240 Effect of meat process conditions on mechanical properties of heat cured whey protein-based edible films: a comparison to commercial collagen films. S.N. Simelane*, A.M. Booren, and Z. Ustunol, *Michigan State University*.

Our previous research has shown that heat cured whey protein isolate (WPI) based films had similar mechanical properties to collagen films. Therefore, the objective of this research was to determine if heat cured WPI-based edible films could withstand temperature, time and relative humidity (RH) conditions typically encountered in a meat process scheme. A whey-protein-isolate based film that can withstand meat processing conditions may provide the meat industry with an alternative to collagen films.

WPI (5%, w/w) was dissolved in distilled water; glycerol (3.3%, w/w) was added and pH adjusted to 8 with 2N NaOH. Solutions were heated at 90°C for 15 minutes while continuously stirred. Candelilla wax (CW; 0.8%, w/w) was added during heating to allow it to melt. Solutions were homogenized, degassed, cast on teflon plates and dried at room temperature (∼23°C) overnight at constant relative humidity. Films used were heat cured at 90°C, 12 h. Next, all films (WPI and collagen) were exposed to conditions typical of a Polish sausage processing scheme; 57°C/60min/36%RH - stage 1, 66°C/90min/60%RH - stage 2 and 77°C/30min/80%RH - stage 3. Samples were collected and tested at the end of each stage; films in stage 3 underwent the whole process sequentially.. Control samples did not undergo these processing conditions. Mechanical properties; tensile strength (TS) and elongation at break (%E) were tested using ASTM standard procedures.

TS of WPI-based control was lower than that of collagen; TS decreased gradually from stage 2 to 3 for both WPI-based and collagen films. WPI-based films were more flexible; evidenced by higher %E, and their flexibility increased between stages 1 and 2. Collagen films were less flexible but maintained their %E throughout all three process stages. Heat cured WPI-based films appear to withstand the conditions that would typically be encountered in meat processing.

Key Words: Whey, Edible, Collagen

241 Utilization of a milk fat globule membrane fraction in the manufacture of low-fat yogurt. Rodrigo Roesch*[1], Douglas Dalgleish[2], and Milena Corredig[1], [1]*The University of Georgia, Athens, GA, USA,* [2]*University of Guelph, Ontario, Canada*.

The presence of material derived from the milk fat globule membrane (MFGM) makes buttermilk (the byproduct of buttermaking) distinct from any other dairy product. The design of reduced-fat products presents challenges when trying to achieve sensory and texture characteristics similar to those of products with higher fat content. The MFGM (the membrane of fat globules in milk and cream) contains large amounts of protein and phospholipids. In particular, phospholipids are known for their health-enhancing properties and they are considered valuable nutritional and functional ingredients in many food products. The objective of this work was to determine if the MFGM present in commercial buttermilk had unique functional properties compared to sodium caseinate or to the buttermilk powder from which it originated. For this reason, a fraction of MFGM was prepared from buttermilk by microfiltration, and then added to skim milk to prepare low-fat yogurt. Samples were homogenized, poured into sterilized cups, heat treated at 90C for 10 min and then cooled to 43C. After cooling the samples were inoculated with commercial yogurt culture. Triplicate experiments were performed, and the rheological properties and microstructure of yogurt containing MFGM were compared to those of samples with added buttermilk powder and sodium caseinate. MFGM extracts had a positive effect on the rheological properties of the low-fat yogurt. When addition of MFGM isolate was compared to the addition of buttermilk powder, no differences seemed to be present in the viscoelastic properties of the samples when lactose in buttermilk powder was taken into consideration. Light scattering measurements of the yogurt mix showed that the addition of MFGM increased the number of particles > 1 μm present. In addition, confocal microscopy with a fluorescent dye (Biodipy#, Molecular Probes) showed differences in microstructure between control samples and yogurt containing MFGM. Results of this research support the potential utilization of MFGM isolates as novel ingredients in fermented products.

Key Words: Yogurt, Milk Fat Globule Membrane

Forages and Pastures
Grazing Systems and Fiber

242 Soybean hulls as a supplement for stocker steers grazing annual ryegrass. J. A. Rush and S. P. Schmidt*, *Auburn University*.

Effects of nonstructural-carbohydrate and structural-carbohydrate supplements on the performance of stocker steers grazing cool-season forage were evaluated in a 3-yr replicated grazing experiment. Each yr, 45 crossbred beef steers (avg. initial BW 253 kg) were assigned randomly into one of fifteen 0.81-ha Marshall annual ryegrass (*Lolium multiflorum*) paddocks. The 15 paddocks were assigned randomly to one of five treatments: no supplement (NS), cracked corn (C), cracked corn with monensin (CR), soybean hulls (S), and soybean hulls with monensin (SR). Supplements were fed daily at 0.4% of mean BW; Rumensin-80® was added at 0.15% of supplement. Grazing began in Dec. or Jan. and ended in May each yr (average 136 d). There were differences ($P<0.01$) in gain response to treatments among years, but the treatment by year interaction was not significant ($P=0.40$). Steers fed supplements gained more over the entire grazing season (170 vs 161 kg) than those not receiving supplements ($P=0.06$), and cattle supplemented with soyhulls gained more (174 vs 165 kg) than those supplemented with corn ($P=0.03$). There was a significant ($P=0.04$) supplement x monensin interaction such that addition of monensin resulted in consistently greater gains for corn but not for soyhulls each year. Average forage height tended to be shorter ($P=0.12$) in non-supplemented paddocks compared with supplemented paddocks, but there were no differences across treatments in forage quality. These data are consistent with studies in which use of carbohydrate supplements with lower quality forages were evaluated, indicating that supplements containing readily degradable structural carbohydrates result in better forage utilization than supplements containing highly fermentable nonstructural carbohydrates.

Key Words: Stocker cattle, Ryegrass, Soybean hulls

243 The effect of an extruded-expeller soybean meal on milk production in grazing dairy cows. J.M. Hernandez Vieyra*, [1]*SOYTECH SA, Buenos Aires, Argentina*.

Argentine dairying is based on grazing alfalfa and other pasture crops plus supplementation with grains and byproducts. Pasture production and quality is higher during Spring, when is suspected that improving protein quality would not have any positive result. One hundred and thirty six first lactation Holstein cows averaging 75 days in milk (DIM) and 21.18 kg of milk were used in a 75 days repeated measurements experiment to determine the response to a high RUP source (SoyPlus, West Central Coop, Ralston, IA) in a typical commercial grazing dairy farm in Argentina. The study duration was from September 9 through November 11 (Spring). Cows were blocked by DIM and milk yield and randomly assigned to two treatments: Control (C) and SoyPlus® (SP). Cows strip grazed an alfalfa pasture and a winter oats pasture after each milking, and were located at both sides of the central path of the same plot, to ensure they received the same pasture quality. Strips of both pastures were moved daily, and strips sizes were determined in order to allow high pasture residual after grazing to guarantee cows ate pasture *ad libitum*. Alfalfa pasture and winter oats pasture had 23 and 18 %CP; 33 and 40 % NDF, respectively. Both groups received before milking, 8kg of a concentrate: C 53% high moisture corn (HMC) and 47% corn gluten feed (CGF) and SP 74% HMC, 13% CGF and 13% SoyPlus®. C and SP concentrates had 15.5 and 15.8 % CP, and 37.4 and 50.1 % RUP respectively. Milk yield was measured before blocking groups on August 23 (wk0), and during the trial on wk3, wk5, wk6, w11. Milk production at wk 0 was the same ($P< .98$) in both groups, when all cows received the same C diet. Milk yield was higher ($P<.01$) for SP during all the trial, being maximum on wk 6, about 100 DIM. Cows on SP produced significantly ($P<.01$) more milk than C, 26.59kg (SEM 0.46) vs 23.15kg (SEM 0.41), respectively. The addition of SoyPlus®

increasing RUP in diets of grazing dairy cows during Spring, resulted in higher milk production.

Key Words: Pasture, Rumen Undegradable Protein, milk yield

244 Performance of lactating dairy cows fed hypernitrogenous red clover based diets supplemented with dextrose.

L. M. Bauman[1] and P. C. Hoffman*[1], [1]*University of Wisconsin, Madison*.

Sixteen early lactation (61 ± 29 DIM) primiparous (N=8) and multiparous (N=8) Holstein cows were assigned to a replicated 4 x 4 latin square to evaluate four dietary treatments. Treatments were arranged as a 2 x 2 factorial and consisted of feeding cows red clover silage based diets with (S) and without .90 kg/cow/d of sugar (dextrose). Diets were also formulated to contain 17.5 (C) and 19.5 % (H) CP to complete the factorial arrangement (C, CS, H, HS). Treatment periods were 21 d with the first 14 d serving as an adaption period followed by 7 d of data collection. Data measurements included milk yield, milk components, milk protein fractions, and nutrient intakes. Treatment diets and production data were also evaluated using the 2001 Dairy NRC model. An abbreviated data summary is listed in the table below. There were no parity by treatment or main effect interactions; therefore, data were combined. Cows fed H produced more milk ($P < 0.001$) that contained more ($P < 0.01$) protein than cows fed C. Cows fed H also consumed more ($P < 0.03$) DM and produced milk containing higher ($P < 0.001$) levels of milk urea nitrogen (MUN). Feeding cows S had no effect on milk yield or components and slightly ($P < 0.10$) depressed milk casein content. The red clover silage contained relatively low levels of RDP (data not shown) and the NRC, 2001 model suggested C diets were adequate in RUP but deficient in RDP. Data suggest characteristically low RDP contents in red clover silages should be accounted for in ration formulation. Data also suggest feeding dextrose was of little value in improving lactation performance.

						Effect ($P \leq$)		
Item	C	CS	H	HS	SE	CP	S	CPxS
Milk, kg/d	33.2	32.5	34.8	34.6	0.5	0.001	NS	NS
Fat, %	3.59	3.64	3.61	3.16	0.07	NS	NS	NS
Protein, %	2.66	2.62	2.69	2.69	0.02	0.01	NS	NS
Casein, %	2.07	2.01	2.07	2.03	0.03	NS	0.10	NS
MUN, mg/dl	10.53	10.44	13.40	13.53	0.13	0.01	NS	NS
DMI, kg/d	21.2	20.7	21.7	21.7	0.3	0.03	NS	NS

Key Words: Red Clover, Lactation, Protein

245 Stock-piled forage or limit-fed corn as an alternative to hay for gestating and lactating beef cows.

J. P. Schoonmaker*, S. C. Loerch, J. E. Rossi, and M. L. Borger, *The Ohio State University*.

In experiment 1, 31, 24, and 17 mature, pregnant Simmental × Angus cows (initial BW = 662.0 ± 10.4) in each of 3 years were used to determine the effects stock-piled forage, limit-fed corn, or ad libitum hay on gestation. In experiment 2, 24 mature, pregnant crossbred cows (initial BW = 677.7 ± 9.4) per treatment in each of 3 years were used to determine the effects stock-piled forage, limit-fed corn, or ad libitum hay on lactation. From November to February, or from January to April, respectively, nutritional needs for gestation (experiment 1) or lactation (experiment 2) were met either by 1) rotating cows on approximately 15.2 or 21.7 ha of predominantly orchardgrass pasture, set aside and fertilized in late August, 2) limit-feeding approximately 5.8 kg of whole shelled corn, 1.1 kg of a pelleted supplement, and 1.2 kg of hay daily, or 3) feeding round-baled hay free-choice. During extreme weather conditions, cows grazing stock-piled forage were limit-fed a grain based diet. *Experiment 1*: Weight and body condition did not differ among treatments at the initiation of the trial (P > 0.93). Post-calving weight (P < 0.10) was greatest for limit-fed cows, and lowest for cows grazed on stock-piled forage; cows fed free-choice hay were intermediate in weight and did not differ from cows limit-fed or cows grazed on stock-piled forage (641.8, 657.4, 634.0 kg; respectively). Calving date, calf birth and weaning weight, and conception rate did not differ among treatments (P > 0.15). *Experiment 2*: Initial and weaning weights for cows did not differ among treatments (P > 0.17); however, post-calving weight (P < 0.01) was greatest for cows fed free-choice hay, intermediate for limit-fed cows, and lowest for cows grazed on stock-piled forage (674.8, 652.4, 624.5). Body condition score at any time point did not differ among treatments (P > 0.38). Calving date, calf birth and weaning weight, and conception rate did not differ among treatments (P > 0.12). Using current market prices, the cost to feed a cow hay in gestation and lactation was nearly double that of limit-feeding the corn-based diet. Relative to limit-feeding a corn-based diet, the breakeven for feeding stock-piled forage was $ 0.49/cow/day in late fall for gestating cows, and $ 0.23/cow/day in mid-winter for lactating cows.

Key Words: Beef Cows, Stock-piled Forage, Limit-fed Corn

246 Digestion of pasture only and pasture plus concentrate diets during continuous culture fermentation.

F. Bargo*[1], G. A. Varga[1], L. D. Muller[1], and E. S. Kolver[2], [1]*The Pennsylvania State University, University Park, PA.*, [2]*Dexcel Ltd., Hamilton, New Zealand*.

A dual flow continuous culture system was used to investigate ruminal fermentation and nutrient digestibility of three levels of intake of pasture only diets and a pasture plus concentrate (PC) diet in a 4 x 4 Latin square design with 10-d periods. The three pasture only diets were defined to determine low (0.33), medium (0.67), and high (1.00) substitution rates (g pasture/g concentrate) when compared to the PC diet. Diets were: low pasture (55 g DM/d; LP); medium pasture (65 g DM/d, MP); high pasture (75 g DM/d, HP); and PC (45 g DM/d pasture plus 30 g DM/d concentrate). Pasture (25.3% CP, 37.5% NDF, 18.0% NSC, 1.52 Mcal/kg NE_L) was fed at 0630, 1000, 1730, and 2100 h. Concentrate (12.9% CP, 14.3% NDF, 57.7% NSC, 1.94 Mcal/kg NE_L) was fed at 0600 and 1700 h. Solid mean retention time and liquid dilution rate in the continuous culture fermenters was 24 h and 11%/h, respectively. On days 8 to 10, effluents were collected daily and composited for nutrient digestibility determination. On day 10, effluents were collected at 0600, 0630, 0700, 0800, 1000, and 1200 h for NH_3-N and VFA analysis. The pH was lower (5.97 vs. 6.55) and the total VFA concentration was higher (113.3 vs. 96.1 mmol/L) for PC compared to HP ($P < 0.05$). Within the pasture only diets, pH linearly decreased from 6.98 to 6.55 and total VFA concentration linearly increased from 61.7 to 96.1 mmol/L as the amount of pasture increased ($P < 0.05$). Concentration of NH_3-N was lower for PC than for HP (15.0 vs. 27.1 mg/dl; $P < 0.05$). The PC diet had similar apparent DM digestibility to the HP diet (50.6%; $P > 0.05$) but higher apparent DM digestibility than the LP diet (52.2 vs. 47.5%; $P < 0.05$). Apparent NDF digestibility was not affected by treatments (77.5%; $P > 0.05$). Concentrate supplementation to pasture reduced pH and NH_3-N concentration compared to pasture only diets, but did not affect DM or NDF digestibility at the same intake.

Key Words: pasture, concentrate, continuous culture fermentation

247 Effect of water addition on selective consumption (sorting) of dry diets by dairy cattle.

C. Leonardi*[1], F. Giannico[2], and L.E. Armentano[1], [1]*University of Wisconsin-Madison, USA*, [2]*University of Bari, Italy*.

The objective was to determine if adding water to a dry diet could reduce sorting, increase intake of long particles and improve cow performance. Eighteen multiparous lactating Holstein cows were utilized in a Cross-over design, with 21-d periods. At the beginning of the study cows averaged 88 DIM and produced 40.8 kg of milk daily. Cows were housed in tie stalls, and fed twice daily at 0800 and 1500 to obtain approximately 10% refusals. Treatments had the same dietary composition, and differed only by adding water (WET) or not (DRY). Diets consisted of 10% alfalfa silage, 30% hay (approximately 80% grass and 20% alfalfa), 44.6% corn grain, 13.2% soybean meal, .6% animal fat, and 1.6% minerals and vitamins (DM basis). Diet DM was 80.2% for DRY and 64.3% for WET. Both diets contained 16.9% CP and 25.9% NDF. Particle size was determined using the Wisconsin Particle Size Separator on the as fed diets. The separator has five square-hole screens (Y1-Y5) with diagonal openings of 26.9 mm =Y1, 18 mm =Y2, 8.98 mm=Y3, 5.61 mm=Y4, and 1.65 mm=Y5, and one pan (PAN). Adding water did not affect total DMI (28.4 kg/d), milk production (41.3 kg/d) or milk composition, although milk fat percentage tended to be greater (3.41 vs. 3.31, $P = .09$) when cows consumed WET. No differences in ruminal pH, or VFA were observed. Diet DM retained on each of the six screens (%), from Y1 to PAN was 2.6, 3.8, 9.1, 7.1, 30.2 and 47.2 for DRY and 1.9, 3.3, 8.4, 7.2, 35.6 and 43.6 for WET. DMI by screen expressed as a percentage of predicted intake assuming no sorting occurred, for DRY vs. WET was for Y1: 61.4 vs. 75.2 ($P=.05$), Y2: 83.8 vs. 98.6

($P<.0001$), Y3: 85.6 vs. 90.8 ($P=.05$), Y4: 95.2 vs. 96.0 ($P=.48$), Y5: 100.1 vs. 101.9 ($P=.09$), and PAN: 105.9 vs. 102.9 ($P=.01$), respectively. Cows sorted against long particles in favor of shorter particles on both diets. Adding water to dry diets reduced sorting and tended to increase milk fat %; however even on the wetter diet one cow completely avoided consumption of Y1 particles.

Key Words: Sorting, Water, Long particles

248 Supplementation of modified yeast cell wall preparations to reduce the effects of toxins in steers fed endophyte-infected fescue. V. Akay*[1], J. A. Jackson[1], and K. A. Dawson[2], [1]*University of Kentucky, Lexington, KY,* [2]*Alltech Biotechnology Inc., Nicholasville, KY.*

Twelve Holstein steers (160 to 290 kg) were blocked by body weight and assigned to one of four treatments to investigate the effects of modified yeast cell wall preparations (MYCWP) on symptoms of fescue toxicosis in steers fed endophyte-infected (EI) fescue during 27 d study. Treatments were: 1) EI fescue; 2) EI fescue plus MYCWP; 3) endophyte-free (EF) fescue; and 4) EF fescue plus MYCWP. Diets consisted of cracked corn grain (21.6%), cottonseed hulls (21.9%), crimped oat grain (21.6%), fescue seed (21.6%), soybean meal (10.8%), and vitamin and mineral supplementation (2.34%). The MYCWP was added into Diet 2 and 4 at the level of 2 kg/tonne. Steers were kept in a temperature-controlled room (30°C) and fed ad libitum once daily. Rectal temperatures and respiration rates were higher ($P<0.01$), and serum prolactin levels lower ($P<0.01$) for steers fed EI fescue diets compared to those fed EF fescue diets. Addition of MYCWP to EI fescue diets increased rectal temperatures compared to EI fescue without MYCWP. However, addition of MYCWP to EF fescue decreased rectal temperatures compared to EF fescue without MYCWP. Addition of MYCWP to EI fescue diet increased respiration rates compared to EI fescue without MYCWP. Addition of MYCWP to EI fescue diet decreased serum alkaline phosphatase level compared to EI fescue without MYCWP. Serum prolactin levels were higher for EF fescue diet supplemented with MYCWP compared to EF fescue without MYCWP. However, addition of MYCWP to EI fescue diet had no effect on serum prolactin content compared to EI fescue without MYCWP. Fecal ergovaline concentration was higher for steers fed EI fescue with MYCWP compared to those fed EI fescue without MYCWP. In conclusion, MYCWP adsorbed toxins but did not reduce the effects of toxins at high inclusion of EI fescue seed in the steers diet. However, addition of MYCWP to EF fescue decreased rectal temperatures and increased serum prolactin concentrations, which indicates that MYCWP did have a positive effect on reducing heat stress.

Key Words: Fescue, Yeast cell wall preparations, Steers

249 Withdrawn , .

250 Transport of tall fescue alkaloids across gastric tissues. Andrea Ayers[1], N.S. Hill*[1], G.E. Rottinghaus[2], J.A. Studemann[3], D.L. Dawe[1], and F.N. Thompson[1], [1]*University of Georgia Athens, GA, USA,* [2]*University of Missouri Columbia, MO, USA,* [3]*USDA-ARS Watkinsville, GA, USA.*

Ergovaline is considered to be the alkaloid responsible for fescue toxicosis. Recently studies have shown that alkaloids are excreted primarily in the urine. Since the route of ergopeptine alkaloid (ergovaline) excretion is the bile, presence of alkaloids in urine suggests lysergic acid amides are the circulating form of the alkaloids. Therefore, studies were organized to investigate rumen microbial fermentation of ergot alkaloids, and which compounds transport through gastric tissues. An in vitro ruminal fermentation of endophyte-infected tall fescue was conducted over 0, 2, 4, 6, 12, 24, and 48 h using autoclaved and viable rumen fluid. Ruminal fluids were analyzed for ergot alkaloids with ELISA (total) and HPLC (species). Soluble ergot alkaloids gradually increased in autoclaved fluids ($P<0.05$). Initial total soluble alkaloid levels decreased, but increased after 24 h when viable ruminal fluid was added ($P<0.01$). Concentration of lysergic acid was constant, ergovaline decreased ($P<0.01$), and an unknown alkaloid metabolite increased with time of digestion ($P<0.01$). A second study was conducted using parabiotic chambers to determine which of the ergot alkaloids pass through ovine ruminal and the omasal tissues. Thus far, only lysergic acid ($P<0.01$) has been observed passing through the gastric tissues.

Key Words: Fescue toxicosis, Ergot alkaloids, Ergovaline

251 The effects of traditional endophyte, endophyte-free, and novel endophyte (MaxQ) Jessup tall fescue hay consumption on digestion and nitrogen retention in steers. A. D. Killebrew*, M. H. Poore, G. B. Huntington, and J. T. Green, *North Carolina State University, Raleigh.*

A digestion trial was conducted to compare the effects of traditional endophyte (TE), endophyte-free (EF), and MaxQ Jessup tall fescue (*Festuca arundinacea*) hay on digestion and N retention in steers. Hay compositions were as follows: TE (10.84 % CP, 59.91 % NDF, 29.43 % ADF), EF (11.79 % CP, 58.45 % NDF, 28.43 % ADF), and MaxQ (11.56 % CP, 58.56 % NDF, 28.32 % ADF). Eight Polled Hereford steers (273 kg average BW) were used in a replicated, 3x3 Latin square design, with an extra animal allotted to each square. Steers were fed ad lib for 14 days followed by a 9-day adaptation to a restricted intake (based upon the animal with the lowest ad lib intake for the square), and a 5-day collection. TE differed from EF and MaxQ ($P<0.01$) in ad lib DMI (5.02 vs. 5.63 and 5. 73 $\pm$ .067 kg/d, respectively) and differed ($P<0.05$) in ad lib DMI as a % BW (1.83 vs. 2.07 and 2.12 $\pm$ .040 %, respectively). There were no differences during the digestion trial for DMI (5.24, 5.15, and 5.29 $\pm$ .055 kg/d), water intake (20.28, 20.47, and 19.90 $\pm$ 1.131 L/d), and urine output (7.46, 7.33, and 7.40 $\pm$ .650 L/d) for MaxQ, TE, and EF, respectively. DM digestibility for TE was lower ($P<0.05$) than EF or MaxQ (61.96 vs. 67.43 or 66.63 $\pm$ .947 %, respectively). TE was also lower ($P=0.05$) for OM digestibility compared to EF or MaxQ (64.87 vs. 69.44 or 68.58 $\pm$ .892 %, respectively). There were no significant differences for NDF or ADF digestibility between hay types. CP digestibility was higher ($P<0.05$) for EF and MaxQ when compared to TE (54.69 and 53.20 vs. 47.40 $\pm$ 1.087 %, respectively). N retention was lower for TE than EF ($P<0.05$) or MaxQ ($P<0.067$) (22.4 vs. 30.4 or 29.1 $\pm$ 1.74 g/d, respectively). Results from this study indicate that TE tall fescue hay had lower ad lib DMI, DM digestibility, and N retention, while the effects of MaxQ tall fescue hay showed no difference from EF tall fescue hay.

Key Words: Cattle, Tall Fescue, Endophyte

252 An evaluation of three grazing systems for beef cows in the Mid-Atlantic region. J. W. Comerford*, V. H. Baumer, H. W. Harpster, E. H. Cash, R. C. Stout, and R. L. Swope, *Penn State University.*

At 2 locations in each of 3 yr, 15 cow-calf pairs (average 1.86 AU per pair) were allotted to one of three grazing treatments: I=cool season grasses only (predominately orchardgrass); II= a combination of small grain pasture, rape, sudangrass, corn crop aftermath, and orchardgrass; or III=a combination of orchardgrass, alfalfa/grass mixtures, and stockpiled fescue. Land allocation per cow-calf pair remained contant at 1.33 ha. Cattle were rotated twice per week. All grazed forage was sampled pre- and postgrazing, and ungrazed forage was sampled and harvested predominately as wrapped balage. Effects of yr, location, and treatment were significant sources of variation ($P<.05$) for grazed DM, but not for harvested or total DM production. Year, treatment, and their interaction were significant sources of variation for cow weight gain, while calf preweaning ADG was significantly less for treatment III (1.22, 1.20, and 1.14 kg/d for treatments I, II, and III, respectively). There were no differences among treatments in actual grazing days (208 d, 212 d, and 216 d for treatments I, II, and III, respectively)or for grazing days adjusted to AU. Stockpiled fescue available for grazing varied by yr ($P<.05$), and accounted for 44% of total fescue grazing days in treatment III. The results indicate annual production costs should determine the combination of forages available in a pasture system in the region.

Key Words: Grazing system, Average daily gain, Stockpiled fescue

253 Evaluation of Illinois bundleflower as a grazing source for ruminants using dual flow continuous culture fermenters. K.A. Caperoon*, M.D. Stern, C.C. Sheaffer, G.I. Crawford, and R.L.K. Hulbert, *University of Minnesota, Saint Paul, MN.*

Illinois bundleflower (*Desmanthus illinoensis*) is a warm season perennial legume that is native to the North American grasslands. Because

of its nitrogen fixation capabilities and crude protein concentration, Illinois bundleflower (IBF) has potential in livestock grazing systems for restored landscapes. The objective of the current study was to compare IBF with alfalfa (*Medicago sativa*) and evaluate their effects on nutrient digestion and ruminal microbial fermentation using dual flow continuous culture fermenters. Eight fermenters were provided with diets consisting of either 100% IBF or 100% alfalfa, fed at a rate of 75 g/d for 10 d, and supplied 1.7 and 2.3 g N/d, respectively. Alfalfa contained 34.3% NDF, 24.4% ADF and 20.3% CP while IBF contained 37.7% NDF, 26.4% ADF and 15.0% CP. Solids and liquid dilution rates were maintained at 4.5 and 10%/h, respectively, while fermenter pH was maintained between 6.0 and 7.0. Average fermenter pH was higher ($P < 0.05$) for the IBF treatment (6.53) than the alfalfa treatment (6.13). True organic matter digestion averaged 48.3%, and did not differ between forage source. Non ammonia-N was greater ($P < 0.05$) for alfalfa (1.34 g/d) than for IBF (1.12 g/d). Total N flow was also greater ($P < 0.05$) for alfalfa but bacterial N flow was similar ($P > 0.05$) for the two legumes. For alfalfa and IBF respectively, crude protein degradation (65.2 and 59.7%), NDF digestion (38.7 and 44.3%), and efficiency of bacterial protein synthesis (17.3 and 12.9 g of N/kg OM truly digested) did not differ ($P > 0.05$) between forages. Results from this study indicate that Illinois bundleflower has the potential to be a sufficient N and fiber source for grazing ruminants.

Key Words: Illinois bundleflower, Forage, Fermentation

254 The effect of yeast *(Saccharomyces cerevisiae)* culture included in a free-choice mineral mix on milk production in beef cattle in a fescue-based pasture grazing system. D.J. Kobs* and S.L. Boyles, *The Ohio State University. Columbus, Ohio.*

Cows and calves grazing on Tall Fescue *(Festuca arundinacea)* pasture had access to free-choice control (C) or yeast-culture (Y) mineral mix. The evaluation of milk production was conducted over three years. Control and yeast groups were comprised of 1 group per treatment for Year 1, 4 groups per treatment for Year 2, and 6 groups per treatment for Year 3. Group served as the experimental unit. Milk production was estimated using a weigh-suckle-weigh technique, at approximately Day 60 and Day 120 post-calving. On each day of milk production evaluation, the calves were separated from the cows for 8 h. After 8 h., the calves were weighed and then allowed to suckle for approx. 10-15 min. After suckling, the calves were immediately re-weighed to assess milk production. The weigh-suckle-weigh technique was conducted three times over 24-h. period. The three weight changes were combined and represented an estimate of milk production in a 24-h period. For Year 2, Y cows tended ($P = 0.06$) to have a higher (5.6 kg.) Day 120 estimated milk production over the C cows (4.3 kg.) When Day 60 and 120 were combined, the Y cows had a significantly ($P=0.05$) higher (6.5 kg.) estimated milk production over the C cows (5.3 kg.). For Year 3, Y cows had a significantly ($P=0.05$) higher (6.3 kg) estimated milk production over the C cows (5.0 kg.). When Day 60 and 120 were combined, the Y cows tended ($P=0.08$) to have a higher (6.9 kg.) milk production estimate over the C cows (6.1 kg.). No differences were found at the Day 60 in Year 2 or 3. When all years were combined, Day 120 Y cows had a significantly ($P \leq 0.01$) higher (5.9 kg.) estimated milk production when compared to C cows (4.6 kg.). In addition, when all years were combined, Day 60 and 120 (combined) Y cows had a significantly ($P \leq 0.01$) higher (6.7 kg.) milk production estimate compared to C cows (5.7 kg.). No differences were found at the Day 60 when all years were combined. Increases in milk production were most likely attributable to increases in intake and digestibility in the late summer months reported in other concurrent experiments.

Key Words: Beef cattle, Yeast culture, Milk production

255 Ruminal undegradable proteins and protein fractions in alfalfa (*Medicago sativa* L.). G. F. Tremblay*, R. Michaud, G. Belanger, and J. Michaud, *Agriculture and Agri-Food Canada, Sainte-Foy, QC, Canada.*

Alfalfa quality would be greatly improved by an increase in its ruminal undegradable protein (RUP) concentration. In a first experiment, 14 genotypes, each represented in the field by four plants harvested at early bloom in the spring of the first production year, were assessed for protein degradation using a rumen inhibitor *in vitro* procedure and the Cornell Net Carbohydrate and Protein System. This system divides protein fractions into soluble non protein N (A), soluble true protein (B1), rapidly degradable true protein (B2), slowly degradable protein (B3), and undegradable protein (C). Genotypes did not differ significantly ($P>0.10$) for CP concentration and the fraction C. However, genotypes differed significantly for fractions A + B1 (32.8 to 46.8%, average of 40.6% of CP, $P<0.01$), fraction B2 (46.2 to 59.6%, average of 52.0% of CP, $P<0.01$), fraction B3 (3.1 to 4.9%, average of 4.1% of CP, $P<0.05$), and *in vitro* RUP concentration (26.6 to 36.0%, average of 30.8% of CP, $P<0.05$). *In vitro* RUP was significantly correlated ($P<0.05$) to fractions B2 ($r = 0.81$) and B3 ($r = 0.52$). In a second field experiment, whole plants of 27 cultivars, seeded in triplicates and harvested at 10% bloom in the spring of the second production year, were assessed for *in vitro* RUP and protein fractions using the same procedures. Cultivars did not differ significantly ($P>0.10$) for any of the protein fractions, including *in vitro* RUP. Fractions A + B1 accounted for 44.3 (42.5 to 47.2) % of CP, fraction B2 for 49.4 (46.9 to 51.8) % of CP, fraction B3 for 2.2 (1.8 to 2.7) % of CP, fraction C for 4.1 (3.4 to 4.8) % of CP, and RUP for 24.3 (22.5 to 26.3) % of CP. Correlations between *in vitro* RUP values and fractions B2 ($r = 0.46$) and B3 ($r = 0.35$) were also significant ($P<0.05$). Our results indicate the presence of genetic variability for ruminal undegradable proteins among alfalfa genotypes and the positive relationship between *in vitro* RUP concentration and degradable true protein fractions (B2 and B3) for both genotypes and cultivars.

Key Words: Ruminal Undegradable Proteins, CNCPS Protein Fractions

Physiology
Endocrinology and Metabolism

256 Effect of 14-day subcutaneous injections of several dosages of glucagon on milk yield and composition in lactating dairy cows. G. Bobe*[1], B. N. Ametaj[2], D. C. Beitz[1], and J. W. Young[1], [1]*Iowa State University, Ames, IA,* [2]*Purdue University, West Lafayette, IN.*

Fatty liver is a major metabolic disease of dairy cows in early lactation that can be treated by 14-day continuous intravenous infusions of glucagon beginning at d 21 postpartum. Intravenous infusions of glucagon decrease milk yield and concentrations of milk protein and fat and increase milk lactose concentrations at the beginning of the infusion period. We tested whether 14-day subcutaneous injections of several dosages of glucagon beginning at d 8 postpartum have the same effect on milk yield and composition in dairy cows as continuous intravenous infusions of glucagon. Multiparous Holstein cows (n=32) were grouped on the basis of their liver TAG concentration at d 4 postpartum into "Normal" (n=8; <10 mg TAG/g wet weight) and "Susceptible" (n=24; >10 mg TAG/g wet weight) cows. "Susceptible" cows were assigned randomly to 3 groups and received beginning at d 8 postpartum 0 (Saline Susceptible), 2.5 (7.5 mg/d Glucagon), or 5 mg (15 mg/d Glucagon) glucagon in 60 ml saline (pH 10.25) by subcutaneous injections of glucagon every 8 h for 14 d. "Normal" cows (saline Normal) received the same treatment as "Saline Susceptible" cows. Milk production and composition and dry matter intake (DMI) were measured at d 4, 6, 11, 21, 24, 28, 35, and 42 postpartum. Glucagon injections decreased milk protein yield and concentrations ($P \leq 0.1$). Milk fat concentrations and milk urea nitrogen yield and concentrations decreased during the 14-day glucagon injection period ($P \leq 0.1$). Milk fat yield, milk lactose and organic substance yield and concentrations were not affected by glucagon injections ($P \geq 0.1$). In contrast to continuous intravenous infusions of glucagon, milk yield and DMI were not affected by subcutaneous injections of glucagon ($P \geq 0.1$). We conclude that subcutaneous glucagon injections have similar effects on milk yield and composition as continuous intravenous infusions without the detrimental effects on milk yield and DMI. We conclude that subcutaneous glucagon injections every 8 h for 14 d beginning at d 8 postpartum increase amino acid uptake by the liver for gluconeogene-