

# Forages and Pastures I

**348 Sustainable goat farming: Pasture enhancement and identification of suitable forages for goats.** U. Karki<sup>\*1</sup>, L. B. Karki<sup>2</sup>, N. K. Gurung<sup>1</sup>, and A. Elliott<sup>1</sup>, <sup>1</sup>Tuskegee University, Tuskegee, AL, <sup>2</sup>PadmaDal Memorial Foundation, Auburn, AL.

Meat-goat farming is becoming popular to many small-scale farmers in Alabama. However, making this business sustainable is a challenge, especially with the existing poor pastures and grazing practice. Not much information is available on suitable forages for improving goat pastures and managing them sustainably. The objectives of this study were 1) to improve the existing goat pasture by incorporating selected cool-season forages, and 2) to determine goats' preference for the selected forages. The study was conducted in Selma and Phenix City, Alabama as a completely randomized design with 3 replications in each site. Five treatments: combination of annual ryegrass (*Lolium multiflorum*) and one of the selected cool-season legumes (arrowleaf clover, *Trifolium vesiculosum*; berseem clover, *Trifolium alexandrinum*; crimson clover, *Trifolium incarnatum*; hairy vetch, *Vicia villosa*; and winter peas, *Pisum sativum*) and a control of sole annual ryegrass plantings were tested. Pastures were managed by rotational grazing. Forage biomass before grazing, and forage height both before and after grazing were measured. The average forage-biomass production in Selma ( $1.0 \pm 0.28$  t ha<sup>-1</sup>) and Phenix City ( $1.4 \pm 0.21$  t ha<sup>-1</sup>) remained similar among the treatments. Average height reduction after grazing was much lower for peas ( $8.0 \pm 1.51$  cm) compared with other forages ( $18.0 \pm 2.06$  cm). Preliminary results show that all selected forage species, except winter peas, were readily grazed by goats. Findings of this research will be very useful to goat producers and Extension personnel for improving and managing goat pastures, and eventually promoting the sustainability of goat farming.

**Key Words:** cool-season legumes, grazing management, sustainable goat farming

**349 Effects of co-grazing on herbivory patterns and performance by cattle and goats grazing native tallgrass rangeland infested by sericea lespedeza (*Lespedeza cuneata*).** L. A. Pacheco<sup>\*1</sup>, W. H. Fick<sup>2</sup>, G. W. Preedy<sup>1</sup>, E. A. Bailey<sup>1</sup>, D. L. Davis<sup>1</sup>, and K. C. Olson<sup>1</sup>, <sup>1</sup>Department of Animal Sciences & Industry, Kansas State University, Manhattan, <sup>2</sup>Department of Agronomy, Kansas State University, Manhattan.

Sericea lespedeza (SL) is classified as a noxious weed in the Great Plains and infests over 0.6 million acres of rangeland in Kansas. Beef cattle avoid grazing SL, presumably due to its high tannin content; however, goats readily graze this plant. Lactating crossbred cows with calves (n = 145; initial BW =  $579 \pm 91$  kg) and non-pregnant, nonlactating Boer × nannies (n = 200; initial BW =  $42 \pm 1.9$  kg) were used to evaluate the effects of co-grazing on herbivory patterns and animal performance while grazing native pastures infested heavily by SL (average SL biomass in October = 2,061 kg/ha; 56% of total forage biomass). Nine pastures were assigned randomly to 1 of 2 season-long grazing systems: 5 pastures (65 ha) were grazed by cows + calves only (single species; 0.8 ha/AUM) and 4 pastures (32 ha) were grazed by cows + calves (0.8 ha/AUM) and goats (multispecies; 0.8 ha/AUE/month). Cows + calves and goats were assigned randomly to pastures. Animal BW was measured at 28-d intervals from June 1 to October 1; BCS were assigned to cows also at those times. Two permanent 100-m transects were marked at the outset of the study (June 15) within each pasture to estimate botanical

composition and SL herbivory. Season-long cow BW change, season-long calf ADG, and cow pregnancy rates were not different ( $P \geq 0.40$ ) between multispecies and single-species pastures. Conversely, season-long cow BCS change was greater ( $P < 0.01$ ) on multispecies pastures than on single-species pastures ( $0.04$  vs.  $-0.38$ , respectively). Biomass of SL was not different ( $P = 0.97$ ) between pastures at the outset of the study. The percentage of individual SL plants that had been grazed at the end of the trial was greater ( $P < 0.01$ ) on multispecies pastures than on single-species pastures ( $94.2$  vs.  $77.5\%$ , respectively). Final SL biomass in multispecies pastures averaged 1,692 kg/ha, whereas final SL biomass in single-species pastures averaged 2,230 kg/ha (SE = 739.4 kg/ha;  $P = 0.37$ ). Residual forage biomass at the end of the study was not different ( $P = 0.54$ ) between treatments and averaged 3,622 kg/ha, indicating that forage availability did not limit forage intake during our trial. Our results were interpreted to suggest that grazing cows + calves and goats in combination increased grazing pressure on SL without negatively affecting beef cow or beef calf performance or residual forage biomass.

**Key Words:** *Lespedeza cuneata*, multispecies grazing, condensed tannins

**350 Effect of different regrowth ages of *Andropogon gayanus* grass silages on intake, digestive efficiency and methane emissions in sheep.** G. O. Ribeiro Junior,<sup>\*</sup> L. C. Gonçalves, and N. M. Rodriguez, School of Veterinary, Federal University of Minas Gerais, Belo Horizonte, Minas Gerais, Brazil.

*Andropogon gayanus* is an important grass due to its high biomass production and its adaptability to withstand a long dry season, and low fertility acidic soils. Currently, there is little research assessing the nutritional quality of *A. gayanus* grass silage at increasing days of regrowth. Thus, the objectives of this study were to determine the effects of different regrowth ages of *A. gayanus* grass silage on dry matter intake (DMI), dry matter digestibility (DMD), net energy, energy balance and CH<sub>4</sub> production in sheep. *A. gayanus* grass silage was made using 56, 84, or 112 d of regrowth in 200 L metallic barrels and fed to sheep (n = 18) for a period of 21 d after which DMI and DMD were measured for 5 consecutive days. Net energy, energy balance and methane emissions were determined with an open circuit respirometry chamber. The animals stayed inside the chamber for 24 h during feeding and fasting. The experimental design was completely randomized with 3 treatments (silage age) and 6 repetitions (sheep). The data were subjected to ANOVA and linear regression. The DMI were similar among treatments ( $P > 0.05$ ) averaging 54.36 g/BW<sup>0.75</sup>; however, DMD reduced linearly ( $P < 0.01$ ) with increasing regrowth age, averaging 52.60, 43.64 and 37.99% for 56, 84 and 112 d of regrowth, respectively. Silage net energy was also reduced linearly ( $P < 0.05$ ) with increasing regrowth age. Furthermore, the energy balance of the animals reduced linearly ( $P < 0.01$ ) with increasing regrowth age and was below zero in the higher regrowth age. Methane emissions (g/kg) of DMD showed a tendency ( $P < 0.10$ ) to increase as regrowth age increased. When methane emissions were expressed in g/kg of digestible cellulose it increased linearly ( $P < 0.05$ ) with increasing regrowth age. Therefore results from this study show that increasing regrowth age of *A. gayanus* grass silage reduced digestive efficiency and increased methane emissions in sheep, which indicates that this forage should be ensiled at younger regrowth age.

**Key Words:** energy efficiency, grass maturity, methane

**351 Effects of feeding perennial peanut hay on growth, development, attainment of puberty, and fertility in beef replacement heifers.** K. M. Bischoff<sup>\*1</sup>, T. E. Black<sup>1</sup>, V. R. G. Mercadante<sup>1</sup>, G. H. L. Marquezini<sup>1</sup>, R. O. Myer<sup>1</sup>, A. T. Adesogan<sup>2</sup>, N. DiLorenzo<sup>1</sup>, and G. C. Lamb<sup>1</sup>, <sup>1</sup>North Florida Research and Education Center, University of Florida, Marianna, <sup>2</sup>Department of Animal Sciences, University of Florida, Gainesville.

We determined the influence of supplemental feeding of perennial peanut hay (*Arachis glabrata*) on growth performance, attainment of puberty, and fertility in replacement heifers. Over 2 yr, 120 heifers (60 heifers/yr) were allocated into pens (5 heifers/pen) and assigned to receive one of 3 supplement treatments during a 140 d development phase (DP) before initiation of the breeding season: 1) 1.23 kg DM/d of a mix of 80% cracked corn and 20% soybean meal, DM basis (CSBM); 2) 2.74 kg DM/d of perennial peanut hay (PPH); and, 3) no supplement (CON). Pen was the experimental unit. During the DP all heifers received ad libitum access to bermudagrass hay (*Cynodon dactylon*). After the DP, heifers were comingled for a 77-d breeding season. During the DP ADG was influenced ( $P = 0.002$ ) by 28-d period. In addition, ADG of CSBM ( $0.48 \pm 0.109$  kg/hd/d) and PPH ( $0.46 \pm 0.109$  kg/hd/d) treatments tended ( $P = 0.07$ ) to be greater than the CON ( $0.18 \pm 0.109$  kg/hd/d) treatment. There was a treatment  $\times$  period interaction ( $P = 0.06$ ) for mean BW with heifers in the CSBM and PPH treatments having a greater ( $P < 0.05$ ) BW than the CON heifers during the periods from d 84 to 112 and d 112 to 140. Total DMI during the 140 d DP was greater ( $P < 0.01$ ) for PPH ( $5.3 \pm 0.25$  kg/hd/d) than for CSBM ( $4.3 \pm 0.25$  kg/hd/d), which were greater ( $P < 0.01$ ) than CON ( $3.4 \pm 0.25$  kg/hd/d). Treatment did not alter age ( $P = 0.38$ ), BW ( $P = 0.16$ ), or BCS ( $P = 0.27$ ) at attainment of puberty or d on treatment before attainment of puberty. No differences existed in fetal age 30 d following the end of the breeding season ( $P = 0.34$ ), however overall pregnancy rates differed ( $P = 0.05$ ) by treatment with PPH ( $88 \pm 6.7\%$ ) having greater pregnancy rates than CON ( $64 \pm 6.7\%$ ), whereas CSBM ( $78 \pm 6.7\%$ ) were intermediate. We conclude that attainment of puberty was not altered by treatment, although differences in DMI intake existed. However, pregnancy rates of heifers receiving PPH were greater than CON, indicating that PPH may be a suitable alternative for development of replacement beef heifers.

**Key Words:** perennial peanut, replacement heifer, heifer development

**352 Effects of different sources of rumen-degradable protein supplementation on performance of cows and calves grazing limpogross stockpiled pastures in Florida.** A. D. Aguiar<sup>\*1</sup>, J. M. B. Vendramini<sup>1</sup>, J. D. Arthington<sup>1</sup>, and L. E. Sollenberger<sup>2</sup>, <sup>1</sup>Range Cattle Research Education Center, Ona, FL, <sup>2</sup>University of Florida, Gainesville.

Limpogross (*Hemarthria altissima* [Poir.] Stapf & C.E. Hubb.) is a warm-season grass used as a stockpiled forage during the winter for cow-calf production in South Florida, however, the usual decreased CP and RDP concentrations may affect animal performance. The objective of this study was to investigate the effect of supplements with different sources of RDP on performance of cow-calf pairs (*Bos sp.*) grazing stockpiled limpogross pastures. The experiment was conducted in Ona, FL from January to March 2011. Treatments were: 1) Cows receiving 1.3 kg/d of cottonseed meal (CSM) and 2) Cows receiving 0.13, 0.33, and 0.9 kg/d of urea, feather meal and corn meal respectively. Treatments were isonitrogenous (48% CP) with similar concentrations of RDP (62 kg RDP/kg CP). All treatments received additional 2.3 kg/d of sugarcane (*Saccharum officinarum* L.) molasses. Treatments were distributed in randomized complete block design with 4 replicates. Twenty 4 cow-calf pairs ( $420 \pm 59$  and  $78 \pm 12$  kg, respectively) were

randomly distributed in 8 limpogross pastures (experimental units; 1.0 ha/pasture; 3 cow-calf pairs/pasture). Cows BCS and cows and calves weights were recorded every 28 d to calculate ADG. Herbage mass (HM) and nutritive value was measured every 14 d. The data were analyzed using PROC GLMMIX with treatment and months as fixed effects, and replicates as random effects. There was no difference in HM ( $P = 0.13$ ; mean = 5392 kg/ha; SE = 134), CP concentration ( $P = 0.21$ ; mean = 14.9%; SE = 0.7), IVOMD ( $P = 0.38$ ; mean = 46.7%; SE = 1.9) between treatments. There was no effect of the treatments on cow ADG ( $P = 0.34$ ; mean = 0.0 kg/d; SE = 0.1), milk production ( $P = 0.37$ ; mean = 6.5 kg/d; SE = 1.2), and blood urea nitrogen concentrations ( $P = 0.83$ , mean = 12.25 mg/dL; SE = 0.77), and calf ADG ( $P = 0.78$ ; mean = 0.85 kg/d; SE = 0.04). However, there was an effect on final BCS for cows consuming CSM supplement compared with urea (5.2 vs. 4.7,  $P = 0.039$ ), respectively. There was an increase in BCS of cows consuming CSM supplement, however performance of cows and calves were not improved.

**Key Words:** cow-calf pairs, limpogross, protein supplementation

**353 Effects of three levels of rumen-undegradable protein supplementation on performance of early weaned calves receiving stargrass.** J. M. B. Vendramini<sup>\*1</sup>, J. D. Arthington<sup>1</sup>, and L. E. Sollenberger<sup>2</sup>, <sup>1</sup>University of Florida/IFAS Range Cattle Research and Education Center, Ona, <sup>2</sup>University of Florida, Department of Agronomy, Gainesville.

Warm-season grasses have reduced concentrations of CP fractions A and B and microbial protein alone may be insufficient to meet the metabolizable protein requirements of young growing cattle. The objectives of this study was to evaluate the effects of increasing levels of rumen-undegradable protein supplementation on performance, forage intake, and total DM intake of early weaned calves receiving stargrass (*Cynodon nlemfuensis*). The experiments were conducted in Ona, FL from May to August 2007 and 2008. The treatments were 3 levels of rumen-undegradable protein supplementation, soybean meal (SBM, 35% RUP 65% RDP), a 50:50 mixture of SBM-Soyplus (modified expeller soybean meal with 60% RUP 40% RDP), or Soyplus, supplemented at 0.15% BW, and distributed in a randomized complete block design. The calves (*Bos sp.*) received additional 0.85% BW of soybean hulls daily. In experiment 1, 4 calves (initial BW =  $217 \pm 30$  kg) were assigned to 8 experimental units (0.51-ha pastures, each divided into 2 paddocks for rotational stocking (14-d grazing and 14-d rest period). Calves were weighed every 28-d and average daily gain calculated. There was no difference ( $P \geq 0.10$ ) in forage CP (11%), IVDOM (64%), herbage mass (2600 kg/ha), and herbage allowance (1.4 kg DM/kg BW) among treatments. Calves average daily gain and liveweight gain per ha did not differ among treatments ( $P \geq 0.10$ ; 0.56 kg/d and 238 kg/ha, respectively). In experiment 2, 3 early weaned steers ( $160 \pm 18$  kg BW) were distributed in a  $3 \times 3$  Latin square, 3 treatments (same treatments described for experiment 1) and 3 periods (10 d adaptation, and 7 d data collection). Ground stargrass hay (11% CP, 51% IVDOM) was offered daily and adjusted to allow 10% refusals. Daily offered forage and refusals were weighed, and subsampled for DM determination. Total feces production was collected. There was no difference ( $P \geq 0.10$ ) in forage DM and total DM intake among treatments (2.0 and 2.9% BW, respectively). However, there was a linear increase in the diet apparent digestibility with increasing levels of Soyplus ( $P = 0.08$ ; from 60 to 64%). Increasing levels of RUP did not improve performance of early-weaned calves grazing stargrass pastures.

**Key Words:** supplementation, RDP, stargrass

**354 Ruminal availability of iron in forages.** Y. L. Huang<sup>\*1,2</sup>, K. E. Lloyd<sup>1</sup>, C. L. Pickworth<sup>1</sup>, and J. W. Spears<sup>1</sup>, <sup>1</sup>North Carolina State University, Raleigh, <sup>2</sup>Southwest University for Nationalities, Chengdu, Sichuan, China.

Iron (Fe) is an essential trace element that is required for several important biological processes. However, excessive Fe can lead to the production of free radicals and expose sensitive tissues to oxidative stress. Many feedstuffs fed to ruminants are frequently high in Fe. Little is known regarding bioavailability of Fe naturally found in feedstuffs. A study was conducted to examine water solubility and ruminal availability of Fe from 4 forages (white clover, KY 31 tall fescue, Max-Q tall fescue, and orchardgrass) at 3 growth stages. Clipped forage samples were collected at 14-d intervals beginning in early April (vegetative stage) and continuing through early May (mid bloom stage). The Fe content of forages ranged from 24.4 to 315.4 mg/kg DM. The percentage of water-soluble Fe in forages varied considerably. Orchardgrass had the highest ( $P < 0.05$ ) Fe water solubility at  $50.9\% \pm 13.3\%$ ; compared with white clover ( $13.6\% \pm 0.4\%$ ), KY 31 tall fescue ( $12.2\% \pm 6.4\%$ ), and Max-Q tall fescue ( $18.2\% \pm 6.7\%$ ) which were similar. Release of Fe from forages in the rumen was measured using the Dacron bag technique. Dacron bags ( $10 \times 20$  cm with 4.0 g sample) were incubated in duplicate for 3, 12, or 24 h in 2 fistulated steers. Despite the greater percentage of water soluble Fe in orchardgrass, percent disappearance of Fe from Dacron bags was less ( $P < 0.05$ ) for orchardgrass compared with the other forages after 3, 12, and 24 h of ruminal fermentation. Iron disappearance after 24 h of incubation was  $83.8 \pm 1.8$ ,  $73.1 \pm 9.5$ ,  $71.6 \pm 5.2$ , and  $45.3 \pm 14.2\%$  for white clover, KY 31 tall fescue, Max-Q tall fescue, and orchardgrass, respectively. Disappearance of Fe was greater ( $P < 0.05$ ) for white clover than the tall fescue varieties after 12 and 24 h. Increasing stage of maturity was associated with reduced ( $P < 0.05$ ) Fe disappearance during ruminal fermentation for the grasses studied, but not for white clover. This study indicates that a large portion of the total Fe in most forages is released in a soluble form in the rumen within 24 h of ruminal digestion.

**Key Words:** iron availability, forage, ruminants

**355 Nutritional profile of native warm season grass grown as a mono- or multi-species pasture.** B. S. Oloyede,\* B. J. Rude, H. T. Boland, and B. S. Baldwin, *Mississippi State University, Starkville.*

The objective of this study was to evaluate the nutritional profile of mono- or multi-species pastures of native warm season grasses (NWSG). Twelve pastures were randomly assigned to one of 4 treatments: 1) Bermudagrass (BG; *Cynodon dactylon*); 2) Indiangrass (IG; *Sorghastrum nutans*); 3) MIX G (Indiangrass, little bluestem (*Schizachyrium scoparium*), big bluestem (*Andropogon gerardii*)) established at 9.0 kg/ha seeding rate; and 4) MIX NG the same as MIX G but established at 4.5 kg/ha seeding rate. The fourth treatment (MIX NG) was not intended to have cattle grazing to facilitate a congruent wildlife research project. One month before grazing was initiated (mid April) P, K, and lime was added per individual pasture recommendation. For IG, MIX G and MIX NG, N was applied at 38 kg/ha while BG was 67 kg/ha. Growing steers ( $n = 225$ , BW =  $237 \pm 1.5$  kg, 2.7 steers/ha) were randomly assigned to one of 9 pastures. Animals were weighed on 2 consecutive days at initiation and termination of the experiment and once every 28 d during the experiment. Grass samples were taken from all pastures every 28 d during 4-mo period and were analyzed for DM, NDF, ADF, OM, EE, and IVDMD. Dry matter was greater ( $P < 0.05$ ) for all NWSG (33.6, 30.7, and 29.5% for MIX G, IG, and MIX NG, respectively) compared

with BG (27.5%). However, OM was similar ( $P > 0.05$ ) for all treatments (between 91.2 and 92.61%). Neutral Detergent Fiber, ADF and hemicellulose were greater ( $P < 0.05$ ) for all NWSG (66.9, 67.8, and 66.6% NDF, 34.6, 35, and 33.5% ADF, 32, 32.8, and 33.1% hemicellulose for IG, MIX G, and MIX NG, respectively) compared with BG (63.6% NDF, 32.9% ADF, and 30.6% hemicellulose). Fat was similar ( $P > 0.05$ ) for all treatments (between 10.8 and 11.1%). Crude protein was less ( $P < 0.05$ ) for NWSG (8.6, 8.2, and 8.6% for IG, MIX G, and MIX NG respectively) compared with BG (10.7%). Crude protein decreased ( $P < 0.05$ ) with increased maturity (12.7% May to 6.6% September) while NDF, ADF, and hemicellulose increased ( $P < 0.05$ ; NDF = 58.3% May to 70.2% Sept.; ADF = 30.4% May to 36.3% Sept.; hemicellulose = 27.8% May to 33.8% Sept.). More forage ( $P < 0.05$ ) was available and consumed by steers on all NWSG pastures compared with BG. It appears that NWSG may offer a viable alternative to BG for grazing cattle during the summer.

**Key Words:** native grass, pasture, beef cattle

**356 Using switchgrass to produce stocker cattle gain and bioenergy feedstock I: Production potential.** J. R. Blanton Jr.,\* J. T. Biermacher, J. Mosali, and B. J. Cook, *The Samuel Roberts Noble Foundation, Ardmore, OK.*

Switchgrass (*Panicum virgatum* L.) has been identified as a potential feedstock for cellulosic bioenergy production. To mitigate the risk of establishing this crop for bio-fuel feedstock production only, producers are looking to incorporate switchgrass into early spring grazing systems. The objective of this study was to determine the effect of stocking density on measures of animal performance and end-of-season residual feedstock yield in an early spring stocker grazing system. Twelve, 0.81-ha paddocks were established in southern Oklahoma in 2007 and evaluated over 3 grazing seasons (2008–2010). Four stocking densities; control (0 steers ha<sup>-1</sup>), low (2.5 steers ha<sup>-1</sup>), med (4.9 steers ha<sup>-1</sup>) and high (7.4 steers ha<sup>-1</sup>) were utilized. Animal weights were collected following 16h shrink at start and end of grazing period. All residual feedstock was harvested following plant senescence. Animal performance and forage yield data were analyzed using random effects mixed ANOVA models. Average daily gain was 1.05, 1.04, and 0.83 kg hd<sup>-1</sup> d<sup>-1</sup> for the high, med and low stocking densities, respectively with no significant effect detected ( $P = 0.12$ ). Stocking density also has no significant effect on total gain with 199, 215 and 167 kg ha<sup>-1</sup> for the high, medium and low stocking densities, respectively ( $P = 0.07$ ). Grazing days were significantly affected by stocking density with the low, med and high densities grazed for 81, 43, and 28d, respectively ( $P < 0.01$ ). Non-grazed controls produced significantly more biomass than any grazed treatments ( $P < 0.01$ ). On average, the control produced 15320 kg ha<sup>-1</sup> of biomass, whereas the low, medium and high stocking densities produced 10539, 8110 and 7771 kg ha<sup>-1</sup> of residual feedstock, respectively. Within stocking density, the low density produced significantly more biomass as compared with medium and high stocking densities ( $P < 0.05$ ). Results from this study indicate that switchgrass has the production potential to be used for stocker cattle gain and the production of bioenergy feedstock; however, further analysis would be important to determine the economic potential of the dual-use crop.

**Key Words:** stocker cattle grazing, switchgrass, bioenergy

**357 Using switchgrass to produce stocker cattle gain and bioenergy feedstock II: Economic potential.** J. T. Biermacher,\* J. Mosali, B. Cook, and J. Blanton Jr., *The Samuel Roberts Noble Foundation Inc., Ardmore, OK.*

Switchgrass (*Panicum virgatum* L.) has been identified as a leading source of biomass feedstock for conversion into bioenergy products in the southern Great Plains. Currently, no large-scale refineries exist in the region; however, in anticipation of the development of a large-scale industry, producers are curious about the economic potential of integrating switchgrass into their present livestock production systems. The objectives of the study were to determine the effects that stocking density treatments have on feedstock yield, ADG and total gain, and to determine the most economical gain/feedstock production system. Data for steer performance and residual feedstock yield were collected from a 3-year (2008–2010) CRD grazing study in south-central Oklahoma. Stocking density treatments [0 (an un-grazed control), 2.5, 4.9, and 7.4 hd ha<sup>-1</sup>] were randomly assigned to a total of 12, 0.81-ha, switchgrass pastures. Enterprise budgeting was used to compute expected values of economic net returns for 5 systems: graze only, no forage (G/NF); no graze, feedstock only (NG/F); lightly grazed plus feedstock (LG/F); moderately grazed plus feedstock (MG/F); and heavily grazed plus feedstock (HG/F). Net return for each system was calculated for feedstock prices ranging from \$0 to \$165 Mg<sup>-1</sup>. The effects of system on yield, gain, and net return were analyzed using random-effects mixed ANOVA models. F-tests were used to determine differences in means between systems and LSD tests were used to rank the profitability of systems. At \$0 Mg<sup>-1</sup>, the most profitable system was the MG/F system, which realized \$45 ha<sup>-1</sup>. At \$55 and \$83 Mg<sup>-1</sup> net return was \$232 and \$524 ha<sup>-1</sup>, respectively, when grazing lightly and by marketing 10.54 Mg ha<sup>-1</sup> of residual feedstock. At prices greater than \$110 Mg<sup>-1</sup>, producers would not graze switchgrass, they would only produce and market feedstock. Early adopters could generate breakeven profitability by grazing switchgrass while waiting on biorefinery development. Moreover, switchgrass will likely not be economically competitive with conventional grazing systems commonly used by producers in the region if the biorefinery's purchase price for feedstock is less than \$110 Mg<sup>-1</sup>.

**Key Words:** bioenergy economics, stocker cattle grazing, switchgrass feedstock

**358 Investigating the nutritive value of *Panicum maximum* leaves for ruminant animals.** A. H. Ekeocha,\* *University of Ibadan, Ibadan, Oyo, Nigeria.*

The *Panicum maximum* leaf (Pml) is a perennial grass readily available to grazing livestock in south western Nigeria. The objective was to determine the proximate composition of Pml. The samples of Pml were collected from the teaching and research farm, university of Ibadan during the onset of the wet season and analyzed for dry matter (DM), crude protein (CP), crude fiber (CF), ether extract (EE), ash and gross energy (GE) using standard procedures. Ten samples of Pml were slashed at 6cm above ground from a grazing paddock and bulked together and a representative sample was collected for proximate analysis. The samples were at vegetative stage and replicated thrice. Average total height of the forage at harvest is 1m. The Pml (g/100gDM) Contained CP 7.95; CF 31.0; EE 4.0, ash 8.90; and GE 3.2 kcal/g. The CP content was 7.95% and this was compared with tropical grass species, which seldom exceed a CP level of 10% and whose protein content is satisfactory for

animal production for only about 4 mo of the year. It is far lower than that of cassava leaf meal (16.67%), and far below the minimum protein requirement (10–12%) for ruminants. The CF level of 31.00% for Pml is low compared with that of tropical grass species which may be as high as 45 – 50% at more matured stages of growth. It is higher than the CF level of *Amaranthus* spp. (17.01%), Siam leaf meal (16.0%), Cassava leaf meal (15.63%), deep litter manure (16.60%) and guava leaf (16.10%). The ether extract content was low (4.00%). This value was lower than the values of 5.61% reported for *Vernonia amygdalina* leaf and far lower than the value of 8.14% reported for Siam weed but higher than the EE reported for *Tithonia diversifolia* (2.81%). The total ash content of 8.90% was low and this was far lower than the ash content reported for *Vernonia amygdalina* leaf (13.86%) and *Tithonia diversifolia* leaf (14.68%) but higher than the value of 8.28% reported for *Acacia albida* used as a browse plant for sheep in the semi-arid region of Nigeria and lower than the value of 11.00% reported for *Leucaena spp* to feed Yankassa sheep and 11.54% reported for Siam weed leaf meal. The Gross Energy (GE) value was 3200kcal/kg. This is comparable with the GE value of Groundnut cake (2600kcal/kg) and *Vernonia amygdalina* leaf (2720kcal/kg) but far higher than the GE of *Tithonia diversifolia* leaf (1900kcal/kg). The Nitrogen Free Extract level of 48.15% for Pml was comparable to that of Siam leaf meal (44.40%) and *Tithonia diversifolia* leaf (44.38%) both used to feed West African Dwarf Sheep but lower than the value of 33.85% reported for *Vernonia amygdalina* leaf. On the whole, gross chemical analysis indicates that Pml contained appreciable level of nutrients that could be utilized in the diets of ruminants.

**Key Words:** nutritive value, *Panicum maximum* leaves, ruminant animals

**359 Evaluating the mineral composition of *Panicum maximum* leaves.** A. H. Ekeocha\* and O. T. Bankole, *University of Ibadan, Ibadan, Oyo, Nigeria.*

The *Panicum maximum* is a perennial grass readily available to grazing livestock in south western Nigeria. The objective was to determine the mineral content of *P. maximum*. Ten samples of *P. maximum* were slashed at 6cm above ground from a grazing paddock and bulked together and a representative sample was collected for mineral analysis. The samples were at vegetative stage and replicated thrice. Average total height of the forage at harvest is 1m. The atomic absorption spectrophotometer was used to determine any of the minerals (except P) using appropriate lamps. The P was determined with vanadomolybdate using spectrophotometer at 425nm. The principal elements present in *P. maximum* are Ca, P, K, Na and Mg while the essential trace elements (macro nutrients) are, Mn, Cu and Zn. The *P. maximum* contained Ca 0.42%, P 0.31%, K 1.03%, Na 0.49%, Mg 0.32%, S 0.24%, Cu 10.00ppm, Zn 50.00ppm and Mn 20.00ppm. Normally, plant materials are not good sources of Ca and P but the levels reported in *P. maximum* would easily satisfy animal needs if they occur in a readily available form. It is often postulated that a mineral supply in excess of dietary requirements is capable of blocking the availability of another. The result of mineral analysis on *P. maximum* leaf showed that the leaf contains high level of micro and macro elements, which is an indication that the leaf can sustain the nutritional and physiological status of the animal.

**Key Words:** mineral composition, *Panicum maximum* leaf