

## PASTURE AND FORAGES

**740 Modifying livestock grazing distribution by strategic placement of cooked molasses supplements.** D. W. Bailey\* and G. R. Welling, *Montana State University, Havre.*

A study was conducted in foothills rangeland during the fall to determine if livestock grazing distribution could be improved by strategically placing cooked molasses supplement blocks (30%CP). Three pastures were categorized into inaccessible, easy, moderate and difficult terrain. Moderate and difficult terrain was further divided into 20 to 50 ha subunits (n=32) and randomly assigned to control and supplement treatments. Every 7 to 10 d, supplement and salt were moved, and then new supplement and control subunits were evaluated. Cattle use of the control and supplement subunits was compared by measuring forage utilization and fecal pat abundance both before supplement and salt placement and after removal. Measurements were collected near randomly selected sites within both control and supplement subunits. Salt was placed at half of the sites in both subunits, and cooked molasses blocks were placed at the sites in the supplement subunit. Average supplement consumption per animal (318±30 g/d) was similar (P=.4) in moderate and difficult terrain. Cattle consumed more (P<.001) salt near supplement than in control areas. More (P=.01) cattle were observed in areas with supplement (32±8%) than in control areas (3±2%). Increase in fecal pats was greater (P=.01) in areas with supplement (3.3±.7 pats/100 m<sup>2</sup>) than control areas (.5±.5 pats/100 m<sup>2</sup>) indicating greater use by cattle. Change in forage utilization was also greater (P>.001) in areas with supplement (17±2%) than in control areas (-1±1%). For supplement areas, the increase in forage utilization was greater (P<.05) in moderate terrain than in difficult terrain. Results from this study suggest that cattle can be lured to underutilized rangeland by strategic placement of cooked molasses supplement blocks.

**Key Words:** Cattle, Distribution, Supplement

**741 Forage and Supplement Intake by Range Cows and Calves.** A. V. Earley\*, B. F. Sowell, and J. G. P. Bowman, *Montana State University, Bozeman.*

One hundred eleven Angus cows (avg 612 kg) and calves (avg 214 kg) grazing improved summer pastures (*Agropyron intermedium*, *Medicago sativa*, *Phleum pratense*, *Poa pratensis*, *Trifolium sp.*) were used to determine cow and calf intake of liquid supplement, and its effect on forage intake and performance. Fifty-one pairs had access to liquid supplement in an open tank and 60 pairs were not supplemented. The study lasted from July 28, 1997 to October 3, 1997 and was conducted in southwestern Montana. Ytterbium chloride was added to the liquid supplement (formulated to be 29% CP, DM basis) to estimate individual supplement intake. All supplemented animals and 10 unsupplemented pairs were dosed with sustained release chromium boluses to estimate fecal output (FO). Extrusa samples were collected using ruminally cannulated cows and were incubated in situ for 48 h to determine DM digestibility. Forage intake was calculated using estimates of FO and 48 h DM digestibility. Individual forage and supplement intakes were estimated and analyzed using individual animal as the experimental unit. Supplemented cows gained .13 kg/d more (P = .02) than unsupplemented cows and were 8 kg heavier (P = .02) at weaning. Change in body condition score was not different between treatments (P > .10). Forage intake by supplemented cows was greater (P < .05) than unsupplemented cows (3.6 vs 2.8 % BW). Supplemented calves had higher (P < .01) WW, 205-d adjusted WW, and ADG than unsupplemented calves (298 vs 281 kg WW, 278 vs 265 kg adj. WW, and 1.3 vs 1.0 kg/d ADG). Forage intake by supplemented calves was greater (P < .02) than unsupplemented calves (9.5 vs 6.2 kg/d). Supplement intake of cows averaged .32 kg/d and ranged from 0 to 2.4 kg/d (142 % CV). Supplement intake of calves ranged from 0 to 1.0 kg/d (160 % CV) and averaged .14 kg/d. Liquid supplementation increased forage intake and ADG of cows and calves grazing improved forages in late summer.

**Key Words:** Supplement Intake, Forage Intake, Cow/Calf Performance

**742 Effects of cow age and liquid supplement delivery method on forage and supplement intake by cows grazing native range.** T. K. Daniels<sup>1</sup>\*, B. F. Sowell<sup>1</sup>, J. G. P. Bowman<sup>1</sup>, E. E. Grings<sup>2</sup>, and M. D. MacNeil<sup>2</sup>, <sup>1</sup>Montana State University, Bozeman, and <sup>2</sup>USDA-ARS, Fort Keogh LARRL, Miles City, MT.

One hundred eighty crossbred cows were assigned to one of six native range pastures during two winters to evaluate forage and supplement intake as affected by cow age (2, 3, 4, 5, or 6 y) and liquid supplement delivery method. Treatments were: 1) no supplement (Control); 2) a lickwheel feeder containing liquid supplement (UNREG); and 3) a computer-controlled lickwheel feeder that dispensed 1 kg/head/d of liquid supplement (REG). Each treatment was applied to two pastures. Supplement used in both tanks contained YbCl to estimate individual supplement intake. Boluses containing Cr<sub>2</sub>O<sub>3</sub> were used to estimate fecal output (FO). Three ruminally cannulated cows per pasture were used to obtain forage extrusa and to measure in situ forage DMD. Forage intake was estimated from FO and 48 h DM indigestibility. Data were analyzed as a replicated completely randomized design with the effects of treatment, year, rep and their interactions, with cow as the experimental unit. A treatment x year interaction (P < .01) was found for DMI, with both REG and UNREG cows having higher DMI than Control cows the first year, and REG cows having higher DMI than UNREG and Control cows in year two. Forage DMI was similar (P > .10) for all age groups (avg 3.2% BW). Forage digestibility was increased (P < .01) by supplementation both years. Blood urea nitrogen (BUN) was highest (P < .01) for UNREG (8.7 mg/dL), intermediate for REG (6.2 mg/dL), and lowest for Control (2.3 mg/dL). Supplemented cows lost less (P < .01) body condition (1-9 scale) than Control cows (-.3 vs -.5 BCS). Supplement intake (as-fed) was higher (P < .01) by cows on UNREG (1.83 kg/d) than those on REG (.72 kg/d). Supplement intake (as-fed) was lowest (P < .01) for 2-year-old cows (.82 kg/d), intermediate for 3-year-olds (1.16 kg/d), and greatest for 4-, 5-, and 6-year-olds (avg 1.46 kg/d). Liquid supplementation increased forage intake, and forage digestibility, and reduced cow body condition score change.

**Key Words:** Liquid Supplement, Forage Intake, Supplement Intake

**743 Effects of wheat variety and stocking rate on beef production and grain yield of winter wheat pasture.** S. I. Paisley\*, G. W. Horn, E. G. Krenzer, and L. A. Redmon, *Oklahoma State University, Stillwater.*

Sixteen 7.3- to 9.7-ha clean-tilled winter wheat pastures were used to study the effects of wheat variety and stocking rate (SR) on cattle performance and grain yield of winter wheat pasture. Four hard red winter wheat varieties were each grazed at four stocking rates to characterize live weight gain of growing beef cattle and grain yield during the wheat pasture years of 1992-93, '93-94, '94-95 and '96-97. Wheat varieties used during the first two years were semidwarf varieties Karl, 2163, 2180 and AgSeCo 7853; varieties used in years three and four included 2180, AgSeCo 7853, Longhorn and Scout 66. Fall-weaned steers (227 kg) grazed winter wheat continuously with SR ranging from .9 to 2.8 steers/ha; they were removed from pastures when first hollow stem was detected in ungrazed plants. Pasture means were analyzed using variety, SR (continuous variable), and variety x SR as sources of variation. A single regression coefficient for SR was obtained from a model that did not include variety x SR. This may be used for predictions when the variety x SR interaction is non-significant (P>.20). Maximum differences due to SR for each year were estimated by multiplying the SR regression coefficient by the range of SR. Gain/ha was not affected (P>.19) by variety during the four years, and the magnitude of the effect of variety was small as compared with the effect of SR. Grain yield of semidwarf varieties in yr 1 and 2 was very sensitive to SR even though cattle were removed from pastures at first hollow stem.

Year	Gain/ha, kg				Grain yield, kg/ha			
	1	2	3	4	1	2	3	4
Variety	.19	.46	.83	.83	.85	**	.58	.74
SR	**	***	***	***	***	***	.31	.18
Variety x SR	.34	.22	.90	.68	.78	.14	.59	.99
Coefficient for SR	-44.0	113.9	91.3	92.2	-912	-403	73	-454
SR range, steer/ha	.82	1.01	1.48	1.48	.82	1.01	1.48	1.48
Difference over SR	-.36	115	135	137	-747	-407	108	-672

\*=P<.10; \*\*=P<.05; \*\*\*P<.01

**Key Words:** Wheat Pasture, Stocking Rate, Grain Yield

**744 Summer gains of heavy vs light weight steers grazing old world bluestem at three stocking rates.** C. J. Ackerman\*, S. I. Paisley, H. T. Purvis II, G. W. Horn, and T. N. Bodine, *Oklahoma State University, Stillwater.*

Two-hundred and fourteen crossbred light weight steers (average initial wt: 140 ± 17 kg: LT) and 115 crossbred heavier weight steers (average initial weight: 260 ± 17 kg: HW) were used to evaluate the effects of stocking rate on weight gains of steers grazing plains old world bluestem (OWB) from May 29, 1997 through August 5, 1997. Three initial stocking rates were used; light (160 kg BW/ha), moderate (210 kg BW/ha), and heavy (340 kg BW/ha). All stocking rate by cattle type combinations were replicated once. Diet quality samples were collected monthly using ruminally cannulated animals; samples were analyzed for DM, ash, Kjeldahl N, NDF, ADF, and IVOMD. Grazing time (HW steers) and forage intake (HW and LT steers) were measured during August. Grazing time was measured using vibracorders, and forage intake was estimated using Captec boluses. Performance and intake data were analyzed as a replicated 2 x 3 factorial, and diet quality data were analyzed as repeated measures within a replicated 2 x 3 factorial. The slope of linear regression for ADG was -.0003 and -.001 kg/steer for LT and HW steers, and the slope for gain per hectare was 1.60 and .57 kg/ha for LT and HW cattle as stocking rate increased. There were significant (P < .10) stocking rate x month interactions for all diet quality factors, except ash. A significant (P < .01) cattle type x stocking rate interaction was detected for gain/ha data, so simple effects were analyzed. Average daily gain was greater for HW than LT steers, however, LT steers gained more LW/ha. LS means for ADG, Gain/ha, forage intake and grazing time are shown below.

	Cattle Type			Stocking Rate			
	Light	Heavy	SE	Light	Moderate	Heavy	SE
ADG	1.01 <sup>a</sup>	1.21 <sup>b</sup>	.027	1.16 <sup>c</sup>	1.13 <sup>d</sup>	1.03 <sup>d</sup>	.033
Gain, kg/ha	282.1	176.6	5.91	165.9	206.5	315.6	7.25
Forage DM Int., %BW	3.2 <sup>a</sup>	2.5 <sup>b</sup>	.11	3.0	2.7	2.8	.15
Grazing Time, min/d	—	—	—	522.0 <sup>a</sup>	573.5 <sup>ab</sup>	609.5 <sup>b</sup>	19.13

<sup>ab</sup> Means within a row without common superscript differ (P < .05).

<sup>cd</sup> Means within a row without common superscript differ (P < .10).

**Key Words:** Growing Cattle, Stocking Rate

**745 Pasture conditions at the initiation of grazing to optimize forage productivity.** S. M. Kremer\*, J. R. Russell, D. R. Strohbehn, D. G. Morrical, and A. M. Cowen, *Iowa State University, Ames.*

To determine environmental, soil, and sward effects at the initiation of cattle grazing in the spring on seasonal (forage accumulated during the grazing season) and cumulative (seasonal + initial forage mass) forage accumulation (FA), 15 commercial cow-calf producers from southern Iowa were selected by historical initial grazing date. At grazing initiation, twelve .25-m<sup>2</sup> samples were hand-clipped from each pasture and sward heights (SH) measured with a falling plane meter (4.8 kg/m<sup>2</sup>) to determine initial forage mass. At each location, soil temperature and load bearing capacity (LBC) were measured and a soil sample was collected to measure pH and moisture, P, and K concentrations. Cumulative degree days (base=3.85°C) and precipitation at grazing initiation were calculated from NOAA records. At the beginning of each month, at least 3 grazing enclosures were placed on each grazed pasture to determine monthly FA, SH in each enclosure was recorded, and a .25-m<sup>2</sup> forage sample was hand-clipped proximate to each enclosure. At the end of each month, SH was recorded and .25-m<sup>2</sup> hand-clipped forage samples from inside enclosures were obtained. In linear regressions, cumulative and seasonal SH increased with greater soil P (r<sup>2</sup>=.5049 and .5417), soil K (r<sup>2</sup>=.4675 and .4397), and initial forage mass (r<sup>2</sup>=.1984 and .2801). Seasonal SH increased with earlier initial grazing dates (r<sup>2</sup>=.1996) and less accumulated degree days (r<sup>2</sup>=.2364). Cumulative and seasonal FA increased with earlier initial grazing dates (r<sup>2</sup>=.2106 and .3744), lower soil temperatures (r<sup>2</sup>=.2617 and .2874), and greater soil P (r<sup>2</sup>=.3489 and .2598). Cumulative FA increased with greater soil K (r<sup>2</sup>=.4675). In quadratic regressions, cumulative and seasonal SH were correlated to soil P (r<sup>2</sup>=.6310 and .5310) and soil K (r<sup>2</sup>=.5095 and .4401). Cumulative and seasonal FA were correlated to degree days (r<sup>2</sup>=.3630 and .4013) and initial grazing date (r<sup>2</sup>=.3425 and .4088). Cumulative FA was correlated to soil P (r<sup>2</sup>=.3539) and seasonal FA was correlated to soil moisture (r<sup>2</sup>=.3688).

**Key Words:** Forage Accumulation, Pasture, Grazing

**746 Supplemental protein requirements for mature cows grazing stockpiled bermudagrass.** J. S. Wheeler\*, D. L. Lalman, and L. A. Redmon, *Oklahoma State University, Stillwater.*

Eighty-eight mature beef cows (547 kg ± 6.39 kg) were used in a completely random design to determine supplemental protein requirements when grazing stockpiled bermudagrass pastures during late fall and winter. Forty-four cows were allotted to one of four supplemental treatments at each of two locations, one in Central and one in East Central Oklahoma. Treatments were no supplement (CON) or one of three supplements individually fed at .91 kg per head per day and containing 114 (12.5%), 228 (25%), or 341 (37.5%) grams of crude protein from a blend of soybean meal and soybean hulls. Bermudagrass pastures were grazed or clipped to an approximate 10 cm stubble height during late August and fertilized with fifty-seven kg of actual N per hectare. Grazing was deferred until Nov 4th at which time grazing and supplemental treatments were initiated and continued for seventy-nine days. Strip grazing was used to decrease forage waste and prolong forage quality. There was no treatment by location interaction. During the first thirty days of grazing, forage quality was adequate to maintain acceptable animal performance without supplementation. However, a minimum of 228 g CP was required to minimize weight loss during the final forty-nine days of the study. The following table shows least squares means for cumulative weight and body condition change.

Days		Stocking Rate			
		CON	12.5%	25%	37.5%
0-30	WT	18.0	21.0	20.8	20.0
	BCS	0.13	-0.02	-0.02	0.03
30-79	WT <sup>a</sup>	-38.1	-16.6	-8.9	-8.6
	BCS	-0.74	-0.28	-0.40	-0.11
0-79	WT <sup>a</sup>	-20.3	5.9	11.9	11.5
	BCS	-0.65	-0.31	-0.42	-0.09

<sup>a</sup>Linear and Quadratic Effect (P < .05).

**Key Words:** Beef Cattle, Grazing, Supplementation

**747 Evaluation of two forage systems for the year-round management of beef cows.** M. J. Hersom\* and J. R. Russell, *Iowa State University, Ames.*

To compare beef cow-calf production systems using sequential grazing of corn crop residues and stockpiled perennial forages (Year-round System) or drylot hay feeding (Drylot System) for winter management, 20 crossbred cows in midgestation were allotted to four 3.04-ha corn crop residue (CCR) fields to strip-graze for 55 d in two years. After CCR grazing, cows strip-grazed four 6.08-ha fields containing either stockpiled endophyte-free tall fescue and red clover (TF-RC) or smooth bromegrass and red clover (SB-RC) forage for 130 d, with hay offered to maintain a body condition score of 5 (9-point scale). In May, cow-calf pairs and yearlings were allotted to four 4.05-ha smooth bromegrass-orchardgrass-birdsfoot trefoil (SB-OG-BT) pastures to graze by rotational stocking for 40 d. Summer forage from TF-RC and SB-RC fields was harvested as hay and strip-grazed by cow-calf pairs. In early August, yearlings were removed and cow-calf pairs were returned to graze SB-OG-BT pastures. In the Drylot System, 16 similar cows were allotted to drylots simultaneous to initiation of CCR grazing and fed hay as necessary to maintain a body condition score of 5. In May, cow-calf pairs were allotted to four 4.05-ha SB-OG-BT pastures to graze by rotational stocking with first growth forage harvested as hay from 1.56-ha in these pastures in June. Forages were sampled monthly from grazed areas and ungrazed enclosures in CCR, TF-RC and SB-RC pastures during winter and grazed areas of pastures in summer. Cow body condition scores did not differ between systems throughout the year (P < .05). Amounts of hay offered to maintain body condition were 3,081, 208, and 252 kg per cow maintained in a drylot or grazing CCR with TF-RC or SB-RC (P < .05). Forage DM yield and IVDDM, CP, and NDF concentrations of SB-OG-BT pastures did not differ between management systems. Mean seasonal calf (P < .05) and growing animal (P < .05) BW gains from summer components of the Year-round and Drylot systems were 91.7, 134.65 and 190.73, 190.73 kg/ha. Net total winter perennial forage yields of the Year-round and Drylot Systems were 3,962.8 and 1,620.6.

**Key Words:** Cattle, Grazing, Systems

**748 Effects of replacing spring hay feeding with subirrigated meadow grazing on cow/calf production.** M. R. Horney\*, W. Schacht, D. C. Adams, S. S. Waller, T. J. Klopfenstein, and W. W. Stroup, *University of Nebraska - Lincoln*.

Subirrigated meadows are a major source of hay for winter feed in the Nebraska Sandhills. Dominated by cool-season grasses they begin producing forage 2–3 weeks in advance of native upland range. This forage is not normally utilized except as hay, which is harvested after the forage has matured and is declining in quality. In each year of this 3-year study 96 cow/calf pairs were assigned to four grazing/feeding treatments in a 2X2 factorial experiment (calendar period X grazing/feeding management) which evaluated spring/summer meadow grazing impacts on cow/calf performance. Treatments were (1) grazing meadow 10 May to 10 June and grazing upland range 11 June to 25 July; (2) grazing meadow 10 May to 25 July; (3) fed meadow hay in drylot 10 May to 10 June and grazing meadow 11 June to 25 July; and (4) fed meadow hay in drylot 10 May to 10 June and grazing upland range 11 June to 25 July. Treatments 2 and 3 were removed to warm season upland range on 25 July, where they and treatments 1 and 4 remained through weaning (6 October). Cow body weight, body condition score, and calf weight were measured on 10 May, 10 June, 25 July, and 6 October. Body condition score of cows grazing meadow increased an average of 0.4 units over that of hay-fed cows between 10 May and 10 June ( $P < .01$ ), and this difference persisted through weaning. Cow weights generally followed body condition trends. No differences among treatments were detected for pregnancy rate and calving interval ( $P > .1$ ). Calves grazing meadow from 10 May to 10 June gained 8 kg more ( $P < .01$ ) than calves from the hay-fed groups, a difference which also persisted through weaning. There were no treatment effects on calf gain from 11 June to 25 July. Although grazed pastures yielded slightly less forage dry matter than comparable hay meadow from 10 May to 25 July, harvested forage quality was greater. Grazing subirrigated meadow when spring forage first becomes available may improve ranch viability by reducing hay demand, and by increasing cow body condition and calf gains above levels supported by feeding meadow hay.

**Key Words:** Meadow, Grazing, Cattle

**749 Fall versus spring calving cycles for cow/calf productivity on improved tropical grass pastures.** J. R. Carpenter\*<sup>1</sup>, J. P. Tritschler<sup>2</sup>, C. M. Campbell<sup>1</sup>, Y. N. Tamimi<sup>1</sup>, B. A. Buckley<sup>1</sup>, B. R. LeaMaster<sup>1</sup>, and R. Y. Niino-DuPonte<sup>1</sup>, <sup>1</sup>*University of Hawaii at Manoa, Honolulu*, <sup>2</sup>*Applied Epidemiology, Inc., Amherst, MA*.

With the cessation of commercial feedlot processing of cattle in Hawaii, light-weight weanoffs (180 to 250 kg) are being shipped to various parts of North America. Year round forage production in tropical areas may provide beef management options to improve economic returns. This study's objectives were: 1) to compare beef cow/calf productivity during fall versus spring, and 2) compare the effects of previous N fertilization level or inclusion of legumes in kikuyu grass (*Pennisetum clandestinum*) pasture on forage yield and beef production. Five grazing cycles were compared: three in the spring, two in the fall. Cow/calf pairs from mixed breed beef cattle were placed on treatment soon after calving. The three 1.2-ha paddocks per treatment had 6-wk rest and 3-wk grazing cycles. Animals were weighed at the beginning and end of each cycle; pasture swards were clipped during each cycle to determine yield, nutrient (NIRs) and mineral (ICPE) composition. Stocking rates (hd/ha) were 2.57 for unimproved paddocks and 3.80 for improved paddocks during the fall cycle which were much lower ( $P < .01$ ) than during the spring (3.47 and 5.43, respectively). Total live weight gain (kg/ha) and average daily gain (kg/d) for calves were lower ( $P < .05$ ) on unimproved paddocks during the fall (287.7 and .69, respectively) than the spring (517.8 and .91, respectively). The same trend was true for improved paddocks although individual calf performance did not differ ( $P > .05$ ) between the two seasons (average 648.6 kg/ha) and .85 kg/d, respectively). Forage DM production during the fall was only 65% that of the spring. Feed conversion (kg forage per kg beef produced) was also better ( $P < .05$ ) during the spring, averaging 7.5% less. Climate, forage yield, pasture nutrient composition, and fluctuations in calf prices must be considered in comparing the economics of a fall versus spring calving cycle in the tropics.

**Key Words:** Beef Cattle Grazing, Tropical Grasses, Fertilization

**750 Urea-treated, high-moisture milo as a supplement for steers grazing ryegrass.** S. P. Schmidt, T. G. Osborn\*, and W. G. Gregory, *Auburn University, AL*.

A source of fermentable starch fed in small quantities may improve the utilization of forage protein in cattle grazing immature, growing forages without decreasing cellulose digestion and result in faster gains. Starch and protein utilization is greater in urea-treated, high-moisture milo (UT) fed in high-grain diets compared to dry milo. Thus, the objective was to evaluate UT milo as a supplement for steers grazing cool-season forages. In each of three years, 45 crossbred steers (225 to 280 kg initially) were assigned to one of five supplement treatments: (1) control, no supplement; (2) UT milo at 0.4% of body weight (BW); (3) UT milo at 0.8% of BW; (4) UT milo at 0.4% of BW + Rumensin-60 at 0.15% of supplement; (5) dry milo at 0.4% of BW (DRY). Milo was cracked prior to feeding. There were three 1.2-ha paddocks per treatment. High-moisture milo was harvested at 25–30% moisture, mixed with urea (3% urea, DM basis) as a preservative and stored (minimum 4 mo) in a roofed, open-front bay until fed. Steers grazed 145 d (3-yr avg.), and overall ADG was 1.07 kg/d. There were no interactions, but a lack of a treatment response during yr 2 resulted in a year effect ( $P < .0002$ ). The response to supplement was linear ( $P < .06$ ), UT milo was equal to DRY as a supplement ( $P > .10$ ), and Rumensin had no effect on gain ( $P > .10$ ). Efficiency of added gain (kg milo/kg added gain) was approx. 2 times better at 0.4% BW compared to 0.8% BW (6–8 vs. 12–15, respectively), indicating substitution of grain for forage.

**Key Words:** Grazing, Supplement, Milo

**751 Effect of escape protein supplementation and advancing gestation on low-quality forage utilization by beef cows.** K. C. Olson\*, R. C. Cochran, T. J. Jones, E. S. Vanzant, and E. C. Titgemeyer, *Kansas State University, Manhattan*.

Effects of undegradable intake protein (UIP) supply and advancing gestation on low-quality forage use by beef cows were evaluated. Angus x Hereford cows ( $n = 18$ ; BW = 426 kg) were fed one of three supplements (.34% of initial BW DM/d) supplying similar amounts of degradable intake protein (DIP); .09% BW DIP) and increasing amounts of UIP: low (LOW; .05% BW), moderate (MOD; .07% BW), and high (HI; .09% BW). The quantity of DIP offered (approximately 11% of total digestible OM intake) was calculated to maximize forage intake and digestion based on previous work. Supplements were fed during the 15 wk period before the average calving date (March 7). Cows were held in individual pens and given ad libitum access to tallgrass prairie hay (2.1% CP; 6 steers were also used to monitor response to environment). Total OM intake (OMI) tended to decrease linearly ( $P < .16$ ) with increasing UIP as calving approached. All groups had similar total OMI from wk 14 to 9. Digestible OMI (DOMI) did not differ between treatments. Cows and steers had similar forage OMI (% BW) during the first 6 wk of the trial. Thereafter, forage OMI of cows was proportionally greater ( $P < .01$ ) than steers. Total OMI and DOMI generally increased ( $P < .04$  quadratic for LOW and MOD;  $P < .01$  cubic for HI) from 14 to 5 wk prepartum. Digestion of OM tended to increase ( $P < .16$ ) with increasing UIP from 7 to 5 wk prepartum but was similar between treatments from 14 to 8 wk prepartum. Digestion of OM decreased ( $P < .01$ ; linear) for all treatments from 14 to 5 wk prepartum. Daily gain decreased linearly ( $P < .01$ ) as UIP increased; however, body condition score was not affected. In conclusion, when common feedstuffs were used to meet the DIP requirement of pregnant cows grazing tallgrass prairie, positive response to additional UIP was not observed. Cows appeared to compensate for the nutritional demands of advancing pregnancy by consuming more forage OM than was attributable to changing environmental conditions.

**Key Words:** Supplementation, Digestion, Pregnancy

**752 Animal and period effects on *in situ* dry matter degradation of warm-season forages.** D. W. Sanson\*<sup>1</sup>, D. D. Redfean<sup>2</sup>, and D. F. Coombs<sup>3</sup>, *LSU Ag. Center, <sup>1</sup>Rosepine Research Station, Rosepine, <sup>2</sup>Southeast Research Station, Franklinton, and <sup>3</sup>Dean Lee Research Station, Alexandria.*

The effect of animal and period on *in situ* degradation of forages was determined using bermudagrass and bahiagrass forages harvested at five different stages of growth in each of two growing periods. A total of 20 forage samples were evaluated. A five X five Latin square was used with five animals and five periods. Duplicate bags (10 X 20 cm) were incubated for 2, 8, 16, 24, 36, 48, 72, and 96 h. Prior to incubation, bags were pre-soaked for 15 minutes in 39°C tap water. Bags within a period were removed at the same time, washed with a automatic washing machine until rinse water was clear, and dried at 40°C for 72 h. Animals were 3 yr old gestating cows (511 kg) housed in a 25.4 by 50.8 m pen and received bahiagrass hay free-choice during all periods. The first three periods were consecutive, beginning December 1. There were 5 days between the end of period 3 and the start of period 4, and 10 days between the end of period 4 and the beginning of period 5. Data were analyzed with GLM procedures of SAS using a model appropriate for a five X five Latin square. There was an effect of period ( $P < .0001$ ) on all incubation times, however there was no consistent pattern to the effect of period on DM degradation. Effect of animal was dependant on incubation times. There was no effect on DM degradation at hour 2 ( $P = .65$ ), 8 ( $P = .09$ ), or 96 ( $P = .20$ ) h. There was an effect of animal on other incubation times ( $P < .03$ ), with animal 4 having lower DM disappearance than the other animals during these times except for hour 48. There were differences among the other animals at various times. These data indicate that both animal and period affect *in situ* DM disappearance and that both should be considered when designing experiments in this area.

**Key Words:** Bermudagrass, Bahiagrass, *In Situ* Dry Matter Disappearance

**753 Ruminant preference for alfalfa hay harvested in the afternoon.** D. S. Fisher\*<sup>1</sup>, J. C. Burns<sup>2</sup>, and H. F. Mayland<sup>3</sup>, *<sup>1</sup>USDA-ARS, Watkinsville, GA, <sup>2</sup>USDA-ARS and North Carolina State University, Raleigh, <sup>3</sup>USDA-ARS, Kimberly, ID.*

In Forage, the concentration of nonstructural carbohydrate varies diurnally with the highest levels observed in the afternoon. Previously, cattle, goats, and sheep preferred fescue hay harvested in the afternoon over fescue hay harvested in the morning of the same 24-h period. This study tested for variation in ruminant preference for alfalfa harvested within the same 24-h period. Alfalfa was mowed at sundown (PM) and again the next morning at dawn (AM). This process was repeated 3 times resulting in 6 hays representing 3 harvests (Hay 1, 8 July PM; Hay 2, 9 July AM; Hay 3, 14 August PM; Hay 4, 15 August AM; Hay 5, 22 September PM; Hay 6, 23 September AM). The hays were field dried, baled, and sliced into 100-mm sections prior to feeding. Three experiments were conducted (Exp. 1, sheep; Exp. 2, goats; and Exp. 3, cattle) utilizing six animals in each case. Hays were offered alone as meals to each animal during an adaptation phase prior to the experimental phase. In the experimental phase, each possible pair of hays (15 pairs) was presented to sheep and goats for approximately 2.5 h and to cattle for approximately .5 h. Presentation of the pairs was randomized. This design allowed statistical analysis by multidimensional scaling and indicated that the animals were basing selection on two criteria. In all three harvests in the three experiments, preference for PM hays was greater than for AM hays ( $p < .01$ ). Cattle (Exp. 1) preference varied among the three harvests ( $p < .01$ ) but this effect was not significant for sheep ( $p = .09$ ) or goats ( $p = .15$ ). However, with goats (Exp. 3), a significant interaction was found because they preferred the PM hays more strongly in the second and third harvests than in the first ( $p = 0.01$ ). Shifting the mowing of alfalfa hay from morning to late afternoon was effective in increasing forage preference in these three ruminant species.

**Key Words:** Feeding Preferences, Voluntary Intake

**754 Aerobic stability of Rhizoma peanut (*Arachis glabrata*) silage treated with salt in a tropical environment.** F. Arias, J. L. Martinez, E. O. Riquelme, and A. A. Rodriguez, *Department of Animal Science, University of Puerto Rico, Mayaguez.*

The effect of salt (KCl or NaCl) on the aerobic stability of Rhizoma peanut (*Arachis glabrata*) ensiled in a tropical environment was determined. Rhizoma peanut (50% DM) was harvested at the Juana Diaz Agricultural Experimental Station, University of Puerto Rico, and was mechanically chopped into 2.5 cm pieces. Chopped forage was ensiled in laboratory PVC silos (1.8 kg) and assigned to one of three treatments; no additive (control; T1), NaCl, (2% of fresh material; T2), and KCl (2% of fresh material, T3). Two silos were prepared for each treatment and ensiled for 60 d. After emptying, silage was placed into styrofoam containers lined with plastic, exposed to air for 0, 1, and 3 d, and analyzed for pH and *in vitro* dry matter digestibility (IVDMD). Temperature was monitored daily, and dry matter recovery (DMR) was determined after 1 and 3 d of aerobic exposure. Over the entire aerobic exposure period, Rhizoma peanut silage treated with T3 tended to have lower pH ( $P < 0.07$ ) as compared to T1 or T2. Neither salt additive influenced ( $P < 0.05$ ) temperature or IVDMD. Ensiling of Rhizoma peanut with T3 had increased ( $P < 0.01$ ) DMR (93.20%) as compared with T1 (85.55%) or T2 (85.99%). In summary, addition of KCl at ensiling improved the aerobic stability of Rhizoma peanut ensiled in a tropical environment as evidenced by lower pH and higher DMR.

**Key Words:** Rhizoma Peanut, Aerobic Stability, Salt

**755 Triple-crop forage production under dairy manure irrigation.** G. L. Newton\*<sup>1</sup>, G. Vellidis<sup>1</sup>, G. J. Gascho<sup>1</sup>, W. G. Hudson, III<sup>1</sup>, R. K. Hubbard<sup>2</sup>, R. R. Lowrance<sup>2</sup>, R. N. Gates<sup>2</sup>, A. W. Johnson<sup>2</sup>, *<sup>1</sup>University of Georgia and <sup>2</sup>USDA-ARS, Tifton.*

Two forage systems producing three different crops of silage and/or hay per year (CBR—temperate corn silage/bermuda hay/rye-clover haylage or CCR—temperate corn silage/tropical corn silage/rye-clover haylage) on the same land are being evaluated. Each of these systems is being fertilized with irrigated dairy manure (about 600 kg of N/ha/y) and commercial fertilizer (based on soil test), in both small plots and under a center pivot system. This project is an attempt to develop and demonstrate a manure utilization system that is capable of utilizing manure from intensive operations; that includes landscape management to utilize or trap nutrients potentially moving from the site as a redundancy; that results in predictable nutrient utilization and movement; that is economically as well as environmentally sound; that considers positive or negative effects of soil dwelling invertebrates; and that produces high quality feedstuffs. The CCR sequence has produced 35% greater forage dry matter yields than CBR. Irrigated manure fertilization has produced a greater than 20% forage dry matter yield advantage over commercial fertilizer. Control of nematodes has produced a 2% greater forage dry matter yield compared to untreated plots. Surface and subsurface drainage from manure application areas has shown a five fold reduction in nitrate concentration after passage through an adjacent riparian wetland. Intensive forage production systems are capable of recycling relatively large amounts of manure nutrients per unit of land area while having limited environmental impact.

**Key Words:** Manure, Forage, Fertilizer

**756 Effect of temperature on the aerobic stability of forage sorghum silage.** A. A. Rodriguez, E. O. Riquelme, and J. A. Acevedo, *University of Puerto Rico, Mayaguez Campus.*

The effect of temperature on the aerobic stability of forage sorghum silage was determined. Second cutting forage sorghum (32.20% DM) was harvested at 75 d of growth in the USDA, Tropical Agricultural Research Center at Isabela, Puerto Rico. Forage was chopped into 2.5 cm pieces and placed into 24 PVC lab-scale micro-silos (1.8 kg). Twelve micro-silos were maintained at room temperature (RT; 28-30 °C) and 12 silos at controlled temperature (CT; 20 °C) during the fermentation process (FP). After 60 d of ensiling, 6 silos from each temperature were opened and silage (400 g) exposed to aerobic conditions (AE) for 3 d at the same temperature of fermentation. The other 6 silos from each temperature were exposed to aerobic conditions at the inverse temperature maintained during the fermentation process. For all treatments, ensiled material was analyzed for pH and IVDMD after 0, 1, and 3 of aerobic exposure. Temperature was monitored daily and dry matter recovery (DMR) was calculated after 1 and 3 d. Silage exposed to air at CT had lower ( $P < 0.01$ ) pH and higher ( $P < 0.01$ ) IVDMD and DMR than silage exposed to air at RT during the entire aerobic exposure period. After 1 and 3 d of aerobic exposure, temperature was decreased ( $P < 0.01$ ) in silage exposed to air at CT as compared to vegetative material in RT. Results indicated that a greater instability occurred in silage maintained at RT during the FP or AE as compared to ailage kept at CT.

**Key Words:** Forage Sorghum , Aerobic Stability, Temperature

**757 Nutritive value of various elephantgrass (*Penisetum purpureum* Schum.) genotypes.** L. P. Passos<sup>1\*</sup>, H. Carneiro<sup>1,2</sup>, T. Sahlu<sup>3</sup>, R. Puchala<sup>3</sup>, and M. C. Vitigal<sup>1</sup>, <sup>1</sup>Embrapa, Gado de Leite <sup>2</sup>CNPq scholarship <sup>3</sup>E (Kika) de la Garza Institute for Goat Research, Langston University, Langston, OK.

More than 200 cultivars of elephantgrass exist. Seventeen cultivars were evaluated for leaf neutral detergent fiber (NDF, in %DM), crude protein content (CP, in DM), nylon bag 24h degradability (DEG, in %) and amino acid composition (mg AA/g DM) using 30-day-old plants. NDF averaged 59.8. NDF was lowest for Cachoeiro do Itapemirim (Cl), Teresópolis, CNPGL 91, F27-5 (F27-5), Hexaplóide 201 (H201), and Dwarf cultivars. CP averaged 17.7%, with highest levels Merker Comum, Pindamonhangaba, Pioneiro, H201, Mott and F27-5. DEG was apparently the highest ( $P < .05$ ) for cultivars Pioneiro (79%) and F27-5 (78%) and the lowest for the Mineiro cultivar (66%). Concentration of cysteine, histidine, isoleucine, methionine and tyrosine did not vary ( $P > .05$ ) markedly among cultivars. However, the cultivar Cameroon Piracicaba was highest ( $P < .05$ ) in alanine (17), arginine (7), aspartic acid (47), glutamic acid (19), glycine (13), leucine (12), lysine (7.9), phenylalanine (6.9), serine (12.9) and threonine (7.2). Cultivars Cl, F27-5 and Pioneiro tended to have the poorest AA quality. These differences among cultivars in composition may be responsible for wide differences in growth and lactation performance of grazing ruminants.

**Key Words:** Elephantgrass, Degradability, Amino acids

**758 Tannin and undegradable protein in birdsfoot trefoil at different stages of maturity.** K. A. Cassida<sup>1\*</sup>, T. S. Griffin<sup>2</sup>, O. B. Hesterman<sup>3</sup>, and S. R. Rust<sup>4</sup>, <sup>1</sup>University of Arkansas <sup>2</sup>University of Maine <sup>3</sup>W.K. Kellogg Foundation, Michigan <sup>4</sup>Michigan State University.

Birdsfoot trefoil is believed to be a good source of rumen escape protein (EP) as a result of its tannin content. We measured in situ EP, in situ degradable dry matter, NDF, ADF, crude protein, and tannin in Norcen birdsfoot trefoil (*Lotus corniculatus* L.) at three stages of maturity in spring and summer cuttings from 1991 (seeding year) to 1993. Relationships among forage composition, leaf:stem ratio, mean stage weight (MSW), days of growth, and growing degree days (GDD) were investigated using linear regression. Tannin concentration increased with maturity in four of six cuttings and was higher in regrowth than spring growth in the two established years. Across all data, undegradable protein concentration was related to tannin concentration ( $R^2 = .49$ ,  $P < .01$ ). Within cuttings, days of growth, GDD, and MSW were better predictors of EP than was tannin concentration.

year	— Spring Cutting —			— Summer Cutting —		
	Date 1	Date 2	Date 3	Date 1	Date 2	Date 3
	Tannin (% catechin equivalent)					
1991	2.98c	3.59b	8.60a	3.84	3.34	2.25
1992	1.78	1.57	1.72	4.42c	5.09b	8.48a
1993	2.94c	5.19b	6.05a	4.96b	7.74a	7.77a
	Escape Protein (%)					
1991	1.68c	2.00b	2.49a	1.55	1.57	1.70
1992	1.12c	1.38b	2.01a	1.34c	1.55b	2.01a
1993	1.54b	2.00a	2.14a	2.82	3.03	2.91

abc Within cuttings for years, means with differing letters are different.

**Key Words:** Undegradable Protein, Tannin, Birdsfoot Trefoil

**759 Investigation of brown midrib sorghum silage in diets for lactating dairy cattle.** G. Aydin\*, *University of Nebraska, Lincoln.*

Sixteen Holstein cows (4 primiparous) were assigned to four diets in a replicated 4 x 4 Latin square with 4-wk periods to compare the effect of brown midrib (BMR) sorghum silage with alfalfa, corn, and normal sorghum silages on lactational performance. Additionally, 3 ruminally fistulated cows were assigned to the same diets in a 3 x 4 Youden square for measurement of ruminal characteristics. Diets were fed as isonitrogenous total mixed rations that contained 65% silage (DM basis). The DMI was greater for the corn (25.3 kg/d) and alfalfa (24.0 kg/d) than for the brown midrib (22.7 kg/d) and normal sorghum (21.5 kg/d) diets ( $p < 0.05$ ). The production of 4% FCM was highest for the corn diet (29 kg/d) and lowest for the normal sorghum diet (20.4 kg/d;  $p < 0.05$ ). The production of milk fat, milk protein and lactose was significantly ( $p < 0.05$ ) lower for the normal sorghum diet than for the other diets. Ruminal pH and total VFA concentration were similar for all diets. Total chewing time was least for the corn silage diet (623 vs. 719 min/d;  $p < 0.05$ ). In situ digestion kinetics of each silage was measured. Rate of digestion (/h) greatest ( $p < 0.05$ ) for alfalfa and BMR silages, lag (h) was longest for corn silage, and potential extent of digestion (%) was least for the alfalfa silage ( $p < 0.05$ ). There was no effect ( $p > 0.05$ ) of diet on rate of silage passage from the rumen (.038/h). The BMR sorghum resulted in significantly better production of FCM compared with the normal sorghum silage.

**Key Words:** Sorghum, Brown Midrib, Milk Production

**760 Corn silage as a substitute of small grain winter pasture for growing heifers.** N. A. Juan\*, R. R. Jouli, and A. J. Pordomingo, *EEA "Guillermo Covas", INTA Anguil, La Pampa (Argentina)*.

Small grains (oats, rye, barley) provide high quality winter forage in the Semiarid-Subhumid Pampean Region, but their dry matter (DM) yield depends heavily on climatic conditions. On the other hand, predictability of DM yield is greater for summer annual crops. Inclusion of corn silage in the system would make production more stable. The objective of this study was to evaluate the effect of partial substitution of small grain forage for corn silage on DM intake (DMI) and average daily gain (ADG) of growing heifers. The study was carried out at Anguil, La Pampa, throughout 104 days in 1996 winter. Angus heifers (average age=9-10 months, live weight (LW)=191kg) were randomly assigned to three treatments (diets): I) Oats grazing (ad libitum), no silage, II) oats (66% of potential DMI, 2% of LW) + silage (ad libitum), and III) oats (33% of potential DMI, 1% of LW) + silage (ad libitum). Two paddocks (reps) per treatment and 10 animals per rep were used. Oats (2890 kg DM ha<sup>-1</sup>, 34.8% DM, 46.1% FDN, 12.0% PB, and 71.3% IVDMD on the average) were grazed in two-day strips. Forage supply was estimated weekly to determine strip area. Corn silage ('Dekalb 4F-37' hybrid, fine chopped, dough grain stage) had 31.7% DM, 8.9% PB, 60.1% FDN, and 64.1% IVDMD). Soybean meal was added when necessary to maintain PB in at least 13%. ADG and DMI were estimated every 21 and 2 days, respectively. Average silage intake was 2.32±.04 kg DM animal<sup>-1</sup>.day<sup>-1</sup> (1.02% of LW) and 4.37±.05 (1.99%) for treatments II and III, respectively. Total DMI (silage + forage), either expressed as kgDM.animal<sup>-1</sup>.day<sup>-1</sup> or as % of LW, was similar (P>.05) in all treatments (6.95 [2.98%], 6.62 [2.78%], and 6.52 [2.79%], respectively). Treatments did not differ (P>.05) either in final LW (276, 281, and 278 kg animal<sup>-1</sup>) or ADG (.820, .837, and .850 kg animal<sup>-1</sup>.day<sup>-1</sup>). We conclude that partial replacement of oats pasture for corn silage would result in similar performance of young grazing heifers than oats pasture alone.

**Key Words:** Corn Silage, Oats Pasture, Grazing Heifers

**761 Effect of hybrid and processing on digestive characteristics of corn silage.** C. G. Doggett\*, C. W. Hunt<sup>1</sup>, J. G. Andrae<sup>1</sup>, G. T. Pritchard<sup>1</sup>, W. Kezar<sup>3</sup>, and J. H. Harrison<sup>2</sup>, <sup>1</sup> *University of Idaho*, <sup>2</sup> *Washington State University*, and <sup>3</sup> *Pioneer Hi-Bred International, Inc.*

Four ruminally cannulated beef heifers were used in a 4 x 4 Latin square experiment with a 2 x 2 factorial arrangement of treatments to determine the effect of processing and hybrid (Pioneer 3335 and 3394) on ruminal fermentation and digestion of corn silage. Processing was accomplished with a field chopper equipped with corrugated rollers. Heifers were fed diets consisting of 70% treatment silages and 30% alfalfa hay. Samples of whole plant and stover were collected and incubated without further processing in 30 x 35 cm nylon bags. In situ DM disappearance of whole plant was greater (P < .08) for hybrid 3335 than 3394 at 8, 16, 24, and 48 h of incubation, which was associated with similar numerical trends for starch disappearance. In situ NDF and ADF disappearance, however was lower for 3335 (P < .05) after 48 h of incubation. Consistent with in situ observations, in vivo digestibility of starch was greater (P < .03) and NDF and ADF digestibility was lower (P < .06) for 3335 than 3394. The net result was no hybrid effect for DM digestibility. Processing increased whole plant in situ DM (P < .02) and starch (P < .06) disappearance at all incubation times and NDF disappearance at 48 h. Processing increased (P < .001) in vivo starch digestibility and decreased (P < .04) NDF and ADF digestibility resulting in only a numerical increase in DM digestibility. In situ ADF disappearance of stover samples was increased, however DM and NDF disappearance was not affected by processing. Ruminant molar proportion of acetate was lower and propionate was higher for heifers fed processed than unprocessed silage suggesting improved ruminal fermentation of starch from processing. Results indicate hybrid and processing are important factors affecting corn silage quality.

**Key Words:** Corn silage, Processing, Hybrid

**762 Enzyme-treated forages for lactating cows.** L. Kung, Jr.\*<sup>1</sup>, R. J. Treacher<sup>2</sup>, and M. A. Cohen<sup>1</sup>, <sup>1</sup> *University of Delaware, Newark*, <sup>2</sup> *Finnfeeds Intl., Marlborough, U.K.*

We evaluated the effect of spraying enzyme formulations onto forages just prior to feeding for lactating cows. In experiments conducted between February and May in 2 consecutive yr, diets consisted of 45% corn silage (1/2 to 2/3 milk line), 5% alfalfa hay, and 50% of a pelleted concentrate (DMB). Forages were sprayed with liquid-enzymes prior to mixing with the concentrate to form a TMR. In experiment 1, the treatments on forages were 1) untreated, 2) enzyme cellulase enzyme complex A (CEC-A), 3,500 CMCase units and xylanase enzyme complex B (XEC-B), 16,000 xylanase units, and 3) high enzyme, CEC-A, 8,800 CMCase units and XEC-B, 40,000 xylanase units. In experiment 2, the forage treatments were 1) untreated, 2) CEC-A, 3,700 CMCase units and XEC-B, 14,000 xylanase units, and 3) cellulase enzyme complex D (CEC-D), 3,600 CMCase and XEC-B 11,000 xylanase units. In both experiments, 10 cows were randomly allocated to each diet based on pretreatment milk, DIM (average of 109), and parity. In experiment 1, cows fed diet 2 produced more milk (39.5 kg/d) than those fed diet 1 (37.0 kg/d, P < 0.10) and those fed diet 3 (36.2 kg/d, P < 0.04). Fat test was depressed (P < 0.06) by the high level of enzyme treatment in diet 3 when compared to diet 1. DM intake was unaffected by treatment (average of 22.1 kg/d). In experiment 1, *in vitro* NDF digestion after 12 h was unaffected by treatment but, after 48 h of digestion, NDF digestion was lower (P < 0.05) in diet 3 than in diet 1. In experiment 2, cows fed diet 3 (35.4 kg/d) produced more milk than those fed diet 1 (32.9 kg/d, P < 0.07) and numerically more than those fed diet 2 (33.6 kg/d). Milk fat and protein were similar among treatments but numerically lower for cows fed enzyme-treated forages. DM intake was similar among treatments (average of 21.6 kg/d). *In vitro* NDF digestion after 12 and 48 h was similar among treatments. Direct-spraying of forages with enzymes prior to feeding can improve milk production from lactating dairy cows.

**Key Words:** Enzymes, Forages, Lactation

**763 The effects of *Lactobacillus plantarum* (LP), *Lactobacillus buchmeri* (LB) and a propionic acid-based preservative on the fermentation and aerobic stability of corn silage and the aerobic stability of a TMR.** N. K. Ranjit\*, M. A. Cohen, R. C. Smoot, J. Y. Tavares, and L. Kung, Jr., *Department of Animal & Food Sciences, University of Delaware, Newark.*

Biological and chemical treatments were tested for their effects on the fermentation and aerobic stability of silage. Whole-plant corn (1/2 milk line, 31.3% DM) was ensiled in quadruplicate 20 L laboratory silos after the following treatments: 1) Untreated; 2) LP strain 30114, 1 x 10<sup>6</sup> cfu/g of fresh forage; 3) LP strain 30115, 1 x 10<sup>6</sup> cfu/g; 4) LB, 1 x 10<sup>5</sup> cfu/g; 5) LB, 1 x 10<sup>6</sup> cfu/g; and 6) Storage Mate™ II (SM, a buffered propionic acid-based product), 60 g/60 kg. After 102 d of ensiling, silage treated with the high level of LB had greater amounts (P < 0.05) of acetate compared to all other treatments. Acetic acid content for treatments 1 through 6 were 1.82, 1.82, 1.68, 1.83, 3.60, and 2.01% (DMB), respectively. Lactic acid content was lower (P < 0.05) in silage treated with the high level of LB (6.3%) compared to the untreated silage (7.7%), but was similar to other treated silages. Yeast and molds were markedly lower (P < 0.05) in treatment 5 (3.09 log cfu/g) when compared to the other treatments (an average of 5.94 log cfu/g). A TMR was formulated using the untreated and treated corn silages (30%, DMB), alfalfa silage (30%), and concentrate (40%). Silages and TMR were exposed to air with a temperature of about 23°C. Aerobic stability was defined as the number of hours before a 2°C rise in the temperature of the silages alone or of the TMR. Yeast counts on the silage and TMR were correlated with the aerobic stability (r<sup>2</sup> = 0.91). Hours of aerobic stability for treatments 1 through 6, were 26, 29, 34, 36, > 200, and 38, respectively for silages only and 48, 47, 52, 53, 128, and 56, respectively for the corresponding TMR. SM and the high level of LB prolonged (P < 0.05) the aerobic stability of silage compared to untreated silage. Only the high level of LB improved (P < 0.05) the aerobic stability of the TMR. The LP strains had minor effects on silage fermentation and aerobic stability.

**Key Words:** Silage, TMR, Aerobic Stability

**764 Effects of substituting high or low quality forage with corn grain, dry corn gluten feed or dry distillers grains on digestibility.** P. Summer\* and A. Trenkle, *Iowa State University, Ames.*

High fiber, corn by-products were compared with corn as energy sources when fed in mixed diets with either low or high quality forage. A digestibility trial, utilizing eight crossbred steers weighing 337 kg ± 74kg, was conducted in an 8 x 8 Latin square. Ground corn stover (S) and alfalfa hay (A) were fed alone or with corn grain (C), dry corn gluten feed (CGF) or dry distillers grains (DDG) in a 1:1 ratio. A 5-d collection period followed 16-d adjustment. Results are shown in the table. DMD of diets containing either forage was increased when fed with concentrates (P<.01). DMD was similar for S and A diets when fed with CGF and DDG. DMD of S+C was less than S+CGF or S+DDG (P<.01). DMD of A+C was greater than A+CGF or A+DDG (P<.01). Feeding C with S did not decrease NDFD (P=.18) whereas feeding CGF or DDG with S increased NDFD (P<.01). There was no effect upon NDFD when any of the concentrates were fed with A. Feeding any of the concentrates with either forage increased DE (P<.01). Feeding CGF or DDG instead of C with A did not increase DE as it did with S. Feeding C with A decreased rumen NH<sub>3</sub>N (P<.05) but not when fed with S (P<.14). Feeding C with A decreased ruminal acetate:propionate ratio (P<.05) but not when fed with S. These results indicate that corn S is more susceptible to negative feed interactions caused by C than is A and that depression in DMD is largely due to a reduction in the digestion of non cell wall portion of these diets.

Item	S	S+ C	S+ CGF	S+ DDG	A	A+ C	A+ CGF	A+ DDG	SEM
DM intake, kg/d	2.92	6.47	6.88	6.17	6.47	9.27	9.36	9.35	0.22
Digest, % DM	39.1	53.7	58.9	59.4	55.8	66.1	60.1	61.8	1.01
Digest, % NDF	45.4	42.8	57.4	58.2	55.8	55.1	57.2	59.2	1.37
Digest, % ADF	44.0	40.0	50.6	52.1	50.7	47.9	46.8	51.5	1.58
Digest, % Energy	39.4	54.7	60.4	62.4	50.2	64.2	59.8	62.1	1.03
DE, Mcal/kg	1.65	2.34	2.57	2.86	2.02	2.76	2.57	2.89	
Rumen NH <sub>3</sub> N	2.21	1.18	4.64	4.95	13.06	5.56	9.63	11.0	1.28
Acet:Prop.	3.53	3.59	3.10	2.84	3.89	3.33	3.22	2.89	0.18

**Key Words:** Cattle, Forages, Digestion

**765 Supplemental feathermeal and bloodmeal effects on digestibility and intake of low quality diets in postpartum range ewes.** L. Appeddu-Richards\*, J. B. Richards, C. L. Schultz, C. R. Krehbiel, and M. K. Petersen, *New Mexico State University, Las Cruces.*

Feathermeal(FM) and Bloodmeal(BM) were fed to increase UIP to study changes in low quality diet use when supplementing postpartum ewes. Ewes were offered hay at 2.5% BW (avg ewe=55 kg) and received a low UIP Control(C); cottonseed meal(CSM); 15%FM:2.4%BM (FM15); 30%FM:4.8%BM (FM30); or 45%FM:7.2%BM (FM45) supplement. Hay N was different among periods 1,2,and 3 (9.6,4.8,and 7.7 g N/kg hay). Hay plus C, CSM, FM15, FM30,or FM45, respectively, provided increasing N intakes (g/48 h) in periods 1 (31,34,36,41,or 42) and 2 (17,22,22,27,or 31). CSM and FM15 provided equal N with plant vs animal sources. Three ewes were not supplemented(NS) in period 2 (12 g N/48 h). Treatments in period 3 provided equal N intakes above C (23,33,32,32,or 32 g/48 h for C, CSM, FM15, FM30,or FM45),but had increasing UIP:DIP. Supplements were isocaloric. Orts were weighed to estimate hay intake. Feces were collected and composited over two 48-h times per period. N and NDF were determined in feeds and feces. Hay intake did not change in period 1, but was highest (P=.07) in FM30- and FM45-fed ewes in period 2. Ewes fed C in period 3 had the lowest (P=.08) hay intake. More N (P<.05) was retained by supplementing vs NS in period 2. N retention increased numerically as more N was consumed in periods 1 and 2, but was highest in FM15- and FM30-fed ewes in period 3. NDF digestibility tended (P<.2) to be improved by supplementing vs NS, but decreased (P=.16) in ewes fed FM30 and FM45 in period 3. Improvements reached a threshold when the 15% FM supplement was fed. Increasing UIP can improve ewe N balance and use of low quality forage when DIP is held constant.

**Key Words:** Protein, Ewe, Digestibility

**766 Digestion and biohydrogenation of foraged-based diets containing soybean oil.** J. L. Carr\*, L. A. Burgwald-Balstad, M. B. Whitney, and B. W. Hess, *University of Wyoming, Laramie.*

The objectives of this experiment were to determine the effects of soybean oil inclusion on in vitro digestion and biohydrogenation of forage-based diets. Diets were bromegrass hay (H), 75% bromegrass hay and 25% corn-based supplement (C), C with 3% added soybean oil (O3), and C with 6% added soybean oil (O6). Supplemental treatments were formulated to be isonitrogenous and isocaloric. Soybean oil replaced corn on a TDN basis, and soybean meal was included at increasing levels in the O3 and O6 diets. Each of the four diets were inoculated with ruminal fluid composited from two steers consuming bromegrass hay. In addition to determining IVDMD, aliquots of fermentation fluid were taken at h 0, 3, 6, 9, 12, 18, 24, and 48 to determine ammonia concentration. Fermentation residues were obtained at h 0, 9, 12, 18, 24, and 48 and analyzed for fatty acids. Fatty acids were expressed as percentage of residual DM. Data were analyzed as a completely randomized design. In vitro dry matter digestibility was greater (P = .07) for C and O3 compared to H and O6. Diet x time interactions were noted for ammonia concentrations and residual fatty acid composition. Overall, in vitro ammonia concentration increased (P < .001) in diets containing greater quantities of soybean meal (O3 and O6). Percentage of 16:0, 18:1, 18:2, and 18:3 were greater (P < .05) for O3 and O6 at 0 h, reflecting the addition of soybean oil to these diets. Percentage of 16:0, 18:0, and 18:1 remained greater for diets with added soybean oil, with the largest difference occurring at 48 h. Percentage of 18:2 decreased (P < .05) from 0 to 48 h for O3 and O6, but these diets had the greatest 18:2 levels at 48 h. Percentage of 18:3 in fermentation residues did not differ (P > .10) among treatments from 9 to 48 h. Addition of 3% soybean oil to a forage-based diet did not affect IVDMD. Changes in percentage of fatty acids in fermentation residues reflect biohydrogenation by the ruminal microorganism; however, only 18:3 was hydrogenated to the same extent across all diets.

**Key Words:** Digestion, Biohydrogenation, Fatty Acids

**767 Extrusion as a method of partially protecting alfalfa proteins from ruminal proteolysis.** C. M. Tsopito\*, B. W. Hess, and L. A. Burgwald-Balstad, *University of Wyoming, Laramie.*

The objectives of this study were to investigate the possibility of partially protecting alfalfa proteins from ruminal microbial degradation. Three bales of alfalfa hay were core sampled, leaves were then separated from the stems by sieving through a wire mesh screen (1 cm<sup>2</sup>). The three components resulting from this process were alfalfa core sample (C), alfalfa leaves (L), and alfalfa stems (S). These components were then ground through a Wiley mill (1 mm screen). One half of each component was brought to a 30% moisture content and extruded through a Stimpson model 422D meat grinder (< 100° C) to form pellets (0.95 cm; P). The products, P and non-extruded (D), were then used in a 3 x 2 completely randomized factorial designed experiment to evaluate the treatments for NDF, ADF, CP and protein fractions A, B<sub>1</sub>, B<sub>2</sub>, B<sub>3</sub>, C, and in vitro ammonia production (0, 2, 4, 6, 8, 12, 16, 24, and 48h). Alfalfa stems had the greatest (P = .0001) content of NDF, ADF and fraction C, but alfalfa leaves had the greatest (P = .0001) CP, B<sub>1</sub>, B<sub>3</sub>, and in vitro ammonia production. Core samples had greatest (P = .0001) B<sub>2</sub> content. Extruding increased (P = .0001) NDF and reduced (P = .0004) ADF of all alfalfa components. Crude protein content of all the treatments was not affected (P = .73) by extrusion. Protein fractions A, B<sub>1</sub> and B<sub>2</sub> were reduced (P < .01), fraction C was not affected (P > .91), and fraction B<sub>3</sub> was increased (P = .0001) by the extrusion process. Overall, extruding decreased (P = .0001) in vitro ammonia production by 2.00, 2.03 and 2.91 mg/dL for L, C, and S, respectively. Ammonia production for all components increased with time, with the greatest (P = .0001) production occurring at 48 h for LD. In conclusion, extruding the alfalfa components decreased degradable protein fractions and increased slowly degradable protein fraction without affecting the unavailable protein fraction. This appeared to have changed protein fermentation characteristics, which would presumably enhance utilization of alfalfa proteins.

**Key Words:** Alfalfa, Protein, Fermentation

**768** Effects of liquid supplemental fat on milk yield and composition, dry matter digestibility, nitrogen retention and blood urea nitrogen in beef cows fed low quality diets. J. S. Serrato-Corona\*, L. Appeddu-Richards, E. Castellanos-Perez, R. Cabanillas-Cruz, R. Lopez-Ordaz, J. Sawyer, M. Brown, J. Richards, and M. K. Petersen, *New Mexico State University, Las Cruces*.

Two experiments were conducted to investigate the effect of supplemental fat on milk yield and composition, dry matter digestibility, nitrogen retention and blood urea nitrogen (BUN) concentration in beef cows fed low quality diets. In experiment 1, twenty four mature lactating beef cows were randomly assigned to one of two molasses based supplements containing 30.0% CP; FAT (105 g/d fat) or NOFAT (supplement without fat). Basal diet consisted of 75% mature lovegrass hay (4.1% CP) and 25% alfalfa hay (17.2% CP) at 2.2% of BW. Milk yield and composition were recorded before and at 12-d and 21-d of supplementation. On 28-d serum samples were collected for BUN determination. In experiment 2, nine ruminally cannulated beef cows were randomly assigned to one of three treatment supplements; Control (C) no supplement, FAT and NOFAT. Cows were fed the same basal diet as in Exp. 1 at 2.1% BW. Dry matter digestibility (DMD) and nitrogen retention were determined by conducting a total fecal and urine collection. On 28-d, BUN and non-esterified fatty acids (NEFA) were determined. In Exp. 1 milk yield was similar ( $P > .27$ ) between treatments at 12-d, however it was greater for cows fed FAT ( $P < .01$ ) at 21-d. Milk composition was unaffected by supplemental treatments. Blood urea nitrogen, glucose and NEFA concentrations were not influenced by supplement. In Exp. 2 digestibility of DM was unaffected ( $P > .39$ ) by supplement. Protein retention was highest ( $183.3 \pm 17.8$  g/d) in cow fed C while it was lowest ( $98.4$  g/d) in NOFAT. Concentration of BUN was similar ( $P = .4$ ) for cows fed each supplement 15.4, 19.2, and  $23.2 \pm 3.7$  mg/dl for C, NOFAT, and FAT, respectively. Concentration of NEFA were increased ( $P < .01$ ) by supplemental fat. These results suggest that supplemental fat can stimulate milk production in beef cattle experiencing negative energy balance.

**Key Words:** Fat, Supplement, Milk Production

**769** Effects of ruminally undegradable intake protein on body weight change and blood metabolites in beef heifers consuming low quality diets. J. S. Serrato-Corona\*, M. K. Petersen, I. Tovar-Luna, L. A. Appeddu-Richards, H. Albertini, J. E. Sawyer, and A. Gomez-Carabali, *New Mexico State University, Las Cruces*.

Eight angus x hereford cross 18 month old beef heifers were used in a replicated 4x4 latin square to investigate the effects of ruminally undegradable intake protein (UIP) on body weight change and blood metabolite concentration. Treatments consisted of 3 day adaptation period followed by a 15 day treatment period. Heifers were individually fed and received a basal diet of buffalo grass hay (93.9% DM, 6.3% CP, 76.1% NDF) at 2% of BW at 0800 h throughout the study. During each period, animals also received 1150 g/d of one of the four protein supplements: 1) cottonseed meal (CSM) to supply 522 g total protein with 166 g UIP, 2) 60% CSM and 40% feather meal plus blood meal (MIX1) to supply 614 g total protein with 250 g UIP, 3) 40% CSM and 60% feather meal plus blood meal (MIX2) to supply 660 g total protein with 293 g UIP, and 4) feather meal plus blood meal (FM+BM) to supply 752 g total protein with 378 g UIP. Ten days after supplementation heifers were submitted to a 10 h intensive serum collection every 15 min, samples were composited by hour and statistically analyzed in a split plot analysis of variance for repeated measurements for glucose, nonesterified fatty acids (NEFA), blood urea nitrogen (BUN), and insulin concentrations. Body weight was not influenced by supplement ( $P > .49$ ). Concentration on insulin serum increased linearly ( $P < .01$ ) with UIP concentration with values of .54, .58, .60, and  $.63 \pm .002$  ng/dl for treatments CSM, MIX1, MIX2, and FM+BM, respectively. Concentrations of glucose (81.0, 80.6, 82.4, 82.1 mg/dl), BUN (18.3, 20.4, 19.3, 19.0 mg/dl), and NEFA (158.7, 186.7, 174.5, 169.6 ueq/l) were similar ( $P > .1$ ) between treatments. These results indicate that insulin concentration in the serum increased as protein intake increased.

**Key Words:** Protein, Supplementation, Blood Metabolites

**770** Bermudagrass cultivar and maturity effects on nutrient composition, digestible dry matter yield, and *in vitro* and *in situ* digestion. P. Mandebvu<sup>1</sup>, J. W. West<sup>\*1</sup>, G. M. Hill<sup>1</sup>, R. N. Gates<sup>2</sup>, R. D. Hatfield<sup>2</sup>, and B. G. Mullinix<sup>1</sup>, <sup>1</sup>University of Georgia, <sup>2</sup>USDA-ARS.

In July of 1997 Tifton 85 (T85) and Coastal (CBG) bermudagrasses established on 0.81-ha pastures were mowed to stage growth and duplicate plots  $1.22 \times 9.14$  m in size were randomly assigned to one of 6 stages of maturity. Dry matter yield (tonne/ha, DMY), digestible DM yield (tonne/ha, DDMY), IVDMD (%) at 48 h of incubation, *in vitro* NDF disappearance at 48 h of incubation (%), IVNDF, and *in situ* total potentially digestible fraction (PDF) and rate (%/h, Rate) of DM calculated by fitting DM disappearance data at 3, 6, 12, 24, 36, 48, 72, and 96 h of incubation to the nonlinear equation  $p = a + b(1 - e^{-ct})$  are shown in table.

Item	Cultivar (C)			Maturity (M), wk						
	T85	CBG	SE	2	3	4	5	6	7	SE
CP,%	16.3	17.0	0.3	20.9	15.6	18.7	17.3	15.0	12.4	0.6 <sup>a</sup>
NDF,%	69.2	66.4	0.4 <sup>a</sup>	68.7	65.5	68.2	68.0	67.7	68.9	0.7 <sup>a</sup>
DMY	1.2	0.9	0.1 <sup>a</sup>	0.1	0.2	0.4	0.8	1.3	3.5	0.1 <sup>a</sup>
DDMY	0.7	0.5	0.1 <sup>a</sup>	0.1	0.1	0.3	0.5	0.8	1.8	0.1 <sup>a</sup>
IVDMD	61.1	57.3	0.6 <sup>a</sup>	62.9	58.0	59.3	62.1	59.8	52.9	1.1 <sup>a</sup>
IVNDF	55.7	48.0	0.8 <sup>a</sup>	58.1	49.2	52.3	56.4	51.2	44.1	1.4 <sup>a</sup>
PDF,%	64.9	59.4	2.5	65.8	61.9	63.7	64.6	60.9	57.2	4.5
Rate	2.8	2.8	0.4	2.7	3.2	2.1	2.7	3.5	2.9	0.6

<sup>a</sup>Main effect difference ( $P < 0.05$ ) within row within Cultivar or Maturity. There were C x M interactions ( $P < 0.05$ ) for CP and DDMY.

Although T85 had higher NDF concentration than CBG, it had 25% higher DMY, 32.4% higher DDMY, and higher DM and NDF digestibilities. Digestibility of bermudagrasses decreased with increase in maturity. It is concluded that the optimal time to harvest T85 or CBG would be between 3 and 5 wk of maturity, and T85 is higher yielding and more digestible than CBG at similar stages of maturity.

**771** Effect of treating bermudagrass forages at ensiling with fibrolytic enzymes or microbial inoculant on carbohydrate content of cell walls, concentrations of p-coumaric and ferulic acids, and *in situ* digestion. P. Mandebvu<sup>1</sup>, J. W. West<sup>1</sup>, R. D. Hatfield<sup>2</sup>, G. M. Hill<sup>1</sup>, M. A. Froetschel<sup>1</sup>, and R. N. Gates<sup>\*2</sup>, <sup>1</sup>University of Georgia, <sup>2</sup>USDA-ARS.

The objective of this study was to determine the cell wall compositional characteristics and *in situ* digestion of Tifton 85 bermudagrass (T85) and Coastal bermudagrass (CBG) treated with fibrolytic enzymes or microbial inoculant at ensiling. The initial nutrient composition (%DM) for T85 harvested at 3 wk and 6 wk and CBG harvested at 3 and 6 wk, respectively, were neutral detergent fiber (NDF): 68.6, 72.3, 66.9, 68.9; acid detergent fiber: 32.7, 35.0, 29.9, 29.9; cellulose: 28.9, 30.8, 25.6, 26.0; permanganate-determined lignin: 4.7, 5.8, 6.6, 6.8; and cell walls: 81.4, 85.3, 84.0, 84.7. The composition of the cell walls (g/kg cell wall) for T85 harvested at 3 wk and 6 wk and CBG harvested at 3 and 6 wk, respectively, were acid insoluble lignin: 164.7, 174.7, 200.5, 191.1; total uronosyls: 26.2, 24.0, 25.7, 23.4; total neutral sugars: 716.0, 703.3, 677.2, 679.1; ester linked p-coumaric acid: 9.3, 9.3, 9.1, 8.9; total ester linked ferulic acid: 11.6, 10.0, 10.6, 10.6; ether p-coumaric acid: 1.0, 0.7, 0.9, 1.1; total ether linked ferulic acid: 6.2, 4.9, 8.1, 7.6; and glucose (mg/g cell wall): 402.3, 394.3, 366.6, 375.4. Fitting data to the nonlinear model  $p = a + b(1 - e^{-ct})$ , indicated that T85 had a larger slowly digested fraction of DM ( $P < 0.05$ ; 55.5 versus 40.85%, SE = 3.62), a larger total potentially digestible fraction of DM ( $P < 0.05$ ; 68.15 versus 53.7%, SE = 3.97), a larger total potentially digestible fraction of NDF ( $P < 0.10$ ; 65.25 versus 50.05%, SE = 1.67), and a smaller indigestible fractions of DM ( $P < 0.05$ ) and NDF ( $P < 0.10$ ) when compared with CBG. Treatment of bermudagrass forages with microbial inoculant increased the potentially digestible fraction of DM ( $P < 0.05$ ; 54.5 versus 59.7%, SE = 1.9) and NDF ( $P > 0.10$ ; 44.4 versus 52.1%, SE = 3.9). Increase in cellulose content of cell walls with the same or less lignin in T85, and the greater concentration of ether linked ferulic acid in CBG explain the greater digestibility of T85 when compared with CBG at similar stages of maturity. Treatment of bermudagrass forage at ensiling with microbial inoculant may have more potential than extracts of fibrolytic enzymes in improving fiber digestion.

**772 Effect of maturity and mechanical processing of corn silage on energy content of corn silage based total mixed rations.** L. M. Johnson<sup>1</sup>, J. H. Harrison<sup>1</sup>, R. E. Riley<sup>1</sup>, D. Davidson<sup>1</sup>, A. Tintzman<sup>1</sup>, J. Strotz<sup>1</sup>, R. Walker<sup>1</sup>, D. Huot<sup>1</sup>, L. Morgan<sup>1</sup>, W. P. Weiss<sup>2</sup>, K. Shinnars<sup>3</sup>, A. Rotz<sup>4</sup>, M. L. Swift<sup>5</sup>, and B. Mahanna<sup>6</sup>, <sup>1</sup>Washington State University Dairy Forage Facility, Puyallup <sup>2</sup>The Ohio State University, Wooster <sup>3</sup>University of Wisconsin, Madison <sup>4</sup>USDA-ARS, University Park, PA <sup>5</sup>Agro Pacific Industries, Ltd., Chilliwack, B.C. <sup>6</sup>Pioneer International, Inc., Johnston, IA.

Pioneer hybrid<sup>®</sup> 3845 corn silage was harvested at three maturities with and without mechanical processing (John Deere 5830 harvester with kernel processor). Corn silages were fed to six ruminally and duodenally cannulated lactating Holstein cows. The experimental design was a 6 x 6 Latin square. The six TMR consisted of similar feed ingredients and composition (13.2% alfalfa hay, 13.6% whole cottonseed, 26.8% corn silage, and 46.4% grain mix) differing only in corn silage treatment. Net energy of lactation (Mcal/kg) was determined on the TMR and corn silages using data collected from the metabolism study. The equations used for energy conversions were: ME = -0.45 + 1.01\*DE and NE<sub>L</sub> = 0.702\*ME - 0.19. Results indicated that, at all three maturities, mechanical processing of corn silage numerically increased the NE<sub>L</sub> content of the TMR. Mechanical processing significantly (P<.02) increased the energy content of the TMR containing corn silage at an advanced stage of maturity (2/3 milkline). The data indicated that the NE<sub>L</sub> content of the TMR increased due to processing by approximately 1.3% at dough stage, 0.7% at 1/3 milkline, and 8.7% at 2/3 milkline.

Maturity Processing <sup>1</sup>	Maturity x Processing						SE
	Dough		1/3 Milkline		2/3 Milkline		
	U	P	U	P	U	P	
DE(Mcal/kg)	2.82	2.84	2.71	2.73	2.81 <sup>b</sup>	3.00 <sup>a</sup>	.054
NE <sub>L</sub> (Mcal/kg)	1.44	1.46	1.39	1.40	1.45 <sup>b</sup>	1.55 <sup>a</sup>	.031

<sup>a,b</sup>P<.02 <sup>1</sup>Processing: U = unprocessed, P = processed

**Key Words:** Corn Silage, Processing, NE<sub>L</sub>

**773 Effect of maturity, chop length, mechanical processing, and silo type on packed density of corn silage.** J. H. Harrison<sup>1</sup>, L. Johnson<sup>1</sup>, D. Davidson<sup>1</sup>, D. Huot<sup>1</sup>, M. Horn<sup>1</sup>, L. Morgan<sup>1</sup>, K. Shinnars<sup>2</sup>, D. Linder<sup>3</sup>, A. Rotz<sup>4</sup>, R. Muck<sup>5</sup>, and B. Mahanna<sup>6</sup>, <sup>1</sup>Washington State University Dairy Forage Facility, Puyallup, <sup>2</sup>University of Wisconsin, Madison, <sup>3</sup>Ag-Bag International, Inc., Astoria, OR, <sup>4</sup>USDA-ARS, University Park, PA, <sup>5</sup>USDA-ARS, Madison, WI, <sup>6</sup>Pioneer International, Inc., Johnston, IA.

Corn silage (Pioneer<sup>®</sup> 3845 and Quanta) was harvested at various stages of maturity, chop length, with and without mechanical processing (John Deere 5830 Harvester with kernel processor), and ensiled in three types of silos. Silos were 80 liter pails (56cm x 35cm hxd), sono tubes (1.2m x 1.2m hxd), and 3m diameter Ag Bags<sup>®</sup>. Silos were compressed with weight: pails - 48gm/cm<sup>2</sup>, sono tubes - 15gm/cm<sup>2</sup>, and Ag Bags<sup>®</sup> - brake pressure of 70 kg/cm<sup>2</sup>. Packed density was affected by all variables studied (see below). Density data is expressed as kg/m<sup>3</sup>.

80 liter pails - 1996	Maturity <sup>1</sup> x Processing <sup>2</sup>					
	DU	DP	1/3MLU	1/3MLP	2/3MLU	2/3MLP
Density	654 <sup>a</sup>	604 <sup>b</sup>	505 <sup>e,j</sup>	563 <sup>c,d</sup>	480 <sup>j</sup>	550 <sup>d</sup>
wet	163 <sup>b,c</sup>	158 <sup>c</sup>	142 <sup>e</sup>	157 <sup>c,d</sup>	150 <sup>d,e</sup>	169 <sup>a,b</sup>
dry						
80 liter pails - 1997	Maturity		Processing			
Density	1/3ML	2/3ML	BL	U	P	
wet	584 <sup>a</sup>	530 <sup>b</sup>	413 <sup>c</sup>	495 <sup>b</sup>	523 <sup>a</sup>	
dry	163 <sup>b,c</sup>	177 <sup>b</sup>	155 <sup>c</sup>	161	169	
Ag Bags <sup>®</sup> - 1997	Chop Length <sup>3</sup> /Processing					
Density	L/U	L/P	M/U	M/P		
wet	144(68) <sup>‡</sup>	144(77)	137(72)	161(71)		
dry	45(19)	45(25)	43(21)	51(20)		
Sono Tubes - 1996	Maturity				Processing	
Density	D	1/3ML	2/3ML	U	P	
wet	698 <sup>a</sup>	635 <sup>b</sup>	588 <sup>c</sup>	630 <sup>b</sup>	650 <sup>a</sup>	
dry	163 <sup>c</sup>	171 <sup>a</sup>	165 <sup>b,c</sup>	168	165	

<sup>a,b,c,d,e,f</sup>P<.10

<sup>‡</sup>(standard deviation)

<sup>1</sup>Maturity - D = dough, ML = milk line, BL = black line

<sup>2</sup>Processing - U = unprocessed, P = processed

<sup>3</sup>Chop Length - L = long, M = medium

**Key Words:** Corn Silage, Processing, Packed Density

**774 The effect of processing corn silage on feedlot performance and nutrient digestibility in growing cattle.** M. A. Young<sup>\*</sup>, T. J. Wistuba, B. E. Brent, L. H. Harbers, and K. K. Bolsen, Kansas State University, Manhattan.

The effect of mechanically processing whole-plant corn silage on feedlot performance and nutrient digestibility was studied using 60 crossbred heifers in an 80 d growing trial and 12 steers in a two period metabolism trial. The treatments were pre-ensiled, processed (PRE); post-ensiled, processed (POST); and non-processed (control) corn silages. The whole-plant corn (Pioneer 3394) was harvested at 36% DM at the 90% milkline stage of kernel maturity with a Claas Jaguar 880 forage harvester, which was equipped with an in-line kernel processor. The forage was chopped to a 10 mm particle length. The three diets were 90% silage and 10% supplement on a DM basis. Heifers fed the PRE and POST corn silage diets gained faster (P<.05) and were more efficient (P<.05) than those fed the control silage diet. Steers fed the PRE and POST silage diets had numerical improvements in DM, OM, NDF, and ADF disappearance verses those fed the control silage diet. Starch disappearance was significantly higher for the POST silage diet compared to the PRE and control silage diets. These data suggest that processing corn silage either prior to or after ensiling has a positive effect on growth performance and nutrient utilization.

Diet	ADG	F/G <sup>1</sup>	DM	OM	NDF	ADF	CP	Starch
	kg		nutrient digestibility, % of the diet					
PRE	1.45 <sup>a</sup>	6.6 <sup>a</sup>	75.7	77.5	59.4	54.4	78.8	94.9 <sup>b</sup>
POST	1.42 <sup>a</sup>	6.4 <sup>a</sup>	75.5	76.7	57.6	54.6	76.5	96.7 <sup>a</sup>
Control	1.32 <sup>b</sup>	7.0 <sup>b</sup>	74.7	76.3	55.7	54.2	77.4	93.1 <sup>b</sup>

<sup>1</sup>100% DM basis.

<sup>a,b</sup>Means within a column with different superscripts differ at P<.05.

**Key Words:** Mechanically Processing, Corn Silage, Growing Cattle

**775 Sensitivity of factors influencing metabolizable protein supply and degradable intake protein balance for cows grazing low quality forage.** D. L. Lalman<sup>\*1</sup> and G. P. Lardy<sup>2</sup>, <sup>1</sup>Oklahoma State University, Stillwater and <sup>2</sup>North Dakota State University, Fargo.

Two sensitivity analyses were conducted to determine the relative influence of various factors in predicting degradable intake protein balance (DIP BAL) and metabolizable protein (MP) supply for beef cows grazing dormant native range. Level One of the 1996 NRC Beef Cattle Requirements model was used to predict DIP BAL and MP supply for 499.4 kg beef cows. Factors evaluated included dry matter intake (DMI), microbial efficiency (MEF), supplement crude protein (SCP), supplement degradable intake protein (SDIP), forage crude protein (FCP), forage DIP (FDIP) and *in vitro* dry matter digestibility (IVDMD). Baseline DIP BAL and MP were established using means reported in the literature for cattle grazing dormant native range and consisted of 9.99 kg, 10% of IVDMD intake, 42.5% DM, 63.1% of SCP, 5.5% DM, 84.7% of FCP and 52.9% DM for DMI, MEF, SCP, SDIP, FCP, FDIP and IVDMD, respectively. Sensitivity analyses were performed in the following manner: In the first analysis each factor was changed by plus or minus one standard deviation while all other factors were held constant; in the second analysis each factor was changed by plus or minus 10% while all other factors were held constant. Based on this sensitivity analysis, accurate estimates of forage intake should be given priority when estimating MP supply for grazing animals. Accurate estimates of MEF are needed to optimize supplemental DIP BAL.

Method	Percentage Change from Baseline				
	Factor	Stddev	MP	DIP BAL	DIP BAL
Standard Deviation	10	Percent			
MP					
DIP BAL					
DIP BAL					
DMI	1.57	11.1	3.4	7.1	2.6
SDIP	10.7	8.8	21.1	5.0	12.4
MEF	1.4	7.8	27.8	5.9	19.9
IVDMD	2.7	3.1	10.2	5.9	19.9
SCP	2.8	2.1	8.3	3.1	12.4
FDIP	2.4	1.9	4.9	6.4	17.3
FCP	.38	.9	12.8	1.2	17.3

**Key Words:** Metabolizable Protein, Degradable Intake Protein, Grazing

**776 Effects of elevated carbon dioxide and nitrogen fertilization on tall fescue nutritional quality.** M. L. Abner\*, R. G. Dado, J. A. Newman, D. J. Gibson, and A. Hickman, *Southern Illinois University, Carbondale.*

Our previous work has shown that double-ambient CO<sub>2</sub> concentrations (expected in the next 50 years due to global change) increase growth but lower protein content of tall fescue, regardless of endophytic status. Objectives of this second year study were to determine if level of soil N altered the CO<sub>2</sub> effect and to measure changes in protein quality. Two-year old fescue plants in 15 L pots were clipped and grown for 12 wk in 20 open-topped chambers in the field beginning in May, 1997. Chambers were maintained at ambient (350 ppm; LC) or double-ambient (700 ppm; HC) CO<sub>2</sub> and held 4 plants each. Plants were harvested every 4 wk and received 1.4 g (LN) or 14 g (HN) of N as NH<sub>4</sub>NO<sub>3</sub> prior to regrowth. Yields were 58% higher with HC (P < .001) and responded more to HC under HN. Plant CP content decreased 28% with HC (P < .001) regardless of soil N. Proportion of CP as ADICP was 0.6% units higher with HC (P < .001) and suggests elevated CO<sub>2</sub> alters nitrogen metabolism by more than just dilution with carbohydrate. Plant NDF, ADF, and lignin were not different with HC under HN, but ADF and lignin were lower (P < .05) with HC under LN. Forage protein quality in future environmental conditions may reduce livestock performance.

Item	LN-LC	LN-HC	HN-LC	HN-HC	P>F		
					C <sup>1</sup>	N <sup>2</sup>	C*N
DM, g	15.4	23.6	43.2	69.9	.001	.001	.001
CP, % of DM	12.5	9.8	20.6	16.1	.001	.001	.001
CP, g	1.9	2.3	8.8	10.9	.001	.001	.001
ADICP <sup>3</sup> , % of CP	4.8	5.4	3.0	3.7	.001	.001	NS
ADF, % of DM	31.4	29.5	29.0	29.1	NS	.001	.001
Lignin, % of DM	3.4	2.6	2.8	2.6	.01	.001	.01

<sup>1</sup>Main effect of CO<sub>2</sub>; <sup>2</sup>Main effect of nitrogen; <sup>3</sup>ADICP = acid detergent insoluble CP.

**Key Words:** Forage quality, Fescue, Carbon dioxide

**777 The effect of diets containing diverse corn silage hybrid types on diet digestibility and chewing activity of lactating dairy cows.** C. S. Kuehn<sup>1</sup>, J. G. Linn<sup>1\*</sup>, D. G. Johnson<sup>2</sup>, and H. G. Jung<sup>1,3</sup>, <sup>1</sup>University of Minnesota, St. Paul <sup>2</sup>West Central Experiment Station, Morris, MN <sup>3</sup>USDA-ARS, St. Paul, MN.

Sixty-two cows (23 multiparous and 39 primiparous) were fed diets containing corn silages of high-grain (G), leafy (L), or generic-blend (B) hybrids. Diets were (DM basis) 40.6% corn silage, 10.2% alfalfa haylage, 23.5% corn grain, 7.4% cottonseed, and 18.3% protein and mineral supplement. Diets contained 53.5, 51.6, and 55.2% DM; and 31.8, 32.6 and 32.3% NDF (DM basis) for the G, L, and B diets, respectively. The L silage was higher (P < 0.05) in IVDMD (69.2%) than the G (66.8%) or B (66.7%) silages. The G, L, and B silage did not differ in IVNDF-dig (34.6, 38.0, and 34.4%, respectively). Cows were fed dietary treatments from 3 to 154 d post-calving. Fecal samples were collected for 4 consecutive days during wk 5 and 14 of treatment. Diet digestibility was determined using acid insoluble ash. When cows within treatments averaged 11 wk into the study, a 24 h observation on eating and chewing was conducted at 10 min intervals. A diet by wk interaction (P = 0.06) occurred for diet DM digestibility. Corn silage hybrid did not affect DMI or rumination activity and had minor effects on diet DM digestibility.

Item	Diet		
	G	L	B
DMI, kg/d	22.3	22.4	21.8
NDF intake, kg/d	7.0	7.2	6.9
Diet DM digestibility, % wk 5	58.0 <sup>a</sup>	55.6 <sup>ab</sup>	53.1 <sup>b</sup>
Diet DM digestibility, % wk 14	53.6	57.2	53.9
Eating, min/d	144	178	204
Chewing, min/d	474	488	435
(Eating + Chewing)/kg DMI	25.5	29.8	30.6
(Eating + Chewing)/kg NDF intake	81.7	92.0	97.4

<sup>ab</sup>Means with different superscripts differ (P < 0.05).

**Key Words:** Forage, Corn Silage, Digestibility

**778 Preservation of salad waste as silage.** L. O. Ely\* and M. A. Froestchel, *University of Georgia, Athens.*

Salad waste containing lettuce, cabbage, onions, carrots, peppers and celery is produced by a plant in Atlanta at a daily rate of 40–60 tons. Because the material is very wet (6%DM), the valued waste deteriorates very rapidly. Preservation by ensiling offers the opportunity to store the material and feed at a later date. Poultry litter, corn, soyhulls, cotton gin trash and molasses were added to salad waste to provide dry matter and carbohydrates for fermentation. All treatments were treated with a microbial additive. Treatments and composition were (1) salad 70, corn 30 (2) salad 70, soyhulls 15, corn 15 (3) salad 70, soyhulls 25, molasses 5 (4) salad 70, corn 15, poultry litter 15 (5) salad 70, poultry litter 25, molasses 5 (6) salad 70, soyhulls 10, poultry litter 10, corn 10 (7) salad 70, soyhulls 12.5, poultry litter 12.5, molasses 5 (8) salad 70, corn 30 (9) salad 60, corn 40, (10) salad 80, corn 20 (11) salad 50, gintrash 45, molasses 5 (12) salad 60, gintrash 35, molasses 5 (13) salad 70, gintrash 25, molasses 5 and (14) salad 60, corn 17.5, gintrash 17.5, molasses 5. Treatments were mixed and placed in sealed brechet silos. Three brechets were opened on day 5 and day 21 per treatment for analysis. Initial pH was 5.5 to 6.2 for all treatments. By day 21 pH was below 4.0 for all treatments except those containing poultry litter and cotton gin trash. Treatment 5 and 11 had mold on the surface. CP was 10.5% with corn treatment. Addition of poultry litter raised CP (17.1 to 22.3%) depending on level of litter. Addition of gin trash resulted in CP levels intermediate (13.1 to 15.3%). The inclusion of 70% salad resulted in DM of 25.1 to 27.9%. Salad waste can be preserved as a silage. The addition of corn had the best fermentation. The addition of cheaper by-products (poultry litter and cotton gin trash) resulted in marginal fermentation.

**Key Words:** Salad Waste, Silage

**779 Accessibility limits cell-wall degradation of alfalfa stem tissues.** H. G. Jung\*<sup>1</sup> and F. M. Engels<sup>2</sup>, <sup>1</sup>USDA-ARS, St. Paul, MN, <sup>2</sup>Wageningen Agricultural University, The Netherlands.

The lignified middle lamella/primary cell wall in forages is hypothesized to constitute an impenetrable barrier for access by rumen microbes to potentially degradable cell-wall polysaccharides. This hypothesis was tested by incubating 2-cm long alfalfa stem pieces in rumen fluid for 24-h. A wax coating was applied to the stem pieces to prevent microbial access to the alfalfa tissues, except for one end which was exposed by cross-sectioning. After the incubations, the stem pieces were serially cross-sectioned (100 μm thick) starting from the exposed end. Degradation of individual tissues was examined in the serial cross-sections by light microscopy. Phloroglucinol staining was used to identify lignified tissues. Examination of multiple stem pieces from two harvest years indicated that non-lignified, thin- and thick-walled tissues (such as protoxylem parenchyma and collenchyma, respectively) were degraded to great depth (up to 8000 and 5600 μm, respectively). Using longitudinal sectioning of non-degraded control stems to determine cell lengths, it was apparent that degradation had penetrated through many cell layers of these tissues. In contrast, tissues which developed a lignified middle lamella/primary wall (such as cortical and xylem fibers) were only degraded in the initial cell layer directly exposed to the rumen microbes by sectioning. Additional cell layers deeper in the stem piece were not degraded. The presence of undegraded, non-lignified secondary cell-wall layers in cortical and xylem fibers in sections taken further down the stem piece than the length of one cell for these tissues provided proof that the lignified middle lamella/primary wall was an impenetrable barrier to rumen microbes. These results highlight the importance of particle size reduction to maximizing forage cell-wall utilization and identifies the lignified middle lamella/primary wall as a target for modification to improve forage quality.

**Key Words:** Alfalfa, Degradation, Lignin

**780 Short term Intake Rate as a method of determining the effect of aerobic deterioration on the intake potential of maize and whole crop wheat silage harvested at two stages of maturity.** S. Harrison\*, R. H. Phipps, E. Owen, and D. E. Beever, *Centre for Dairy Research, The University of Reading, UK.*

Satisfactory correlations between potential intake rate and voluntary food intake (VFI) have been established for specific feeds. This experiment examined Short Term Intake Rate (STIR) as a method of ranking maize (MS) and whole crop wheat silage (WS) in terms of intake potential. Eight Simmental cross heifers were offered eight treatments (T1-T8) daily for eight days in a latin square design. On each day four forages were offered fresh (0h) or 48 hours after removal from the clamp (48h), during which time they were stored at ambient temperature. Heifers were allowed access to 0.25 of their daily ration for 1 hour followed by a four hour fasting period, after which intake for T1-T8 was measured over four minute periods with 15 minute intervals of food deprivation between treatments. The treatments consisted of MS (280 g DM/kg): 0h (T1) and 48h (T2); MS (370 g DM/kg): 0h (T3) and 48h (T4); WS (290 g DM/kg): 0h (T5) and 48h (T6) and WS (470 g DM/kg): 0h (T7) 48h (T8). The results obtained for T1-T8 respectively were: forage temperature ( $^{\circ}\text{C}$ ) 12.7, 22.2, 13.5, 23.2, 12.2, 25.0, 14.4 and 17.3; intake rate (g DM/min) 64.9, 76.7, 81.0, 89.4, 72.0, 85.2, 65.9 and 64.9 (s.e.d = 4.61); post feeding pH values 3.9, 4.0, 3.9, 4.1, 3.5, 3.7, 4.1 and 4.2. The order in which forages were offered and forage temperature did not ( $P > 0.05$ ) affect intake rate. Increasing DM content of MS had a positive effect on intake rate ( $P < 0.05$ ), although the reverse trend was noted in WS ( $P > 0.05$ ). With the exception of WS (High DM, T7 and T8), intake rate increased as the length of time the forage was exposed to aerobic conditions increased ( $P < 0.05$ , except WS (Low DM, T5 and T6)  $P > 0.05$ ). It is concluded that intake rate of silage was not affected by silage temperature, which was used as a measure of aerobic deterioration. This suggests the involvement of other mechanisms in the consistent finding that VFI is impaired by aerobically unstable silages.

**Key Words:** Intake Rate, Aerobic Deterioration

**781 Sheep production performance under rotational grazing method.** J. Dorsey\*, A. Felix, J. Correa, and M. Lema, *Alabama A & M University.*

The effect of rotational grazing (RG) versus continuous grazing (CG) methods on sheep production performance, forage production, utilization, and persistency was evaluated in the 1995 and 1996 grazing seasons. The AU triumph fescue/clover pasture was grazed in the Spring and Fall. The Tifton 44 bermuda pasture was grazed in the Summer. Each pasture was divided into two equal grazing portions of 1 ha each. Sixty Suffolk lambs were divided into two comparable groups of 30 animals each. One group was assigned to CG and the other to RG. Lambs under CG had free access to pasture while those under RG were restricted to graze for 3 d each on strips of pasture separated by a three-strand poly ethylene electric fence. Forage samples were collected from five  $0.9^2\text{m}$  quadrats from each plot to evaluate forage yield and proximate composition. Excess of ungrazed forage from RG plots was clipped and DM yield calculated. Body weights were recorded fortnightly. All animals were bred during the breeding season. ADG was not significantly different between CG and RG for Spring (94.6 vs 99.9 g) and Summer (9.9 vs 12 g), respectively for 1995. Fall ADG was higher for CG than for RG (190.6 vs 132.1 g). ADG for 1996 were comparable among CG and RG groups both in the Spring (129.1 vs 133.9 g) and Fall (168.7 vs 176.4 g). The CG method resulted in higher ADG than the RG in the Summer (8.3 vs -27.9 g). Lamb crop production was higher for CG than for RG both for 1995 (539.3 vs 339.9 kg/ha) and 1996 (512.4 vs 440.0 kg/ha). On the other hand, for each grazing season forage availability was depleted on CG plots while one-third of the forage on the RG plots remained ungrazed. Results of the study show that CG was more beneficial than RG in terms of body weight gain. However, RG method appears to emphasize greater stocking rate, more lamb production per ha, forage utilization and persistency than increased performance per animal.

**Key Words:** Rotational Grazing, Lamb Production

**782 Stockpiled forage for cattle over winter.** J. L. Riesther\*, D. J. Undersander, M. D. Casler, and D. K. Combs, *University of Wisconsin, Madison, WI.*

Graziers are accumulating forage after August 1 (stockpiling) to extend the grazing season and to reduce costs of harvesting and storing forage. We studied stockpiling characteristics of seven cool-season grass species at the University of Wisconsin at the Arlington, Lancaster, and Marshfield Agricultural Experimental Stations. Yield and neutral detergent fiber (NDF), acid detergent fiber (ADF), crude protein (CP), and in vitro organic matter digestibility (IVOMD) were measured on forage over winter. The forage was sampled three times over fall and winter: The first harvest was taken just after the first killing frost; the second harvest was taken just prior to winter; and the third harvest was taken in early spring before the spring greenup. Plots received either 0 or 60 lb N/acre on August 1. The plots were harvested mechanically at Arlington and Marshfield and grazed at Lancaster. Tall fescue and orchardgrass were the two highest yielding species while smooth bromegrass and quackgrass were the lowest yielding species. Animal stocking rates from mid-December through March on tall fescue would be .8 acre/animal unit. Orchardgrass would require 1 acre/animal unit for this period. Both smooth bromegrass and quackgrass would require 1.5 acre/animal unit from mid-December through March. Quality was measured by estimating NDF, ADF, CP, and IVOMD, using NIR. Over winter, IVOMD fell from 74.0 to 63.0%; NDF increased from 53.0 to 63.2%; CP decreased from 11.5 to 9.3%. The largest decline in quality occurred from the first harvest treatment and the second harvest treatment. Nonetheless, quality of stockpiled forage can maintain cattle over winter if the forage is accessible and adequate animal stocking density is maintained.

**Key Words:** Winter Grazing, Stockpiling, Fall Accumulation

**783 N-Alkane as an internal marker for predicting digestibility of forages.** R. E. Sandberg\*<sup>1</sup>, D. C. Adams<sup>1</sup>, T. J. Klopfenstein<sup>2</sup>, and R. J. Grant<sup>2</sup>, <sup>1</sup>UNL WCREC, North Platte, NE, <sup>2</sup>UNL Lincoln, NE.

Independent digestion trials with five forages were conducted with five beef steers (275 kg) in a randomized complete block to compare n-alkane with indigestible ADF (IADF) as internal markers to predict in vivo dry matter digestibility. Forages were mixed grasses from subirrigated meadow (meadow), meadow regrowth, native range, mature mixed grass hay from meadow, and alfalfa hay. The meadow, meadow regrowth, and native range forages diets were immature grasses harvested .5 h before feeding. All diets were fed twice daily at 2% of body weight. Feces from the meadow hay and alfalfa hay trials were divided and either freeze dried or oven dried ( $60^{\circ}\text{C}$ ) to compare drying methods. N-alkane was separated from the diets and feces by 4.5 h saponification with alcoholic KOH followed by extraction with n-hexane. The IADF was extracted from the diets and feces by 96-h in vitro fermentation followed by ADF extraction. Dry matter digestibility (DMD) was calculated using the feed:feces ratio of each marker and compared with the in vivo DMD for each diet. Digestion coefficients from n-alkane ratio were lower ( $P < .01$ ) than in vivo DMD for all diets. Comparison of n-alkane ratio to IADF ratio showed higher DMD using n-alkanes for meadow ( $P < .01$ ), meadow regrowth ( $P = .06$ ), and alfalfa hay ( $P = .06$ ), and lower DMD for meadow hay ( $P < .02$ ). Digestibilities calculated using n-alkane ratio for native range tended to be higher ( $P = .14$ ) than IADF ratio values. Fecal recoveries of n-alkane were higher ( $P < .02$ ) than IADF for meadow, meadow regrowth, and native range, similar for alfalfa hay ( $P = .14$ ) and lower for meadow hay ( $P = .07$ ). Freeze drying increased ( $P < .01$ ) the amount of n-alkane extracted from alfalfa hay compared with oven drying, but did not affect ( $P > .10$ ) the amount extracted from meadow hay. Neither marker was completely recoverable in feces although recovery of n-alkane was higher than IADF. N-alkane recovery was not consistent across forages. Oven drying may decrease the amount of n-alkane extracted from feces.

**Key Words:** Digestibility Markers, Indigestible ADF

**784 Evaluation of tropical grasses for milk production with dual purpose cows in the gulf of Mexico coastal region.** F. I. Juarez\*, D. G. Fox, R. W. Blake, and A. N. Pell, *Cornell University, Ithaca, NY.*

Because tropical grasses form the basis of production of dual purpose cattle in Latin America, three evaluations were conducted to estimate the nutritive value of these forages. First, we compared dry matter intake (DMI) requirements for observed milk production of dual purpose cattle grazing pangola grass with DMI predictions from the National Research Council (NRC) Dairy (1989), the NRC Beef (1996) and the Cornell Net Carbohydrate and Protein System (CNCPS). Second, the effects of changes in chemical composition of 15 tropical grasses on milk production were evaluated. Third, the effects of N fertilization of 4 tropical grasses on milk production were studied. In the first evaluation, the DMI predicted by the CNCPS was close to the observed DMI. When the CNCPS predictions with measured data on carbohydrate and protein pool sizes and digestion rates were compared with the other models, the DMI requirement was 26% higher than the NRC Dairy, 15% lower than the NRC Beef, and 40% lower than the CNCPS with tabular values. The NRC tabular systems had lower metabolizable energy (ME) requirements compared to the CNCPS. In the second evaluation with the CNCPS, predicted (ME) allowable milk decreased 35% as neutral detergent fiber (NDF) increased from 60 to 80%, decreased 22% as lignin increased from 4 to 8% of the NDF, and increased 88% when the rate of digestion of the NDF increased from 3 to 6%. The metabolizable protein (MP) allowable milk doubled as CP increased from 4 to 12% and decreased 25% as the solubility of the protein increased from 20 to 50%. In the third evaluation, the DMI, ME and MP allowable milk were higher for *Brachiaria brizantha* than for *Andropogon gayanus*, *Panicum maximum* and *Cynodon plectostachyus*. Nitrogen fertilization increased MP allowable milk. We conclude that the CNCPS coupled with adequate information on forage chemistry and digestion kinetics can predict ME and MP content of grasses for cattle in the tropical area of the Gulf of Mexico coast.

**Key Words:** Tropics, Grass, Modeling

**785 Milk production of cows grazing *Cynodon dactylon* (L.) Pers., cv. coast-cross.** D. Vilela\*<sup>1,2</sup> and M. J. Alvim<sup>1</sup>, <sup>1</sup>Embrapa National Dairy Cattle Research Center, Juiz de Fora, Brazil. <sup>2</sup>Fellowship of the Brazilian National Research Council - CNPq.

Use of grazing in Brazilian dairy cattle farms has been predominant. Research and farmer experiences with dairy cows grazing have demonstrated to reduce feed cost, labor use and to increase profit per cow. During 1992-97, coast-cross pasture was fertilized with NPK after grazing and irrigated throughout the dry season. Rotational grazing managed by means of electric fence as to allow 1 day for occupation, 25 days (spring/summer), and 32 days (fall/winter) for resting. It showed a profitable alternative system for purebred Holstein cows grazing. When switching from a system in which the forage component of the ration is grazed coast-cross 1 pasture to a confinement system, the gross margin per cow was 32% superior. Moreover, the effect of feeding 3 and 6 kg/cow/day of concentrate for milk production of cows grazing coast-cross pasture was evaluated. Average milk yield were respectively, 16.9 and 20.0 kg/cow/day, both being profitable. Average stocking rates and average annual milk production per hectare for cows fed 3 and 6 kg of concentrate/cow/day, were respectively, 4.5 and 5.1 cows/ha and 77.9 and 104.0 kg/ha/day. It was also evaluated two strategies of concentrate feeding: fixed amount of concentrate (6 kg/cow/day throughout the lactation period), and varying amount (9, 6 and 3 kg/cow/day respectively in each third of the lactation). Both strategies did not affect ( $P > 0.05$ ) on milk production. Milk production increased ( $P < 0.05$ ) when additional commercial high energy supplement was included for cows fed 6 kg of concentrate per day in the first third of the lactation. On the other hand, the commercial high energy supplement was not economically viable.

**Key Words:** Coast-cross, Holstein Cattle, Pasture

**786 Comparison of cracked and steam flaked corn supplementation on the performance of lactating dairy cows on pasture.** J. E. Delahoy\*, L. D. Muller, L. A. Holden, and T. W. Cassidy, *The Pennsylvania State University, University Park.*

The objective of the study was to compare two types of corn supplementation with grazing dairy cows. Twenty eight Holstein cows averaging 216 days in milk were grazed in one group for 6 wk. Cows were paired according to BCS, stage of lactation and milk production and were randomly assigned within pairs to either a cracked corn (CC) or steam flaked corn (SFC) supplement. Total supplement was comprised of corn (66.7% of DM) and a pelleted protein-mineral supplement and was fed at 1 kg of DM per 4 kg of milk production. Cows were milked twice daily and fed the grain supplement twice daily after each milking. Pastures consisted primarily of orchardgrass (*Dactylis glomerata*), and averaged, 43% NDF; and 19% acid detergent fiber. Cows were allotted a new paddock twice daily. Statistical analysis was a split plot design with treatment and time. Milk yield and composition did not differ between treatments and averaged 24.3 and 24.3 kg milk, 3.73 and 3.58% fat, and 3.26 and 3.34% protein for CC and SFC, respectively. Urea nitrogen in blood (13.7 vs. 12.5 mg/dl,  $P < .02$ ) and milk (16.3 vs. 14.8 mg/dl,  $P < .10$ ) was lower with the SFC. Pasture DMI was measured twice using  $Cr_2O_3$ , and did not differ between treatments and averaged 14.0 kg/day and 13.3 kg/day for CC and SFC. Total DMI was 21.3 kg/day and 20.3 kg/day for CC and SFC. Milk yield and composition did not differ when late lactation cows were fed steam flaked or cracked corn with high quality pasture as the sole forage.

**Key Words:** Pasture, Supplementation, Dairy Cows

**787 Heat production by grazing ewes with low forage mass and supplemental grain.** A. L. Goetsch\*<sup>1</sup> and G. E. Aiken<sup>2</sup>, <sup>1</sup>E (Kika) de la Garza Institute for Goat Research, Langston University, Langston, OK, <sup>2</sup>Dale Bumpers Small Farms Research Center, USDA-ARS, Booneville, AR.

Three mature Dorset ewes were used in a 3 x 3 Latin square (two 28-d periods and one 35-d) to determine effects of level of supplemental corn (0, .5, and 1.0% BW; DM) on intake, digestion, grazing behavior, and heat production by the whole body and splanchnic and extra-splanchnic tissues with grazing of paddocks low in forage mass. Live and dead forage mass ranged from 1 to 4 kg and 17 to 40 kg DM per 0.036-ha paddock, respectively; initial ewe conditions (urea dilution) were  $71 \pm 2.5$  kg shrunk BW,  $47 \pm .4\%$  fat, and  $11 \pm .1\%$  protein; and in periods 1, 2, and 3, hand-plucked forage samples were 17, 20, and 29% CP and 62, 56, and 58% NDF, respectively. Intake of ME (1.39, 2.32, and 3.16 Mcal/d; SE .11) and energy accretion (-1.09, .02, and .39 Mcal/d; SE .224) increased linearly with increasing corn level ( $P < .01$  and = .04, respectively), and grazing time decreased ( $P = .06$ ) 76, 63, and 48% of daylight for 0, .5, and 1.0% BW of corn, respectively; SE 4.9). However, corn level did not affect ( $P > .10$ ) whole body heat (2.48, 2.30, and 2.77 Mcal/d; SE .171), heat increment (.91, .80, and 1.24 Mcal/d; SE .172), splanchnic bed heat (1.09, 1.12, and 1.05 Mcal/d; SE .091), or extra-splanchnic tissue heat (1.39, 1.18, and 1.72 Mcal/d for 0, .5, and 1.0% BW of corn, respectively; SE .241). In conclusion, with increasing intakes of corn, total DM, and ME, increased heat produced in dietary energy metabolism for tissue maintenance or maintenance plus energy accretion may only have compensated for decreased grazing-related or -specific heat production by both splanchnic and extra-splanchnic tissues of ewes, resulting in decreased tissue mobilization or increased energy accretion.

**Key Words:** Energy Metabolism, Grazing, Supplementation

**788 Effect of grazing pressure on incidence of *Neotyphodium coenophialum* in tall fescue pastures.** J. C. Waller\*, H. A. Fribourg, K. D. Gwinn, and R. J. Carlisle, *University of Tennessee*.

Tall fescue (*Festuca arundinacea* Schreb.) persistence depends on the presence of the mutualistic fungal endophyte *Neotyphodium coenophialum* (Morgan-Jones & Gams) Glenn, Bacon & Hanlin. Changes in endophyte infestation levels of tall fescue pastures were measured during 3 yr of grazing at 3 grazing pressures (GP) with steers. Eighteen 1.2-ha pastures were seeded in 1992 with Kentucky-31 tall fescue infested with *N. coenophialum* at 4 levels ranging from endophyte-free (E-) to 85% infestation (E+). The two intermediate (20 to 35, and 40 to 60%) E+ levels were obtained by mixing E- and 85% E+ seed. Low GP was 2 to 3 steer/1.2 ha in fall/winter and summer, and 3 in spring; high GP was 4 to 5 in fall/winter and summer, and 7 in spring. A minimum difference of 1 steer/1.2 ha existed in GP among levels during any one season. Pastures arranged in an incomplete block design were grazed for about 10 mo each year from fall 1993 until summer 1996. Endophyte levels were monitored yearly with PAS-ELISA. Stand density of tall fescue remained satisfactory throughout the study. In 1996, E+ levels in low GP pastures were at the same level as in 1993 (slopes of linear regression lines for changes in E+ level over years ranging between 0 and 4.8). Similarly, E+ levels remained constant in all pastures that started at 85% E+, regardless of GP (regression line slopes being less than 5). In contrast, E+ levels increased by 20 to 30% from 1993 to 1996 (an average of 14%/yr) in high and medium GP pastures when initial E+ level was between 20 and 60% E+. Slopes of regression lines for these four treatment combinations ranged between 13.2 and 19.0 and for the most part were significantly different from 0 at  $P < 0.01$ . Moderate as well as high GP resulted in progressively greater E+ infestation levels of tall fescue pastures by differentially affecting survival of E- and E+ plants. These results have immediate implications when designing pasture management systems that include endophyte infested pastures and help explain the existing high incidence of infested pastures in the tall fescue belt.

**Key Words:** *Festuca arundinacea*, Endophyte Infestation, Cattle

**789 Supplemental cracked corn for steers fed fresh alfalfa. I. Effects on digestion of organic matter, fiber, and starch.** J. C. Elizalde\*, N. R. Merchen, and D. B. Faulkner, *University of Illinois, Urbana*.

We studied the effect of supplementation of different levels of cracked corn (CC) on the sites of OM, total dietary fiber (TDF), ADF, and starch digestion in steers fed fresh alfalfa indoors. Six Angus steers (338 ± 19 kg) fitted with cannulas in the rumen, duodenum and ileum, were fed 1) alfalfa (20.4% CP, 41.6% NDF) ad libitum (AALF), 2, 3, and 4) AALF and supplemented (S) with .4, .8, or 1.2% of BW of CC, or 5) alfalfa restricted at the average level of forage intake of S steers (RALF), in a Latin square design. Total OM intake was lower in RALF ( $P < .01$ ) than AALF but the levels of forage intake did not affect ( $P > .05$ ) the sites of OM, TDF, or starch digestion. Forage OM intake was decreased ( $P < .01$ ) linearly (8,496 to 5,840 g/d) but total OM intake was increased ( $P = .03$ ) linearly (8,496 to 9,344 g/d) as CC increased from .4 to 1.2% BW. Ruminant apparent or true OM disappearance (g/d) was not affected ( $P > .05$ ) but OM disappearing in the small intestine (g/d) increased ( $P < .01$ ) linearly with increasing levels of CC. Total tract OM digestibility (71.2 to 76.2%) and the proportion of OM intake that was digested in the small intestine (15.4 to 24.5%) increased ( $P < .01$ ) linearly as CC increased. The TDF and ADF intakes (g/d) decreased linearly ( $P < .01$ ) as levels of CC increased. Total TDF and ADF intakes (g/d) did not differ between the average intakes of S and RALF steers. Total tract TDF and ADF digestibilities were not different ( $P > .05$ ) among treatments (average 62.9 and 57.8%, respectively). Starch intake and starch digested in the rumen, small and large intestine (g/d) were increased linearly ( $P < .01$ ) with CC level. Ruminant pH and VFA concentrations were decreased and increased ( $P < .01$ ), respectively by CC levels. Acetate:propionate ratio decreased ( $P < .01$ ) linearly with CC levels. Supplementation increased total OM intake, decreased forage OM intake, and increased the proportion of OM that was digested in the small intestine, but fiber digestion was not affected.

**Key Words:** Steers, Fresh Alfalfa, Supplementation

**790 Supplemental cracked corn for steers fed fresh alfalfa. II. Protein and amino acid digestion.** J. C. Elizalde, N. R. Merchen\*, and D. B. Faulkner, *University of Illinois, Urbana*.

We studied the effect of different levels of cracked corn (CC) on N intake, ruminal bacterial CP synthesis, duodenal flows and small intestinal digestion of amino acids (AA) in steers fed fresh alfalfa indoors. Six Angus steers (average BW 338 ± 19 kg) cannulated at the rumen, duodenum, and ileum were fed each of five diets over five periods in Latin square design. Steers were fed 1) alfalfa (20.4% CP, 41.6% NDF) ad libitum (AALF), 2, 3, and 4) AALF supplemented (S) with three levels of CC (.4, .8, or 1.2% of BW), or 5) alfalfa restricted (RALF) to the average forage intake of S steers. Average N intake and duodenal flow (g/d) of nonammonia N (NAN) were greater ( $P < .01$ ) in S than in RALF steers. Greater duodenal flows of NAN in S compared with RALF were due to higher ( $P = .06$ ) flows of both bacterial and dietary N. Levels of CC decreased ( $P < .01$ ) linearly the N intake (g/d) and increased ( $P < .01$ ) linearly the duodenal flow of NAN (g/d) due to a linear increase in nonbacterial N ( $P = .15$ ) but not ( $P = .68$ ) of bacterial N flow. Duodenal NAN flows as percentage of N intake increased ( $P < .01$ ) linearly (69.3 to 91.0%) as CC increased. Ruminant NH<sub>3</sub> N concentration (mg/dL), ruminal CP degradability (%), and the proportion (%) of bacterial N in duodenal NAN were decreased ( $P < .01$ ) linearly as CC increased. Efficiency of net microbial CP synthesis was not affected ( $P > .05$ ) by treatment (average 42.6 and 30.9 g N/kg of OM apparently or truly digested in the rumen, respectively). Small intestinal disappearance (g/d) of total N and individual AA (except for threonine and lysine), and small intestinal digestibility (% entering) of N and individual AA (except for methionine, histidine, and proline) increased ( $P < .01$ ) linearly with the level of CC and were greater ( $P < .01$ ) in S than in RALF steers. Supplementing CC to steers fed fresh alfalfa reduced ruminal N losses and CP degradability, and increased the duodenal flow and the small intestinal disappearance and digestibility of total N and total, essential, and nonessential AA.

**Key Words:** Fresh Alfalfa, Supplementation, Nitrogen

**791 Effects of previous grazing on feedlot cattle performance.** B. M. Capitan\*, C. R. Krehbiel, R. E. Kirksey, L. M. Lauriault, G. C. Duff, G. D. Donart, and M. K. Petersen, *New Mexico State University, Las Cruces*.

The effects of summer grazing treatments on gain and subsequent finishing performance of 114 Angus x Hereford steers were evaluated in a randomized complete block design. Sixty eight steers were blocked by weight and allotted randomly to one of four grazing treatments: (1) native range (NR), grazed Mar. 9 through Sept. 10, (2) Jose tall wheat grass (JTW), grazed Mar. 9 through Sept. 10, (3) bluestem (BL), grazed May 14 through Sept. 10, or (4) free-access to bermuda grass, alfalfa, and JTW (BAJ), grazed May 14 through Sept. 10. From Mar. 9 through May 14, steers not grazing BL or BAJ grazed either native range or winter wheat. All pastures were replicated. Stocking rates were 0.3, 3.8, 6.7, and 6.0 hd/ha for NR, JTW, BL, and BAJ, respectively. Steers not assigned to grazing treatments were placed in a feedlot on May 16 and finished on a 90% concentrate diet for 112 days (SF). Following summer grazing (Sept. 11), the remaining steers were finished on the same diet for 97 days. From Mar. 9 through Sept. 10, steers grazing JTW had greater ( $P = .05$ ) ADG compared with BL or BAJ. Daily gain was similar ( $P = .55$ ) in steers grazing NR and JTW. Carcass measurements for grazed steers were similar ( $P > .10$ ). Steers finished in the summer had lower hot carcass weight ( $P < .01$ ), quality grade ( $P < .01$ ), and yield grade ( $P < .05$ ), and similar backfat ( $P > .10$ ) compared with grazed steers. Data suggest that grazing NR or irrigated pastures results in similar performance. Stocking steers on grass before finishing results in lower ADG and gain/feed but greater final weights compared with steers not grazed.

Item	NR	JTW	BL	BAJ	SF	SE
Initial wt., kg	250.5	246.7	247.3	252.8	248.9	7.2
Finishing						
Initial wt., kg	413.4	416.5	398.8	392.7	-	10.7
Final wt., kg	590.4 <sup>a</sup>	586.9 <sup>a</sup>	577.3 <sup>a</sup>	569.6 <sup>a</sup>	525.8 <sup>b</sup>	12.1
DM Intake, kg/d	12.01	11.85	11.79	11.43	11.07	-
ADG, kg	2.06 <sup>a</sup>	1.98 <sup>a</sup>	2.03 <sup>a</sup>	2.04 <sup>a</sup>	2.31 <sup>b</sup>	0.07
Gain/Feed	0.172 <sup>a</sup>	0.168 <sup>a</sup>	0.173 <sup>a</sup>	0.178 <sup>a</sup>	0.209 <sup>b</sup>	.006

<sup>a,b</sup>Means within a row with unlike superscripts differ ( $P < .05$ ).

**Key Words:** Irrigated Pasture, Rangeland Pasture, Feedlot Cattle

**792 Effects of grazing system and stocking rate on performance of summer stocker cattle grazing tallgrass prairie.** T. N. Bodine\*, H. T. Purvis II, S. D. Fuhlendorf, G. W. Horn, R. L. Gillen, F. T. McCollum III, and B. K. Karges, *Oklahoma Agricultural Experiment Station, Stillwater.*

The effects of grazing system and stocking rate on performance of steers grazing tallgrass prairie were evaluated over three years. Treatments were applied in a replicated 2 X 3 factorial arrangement. Steers (n = 203/yr) were randomly allotted to 12 pastures (20 ha) and grazed from mid-April to mid-September. Grazing was continuous (CG) or rotational (RG; four paddocks/ pasture) at one of three stocking rates. Each RG paddock was grazed 6-8 times per season for 3-7 d. Stocking rates were moderate (M; 137 kg/ha), heavy (H; 214 kg/ha) and very heavy (VH; 260 kg/ha) based on initial BW/ha. Cattle were fed a 40% CP supplement from mid-July until trial end at the rate of .45 kg/(steer\*day) prorated for three feedings weekly. No interactions (P > .21) of stocking rate by grazing system were noted. Steers on CG vs RG had increased (P < .05) ADG during early season (ES; April-July) and season long (SL; April-September), but not late season (LS; July-September) grazing periods. Gain/ha (G/HA) during ES and SL was greater (P < .05) for CG than RG. Stocking at M levels increased (P < .05) ES ADG for M vs H and VH. Also, SL ADG was greater (P < .05) for M vs VH. Reduced (P < .05) G/HA was realized by stocking at M vs H and VH during ES, LS and SL. At similar stocking rates CG steers had increased ADG and G/HA vs RG steers. As stocking rate increased, ADG decreased and G/HA increased for cattle grazing RG and CG.

	CG, kg	RG, kg	SE	M, kg	H, kg	VH, kg	SE
ADG, ES	.71 <sup>a</sup>	.61 <sup>b</sup>	.05	.74 <sup>a</sup>	.64 <sup>b</sup>	.60 <sup>b</sup>	.06
ADG, LS	.68	.66	.09	.70	.70	.62	.11
ADG, SL	.69 <sup>a</sup>	.62 <sup>b</sup>	.04	.71 <sup>ac</sup>	.66 <sup>abd</sup>	.60 <sup>be</sup>	.05
G/HA, ES	55 <sup>a</sup>	48 <sup>b</sup>	1.6	40 <sup>a</sup>	54 <sup>b</sup>	60 <sup>b</sup>	2.1
G/HA, LS	32	30	1.7	21 <sup>a</sup>	34 <sup>b</sup>	37 <sup>b</sup>	2.1
G/HA, SL	87 <sup>a</sup>	78 <sup>b</sup>	2.0	62 <sup>ac</sup>	89 <sup>bd</sup>	96 <sup>be</sup>	2.5

<sup>ab</sup> Means within row without common superscript differ (P < .05)

<sup>cde</sup> Means within row without common superscript differ (P < .10)

**Key Words:** Stocker Cattle, Grazing System, Stocking Rate

**793 Food finding along the grazing pathway: a fractal analysis.** M. R. Keil\* and L. R. Rittenhouse, *Colorado State University, Fort Collins.*

Effective food finding is a requisite of range forage based animal production systems. Empirical evidence shows cattle possess the ability to pair visual cues with food location and remember those locations through learning and memory. The object of this study was to investigate movement along the grazing pathway. We wanted to know if animals can use repeating environmental patterns as cues to make foraging decisions on multiple spatial scales. To accomplish this we chose to look at the deliberateness vs tortuosity of a grazing pathway as determined from feeding station behavior. A feeding station was defined as an area represented by continuous feeding. A new feeding station was identified when the animal took at least 2 steps in a head up position. The number of bites and steps within a feeding station were recorded. The fractal dimension of the grazing pathway was determined from the Ln:Ln plot of ruler length and pathway length. Values less than 1.5 were assumed to represent deliberate movement along the grazing pathway. As the fractal dimension approaches 1, we assume the animal perceives their environment at larger scales. The average fractal of pathways in a shortgrass prairie was 1.16. The average number of bites per step was 8.01 ± 0.74. One interpretation from this study is that deliberate movement is related to large spatial scales (10s of m), but actual food ingestion decisions occur on multiple scales.

**794 Evaluation of stockpiled berseem clover or sorghum x sudangrass as supplements for grazed corn crop residues in beef cows wintering systems.** J. R. Russell\*, M. J. Hersom, and S. M. Kremer, *Iowa State University, Ames.*

To evaluate the use of stockpiled berseem clover (BC) as a supplement for grazed corn crop residues (CCR), 'Frank' forage oats and 'Bigbee' berseem clover were seeded into replicate 2.03-ha fields adjacent to 4.04-ha corn fields. Oat and BC forage was harvested in two cuttings before allowing residual forage to be stockpiled. In yr 2 and 3, brown midrib and normal sorghum x sudangrass (SS) hybrids, respectively, were planted in replicate .92-ha fields adjacent to 2.83-ha corn fields. After grain harvest, fields were divided to allow simultaneous grazing of stockpiled BC and CCR, sequential grazing of CCR and SS or grazing of replicate 6.07-ha fields of CCR. Charolais x Angus x Simmental cows in midgestation were allotted to fields to strip-graze at an allowance of 1.01-ha/cow or allotted to replicate drylots. All cows were offered hay to maintain a condition score of 5 (9-point scale). Initial OM yields of CCR were greater than (P<.05) those of stockpiled BC and SS in yr 1 and 2, but less than (P<.05) those of the stockpiled forages in yr 3. Rate of OM loss from CCR was greater than (P<.05) stockpiled BC forage in yr 1, but less than (P<.05) stockpiled BC and SS forages in yr 2 and 3. In all years, initial IVDOM and CP concentrations and the rate of change in IVDOM concentration of CCR were less than (P<.05) stockpiled BC forage. Initial IVDOM concentration of CCR was less than (P<.05) brown midrib SS in yr2, but greater than (P<.05) normal SS in yr 3. Seasonal body condition score changes of cows grazing BC and CCR did not differ from grazing CCR or maintained in a drylot. Body condition score changes of cows grazing CCR and SS did not differ from grazing CCR or maintained in a drylot, but decreased more than grazing CCR and BC in yr 3. Mean amounts of hay offered to cows maintained in a drylot, grazing CCR, and grazing CCR and BC were 3613, 1239 and 1114 kg/cow over 3 yr. Mean amounts of hay offered to cows maintained in a drylot, grazing CCR or grazing CCR and SS were 2840, 1511, and 470 in yr 2 and 3.

**Key Words:** Cows, Crop Residues, Stockpiled Forage

**795 Undegraded Intake Protein (UIP) Supplementation of Fall Calving Cows Grazing Native Mixed Grass Prairie.** K. J. Hintze\*<sup>1</sup>, G. P. Lardy<sup>1</sup>, T. C. Gilbert<sup>1</sup>, J. S. Caton<sup>1</sup>, D. Kreft<sup>2</sup>, and D.V. Dhuyvetter<sup>3</sup>, <sup>1</sup>North Dakota State University, Fargo, ND, <sup>2</sup>Central Grasslands Research Center, Streeter, ND, <sup>3</sup>Farmland Industries, Kansas City, MO.

Fall calving, crossbred cows (39; 645.9 ± 60.9 kg) were used to determine the response to protein supplementation during early lactation (September through November). Following calving, cows were stratified by weight and randomly allotted into three treatment groups; control, (no supplement; CON); rumen degradable intake protein supplementation, (DIP); and DIP + undegradable intake protein supplementation, (DIP+UIP). Supplements were based on wheat midds and sunflower meal. Blood meal and corn gluten meal were used to supply UIP. The DIP supplement was formulated to contain 24% CP and 70% DIP. The DIP+UIP supplement was formulated to contain 33% CP and 50% DIP. Cows were stanchioned every other day and individually fed the supplement for thirty days; (2 kg / feeding). Supplements were formulated to provide equal levels of energy (based on TDN) and DIP. Cows grazed native mixed-grass prairie for the duration of the trial. Difficulty was observed with consumption of all supplements early in the trial. Cow and calf weight change, cow body condition score change, four hour milk production, milk fat percentage, and milk protein percentage were measured. Preplanned contrasts were used to compare the CON to the average of DIP and DIP+UIP, and to compare DIP to DIP+UIP. Milk production and characteristics were not influenced by treatment (P > .10). Four hour milk production averaged 1.67 kg. Supplemented cows with DIP + UIP had less weight loss than DIP fed cows (P < .01). Calves nursing supplemented cows gained more weight than calves nursing non-supplemented cows (P < .005; 63.8 kg, 71.8, and 71.1 for CON, DIP, and DIP+UIP respectively). These data suggest that protein supplementation improves calf weight gain during early lactation of fall calving cows.

**Key Words:** Lactation, Grazing, Supplementation

**796 Performance of lactating cows pastured or housed under the influence of bST.** D. G. Johnson\*, S. Foell, and B. Seguin, *University of Minnesota, Morris and St. Paul.*

Seasonal pasture-based dairying in the upper Midwest must control costs and maintain a twelve month calving interval to be successful. The objective of this study was determine the effect of feeding system (P,H) and bST (+,0) on production, body condition and reproduction of lactating cows. Non-pregnant Holstein cows (48) were assigned to: Pasture with bST (P+); Pasture without bST(P-); Housed with bST (H+); and Housed without bST(H-). Pasture was bromegrass changed twice daily and 7.3 kg concentrate with limited corn silage. Stable housing was tie-stalls and a TMR comprised (DM) of corn silage,.275; alfalfa silage,.275; concentrate, .45. Concentrate contained finely ground shelled corn, dried distillers grains and vitamin/mineral mix. Administration of bST (Posilac) was at 14 day intervals. All cows were pastured prior to the 88 day experimental period (July-September. At day 14 the Ovsynch protocol was initiated (day 14 - GnRH, day 21 - Prostaglandin, Day 23 GnRH, day 24 bred. Blood plasma from days 14,21,23, and 44 was analyzed for progesterone (P) concentration. Body weight(BW)and Condition score (CS) were obtained on day 29.

Treatments	P+	P-	H+	H-
Milk (kg)	23.3 <sup>1</sup> (1.2) <sup>2</sup>	21.4(1.2)	23.2(1.2)	21.4(1.2)
BW day 29 (kg)	533 (19)	522 (20)	512 (19)	497 (19)
CS day 29	2.9 (.1)	2.9 (.1)	2.8 (.1)	2.9 (.1)
P day 14 (ng/ml)	3.99 (1.23)	4.17 (1.28)	2.95 (1.23)	4.48 (1.23)
P day 21 (ng/ml)	3.95 (.76)	4.5 (.79)	2.86 (.76)	2.81 (.76)
P day 23 (ng/ml)	0.09 (.11)	0.03 (.12)	0.23 (.12)	0.22 (.12)
P day 44 (ng/ml)	0.74 (.69)	2.00 (.72)	1.90 (.69)	2.31 (.69)

<sup>1</sup>LS means <sup>2</sup>Standard Error

**Key Words:** Pastures, Reproduction

**797 Effect of defoliation and sowing density on yield and gross energy of *Gliricidia sepium*.** T. Clavero\*, R. Razz, and A. Rodriguez-Petit, *Universidad del Zulia, Venezuela.*

A field experiment under tropical dry forest conditions was carried out in Venezuela in order to evaluate the dry matter yield (DMY) and gross energy content (GE) of mouse bush (*Gliricidia sepium*). The plants were established in two sowing densities (2500 and 5000 plants/ha) and three cutting frequencies (6, 9 and 12 weeks). Samples were analyzed for gross energy of the fine fractions (sheets and minor stems of 5 mm) and bulk (greater stems of 5 mm) of the mouse bush. A split plot in a random block design with four replications was used. The results showed the highly significant differences ( $P < 0.01$ ) for frequencies x density interaction. DMY of *Gliricidia sepium* was increased with maturity and high densities. The highest values for DMY (1425 kg DM/ha) were obtained when the density for *gliricidia* was 5000 plants/ha and harvested every 12 weeks. The maximum values of gross energy content in both fractions was with a harvest interval of 9 weeks and 5000 plants/ha, with mean values of 4680 and 4168 cal/g for fine and bulk fractions, respectively.

**Key Words:** *Gliricidia Sepium*, Gross Energy, Defoliation

**798 Effects of supplemental degradable intake protein on intake and digestibility of medium-quality bermuda and low-quality brome hay.** C. P. Mathis\*, R. C. Cochran, J. S. Heldt, B. C. Woods, K. C. Olson, and E. C. Titgemeyer, *Kansas State University, Manhattan.*

Two independent experiments were conducted using sixteen ruminally fistulated beef steers (Exp. 1, 296 kg; Exp. 2, 306 kg). Steers were blocked by weight and assigned to one of four treatments to evaluate the effect of increasing level of supplemental degradable intake protein (DIP) on forage intake and digestion. In Exp. 1, steers were fed bermuda hay containing 70.8% NDF, 8.2% CP, and 58.6% DIP and in Exp. 2 brome hay containing 65.4% NDF, 5.9% CP, and 49.2% DIP was fed. In both experiments, hay was offered to each steer at 130% of average voluntary intake for the preceding 5-d period. Supplemental DIP (sodium caseinate; 91.6% CP, 100% DIP) was ruminally infused at 0700, immediately prior to feeding forage. Levels of DIP supplementation were 0, .041, .082, and .124% BW (0, .045, .090, and .135% BW of casein DM/d). Following a 10-d adaptation, intake and total fecal output were measured for 7 d. In Exp. 1, neither forage OM intake nor total OM intake and digestibility were influenced ( $P > .35$ ) by increasing level of DIP supplementation. The DIP intrinsic to the bermuda hay was estimated to be approximately 8% of the total digestible OM intake (TDOMI) in the steers that did not receive supplemental DIP. In Exp. 2, increasing level of supplemental DIP tended to increase total OM intake ( $P = .10$ ) and OM digestibility ( $P = .19$ ). The concomitant effects on intake and digestion resulted in an increase ( $P = .06$ ) in TDOMI. However, TDOMI tended ( $P = .17$ ) to exhibit diminishing response, with a peak response achieved when total DIP intake comprised approximately 10% of the TDOMI (supplemental DIP treatment of .082% BW). In general, when steers were fed a low-quality brome hay, DIP supplementation enhanced forage utilization. However, when steers were fed a bermuda hay of slightly higher quality, DIP supplementation had no influence on forage intake and digestion.

**Key Words:** Forage, Intake, Protein

**799 The effects of stage of maturity and method of preservation on the nutritive value of Smooth Bromegrass And Eastern Gamagrass.** J. E. Turner\*, L. H. Harbers, M. K. Seifers, M. A. Young, G. L. Huck, and K. K. Bolsen, *Kansas State University, Manhattan.*

In Trial 1, smooth bromegrass (SBG) and eastern gamagrass (EGG) were harvested at the early-bloom and late-flowering stages of maturity and ensiled in pilot-scale silos after a 24-h field-wilting period. Pre-bloom, field-wilted alfalfa was included as a control. The five silages were fed to 20 wether lambs in a two-period DMI and digestion trial. Voluntary DMI, nitrogen retention, and nutrient digestibilities were highest ( $P < .05$ ) for lambs fed alfalfa silage. Dry matter digestibility decreased ( $P < .05$ ) with advancing maturity in the grass silages, and NDF and ADF digestibilities tended to be higher in early-bloom versus late-flowering grass silage. In Trial 2, early-bloom SBG and EGG and pre-bloom alfalfa were field-wilted and ensiled as described in Trial 1. The three silages and early-bloom SBG hay were fed to 16 wether lambs in a two-period DMI and digestion trial. The SBG hay was packaged in small rectangular bales after a 72-h field-wilting period, and the hay was ground before feeding. The SBG silage and hay and EGG silage had statistically similar nutritive values. Alfalfa silage supported the highest ( $P < .05$ ) DMI, nitrogen retention, and DM and CP digestibilities. Weather conditions were excellent (warm temperatures and low humidities) for each of the field-wilting periods. All eight forages ensiled in the two trials were satisfactorily preserved, as evidenced by terminal pH values between 4.04 and 4.69, DM contents between 37.3 and 53.8%, and the absence of visible mold.

**Key Words:** Grass, Smooth Brome, Silage

**800 Effect of supplemental carbohydrate source on intake and digestion of low-quality tallgrass-prairie forage by beef steers.** J. S. Heldt\*, R. C. Cochran, C. G. Farmer, C. P. Mathis, T. G. Nagaraja, E. C. Titgemeyer, and E. S. Vanzant, *Kansas State University, Manhattan*.

Two consecutive randomized complete block experiments were conducted to evaluate the effects of supplemental carbohydrate (CHO) source on the utilization of low-quality, tallgrass-prairie forage by beef steers. Twenty ruminally cannulated steers (Exp. 1, 448 kg and Exp. 2, 450 kg) were blocked by weight and assigned to one of five treatments. The treatments were no supplement (NC), or supplemental starch, dextrose, fructose, or sucrose fed at .30% BW/d. Supplemented steers also received degradable intake protein (DIP; sodium caseinate) fed at .031% BW/d in Exp. 1 and .122% BW/d in Exp. 2. Supplements were placed directly into the rumen once daily. Steers had ad-libitum access to low-quality tallgrass-prairie hay (Exp. 1; 5.2% CP and 72.7% NDF and Exp. 2; 5.2% CP and 76.0% NDF). Fecal output was determined using ADIA as an internal marker. Supplements did not ( $P > .07$ ) affect forage OM intake compared with NC in either experiment. However, in both experiments supplemented cattle had higher ( $P \leq .06$ ) total OM intake compared with NC. In Exp. 1, when low DIP was supplied, NDF digestion was lower ( $P < .03$ ) than NC for the dextrose and sucrose groups, and starch and fructose were intermediate. In Exp. 2, when DIP was high, supplemental dextrose and fructose increased ( $P \leq .06$ ) NDF digestion whereas starch and sucrose were similar to NC. Because NDF digestion was not depressed by supplementation in Exp. 2, all supplemented groups had higher ( $P \leq .06$ ) total diet OM digestion. In both experiments total digestible OM intake was increased ( $P \leq .06$ ) by supplementation, with some trends evident for differences among the CHO sources. In general, when DIP was inadequate, supplemental CHO depressed fiber digestion. However, when DIP was high, negative effects on fiber digestion were alleviated. Additionally, there was some evidence that supplemental CHO source may influence OM and NDF digestion.

**Key Words:** Forage, Intake, Carbohydrates

**801 Grazing millet during late fall-early winter that was harvested and stored in windrows: An alternative to feeding baled millet in Eastern Colorado.** C. L. Munson\*, J. C. Whittier, D. N. Schutz, and R. L. Anderson, *Colorado State University*.

The objective of this study was to determine if grazing millet stored in windrows is a viable alternative to baling and re-feeding millet hay. Sixty primiparous heifers (458 kg, 5.9 BCS), bred to begin calving February 17, were randomly allotted to windrow grazing or bale feeding to determine if heifer performance would differ between treatments. Research was conducted from November 5, 1997 to January 8, 1998. Millet was planted in early July in two fields and was harvested using a 17' draper type swather in early September. The fields were divided into strips of 8 to 10 windrows prior to baling and the strips were either baled into small square bales or left as windrows, based on forage yield. Bales were weighed to estimate the forage amount in the windrows of similarly yielding strips. Bales were removed and stacked at the end of the respective baled strip for later feeding. Windrows were approximately 1 m wide and 20 cm high. Bales and windrows were analyzed October 9 for ADF, NDF and CP % to determine the amount of forage needed to meet the heifers' requirements. Field one (19.43 ha) was divided into 3 baled and 3 windrowed strips. Field two (2.08 ha) was divided into 1 baled and 1 windrowed strip. Treatments were: 1) windrow grazing with forage allocation controlled to  $13.2 \text{ kg} \cdot \text{heifer}^{-1} \cdot \text{H} \cdot \text{d}^{-1}$  by moving a temporary cross fence every day and 2) daily bale feeding of  $13.2 \text{ kg} \cdot \text{heifer}^{-1} \cdot \text{H} \cdot \text{d}^{-1}$ . Bale fed heifers were confined on baled strips and allotted the same amount of space as windrow grazing heifers by moving the temporary cross fence. Heifer weight and BCS were measured at d 1, 28, 56, and 65. Heifer ADG and BCS change were calculated from d 1 to 28, d 28 to 56 and d 1 to 65. Weight or BCS changes between the treatments were not different for any time period ( $P > .15$ ). Forage samples were collected every two weeks for later analysis. Overall, similar heifer performance was attained while the costs of baling and re-feeding were eliminated by grazing the windrows.

**Key Words:** Grazing Systems, Forages, Beef cattle

**802 Intake, digestion and nitrogen balance in lambs supplemented with high or low levels of undegradable intake protein.** M. W. Salisbury\*, T. T. Ross, C. R. Krehbiel, C. L. Schultz, and L. Melton, *New Mexico State University, Las Cruces*.

Six white face wether lambs (initial BW, 48.2 kg) were used in a replicated 3 x 3 Latin square to determine the effect of undegradable intake protein (UIP) on intake, nitrogen (N) balance and total tract digestibility. Wethers were kept in metabolism crates with ad libitum access to a lovegrass, bluegrama mixture (7.5% CP) and fresh water. Three treatments consisted of control (no supplement), High UIP (209.3 g/d of a 32% CP supplement supplying 41.86 g/d of UIP and 25.11 g/d of degradable intake protein, DIP), and Low UIP (209.3 g/d of a 32% CP supplement supplying 18.84 g/d UIP and 48.14 g/d DIP). Wethers were given a 7 d adaptation period followed by a 4-d collection in which total urine and feces were collected for analysis of urine and fecal N, fecal DM, OM, and ADF. Forage refusals were collected daily to determine DM intake. Control lambs consumed more forage and ADF ( $P = .001$ ) but less total DM and OM ( $P = .01$ ) than lambs consuming High and Low UIP. Total N intake ( $P = .001$ ), fecal N excretion ( $P = .03$ ), and total N excretion ( $P = .001$ ) were greater in lambs supplemented with protein compared to the controls. Urinary N excretion was greater ( $P = .001$ ) for High UIP lambs than Low UIP lambs, and Low UIP lambs were greater ( $P = .001$ ) than controls. Total N retained ( $P = .01$ ) and total N retained as a percent of N intake ( $P = .05$ ) were greater for supplemented lambs than control lambs. Supplementation did not affect ( $P > .10$ ) fecal DM, OM, ADF or forage digestibility. Feeding a 32% CP supplement will increase N retention in lambs consuming a medium-quality forage. However, N retention may not be affected by the ruminal degradability of the protein supplement.

**Key Words:** Undegradable Intake Protein, Digestibility, Lambs

**803 Value of various levels of corn and soybean meal fed with hay to stocker steers.** R. L. McCraw and B. C. Allison\*, *NC State University, Raleigh*.

The objective was to determine the feeding value of a corn plus soybean oil meal (SBOM) supplement (CS) fed at various levels with hay to stocker calves. CS consisted of 96.3% ground shelled corn and 3.7% SBOM (49% CP). Eighty steers (208 kg) were included in a randomized block design with 10 animals in each of four treatments with each treatment replicated. Treatments were 0 (T0), 1.1 (T1), 2.3 (T2), and 3.4 (T3) kg/h/d of CS fed once daily for 126 d with all the ground hay that animals in a pen would consume. Bov-A-Min<sup>TM</sup> mineral supplement containing Bovatec<sup>TM</sup> was provided free choice. Animals did not differ in initial wt or mineral supplement intake ( $P > .10$ ). Hay consumed (kg DM/h/d), daily gain (kg), total feed cost (\$), and feed cost per 45 kg of gain (\$) for T0, T1, T2, and T3 were: 6.1, 0.46, 78.81, 27.82; 5.6, 0.67, 106.38, 26.14; 5.5, 0.78, 135.59, 28.57; and 4.1, 0.80, 150.90, 31.02, respectively. Hay consumption differed ( $P < .01$ ) except between T1 and T2 ( $P > .10$ ). Gains differed ( $P < .01$ ) except between T2 and T3 ( $P > .10$ ). Feed costs per 45 kg of gain differed ( $P < .05$ ) except between T0 and T1 ( $P > .05$ ) and T0 and T2 ( $P > .05$ ). Results indicated that increasing levels of CS in the diet decreased hay consumption and increased gains. However, with hay (89.4% DM, 11.7% CP, 61.6% TDN) valued at \$82/t, ground corn at \$220/t, SBOM (53% CP) at \$352/t and the cattle selling for \$1.12 to \$1.28/kg (1995-1996), supplementing hay with CS was not economical.

**Key Words:** Stocker Cattle, Growing Ration

**804 Lactation performance of Holstein cows fed orchardgrass silage.** D. J. R. Cherney\*, J. H. Cherney, and L. E. Chase, *Cornell University, Ithaca, NY.*

Two studies were conducted to study the effects of orchardgrass quality on lactation performance. In study one, 60 Holstein cows in midlactation (109 ± 49 DIM initially) were randomly assigned to one of three diets for the 10 wk trial. Each diet was balanced to provide NDF equal to 0.95 % of BW, primarily from forage with corn silage (47 % NDF) set at 20 % of the total forage DM. Forages studied included alfalfa (52 % NDF; ALF), an early cut orchardgrass (46 % NDF; OGE) and a late cut orchardgrass (68 % NDF, OGL), all ensiled. Diets were balanced for NE<sub>L</sub> (38 Mcal/d) and CP (4.0 kg CP/d) with high moisture corn grain and soybean meal and fed as TMRs. Forages comprised 53 %, 47 %, and 44 % of total diet DM for ALF, OGE, and OGL based TMRs, respectively. Milk production tended to be higher for cows fed the OGE (38.7 ± 9.8 kg/d) than for cows on the ALF (34.7 ± 7.4 kg/d) or OGL (32.9 ± 8.3 kg/d). This was primarily due to a higher DMI by cows on OGE (23.5 ± 1.0 kg/d) than on other diets (22.0 ± 1.1 and 21.3 ± 1.6 kg/d for ALF and OGL, respectively). Milk production differences between diets were larger early in the study and in cows less than 60 DIM. In a second study, 50 early-lactation (57 ± 28 DIM initially) Holstein cows were assigned randomly to one of two TMR diets: early cut orchardgrass silage (54 % NDF) or late cut orchardgrass silage (58 % NDF). As in study one, each diet was balanced to provide NDF equal to 0.95 % of BW and were balanced for NE<sub>L</sub> (38 Mcal/d) and CP (4.0 kg CP/d) with high moisture corn grain and soybean meal. Cows on the early cut TMR had higher (P < 0.01) DMI (19.3 ± 3.4 kg/d) during the 7 wk trial than those on the late cut TMR (15.6 ± 2.8 kg/d). Higher DMI by the cows on the early cut TMR resulted in more (P < 0.05) milk produced (35.3 ± 6.8 kg/d) than those on the late cut TMR (31.3 ± 5.8 kg/d). Results indicate that quality of orchardgrass NDF is important in determining DMI and resulting milk production.

**Key Words:** Grass, Forage Quality, Lactation

**805 Effect of dairy manure on yield and quality of alfalfa and orchardgrass.** W. M. Coleman\* and R. G. Dado, *Southern Illinois University.*

Increasing animal density on modern dairy operations may necessitate application of manure on forage crops. Little is known how forage quality may change with this practice. Objectives were to determine the effect of dairy manure on yield, botanical composition, and nutrient content of alfalfa (ALF) and orchardgrass (OG). Three plots (ALF: 476 m<sup>2</sup>; OG: 237 m<sup>2</sup>) of each forage were established in each of four field locations and received one of three rates (0, 11.2, or 22.4 t/ha/application) of dairy manure (28.1 ± 2.1% DM). Manure was applied prior to initial spring growth and immediately following each of three harvests. Prior to harvests, samples were collected and forage separated from weeds. Small square bales from each harvest were weighed and cored to determine yield and nutrient content. Yield and height of both ALF and OG increased linearly (P < .02) with increasing manure; OG responded to a greater extent. Weed content (% of DM yield) was high, but not affected by manure (P > .25). Fiber content (NDF, ADF, and lignin) of bale core and pure forage samples was not affected by manure treatments (P > .10); CP of alfalfa cores differed (P < .05). Manure increased yield but did not alter fiber content of forages to which it was applied. Palatability studies are in progress.

Item	Manure Treatment			Contrast(P>F)	
	None	Low	High	Linear	Quadratic
<b>Alfalfa</b>					
Yield (t/ha)	2.15	2.58	2.65	<0.01	0.08
Weeds (%)	46.3	47.1	50.0	0.20	0.65
CP (% of DM)	15.8	15.0	15.4	0.14	<0.01
<b>Orchardgrass</b>					
Yield (t/ha)	1.41	2.06	2.41	<0.01	0.28
Weeds (%)	25.3	23.5	21.7	0.56	0.99
CP (% of DM)	11.0	11.4	10.7	0.44	0.20

**Key Words:** Manure, Forage Quality, Nutrient Management

**806 Comparison of different forms and amounts of corn supplements for lactating grazing Holstein cows.** F. D. Soriano\*, C. E. Polan, and C. N. Miller, *Virginia Polytechnic Institute and State University.*

A ten-week grazing study was carried out during the months of May, June, and July to compare milk yield and composition by 36 lactating Holstein cows averaging 107 days in milk. An intensive rotational grazing system was used. Cows were supplemented daily either with (kg/d) 7.8 high moisture corn (HMCH), 6.7 coarsely ground corn (CGC), 6.7 finely ground corn (FGC), or 5.2 high moisture corn (HMCL) in two equal feedings. Twice a week pasture samples were taken and compressed sward height was measured to determine herbage dry matter availability and chemical composition prior to grazing. Pasture crude protein (CP) as a % of dry matter (DM), and NEL (Mcal/kg DM) averaged 19.6, 27.4, and 23.9 and 1.68, 1.69, and 1.63, during the months of May, June, and July, respectively. Average herbage DM availability was of 2245, 1876, and 1348 kg/ha for each month of the study. Milk yield was similar (30.8, 30.1, 29.7, and 30.5 kg/d) for cows supplemented with HMCH, CGC, FGC, or HMCL, respectively. Milk protein (2.96, 2.96, 2.99, and 2.95 %) and milk urea nitrogen (13.7, 14.3, 15.0, and 15.8 mg/dl) did not differ among treatments. Similarity in milk production, milk composition, body weight change, and body condition score change between treatments indicates that the quality and availability of pasture permitted equal response regardless of the type or amount of corn supplemented.

**Key Words:** Dairy Grazing, Pasture Composition, Corn Supplementation

**807 Increasing milk output of seasonal pasture-based dairy systems with nitrogen fertilizer (N) and supplementary feeds.** J. W. Penno\*, J. M. McGrath, K. A. Macdonald, and A. M. Bryant, *Dairying Research Corporation, Hamilton, New Zealand.*

Grazed grass and legume based pasture is almost the only feed used for milk production in New Zealand. Therefore, the amount of pasture grown constrains total milksolids (MS; milkfat + protein) output. Annual dry-matter (DM) production of developed pastures has reached a plateau limited by climate and the rate of legume nitrogen fixation. Eight farmlets of 5.7 ha, stocked with 500 kg Friesian cows were established to measure the increase in MS output resulting from increasing pasture production with N (Farmlets 2 - 5), and offering the herd either cracked maize grain (Farmlet 6), maize silage (Farmlet 7), or a TMR type ration (Farmlet 8). Results are presented for two complete seasons from June 1995. Applying 210 and 427 kg N/ha/year increased annual pasture and MS production by 1.8 and 3.4 t DM/ha/year, and 141 and 219 kg MS/ha/year. Stocking rate had little effect on the MS response to N. Offering large amounts of cracked maize, maize silage, or a balanced ration increased output by 581, 429 and 572 kg MS/ha/year, respectively. The balanced ration showed no advantage over offering cracked maize grain alone. While this trial has demonstrated the large increases in production that are achievable within seasonal pasture-based farm systems, at current prices only Farmlet 2 demonstrated higher profitability than the traditional pasture only system (Farmlet 1).

Farmlet	1	2	3	4	5	6	7	8
Cows/ha	3.34	3.34	3.34	4.41	4.41	4.41	4.41	4.41
kg N/ha/year	0	204	428	205	425	211	215	216
<i>Supplementary feed (kg DM/cow/year)</i>								
Pasture silage	0	209	254	101	78	204	161	134
Maize silage	0	0	0	0	0	0	1154	457
Cracked maize grain	0	0	0	0	0	1283	0	484
Other concentrates	0	0	0	0	0	0	0	338
Pasture (t DM/ha/year)	17.8	19.5	21.0	18.7	21.4	19.7	20.2	20.1
Milksolids (kg /cow/year)	325	373	394	275	294	406	371	404
Milksolids (kg/ha/year)	1086	1244	1313	1211	1297	1792	1640	1783

**Key Words:** Milk Production, Pasture, Dairy Farm Systems

**808 Milk production of cows grazing ryegrass, clover or birdsfoot trefoil.** S. L. Harris\*, D. A. Clark, and P. G. Laboyrie, *Dairying Research Corporation Hamilton, New Zealand.*

New Zealand dairying is based on ryegrass (*Lolium perenne*) - white clover (*Trifolium repens*) pastures. The experimental objective was to investigate birdsfoot trefoil (*Lotus corniculatus*) as a forage for dairy cows. *Lotus* contains condensed tannins (CT) that bind plant protein in the rumen but release it in the intestine so increasing amino acid absorption and utilisation compared with non-CT containing legumes eg. white clover. Two groups of 10 cows grazed either pure ryegrass or 70% clover:30% ryegrass pasture (dry matter (DM) basis) and one group of 6 cows grazed *Lotus* (73% *Lotus*, 10% clover, 17% ryegrass). A pasture allowance of 60 kg DM/cow/d was offered to each group for the 10 day experiment in mid lactation. Herbage intake (DMI, alkane technique), milk yield and composition measurements were made over the final 5 days. Milk yields on clover and *Lotus* pastures were 38% and 53% greater respectively than on ryegrass ( $P < 0.05$ ). Forage species had no effect on fat% but protein% was significantly higher ( $P < 0.05$ ) on both clover and *Lotus*. Increased yields on clover were due to higher forage quality and DMI resulting in an increased metabolizable energy (ME) intake. Increased milk yields on *Lotus* were due to both improved forage quality and the effect of CT in *Lotus*. DMI of cows grazing *Lotus* were not significantly different from DMI on either ryegrass or clover. Higher milk yields on *Lotus* compared with clover can be explained by the higher legume content of the pasture and greater efficiency.

Pasture	Ryegrass	Clover	<i>Lotus</i>	SED
Milk yield (l/cow/d)	12.95	17.82	19.77	0.64
Fat%	4.29	4.41	4.07	0.13
Protein%	3.15	3.30	3.36	0.03
Pasture ME (MJ/kg DM)	10.8	11.9	12.7	0.2
Intake (kg DM/cow/d)	13.5	15.4	14.6	0.8
Efficiency	0.089	0.096	0.111	0.009

**Key Words:** *Lotus corniculatus*, Milk Yield, Pasture

**809 Selective grazing by dairy cattle in the Hyblean region of Sicily.** S. Carpino<sup>1</sup>, G. Campisi<sup>1</sup>, S. Caruso<sup>1</sup>, A. Rizza<sup>1</sup>, E. Tumino<sup>1</sup>, G. Licitra<sup>1\*</sup>, and P. J. Van Soest<sup>2</sup>, <sup>1</sup>*Consorzio Ricerca Filiera Lattiero-Casearia, University of Catania, Italy,* <sup>2</sup>*Cornell University, Ithaca, NY.*

Dairy cattle in Hyblean area of Sicily traditionally graze on mixed native pastures. The possible correlation between the nutritional characteristics of the pastures and milk and cheese quality encourages study. Previous botanical studies (Licitra et al., 1995) identified 105 different species from 20 plant families in the area. Objective of our study was to identify the most representative Hyblean native plants species for palatability. Plants were collected at different stages of growth during the forage season. Two kinds of samples were collected in the grazed fields: one, a random bulk sample of existing species, and a selective one chosen by observation following the cows for two hours a day. Existing species were also monitored on ungrazed fields. Preference was based on the relative occurrence of species in the respective grazed and ungrazed fields. Several families were identified in the ungrazed bulk sample. In order of declining order of occurrence were: Compositae, Geraniaceae, Leguminosae, Cruciferae, Boraginaceae, Malvaceae, Graminaceae, and Ranunculaceae. The results showed cows have a high selectivity in the complex pastures. Early stages of growth were preferred. Depending on availability during the forage season order of preference was: Geraniaceae, Malvaceae, Primulaceae, Leguminosae, Boraginaceae, while Cruciferae, Euphorbiaceae, Ranunculaceae, Compositae, and Graminaceae were discriminated against. Quantitatively the Geraniaceae, Leguminosae, Cruciferae, Boraginaceae and Malvaceae provided the most forage. Composition of Hyblean native pastures indicated high nutritive value and encourages more study to characterize these species.

**Key Words:** Pastures, Composition, Selectivity