M63 Body growth and first-lactation milk production of pregnant Holstein heifers reared on pasture or conventional diets. R. R. Peters*[1], S. W. Fultz[2], J. W. Semler[3], and R. A. Erdman[1], *[1]University of Maryland, College Park, [2]University of Maryland Extension, Frederick, [3]University of Maryland Extension, Boonesboro.*

The objective was to compare body growth rates and first lactation milk production of pregnant heifers reared on intensively grazed pasture (P) to those fed conventional (C) diets in a 2-yr replicated study. Pregnant Holstein heifers based on date of pregnancy confirmation were assigned to P (yr 1, n = 15; yr 2, n = 16) or C (yr 1, n = 15; yr 2, n = 16) for study in spring to summer seasons of 2010 and 2011. Heifers fed conventional TMR included corn and rye silage, grass hay, and a monensin-supplemented grain mix. Pastured heifers were fed 0.454 kg /heifer per d of ground shelled corn with minerals and monensin. Pasture consisted primarily of endophyte-infected tall fescue. Pasture-fed heifers were rotated daily to a new paddock of 0.1 to 0.3 ha, based on available DM. Measurements included body weight (BW), wither height (WH), and hip height (HH) taken every 2 wk. Growth rates and projected first lactation 305 d actual milk, fat, protein, calving age, and somatic cell count from DHI records were analyzed using ANOVA using treatment group within year as a replicate. No differences were found in least square treatment means of any variable averaged by year when comparing pasture and conventionally raised heifers. It is concluded that pregnant heifers can be reared on pasture without detrimental effects on skeletal development, milk production, or somatic cell count.

Table 1.

Growth and lactation measure	Pasture	Conventional	SEM	*P*-value
ADG, kg/d	0.77	0.75	0.347	0.876
WH gain, cm/d	0.042	0.038	0.004	0.606
Mean HH gain, cm/d	0.028	0.034	0.004	0.724
Projected 305 d milk, kg	8558	8369	253	0.651
Projected 305 d fat, kg	341	328	6.1	0.255
Projected 305 d protein, kg	270	259	6.4	0.330
Calving age (mo)	23.0	23.0	0.24	0.926
SCC (cells/mL)	52	76	20	0.481

Key Words: pasture, body growth, milk production

M64 Antioxidant activity and blood parameters in early weaned calves fed yeasts and fermented apple pomace. C. Rodríguez-Muela,* P. Mancillas-Flores, C. Arzola, D. Díaz-Plascencia, O. Viramontes, G. Corral, A. Grado-Ahuir, and A. Ramírez-Godínez, *Universidad Autonoma de Chihuahua, Chihuahua, México.*

The objective was to evaluate the effect of a yeasts inoculate and fermented apple pomace in the diet on the antioxidant activity and blood biometric. Twenty-seven calves (BW = 126.2 kg) were randomly assigned to 3 diets. CD: 1.2 kg oat hay, 1.7 kg corn silage, and 1.2 kg DMI.d^{-1} protein and energy supplement; FD: CD + 12% of fermented apple pomace in the supplement and YD: CD + 2% of yeasts in the supplement. Animals were fed for 98 d including a 14-d adaptation period and were bled every 28 d. The variables evaluated were antioxidant activity (AA), white cells count (WBC), hemoglobin (HM), corpuscular volume (CV), corpuscular hemoglobin (CH) and plaques (PQ). The data were analyzed with PROC MIXED of the SAS program in a completely randomized design. The results are shown in Table 1. AA in the calves of the 3 diets was reduced during the study, however, AA at 84 d as well as WBC were higher ($P < 0.05$) in the calves of FD and YD than those of CD. We concluded that the addition of the fermented apple pomace and yeasts in the diet of early weaned calves increased the antioxidant activity and tended to improve the immune system.

Table 1. Means of the square minimums and standard error of antioxidant activity (AA) and blood parameters (d 56 of test) in early weaned calves

	CD	FD	YD	SE
AA d 0 (mM Fe_2)	15.73^{c}	15.99^{a}	15.81^{b}	±0.03
AA d 84 (mM Fe_2)	15.62^{b}	15.72^{a}	15.71^{a}	±0.03
WBC (10^3/μL)	0.24^{b}	0.53^{a}	0.59^{a}	±0.09
HM (g/dL)	11.45^{a}	11.33^{a}	11.71^{a}	±0.05
CV (fL)	73.78^{a}	63.51^{b}	61.53^{b}	±3.38
CH (g/dL)	31.47^{b}	33.29^{b}	37.02^{a}	±1.25
PQ (105/μL)	5.69^{a}	5.67^{a}	4.37^{b}	±0.37

Different superscripts between columns indicate statistical difference ($P < 0.05$).

Key Words: blood parameters, antioxidant activity, yeasts

M65 Use of yeasts and fermented apple pomace in the diet of early weaned calves. P. Mancillas-Flores,* C. Rodríguez-Muela, C. Arzola, D. Díaz-Plascencia, A. Grado-Ahuir, O. Viramontes, A. Flores, and A. Ramírez-Godínez, *Universidad Autonoma de Chihuahua, Chihuahua, México.*

The objective was to evaluate the effect of yeasts inoculate and fermented apple pomace on blood mineral levels of early weaned calves diets. Twenty 7 Angus calves (PV = 126.2 kg) were assigned to CD:oat hay 1.2; corn silage 1.7 and protein and energy supplement 1.2 kg DMI/d^{-1}), FD: CD+12% of fermented apple pomace in the supplement and YD: CD+2% of yeasts inoculate in the supplement. The animals were fed during 98d. The variables evaluated were DMI, ADG and Zinc (Zn), Manganese (Mn) and Copper (Cu) in the blood serum. Data were analyzed with PROC GLM of the SAS program, in a completely randomized design for DMI and AVG and PROC MIXED for minerals concentration. The results are shown in Table 1. DMI of YD calves was greater ($P < 0.05$) than those of CD and FD. There was a reduction ($P < 0.05$) of level of Zn at 84 d in calves of FD. Calves of YD showed a greater concentration of Zn at 84 d of study ($P < 0.05$) than those of CD and FD. We concluded that the yeasts inoculate in early weaned calves diets increased significantly DMI and Cu serum concentration however fermented apple pomace decreased Zn serum concentration.

Table 1. Means of the square minimums and standard error of the variables analyzed by tratment in early weaned calves

	CD	FD	YD	SE
DMI (kg/d)	4.260[b]	4.114[b]	4.711[a]	±0.10
ADG (kg/d)	0.855[a]	0.816[a]	0.771[a]	±0.05
Zn d 1 (ppm	0.56[a]	0.57[a]	0.56[a]	±0.05
Zn d 84 (ppm)	0.52[a]	0.40[b]	0.45[a]	±0.05
Mn d 1 (ppm)	0.41[a]	0.38[a]	0.38[a]	±0.04
Mn d 84 (ppm)	0.40[a]	0.43[a]	0.43[a]	±0.04
Cu da 1 (ppm)	0.40[a]	0.44[a]	0.42[a]	±0.04
Cu d 84 (ppm)	0.42[b]	0.38[b]	0.53[a]	±0.04

Different superscripts between columns indicate statistical difference ($P < 0.05$).

Key Words: early weaned, apple pomace, yeasts

M66 Performance and carcass traits of steers grazing annual ryegrass supplemented with increasing levels of flaxseed. N. Fanego[1,2], L. B. Pouzo[2,4], F. J. Santini[1], J. Killefer[5], and E. Pavan*[1], *[1]Unidad Integrada Balcarce (INTA, EEA Balcarce-UNMdP, FCA), Balcarce, Bs. As., Argentina, [2]Comisión Investigaciones Científicas, Buenos Aires, Argentina, [3]Universidad Nacional de La Plata, La Plata, Buenos Aires, Argentina, [4]Consejo Nacional de Investigaciones Científicas y Tecnologícas, Argentina, [5]Oregon State University, Corvallis.*

This study evaluated the effects of increasing flaxseed addition to corn grain supplemented to steers grazing annual ryegrass on performance and carcass traits and whether dietary treatment effects were affected by animal live weight (LW). Forty-eight Angus steers were randomly assigned to 8 treatment combinations: 2 animal weights (LIGHT and HEAVY) and 4 dietary treatments (CNTRL = no supplement; CORN = 0.7% LW of cracked corn; LFLAX and HFLAX = CORN + 0.125% and 0.250% LW of whole flaxseed, respectively). Steers assigned to LIGHT received their dietary treatment when the average LW reached 366 ± 27.3 kg (mid winter) and those assigned to HEAVY, when they reached 458 ± 42.8 kg (mid spring). Steers were managed under a daily rotational system with no forage limitation and individually supplemented with 0.5 kg/d of wheat bran in addition to their dietary treatment. Steers were slaughtered after 70 d on trial. Data were analyzed as a complete randomized design with a 2 × 4 factorial arrangement; preplanned contrasts were used to compare CNTRL vs. supplemented treatments, and linear and quadratic flaxseed effects. No main factor interactions were found ($P > 0.10$). Average daily gain (ADG) was greater ($P < 0.01$; SEM = 0.028) in LIGHT than in HEAVY (1.43 and 0.75 kg). Final LW and HCW were greater ($P < 0.05$) in HEAVY than in LIGHT, but subcutaneous fat thickness (FT), carcass yield and ribeye area did not differ ($P > 0.05$). Supplemented steers tended ($P = 0.06$) to have greater ADG (87 ± 45 g) than CNTRL steers, but no effect was observed ($P > 0.05$) by increasing flaxseed level. Supplementation increased ($P = 0.04$) FT by 1.4 ± 0.68 mm, and each increment of flaxseed increased ($P = 0.03$) FT by 0.9 ± 0.42 mm. No dietary treatment effects ($P > 0.05$) were observed for final LW, HCW, carcass yield, or ribeye area. In conclusion: (a) the different animal weights considered in the present study did not influence supplementation response; (b) with no limiting forage availability, the main effect of energy supplementation was to increase FT; and (c) flaxseed could be supplemented up to 0.25% of LW without negative effects on animal performance or carcass traits.

Key Words: pasture, oil, corn

M67 Evaluating grazing performance and forage quality differences between AC-Saltlander green wheatgrass (*Elymus hoffmannii*) and smooth bromegrass (*Bromus inermis*). A. D. Iwaasa,* H. Steppuhn, and E. Birkedal, *Semiarid Prairie Agricultural Research Centre, Agriculture and Agri-Food Canada, Swift Current, Saskatchewan, Canada.*

AC-Saltlander (ACS) green wheatgrass (*Elymus hoffmannii*) is a Canadian perennial forage cultivar that has salinity tolerance equaling that of tall wheatgrass. Study objective was to evaluate beef and forage production and forage quality differences between ACS and smooth bromegrass (SB; *Bromus inermis*). Seeding of the 6 paddocks (ea 1.2 ha in size) occurred in 2006 and each pasture treatment was replicated 3 times. Paddocks were grazed by Angus yearling steers (308 ± 10 kg) when the grasses were at the bloom to heading stage at a stocking rate of 2.0 AU ha^{-1}. Forage and gazing data were collected over 4 production years (2008 to 2011). No interactions ($P \geq 0.10$) were observed, thus only significant main effects were presented. Available biomass production at time of grazing and peak biomass production did not differ ($P \geq 0.10$) between pasture treatments. However, peak forage biomass production for ACS was numerically higher than SB in 2008, 2009 and 2010. Percent organic matter digestibility (OMD), NDF, ADF, CP, Ca and P differed ($P \leq 0.01$) among years which was expected due to changing environmental growing conditions. Percent forage OMD values (mean ± SE) were higher ($P \leq 0.01$) for SB versus ACS and were 60.8 versus 57.6 ± 0.48, respectively. Average daily gains, total livestock production and number of grazing days did not differ ($P \geq 0.10$) between ACS versus SB, and the values were 1.32 and 1.14 ± 0.12 kg d^{-1}, 87.9 and 87.8 ± 1.9 kg ha^{-1}, and 53.2 and 46.8 ± 5.8 d ha^{-1}, respectively. Beef cattle grazing performance and forage qualities were generally similar between ACS and SB. Throughout the entire study differences in overall system performance of the 2 grasses were not observed.

Key Words: AC-Saltlander green wheatgrass, smooth bromegrass, grazing

M68 Continuous versus rotational stocking of rye and ryegrass pastures at different stocking rates and forage allowance. F. Rouquette Jr.,* J. Kerby, G. Nimr, and K. Norman, *Texas AgriLife Research and Extension Center, Overton.*

Stocking strategies are implemented for cool-season annual grass pastures to enhance efficiency of gains per animal and per unit land area. A 7-year stocking study with 482 steers and heifers quantified ADG and gain/ha using stocking methods (MTH) of continuous (CONT) vs. an 8-paddock rotational (ROTN) system on Maton rye (*Secale cereale* L.) plus TAM-90 annual ryegrass (*Lolium multiflorum* Lam.) pastures at different fixed stocking rates (STK). Two replicate pastures of MTH × STK each with 6 to 8 270-kg fall-weaned calves were stocked from late Dec to mid-May each year at the Texas AgriLife Research Center at Overton. The 8-paddock ROTN system consisted of a 2 d graze and 14-d deferment cycle with forage mass measurements pre- and post-graze. The ADG ranged from 1.38 kg/d on low STK to 0.23 kg/d on high STK, and was affected ($P < 0.01$) by year, STK, year × STK, year × MTH, and at $P = 0.07$ for STK × MTH. Only at one STK in each of 3 years and when forage allowance (FORG) was <0.80 kg forage DM per kg body weight was ADG affected ($P < 0.01$) by MTH. At low STK with FORG >1.0, MTH had no affect on ADG. Gain per ha was affected ($P < 0.01$) by year, STK, and year x STK, and ranged from 1206 kg/ha for medium STK to 389 kg/ha for high STK. Gain per ha was maximum at the medium to medium-high STK. With the nutritive value of rye plus ryegrass, there were no biological nor economic advantages to using an 8-paddock ROTN system compared with CONT

stocking. Although forage DM tended to be increased on ROTN pastures due to the 14-d deferment, gains were not enhanced. Stocking rate and resultant decreased forage DM and FORG affected ADG and gain/ha each year, thus, STK should be the primary consideration for stocking strategies and management.

Key Words: stocking rate, rotational stocking, ryegrass

M69 Improving calf performance by extending the grazing season with warm season grasses and brassica forages. S. J. Filley* and J. Hunter, *Oregon State University, Corvallis.*

The objectives of this experiment were to determine whether grazing cow-calf pairs on warm season grasses and brassica pastures would extend the grazing season by providing high quality forage into the late summer and improve calf weaning weight. Treatments were pasture type; extended season pasture (EXT), a new planting mixture of sorghum × Sudangrass (*Sorghum bicolor* (L.) Moench) and brassica forages (*Brassica* and *Raphanus* species), and control pasture (CON), an existing field of cool season forage (*Festuca* and *Lolium* species plus *Trifolium repens* and *subterraneum*). Thirty cow-calf pairs (cows with 6 mo old steer calves) were stratified by calf weight and assigned to treatments randomly. Each pasture type was divided into 3, 2-ha paddocks (replicates of experimental unit) and grazed with 5 cow-calf pairs until late summer weaning. Data were analyzed by ANOVA as a randomized design. Cool spring weather at planting (May 14, 2010) slowed EXT establishment and growth so that grazing was delayed until mid-August, allowing for only a 14-d grazing period. Prussic acid and nitrate screening tests were conducted, and forages were determined to be safe to graze. Forage yield of EXT tended ($P = 0.06$) to be lower than that of CON (4,972 and 7,642 kg/ha, respectively; SEM ± 746.8). In contrast, CP (10.3% and 6.7%; SEM ± 0.839) and TDN (69% and 56%; SEM ± 2.86) of pasture plants sampled randomly were higher ($P < 0.04$) for EXT compared with CON, respectively. Calf weaning weights (205-d adjusted) were not different ($P = 0.21$) between EXT and CON (288.1 and 305.0 kg, respectively; SEM ± 9.36). In year 2, planting strategy for EXT was adjusted to delay seeding until soil temperature reached 16°C (June 15, 2011). However, growing conditions were again less than optimal, pasture was not sufficient for grazing, and no additional data were obtained. Early establishment of warm season forages in western Oregon can be severely affected by weather, making it difficult to graze cows with February–March born calves for the purpose of improving late summer weaning weights. Strategies that include grazing cow-calf pairs that are to be weaned in the fall may be more advantageous.

Key Words: brassica, sorghum, weaning weight

M70 Beef steer performance when grazing native warm season grasses. H. T. Boland[1,2], B. J. Rude*[2], J. A. Martin[3], S. K. Riffell[3], and L. W. Burger Jr.[3], *[1]Prairie Research Unit, Mississippi Agricultural and Forestry Experiment Station, Prairie, [2]Department of Animal and Dairy Sciences, Mississippi State University, Mississippi State, [3]Department of Wildlife, Fisheries and Aquaculture, Mississippi State University, Mississippi State.*

Use of native warm-season grasses (NWSG) in forage systems may maintain, or improve, animal performance while providing vital ecosystem services. The drought tolerance, low fertilizer needs, high production, and nutritive value of NWSG suggest they could provide a valuable forage base for cattle producers in the south. Also, NWSG provide superior wildlife habitat compared with non-native forages such as Bermudagrass (*Cynodon dactylon*). The objective of this study is to evaluate the productivity of forage systems for beef cattle production that integrate NWSG. Three forage treatments were evaluated: Indiangrass (*Sorghastrum nutans*) monocultures (IND); mixed specie pastures of Big Bluestem (*Andropogon gerardii*), Little Bluestem (*Schizachyrium scoparium*), and Indiangrass (MIX); and Common Bermudagrass (BG) which is a typical summer forage of the region. Site preparation began in spring 2008 and forages were planted in spring 2009. Grazing began in May 2011, with 225 British-crossbred beef steers (IBW 237 kg ± 1.5). Nine pastures were used (3 per treatment) ranging in size from 7 to 11 ha. Pastures were stocked at 2.7 steers/ha and continuously grazed. Cattle were weighed every 28 d and remained on pasture for 110 d. Selected cattle wore activity monitors (IceTag, v 2.004) to measure grazing behavior. Data were analyzed using PROC MIXED of SAS (SAS Inst., Cary, NC) and a significance level of $\alpha \leq 0.05$ was used, with trends defined at $0.10 \geq \alpha > 0.05$. Average daily gain (ADG) of steers did not differ between treatments during periods, d 1–28, 56–84, or 84–110. However, during the peak of the season (d 28–56), ADG was greater ($P < 0.02$) in IND (1.1 kg) and MIX (0.9 kg) than BG (0.64 kg). Overall season ADG tended ($P \leq 0.10$) to be greater for IND (0.6 kg) and MIX (0.6 kg) than BG (0.4 kg). Percent of the day that animals spent grazing (IND 45%, MIX 45%, BG 46%), lying down (IND 41%, MIX 40%, BG 38%), or standing still (IND 13%, MIX 13%, BG 14%) did not differ within period or overall during the season. Time spent walking did differ between treatments with IND steers walking less (1.6%, $P < 0.05$) than BG (2.3%) or MIX (2.2%) steers. These NWSG show promise for use in beef grazing systems in Mississippi.

Key Words: native warm season grass, forage systems, grazing behavior

M71 Animal performance on pastures managed at two forage heights to produce grass finished beef. M. J. Baker*[1], M. L. Thonney[1], L. O. Tedeschi[2], G. Jacimovski[1], and L. M. Furman[1], *[1]Cornell University, Ithaca, NY, [2]Texas A&M University, College Station.*

The animal benefits of management intensive grazing (MIG) are well documented but little is known about managing pastures using the tall grass grazing (TGG) principle. The purpose of this experiment was to evaluate animal performance on pastures managed using either MIG or TGG. Sixteen Angus steers (n = 10, BW = 371 ± 15 kg) and heifers (n = 6, BW = 317 ± 15 kg) were assembled from 2 farms (8 per farm). The cattle were blocked by sex and randomly assigned to MIG or TGG (treatments) based on projected adjusted final BW (AFBW) computed from frame score. Land area required was computed based on average BW, 2 d rotation, 60 d rest period, an estimated forage yield of 183 kg/ha/rotation, and a DMI of 2.5% of BW. Before animals were rotated, forage height was measured on both paddocks. Forage was sampled to approximate the plants cattle grazed. Statistical analyses were conducted assuming farm as a random factor; treatment and sex were assumed to be fixed effects. The initial BW was used as covariate. No interactions were significant ($P > 0.10$) and were removed. Cattle were placed on MIG and TG when forage was 4.24 ± 0.08 cm and 7.43 ± 1.95 cm, respectively. There were no treatment effects ($P > 0.05$) for AFBW, initial BW, final BW, 64 d ADG or 64 to 135 d ADG. The ADG was greater ($P = 0.0067$) for MIG compared with TGG from 64 to 135 d (0.90 ± 0.09 vs. 0.54 ± 0.07 kg, respectively). Cumulative ADG (165 d) was greater ($P = 0.0197$) for MIG compared with TGG (0.95 ± 0.08 vs. 0.79 ± 0.07 kg, respectively). Body condition score was higher ($P = 0.0089$) for MIG compared with TG (7.7 ± 0.13 vs. 7.0 ± 0.21, respectively). There were no treatment effects ($P > 0.05$) for forage NDF, CP, ME or forage composition. However MIG tended ($P = 0.0632$) to produce higher proportion of grass (86.0 ± 2.2%) compared with TGG (71.0 ± 7.4%) and a lower ($P = 0.0743$) proportion

of weed (8.5 ± 1.7% vs 22.5 ± 7.2%, respectively). It is likely that the MIG cattle consumed more DM compared with TGG, but the residual forage height between MIG and TGG (0.24 ± 0.11 vs. 0.49 ± 0.12 cm, respectively) was not significant ($P = 0.1778$). While TGG forage was of similar quality to MIG animal performance was reduced, perhaps due to reduced DMI.

Key Words: beef, pasture, finishing

M72 Nutritive value of plants and milk production from crossbreed cows grazing Tanzania guinea grass subjected to rotational stocking managements. M. L. P. Lima*[1], F. F. Simili[1], A. Giacomini[2], C. C. P. Paz[1], L. C. Roma Jr.[1], and E. G. Ribeiro[2], *[1]SAA Agencia Paulista de Tecnologia dos Agronegocios APTA, Ribeirao Preto, Sao Paulo, Brazil, [2]Instituto de Zootecnia, Nova Odessa, Sao Paulo, Brazil.*

Managements for grazing strategies can promote change in the sward structure and can affect nutritive value and animal production in grazing system. The objectives were to evaluate the crude protein (CP) and neutral detergent fiber (NDF) and milk yield from crossbred cows grazing Tanzania guinea grass (*Panicum maximum* Jacq. cv. Tanzania) and the stocking rate, subjected to rotational stocking managements. The 2 treatments were grazing when swards height was 70 cm or growing fixed period of 30 d, according to a randomized complete block design. The 16 paddocks with 4,000 m^2 were evaluated during spring, summer and fall (5 grazing cycles). The pre-grazing samples of plants and leaves were analyzed for CP and NDF. Eight cows, per treatments, were used for milk production evaluations, in a randomized complete block design. The concentrate supplementation was 4 kg/cow/day. The data were analyzed using the Proc Mixed Procedure of SAS. Interactions between treatments and grazing cycles for CP in forage mass and leaves ($P < 0.001$) were observed. The average for CP was 12.6% for grazing when swards height was 70 cm. The grazing cycles affected ($P = 0.014$) the CP for the fixed period of 30 d treatment. The average of CP was 8.6% for the 1st cycle and end 9.6% for the last cycle (fall). During the summer, the CP was 13.16% for leaves. NDF of leaves was higher ($P = 0.006$) for growing fixed period of 30 d (75.3%) compared with swards height was 70 cm (72.3%). No effect on milk yield and milk composition was found. The average were 19.83 and 18.56 kg/cow/day for 3.5% fat corrected milk, 3.19 and 3.14% of fat; 3.02 and 2.99% of protein; 4.46 and 4.37% of lactose for grazing when swards height was 70 cm or for fixed period of 30 d, respectively. The stocking rate was higher ($P = 0.0456$) for the fixed period of 30 d treatment (6.18/ha) compared with grazing when swards height was 70 cm (5.76/ha). The management based on growing fixed period of 30 d can affect the nutritive value of pasture and the stocking rate but do not affect the milk production from cows supplemented with concentrate.

Key Words: milk components, *Panicum maximum*, sward height

M73 Sward structural characteristics, herbage accumulation of Tanzania guinea grass subjected to rotational stocking managements. M. L. P. Lima*[1], F. F. Simili[1], A. Giacomini[2], C. C. P. Paz[1], L. C. Roma Jr[1], and E. G. Ribeiro[2], *[1]SAA Agencia Paulista de Tecnologia dos Agronegocios APTA, Ribeirao Preto, Sao Paulo Brazil, [2]Instituto de Zootecnia, Nova Odessa, Sao Paulo, Brazil.*

Managements for grazing strategies promote change in sward structure and can affect herbage accumulation. The objectives of this study were to evaluate the plants structural characteristics, the production and the herbage accumulation in pasture of Tanzania guinea grass (*Panicum maximum* Jacq. cv. Tanzania) subjected to rotational stocking managements. The 2 treatments were grazing when swards height was 70 cm or growing fixed period of 30 d for each grazing cycle, according to a randomized complete block design. The 16 paddocks with 4,000 m2 were evaluated during spring, summer and fall, for 5 grazing cycles. The height of plants was compared. The forage mass was evaluated before and after grazing time and the herbage accumulation. The morphological composition of plant (leaves, stem and dead material), the interception of the incident light (LI) and the leaf area index (LAI) were evaluated in pre-grazing samples. The data were analyzed using the Proc Mixed Procedure of SAS. No influence of treatments was found for post-grazing mass and herbage accumulation. The height of plants was 20% higher ($P = 0.0014$) and the forage mass was higher ($P = 0.0034$) for the fixed growing period of 30 d treatments. In pre-grazing samples, the leaves ($P = 0.00429$), stem ($P = 0.0131$), dead material ($P = 0.0106$), LI ($P = 0.0071$) and LAI ($P = 0.023$) were higher for the fixed growing period of 30 d treatment. The results for forage mass were 2508 and 3317 kg/ha; the leaves mass were 1527 and 1790 kg/ha; the stem mass were 699 and 984 kg/ha; the dead material were 282 and 472 kg/ha; the IL were 97 and 91% and the LAI were 4.5 and 5.2, for grazing when swards height was 70 cm and the growing fixed period of 30 d, respectively. The fixed period of 30 d for each grazing cycle improved the forage production and change characteristics in sward.

Key Words: grazing management, *Panicum maximum*, sward height

M74 Simulation of the effect of stocking rate on forage harvest efficiency under New Zealand intensive grazing systems. P. Gregorini*[1], A. J. Romera[1], J. R. Galli[2], P. C. Beukes[1], and H. H. Fernandez[3], *[1]DairyNZ, Hamilton, New Zealand, [2]Facultad de Ciencias Agrarias, Universidad Nacional de Rosario, Rosario, Santa Fe, Argentina, [3]Instituto Nacional de Tecnología Agropecuaria, Balcarce, Buenos Aires, Argentina.*

Long-term experiments comparing the effect of stocking rates (SR) on forage harvest efficiencies (FHE) in dairy grazing systems are costly and time consuming; however, this can be facilitated by the use of simulation models. The objective of this work was to explore the effect of SR on FHE using DairyNZ Whole Farm Model (WFM). The WFM is a farm-scale computer model that includes a mechanistic model of a dairy cow and a climate driven pasture growth model, which interact with a grazing behavior model to mechanistically and dynamically determine FHE (proportion of forage consumed [FC] by cows related to the net forage produced [NFP] by pasture). An average, pasture-based New Zealand farm (forage base: 80% *Lolium perenne* and 20% *Trifolium repens*; cow: Holstein-Friesian crossbreed, 450 kg liveweight and 270 d in milk) was simulated using 7 SR (treatments) and over 3 series of 3 different (e.g., rain, temperature, solar radiation and potential evapotranspiration) climate years (replicates). Resulting variables of the simulation, NFP (ton DM/ha/year) and FC (tonnes DM/ha/year) were analyzed by regression analysis. Then FHE was estimated as FC/NFP. Results of the simulations (Table 1) demonstrated a significantly ($P < 0.001$) positive relationship between SR and the output variables (NFP, FC and FHE), which are concomitant with experimental results (Macdonald et al., 2008 J. Dairy Sci.). Simulation modeling allows examination of costly experimental frameworks and outcomes under pastoral production systems, providing useful information for researchers and farmers in a relatively short period of time and at low cost. This study indicates that under the simulated conditions, increments in SR will lead to greater NFP and FC, and consequently a greater FHE.

Table 1. Effect of stocking rate (SR) on net forage production (NFP), forage consumed (FC), and forage harvest efficiency (FHE)

	NFP (t of DM/ha/yr)		FC (t/ha/yr)		FHE	
SR (cows/ha/yr)	Mean	SD	Mean	SD	Mean	SD
2.0	18.4	0.88	10.5	0.21	0.57	0.146
2.5	18.6	0.66	12.4	0.21	0.67	0.129
3.0	18.8	0.47	13.9	0.33	0.74	0.030
3.5	19.0	0.52	14.5	0.56	0.77	0.207
4.0	19.4	0.56	15.5	0.52	0.80	0.041
4.5	19.9	0.69	15.8	0.60	0.80	0.048
5.0	20.0	0.59	15.8	0.68	0.79	0.086
P-value	<0.001		<0.001		<0.001	
SE	547		426		0.01	
Intercept	17.2		176		0.03	
Linear coefficient	533		6.61		0.35	
Quadratic coefficient			−697		−0.04	
R^2 adjusted	0.48		0.95		0.97	

Key Words: modelling, forage produced and consumed, grazing management

M75 Nitrogen fertilizer management to improve forage production in south-central Vietnam. K. C. McRoberts[1], D. Parsons[2], J. H. Cherney[1], Q. M. Ketterings[1], and D. J. R. Cherney*[1], *[1]Cornell University, Ithaca, NY, [2]University of Tasmania, Hobart, Tasmania, Australia.*

The objective of this field trial was to assess the effect of nitrogen (N) fertilization from composted cattle manure and urea on forage yield in tropical sandy soils (organic matter < 1%). *Brachiaria* 'Mulato II' was established in summer 2010 on 6 farms in Binh Dinh Province of south-central Vietnam. Experimental design was a randomized complete block with 5 levels of manure N (0, 40, 80, 120, 240 kg N/ha/yr) and 3 levels of urea N (0, 60, and 120 kg N/ha/yr) applied in 6 split applications at 2 mo intervals. Canopy height, maximum height, live tiller count, and dry matter (DM) yield were measured monthly (n = 830). DM yield data through January 2012 were log-transformed and analyzed using a linear mixed model (REML) in JMP Pro 9.0.2. Coefficient of determination was 0.78. Fixed effects included urea ($P < 0.0001$), manure ($P = 0.8387$), and their interaction ($P = 0.0994$), as well as additional covariates (pre-experiment soil pH, month, and plant count). Random effects included block (52.4% residual variance) and block x treatment (4.1%). Mean differences were evaluated using Tukey's test. Urea levels 60 (18 mt/ha/yr; 95% CI [11.3, 28.6]) and 120 (18.5; [11.6, 29.4]) were significantly higher than level 0 (14.7; [9.2, 23.4]). In the urea × manure interaction, 120 × 240 (21; [13.2, 33.5]) and 60 × 40 (20.9; [13.1, 33.3]) treatment combinations were significantly higher than 0 × 120 (14.1; [8.8, 22.4]). Urea significantly affects yield. Manure × urea interaction plot suggests positive yield response for urea level 120 at increasing levels of manure. Yield response to urea level 60 across manure levels suggests net N immobilization when the C:N ratio is high. Yield response to manure was absent without urea. Model results for tiller count response were similar to the yield model. Preliminary results suggest that high forage yield requires sufficient inorganic N, and organic matter in composted manure may decrease N available for plant uptake. Future field trial priorities include continued field data collection and assessment of forage nutritive value and soil fertility changes over time. N fertilization recommendations will be developed and disseminated to farmers and educators in the study region.

Key Words: tropical forage yield, nitrogen, manure

M76 Anatomy and histochemistry of lignin in *Festulolium* and its progenitors. J. M. Vargas-Romero[1], H. A. Zavaleta-Mancera[2], S. S. González-Muñoz*[2], J. Burgueño-Ferreira[3], M. Meneses-Mayo[2], and B. Alarcón-Zúñiga[4], *[1]Universidad Autónoma Metropolitana-Iztapalapa, México D.F., México, [2]Colegio de Postgraduados, Montecillo, Estado de México, México, [3]CIMMYT, Estado de México, México, [4]Universidad Autónoma Chapingo, Chapingo, Estado de México, México.*

The objective of this study was to evaluate the lignified tissue distribution in *Festulolium* and its progenitors. *Festuca arundinacea* Schreb, *Lolium perenne* L. and *Festulolium* sp. (*F. arundinacea* × *L. perenne*) were cultivated in a greenhouse. At 22 d after sowing mature leaves from the 3 species were studied for anatomy, lignin histochemistry and NDF and ADF content by light microscopy, scanning electron microscopy, phloroglucinol staining and the Van Soest method. The cross sectional area of protoxylem and metaxylem of the central vein, number of bulliform cells, number and distance between vascular bundles, stomata and epidermal hair density were measured. The relative lignin content (%) was estimated measuring the cross sectional area or the lignified cellular components/total leaf area with the software Motic Images Plus 2.0. The data were statistically analyzed with SAS using the *genmod-zero inflated* Poisson method of the observed and residuals data. The number of vascular bundles did not show differences among species but it related significantly with the epidermal hair density. The adaxial stomata density was related inversely with the metaxylem size; in contrast the abaxial stomata density showed a positive relation with the protoxylem, but there were no differences among species. The distance between veins, associated with the photosynthetic mesophyll, was directly proportional with the NDF and inversely with ADF, behaving differentially among species. There was more lignin in *Festuca* than in the other species, particularly in the abaxial and adaxial epidermis, subepidermal fibers, vascular bundle sheath, marginal fibers, metaxylem vessels and fibers. *Lolium* showed lignin only in the metaxylem of veins. *Festulolium* inherited from *Festuca* large vascular bundles but less lignified, and from *Lolium* the absence of lignin in epidermis, margin and vascular bundle sheath. These characters confer a greater robustness to *Festulolium* in its architecture but with less lignin and greater digestibility.

Key Words: *Festulolium*, anatomy, lignin

M77 The n-alkane technique provides a reliable estimate of fescue and clover composition in mixed forages. N. Vargas Jurado,* A. E. Tanner, S. R. Blevins, H. M. McNair, and R. M. Lewis, *Virginia Polytechnic Institute and State University, Blacksburg.*

N-alkanes are saturated hydrocarbons found in the cuticular wax of plants. Because patterns of n-alkanes differ among plants, they can be used to define the dietary composition of grazing herbivores. N-alkanes are extracted by saponification, with concentrations determined by gas chromatography. Methodological differences, including operator expertise, may contribute to variability in the technique's reliability. Our objectives were to determine: (i) the reliability of estimating the composition of a 2-plant mixture using n-alkanes, and (ii) the extent within and between operator variability affects those estimates. Pure and 2-plant mixtures of red clover and fescue were prepared; the mixtures contained 10 to 90%, at 10% increments of each plant. Two operators, one experienced and one novice, performed 2 extractions of each mixture. For the 4 extractions, concentrations of C_{27}, C_{29}, C_{31} and C_{33}, as plant markers, and C_{22} and C_{34}, as internal standards, were determined. The compositions of the 9 mixtures were estimated using nonnegative least squares. Reliability was assessed by regressing actual on estimated fescue contents, testing the hypothesis that the slope equaled unity. Operator differences were tested with ANOVA.

Across extractions, mean concentrations of C_{27}, C_{29}, C_{31} and C_{33} were 28.0 ± 1.5, 116.8 ± 6.7, 168.5 ± 5.9 and 45.6 ± 1.5 mg/kg for fescue, and 19.6 ± 1.5, 284.6 ± 6.7, 35.6 ± 5.9 and 8.6 ± 1.5 mg/kg for red clover, respectively. The 3 longer chain n-alkanes provided greater discrimination between the plants. Within operator, concentrations of C_{27} and C_{29} differed between extractions ($P < 0.05$). Between operators, only concentrations of internal standards differed (C_{22}, $P = 0.02$; C_{34}, $P = 0.01$), likely due to differences in the standard solutions used. For the experienced operator, the slopes were 0.98 ± 0.03 and 0.98 ± 0.01. For the novice operator, the slopes were 0.83 ± 0.08 and 0.97 ± 0.04. None of the slopes differed from unity, although predictions based on the first extraction of the novice operator were less consistent. Clearly, with training, the n-alkane methodology provides reliable estimates of the composition of plant mixtures.

Key Words: n-alkanes, forage composition, reliable estimate

M78 Assessment of stockpiling methods to increase late summer and early fall forage biomass. A. L. Hickman,* A. O. Abaye, B. F. Tracy, C. D. Teutsch, and D. A. Fiske, *Virginia Polytechnic Institute and State University, Blacksburg.*

In Virginia, tall fescue can be found on more than 4 million acres as hay and pastureland. Management programs to optimize stockpiled tall fescue can potentially increase livestock productivity in Virginia and throughout the region. Prior to making a decision on stockpiling, the producer needs to consider the need for high quality forage. This includes the time of greater forage needs, number, and production level of animals. The objective of this study was to assess the effect of summer stockpiling endophyte-infected Kentucky 31 tall fescue on biomass and nutritive value of tall fescue forage. The experiment consists of 4 treatments each replicated 6 times in a split plot design. The 4 treatments were 2 nitrogen application timing, legume inclusion, and control. Each of the 4 treatments was divided into a cut and a no cut treatment. The cutting treatment consisted of a single cutting taken in May. Nitrogen in the form of urea was applied in March (before the cutting) to one nitrogen application timing treatment and in May (after the cutting) to the other nitrogen application timing treatment at the rate of 56.04 kg/ha. The extent of clover establishment was dependent on the amount of tall fescue residue present at the time of frost seeding. Yield and nutritive value results were analyzed using the glimmix procedure in SAS statistical analysis software. Significance was determined at a level of $\alpha = 0.05$ and responses for significant effects were separated using the Tukey-Kramer grouping of least squares means. Initial results indicate no biomass yield differences between fertilization treatments ($P = 0.3556$) or cutting treatments ($P = 0.8510$). However, some differences in the nutritive value of the stockpiled fescue were observed between the cut and no cut treatments for acid detergent fiber ($P < 0.0001$), neutral detergent fiber ($P < 0.0001$), and crude protein ($P = 0.0022$). Additionally, effect of fertilization treatment on nutritive value was not evident for acid detergent fiber ($P = 0.1199$), neutral detergent fiber ($P = 0.5637$), or crude protein ($P = 0.1488$). The same experiment will be repeated during the 2012 growing season.

Key Words: tall fescue, summer stockpile, forage

M79 Soil nutrients in tall fescue (*Festuca arundinacea* L.) paddocks managed under different outdoor hog systems. S. Pietrosemoli*[1] and J. T. Green[2], [1]*Animal Science Department, North Carolina State University, Raleigh,* [2]*Crop Science Department, North Carolina State University, Raleigh.*

To evaluate the effects of outdoor hog management systems (MS) on soil nutrients, nine 0.16-ha tall fescue paddocks were established at the Center for Environmental Farming System (Goldsboro, NC). The 12-wk-long experiment was conducted twice (Dec 2010 - Mar 2011, and May - Aug 2011). The stocking rate was equivalent to 49 wean-finish hogs/ha. Hogs (23.4 ± 0.6 and 84.8 ± 1.12 initial and final weight, respectively) had ad libitum access to shelter, water and a concentrated feed (16% CP). Animals were managed under 3 systems: continuous (C), rotational (R) and strip (S). In C, hogs had access to the whole paddock area. In R, the paddocks were divided into 9 sections and the central section where shelter and water were located considered a heavy use area (HUA); hogs had permanent access to the HUA and were moved weekly to one of the other 8 sections where feed was provided; after the first 8 weeks, animals had access to the HUA + 2 sections. In S, the paddocks were divided into 8 strips and shelter, water and feed were moved with the animals once a week; after the first 8 weeks, animals were moved to 2 strips on a weekly basis. Soil samples were hand probe collected on 2 dates: before (Dec 2010) and after (Aug 2011) hogs, and at 2 depths (0–15 cm; D1) and (15–30 cm; D2). Paddocks were divided into 9 sections, and 12 core samples per depth were randomly collected within each section and composited. A composite sample per paddock was analyzed for nitrate concentration. The experimental design was a randomized complete block with 3 field replicates. Data were analyzed using the PROC MIXED procedure of SAS and included MS and depth as main effects. The MS affected concentrations of P, K, Mn, Zn, Cu ($P < 0.05$) and NO_3 ($P < 0.09$). Higher ($P < 0.05$) concentrations of nutrients were observed in D1. According to the conditions of this experiment, lower soil nutrient contents were observed in the paddocks managed under the rotational compared with the continuous system.

Table 1. Soil nutrients (mg/dm^3) in tall fescue paddocks under 3 outdoor hogs managing systems (C, R, S[1]) and 2 depths (D1 and D2)

	C	R	S	D1	D2
P	49.0 ^{a}	40.2 ^{b}	39.6 ^{b}	50.4^{b}	35.4^{b}
K	97.6^{a}	78.7^{b}	78.5^{b}	113.3^{a}	56.6^{b}
Ca	643	650.5	655.5	654.5	644.8
Mg	151	155.9	157.9	151.8	158.1
S	14.4	14.4	13.4	15.6	12.5
Mn	47.5^{a}	41.0^{b}	46.3^{a}	46.4	43.5
Zn	4.2^{a}	3.4^{b}	3.8^{a,b}	4.6^{a}	3.0^{b}
Cu	1.8^{a}	1.6^{b}	1.7^{a,b}	2.0^{a}	1.5^{b}
Na	23.1	26.1	25.6	26.8^{a}	23.0^{b}
NO_3[2]	21.8^{c}	16.9^{d}	18.1^{c,d}	25.2^{c}	12.8^{d}

Means with different letters differ (a, b: $P < 0.05$; c, d: $P < 0.09$).

[1]C, R, S values averaged over depths.

[2]Composite sample/paddock.

Key Words: outdoor swine, soil nutrients, *Festuca arundinacea*

M80 Effect of outdoor swine management systems on tall fescue (*Festuca arundinacea* L.) ground cover and animal performance. S. Pietrosemoli*[1] and J. T. Green[2], [1]*Animal Science Department, North Carolina State University, Raleigh,* [2]*Crop Science Department, North Carolina State University, Raleigh.*

During 2 seasons (S; December 2010-March 2011 = S1, and May–August 2011 = S2), the ground cover (GC) of tall fescue paddocks (0.16 ha) was recorded weekly for 12 wk at the Center for Environmental Farming Systems (Goldsboro, NC), to evaluate the effects of 3 outdoor hogs management systems (MS). The stocking rate (8 pigs/plot) was equivalent to 49 weaning-finishing hogs/ha. Initial and final (avg 23.3 ± 1 and 84.8 ± 1 kg, respectively) animal weights were recorded and daily weight gain (DWG) was calculated. The MS evaluated were: continuous (hogs had permanent access to the entire paddock [MS1]), rotational (hogs had permanent access to 1/9 of the area considered as a heavy use area, and were rotated to another 1/9 section on a weekly basis (wk 1–8) or to 2/9 sections (wk 8–12) [MS2]) and strip grazing (hogs had access to 1/8 of the paddock (wk 1–8) or to 2/8 sections (wk 8–12) [MS3]). Animals had ad libitum access to shelter, water and feed (16% CP). Intake averaged 1.96 kg/pig/d. A modified step point method was employed to estimate live vegetation (LV), vegetation residue (VR) and bare soil (BS). The GC was defined by GC = LV+VR. The experimental design was a randomized complete block with 3 field replicates (REP). The LV, BS and GC data were log(x+1) transformed whereas the equation $((x+1)/100)^{1/2}$ was used for VR. After pigs removal data (wk 12) were analyzed using PROC MIXED of SAS v 9.2, following a mixed linear model including MS, S and MS*S as fixed effects, and REP and REP*MS as random effects. For DWG, initial weight and sex condition (female or castrate) were used as covariates. Under the conditions of this experiment GC, its components or DWG did not differ ($P > 0.05$) among management systems. Season affected the variables under evaluation with the exception of DWG.

Table 1. Ground cover (%) of tall fescue paddocks and DWG (kg/pig) under 3 outdoor hogs managing systems (MS 1, MS2, MS3) during 2 seasons (S1 and S2)

	MS1	MS2	MS3	SE
LV	62.4	69.8	69.8	3.1
VR	4.6	2.6	4.4	1.1
BS	31.9	28.3	25.8	2.9
GC	67.5	72.4	74.3	2.5
DWG	0.7	0.8	0.7	0.02
	S1	S2	SE	
LV	58.8[b]	76[a]	3.1	
VR	6.7[a]	1.0[b]	1.0	
BS	33.9[a]	23.5[b]	2.4	
GC	65.5[b]	77[a]	2.5	
DWG	0.7	0.8	0.02	

a,b: Means with different letters differ ($P < 0.05$).

Key Words: outdoor swine, ground cover, *Festuca arundinacea*

M81 Effect of outdoor swine management systems on the botanical composition of tall fescue (*Festuca arundinacea*) paddocks. S. Pietrosemoli*[1], J.-M. Luginbuhl[2], and J. T. Green[2], [1]*Animal Science Department, North Carolina State University, Raleigh,* [2]*Crop Science Department, North Carolina State University, Raleigh.*

An experiment was performed at the Center for Environmental Farming Systems (Goldsboro, NC) to compare the botanical composition (BC) of tall fescue paddocks under 3 outdoor swine management systems. The systems consisted of Continuous (C; hogs had access to the entire paddock during the length of the evaluation), Rotational (R; the paddocks were divided into 9 sections with the central section used as a heavy use area [HUA]); hogs had permanent access to the HUA and were moved weekly to one of the other 8 sections), and strip grazing (S; the paddocks were divided into 8 strips, and the hogs were moved once a week with shelters, feeders and drinkers). Nine 0.16-ha tall fescue paddocks were managed with a stocking rate equivalent of 49 weaning-finishing hogs/ha for 12 weeks during 2 periods: winter 2010–2011 and summer 2011 (S2011). Hogs had ad libitum access to feed (16%CP) and water and free-choice access to shelter. One week after hog removal in S2011, the botanical composition of the paddocks (tall fescue, broadleaf weeds and other grasses) was estimated using the visual estimation (VE) and the dry weight rank (DWR) methods. Paddocks were divided into 9 sections, and 5 quadrats (0.25 m^2) were randomly thrown into each section for the DWR, and the VE of each section was also estimated. The experimental design was a complete randomized block with 3 field replicates. Data were analyzed using Proc Mixed of SAS 9.2 and repetition, treatment × repetition, method × treatment, and method × repetition were included as random effects. No statistical differences ($P > 0.05$) were observed among management systems nor methods of botanical composition estimation. Tall fescue was the main component of the pasture (64.97%), followed by other grasses (29.82%) and broadleaf weeds (4.13%). Crabgrass (*Digitaria sanguinalis*) was the most frequently observed grass, while ragweed (*Ambrosia artemisifolia*) was the most prominent broadleaf weed. The 3 management systems under evaluation had no impact on the botanical composition components of tall fescue paddocks. In addition, similar botanical composition results were obtained using the VE or the DWR methods.

Key Words: outdoor swine, botanical composition, *Festuca arundinacea*

M82 Endophyte-infected fescue seed causes constriction of the palmar and uterine arteries in pregnant mares. K. J. McDowell,* M. A. Stickney, E. Delaney, and D. A. Hestad, *University of Kentucky, Lexington.*

Pregnant mares grazing endophyte-infected (E+) tall fescue may incur problems in late pregnancy such as extended gestation, thickened placenta, decreased prolactin secretion and agalactia. One hallmark of E+ fescue consumption in cattle is vasoconstriction, and we previously demonstrated that it also caused a marked constriction of the palmar artery in nonpregnant horses. The purpose of this experiment was to determine if consumption of E+ tall fescue seed caused constriction of the palmar and uterine arteries in pregnant mares, and if it altered the combined uterine/placental thickness (CUPT). Pregnant mares (n = 23)

at 276 + 4.79 (mean ± SE) days gestation were used in an experiment that was divided into 3 periods (P) of 1-week each. During P1, all mares received E- fescue seed, while during P2, 11 mares received E- seed and 12 mares received E+ seed. During P3, all mares once again received E- seed. Seed, averaging 6.5 ppm ergovaline + ergovalinine, was mixed with the daily grain ration in twice/day feedings such that each day mares received seed at 0.2% body weight. Three times per week during P1 and P2 the left palmar and uterine arteries of each mare were scanned via Doppler ultrasonography, and CUPT near the cervical star was measured. The same measurements were taken again on the last day of P3. Blood samples were taken 3 times per week throughout the study to measure hormone concentrations. When P2 was compared to P1, mares consuming E+ fescue seed, but not E- seed, had reduced diameters of the palmar ($P = 0.0001$) and uterine ($P < 0.0174$) arteries. However, there were no period or treatment differences in the CUPT measurements. Prolactin was lower ($P = 0.0009$) in P2 vs P1 when mares received E+ seed but there were no differences in progesterone or estradiol concentrations. In conclusion, consumption of E+ fescue seed caused constriction of both the palmar and uterine arteries but did not alter CUPT. Constriction of the palmar artery is a sensitive response variable in mares receiving E+ seed, and measuring palmar artery diameter may be a useful tool in monitoring mares' exposure to E+ tall fescue in pastures.

Key Words: horse, fescue, pregnancy

M83 Consumption of endophyte-infected tall fescue seed causes constriction of the palmar artery and vein but does not alter estradiol, progesterone, or estrous cycle length in nonpregnant mares. D. A. Hestad* and K. J. McDowell, *University of Kentucky, Lexington.*

Endophyte-infected (E+) tall fescue (TF) has deleterious health effects in pregnant mares, however, effects are not well understood in nonpregnant mares. Previously, our lab has demonstrated constriction of the palmar artery of nonpregnant horses consuming E+TF seed (Moore et al., 2008). The purpose of this experiment was to determine if the consumption of E+TF seed by nonpregnant mares alters interovulatory intervals and serum hormone concentrations, and to determine if E+TF causes constriction of the palmar vein as well as the artery. Nonpregnant cycling mares (n = 12) were used in a crossover experiment consisting of 2 periods (P), where each P was the duration of 1 estrous cycle (from ovulation, d 0, to next ovulation). On d 0 of P1 mares were assigned to receive either E+ (at 6.5 ppm ergovalinine + ergovalinine) or endophyte free (E-) TF seed. All mares were placed on E- seed at the end of P1 to allow for a washout period, where Lutalyse (10 mg) was given on Day 6 to cause luteal regression. On d 0 of P2 (day of next ovulation) mares began receiving the treatment alternate from P1. Seed was mixed with the daily grain ration such that each day mares received seed at 0.2% body weight. During P1 and P2, the palmar artery and vein of each mare were scanned via Doppler ultrasonography every 2 to 3 d. Blood samples were taken every other day during P1 and P2, with more frequent ultrasound scanning and blood sampling on days immediately around ovulation. Lengths of estrous cycles and concentrations of progesterone and estrogen were not different between treatments. However, E+ seed caused constriction of the palmar artery ($P < 0.0001$) and vein ($P = 0.014$) compared with the E- seed. Measuring vasoconstriction therefore may be a useful tool in monitoring mares' exposures to E+ TF, and vasoconstriction could affect fertility and embryonic development. Future experiments will assess the effects of E+TF on the vascularity of the uterine endometrium.

Key Words: tall fescue, Doppler ultrasound

M84 Changes in bovine vascular contraction and constriction relative to time off endophyte-infected tall fescue. J. R. Bussard*[1], G. E. Aiken[3], J. R. Strickland[3], K. R. Brown[3], B. M. Goff[1], A. P. Foote[2], and J. L. Klotz[3], *[1]Department of Plant and Soil Sciences, University of Kentucky, Lexington, [2]Department of Animal and Food Sciences, University of Kentucky, Lexington, [3]USDA-ARS, FAPRU, Lexington, KY.*

Beef cattle grazing endophyte-infected (E+; *Neotyphodium coenophialum*) tall fescue (TF; *Lolium arundinaceum*) are exposed to ergot alkaloids produced by the endophyte. Ergot alkaloids induce constriction in vascular tissue of extremities of animals grazing TF, which leads to an inability to regulate body temperature and an increased susceptibility to heat and cold stresses. To better understand consequences of alkaloid exposure, a study was conducted to evaluate changes in vascular contraction relative to time-off E+ TF pasture after an 88-d grazing period. Lateral saphenous veins were biopsied from 24 predominantly Angus steers (361 ± 4 kg) at 0-, 21-, 42-, and 63-d off of TF pasture (n = 6 per time point) and 6 control steers (370 ± 18 kg) at 0-d and 63-d off bermudagrass (BG) pasture (n = 3 per time point). Off pasture, steers were housed in a dry lot and fed a non-toxic corn silage diet. To evaluate contractile response, biopsied vessels were cleaned, incubated in a multimyograph, and exposed to increasing concentrations (1×10^{-11} to 10^{-4} *M*) of ergotamine. Myograph data were normalized to a reference edition of 1×10^{-4} *M* norepinephrine. Cross-sectional ultrasound scans of caudal artery at the fourth coccygeal vertebra were taken on d 0, 8, 15, 21, 29, 36, 42, and 45 using an Aloka 3500 Ultrasound Unit with a UST-5542 (13 MHz) linear array transducer set to 2-cm depth to determine mean artery luminal area to evaluate constriction. Data were analyzed as a CRD using mixed models in SAS with steer as experimental unit. Veins from steers of TF pasture differed over time ($P < 0.05$) and d-0 TF veins had a much lower ($P < 0.05$) contractile response to ergotamine compared with d-0 BG veins. By 63-d myograph contractile responses for TF steers were similar to those of BG steers ($P = 0.29$). Luminal areas of caudal arteries in steers grazed on E+ TF had relaxed and were similar to steers that had grazed BG by 36-d on the non-toxic diet ($P = 0.15$). Measures of contraction indicate that cattle should be removed from E+ TF pastures for a minimum of 4 weeks to obtain vascular responses similar to those of cattle grazed on non-toxic pastures.

Key Words: bovine, ergot alkaloid, tall fescue

M85 Lateral saphenous vein responses to serotonergic and α-adrenergic receptor agonists increase with time off endophyte-infected tall fescue. J. L. Klotz*[1], J. R. Bussard[2], G. E. Aiken[1], A. P. Foote[3], D. L. Harmon[3], K. R. Brown[1], B. M. Goff[2], and J. R. Strickland[1], *[1]USDA-ARS, Forage-Animal Production Research Unit, Lexington, KY, [2]Department of Plant and Soil Sciences, University of Kentucky, Lexington, [3]Department of Animal and Food Sciences, University of Kentucky, Lexington.*

Previous research has indicated that serotonergic and α-adrenergic receptors in peripheral vasculature are affected by exposure of cattle grazing toxic endophyte-infected (E+) tall fescue (TF; *Lolium arundinaceum*). This study was conducted to investigate changes in vascular contractile response over time relative to removal from an E+ TF pasture after an 88-d grazing period. Lateral saphenous veins were biopsied from 24 Angus-cross steers (361 ± 4 kg) at 0-, 21-, 42-, and 63-d off of TF pasture (n = 6 per time point) and 6 steers (370 ± 18 kg) off of bermudagrass (BG) pasture on d-0 and d-63 (n = 3 per time point). Off pasture, steers were housed in a dry lot and fed a corn silage diet. Biopsied vessels were cleaned and incubated in a multimyograph and exposed to increasing concentrations (5×10^{-8} to 1×10^{-4} M) of TCB-2 (TCB; $5HT_{2A}$ agonist), guanfacine (GF; α_{2A}-adrenergic agonist), and

(R)-(+)-m-nitrobiphenyline oxalate (NBP; α_{2C}-adrenergic agonist). Data were normalized to a reference addition of 1×10^{-4} M norepinephrine and analyzed as a CRD using mixed models of SAS for main effects of d off pasture, agonist concentration, the interaction, and comparison of TF to BG veins at d 0 and d 63 included a pasture effect. Steer was the experimental unit. Increasing concentrations of 3 agonists incubated with TF veins were significant for agonist ($P < 0.01$) and d off pasture ($P < 0.01$), but only TCB was significant for d off pasture × concentration interaction ($P < 0.01$). Vasoactivity to agonists was reduced when steers were initially removed from E+ TF pasture. Contractile response at d 63 was greatest ($P < 0.05$) for GF, NBP, and TCB and d-42 TCB response was greater ($P < 0.05$) than on d 21 or d 0 (which did not differ). Contractile responses to NBP at d 0 were greater in BG veins ($P < 0.01$) than TF and tended to be greater ($P = 0.07$) for GF and TCB, but none were different at d 63. These data demonstrate changes in peripheral vasoactivity occur beyond 1 mo off pasture and $5HT_{2A}$ receptors appear to be more dramatically affected in the lateral saphenous vein by grazing E+ TF pasture than adrenergic receptors.

Key Words: bovine, tall fescue, vasoconstriction

M86 Validation of a housekeeping gene for use in bovine vascular gene expression studies. J. L. Klotz*[1], K. R. Brown[1], J. C. Matthews[2], J. A. Boling[2], and J. R. Strickland[1], *[1]USDA-ARS, Forage-Animal Production Research Unit, Lexington, KY, [2]Department of Animal and Food Sciences, University of Kentucky, Lexington.*

Exposure of ungulate vasculature to ergot alkaloids while grazing endophyte (*Neotyphodium coenophialum*)-infected tall fescue (*Lolium arundinaceum*) affects vasoactivity and causes vasoconstriction. Bovine vascular gene expression as affected by exposure to ergot alkaloids in tall fescue is largely unstudied. The objective of this study was to investigate the suitability of β-actin (ACTB), glyceraldehyde 3-phosphate dehydrogenase (GAPD), hypoxanthine phosphoribosyl-transferase I (HPRT), succinate dehydrogenase flavoprotein subunit A (SDHA), and ubiquitin C (UBC) as potential housekeeping genes for use in bovine vascular gene expression studies that include different levels of exposure to ergot alkaloids. Lateral saphenous (SV) and right ruminal veins (RV) were selected as models for comparison of peripheral and visceral vasculature for future experiments. Veins were collected immediately after slaughter from 19 predominantly Angus steers that had grazed either a low-endophyte-infected tall fescue pasture (LE; 5.7 ha; n = 9; BW = 266 ± 6 kg) or a high-endophyte-infected tall fescue pasture (HE; 5.7 ha; n = 10; BW = 267 ± 6 kg) for 89–105 d. Isolated veins were frozen in liquid N and stored at −80°C until completion of total RNA isolation and 1st strand synthesis of cDNA. Real-time PCR was run using SYBR Green with PCR product verified by dissociation curve analysis. Relative standard curve analysis of each gene was done using separate serial dilutions of composite cDNA (10 ng/μL) from SV and RV. Transcript levels (ng/μL) for each gene were analyzed as CRD factorial for endophyte level and vein with mixed models in SAS. Endophyte level (HE vs. LE) did not affect expression of any gene, nor were any endophyte level × vein interactions detected. There was a main effect of vein for HPRT, GAPD, and SDHA ($P < 0.01$). Expression levels of HPRT, GAPD, and SDHA were all greater ($P < 0.05$) in SV than RV, whereas levels of ACTB and UBC did not differ between veins. Thus, ACTB or UBC mRNA transcripts are appropriate to use as normalizing genes when assessing the effects of grazing endophyte-infected tall fescue on gene expression by bovine RV and SV tissues.

Key Words: bovine, housekeeping gene, vein

M87 Tiller appearance in pastures of Guinea grass 'Tanzania' managed with different frequencies and defoliation severities. D. Nascimento Júnior*[1], A. M. Zanine[2], B. M. L. Sousa[1], and W. L. Silva[3], *[1]Univsersidade Federal de Viçosa, Viçosa, MG, Brazil, [2]Universidade Federal do Mato Grosso, Rondonópolis, MT, Brazil, [3]Universidade Estadual Paulista, Jaboticabal, SP, Brazil.*

The experiment was conducted from November 2005 to October 2006 in Viçosa, MG, Brazil (20°45′ S; 42°51′ W; 651 m a.s.l.). Tiller appearance was evaluated in Guinea grass 'Tanzania' (*Panicum maximum* 'Tanzania') subjected to rotational stocking management characterized by 2 post-grazing heights (30 and 50 cm) and grazings carried out at the 90 and 95% canopy light interception condition. The 4 grazing management strategies (90/30, 90/50, 95/30, and 95/50) were allocated to experimental units in a completely randomized block design with 3 replications.Tiller dynamics were assessed in 3 clumps per experimental unit. This assessment made it possible to calculate the tiller appearance rate {[new tillers/total of live tillers in the previous marking) x 100]/ regrowth days}. The data were grouped into 4 seasons: end of spring (November and December 2005), summer (January to March 2006), fall (April to June 2006) and winter/beginning of spring (July to October 2006). The data were submitted to variance analysis using the GLM Procedure of SAS (Statistical Analysis System) and compared by the Tukey′s test, with 10% of significance. The tiller appearance rate was influenced by the interaction post-grazing height × light interception × season of the year ($P < 0.10$). In the end of the spring, pastures managed with 90/30 and 90/50 presented higher values ($P < 0.10$) relatively to the ones managed at 95/30 and 95/50 (1.10 and 0.85 versus 0.45 and 0.45 tiller/100.tiller.day, respectively). Swards managed with 90/30 (1.92 and 1.10 tiller/100.tiller.day) and 95/30 (2.33 and 1.30 tiller/100. tiller.day) presented higher values ($P < 0.10$) in comparison to the ones managed at a 90/50 (1.66 and 1.79 tiller/100.tiller.day) and 95/50 (1.40 and 0.70 tiller/100.tiller.day) in the summer and in the fall, respectively. In the winter/beginning of the spring, pastures managed with 95/30 presented lower tiller appearance rate ($P < 0.10$) comparatively to the ones managed at 90/30, 90/50, and 95/50 (0.69 versus 1.21, 1.08 and 0.98 tiller/100.tiller.day, respectively). All the evaluated management strategies were adequate for Guinea grass.

Key Words: ecophysiology, post-grazing height, light interception

M88 Aerial tiller density in pastures *Pennisetum purpureum* submitted to different post-grazing heights. B. M. L. Sousa, D. Nascimento Júnior*, H. C. F. Monteiro, F. C. Gomes, C. Z. Assis, and C. S. Almeida, *Universidade Federal de Viçosa, Viçosa, MG, Brazil.*

Elephant grass is a plant that has a high forage yield potential and is widely used in dairy farming under grazing in Brazil. With this type of management, attention should be given to the type of tiller being produced because, under grazing, Elephant grass produces a great quantity of aerial tillers. The experiment was carried out from February to May in 2009 to evaluate the aerial tiller density in Elephant grass 'Napier' (*Pennisetum purpureum* Schum.) submitted to different grazing severities. The study was conducted in an area cultivated with Elephant grass 'Napier' in Vicosa, MG, Brazil (20°45′ S; 42°51′ W; 651 m a.s.l.). Soil is classified as Inceptic Hapludults, with clay-loam texture. Treatments corresponded to 3 post-grazing conditions (residues of 30, 50 and 70 cm) associated with a pre-grazing condition of 95% sward canopy light interception during regrowth. A complete randomized block design with 3 replications was used. The monitoring of the light interception was done using the canopy analyzer (LAI 2000). The aerial tiller density was evaluated by counting the living tillers within 4 existing metal frames measuring 0.25 m × 1.00 m per experimental unit. The data

were grouped by month and subjected to an ANOVA using the Mixed Procedure of SAS (Statistical Analysis System).The means were compared by the Student's *t*-test at a 5% significance level. The aerial tiller density was influenced by the post-grazing height ($P = 0.0017$) and was lower in the pastures that were managed at a post-grazing height of 30 cm (125 tillers/m^2) compared with those that were managed at 50 or 70 cm (211 and 201 tillers/m^2, respectively). These swards had also lower tiller renewal and higher quantity of weeds, suggesting the beginning of degradation process and that this post-grazing height (30 cm) should not be recommended for grazed elephant grass. The aerial tiller density was not affected by the month ($P = 0.5567$), being on average 179 tillers/m^2. The post-grazing height of 30 cm can drastically reduce the pasture accumulation rate.

Key Words: ecophysiology, grassland management, light interception

M89 Tiller density stability of Piatã palisadegrass swards deferred with different initial heights. B. M. L. Sousa[1], D. Nascimento Júnior*[1], M. E. R. Santos[2], H. H. Vilela[1], M. C. T. Silveira[3], G. O. Rocha[1], B. D. Faria[1], and C. A. S. Freitas[1], *[1]Univsersidade Federal de Viçosa, Viçosa, MG, Brazil, [2]Faculdade de Medicina Veterinaria e Zootecnia, Uberlândia, MG, Brazil, [3]Empresa Brasileira de Pesquisa Agropecuária - Pecuária Sul, Bagé, RS, Brazil.*

The study was conducted to evaluate the stability index of the tiller density of the Piatã palisadegrass (*Brachiaria brizantha* 'Piatã') deferred with 3 initial heights of the sward (20, 30 and 40 cm) and 4 deferring periods (1 to 30, 31 to 60, 61 to 90, and 91 to 120 d). The experiment was carried out in the Federal University of Vicosa, in Viçosa, Minas Gerais, from March 1 to July 7, 2011. The experimental design was a complete randomized block with 3 replications in subdivided plots repeated in time. Tillering was evaluated inside of a 30 cm diameter metal ring in each experimental unit. This evaluation made it possible to calculate the stability index of the tiller density [survival rate × (1 + appearance rate)] for the basal and aerial tillers. Data were analyzed using the SAEG (Statistical Analysis System and Genetics) and the means comparisons were made by the Student-Newman-Keuls′s test at a probability of 5%. In general, the stability index values under 1.0 indicate that the survival and appearance of new tillers are not enough to compensate the death rates, and, thus, the density tends to decrease, while higher values than 1.0 suggest increase, and values near 1.0 indicate a stable tiller density, in which the number of tillers does not practically vary. The stability index of basal ($P = 0.6652$) and aerial ($P = 0.6907$) tillers was not affected by the initial deferring height, presenting, in average, 1.05 and 1.68, respectively. However, the stability index of basal ($P = 0.0007$) and aerial ($P = 0.0003$) tiller density was influenced by the deferring period. The Piatã palisadegrass deferred from 1 to 30 d (1.62 and 4.11) presented higher value of stability index of basal and aerial tillers in relation to the ones deferred from 31 to 60 (0.89 and 0.90), 61 to 90 (0.83 and 0.94) and 91 to 120 d (0.85 and 0.79), respectively.

Key Words: *Brachiaria brizantha*, grassland management, structural characteristics

M90 Tiller density in Piatã palisadegrass deferred in different seasons and initial heights. B. M. L. Sousa[1], D. Nascimento Júnior*[1], H. H. Vilela[1], M. E. R. Santos[2], C. Z. Assis[1], G. O. Rocha[1], and B. D. Faria[1], *[1]Univsersidade Federal de Viçosa, Viçosa, MG, Brazil, [2]Faculdade de Medicina Veterinaria e Zootecnia, Uberlândia, MG, Brazil.*

Deferring management strategies can affect the number of tillers of the sward, compromising the persistency, the productivity and sustainability of the grassland. Therefore, the study was conducted to evaluate the effect of the seasons and initial deferring heights on the number of tillers of the Piatã palisadegrass (*Brachiaria brizantha* 'Piatã'). The experiment was carried out in the Federal University of Viçosa, in Viçosa, Minas Gerais, in 3 areas deferred in March 20, April 10, and May 1, 2010, and with initial heights of 20, 30, and 40 cm. A complete randomized block design with 3 replications in a subdivided plot scheme was used. The area was deferred until 07/01 in 2010, at which time the number of tillers inside 2 square metal frames of 0.4 × 0.4 m was determined. The data were analyzed using the SAEG (Statistical Analysis System and Genetics) and compared by the Tukey test at 5% of significance. The number of tillers was influenced by the interaction between initial height and season ($P = 0.0345$). Higher number of tillers was obtained in the area deferred in May 1 in the initial heights of 20 (1,056 tillers/m^2), 30 (1,158 tillers/m^2), and 40 cm (1,113 tillers/m^2), in April 10 in the heights of 20 (1,069 tillers/m^2) and 30 cm (1,356 tillers/m^2), and in March 20 in the height of 20 cm (1,135 tillers/m^2), in relation to the ones deferred in April 10 in the height of 40 cm (704 tillers/m^2) and in March 20 in the heights of 30 (911 tillers/m^2) and 40 cm (808 tillers/m^2). Long deferring periods associated to the high initial sward heights decreases the number of tillers of deferring Piatã palisadegrass.

Key Words: *Brachiaria brizantha*, grassland management, structural characteristics

M91 Animal productivity on brachiaria grass deferred at different heights[1]. M. C. T. Silveira[1], D. M. Fonseca[2], D. Nascimento Júnior*[2], M. E. R. Santos[3], V. M. Gomes[2], F. K. Gomes[2], V. L. N. Brandâo[2], G. O. Rocha[2], B. M. L. Sousa[2], A. Deus[2], R. L. Albino[2], L. S. Moura[2], and G. A. Borges[2], *[1]CPPSU-Embrapa Pecuária Sul, Bagé, RS, Brazil, [2]Universidade Federal de Viçosa, Viçosa, MG, Brazil, [3]Faculdade de Medicina Veterinaria e Zootecnia-UFU, Uberlândia, MG, Brazil.*

Pasture deferment consists of postponing the grazing in one area for utilization in the offseason period. Thus, the objective of this study was to evaluate the animal productivity on brachiaria grass pastures deferred at different heights. The experiment was conducted in a field of the Animal Science Department of Universidade Federal de Viçosa, Minas Gerais, Brazil. The experimental area consisted of Brachiaria decumbens Stapf. 'Basilisk' pasture subdivided in 8 paddocks (experimental units), plus a reserve area, totaling approximately 3 ha. The experiment was conducted in randomized block design with 2 replicates and 4 heights at the beginning of deferment (10, 20, 30, and 40 cm). In March 2010, pastures were managed under continuous stocking and variable stocking rate, so that the heights could be established, and the deferment was started. In June 2010, the grazing on deferred pastures began. During 115 d, pastures were managed under continuous stocking, and the initial fixed stocking rate was approximately 3.0 AU/ha. The animals were growing crossbred steers, with an average weight of 190 kg. During the grazing period, cattle consumed, in addition to deferred pasture, mineral salt ad libitum. Average daily weight gain, stocking rate and production per area were measured. Variance and regression analyses at significance level up to 10% of probability were carried out. Stocking rate and animal production per area were not affected by pasture heights ($P > 0.10$), with an average value of 3.78 AU/ha and 0.69 kg/ha.d. This result can be explained by the stocking rate, which was fixed at the beginning of the grazing period. These productivity rates are high for this period, since in Brazil the climatic conditions are not conducive to pasture growth. The average daily gain increased quadratically with pasture height at the beginning of deferment ($P < 0.10$), with maximum value of 0.134 kg/animal.d in the pasture deferred at 20 cm. Therefore, with lowering of brachiaria pastures to 20 cm at the beginning of the deferment period, it is

possible to avoid weight loss in cattle kept on pasture, which is common during the fall and winter seasons (June to September).

Key Words: *Brachiaria decumbens* 'Basilisk', grazing management, stocking rate

M92 The effect of cutting at different stages of maturity on yield and quality of nine forage oat varieties in the peace region of Alberta. T. A. Omokanye*[1] and K. S. Gill[2], *[1]Peace Country Beef and Forage Association, Fairview, Alberta, Canada, [2]Smoky Applied Research and Demonstration Association, Falher, Alberta, Canada.*

Beef cattle producers commonly use annual cereals for silage, greenfeed and swath grazing in parts of the Peace Region of Alberta. In Alberta, oats account for more than 40% of total annual greenfeed production. As with most forage crops, there is a yield and quality trade off as small grains mature from boot to dough maturity stages. Timing of the cereal forage harvest is critical to obtain the desired forage quality. The objective of this study was to examine the effects of stage of maturity at cutting on forage yield and feed value of forage oat varieties for greenfeed and swath gazing systems. Nine forage oat varieties were seeded and cut at the late milk and dough stages for yield and feed value in a split-plot experimental design. Forage dry matter (DM) yields of all oat varieties did not show any significant ($P > 0.05$) increase as cutting was delayed from the late milk stage until the dough stage. The mean forage DM yields across the 9 oat varieties ($P > 0.05$) were, respectively, 8,496 and 9,601 kg/ha for late milk and dough stages. When pooled across the 2 stages of maturity at cutting, the average forage DM yield was in the following order ($P > 0.05$): Warden > Foothills > Mustang > SO-I > Murphy > Baler > Morgan > Everleaf > Jordan. When averaged across the 9 oat varieties, mean forage crude protein (CP) was significantly ($P < 0.05$) higher at the late milk stage (9.17%) than at the dough stage (5.66%). For the late milk stage, SO-I oat had the highest CP (10.55%) and Jordan oat had the least CP with 7.24%. When harvesting was delayed till the dough stage, Everleaf significantly ($P < 0.05$) had the most CP (7.20%), while Mustang had the least CP (4.54%). Generally, for each oat variety, cutting at the late milk stage gave slightly lower total digestible nutrients (TDN) (3–8% less energy) than cutting at the dough stage. For all the forage oat varieties examined, the dough stage had significantly ($P < 0.05$) lower ADF and NDF contents than the late milk stage. In summary, the stage of maturity at cutting oat in the present preliminary study did not affect forage DM yield. However, harvesting the forage oat in the late milk stage gave better CP than at the dough stage, but higher energy harvested per acre occurred at the dough stage.

Key Words: Stages of maturity, oats, forage yield and feed value