a differential mRNA expression of Δ-hLf. The presence and perhaps the significance of Δ-bLf in bovine mammary tissue is unresolved.

Key Words: Lactoferrn, Δ-Lf, Bioinformatics

198 The tight junction (TJ) protein zonula occludens-1 (ZO-1) is down-regulated during apoptosis of rat mammary glands. C. V. C. Phyn*[1,2], J. M. Dobson[1], C. D. McMahon[1], S. R. Davis[3], K. Stelwagen[1], and K. Singh[1], [1]*AgResearch Ltd.*, *Hamilton, New Zealand*, [2]*Dexcel Ltd.*, *Hamilton, New Zealand*, [3]*ViaLactia Biosciences (NZ) Ltd.*, *Auckland, New Zealand*.

Extended periods of milk accumulation result in reduced milk secretion, increased apoptosis and eventually, involution of mammary glands. This process is associated with increased TJ permeability between mammary epithelial cells and down-regulated expression of the major transmembrane TJ proteins, occludin and claudin-1. This study investigated the temporal expression of the cytoplasmic TJ component ZO-1 relative to the onset of apoptosis during mammary engorgement. Sprague-Dawley rats at peak lactation had three abdominal inguinal glands on one side sealed to induce mammary engorgement; the remaining glands were not sealed and acted as suckled controls. Mammary tissue was collected post-mortem at 0, 6, 12, 18, 24 and 36h after teat sealing (n = 6 per time point). A dramatic increase ($P<0.001$) in the number of apoptotic nuclei located within alveolar epithelia or lumina was observed by 18, 24 and 36h in the engorged glands compared with suckled controls. The number of apoptotic nuclei was generally greater ($P<0.001$) in the epithelial layer than within alveolar lumens for both control and engorged glands, except at 36h when a similar number was detected in both locations for engorged glands. Apoptotic nuclei present in the alveolar lumen of engorged glands at 18, 24 and 36h were associated with the presence of leukocytes. These changes were accompanied by a significant reduction in ZO-1 protein expression in engorged glands compared with control glands within 12h following teat-sealing. Furthermore, quantitative real-time RT-PCR analysis showed that mRNA expression of ZO-1 was decreased 1.8-fold by 12h ($P<0.05$). Responses to mammary engorgement were locally regulated as no changes were detected in suckled controls. In conclusion, the down-regulation of TJ proteins is consistent with a loss of epithelial cell-cell integrity and communication during mammary apoptosis and involution.

Key Words: Tight junction, Apoptosis, Mammary engorgement

199 *Streptococcus uberis* increases apoptosis of bovine mammary epithelial cells (MEC) and decreases integrin and focal adhesion kinase (FAK) mRNA expression. K. Singh*[1], J. Dobson[1], C. Phyn[1], S. Davis[2], V. Farr[1], and A. Molenaar[1], [1]*Agresearch Ltd., Ruakura Research Centre*, *Hamilton, New Zealand*, [2]*ViaLactia Biosciences (NZ) Ltd.*, *Auckland, New Zealand*.

Mastitis is caused by bacterial infection of the mammary gland. The inflammatory responses caused by mastitis pathogens reduce milk yield, possibly via apoptosis of MEC. Survival of MEC requires anchorage to the extracellular matrix (ECM), mediated via integrin signalling. *S. uberis* is the main causative organism of mastitis in New Zealand. We have investigated the importance of cell-ECM communication in MEC survival and the downstream apoptotic signalling events following mastitis. Two mammary quarters of mid-lactating Friesian heifers (n=5) were infused (~1000 cfu) with *S. uberis* isolated from a cow with acute mastitis. Clinical signs of mastitis were observed, bacteriology of milk confirmed *S. uberis* infection and milk SCC were increased in infused quarters. Alveolar tissue was collected from infused and control non-infused quarters. Histological analysis showed the infected quarters to have a more involuting non-lactating phenotype with increased neutrophil infiltration compared to control quarters. Apoptotic mammary nuclei were measured by in situ end-labelling (ISEL). The control non-mastitic samples had low levels of positive ISEL nuclei per alveolus whereas apoptosis was increased ($P<0.001$) in mastitic samples. There was a strong positive association ($P<0.001$) within cows between number of ISEL nuclei per alveolus and logSCC. mRNA levels were measured by quantitative real-time RT-PCR. There was a negative association ($P<0.05$) of logSCC with the expression of β1-integrin, α6-integrin and cell survival factors FAK and Bcl-x$_{long}$. Pro-apoptotic Bax mRNA levels were the same in mastitic and non-mastitic controls. These results demonstrate that *S. uberis* infection stimulates apoptosis in bovine MEC by down-regulating the cell survival pathway via a loss in communication between integrins and the ECM.

Key Words: Mastitis, Apoptosis, Integrin

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