

Forages and Pastures II

434 Effect of limiting hay access time on dry matter intake by beef cows. C. J. Fleenor*, R. P. Lemenager, M. C. Claeys, and S. L. Lake, *Purdue University, West Lafayette, IN.*

Sixty-three two and three year old mid-gestation Angus cross cows (BW=596.7 kg; BCS=5.15) were randomly assigned by BW, BCS and age to three treatments, with three replications per treatment, to determine the effects of limiting access time and forage quality on hay DMI. Treatments were limited access time (1, 2 or 4 h) to different qualities of hay per 24 h period. Daily, cows were fed large round bales (LRB) of low quality hay (50.65% TDN, CP 8.9%, 64.35% NDF) in rectangular hay feeders that provided adequate bunk space/cow; and were supplemented with soybean hulls and a vitamin-mineral mix to meet NRC requirements for maintenance. Average DMI/d for the 1, 2 and 4 h access times was 3.19, 5.18 and 7.31 ($P < 0.001$) kg and 0.53, 0.90 and 1.23 ($P < 0.001$) % of BW, respectively. To determine the effect of forage quality on DMI, small square bales differing in quality were fed one d/wk in lieu of LRB (9 estimates/hay quality/access time). High quality grass hay (HQ; 58.0% TDN, 15.4% CP, 51.28% NDF) was fed during wk 1-3, low quality grass hay (LQ; 44% TDN, 11.37% CP, 60.0% NDF) was fed during wk 4-6 and a mixed grass-legume hay (MX; 61.0% TDN, 14.81% CP, 52.08% NDF) was fed during wk 7-9. Average DMI was 7.32, 6.43 and 6.90 ($P < 0.05$) kg/d; 1.23, 1.07 and 1.16 ($P < 0.01$) % of BW/d; and 3.36, 2.96 and 3.27 ($P = 0.04$) kg consumption rate/hour for the HQ, LQ and MX hays, respectively. Estimated DMI/d was calculated from NDF as 2.34, 2.00 and 2.30% of BW and 13.96, 11.93 and 13.75 ($P < 0.001$) kg. Average DMI for 1, 2 and 4 h access time was, respectively, 3.72, 6.57 and 10.36 ($P < 0.001$) kg/d; 0.62, 1.10 and 1.74 ($P < 0.001$) % BW/d; and 3.72, 3.29 and 2.59 ($P < 0.01$) kg consumption rate/hour. Estimated DM savings compared to calculated ad libitum daily consumption was 71.9, 50.2 and 21.5% for the 1, 2 and 4 h access times. These data can be used by producers that need to extend limited forage supplies and provide a basis for creating diets using nutrient dense feeds that meet cow requirements.

Key Words: Cows, Hay Intake, Limited Access Time

435 Effect of ruminal fill on foraging behavior, intake rate, and plasma ghrelin, serum insulin and glucose levels of cattle grazing a vegetative micro-sward. P. Gregorini*¹, K. J. Soder¹, and R. S. Kensinger², ¹USDA-ARS Pasture Systems and Watershed Management Research Unit, University Park, PA, ²Pennsylvania State University, University Park.

The impact of ruminal fill (RF) on foraging behavior, intake rate and levels of circulating ghrelin, insulin and glucose was measured with four rumen-cannulated lactating dairy cows foraging micro-swards of vegetative orchardgrass. The treatments compared were removal of 1.00 (RF0), 0.66 (RF33), 0.33 (RF66) or 0 (RF100) of total ruminal content. Treatments were randomly applied in a 4 x 4 Latin-square design. Cows were evacuated and re-filled according to treatment at 1200 (treatment setting), then offered the micro-swards at 0200. Micro-swards were weighed before and after foraging sessions. Foraging sessions were time unlimited, but cows were allowed to take a maximum of 15 bites.

Herbage was analyzed by canopy strata for chemical composition, toughness and module of elasticity. Eating time, intake rate, total jaw movements, and bite parameters (mass, depth, area and rate) data were collected. Plasma was analyzed for ghrelin and serum for insulin and glucose. Short-term intake rate, bite mass and bite area decreased ($P < 0.05$) while bite depth increased as RF increased. The RF did not affect ($P > 0.05$) biting rate or total jaw movements. Increasing RF resulted in lower ($P < 0.05$) mean levels of circulating ghrelin, with no changes ($P > 0.05$) in mean levels of insulin and glucose. However, increasing RF decreased ($P < 0.05$) the incremental change in ghrelin, insulin and glucose levels from the time of treatment setting until the foraging sessions. Little was known regarding bite dimensions and instantaneous herbage intake rate adjustment as a function of RF, or if short-term temporal variations of RF reflect changes in the underlying endocrine physiology. The present study elucidates some of the underlying endocrine physiology under short-term temporal variations of RF and its effect on foraging behaviour.

Key Words: Appetite Regulating Hormones, Foraging Behavior, Ruminal Fill

436 Microclimate effects on temporal/spatial distribution of beef cows in cool-season grass pastures. D. Bear*, J. Russell, and M. Haan, *Iowa State University, Ames.*

Pastures on five southern Iowa cow/calf farms were used to evaluate the effects of microclimatic conditions on cattle grazing in cool-season grass pastures with streams and/or ponds. Pastures ranged from 14 to 129 ha and contained varying proportions of cool season grasses, legumes, sedge, weeds, brush, and bare ground. The percentage of shade ranged from 22 to 73% within pastures. Cows were Angus and Angus-cross on four of the farms, and Mexican Corriente on the remaining farm. In spring, summer, and fall of 2007, 2 to 3 cows per farm were fitted with Global Positioning System (GPS) collars to record position at 10 min intervals for periods of 5 to 14 d. Ambient temperature, black globe temperature, dew point, wind speed and wind direction were collected with HOBO data loggers at 10 min intervals over the grazing season on each farm. Streams, ponds, and fence lines were referenced on a geospatial map and used to establish zones in the pastures. Designated zones were: in the stream or pond, and <15.2, <30.5, <61.0, and >61.0 m from the stream or pond. Thirty-four data sets were obtained throughout the grazing season to determine cattle position. Mean proportions of observations when cattle were in the streams or ponds in summer (1.9%) did not differ from fall (1.3%), but were greater ($P < 0.10$) than spring (0.9%). Cattle distribution amongst other zones did not differ between seasons. Mean proportions of time cattle spent in any of the designated zones differed ($P < 0.05$) among farms. The proportion of time cattle were in and within 15.2 m of a stream or pond increased with increasing ambient temperature ($^{\circ}\text{C}$; $y = 3.8837 + -0.1249x + 0.0181x^2$, $r^2=0.37$) and black globe temperature ($^{\circ}\text{C}$; $y = 3.3538 + 0.0303x + 0.0068x^2$, $r^2=0.28$). The proportion of time cattle are in or near to surface water resources increases with increasing temperatures, but remains less than 24.0% at temperatures up to 37 $^{\circ}\text{C}$.

Key Words: Beef Cattle, Grazing, Temporal/Spatial Distribution

437 Grazing management and microclimatic effects on cattle distribution patterns in riparian pastures. M. Haan, J. Russell*, D. Bear, and D. Morrical, *Iowa State University, Ames.*

Cattle grazing in riparian areas may contribute to sediment and nutrient loading of surface waters. The objectives of the current study were to determine the impacts of grazing management and microclimate on cattle distribution patterns relative to a pasture stream. Six 12-ha cool-season grass pastures, each bisected by a 195-m stream segment, were assigned to one of three treatments using a randomized complete block design with two replicates: continuous stocking with unrestricted stream access (CSU), continuous stocking with stream access restricted to a stabilized crossing (CSR), and rotational stocking with stream access in a riparian paddock (RS). Pasture was considered the experimental unit. In 2005, 2006, and 2007 each pasture was stocked from mid-May through mid-October with 15 Angus cows, initial BW (mean±SE) 614±72, 577±53, and 621±56 kg, respectively. Cattle distribution patterns were monitored by visual observation and GPS collars monthly. Over three grazing seasons, cattle were in or within 34 m of the stream an average of 6 and 16% of the time, respectively, in CSU pastures, based on visual observations. Based on GPS collars, cattle were in or within 34 m of the stream an average of 1.2 and 10.6%, respectively, in CSU pastures. Based on visual observation and GPS collars the proportion of time cattle in CSR and RS pastures were present in and within 34 m of the stream were less ($P<0.05$) than CSU pastures. The presence of off-stream water decreased ($P<0.05$) the proportion of time cattle spent in the stream during the 2006 grazing season but not in 2005 or 2007. At greater ambient temperatures ($Y=112.9-4.4X+0.04X^2$, $r^2=0.85$) and heat load index ($Y=12.2-0.96X+0.02X^2$, $r^2=0.80$), the proportion of time cattle were within 34 m of the stream increased. Observed cattle distribution patterns were highly related ($r^2=0.99$) with defecation distribution patterns. The use of RS, CSR, and the presence of off-stream water may be effective management practices for altering cattle distribution patterns and reduce nutrient and pathogen loading of pasture streams.

Key Words: GPS, Water Quality, Heat Load Index

438 Morphological composition of marandu palisadegrass pasture managed under different herbage allowance grazed by dairy cattle in rotational stocking system. A. C. R. Ruggieri*, E. R. Januskiewicz¹, D. R. Casagrande^{1,3}, R. A. Reis^{1,2}, and M. A. Magalhães^{1,2}, ¹São Paulo State University, Jaboticabal, São Paulo, Brazil, ²Conselho Nacional de desenvolvimento Científico e Tecnológico, Brasília, DF, Brazil, ³Fundação de Amparo a Pesquisa do Estado de São Paulo, São Paulo, Brazil.

This study evaluated the effect of herbage allowance (HA) on sward morphological characteristics in a palisadegrass (*Brachiaria brizantha* cv. Marandu) pasture grazed by dairy cattle (BW= 450kg) in a rotational stocking system. The experiment was conducted at UNESP in Sao Paulo State, Brazil, from November 2005 to April 2006. Four HA (4, 7, 10 and 13% of BW) treatments were allocated in a complete randomized block design with three replications. Stocking density was calculated based on paddock occupation for eight hours in one day followed by 21 days rest. Hand-plucked samples and sward height of the paddock were collected and measurements were performed during the morning and afternoon of five grazing cycles. There was a tendency ($P=0.1507$) for animals to select the leaf fraction in the morning and stems in the afternoon for 4, 7 and 10% HA. The opposite was observed at 13% HA with greater ($P<0.05$) intake of stems in the morning and leaves the

afternoon. At 13%HA, sward height was taller ($P<0.01$) than that on other HA and had longer stem elongation. Thus when the grazing started the intake of stems may have increased. However, in the fifth cycle, there was a tendency ($P=0.25$) for more intake of stems in the morning on all HA. This may be associated with the transition from summer/winter growing conditions. In the afternoon the intake of leaves was greater. The greater intake of stems in the morning exposed leaves in the lower pasture strata, facilitating increased leaf intake. Among the HA studied the 7% HA presented highest leaf: stem ratio during the experimental period.

Key Words: *Brachiaria brizantha*, Pasture, Intake

439 Evaluation of forage sampling method and chemical composition of diet selection by cattle grazing subtropical forages during the summer. A. Hughes* and M. Hersom, *University of Florida, Gainesville.*

As with many tropical grasses, the nutritive value of bahiagrass (*Paspalum notatum*) has been reported to be relatively low, and the data that does exist consists of hand-harvested samples, which does not account for the ability of cattle to selectively graze pasture. The objective of this study was to characterize the chemical composition of forage selected by cattle and compare that to forage collected by hand sampling during the summer. Forage and masticate samples were collected monthly from pastures with estimated high and low forage availabilities (FA). Samples were collected at four locations from May 2007 to August 2007 and were analyzed to determine DM yield, height-adjusted DM yield, IVOMD, NDF, ADF, and selection index. Forage height was measured using a rising-disk meter to estimate forage quantity within the pasture. Forage samples were collected by hand-clipping the herbage to a height of 3.5 cm and dried at 55°C for 48 h. Masticate samples were collected using eight ruminally cannulated steers (2 steers/location) and then lyophilized. Mean DM yield across all 4 locations exhibited a FA x month interaction ($P<0.001$). Height-adjusted DM yield differed between months ($P<0.001$) and between FA ($P=0.05$). Concentration of IVOMD was greater ($P<0.001$) in masticate compared to hand-samples. Also, IVOMD concentration demonstrated a month x type interaction ($P=0.005$). Selection indices indicate that steers were able to select diets from May to August that were 20, 8, 19 and 28% greater in IVOMD concentrations than hand-samples. The ability to select for greater IVOMD differed ($P=0.05$) among months but not between FA ($P=0.06$). Concentrations of NDF and ADF differed among months ($P<0.05$) being lowest in May (67 and 32%) and increasing in August (73 and 42%). Concentrations of NDF and ADF were 3% less ($P<0.02$) for masticate samples compared to hand samples, indicating that steers were selecting a diet that was lower in cell wall concentrations. During the growing season, cattle will selectively graze bahiagrass forage that is greater in IVOMD and lower in NDF and ADF than what is estimated by hand-sampling.

Key Words: Forage, Grazing, Selection

440 Productivity and *in vitro* gas production of leaves and stems of *Pennisetum purpureum* cv Cuba CT-115 in Northern Mexico. E. Gutiérrez-Ornelas*, A. Cerrillo-Soto², A. S. Juárez-Reyes², H. Bernal-Barragán¹, H. Morales-Treviño¹, R. S. Herrera³, and R. Mejías³, ¹Facultad de Agronomía Universidad Autónoma de Nuevo León, Car-

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Pennisetum purpureum cv Cuba CT-115 (CT115) is a tropical tall grass introduced to subtropical regions in northern Mexico. The objective of this study was to evaluate DM production, in vitro gas production and chemical characteristics of leaves, stems and whole plant samples. Four plots (5 × 10 m) of CT115 were established with no fertilization in non-irrigated clay soil in February 2006. Productivity was assessed by harvesting by hand three random samples (5 m² each) at 30 cm height in two growing seasons (autumn 2006 and summer 2007). Forty plants were selected during the autumn of 2006 to establish the relationship between number of stems and DM production. Sub-samples from both years were separated into leaves and stems. Forage components above 1 m height from summer growing season were used for in vitro gas production and chemical analyses. Triplicate samples (200 mg DM each) were incubated in 100 ml calibrated glass syringes and gas production was registered at 3, 6, 9, 12, 24, 48, 72, and 96 h. Data were

fitted to the equation: $p=a+b(1-e^{-ct})$, where **p** represents gas volume (ml) at time **t**; **a** the intercept; **a+b** the potential gas production and, **c** is the constant rate. In vitro gas parameters were analyzed by ANOVA for a completely randomized design with 3 × 2 factorial arrangement of treatments (plant components and years). Dry matter production was 8.5 and 15.7 ton/ha during 2006 and 2007, respectively. In 2006, DM production increased linearly ($P<0.05$; $r^2=0.87$) with number of stems per plant. Rate of gas production was higher ($P<0.05$) for stems (5.6% h⁻¹) than leaves (3.8% h⁻¹) and whole plant (4.0% h⁻¹), with no year or interaction effect ($P>0.05$). The other in vitro gas parameters were not affected ($P>0.05$, **a** = -0.45 ml; **a+b** = 50.2 ml) by treatments. Leaf:stem ratio for the 2007 forage samples was 2.7, CP and NDF contents were respectively 8.0% and 74.2% for leaves, and 9.4% and 72.4% for stems. CT-115 is a good forage for livestock in northern Mexico; its leaves and stems had similar chemical composition but the higher constant rate of *in vitro* gas production for stems may imply better nutritive value of this plant component.

Key Words: *Pennisetum purpureum*, In Vitro Gas Production, Tropical Grass