mRNA expression was unaffected by prolificacy, day of the cycle, or pregnancy status in ewes or cows. The riboprobe hybridized to oocytes of bovine preantral and antral follicles. In bovine ovarian cortical cultures on Day 0, the tissue contained mostly primordial follicles (5.6 ± 0.6 follicles/section); however, after 10 days in culture, the number of primordial follicles per section decreased (0.5 follicles/section) and the number of primary follicles increased as follicles activated (Day 0 = 0.5 ± 0.6 vs. Day 10 = 10.4 ± 0.6 primary follicles/ section; $P < 0.001$). Per1 mRNA did not change over time in culture. We conclude that Per1 mRNA is expressed by ruminant oocytes in preantral and antral follicles; however, its physiological role in mammalian ovarian function remains to be elucidated.

**Key Words:** Oocyte, Fertility, Gene expression

**642 Trace element concentration of bovine ovarian and hepatic tissue.** W. S. Swecker, Jr*[1] and D. J. Tomlinson[2], [1]*Virginia Tech*, *Blacksburg*, [2]*Zinpro Corp*, *Eden Praire, MN*.

Adequate provision of nutrients is essential to bovine reproduction. Ovarian tissue in cycling beef and dairy cows must support follicular growth, corpus luteum (CL) formation and lysis. Antioxidant enzymes such as superoxide dismutase and glutathione periodixase are essential to protect the ovary and may have regulatory functions in hormone synthesis. The objective of this study was to compare concentrations of trace element constituents (Mn, Cu, Zn, Se) of antioxidant enzymes and trace element antagonists (Fe, Mo) in ovarian stroma, luteal tissue, and liver. Liver and ovarian tissue was collected from cows at a commercial abbatoir. Trace element analysis of ovarian stroma, CL, and liver tissue was submitted on a subset of 18 cows that had a CL > 10 mm present. Mineral concentrations were determined by Inductively Coupled Plasma Mass Spectrometry. Manganese concentrations in the CL were similar to liver concentrations and both were 10-fold greater than ovarian Mn concentrations. Copper concentrations were similar between ovarian stoma and CL and were 60-fold lower than liver Cu. Zinc concentrations were similar between CL and ovarian stroma and were 4-fold lower than liver concentrations. Corpus luteum selenium was similar to ovarian concentrations and both were 75% of liver concentrations. For antagonistic trace elements, both Fe and Mo concentrations of the CL were intermediate to liver and ovarian concentrations. In summary, Mn, Fe, and Mo appear to be concentrated in the CL relative to ovarian stroma. Selenium concentrations of ovarian stroma and CL are most similar to liver concentrations as compared to the other elements.

**Table 1. Mineral Content of Tissues**

| Element | Corpus Luteum | Ovarian Stroma | Liver | Pooled SEM |
|---|---|---|---|---|
| Cu | 5.7[a] | 3.7[a] | 360.6[b] | 33.9 |
| Se | 1.1[a] | 0.9[a] | 1.3[b] | 0.1 |
| Mn | 9.5[a] | 0.7[b] | 8.1[a] | 0.7 |
| Zn | 58.1[a] | 68.7[a] | 262.6[b] | 17.6 |
| Fe | 182.3[a] | 75.0[b] | 328.3[c] | 23.8 |
| Mo | 0.7[a] | 0.2[b] | 2.8[c] | 0.1 |

Concentrations are ppm [a,b,c] values within row with different superscripts differ P < 0.05 DM basis

**Key Words:** Trace elements, Antioxidant enzymes, Ovary

# Ruminant Nutrition: Grazing Nutrition

**643 Effects of ruminal fill on bite and grazing dynamics.** P. Gregorini*[1,2], S. Gunter[1], C. Masino[2], and P. Beck[1], [1]*University of Arkansas*, *Hope*, [2]*Universidad Nacional de La Plata*, *La Plata, Buenos Aires, Argentina*.

Hunger affects intake rate. Ruminal fill (RF) has been related to such a state; thus, its level may operate in intake regulation, and grazing behavior. This experiment assessed the impact of manipulated ruminal fill on bite traits and grazing dynamics. During 15 d, 3 ruminally cannulated heifers individually grazed bermudagrass pastures. The first 11 d were adaptation to grazing management. New strips were allocated daily at 0800. At 1700 heifers grazed for a session (GS) of 30 min on a new strip. From d 12 to 15, the treatments, ruminal fill 100 (RF100), 66 (RF66) 33 (RF33), and 0% (RF0) of total ruminal contents, were randomly applied in a 3 x 4 Youden-square design. The rumen was emptied and contents weighed at 0700 and 1300, and after each GS to assess morning intake, set treatments (before GS), and estimate bite mass (BM), respectively. All GS were video recorded and analyzed for bite rate (BR), bites/feeding station (BFS), FS/min (FSR), intake/FS (IFS), and time/FS (TFS). Apparent bite depth (ABD), area (ABA), and area grazed/FS (AFS) were calculated. Dependent variables were analyzed by ANOVA. The linear, quadratic and cubic effects of RF were detected using orthogonal contrasts. As RF decreased, BM, BA, BFS, AFS, TFS and IFS increased (P < 0.01); while ABD and FSR decreased (P < 0.01). Heifers increased IR by changing bite shape and increasing TFS instead of BR. These results support the connection of ingestive and digestive behaviors, and its use in new grazing strategies.

**Table 1.**

| Variable | Treatment | | | | se | Orthogonal contrast[a] | | |
|---|---|---|---|---|---|---|---|---|
| | RF0 | RF33 | RF66 | RF100 | | L | Q | C |
| BM, g | 0.77 | 0.58 | 0.26 | 0.22 | 0.01 | <0.01 | 0.10 | 0.05 |
| ABA, $cm^2$ | 288.48 | 214.93 | 93.92 | 75.84 | 9.15 | <0.010 | 0.37 | 0.29 |
| ABD, % | 46 | 48.37 | 50.62 | 53 | <0.01 | <0.01 | 0.91 | 0.86 |
| BR, bites/min | 49.7 | 52.1 | 53.5 | 51.6 | 1.27 | 0.69 | 0.6 | 0.89 |
| BFS | 9.17 | 9.04 | 7.64 | 5.35 | 0.25 | 0.01 | 0.23 | 0.92 |
| FSR | 4.86 | 5.91 | 7.14 | 9.67 | 0.17 | <0.01 | 0.25 | 0.68 |
| Intake/FS, g | 6.86 | 5.20 | 2.21 | 0.91 | 0.13 | <0.01 | 0.67 | 0.16 |
| TFS, s | 11.18 | 10.17 | 8.61 | 6.28 | 0.23 | <0.01 | 0.41 | 0.94 |
| AFS, % | 96.53 | 69.01 | 29.07 | 10.66 | 2.54 | <0.01 | 0.6 | 0.35 |

[a]Linear (L), Quadratic (Q), and Cubic (C) effects.

**Key Words:** Ruminal fill, Bite features, Feeding stations

**644 Strain of Holstein-Friesian and concentrate feeding level influence endogenous plasma ghrelin concentration.** A. J. Sheahan[1], D. P. Berry[2], and J. R. Roche*[1], [1]*Dexcel, Hamilton, New Zealand*, [2]*Moorepark Dairy Production Research Center*, *Fermoy, Co. Cork, Ireland*.

Ghrelin (G) is an endogenous ligand of the growth hormone (GH) secretagogue receptor and a potent orexigenic agent in monogastrics and ruminants. Although also known to increase GH in dairy cows, little is known about the effect of nutrition or genetics on plasma G concentration in grazing dairy cows. Our objective was to determine the effect of strain of Holstein-Friesian and/or concentrate supplementation on plasma G before and after feeding. Sixty cows of either New Zealand (NZ; n=30) or Northern hemisphere (NH; n=30) ancestry were randomly allocated at calving to 3 levels of concentrate supplementation (0, 3 or 6 kg DM/cow/d fed daily in two feeds at milking) on a pasture diet. Blood was sampled before the morning feed and following a 2 h grazing bout, on average 75 and 82 DIM. Extracted plasma was analyzed for G, GH, NEFA and glucose. Plasma ghrelin concentrations pre- (PreG) and post-feeding (PostG), and the change in ghrelin (ΔG) were correlated with plasma metabolites, milk production variables and estimated breeding values for production traits. Repeatability of ghrelin concentration using all data was 0.51. Plasma G concentration averaged 271 ng/ml at baseline (prefeeding) and declined (P<0.001) to 154 ng/ml following a grazing event. There was a tendency (P<0.1) for NH cows to have higher G concentrations than NZ cows (219 vs. 190 ng/ml), but strain did not affect ΔG. Concentrate supplementation did not affect PreG but linearly (P<0.05) reduced PostG. There was no significant correlation between PreG and any milk production variable, but PostG and ΔG were negatively correlated (P<0.05) with milk, fat, protein and lactose yield. PreG and PostG were negatively correlated with the estimated breeding value for milk fat (P<0.01) and protein (P<0.1) yield. PreG, PostG and ΔG were positively correlated (P<0.05) with plasma glucose, and ΔG was positively correlated (P<0.001) with the change in plasma NEFA. Results point to a possible role of ghrelin in strain and nutrition effects on DMI.

**Key Words:** Ghrelin, Pasture, Concentrates

**645 Nutrient status of young postpartum range cows fed range supplements containing increased glucogenic precursors.** R. L. Endecott*, C. M. Rubio, S. H. Cox, M. R. Rubio, R. B. Lueras, I. Cowboy, R. D. Speckmann, C. A. Löest, D. E. Hawkins, and M. K. Petersen, *New Mexico State University*, *Las Cruces*.

Consistent responses of young postpartum beef cows to protein supplementation could improve reproduction and cow sustainability. A 2-yr study conducted at the Corona Range and Livestock Research Center from February to July in 2003 (n = 51) and 2004 (n = 40) evaluated responses of 2- and 3-yr-old postpartum beef cows grazing dormant native range to three protein supplements with increasing glucogenic potential (**GP**). Supplements were fed at 1135 g•cow$^{-1}$•d$^{-1}$ twice weekly for approximately 70 d and provided 1) 341 g CP, 142 g ruminally undegradable protein (**RUP**), 57 g GP (**RUP0**), 2) 341 g CP, 151 g RUP + 80 g propionate salt (NutroCAL™, Kemin Industries, Inc.), 124 g GP (**RUP80**), or 3) 341 g CP, 159 g RUP + 160 g propionate salt, 192 g GP (**RUP160**). Weekly serum samples were composited and analyzed for glucose, non-esterified fatty acids (**NEFA**), and serum urea nitrogen (**SUN**). Supplement × yr interactions were observed for each metabolite ($P \le 0.04$). Cows fed RUP0 had higher glucose concentrations in 2004 than in 2003. In 2003, cows fed RUP160 had higher serum SUN concentrations than RUP80-fed cows; the opposite effect was observed in 2004. However, SUN concentrations for all cows were higher in 2004 than in 2003. Serum NEFA concentrations of RUP160-fed cows were higher in 2003 than in 2004. Cows fed RUP80 had the most consistent response, regardless of yr. Implications of this study suggest that cows fed the moderate level of GP were able to compensate for yr differences.

**Table 1.**

| Response | Supplement | Year 2003 | Year 2004 |
|---|---|---|---|
| Serum glucose (mg/dL) | RUP0 | 47.3 (3) | 57.4 (3) |
| supp × yr $P < 0.01$ | RUP80 | 48.6 (2) | 54.0 (3) |
| | RUP160 | 52.9 (2) | 49.4 (3) |
| Serum SUN (mg/dL) | RUP0 | 9.2 (0.5) | 15.6 (0.5) |
| supp × yr $P = 0.03$ | RUP80 | 8.7 (0.5) | 15.9 (0.5) |
| | RUP160 | 10.2 (0.4) | 14.5 (0.5) |
| Serum NEFA (mEq/L) | RUP0 | 408 (25) | 293 (23) |
| supp × yr $P = 0.03$ | RUP80 | 374 (22) | 342 (23) |
| | RUP160 | 472 (20) | 330 (22) |

Mean (SE)

**Key Words:** Propionate, Protein supplements, Reproduction

**646 Effect of daily herbage allowance and concentrate level on the milk production performance of spring calving dairy cows in early lactation.** E. Kennedy*[1,2], M. O'Donovan[1], M. Rath[2], F. O'Mara[2], and L. Delaby[3], [1]*Dairy Production Research Centre*, *Teagasc Moorepark, Fermoy, Co. Cork, Ireland*, [2]*School of Agriculture, Food Science and Veterinary Medicine*, *NUI Dublin, Belfield, Dublin, Ireland*, [3]*INRA*, *UMR Production du Lait, St. Gilles, France*.

The objective of this study was to establish the influence of daily herbage allowance and concentrate supplementation on the milk production performance of spring calving dairy cows in early lactation. Sixty-six (30 primiparous and 36 multiparous) Holstein Friesian dairy cows (mean calving date 7 Feb) were randomly assigned to a 6 treatment (n=11) grazing study. The treatment groups were comprised of 3 DHA's (13, 16 and 19 kg DM/cow/day >4 cm) and 2 concentrate supplementation levels (0 and 4 kg DM/day). Treatments were imposed from 21 February to 8 May (11 weeks). Milk yield was recorded daily; milk composition and liveweight were determined weekly. All animal parameters were analysed using covariate analysis within a completely randomised statistical design. Offering a low DHA in early lactation resulted in only a slight reduction in milk yield and liveweight. The inclusion of concentrate in the diet increased (P<0.001) milk yield, milk composition and liveweight. These results indicate that as DHA increases, the rate of increase in milk production declined. Including concentrate in the diet resulted in increased milk production and liveweight.

**Table 1. Effect of DHA and Conc on milk production**

| | Low DHA | Med DHA | High DHA | No Conc | Conc | SED | DHA | Conc | Linear |
|---|---|---|---|---|---|---|---|---|---|
| Milk yield (kg) | $25.6^{b}$ | $26.6^{ab}$ | $27.1^{a}$ | $24.3^{b}$ | $28.6^{a}$ | 0.87 | 0.08 | *** | * |
| Fat yield (g/day) | 980 | 1009 | 998 | $925^{b}$ | $1066^{a}$ | 53.67 | NS | *** | NS |
| Protein yield (g/day) | $840^{b}$ | $877^{ab}$ | $900^{a}$ | $800^{b}$ | $945^{a}$ | 33.90 | * | *** | ** |
| Lactose yield (g/day) | $1234^{b}$ | $1282^{ab}$ | $1313^{a}$ | $1157^{b}$ | $1396^{a}$ | 49.86 | 0.09 | *** | * |
| SCM yield (kg) | $23.5^{b}$ | $24.9^{a}$ | $24.6^{a}$ | $22.5^{b}$ | $26.3^{a}$ | 0.87 | * | *** | 0.08 |
| Liveweight (kg) | $489^{c}$ | $499^{b}$ | $508^{a}$ | $493^{b}$ | $504^{a}$ | 6.9 | *** | *** | *** |

P≤0.001,**=P≤0.01,*=P≤0.05.[abc]values in the same row not sharing a common superscript differ significantly. DHA=Daily herbage allowance; Conc=concentrate level

**Key Words:** Daily herbage allowance, Concentrate, Milk production

**647 Effects of offering different types of supplementation to spring calving dairy cows at grass in autumn.** M. O'Donovan*[1], E. Kennedy[1], T. Guinee[2], and J. J. Murphy[1], [1]*Teagasc*, *Dairy Production Research Centre, Teagasc Moorepark, Fermoy, Co. Cork, Ireland*, [2]*Teagasc*, *Moorepark Food Research Centre, Teagasc Moorepark, Fermoy, Co. Cork, Ireland*.

The objective of this experiment was to compare alternative forages and concentrate as buffer feeds offered to spring-calving dairy cows in the autumn. Ninety Holstein-Friesian cows were balanced on calving date and milk yield (19.9 ± 1.5 kg/cow/day) and randomly assigned to one of 6 treatments; (i) 17.5 kg of grass DM allowance (LG), (ii) 24 kg of grass DM allowance (HG), (iii) LG + 4 kg concentrate DM (C), (iv) LG + 4 kg maize silage DM (M), (v) LG + 4 kg urea-treated processed whole crop wheat DM (UPWCW) and (vi) LG + 4kg fermented whole crop wheat DM (FWCW). Treatments were imposed from 13 September to 7 November 2004 (2 grazing rotations). Both LG and HG herds grazed separately while the 4 supplemented treatments grazed together, as a single herd. The supplementary forages were group fed from a diet feeder after morning milking. Concentrates were offered individually in the milking parlour during am milking. Herbage removal rate was 18.7, 15.0 and 14.4 kg/cow/day (s.d. 2.65 kg) for HG, LG and supplemented herds, respectively. Animals supplemented with concentrate (18.3kg/cow) had a significantly (P<0.001) higher milk yield compared to the HG (15.5kg), M (15.0kg) and UPWCW (14.9) treatments, which in turn had a significantly greater milk yield than LG (13.2kg) and FWCW (14.2 kg). Solids corrected milk (SCM) yield was significantly (P<0.001) greater for C (+2.3kg) than HG (14.9), which was greater than M (14.5), UPWCW (14.3) and FWCW (13.8kg /cow), the LG herd (12.6kg /cow) had the lowest SCM yield. Milk fat, protein and lactose concentrations, as well as body condition score (BCS) and liveweight were not significantly different across treatments. The rennetability of milk tended to be higher in treatments M and FWCW while it was poorest in C. There is a large solids-corrected milk production benefit to supplementing grazing cows, on a restricted grass allowance in late lactation, with concentrate. Supplementing with other forages gave smaller responses, while extra herbage allocation proved superior.

**Key Words:** Supplementation, Herbage, Milk production

**648 The effect of supplementing grazing cows with barley, corn or a mixture of both on milk yield, blood metabolites and rumen pH fluctuation.** F. Dohme*, A. Scharenberg, and A. Münger, *Agroscope Liebefeld-Posieux, Swiss Federal Research Station for Animal Production and Dairy Products (ALP)*, *Posieux, Switzerland*.

A different degradability of starch sources may influence rumen fermentation and consequently milk production. In a 3 × 3 Latin square design experiment with 12 cows (6 rumen-cannulated) grazing ryegrass/clover pasture, the effect of three supplements, differing in their ruminal starch availability, on milk production, blood metabolites and rumen pH fluctuation was determined. From a milk production of 21 kg/d on, cows received the same amount of net energy for lactation (3.9 MJ $NE_L$) per kg additionally produced milk as ground barley (**B**), barley/corn (**B/C**) or corn (**C**). Each experimental period lasted for 28 d with data collection from d 21 to 28. Grass intake was quantified by the double alkane technique using controlled-release capsules. Milk yield and milk constituents were recorded for each milking. Rumen pH was measured continuously for 22 h/d with a pH electrode placed in the rumen through the cannula. For each cow pH data were summarized as mean, maximum and minimum pH and time period when pH was <5.8 and <6.2. Venous blood was sampled on d 21 and 27 of each experimental period. Cows of treatment B (4.0 kg dry matter (DM)/d) were allocated more supplement ($P < 0.1$) than cows of treatment B/C (3.6 kg DM/d) and C (3.4 kg DM/d). However, total intake of DM and $NE_L$ were not affected by treatments. Milk yield and milk fat content did not differ among treatment groups whereas the milk protein content was higher for group B compared to group C ($P < 0.05$). While the concentration of milk urea nitrogen was higher ($P < 0.05$) for cows fed B/C than for cows fed B or C, the plasma urea concentration was highest in groups B/C and B and lower ($P < 0.05$) in group C. The type of supplement had no influence on mean (6.17), maximum (6.56), and minimum (5.73) rumen pH and time when the pH was <5.8 (88 min/d) or <6.2 (676 min/d). In conclusion, the starch source provided by the supplement had an effect on nitrogen use efficiency in dairy cows whereas the influence on rumen pH was low. However regardless of treatment, the time when the pH was <6.2 was quite long which might compromise rumen microbial activity.

**Key Words:** Grazing, Rumen pH, Supplement

## Ruminant Nutrition: Nitrogen Metabolism - Beef

**649 Balancing diets to meet the animal's requirement for absorbable amino acids.** J. W. Golden*[1], M. S. Kerley[1], and N. A. Pyatt[2], [1]*University of Missouri*, *Columbia*, [2]*ADM Animal Nutrition Research*, *Decatur, IN*.

A study was conducted to determine if growth rate and gain to feed ratio (GF) could be improved in feedlot steers by balancing the diet for absorbable amino acid requirements. The ruminally degradable protein (RDP) in the diet met, but did not exceed predicted degradable nitrogen required to maximize microbial efficiency. Two protein sources, bloodmeal (BM) and fishmeal (FM) were contrasted to test the hypothesis that diets could be formulated, based on absorbable amino acid requirements. BM and FM diets were whole corn based. The control diet (14%CP; SBM) was whole corn based with soybean