regard to beef cattle, prevalence rates of *E. coli* O157 ranged from 0.3 to 19.7% in the feedlot and from 0.7 to 27.3% on pasture. The corresponding prevalence rates of non-O157 STEC were 4.6 to 55.9% and 4.7 to 44.8%, respectively. Of the 350 STEC serotypes isolated from cattle feces or hides, 63 were detected in HUS patients and 61 are known to cause other human illnesses. The results indicated prevalence of a large number of pathogenic STEC in beef cattle and their products at high rates and emphasized the critical need for control measures to assure beef safety.

Key Words: Food safety, *Escherichia coli*, Beef cattle

45 Pre-harvest control of *Escherichia coli* O157. J. T. LeJeune* and A. N. Wetzel, *The Ohio State University*, *Wooster*.

Bovine manure is an important source of *Escherichia coli* O157 contamination of the environment and foods; therefore, effective interventions targeted at reducing the prevalence and magnitude of fecal *E. coli* O157 excretion by live cattle (pre-harvest) is desired. Pre-harvest intervention methods can be grouped into three approaches: (1) exposure reduction strategies; (2) exclusion strategies; and (3) direct anti-pathogen strategies. Exposure reduction involves environmental management targeted at reducing bovine exposure to *E. coli* O157 through biosecurity and environmental niche management such as feed and drinking water hygiene, reduced exposure to insects or wildlife, and the condition of the bedding, or pen floor. In the category of exclusion, we group vaccination and dietary modifications such as, selection of specific feed components, in-feed delivery of prebiotics, probiotics, and competitive exclusion cultures-all strategies that would theoretically limit the proliferation of *E. coli* O157 in or on the live animal following exposure. Direct anti-pathogen strategies are those that are intended to be bacteriocidal to *E. coli* O157 in or on cattle. This includes treatment with chemicals (sodium chlorate, antibiotics), bacteriophages, or physical washing of animals pre-slaughter. Presently, only one pre-harvest control for *E. coli* O157 in cattle has been demonstrated repeatedly to be effective and gained widespread adoption (the feeding probiotic *Lactobacillus acidophilus*). Progress is being made in the direction of pre-harvest control strategies in cattle. More research into the effectiveness of parallel and simultaneous application of one or more pre-harvest control strategies, as well as the identification of new pre-harvest control techniques, may provide practical means to substantially reduce the incidence of human *E. coli* O157-related illnesses by intervening at the farm level.

Key Words: *E. coli* O157, Pre-harvest, Food safety

Forages and Pastures: Quality and Antiquality

46 The biochemistry of tannins: Role in ruminant production. J. Foster*, *USDA, ARS, Appalachian Farming Systems Research Center*, *Beaver, WV*.

Tannins are high molecular weight, water-soluble polyphenols that form reversible complexes with proteins through pH-dependent hydrogen bonding and hydrophobic interactions. Hydrolyzable tannins (HT) contain a carbohydrate core esterified with gallic or hexahydroxydiphenic acid. Binding of HT to abomasal mucosal proteins causes lesions that result in diarrhea or constipation. Hydrolytic products of HT are absorbed from the small intestine, disrupt liver and kidney function, and may cause photosensitization and dehydration. Condensed tannins (CT) or proanthocyanidins are oligomers of flavan-3-ols or flavan-3,4-diols that are linked by C-4/C-8 or C-4/C-6 interflavan bonds. Variations in chemical reactions of CT arise from differences in monomeric constituents, interflavan bond type, polymer length and branching, molecular weight, and concentration. High concentrations of CT in ruminant diets result in formation of stable, insoluble complexes with digestive enzymes and proteins in feed, saliva, and microbial cells, decreasing feed intake and digestibility and increasing fecal N excretion. Complexation of metal ions by CT can result in microbial mineral deficiencies. Protection against the negative effects of CT is provided by proline-rich salivary proteins in some ruminants and can be achieved with polyethylene glycol supplements which disrupt tannin-protein complexes. At low concentrations, CT decrease proteolysis of dietary proteins, rumen ammonia production, and rumen bacterial biomass, and increase N flow to the abomasum and absorption of essential amino acids in the small intestine. Results include increased animal weight gain; improved fiber, meat, and milk production; and higher ovulation rate. Protein-CT complex formation also reduces rumen gas formation and prevents production of a stable foam in the rumen, alleviating bloat in ruminants consuming protein-rich diets. Anthelmintic properties of CT in ruminants are associated with improved nutrient supply to the lower gastrointestinal (GI) tract. Positive effects of CT on GI nematode parasites include lower fecal egg counts, decreased worm burdens, and inhibition of egg hatch and larval development.

Key Words: Tannins, Nutrient utilization, Herbal anthelmintic

47 Polyphenols and mechanical maceration shift protein fractions in legume hays from rapidly to slowly degraded forms. J. H. Grabber*, *USDA-Agricultural Research Service, US Dairy Forage Research Center*, *Madison, WI.*

Rapid proteolysis of forage protein during rumen fermentation can impair protein use by dairy cattle. The severity of conditioning at harvest may influence protein degradability in forages, particularly if protein-binding polyphenols are present. In 2002 and 2003, first and second cuttings of alfalfa, red clover with o-diphenols and polyphenol oxidase, and three birdsfoot trefoil populations with low to high tannin levels were conventionally conditioned with rolls or macerated and then dried as hay. Forage protein was partitioned with buffer and detergent solutions into rapidly (AB1), moderately (B2), and slowly (B3) degraded and undegradable (C) fractions. Treatment differences noted below were significant at the 0.05 level. Averaged over years and harvests, crude protein averaged 222 g/kg for alfalfa and 207 g/kg for trefoils and clover. Protein in roll conditioned alfalfa was comprised of 440 g/kg of AB1, 451 g/kg of B2, 75 g/kg of B3, and 34 g/kg of C. The high tannin trefoil had 64 g/kg less AB1, 59 g/kg more B2, similar B3, and 7 g/kg more C than alfalfa. Red clover had 107 g/kg less AB1, 40 g/kg more B2, 68 g/kg more B3, and similar C compared to alfalfa. Shifting from roll conditioning to maceration decreased AB1 by an average of 115 g/kg in all forages. Maceration increased B2 by 53 g/kg in alfalfa, decreased B2 by 41 g/kg in red clover, and had no effect on B2 in high tannin trefoil. Maceration increased B3 by 63 g/kg in

alfalfa, 94 g/kg in high tannin trefoil, and 163 g/kg in red clover, and increased C by 15 g/kg in high tannin trefoil and 7 g/kg in red clover without altering C in alfalfa. The results indicate that polyphenols and maceration shifted protein fractions from rapid to slowly degraded forms. Maceration enhanced the action of polyphenols, shifting protein to the slowly degraded B3 and undegradable C fractions. The impact of these shifts on milk production and nitrogen utilization by dairy cattle will be evaluated using nutrition models.

Key Words: Hay protein fractions, Mechanical conditioning methods, Polyphenols

48 Lipolysis of red clover with differing polyphenol oxidase activities in batch culture. M. R. F. Lee*[1], L. J. Parfitt[2], and F. R. Minchin[1], [1]*Institute of Grassland and Environmental Research, Aberystwyth, Ceredigion, UK*, [2]*Institute of Rural Studies, University of Wales, Aberystwyth, Ceredigion, UK*.

Polyphenol oxidase (PPO) oxidizes endogenous phenols to quinones, which react with nucleophilic sites of other compounds such as proteins. In red clover (Trifolium pratense L.) , this complexing reaction has been shown to reduce both plant mediated proteolysis and lipolysis. This experiment investigated the role of red clover PPO on lipolysis in the presence and absence of rumen microorganisms. Triplicate macerated shoot samples of two red clover lines, a wild type with a basal level of PPO activity (High PPO) and a mutant with reduced PPO activity (Low PPO), were incubated in anaerobic buffer, with and without strained rumen liquor inoculum (I+ and I-), at 39°C, and sampled at six time (0, 1, 2, 4, 6 and 24 h). At each time point the samples were destructively harvested and lipolysis measured as percentage loss of membrane lipid. Lipolysis data was analysed using a general analysis of variance with repeated measurements (Genstat 8®). The table shows the reducing effect of PPO on lipolysis (High vs Low) but also the elevated level of lipolysis when micro-organisms are present (I+ vs I-). If the PPO effect was solely due to the deactivation of plant lipases this difference should be neutralized through the addition of microbial lipases. The retention of the PPO effect in the I+ treatments suggests that PPO exerts some form of protection on the membrane lipids in a manner similar to the complexing of protein. The lipid in forages is mainly in the form of polar membrane lipids, and polar lipid - phenol complexes could form due to the highly electrophilic nature of the PPO-produced quinones.

Table 1.

	High PPO		Low PPO			Significance		
	I+	I-	I+	I-	s.e.d.	PPO	I	PPO×I
Lipolysis (%) at 1h	10.6	6.6	37.4	8.5	2.97	*	*	NS
2h	16.7	8.9	37.5	17.2	5.10	*	*	NS
4h	36.0	14.6	44.6	21.9	3.68	*	***	NS
6h	35.0	23.8	57.5	25.6	6.43	*	**	NS
24h	71.5	28.3	82.4	41.9	5.94	*	***	NS

*P<0.05, **P<0.01, ***P<0.001

Key Words: Polyphenol oxidase, Lipolysis, Red clover

49 Physiological changes in heifers following grazing of toxic or non-toxic tall fescue. G. E. Aiken*[1], M. L. Looper[2], and B. H. Kirch[1], [1]*USDA-ARS, Forage-Animal Production Research Unit*, [2]*USDA-ARS, Dale Bumpers Small Farms Research Center*.

Rectal temperature and serum prolactin in yearling heifers were monitored for 22-d following a grazing trial that compared BW gains between Kentucky-31 and MaxQ tall fescues (*Lolium arundinaceum*). Response variables were used to compare physiological changes between heifers removed from Kentucky-31, infected with the toxic endophyte (*Neotyphodium coenophialum*), and those removed from MaxQ (cv. Jessup infected with a non-toxic endophyte). Heifers were stratified by BW and pregnancy status into 4 groups of 6 heifers and groups were randomly assigned to pastures in a completely randomized design with 2 replications. Grazing was initiated on 1 March, 2005 and terminated on 21 June, 2005. At termination of grazing, the heifers were maintained as a single group, and grazed on a 0.4-ha pasture of bermudagrass (*Cynodon dactylon*) and offered free choice bermudagrass hay. Following termination of fescue grazing, rectal temperatures were determined and blood samples were collected at 0830 on d 1, 3, 6, 8, 10, 14, 16, 20, and 22. Carryover effects from the fescue treatments were evaluated using pasture as the experimental unit. Rectal temperature was not affected ($P > 0.10$) by pregnancy status, but there was a cubic ($P < 0.05$) relationship between rectal temperature and days on bermudagrass. Rectal temperatures on Kentucky-31 were maximum (39.8°C) in 6 d, but declined and stabilized at 39.2°C in 14 d. Prolactin had a cubic ($P < 0.001$) relationship with days on bermudagrass, but the trends differed ($P < 0.001$) between the two fescues. Prolactin was initially low (15.0 ng/mL) in Kentucky-31 heifers, but increased nonlinearly and stabilized at approximately 113.8 ng/mL in 10 d. Although prolactin tended ($P < 0.10$) to be highest for pregnant heifers stocked on MaxQ, prolactin for both groups on MaxQ were initially high (pregnant = 292.8 ng/mL; open = 280.3 ng/mL), but decreased nonlinearly and stabilized (pregnant = 160.1 ng/mL; open = 127.3 ng/mL) in 10 d. Results indicated that heat stress can be alleviated for pregnant and open heifers grazed on toxic tall fescue by removing them from fescue and providing non-toxic diets for 10 to 14 days.

Key Words: Beef cattle, Tall fescue, Fescue toxicosis

50 Differences in morphological and cell wall traits of alfalfa plants selected for divergent stem in vitro fiber digestibility. H. G. Jung* and J. S. F. Lamb, *USDA-ARS, St. Paul, MN*.

This study compared alfalfa clones identified as either low or high rapid (16 h), or low or high potential (96 h) stem in vitro neutral detergent fiber digestibility (IVNDFD) for stem fiber, cell wall, and morphology traits. Five clones of each selection group were grown in replicated field plots at two locations. Primary spring growth and first summer regrowth was harvested in 2002 and 2003. Data were analyzed as a randomized complete block in a split-split plot design. Results were averaged across growth environments and harvests because interactions with alfalfa selection groups were non-significant. As expected, the high rapid clonal group was greater for 16-h IVNDFD than the corresponding low rapid clonal group. Similarly, the high potential clonal group was greater than the low potential clonal group for 96-h IVNDFD. Comparing the low and high rapid clonal groups, NDF and cell wall concentrations were lower for the high clonal group, but ADL and Klason lignin concentrations were only marginally different. Cell wall pectin concentration was greater in the high rapid clonal group (data not shown). In contrast, NDF and cell wall

concentrations were not different between the low and high potential clonal groups, but both ADL and Klason lignin were substantially lower for the high potential clonal group than the corresponding low clonal group. Stem lengths were longer for the low rapid and high potential clonal groups than their corresponding clonal groups, and all clonal groups had similar numbers of stem internodes. Mean internode lengths were greater for the low rapid and high potential clonal groups than their corresponding clonal groups. Our results indicate that rapid IVNDFD of alfalfa stems was associated with reduced cell wall concentration, increased cell wall pectin, and short internodes. High potential IVNDFD of alfalfa stems was a result of reduced cell wall lignification and long internodes.

Table 1. Morphology, cell wall traits, and IVNDFD of selected alfalfa clonal groups.

Trait	Low Rapid	High Rapid	Low Potential	High Potential
16-h IVNDFD, %	21.2d	22.3a	21.6b	21.4c
96-h IVNDFD, %	40.7c	42.2b	38.9d	42.8a
NDF, % DM	61.4a	58.6c	60.5b	60.5b
ADL, % NDF	16.1b	16.2b	16.8a	15.3c
Cell wall, % DM	68.8a	66.7c	68.2b	68.4ab
Klason lignin, % CW	21.4b	21.2c	22.8a	20.8d
Stem length, cm	52a	49b	46c	50b
Internodes	11.5	11.8	11.7	11.6
Internode length, mm	4.6a	4.2c	4.0d	4.4b

Trait means not sharing a common letter were different (P<0.05).

Key Words: Alfalfa, Fiber, Digestibility

51 Length of the daylight period before cutting improves rumen fermentation of alfalfa assessed by in vitro gas production. R. Berthiaume*[1], G. Tremblay[2], Y. Castonguay[2], A. Bertrand[2], G. Bélanger[2], C. Lafrenière[3], and R. Michaud[2], [1]*Agriculture & Agri-Food Canada*, *Lennoxville, QC, Canada*, [2]*Agriculture & Agri-Food Canada*, *Sainte-Foy, QC, Canada*, [3]*Agriculture & Agri-Food Canada*, *Kapuskasing, ON, Canada*.

The effect of the length of the daylight period before cutting (0, 2, 4, 8, or 12 hours) on water soluble carbohydrates, starch, and total non-structural carbohydrates (TNC) concentrations was assessed on alfalfa (Medicago sativa cv AC Caribou) grown under controlled conditions. We also determined the impact of the length of the daylight period on rumen fermentation assessed by in vitro gas production. Forage samples (n=4) at each sampling time were dried at 55°C immediately after harvest, ground to pass a 1 mm screen, and incubated for up to 142 h in an anaerobic medium inoculated with rumen fluid. Regular measurements of gas were taken to assess the rate of fermentation using the following gas production model ($Y = A \{1- e^{[-b (t-T) -c (\sqrt{t} - \sqrt{T})]}\}$). At the end of the incubation period, samples of the liquid phase were analysed for ammonia-N and volatile fatty acids. Gas production model parameters and measured effluent parameters were analyzed as a completely randomized design with 5 duration of daylight and 4 replicates per treatment. Starch and TNC concentrations in alfalfa increased (mean starch = 4.2, 5.6, 5.6, 4.5 and 10.4% DM; mean TNC = 11.9, 13.7, 14.0, 12.9 and 18.5% DM; $P < 0.001$) with the length of the daylight period. Rumen fermentation also increased ($P < 0.01$) with the length of the daylight period before cutting as shown by parameters (half-life; mean = 10.09, 10.61, 10.56, 10.24, 11.32 h and maximum values; mean = 231.5, 236.3, 236.9, 230.7, 248.9 ml) describing cumulated gas production curves. Propionate concentrations in the liquid phase increased linearly (mean = 11.8, 11.6, 12.8, 13.6, 14.6 mmol/L; $P = 0.01$) with a longer daylight period. Increasing the daylight period up to 12 h before cutting favoured the accumulation of starch and TNC in alfalfa and had a positive effect on rumen fermentation.

Key Words: Alfalfa, Carbohydrates, In vitro gas production

52 Effect of harvest schedule and plant part on in vitro gas production of temperate forages. J. L. Repetto*[1], A. Britos[1], N. Errandonea[1], D. Cozzolino[2], and C. Cajarville[1], [1]*Departamento de Nutrición Animal, Facultad de Veterinaria*, *Montevideo, Uruguay*, [2]*The Australian Wine Research Institute*, *Adelaide, Australia*.

The effects of harvest schedule and plant part on in vitro gas production and water soluble carbohydrate content (WSC), were studied on Uruguayan pastures in autumn. Two paddocks of Lucerne and one of Fescue (pastures) were sampled on 3 cuts (date): April 3, May 8 and May 30, at 3 moments (hour): 900, 1300 and 1700 h. Leaves (L), stems (S) and whole plant (WP) of each sample (part) were analyzed for WSC and nitrogen (N) content and were used as substrates to measure the in vitro gas production in ruminal liquor during 2, 4, 6, 9, 12, 24, 48 and 72 hours. Gas recordings (mL/g DM) were fitted to the model: $gas=a+b\ (1-e^{-ct})$, where a+b (mL) was the potential and c (%/h) the rate of gas production. Results were analyzed as a split-plot, using pasture as block, date and hour as main plots and part as split-plot. Correlations were made between chemical components and gas production. Afternoon harvests produced higher a+b and c. The correlation between a+b and WSC was non-significant, but there was a relationship between WSC and c (r=0.55; P<0.001). There were no differences in WSC among parts, but WSC/N was higher in S than in L. Leaves had the highest c values. Forages cut in the afternoon had higher ruminal fermentation capacity. This should be considered for grazing management.

Acknowledgements: Funded by IFS and CSIC (UdelaR)

Table 1.

		a+b(mL/g)	c (%/h)	WSC (%/DM)	WSC/N
hour	9	122.2	7.006	3.252	1.153
	13	125.6	7.212	4.766	1.820
	17	129.8	7.698	6.400	2.490
	SE	0.370	0.027	0.246	0.148
	P (hour)	0.018	0.003	<0.001	<0.001
	P (date×hour)	ns	ns	ns	ns
part	WP	124.3	7.231	5.069	1.645
	L	125.7	7.751	4.417	1.151
	S	127.5	6.934	4.931	2.667
	SE	0.123	0.009	0.142	0.085
	P (part)	ns	<0.001	ns	<0.001
	P (hour×part)	ns	ns	ns	ns

SE: standard error; ns: non-significant (P>0.05)

Key Words: In vitro fermentation, Temperate pastures, Soluble carbohydrates

53 Effect of the timing of cut on ruminal environment of lambs consuming temperate pastures. C. Cajarville*, A. Pérez, M. Aguerre, A. Britos, and J. L. Repetto, *Departamento de Nutrición Animal, Facultad de Veterinaria*, *Montevideo, Uruguay*.

The objective of this experiment was to determine if timeof day (t) affects ruminal environment of the animal that consumes a pasture. The study was conducted in Uruguay during August. Four Corriedale×Milkschaf lambs (25±0.86 kg BW) were individually fed fresh forage (grass and legume mix). The forage was cut at 700 or 1800 h and immediately offered to lambs in a cross-over design with 2 periods of 17-d each. The forage (500 g of DM/lamb/day) was consumed in less than 4 h. Samples of ruminal liquor were extracted each hour (h) during 24 h using permanent ruminal tubes (fixed via a cannula), and pH and ammonia were determined. Concentrations of acetic, propionic, butyric, isobutyric, valeric, isovaleric, and total volatile fatty acids (VFA) were determined hourly from hours -1 to 8 relative to time of feeding. Data were analyzed as repeated measures using the mixed model and included animal, period, t, h, and t×h interaction effects. Ruminal pH was lower and higher butyric concentrations were observed for 1800 h feeding. Minimum values of pH were observed 4 and 3 h after the beginning of the ingestion for 700- (5.69) and 1800-h (5.35) feedings. Maximum values of ammonia were observed 4 h after the beginning of the ingestion for both treatments (32.57 and 25.29 for 700- and 1800-h feedings). The shape of pH and ammonia curves were similar for both treatments as the interaction t×h was non-significant. The lower pH observed when forage was fed in the afternoon suggests that ruminal fermentation was improved.

Acknowledgements Funded by CSIC and CIDEC (UdelaR)

Table 1.

				P		
	700 h	1800 h	SE	t	h	t×h
ammonia (mg/100 mL)	17.78	18.53	1.405	ns	0.002	ns
pH	6.470	6.285	0.057	0.001	<0.001	ns
VFA (mM)	92.53	95.42	4.043	ns	<0.001	ns
acetic (mM)	54.57	53.92	2.636	ns	<0.001	ns
propionic (mM)	25.93	25.82	1.757	ns	<0.001	ns
butyric (mM)	8.757	11.88	0.872	<0.001	<0.001	ns
isobutyric (mM)	0.886	0.597	0.218	ns	0.002	ns

SE: standard error; ns: non-significant (P>0.05)

Key Words: Remperate pastures, Ruminal pH, Volatile fatty acids

54 Gas production and volatile fatty acid profile of subtropical grasses from México incubated in rumen fluid *in vitro*. A. S. Juárez-Reyes[1], M. A. Cerrillo-Soto*[1], E. Gutiérrez-Ornelas[2], E. Romero-Treviño[3], J. Colín-Negrete[2], and H. Bernal-Barragán[2], [1]*Universidad Juárez del Estado de Durango*, *Durango, Dgo. México*, [2]*Universidad Autónoma de Nuevo León*, *Monterrey, N.L. México*, [3]*Instituto Tecnológico Agropecuario N° 4*, *Altamira, Tamps. México*.

Six species of grasses commonly used for beef cattle production systems in the subtropical region of northern México were incubated in rumen fluid *in vitro* in order to determine their gas production and volatile fatty acid (VFA) profile. Samples of Guinea (*Panicum maximum*), Pangola (*Digitaria decumbens*), Bermuda (*Cynodon dactylon*), Pretoria 90 (*Dichantium annulatum*), Buffel (*Cenchrus ciliaris*) and Tanzania (*Panicum maximum var Tanzania*) were collected at flowering stage of maturity. Samples (500 mg DM) were incubated in calibrated 100 ml glass syringes using rumen fluid from two sheep fed alfalfa hay and commercial concentrate (75:25) as inoculum. Gas production was recorded at 3, 6, 9, 12 and 24 h. Incubations were terminated after 24 h and VFA determination was subsequently performed in 5 ml aliquots of centrifuged syringe content mixed with 1 ml of 25% metaphosphoric acid using gas chromatography. Data were analyzed by ANOVA according to a completely randomized design (SAS). Simple linear correlation coefficients between total VFA concentration and gas production were computed by PROC REG (SAS). Values for *in vitro* gas production, were higher in Pangola while lower in Buffel (P<0.05). Similarly, VFA concentrations were higher in Pangola (P<0.05), whereas lower (P<0.05) values were observed in Guinea, Buffel and Tanzania grasses. A significant (P<0.05) correlation coefficient between total VFA and *in vitro* gas production was calculated (r=0.688). The ratio of acetate:propionate (A:P ratio) was similar between grasses with a mean value of 6.60. The results obtained in the present study indicated that *in vitro* gas production technique discriminated subtropical grasses in the same pattern as VFA production technique did, and Pangola grass offered the best profile in terms of studied variables. Moreover, these variables contribute to the evaluation of the nutritional value of different grasses and they allowed to recognize the good potential of Pangola grass for grazing cattle of the subtropic in Northern Mexico.

Table 1. Gas production and volatile fatty acid profile of subtropical grasses of Northern Mexico

Grass	Gas 24h (ml/500 mg DM)	Acetate (mM/L)	Propionate (mM/L)	Butyrate (mM/L)	Total VFA (mM/L)	A:P ratio
Guinea	53.9^{b}	8.69^{d}	1.27^{c}	0.41^{c}	10.7^{d}	6.84^{a}
Bermuda	50.0^{b}	11.9^{c}	2.12^{b}	0.46^{b}	15.1^{c}	5.62^{a}
Pangola	76.4^{a}	19.7^{a}	2.95^{a}	1.17^{a}	24.3^{a}	6.68^{a}
Pretoria	52.3^{b}	16.5^{b}	2.37^{b}	0.83^{b}	20.0^{b}	6.93^{a}
Buffel	37.1^{c}	9.33^{cd}	1.43^{c}	0.30^{c}	11.5^{d}	6.57^{a}
Tanzania	52.1^{b}	8.45^{d}	1.33^{c}	0.41^{c}	10.7^{d}	6.91^{a}
Mean	53.6	12.4	1.91	0.65	15.4	6.60
sem	6.35	2.02	0.29	0.18	2.41	1.06

Means between columns with different superscript differ (P<0.05)

Key Words: Gas production, Volatile fatty acids, Grazing cattle

55 Coastal, Russell and Tifton 85 bermudagrass hay consumption by growing beef steers and in situ digestion. V. A. Corriher*, G. M. Hill, and B. G. Mullinix, Jr., *University of Georgia*, *Tifton*.

Steer performance and in situ digestion of Coastal (C), Russell (R), and Tifton 85 (T85) bermudagrass hays were determined in two experiments. Hays were produced on the same farm and harvested the same day, containing DM, CP, ADF and NDF (%), respectively: C=91.6, 11.4, 33.8, 71.5; R=91.7, 12.2, 36.4, 75.3; T85=92.0, 10.0, 40.6, 76.8. Exp1. Hays were fed free-choice for 40 d with a supplement (2.94 kg DM/steer daily; 85% corn, 10% SBM, 6% dried molasses, and 1.5% minerals; 89% DM, 14% CP) to beef steers (n=30; age=11 mo, 232 ± 24.7kg initial BW). Steers were randomly assigned to six pens in a completely random design. Steer ADG and hay DMI (Table) were affected by hay cultivar, with higher gains and DMI on C than R or T85. Exp 2. Two ruminally cannulated Polled Hereford (PH) steers were fed Tifton 85 hay ad libitum for 11 d. Starting on d 8, C, R,

and T85 ground samples were, placed in nylon in situ bags, and ruminally incubated for 0, 6, 12, 24, 36, 48, and 72 h. The average in situ digestion for the times sampled(Table) was similar for digestion of DM (DMD), ADF (DADF), and NDF (DNDF), but digestion of CP (DCP) was higher for C than T85. Incubation time affected all variables (P < 0.01), and after data was centered (28.28 h), digestion rate/h increased linearly for DDM (+0.48 %/h), and decreased linearly at the same rate for DADF and DNDF (0.12 %/h). For DCP digestion, hay and time interacted (P < 0.01), and rate of digestion increased linearly for C (+0.100%/h), R (+0.098%/h) and T85(+0.137%/h). Steers had higher DMI and gains on C than R or T85 hays, but chemical composition and overall average digestion of the hays was similar. Results differ from studies in which cattle gains and digestibility were consistently higher for T85 than C hays and pasture forages.

Table 1.

Item	C	R	T85	SE	*P* <
Final BW, kg	268.3	254.3	255.3	1.74	0.05
ADG, kg	0.90	0.58	0.55	0.04	0.01
Hay DMI, kg	5.43	4.04	4.11	0.08	0.16
Total DMI, kg	8.37	7.01	12.05	0.10	0.20
DDM, %	42.7	37.3	38.2	2.02	0.17
DCP, %	16.5	16.2	15.8	0.19	0.02
DADF, %	39.7	40.3	41.4	0.60	0.18
DNDF, %	83.0	83.1	83.2	0.67	0.90

Key Words: Bermudagrass hay, In situ, Steer

Goat Species:Potential of Goats as Biological Agents to Produce Meat, Control Vegetation and Restore Land

56 Meat goat industry, an emerging animal-agriculture enterprise in the U.S. S. Solaiman*, *Tuskegee University*, *Tuskegee, AL*.

Goats are the most popular farm animals in the world, and goat meat and milk are the most consumed of all animal products. Goats are popular with small land holders because of their efficient conversion of feed into edible and high quality meat, milk and hide. Goats are also used as holistic tools for land vegetation management and fire fuel load control. With proper grazing management, goats can eliminate noxious weeds, restore native grasses and prevent fires through fuel load reduction. In the U.S., meat goat production has been gaining popularity in recent years particularly because of a growing population of ethnic and faith-based groups who consume goat meat. The national estimates, based on import data only, indicate that the U.S. is more than 500,000 head deficient in meeting current demands for goat meat. However, when the demand for goat meat is estimated based on increasing ethnic populations and faith-based consumers in the U.S., it far exceeds this number. Australia has been experiencing enormous growth in export of its goat meat, from about 2000 metric tones in 1999 to more than 8000 metric tones in 2004, and this has pressured Australian exporters to market their bush or feral goats to fulfill their existing contracts. This increase in demand of goat meat is also supported by the more than 19% increase in number of goat farms with over a 12% increase in the goat population from 1997-2002 in the U.S.; more-over, the number of farms selling goats increased by over 45%, and goat sales were up by more than 55%. Goat industry is in its infancy and is just like beef industry that was turned around when European breeds were imported to the U.S. For the industry to grow, Meat Goat Quality Assurance programs using Hazard Analysis Critical Control Points (HACCP) principals for pre- and post-harvest meat goats similar to those for beef, pork, and poultry must be developed to assure quality and uniformity of product. Meat goat industry is a new and emerging industry and it is an opportunity for U.S. animal agriculture to present another quality product to consumers.

Key Words: Emerging industry, Goat meat, U.S.

57 Nutritional quality assessment of browse for goats . W. Pittroff*, *University of California*, *Davis*.

Goats are classified as an intermediate ruminant feeding type, i.e. selecting a major proportion of their diet as browse. In recent years, the nutritional properties of browse for goats have received increased attention, for two reasons: (1) goats are recognized as an important element of the livelihoods of rural poor in developing countries, and (2) goats are emerging as the potentially most effective biocontrol agent for removal of fire fuel and invasive species biomass. In both cases, the major constraint to the more effective use of goats is the near total lack of knowledge about the specific nutritional and anti-nutritional properties of browse species. A cost effective solution to this problem is an in vitro method capable of providing solid data on ME concentration of browse species. The Hohenheim Gas Production Test, coupled with crude protein analysis, has proven to meet this requirement. A thorough discussion of the method and its application for the development of nutritional tables for the use of goats in fire fuel management in California is presented. This approach has the potential to serve as the method of choice for determination of nutritional quality of forage and browse species of low economic significance in cases where research budgets do not allow to perform exhaustive in vivo experiments. We further demonstrate the use of this method to assess the effects of nutritional and non-nutritional supplementation, and as a bioassay for tannins. Correlations between in vivo data on consumption and digestibility of tannin-rich browse with and without PEG supplementation clearly illustrate this capability. Further, the capability to infer rumen fermentation properties from the non-linear analysis of gas production profiles is emerging as a powerful tool to describe ruminant feedstuffs in a more differentiated manner, for example in regards to their potential impact on emission levels from livestock production.

Key Words: Gas test, Goats, Nutritional quality

58 Vegetation control using goats. S. Hart*, *Langston University*, *Langston, OK*.

Goats can be a valuable biological agent for brush and weed control, converting these unwanted plant materials into an income stream with minimal adverse impact on the environment. It is well established that goats can control a number of species of weeds and brush, however, there is a lack of knowledge on many specific plant species. The objective of brush or weed control is to overgraze (defoliate repeatedly before the plant can restore its carbohydrate reserves) the target species. Achieving this objective requires that the goat consume the target species. Predicting the species of plants that goats will consume is