

naloxone and naloxone treated ewes ovulation rate was significantly increased as compared with controls ($2.9 \pm .5$ and $3.1 \pm .4$ Respectively $P < .01$). It was concluded that endogenous opioids are important modulators of ovulation.

Key Words: Ewe, Estrus, Naloxone

645 Luteinizing hormone-releasing hormone immunization alters pituitary hormone synthesis and storage in bulls and steers. K. J. Wells*¹, T. W. Geary², D. M. de Avila¹, J. de Avila¹, V. A. Conforti¹, H. Ulker¹, D. J. McLean¹, A. J. Roberts², and J. J. Reeves¹, ¹Washington State University, Pullman, ²USDA ARS Fort Keogh, Miles City, MT.

Objectives of this study were (1) to determine if trenbolone acetate (TBA) co-administered with LHRH immunization would suppress reproductive function in beef bulls and (2) to examine the effects of LHRH immunization and TBA treatment on pituitary function. To address these objectives 44 Angus x Hereford bull calves (mean BW = 225 ± 2 kg; mean age = 187 ± 6 d) were randomized into eight treatments in a $2 \times 2 \times 2$ factorial experiment, with castration, LHRH immunization, and TBA administration as treatment factors. Calves immunized against LHRH received a primary injection of ovalbumin-LHRH-7 fusion protein on d 0, followed by two booster injections on d 42 and 196. Calves treated with TBA were implanted on d 224. Mean LHRH antibody binding activity in serum increased after each booster for immunized calves, but was negligible in non-immunized animals throughout the experiment. Concentrations of testosterone in serum were lower ($P < 0.0001$) by d 84 and scrotal circumference smaller ($P < 0.05$) by d 168 in LHRH immunized bulls compared to non-immunized bulls. Treatment with TBA tended ($P = 0.07$) to decrease concentrations of testosterone in serum from bulls. Testes + epididymides weights at slaughter (d 272) were lighter ($P < 0.0001$) for immunized compared to non-immunized bulls. Both LHRH immunization and castration resulted in decreased anterior pituitary stores of LH and FSH ($P < 0.001$). Immunization against LHRH suppressed expression of the LH β , and common α -subunit genes ($P < 0.0001$), while castration increased expression of the same two genes ($P = 0.02$). Synthesis and storage of LH and FSH, as measured by pituitary

LH and FSH content and expression of the LH β -subunit and common α -subunit genes, was suppressed by LHRH immunization.

Key Words: LHRH Immunization, Trenbolone Acetate, Pituitary

646 Glial cell line-derived neurotrophic factor enhances porcine oocyte developmental competence in vitro. K. Linher*¹, D. Wu^{1,2}, and J. Li¹, ¹University of Guelph, Guelph, Ontario, Canada, ²Sichuan Agricultural University, China.

The success of early embryonic development depends on oocyte nuclear and cytoplasmic maturation. We have investigated whether glial cell line-derived neurotrophic factor (GDNF) affects the in vitro maturation (IVM) of porcine oocytes and their subsequent ability to sustain preimplantation embryo development. GDNF and both its co-receptors, GDNF family receptor α -1 (GFR α -1) and the rearranged during transformation (RET) receptor were expressed in oocytes and their surrounding cumulus cells derived from small and large follicles. When included in IVM medium, GDNF significantly enhanced cumulus cell expansion of both small ($P < 0.05$) and large ($P < 0.001$) cumulus-oocyte complexes. It also significantly increased the percentage of small follicle-derived oocytes maturing to the metaphase II (MII) stage ($P < 0.01$), although the nuclear maturation of large oocytes was not significantly affected. Examination of cyclin B1 protein expression as a measure of cytoplasmic maturation revealed that in the presence of GDNF, cyclin B1 levels were significantly increased in large follicle-derived oocytes ($P < 0.05$). Although not significant, cyclin B1 expression was also elevated in small follicle-derived oocytes to levels comparable to untreated large oocytes. After parthenogenetic activation, a significantly higher percentage of both small and large follicle-derived oocytes that were matured in the presence of GDNF developed to the blastocyst stage compared to untreated controls ($P < 0.05$). Indeed, GDNF enhanced the blastocyst rate of small follicle-derived oocytes to levels comparable to those obtained for large oocytes matured without GDNF. Our study provides the first functional evidence that GDNF enhances oocyte maturation and preimplantation embryo developmental competence in a follicular stage-dependent manner. This finding may provide insights for improving the formulation of IVM culture systems, especially for small follicle-derived porcine oocytes.

Key Words: GDNF, Oocyte Maturation, Preimplantation Development

Ruminant Nutrition: Corn Milling Co-Products - Dairy

647 Maintaining milk components when feeding co-products of corn ethanol production. L. Armentano*, University of Wisconsin, Madison.

Use of DGS at 15 to 20% of ration DM may be economical, but requires caution to ensure optimal production of milk protein and fat. DGS can affect milk protein yield through altered diet carbohydrate and protein profile. Adequate dietary degradable protein should be supplied from other sources, and some attention to the lysine concentration in the remaining undegraded protein sources is warranted. However, recent research with modern DGS suggests that lysine content is less of a concern than previously thought. Starch content of the diet should be monitored for adequacy if DGS replaces grain. Laboratories may

analyze DGS NDF with Na sulfite and NDFCP without sulfite. Using these values to calculate NFC as $100 - \text{ash} - \text{CP} - \text{NDF} - \text{Ether Extract} + \text{NDFCP}$, will overestimate NFC. Several characteristics of DGS may impact milk fat yield and composition. Excess oil may be present in diets with DGS. Different analytical methods (acid hydrolysis ether extract, ether extract variations) may not accurately measure fatty acids in DGS, and this content will vary. To the extent that DGS carbohydrate displaces starch, this will tend to have a positive effect on milk fat production, but care must be taken if DGS NDF replaces physically effective fiber from forages. Low forage fiber combined with high oil could trigger milk fat depression. If DGS is added to low oil diets, and diet oil is thereby increased, there may be less secretion of fatty acids shorter than 16 carbons, however, this may be compensated

for by an increase in 18 carbon fatty acids arising from the increased dietary supply. Adding fat to diets often increases milk yields more than it does milk fat or protein yields. This is generally an economically positive response for low cost oils, but may be interpreted by casual observers as a decrease in fat or protein due to lowered milk fat concentration. Field reports of milk fat depression probably relate to all of the above considerations. New processes will result in co-products that differ in composition from DGS.

Key Words: Distillers Grains

648 Phosphorus utilization in dairy cows fed increasing amounts of dried distillers grains with solubles. K. Mjoun*, K. F. Kalscheur, B. W. Pamp, D. J. Schingoethe, and A. R. Hippen, *South Dakota State University, Brookings.*

When phosphorus (P) is fed in excess of the dairy cow's requirement, an increase in fecal excretion of P is expected, which can lead to environmental pollution. The objective of this experiment was to investigate the effect of dietary concentration and source of P on P utilization in lactating dairy cows. Five multiparous Holstein cows fitted with rumen cannula were used in a 5 × 5 Latin square design with 28-d periods. A basal diet was formulated to contain 0.28% of P. Two additional dietary concentrations of P (0.34 and 0.40%) were formulated by including soybean products (SB), with increasing amounts of a supplemental source of P (dicalcium phosphate) or increasing amounts of dried distillers grains with solubles (DG), without a supplemental source of P. Experimental diets were formulated to provide: 1) 0.28% P (no supplemental P); 2) 0.34% P from SB and 0.18% supplemental P; 3) 0.40% P from SB and 0.36% supplemental P; 4) 0.34% P from DG (11% DG); and 5) 0.40% P from DG (22% DG). With increasing dietary P concentration (0.28, 0.34, and 0.40%), increases in P intake (68.7, 78.7, and 98.4 g/d, $P < 0.001$), fecal P output (28.2, 33.8, and 42.3 g/d, $P = 0.01$), net absorption (31.2, 39.0, and 47.0 g/d, $P = 0.04$), and net retention of P (4.6, 12.6, and 19.5g/d, $P = 0.07$) were observed; however, none of these parameters was affected by altering the source of P. Phosphorus excreted in milk was greater ($P = 0.001$) for DG diets compared with SB diets (28.9 and 25.8 g/d) primarily because of greater ($P = 0.01$) milk production for DG diets compared with SB diets, 35.9 and 34.4 kg/d, respectively. Milk P concentration was constant across all diets (0.083% P) regardless of dietary P concentration. Apparent P digestibility was similar for all diets averaging 52.9%. Total and inorganic water soluble P, indicators of P susceptibility to runoff, were unaffected by diet averaging 2.53 and 1.82 g/kg of feces DM, respectively. Data from this experiment suggest that feeding DG can sufficiently meet P requirements of high producing dairy cows without supplementary mineral source.

Key Words: Phosphorus, Fecal Excretion, Dried Distillers Grains with Solubles

649 The effect of replacing corn dry distillers grains with triticale dry distillers grains on milk yield and composition of lactating dairy cows. A. M. Greter*, E. C. Davis, G. B. Penner, and M. Oba, *University of Alberta, Edmonton, Alberta, Canada.*

The objective of this study was to compare milk yield and composition of dairy cows fed corn dry distillers grains with solubles (CDDGS)

or triticale dry distillers grains with solubles (TDDGS) as a protein supplement. Thirty lactating Holstein cows (128 ± 57 DIM) were used in a crossover design with 14-d periods. Cows were assigned to one of two diets containing either CDDGS or TDDGS, at 20% of dietary DM, with barley silage, alfalfa silage, dry rolled barley, and the premix of minerals and vitamins. Both experimental diets were formulated to contain 16.7% crude protein and 22.0% forage neutral detergent fiber. Dry matter intake and milk yield were not affected by treatment, and averaged 23.2 and 31.5 kg/d, respectively. However, cows fed TDDGS decreased concentration of milk urea nitrogen compared to those fed CDDGS (15.7 vs. 16.6 mg/dl; $P < 0.01$), indicating that less N might be wasted in cows fed TDDGS. There were interactions between parity and treatment for 4%-FCM yield, milk fat concentration, and milk fat yield ($P < 0.05$). Multiparous cows fed TDDGS had greater 4%-FCM yield (32.8 vs. 26.9 kg/d) and milk fat concentration (3.81 vs. 3.46%) compared with primiparous cows fed TDDGS although there were no differences for cows fed CDDGS. In addition, multiparous cows fed TDDGS had greater milk fat yield compared with primiparous cows fed CDDGS or TDDGS (1.29 vs. 1.08 or 1.01 kg/d). These data indicate that high producing dairy cows may benefit more from TDDGS than lower producing cows. Consistent with this speculation, the response in milk yield to TDDGS relative to CDDGS in individual cows was positively related to their pretrial milk yield ($P = 0.03$). The results of this study demonstrate that TDDGS can replace CDDGS without negative impacts on lactation performance, however, its effects on the efficiency of N utilization is of further research interests.

Key Words: Triticale Distillers Grain, Corn Distillers Grain, Milk Production

650 Response of lactating Holstein cows to increased amounts of wet corn gluten feed. M. J. Brouk*¹, J. F. Smith¹, and K. N. Grigsby², ¹*Kansas State University, Manhattan,* ²*Cargill, Inc., Blair, NE.*

Forty, lactating Holstein cows were allotted into groups of five animals and assigned to one of eight pens containing 10 freestalls each. Each group contained 3 primiparous and 2 multiparous animals and groups were balanced by milk production and days in milk. Diets were formulated to contain 0%, 12%, 24% or 36% WCGF (wet corn gluten feed) on a dry matter basis. Increasing levels of WCGF and heat treated expeller soybean meal replaced a portion of the corn silage, alfalfa hay, corn grain, soybean meal and soybean hulls of the 0% diet to maintain similar concentrations of crude protein, ruminally undegraded crude protein and neutral detergent fiber. A 4×4 Latin square design with 4-wk periods allowing for 2 wk of adjustment followed by 2 wk of data collection was utilized. Milk weights were recorded at each milking and weekly milk samples, am and pm, were collected for milk component analysis. Milk and feed data were averaged by pen and week prior to analysis. Addition of WCGF to the diet reduced the dry matter content of the TMR. Dry matter intake was unaffected ($P > 0.1$) by treatment. Cows fed 36% WCGF produced more ($P < 0.01$) milk for diets containing 0%, 12%, 24% and 36% WGGF (36.6, 37.6, 38.8 and 40.5 kg/cow/d, respectively). Percentages of milk fat and lactose were unaffected ($P > 0.1$) by diet. Diets containing either 24 or 36% WCGF resulted in greater ($P < 0.01$) 4% fat and energy corrected milk production as compared to diets with 0 or 12% WCGF. Production of milk fat and protein was greater ($P < 0.01$) when feeding WCGF. Increased milk, protein and fat production with increasing amounts of WCGF without a change in DM intake, suggests that total diet digestibility was increased when WCGF replaced diet ingredients that

were possibly less digestible than WCGF. Diets containing WCGF also resulted in greater ($P < 0.01$) fat intake due to the fat associated with WCGF. These data show that WCGF can be utilized effectively at 36% of the ration dry matter if concentrations of RUP, CP and NDF are maintained in the diet.

Key Words: By-Products, Corn Milling, Nutrition

651 Increased diet fermentability reduces production response to corn distiller's grains in lactating cows: A statistical analysis. M. Hollmann*, D. K. Beede, and M. S. Allen, *Michigan State University, East Lansing.*

Increasing supply of corn distiller's grains (DG) has raised questions regarding the extent to which they can be used in dairy cow diets. A database was created of treatment means ($n = 122$) reported in 23 peer-reviewed journal articles published between 1982 and 2006. The database included 4% fat-corrected milk yield (FCM) response to DG treatment compared with control (no DG), DG (% of dietary DM), and various indicators of diet fermentability including forage type, concentration of cereal grain in DG diet, and grain fermentability. Forage type was classified as alfalfa ($n = 27$), corn silage ($n = 49$), or a mixture of each ($n = 46$), grain concentration was classified as high ($> 20\%$ of dietary DM; $n = 34$) or low ($\leq 20\%$ of dietary DM; $n = 13$), and grain fermentability was classified as high moisture corn (HMC; $n = 9$) or dry corn (DC; $n = 38$); responses with diets including more than one grain source ($n = 8$) were eliminated from the analysis. Supplementation of DG ranged from 4.2 to 42% of dietary DM. Response to DG ranged from -5.0 to 5.6 kg/d for FCM (mean = 0.6 kg/d), but response was not related to DG concentration of diets ($P > 0.15$). Fat-corrected milk yield was affected by forage type ($P < 0.001$), percent grain ($P < 0.01$), and grain fermentability ($P < 0.03$); these three factors explained 56% of the variation in FCM from DG supplementation. Among forage types, FCM response to DG was greatest for alfalfa (2.6 kg/d), lowest for corn silage (-2.1 kg/d), and intermediate for the mixture (1.3 kg/d). Response of FCM to DG was greater when concentration of corn grain in the diet was low (1.5 kg/d) compared with high (-0.2 kg/d) and for DC (1.1 kg/d) compared with HMC (0.1 kg/d). Increasing fermentability of forages (corn silage $>$ alfalfa), corn grain (HMC $>$ DC), and increasing the grain concentration of diet resulted in lower and sometimes negative FCM responses to DG supplementation. Fat-corrected milk yield response to DG supplementation is likely greatest when diet fermentability is limited.

Key Words: Milk Fat Depression, Ethanol Byproduct

652 Dried distillers grains + solubles from wheat fed to dairy cows. T. Andersson*¹, M. Murphy¹, E. Nadeau², and M. Carlsson², ¹*Lantmännen Feeds, Stockholm, Sweden*, ²*Swedish University of Agricultural Sciences, Skara, Sweden.*

The coproduct, dried distillers grains + solubles (DDGS), from ethanol production for biofuels based on wheat, has more RDP and NDF with a lower digestibility compared to DDGS from corn. To compliment wheat DDGS in diets based on grass silage the silage should be low in protein and high in digestible fiber (DNDF). Four groups of dairy cows (10 per group) were used in a 4 by 4 Latin Square experiment

with four treatments and four 3-wk periods. The treatments were a normal grass-clover silage (17.8% CP, 46.2% NDF) with 1 kg DDGS (C), an adapted silage (14.6% CP, 52.9% NDF) with 1 kg DDGS (A), 2.5 kg DDGS (A+2.5) or with 4 kg DDGS per cow and day (A+4). The Total Mixed Rations (TMR) had similar contents of CP (17.5%), starch (17.5%), and NDF (37.5%). Diet A+4 had less DNDF and more RDP. TMR were fed ad lib. Intake was recorded on the last 10 days and milk production on the last 4 days of each period. Fecal samples were collected from three cows in each group for analysis. Data were analyzed with PROC GLM in SAS. DMI was greater for A+4 (23.9 kg) than for A and A+2.5 (22.5 kg; SEM=0.40). Diet A tended to give a higher milk yield, 38.3 kg d⁻¹, than C, 37.1 kg d⁻¹ (SEM=0.35), as well as a higher ECM. Diet A produced more ECM per kg of DM intake than A+4 and C, 1.81 vs. 1.63 (SEM=0.042). Diets A+2.5 and A+4 gave higher percentages of milk fat than diet A, 4.12 vs. 4.01% (SEM=0.03). Diet A gave the highest percentage and yield of milk protein (3.52 vs. 3.47%, SEM=0.01 and 1.32 vs. 1.27 kg, SEM=0.01). Diet A+4 resulted in a higher body condition score (3.01) than diets C (2.92) and A+2.5 (2.87; SEM=0.03). Fecal pH was lowest for A (6.97 vs. 7.55; SEM=0.11). The declining milk protein contents in A+2.5 and A+4 compared to A might indicate lower protein quality in wheat DDGS. Inclusion of DDGS was positive for milk fat percentage, probably related to the fiber content. Grass-clover silage and 5% of DDGS gave similar performance as adapted grass silage and 20%

Key Words: DDG+S, Silage, Dairy Cows

653 Interactions of yeast culture and dried distillers grains plus solubles in diets of lactating dairy cows. A. R. Hippen*¹, D. J. Schingoethe¹, K. F. Kalscheur¹, P. Linke¹, K. Gross¹, D. Rennich¹, and I. Yoon², ¹*South Dakota State University, Brookings*, ²*Diamond V Mills, Inc., Cedar Rapids, IA.*

Sixteen multiparous Holstein cows (127 ± 52 DIM) were used in four replicated 4×4 Latin squares with 4-wk periods to evaluate interactions of dietary yeast culture (YC, Diamond V XPC™ Yeast Culture, Diamond V Mills, Cedar Rapids, IA) and dried distillers grains plus solubles (DDGS) on production of milk and milk components when fed diets containing low amounts of forage fiber. Treatments were a 2×2 factorial arrangement of: 1) no YC with no DDGS (NYND); 2) no YC with DDGS at 20% of diet DM (NYD); 3) 14 g/d YC with no DDGS (YND); and 4) 14 g/d of YC with DDGS (YD) at 20% of diet DM. Diets consisted of corn silage (27%), alfalfa hay (18%), and a concentrate mix (55%) on a DM basis. Diets were isocaloric and isonitrogenous. Forage NDF was calculated to be 19.3% of diet DM. Dry matter intake (26.0 kg/d) was similar for all diets. Milk production (42.5, 41.6, 44.8, and 42.3 kg/d for NYND, NYD, YND, and YD, respectively) increased ($P = 0.05$) with the addition of YC and decreased ($P = 0.04$) in diets containing DDGS. Milk fat percentage (3.23, 3.07, 3.21, and 3.00%) and yield (1.38, 1.26, 1.44, and 1.28 kg/d) were decreased ($P < 0.05$) by the addition of DDGS but were not affected by YC. Milk true protein concentrations (3.05, 3.04, 3.02, and 3.08%) were similar for all diets; however, the addition of YC increased ($P = 0.05$) yield of true protein (1.29, 1.26, 1.35, and 1.30 kg/d). Concentrations of MUN (11.2, 10.9, 10.7, and 12.4 mg/dl) increased ($P < 0.01$ for YC \times DG) when both YC and DDGS were included in the diet. The DDGS decreased ($P = 0.02$) yields of energy-corrected milk (ECM; 41.1, 39.1, 43.0, and 39.7 kg/d) and tended to decrease ($P = 0.08$) feed efficiency (1.56, 1.53, 1.66, and 1.53 kg ECM/kg DMI). Body weights and condition scores were not affected

by treatments. Results suggest that, in diets containing minimal amounts of forage fiber, DDGS at 20% of diet DM will contribute to milk fat depression. The addition of YC did improve milk and milk protein yields but did not prevent milk fat depression caused by DDGS. Production responses to YC were similar when cows were fed DDGS or non-DDGS diets.

Key Words: Yeast Culture, Distillers Grains, Lactating Cows

654 Lactation performance of cows fed diets using soybean or byproduct protein sources. Z. Wu* and J. D. Ferguson, *University of Pennsylvania, Kennett Square.*

Milk production and economic returns were determined for dairy cows fed diets utilizing soybean or byproduct protein sources. Thirty-nine Holsteins (averaging 95 DIM, SD = 54) were utilized in an 8-wk trial. The soy diet utilized 16% soybean meal and roasted soybeans as the sole supplemental protein source, whereas the byproduct diet used 6.5% mixed fishmeal, brewer's grain, and corn gluten feed (equal proportions) to replace part of the soy combination while still containing 10% soybean meal and roasted soybeans. The diets contained 50% forage, with 30% contributed from corn silage; the remaining forage was alfalfa silage during the first 4 wk (period 1) or sorghum silage for the second 4 wk (period 2). Average DMI was similar between protein sources in both periods. Milk yield was higher during the first half than the second half of the trial, but similar between protein sources in each period. Milk fat and protein concentrations and FCM increased during the second part of the trial, but did not differ between protein sources. Milk fat and protein yields did not differ during the trial or with protein source. There was no interaction between protein and forage sources in lactation measurements. Economic analysis using averages of the two periods showed \$0.21/d less on feed cost and \$0.13/d more in income over feed for soy than byproduct protein sources. Soy protein source resulted in better economic returns than mixed fishmeal, brewer's grain and corn gluten feed with similar milk production responses. (Partially supported by Pennsylvania Soybean Promotion Board, Salisbury, MD)

Table 1.

| Item | Period 1 | | Period 2 | | SEM | P | <i>P</i> ¹ | |
|------------------------|-----------|-------|-----------|-------|-------|------|-----------------------|-------|
| | Byproduct | Soy | Byproduct | Soy | | | T | P x T |
| DMI, kg/d ² | 23.0 | 23.4 | 22.0 | 22.4 | ... | ... | ... | ... |
| Milk, kg/d | 33.5 | 32.8 | 31.7 | 31.8 | 0.8 | 0.01 | 0.77 | 0.31 |
| Fat, % | 3.67 | 3.65 | 3.79 | 3.73 | 0.10 | 0.06 | 0.77 | 0.70 |
| Fat, kg/d | 1.165 | 1.159 | 1.132 | 1.124 | 0.049 | 0.30 | 0.91 | 0.97 |
| FCM, kg/d | 33.8 | 34.5 | 32.9 | 33.2 | 0.8 | 0.02 | 0.65 | 0.68 |
| Protein, % | 2.97 | 2.97 | 3.15 | 3.14 | 0.04 | 0.01 | 0.97 | 0.56 |
| Protein, kg/d | 0.995 | 0.987 | 0.997 | 1.000 | 0.021 | 0.75 | 0.99 | 0.52 |

¹*P* values for P = period, T = treatment, and P x T = period by treatment interaction. ²Group average.

Key Words: Feed Protein Source, Milk Production, Dairy Cow

655 Ruminal fermentation and total tract apparent digestibility in dairy cows fed increasing concentrations of corn germ. M. M.

Abdelqader*, A. R. Hippen, D. J. Schingoethe, and K. F. Kalscheur, *South Dakota State University, Brookings.*

Four multiparous Holstein canulated cows (132 ± 36 days in milk) were used in a multiple 4 × 4 Latin square design with 4-wk periods to determine the effects of feeding corn germ on ruminal fermentation and total tract apparent digestibilities. Diets were formulated with increasing concentrations of corn germ at 0, 7, 14, and 21% of the diet DM. All diets contained 55:45 forage to concentrate ratio, where forage was 60% corn silage and 40% alfalfa hay. Dietary fat increased from 4.6% in the control diet to 8.3% at the highest inclusion rate of corn germ. Feeding increasing concentrations of corn germ resulted in a quadratic response in DMI (24.5, 27.7, 27.0, 24.1 kg/d; P < 0.05). Ruminal pH tended to linearly decrease (6.49, 6.51, 6.41, 6.37; P = 0.08) as concentrations of corn germ increased in the diet. Dietary treatments had no effect on the total concentrations of VFA; however, increasing the concentrations of corn germ linearly decreased the molar proportion of acetate (62.8, 61.6, 61.9, 59.4; P < 0.001) and linearly increased the molar proportion of propionate (20.9, 21.9, 21.5, 23.4; P < 0.001). Increasing corn germ in the diet had no effect on the total tract apparent digestibility of DM, CP, ether extract and total fatty acids. The addition of corn germ resulted in an increase in the total tract digestibility of C18:2 (95.8, 97.3, 97.8, 98.4 %; P < 0.01) and C18:1 (80.9, 88.4, 92.0, 90.0%; P < 0.001). However, total tract apparent digestibility of C18:0 and total C18 fatty acids were not affected by dietary treatments. Inclusion of corn germ in dairy cow diets had no adverse effect on ruminal fermentation and total tract nutrient utilization. Corn germ provides an alternative fat source in dairy cow diets.

Key Words: Corn Germ, Dairy Cows, Fermentation

656 Wheat grain as a prepartum cereal choice to ease periparturient stress in Holstein cows. H. Amanlou¹, D. Zahmatkesh¹, and A. Nikkha^{*1,2}, ¹*Department of Animal Science, Zanjan, Iran,* ²*Department of Animal Science, Winnipeg, MB, Canada.*

Wheat grain is a unique cereal rich in easily-fermentable starch and low in cation-anion difference. The controlled prepartum dietary inclusion of wheat grain, thus, has the potential to ease adapting the rumen environment to the high-starch lactation diets, stimulate feed intake, reduce hypocalcemia by reducing extracellular alkalinity and a moderate induction of bone resorption, and improve milk yield in periparturient cows. Our principal objective was to underline the importance of wheat grain as a proper cereal choice in the preparturient diet. Twenty-four dry multiparous cows and sixteen pregnant heifers were blocked based on parity and projected calving date and fed a prepartum diet containing either 1) ground wheat grain (WG) or 2) ground barley grain plus wheat bran (BGW i.e., control diet) from 28-d prepartum until parturition. Cows were kept in loose houses, group-fed, and fed the BGW diet during 21-d postpartum. Feeding WG instead of BGW increased blood glucose (58.3 vs. 52.8 mg/dl, P=0.01), attenuated hypocalcemia (9.5 vs. 7.8 mg/dl, P<0.01), and reduced urine pH (6.4 vs. 6.9, P<0.01) at 7-d prepartum. At 1-d postpartum, WG-fed cows had higher blood glucose (63.0 vs. 56.2 mg/dl, P=0.03) and calcium (7.0 vs. 5.5 mg/dl, P<0.01) than BGW-fed cows. Prepartum feeding of WG instead of BGW led to enhanced (P<0.05) milk fat percent (3.7 vs. 3.5%) and 3.2% fat-corrected milk yield (34.8 vs. 31.3 kg/d) during 21-d postpartum. Blood proteins at 7-d prepartum were higher (P<0.05) and placenta was expelled sooner (P=0.08) in

wheat grain-fed cows than in other cows. Treatments did not affect milk protein; changes in body condition score; total time spent eating, ruminating, and chewing; blood levels of urea nitrogen, cholesterol, and phosphorous; fecal pH; and calving difficulty. Therefore, the prepartum provision of WG (18% on a dry matter basis) instead of

BGW proved effective in the simultaneous improvement of calcium and energy states, and thereby, in easing the periparturient stress in Holstein cows.

Key Words: Holstein Cow, Periparturient Stress, Wheat grain

Ruminant Nutrition: Intake and Performance - Beef

657 Factors affecting residual feed intake in feedlot steers.

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Profitability in beef production is a function of both inputs and outputs. The beef industry has focused on outputs such as weight, gain, and carcass merit. Feed costs are estimated to be approximately 60% of the total cost of production, and therefore represent an opportunity to increase profitability through improving feed efficiency. Four hundred six steers (330.1 + 47.07 kg) originating from four different sources and from 29 different Simmental, Angus, and Simmental X Angus sires were used to determine factors affecting feed efficiency in feedlot steers. Seven dietary treatments were used that were composed primarily of corn, corn-based co-products and/or soy hulls. Daily individual animal intakes were recorded by the Growsafe® feed monitoring system. All steers were weighed and ultrasound measurements of marbling score, backfat thickness, and ribeye area were taken approximately every 28 d through 146 d. A total pen collection method established the digestible energy (DE) content of each diet. Residual feed intake (RFI, Mcals of DE/d) was not ($P > 0.05$) correlated to body weight (BW) or average daily gain. However, RFI was highly positively correlated to DE intake (Mcals/d) and average daily dry matter intake (ADDMI). RFI was negatively correlated to gain to feed (G:F) and was lowly, but significantly correlated to empty body fat. G:F was highly correlated to BW, average daily gain (ADG), ADDMI, and DE intake. Dietary treatment accounted for the majority of the variation (43%) in RFI. Dietary treatment and ADG accounted for approximately 51% of the variation in intake over maintenance requirements. Steers that ate more than 15 Mcals of DE per day over their maintenance requirements were less efficient than those eating less than 15 Mcals of DE per day over their maintenance requirements. Sire effects accounted for 9% of the variation in RFI. The range of RFI for progeny of the 29 sires was -2.10 to 2.22 Mcals of DE per day.

Key Words: residual Feed Intake, Steers, Feed Efficiency

658 The effect of residual feed intake rank in beef cows on forage intake and pasture carrying capacity. A. Meyer*, R. Kallenbach, M. Kerley, and K. Ladyman, *University of Missouri, Columbia.*

During the summer of 2005, residual feed intake (RFI) was calculated for 42 purebred Hereford heifers using the GrowSafe feed intake system. The heifers were ranked by RFI and split into low RFI (highly efficient), mid RFI, and high RFI (lowly efficient). After their first calving season, the low and high RFI groups were used to determine the difference in their grazed forage intake. Each group was split into two reps and grazed non-endophyte infected tall fescue-based pastures (1.8-2.4 ha/paddock) for 84 d. The cows were weighed on d 0, 21, 42, 63, and 84 and body condition scored (BCS) on d 0, 42 and 84. At the beginning of the experiment and every 21 d thereafter, the

grazed pastures were sampled for DM on offer. To measure forage accumulation, each paddock had 10 exclosures that were sampled for forage DM and moved every 21 d. Rising plate meter (RPM) readings were taken weekly, and paddock size was adjusted as needed to keep forage availability similar between groups. RPM readings and date of experiment were used in a stepwise model selection to predict forage DM yield. These yields and exclosure growth data were then used to calculate dry matter intake (DMI). Low and high RFI groups did not differ ($P > .05$) in BW change or BCS change over the trial (19.5 vs. 22.1 kg and 0.11 vs. 0.10 BCS). The average DM yield for all paddocks was 2336 kg DM/ha. The average NDF, ADF, and CP were 72.1, 42.4, and 6.8%, respectively. Low RFI cows had a 21% numerically lower DMI than high RFI cows (12.4 vs. 15.6 kg, $P=0.23$). The average acres needed per paddock over the trial was numerically less for low RFI than high RFI cows (1.71 vs. 1.82 ha, $P=0.35$). The average DM on offer over the trial tended to be lower for low RFI than high RFI cows (4215 vs. 4376 kg, $P=0.06$). Although differences seen between low and high RFI cows were not statistically different, this could be due to the difficulty of measuring forage intake during the growing season and the low number of replications. Additional studies are necessary to confirm these differences.

Key Words: Beef Cows, Feed Efficiency, Forage Intake

659 Evaluation of feed efficiency in Santa Gertrudis steers and relationships with temperament and feeding behavior traits.

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The objectives of this study were to characterize feed efficiency traits in growing calves, and to examine their relationships with temperament and feeding behavior traits. DMI and feeding behavior traits were measured over a 70-d period using a GrowSafe® feeding system, following a 28-d adaptation period, in Santa Gertrudis steers ($n = 118$, initial BW = 308.8 ± 27.8 kg). Meal duration (min/d) and meal frequency (meals/d) were averaged over the 70-d period. Body weights were measured at 14-d intervals. Steers were fed a roughage based diet (ME = 2.26 Mcal/kg DM). Chute scores (1 to 5) were recorded and exit velocity (EV) measured as the rate of distance traveled (m/s) while exiting a confined area on days -28, 0, and 70. Residual feed intake (RFI) was calculated as the residual from the linear regression of DMI on mid-test BW^{0.75} and ADG. Overall mean (±SD) of ADG, DMI and RFI were 0.84 ± 0.16, 9.44 ± 0.99, and 0.0 ± 0.86 kg/d respectively. RFI was correlated ($P < 0.05$) with DMI (0.86) and feed conversion ratio (FCR; 0.50), but not with ADG or MBW. Steers with low RFI consumed 19.1% less DMI and had 18.7% lower FCR than steers with high RFI. Meal duration was not correlated with ADG or FCR, but was moderately correlated ($P < 0.05$) with DMI (0.35) and RFI (0.34). Meal frequency was not correlated with ADG, FCR, DMI