

Forages and Pastures: Grazing and Forage Management

M118 Summer annuals for fall grazing in the high elevation Intermountain West. J. B. Hall*, B. R. Johnson, R. H. Stokes, and R. Ambrosek, *University of Idaho, Moscow.*

The objective of this study was to compare summer annuals for fall and winter grazing on irrigated pastures in the Intermountain West. The cool desert areas of this region have short growing seasons (≤ 120 d) with high daytime temperatures and cool nights resulting in sufficient growing degree days, but impaired production on cool season forages during late summer. Five species were planted in Carmen, ID ($45^{\circ}17'N$, $113^{\circ}53'W$; 1155 m elevation) in 0.10 ha plots with 3 plot replicates per species. Four species were planted in yr 1 and 2: CORN (*Zea mays*), sorghum x sudangrass (*Sorghum* spp; SUDEX), TEFF (*Eragrostis tef*), and GERMAN foxtail (*Setaria italica*). PEARL millet (*Pennisetum glaucum*) planted in yr 1 was replaced by PROSO millet (*Panicum miliaceum*) in yr 2. All species except TEFF were planted no-till from June 25 to July 2. TEFF was planted after minimum tillage. Three 1/1000 ha yield samples were taken from each plot. Pooled samples for each species were analyzed for CP, ADF, NDF, Ca and P. TEFF was sampled at 50 d post planting (haying) with all species sampled after killing frost (September 8 and 16, yr 1 and 2, respectively). Heifers grazed the plots during November and December, and animal grazing days were recorded. Yield data were analyzed by ANOVA with means compared using a *t*-test. Data for each yr were analyzed separately. Species affected DM yield ($P = 0.10$ yr 1; $P < 0.02$ yr 2). Yields (DM; Mg ha⁻¹) were not different ($P = 0.22$) for CORN (5.5 ± 1.6 , 10.7 ± 1.0), GERMAN (5.4 ± 0.4 , 5.8 ± 1.0), and SUDEX (7.0 ± 0.7 , 7.1 ± 1.8) in yr 1 and 2, respectively, and TEFF (6.1 ± 0.2 ; yr 1 only). In yr 1, yields of SUDEX and TEFF exceeded ($P < 0.01$) PEARL (3.9 ± 1.2 Mg ha⁻¹). CORN yields were greater ($P < 0.01$) than GERMAN or PROSO (3.9 ± 1.6 Mg ha⁻¹) in yr 2. Nutrient content of all forages exceeded NRC requirements for cows in mid-gestation. TEFF, PROSO, and PEARL produced fewer ($P = 0.10$) animal grazing days than the other species. In conclusion, CORN, SUDEX, and GERMAN produce acceptable fall and winter grazing for the Intermountain West.

Key Words: cattle, grazing, fall

M119 Biological parameters by spring and fall-calving cows grazing with full access, limited access, or no access to endophyte-infected tall fescue—2 year summary. J. Caldwell*¹, K. Coffey¹, M. Looper², D. Kreider¹, E. Kegley¹, J. Jennings³, C. West¹, D. Hubbell III¹, J. Tucker¹, A. Young¹, T. Hess¹, M. Popp¹, M. Savin¹, D. Philipp¹, C. Rosenkrans Jr.¹, ¹University of Arkansas, Fayetteville, ²USDA-ARS, Booneville, AR, ³University of Arkansas Cooperative Extension Service, Little Rock.

Cattle consuming *Neotyphodium coenophialum*-infected tall fescue (E+) may have altered physiological responses. Replacing E+ with non-toxic endophyte-infected fescue (NE+) may help this problem, but acceptance of NE+ by producers has been slow. Our objective was to determine the extent limited access to NE+ will alter biological parameters by spring (S) and fall-calving (F) cows grazing E+ or NE+ at different percentages of the total pasture area. Crossbred cows ($n = 178$) were stratified by BW and age within calving season and allocated randomly within calving season to 1 of 14 groups representing 5 treatments: 1) F on 100% E+ (F100; $n = 3$); 2) S on 100% E+ (S100; $n = 3$); 3) F on 75% E+ and 25% NE+ (F75; $n = 3$); 4) S on 75% E+ and 25% NE+ (S75; $n = 3$); and 5) S on 100% NE+ (NE100; $n = 2$). Cow serum K, Cu, NEFA, and prolactin (PRL) concentrations at breeding, and serum

Na and PRL concentrations at the end of breeding were greater ($P < 0.05$) for S vs. F. Serum Ca, Mg, and Fe concentrations at breeding and serum Fe, Zn, Cu, and NEFA concentrations at the end of breeding were greater ($P < 0.05$) for F vs. S. Serum P and PRL concentrations at breeding were greater ($P < 0.05$) for S75 and F75 vs. S100 and F100; serum NEFA concentrations at the end of breeding were greater ($P < 0.05$) for S100 and F100 vs. S75 and F75. At breeding, serum NEFA concentrations were lower ($P < 0.05$) for NE100 vs. S75, and serum PRL concentrations at the end of breeding were greater ($P < 0.05$) for NE100 vs. S75. Calf serum Zn concentrations at weaning were greater ($P < 0.05$) for F vs. S, but serum Fe and Cu concentrations at weaning were greater ($P < 0.05$) for S vs. F. Serum Fe concentrations at weaning were also greater ($P < 0.05$) for S75 and F75 vs. S100 and F100. Therefore, calving season may alter biological parameters for cows grazing E+ during critical stages of production. Limited access to NE+ may improve cow PRL concentrations at breeding, and may affect calf serum Zn concentrations at weaning.

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Key Words: cow, fescue

M120 Immune function responses by spring and fall-born calves weaned from wild-type or non-toxic endophyte-infected tall fescue. M. A. Ata*¹, K. P. Coffey¹, J. D. Caldwell¹, E. B. Kegley¹, M. L. Looper², A. N. Young¹, D. Philipp¹, C. P. West¹, G. F. Erf¹, D. S. Hubbell III¹, and C. F. Rosenkrans Jr.¹, ¹University of Arkansas, Fayetteville, ²USDA-ARS, Booneville, AR.

Cattle grazing *Neotyphodium coenophialum* infected tall fescue (E+) may have reduced immune function. Recently, non-toxic endophyte-infected fescues (NE+) were shown to enhance cattle performance. A 3-years study (2007–2009) was conducted using Gelbvieh x Angus calves (558 ± 9.2 lb, $n = 500$) to determine how limited access to NE+ affects immune function in calves weaned from E+ pastures. Prior to weaning, groups of spring (S) and fall-born calves (F) grazed E+ continuously (S100 and F100, respectively), or E+ for much of the year, but grazed NE+ for 1 mo. before weaning (S75 and F75, respectively). Groups of spring-born calves also grazed NE+ continuously (NE100). Blood samples were collected at weaning for all 3 years and analyzed for whole blood cell counts (K/ μ l). Starting in 2008, calves (1 fall and 2 spring groups, $n = 266$) were injected at weaning with 200 μ g of phyto-hemagglutinin (PHA) in the caudal fold underneath the tail head. Blood samples were collected for serum prolactin (PRL) analysis. Skinfold thickness was measured before injection (0 h) and at 6, 12, 24, 48 h after injection. Statistical analyses performed by using PROC MIXED procedure of SAS. Concentrations of neutrophils, hemoglobin, and hematocrit were greater ($P < 0.05$), while concentrations of eosinophils and basophils were lower ($P < 0.05$) for F vs. S. Lymphocytes concentrations were greater ($P < 0.05$), and that of red blood cells were lower ($P < 0.05$) for NE100 vs. S75. Concentrations of total white blood cells and neutrophils were greater ($P < 0.05$) for S75 and F75 vs. S100 and F100. Within spring-born calves, skinfold thickness was greater ($P < 0.05$) for NE100 vs. S75 at 0h, and 6, 12, and 24 h after injection with PHA. Serum PRL concentrations were greater ($P < 0.05$) for S75 vs. S100 at 24 h post-weaning. Within fall-born calves, serum PRL concentrations were greater ($P < 0.05$) for F75 vs. F100 at weaning. Therefore, allow-

ing calves limited access to NE+ before weaning may enhance certain aspects of immune function.

This project supported by the National Research Initiative of the National Institute of Food and Agriculture, USDA, grant # 2006–55618–17114.

Key Words: fescue, immunity, calves

M121 Antagonism of 5-hydroxytryptamine_{2A} receptor results in decreased contractile response of bovine lateral saphenous vein to tall fescue alkaloids. J. L. Klotz*¹, J. R. Strickland¹, L. P. Bush², B. H. Kirch¹, K. R. Brown¹, and G. E. Aiken¹, ¹USDA-ARS, FAPRU, Lexington, KY, ²University of Kentucky, Lexington.

Pharmacologic profiling of 5-hydroxytryptamine (5HT) receptors of bovine lateral saphenous vein has shown that cattle grazing endophyte-infected (*Neotyphodium coenophialum*) tall fescue (*Lolium arundinaceum*) have altered responses to ergovaline (ERV), 5HT, 5HT_{2A} and 5HT₇ agonists. To determine if 5HT receptor binding of tall fescue alkaloids is affected by grazing endophyte-free (EF), wild type (WT), or novel endophyte-infected (NE) tall fescue, contractile responses of lateral saphenous veins biopsied from cattle grazing these different fescue-endophyte combinations were evaluated in presence or absence of antagonists for 5HT_{2A} (ketanserin; KET) or 5HT₇ (SB-269970; SB). Biopsies were conducted over 2 years on 35 mixed breed steers (361.5 ± 6.3 kg) grazing KY31 (WT; n = 12), EF (n = 12), MAXQ (NE AR542; n = 6) or KYFA9301 (NE AR584; n = 5) pasture treatments (3 ha) between 84 and 98 d (Yr 1) or 108–124 d (Yr 2). Segments (2–3 cm) of vein were surgically biopsied, sliced into 2–3 mm cross-sections, and suspended in a myograph chamber containing 5 mL of oxygenated Krebs-Henseleit buffer (95% O₂/5% CO₂; pH = 7.4; 37°C). Veins were exposed to increasing concentrations of 5HT, ERV, and ERV+1 × 10⁻⁵ M KET, or +1 × 10⁻⁶ M SB in Yr 1. In Yr 2, ergotamine (ERT) and ergocornine (ERO) were evaluated in presence or absence of 10⁻⁵ M KET. Data were normalized to a reference addition of 1 × 10⁻⁴ M norepinephrine and analyzed as a CRD factorial with steer as experimental unit. In Yr 1, contractile response to 5HT and ERV were lowest in WT KY31 pastures (*P* < 0.05) and the presence of KET greatly reduced the response to ERV in all pastures (*P* < 0.05). The presence of SB did not alter contractile response to ERV. In Yr 2, there was no difference in response to ERO or ERT across pastures, but KET again reduced the contractile response (*P* < 0.05). The 5HT_{2A} receptor is involved in alkaloid-induced vascular contraction and alkaloid binding may be affected by exposure to different endophyte-fescue combinations.

Key Words: alkaloid, bovine, 5-hydroxytryptamine

M122 Tall fescue alkaloids cause vasoconstriction in equine medial palmar artery and vein. J. L. Klotz*¹ and K. J. McDowell², ¹USDA-ARS, FAPRU, Lexington, KY, ²University of Kentucky, Lexington.

Mares grazing endophyte-infected (*Neotyphodium coenophialum*) tall fescue (*Lolium arundinaceum*) typically exhibit reproductive dysfunction rather than peripheral vasoconstriction as a primary sign of the fescue toxicosis syndrome. Recent work using Doppler ultrasonography demonstrated that consumption of endophyte-infected tall fescue seed causes measurable vasoconstriction in the medial palmar artery (PA). The objective of this study was to evaluate contractile responses of medial palmar artery and vein (PV) to increasing concentrations of tall fescue alkaloids. Medial PA and PV were collected immediately following euthanasia from 18 horses of mixed breed, age and gender along the third metacarpal proximal to the fetlock joint from both forelimbs.

Vessels were separated, cleaned of excess connective and adipose tissue, divided into 2–3 mm cross-sections and suspended in a multi-myograph chamber with continuously oxygenated Krebs-Henseleit buffer (95% O₂/5% CO₂; pH = 7.4; 37°C). Following a 90-min equilibration and recovery from a 1 × 10⁻⁴ M NE reference addition, additions of ergotamine (ERT), ergonovine (ERN), ergocryptine (ERP), ergocristine (ERS), ergocornine (ERO), lysergic acid (LSA), norepinephrine (NE) and 5-hydroxytryptamine (5HT) occurred every 15 or 20 min for PV and PA, respectively. Data were normalized as a % contractile response induced by the 10⁻⁴ M NE addition and analyzed as a completely randomized design with significance set at *P* = 0.05. Response between PA and PV for alkaloid or biogenic amine did not differ. All alkaloids produced a contractile response, except neither PA nor PV responded to LSA. Both NE and 5HT had a 2-fold greater (*P* < 0.05) maximal response than all alkaloids in both PA and PV, ERN had the greatest PV response (*P* < 0.05), and ERN and ERO had greatest PA maximal responses (*P* < 0.05). Although horses do not outwardly appear to be affected by peripheral vasoconstriction as observed in cattle, these data indicate that tall fescue alkaloids are vasoactive and suggest that potential exists for peripheral vascular effects of tall fescue alkaloids in horses.

Key Words: alkaloids, equine, vasoconstriction

M123 Comparison of management strategies commonly used to lessen or alleviate the symptoms of fescue toxicosis in cattle using meta-analysis. J. Hawley*, J. D. Caldwell, E. B. Kegley, and K. P. Coffey, University of Arkansas, Fayetteville.

Cattle consuming toxic endophyte-infected fescue (E+) may develop fescue toxicosis, causing production losses exceeding \$600 million annually. Currently, there is no cure for fescue toxicosis; however, management strategies that are primarily designed to limit the amount of toxin ingested by the animal are available to producers. This review of data compared cattle performance effects (ADG and DMI) of management strategies used to lessen or alleviate the symptoms of fescue toxicosis. Management strategies evaluated were novel endophytes (NE), diet supplementation, interseeding, and other inventive remedies. For inclusion in the analysis, studies (n = 38) were conducted in the United States from 1985 to present, reported randomization to treatment and untreated control groups, used cattle, were sourced from peer-reviewed journals, and reported sufficient information to calculate correlation coefficients (*r*). Dot plots were used to examine the data for trends toward a uniform effect of management strategy on cattle performance. Management strategies displaying a uniform response on the dot plot compared with negative controls were analyzed using mixed models. Examination of dot plots for NE, diet supplementation, and other inventive remedies revealed performance advantages for treated cattle relative to cattle in negative control groups. An insufficient number of studies met the inclusion criteria to conduct meta-analyses comparing interseeding with negative controls. Studies comparing NE to E+ indicated a large (*r* and 95% confidence interval [CI] = 0.63 [0.52, 0.75], *P* < 0.05) effect on cattle performance. Studies comparing diet supplementation to no diet supplementation indicated a medium (*r* and 95% CI = 0.35 [0.24, 0.46], *P* < 0.05) effect on cattle performance. Similarly, studies comparing other inventive remedies to no other inventive remedies indicated a medium (*r* and 95% CI = 0.35 [0.24, 0.46], *P* < 0.05) effect on cattle performance. The data discussed herein illustrate that the negative effects of fescue toxicosis on cattle performance may be mitigated by altering management strategies.

Key Words: cattle, fescue toxicosis, meta-analysis

M124 Yield potential of eastern gamagrass in central Wisconsin. W. K. Coblenz*¹, W. E. Jokela¹, M. G. Bertram², and P. C. Hoffman², ¹US Dairy Forage Research Center, Marshfield, WI, ²University of Wisconsin, Madison.

Recently, perennial warm-season grasses have received considerable interest, largely through bioenergy initiatives, but their suitability for limiting caloric intake by ruminants has not been explored. Our objective was to assess the yield potential of eastern gamagrass [*Tripsacum dactyloides* (L.) L.] for potential incorporation into dairy-heifer diets offered throughout the north-central US. Replicated plots of 'Pete' eastern gamagrass were arranged in a split-plot design, where 9 harvest systems (wholeplots) and 4 N fertilization regimens (subplots) were evaluated over a 3-yr period. Harvest systems included one-time cuts on 1 June, 15 June, 1 July, 15 July, 1 August, and 15 August, plus 3 2-cut systems with harvests spaced at 45-d intervals (1 June/15 July, 15 June/1 August, and 1 July/15 August). Nitrogen fertilization was applied as ammonium nitrate (34-0-0) at rates of 0, 67, 134, or 202 kg N/ha annually. For 1-cut harvest systems, yields of DM increased across harvest dates, reaching numerical maximums of 7192, 9764, and 7554 kg/ha by mid-August of 2007, 2008, and 2009, respectively. During each year, there was a strong linear ($P < 0.001$) effect of harvest date; however, higher-ordered effects varied within year. Relatively large yield increases (≥ 1812 kg/ha) between 1 and 15 August during 2008 and 2009 suggested that improved yields could be achieved by delaying 1-cut harvests beyond 15 August. Yields of DM from 2-cut harvest systems were not competitive with 1-cut harvest systems timed in mid-August. Nitrogen fertilization rate affected ($P < 0.001$) yields of DM, but did not interact with other treatment effects ($P \geq 0.082$). Overall, yields of DM increased with N fertilization, exhibiting both linear ($P < 0.001$) and quadratic ($P = 0.027$) effects, but efficiencies were reduced at greater application rates. Current recommendations for eastern gamagrass generally adopt a conservative philosophy concerning growth-reserve status; therefore, delaying a 1-cut harvest closer to first-frost may improve yields, but also could negatively affect persistence. This approach for further increasing yields of DM might be viable, but it needs to be evaluated critically.

Key Words: eastern gamagrass, N fertilization, DM yield

M125 Nutritive value of pearl millet hay as affected by moisture concentration and bale sampling depth. J. Kanani*, D. Philipp, K. P. Coffey, A. N. Young, R. Rhein, and J. D. Caldwell, University of Arkansas, Fayetteville.

A study was conducted to evaluate the effects of moisture (15, 21, and 28% DM) and sampling depth (0.2, 0.4, and 0.6 m) on chemical composition and in situ disappearance of pearl millet [*Pennisetum glaucum* (L.) R. Br.] hay stored for 71 d. Seven ha of pearl millet were divided into 3 blocks and 3 subplots to assign moisture treatments of which 3 round bales (1.2 × 1.5 m) were obtained and stored (n = 27). Heating degree days (HDD) were calculated as summation of the daily internal bale temperature above 35°C. Duplicate sample bags for in situ (10 × 20 cm) analysis were incubated in 6 ruminally cannulated cows (BW = 585 ± 37.8 kg) for 0, 6, 12, 18, 24, 36, 48, 72, 96, and 120 h. Data for bale temperature and forage chemical composition were analyzed as a randomized complete block design using Proc Mixed procedures of SAS and tested for moisture, depth, and their interactions. Residual DM weight for each in situ sampling time was fit to a non-linear statistical model using PROC NLIN of SAS to determine DM degradation kinet-

ics. Increasing bale moisture led to increased bale temperature (140.4, 365.3, and 840.8 HDD; $P < 0.01$). Crude protein concentration was not affected ($P > 0.1$) by moisture or sampling depth, but increasing moisture tended ($P = 0.07$) to affect NDF, OM, and ADF negatively. Increasing moisture increased ($P < 0.05$) NDIN (40.8, 47.5, and 49.8% of total N), ADIN (7.0, 9.5, 22.8% of total N), and ADL (3.0, 2.9, and 6.0% DM); however, hemicellulose decreased ($P < 0.05$) with increasing moisture (31, 31, and 25% DM). Increasing bale moisture also reduced the rate of DM disappearance (K_d ; 0.047, 0.043, 0.036 h⁻¹; $P = 0.03$). Sampling depth did not affect ($P > 0.1$) any of the digestion variables, but the immediately degradable fraction (A), potentially degradable fraction (B), and effective disappearance were affected ($P < 0.05$) by a moisture × sampling depth interaction. Storing pearl millet at high moisture concentrations appeared to result in heat damage and reduced forage quality and digestibility.

Key Words: pearl millet, moisture and sampling depth, nutritive value

M126 Characterization of plant cuticular wax markers in native grazing pastures of southwest Virginia. A. E. Tanner*¹, S. R. Blevins¹, E. Green², R. W. Mayes², and R. M. Lewis¹, ¹Virginia Tech, Blacksburg, ²The Macaulay Land Use Research Institute, Aberdeen, Scotland, UK.

Plants contain cuticular wax compounds in varied concentrations, and can be used to estimate intake and diet composition of grazing animals. Native plant species available to pasture-raised beef cattle were evaluated during the production season on a southwest Virginia farm. Our objectives were to: i) determine forage heterogeneity; ii) quantify *n*-alkane and long chain alcohol (LCOH) concentrations; and iii) investigate changes over time. Six 0.73 ha paddocks were selected randomly and sampled bi-monthly (April to September 2009). A 0.5m × 0.5m quadrat was thrown in random directions within each paddock. Plants within quadrats were harvested and separated according to species. Milled oven-dried (85°C) samples were heated with ethanolic KOH (90°C, 16h), extracted into heptane and separated into *n*-alkane and LCOH fractions before being quantified by GC. Patterns of *n*-alkane and LCOH concentrations were analyzed for 3 plant categories: grass, legume, and weed, with ANOVA. Plant species, carbon chain length, their interaction, and sampling period were fitted as fixed effects. Plant *n*-alkane C29 and C31 concentrations were higher in May (294 ± 8 mg/kg DM; $P < 0.001$) then declined to 1/3 that amount. Plants differed in C27, C29, C31 and C33 concentration ($P < 0.001$), although orchardgrass and dandelion were difficult to differentiate. *N*-alkane patterns were not specific to a plant category. Orchardgrass had extremely high concentrations of 1-C26-OH from July onward (18447 to 19670 mg/kg DM), 10 times that of other plants, inflating variance. There was no change in LCOH over time ($P = 0.09$) for other species. Plants differed in 1-C26-OH, 1-C28-OH, and 1-C30-OH concentrations ($P < 0.001$), but LCOH patterns were not specific to a plant category. Plant total LCOH concentration was more consistent than *n*-alkane concentration (CV 17.9% and 69.9%, respectively), suggesting greater utility to delineate plant species. Plant heterogeneity limits the usefulness of grouping plants by category. Combined *n*-alkane and LCOH data delineates plants. Plant patterns remain fairly static over time, which will be important for investigating foraging patterns in cattle.

Key Words: cuticular wax, *n*-alkane, LCOH

M127 Statistical variation in predicting dry matter intake of Brahman bulls using the n-alkane technique. A. D. Aguiar^{*1,4}, L. O. Tedeschi¹, F. M. Rouquette², T. D. A. Forbes³, C. M. Hensarling³, and R. D. Randel², ¹Texas A&M University, College Station, ²Texas AgriLife Research, Overton, ³Texas AgriLife Research, Uvalde, ⁴University of Florida, Gainesville.

The objectives of this study were to determine the variation structure within and across days when determining DMI using C₃₂ alkane as an external marker, to determine the optimum fecal collection periods, and to compare C₃₁ and C₃₃ as plant markers in estimating DMI. Brahman bulls (n = 16) stratified by previous residual feed intake (RFI) rankings were placed in 4 groups. Each group had 2 high (inefficient) and 2 low (efficient) RFI bulls. Groups were randomly assigned to 4 Coastal bermudagrass [*Cynodon dactylon* (L.) Pers.] pastures and stocked at moderate to low grazing pressure. Corn gluten was marked with C₃₂ n-alkane and bulls were individually fed 400 g twice daily to estimate DMI. There were 3 periods (P1, P2, P3) of collection from mid-July to late-Aug; each period was divided into 2 sub-periods in which fecal samples were collected 4 times a day for 5 d (0700, 1100, 1500, and 1900 h). Gas chromatography was used to determine n-alkanes. A double repeated measure design in a completely randomized block design was used. During P1 and P2, the prediction of DMI using C₃₃ had a better fit (smaller $-2 \times \text{Log}$) than C₃₁ either with or without adjustments for forage C₃₂. The variation in DMI decreased when adjustments for forage C₃₂ were not used. The variances of DMI were similar using C₃₁ across days, but the correlations between days were low, suggesting that several days of collection were needed to accurately predict DMI. Correlations between times of fecal collection were medium to high for all periods and varied from 0.65 to 0.97 for C₃₁ and from 0.26 to 0.96 for C₃₃. When all periods were analyzed together, estimates of DMI using either C₃₁ or C₃₃ had low correlations between days of collection. In addition, the adjustment for forage C₃₂ did not improve the variance and (co)variance matrix. In conclusion, C₃₃/C₃₂ had the lowest variation in predicting DMI and at least 5 d of continuous fecal collection were needed to decrease the variability of DMI. The optimum times for fecal collection were 0700 and 1500 h and it was important to adjust for forage C₃₂ concentration to predict DMI of Brahman bulls grazing Coastal bermudagrass.

Key Words: cattle, correlation, grazing

M128 A comparison of anatomical and compositional differences of residual feed intake (RFI)-indexed Brahman bulls under grazing conditions. T. D. A. Forbes^{*1}, F. M. Rouquette², L. O. Tedeschi³, R. D. Randel², and F. R. B. Ribeiro⁴, ¹Texas AgriLife Research, Uvalde, ²Texas AgriLife Research, Overton, ³Texas A&M University, College Station, ⁴Texas A&M University-Commerce, Commerce.

This study compared gastrointestinal tract (GIT) measures, carcass composition, and ADG of Brahman bulls grazing Coastal bermudagrass at 2 stocking rates (SR) for 60 d. Prior to the grazing trial, bulls were fed a high roughage diet for 70 d, stratified as efficient (LRFI) or inefficient (HRFI), and randomly assigned to high (HSR) or low (LSR) SR pastures. Shrunken BW (SBW) was recorded after animals fasted for 18 h before harvest. Carcass was weighed; KPH and internal organs were separated; the GIT was dissected and emptied; small and large intestine lengths were recorded, and internal fat (excluding KPH) was separated from the GIT; all components were then weighed. After a 48 h chill, the

9–11th rib section (RIB) was removed from the left carcass. Lean, fat, and bone were physically separated. Fat and lean tissues were analyzed for moisture and fat. Independent variables were expressed as amount and percent of SBW. Data were analyzed using a split-plot design in a 2 × 2 factorial arrangement with pastures within SR as random factors. There was no effect of RFI ($P = 0.74$) or SR ($P = 0.74$) on initial BW. Low RFI bulls had heavier SBW ($P = 0.04$) and HCW ($P = 0.01$) (393 and 217 kg, respectively) than HRFI bulls (381 and 203 kg, respectively). There was no effect of RFI ($P = 0.09$) on ADG (0.66 and 0.50 kg/d for LRFI and HRFI, respectively). There was a tendency ($P = 0.08$) for an interaction between RFI and SR for fat thickness (FT). Low RFI bulls at LSR had less FT compared with LRFI bulls at HSR (1.7 vs 2.94 mm). There was an interaction between RFI and SR ($P = 0.02$) on the lipid content of the RIB which was greater (17.9%) in LRFI bulls at HSR. Low SR bulls had greater ($P = 0.03$) liver % BW than HSR bulls while HRFI tended to have greater ($P = 0.07$) liver % BW than LRFI bulls. Low RFI bulls had lighter ($P = 0.02$) small intestine % BW and more ($P = 0.06$) internal fat % BW than HRFI bulls. These initial results suggest that efficient bulls tend to gain more and may deposit more fat when forage availability does not limit DMI, but when forage is limited there may be no influence of RFI on carcass composition.

Key Words: cattle, efficiency, carcass

M129 *Cenchrus ciliaris* in a silvopastoral system with *Prosopis juliflora*. T. Clavero^{*} and R. Razz, *Centro de Transferencia de Tecnología en Pastos y Forrajes. Universidad del Zulia., Maracaibo, Estado Zulia, Venezuela.*

Buffelgrass (*Cenchrus ciliaris*) planted under and outside the canopies of mesquite (*Prosopis juliflora*) in Venezuela's semi-arid region were evaluated to determine dry matter production, forage quality, and soil chemical characteristics. Harvested buffelgrass was analyzed for dry matter yield (DM), crude protein (CP), neutral detergent fiber (NDF), acid detergent fiber (ADF), and lignin. Transects extending from the tree trunk to open grass areas were established and soil samples (0–15 cm) and buffelgrass cv. Biloela (standing live biomass in one square meters plots) samples were taken at 5 sites (0, 20, 80, 150, 200% of the average canopy radius) during growing season. A randomized block design was used with 5 replications. The results showed that DM decreased as shading increased ($P \leq 0.05$). The DM production was about 21% lower in the understory areas. The shaded plants exhibited a trend for larger, thinner, wider leaves and developed larger leaf area ($P \leq 0.05$). Tree canopies had a positive effect on CP content on buffelgrass ($P \leq 0.05$). Overall, soil moisture content was greater ($P \leq 0.05$) under mesquite, and leaf blade increased, which is highly correlated to CP ($r = 0.87$). Grass samples showed no significant differences ($P \geq 0.05$) in NDF, ADF, and lignin under mesquite compared with open pasture. Greater levels of soil C, N, P, Ca, Mg and K were found under the canopies of mesquite ($P \leq 0.05$), with differences of 0.64% C, 0.46% N, 2.40 ppm P, 2.10 ppm Ca, 1.27 mEq/100 g Mg and 0.57 mEq/100 g K. Soil analyses showed no significant differences ($P \geq 0.05$) in Na and Mn under mesquite compared with open grassland. Results suggest that mesquite has a lot of potential for use in a silvopastoral system with buffelgrass. Fodder availability of buffelgrass was lower under the trees; however, canopies had a positive effect on nutritional value and improved soil chemical conditions.

Key Words: *Prosopis juliflora*, *Cenchrus ciliaris*, silvopastoral

M130 Quantifying terpenes in rumen fluid, serum, and plasma from sheep. R. E. Estell¹, S. A. Utsumi², and A. F. Cibils³, ¹USDA, ARS, Jornada Experimental Range, Las Cruces, NM, ²Michigan State University, Kellogg Biological Station, Hickory Corners, ³New Mexico State University, Las Cruces.

Determining the fate of terpenes consumed by browsing ruminants require methods to quantify their presence in blood and rumen fluid. Our objective was to modify an existing procedure for plasma terpenes to quantify 25 structurally diverse mono- and sesquiterpenes in serum, plasma, and rumen fluid from sheep. The terpenes examined were tricyclene, α -pinene, camphene, sabinene, β -pinene, myrcene, 2-carene, 3-carene, α -terpinene, *p*-cymene, limonene, 1,8-cineole, *cis*- β -ocimene, γ -terpinene, *cis*-sabinene hydrate, terpinolene, linalool, camphor, borneol, terpin-4-ol, α -terpineol, longifolene, β -caryophyllene, α -humulene, and caryophyllene oxide. Terpenes were extracted with SPE columns and quantified using gas chromatography (n = 8 per terpene/fluid combination). Data were analyzed with the MIXED procedure of SAS with fluid as the independent factor, and means were separated by LSD in the event of a significant *F* test ($\alpha = 0.05$). Recovery estimates were 100 \pm 5% for 14, 7, and 4 terpenes from serum, plasma, and rumen fluid, respectively. Recovery from plasma and serum differed for 12 terpenes ($P < 0.05$), although typically differences were <10%. Recovery from rumen fluid differed ($P < 0.05$) from both serum and plasma for 16 compounds (lower in each case except linalool). Recovery did not differ ($P > 0.05$) among the 3 matrices for only 2 compounds (*p*-cymene and terpinolene). Greater recovery was generally observed for oxygenated terpenes than hydrocarbon compounds, particularly for monoterpenes. This procedure is applicable to a wide array of terpenes in fluids from sheep, but differential recoveries among terpenes and fluids require that estimated concentrations of each analyte be corrected for recovery using that specific compound in the same matrix collected under the same set of experimental conditions, and that caution be exercised in generalizing responses among different compounds with this procedure.

Key Words: terpene, serum, rumen fluid

M131 The effect of supplementing corn by-products or mesquite twigs on daily gain of Creole x Zebu young steers: A simulation model. J. M. Tapia-González¹, A. Tewolde-Medhin², W. E. Grant³, J. C. Martinez-González², H. Diaz-Solis⁴, A. Moreno-Valdéz⁵, O. D. Montañez-Valdez¹, J. A. Martínez-Ibarra¹, and G. Rocha-Chavez¹, ¹CUSUR, U de G, Ciudad Guzman, Jalisco, Mexico, ²Unidad Académica Multidisciplinaria Agronomía y Ciencias. UAT, Cd. Victoria, Tamaulipas, México, ³Wildlife and Fisheries Sciences, Texas A&M University, College Station, ⁴Área de Recursos Naturales, UAAAN, Saltillo Coahuila, México, ⁵Área de Recursos Naturales, Instituto Tecnológico de Ciudad Victoria, Cd. Victoria, Tamaulipas, México.

The Software STELLA II Version 5 was used for predicting a potential beef cattle daily gain scenario out of a conceptual mathematical model. Type of feed (hay or hay + supplement) was used to examine the effect on daily gain of Creole-Zebu steers. The model was created using real data coming out of several types of production systems totaling up to 30,000 cases. A total of 20 repetitions during 48 mo were represented in the model to predict daily gain of 8-weeks old steers up to 48 mo of age. The growing sector of steers was evaluated under the effect of supplementing several types of ingredients included in 4 experimental groups: (1) hay only, (2) hay + silage, (3) hay + nutritional blocks and (4) hay + mesquite twigs. Two types of corn were used for groups 2 and 3 (local creole maize or hybrid) and 2 types of crops were considered (raised either with or without cultural management practices). Blocks are made of chopped dry corn plant (including grain and straw), molasses

and minerals pressed together to form a brick. Mesquite twigs include small branches and leaves of *Prosopis farcta* and *Celtis spinosa*. ANOVA was used to compare means and significance was set to $P < 0.05$. Higher gains were observed in steers supplemented with something more than hay because they had 14 to 21% of crude protein (CP) whereas hay had only 4.4 to 14% of CP with 30% digestibility. The highest gain was observed in group 4 probably because *Celtis spinosa* may have up to 21% CP and digestibility of 46% while nutritional blocks only have 14% CP and silage 14.6% of CP. There was no effect of corn type or rising method on total gain of steers (Table 1). Since all these parameters (coming exclusively out of the simulation model) are similar to those obtained in the field by several researches, we can conclude that simulation models are useful for predicting beef production scenarios.

Table 1. Total gain of 48-month steers with several types of feed regimen

Treatment	Cycles ¹	Total gain of steers (kg, mean \pm SE)
Hay only	20	144.91 \pm 16.92 ^c
Hay + corn silage	20	182.30 \pm 17.71 ^b
Hay + corn blocks	20	179.29 \pm 35.95 ^b
Hay + mesquite twigs	20	224.80 \pm 9.60 ^a

¹All values evaluated for each treatment representing a cycle of 48 months totalizing 80 years of evaluation.

^{a-c}Different letters in the same column differs significantly ($P < 0.05$).

Key Words: mesquite, daily gain, steers