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## FORAGES AND PASTURES II: FORAGES IN BEEF PRODUCTION SYSTEMS

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**1095 (T108) Reducing winter feeding needs in southern arkansas through the use of best management grazing principles.** B. Stewart<sup>\*1</sup>, P. Beck<sup>1</sup>, L. Sullivan<sup>1</sup>, M. Sims<sup>1</sup>, and J. Jennings<sup>2</sup>, <sup>1</sup>University of Arkansas SWREC, Hope, <sup>2</sup>Dep. of Animal Science, University of Arkansas, Little Rock.

Research is being conducted at the University of Arkansas Southwest Research and Extension Center in Hope, AR, to determine the impacts of best management principles (BMPs) on production and winter feed requirements of spring calving cows ( $n = 72$ , BW =  $547 \pm 33.2$  kg) grazing warm-season based pastures ( $n = 9$ , 4.7 ha pastures). The BMPs used include rotational grazing to improve pasture utilization; stockpiled bermudagrass, to extend grazing into the fall and early winter; and complementary cool-season annual grass plantings, to provide high quality forage in the spring. This research compares low management (CG, continuous grazing at a moderate stocking rate of 0.8 ha/cow) and intensive management at moderate (MR, 0.8 ha/cow) and high stocking rates (HR, 0.4 ha/cow). Stockpiling was managed by fertilization of 0.25 ha/cow of bermudagrass in early August with 168 kg ammonium nitrate/ha and deferring grazing until November. Pregnancy rate data were analyzed using the Chi-square test and cow performance data were analyzed by ANOVA using the PROC MIXED of SAS (SAS Inst. Inc., Cary, NC). Stockpiled bermudagrass produced over  $5,800 \pm 500$  kg forage DM/ha which was adequate to hold cows grazing these pastures until late February. During calving, from mid-February to mid-April, cows on MR and HR grazed cool-season annuals and stockpiled bermudagrass or fed hay on alternating days. Cows on CG pastures were fed hay an average of  $74 \pm 7.3$  d compared with  $43 \pm 7.3$  d for HR and 0 for MR ( $P = 0.04$ ). Pregnancy rates at weaning were similar ( $P = 0.99$ ) across treatments averaging 85%. Growth performance of calves was reduced ( $P = 0.04$ ) by both rotational grazing and increased stocking rate, with weaning weights of calves from CG ( $251 \pm 9.1$  kg) being greater than MR ( $222 \pm 9.5$  kg) which was greater than HR ( $212 \pm 7.2$  kg). However, total weaning weight per hectare was 68 and 90% greater ( $P = 0.01$ ) for HR compared with CG and MR, respectively. With rotational stocking there was the opportunity to harvest excess forage as hay in both the moderate (9,418 kg/pasture) and high (2,206 kg/pasture). In this system every year will be different and flexibility of management will be key. Using rotational grazing, stockpiled bermudagrass, and complementary cool-season annual grasses can drastically reduce stored winter feed requirements and simultaneously increase carrying capacity and total net return.

**Key Words:** bermudagrass, cool-season annuals, cow calf, rotational grazing

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**1096 (T109) Bale diameter and feeder design effects on hay waste.** D. Tomczak, N. E. Mertz, and W. J. Sexten<sup>\*</sup>, University of Missouri, Columbia.

Forty-eight mid-gestation spring-calving cows were stratified by BW ( $583 \pm 77.2$  kg), BCS ( $5.4 \pm 0.6$ ), and age ( $5.6 \pm 2.5$  yr) into 6 pens to evaluate influence of bale diameter and feeder design on hay waste. Tall fescue round hay bales (85.5% DM, 8.22% CP, 66% NDF, 152 cm height) were classified as Small ( $128.3 \pm 3.19$  cm), Medium ( $160.7 \pm 6.38$  cm), or Large ( $187.7 \pm 3.52$  cm) diameter, and placed in hay feeders equipped with cradle chain (CONE) or without (RING) in a 3 x 2 factorial design randomly assigned to a 6 x 6 Latin square. We hypothesized hay waste would increase as initial bale diameter increased in RING and not differ in CONE. Bales were placed on the circular end in round bale feeders (230 cm diameter, 170 cm height) with 16 feeding stations and metal sheeting on top (50 cm) and bottom (60 cm). Small, medium, and large bales were replaced every 2, 3, and 5 d, respectively to ensure ad libitum hay access. Waste was collected daily, and residual forage was collected prior to new bale feeding. CONE (15.8%) reduced ( $P < 0.10$ ) waste as a percent of initial bale weight compared to RING (18.3%). Waste was increased ( $P < 0.05$ ) for large (19.4%) compared to small (14.2%), while medium (17.6%) did not differ ( $P > 0.05$ ) from large or small. Bales were not fed for equal number of days, so data were analyzed as an incomplete 6 x 6 Latin square to evaluate feeder effects relative to access time. Waste was not different ( $P > 0.10$ ) due to increased access time to small in CONE however waste was reduced ( $P < 0.05$ ) as access time increased for small in RING. As access time increased to medium and large waste was reduced ( $P < 0.05$ ). In conclusion, CONE tended to decrease waste. Increasing access time due to increased bale diameter increased waste in all cases, except small CONE.

**Key Words:** hay waste, bale size, bale feeder

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**1097 (T110) Forage and shade type effects on stocker heifers' performance.** G. Scaglia<sup>\*</sup>, Louisiana State University AgCenter, Jeanerette.

In the Gulf Coast region, performance of young cattle is restricted by the nutritional value of perennial grasses and weather conditions (temperature and humidity). Natural shade is often limited because of grazing on reclaimed croplands or due to reduced number of trees in pasturelands. The objective of this experiment was to evaluate the performance of yearling heifers continuously stocked on alyceclover (*Alysicarpus vaginalis* L.) or pearl millet (*Pennisetum glaucum*) for 60 d-grazing periods (early-July to September) with artificial or natural shade. In two consecutive years, 36 crossbred heifers (BW =  $323 \pm 15$  kg) were randomly allotted to 12 paddocks (1.3 ha;

750 kg BW/ha) in a factorial arrangement of treatments with 3 replicates each. Portable shades were built with 6.25 cm pipe and welded into a 3 x 3.5 m frame which held a black woven polypropylene cloth providing 80% shade. These shades were available in half the paddocks while trees provide natural shade to the other half of the paddocks. Alyceclover (12 kg/ha) and pearl millet (22 kg/ha) were no-till drilled after two applications of herbicide for weed control. Despite these applications, areas with some crabgrass and johnsongrass were present 30-40 d into the grazing season in all pastures. In July and August, THI (temperature humidity index, an indicator of heat load) was above 76 for the entire day and above 79 from 0600 to 2100. The latter indicates severe heat load which can adversely affect animal performance. Dry matter production of pearl millet (1800 kg DM/ha) was greater ( $P < 0.05$ ) than alyceclover (1050 kg DM/ha). Alyceclover's CP concentration (21%) was greater while NDF (53%), and ADF (41%) concentrations were lower ( $P < 0.05$ ) than pearl millet (11, 63, and 53%, respectively), however, animal gains were not limited by forage mass and nutritional value of either forage. There was no interaction between forage and shade type on ADG ( $P = 0.84$ ). Forage type ( $P = 0.029$ ) affected animal performance. Heifers grazing alyceclover gained more (0.94 kg/d) than those grazing pearl millet (0.80 kg/d). No effect of shade was detected ( $P = 0.19$ ). Heifers with artificial shade gained 0.91 kg/d while those with natural shade gained 0.83 kg/d. As determined by our laboratory before and despite adverse environmental conditions, heifers grazing pearl millet or alyceclover performed better than those grazing bermudagrass (0.60 kg/d). Artificial shades like these are a viable alternative to improve animal welfare when natural shade is not available.

**Key Words:** alyceclover, pearl millet, shade

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**1098 (T111) Monensin supplementation levels effects on rumen fluid and blood parameters of steers receiving warm-season grass.** J. M. B. Vendramini<sup>\*1</sup>, R. F. Cooke<sup>2</sup>, A. D. Aguiar<sup>1</sup>, O. F. R. Cunha<sup>1</sup>, A. C. J. Pereira<sup>3</sup>, P. D. S. Ferreira<sup>1</sup>, and C. B. Zactiti<sup>1</sup>, <sup>1</sup>UF/IFAS Range Cattle Research and Education Center, Ona, FL, <sup>2</sup>Oregon State University - EOARC Burns, Burns, <sup>3</sup>Elanco Animal Health, Greenfield, IN.

Variable effects of monensin on performance of beef cattle grazing warm-season grasses have been reported in the literature. Lack of response is generally associated with low levels of monensin; thus increasing monensin levels on the animal diet may be an effective management approach to improve its efficiency and positive effects on beef cattle performance. The objective of this study was to evaluate the effects of levels of monensin on rumen fluid and blood parameters of beef steers (*Bos* sp.) receiving warm-season grass. The experiment was conducted in Ona, FL from July to September 2013. Treatments were three levels of monensin, 10, 20, and 30 ppm and control (no monensin) tested in a 4 × 4 latin square with 10

d adaptation period and 5 d of rumen fluid collection and total DM intake evaluation. Blood samples were collected on d 4 and 5 of the collection period. Ground stargrass (*Cynodon nlemfuensis*) hay (9% CP, 51% IVDOM) was offered daily and adjusted to allow 10% refusals. The steers received 0.4 kg of a concentrate supplement (14% CP and 78% TDN) daily. Total DM intake was similar among treatments ( $P = 0.64$ , mean = 2.0% BW). There was a linear increase ( $P < 0.01$ ) in propionic acid concentration in the rumen (from 16.9 to 19.4 mol/100 mol) with increasing levels of monensin; however, there was no effect of monensin levels on pH ( $P = 0.19$ , mean = 6.6), acetic acid ( $P = 0.14$ , mean = 72.3 mol/100 mol), isobutyric acid ( $P = 0.47$ , mean = 0.73 mol/100 mol), butyric acid ( $P = 0.83$ , mean = 8.3 mol/100 mol) and NH<sub>4</sub>-N ( $P = 0.53$ , mean = 6.8 mg/dL). In addition, there was no effect of monensin levels on blood glucose ( $P = 0.75$ , mean = 62.0 mg/dL), insulin ( $P = 0.82$ , mean = 3.5 uIU/mL), IGF-1 ( $P = 0.73$ , mean = 12.4 ng/mL), and blood urea nitrogen ( $P = 0.83$ , mean = 26.4 mg/dL). Increasing levels of monensin alone may not be effective to increase performance of beef cattle receiving warm-season grasses with limited nutritive value.

**Key Words:** ionophore, monensin, warm-season grasses

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**1099 (T112) Polymers molecularly imprinted with ergotamine: Recognition properties to template and related alkaloids.** M. B. Kudupoje<sup>\*1</sup>, E. S. Vanzant<sup>2</sup>, A. Yiannikouris<sup>3</sup>, K. A. Dawson<sup>3</sup>, and K. R. McLeod<sup>2</sup>, <sup>1</sup>Alltech-University of Kentucky Nutrition Research Alliance, Lexington, <sup>2</sup>University of Kentucky, Lexington, <sup>3</sup>Center for Animal Nutrigenomics and Applied Animal Nutrition, Alltech, Nicholasville, KY.

Alkaloid toxicities negatively impact livestock health and production. Adsorbent technologies may offer effective means to manage alkaloid toxicities. In this study, molecularly imprinted polymers (MIP) were synthesized and evaluated for specificity of adsorption to various ergot alkaloids. Six different noncovalent copolymers were synthesized from styrene and methyl methacrylate functional monomers with a free radical initiator (2,2'-azobis isobutyronitrile) and three different molar ratios (1x, 2x, 4x) of crosslinker (ethylene glycol dimethacrylate) in toluene. Synthesis was performed in the absence (non-imprinted polymer, NIP) or presence of ergotamine template (MIP), yielding products NIP1x, NIP2x, NIP4x, MIP1x, MIP2x and MIP4x. An isothermal adsorption experiment was conducted in triplicates, with product inclusion of 0.01% w/v, using 5 concentrations (range 65 to 1550 ng/mL) of each of three alkaloids (ergotamine, bromocriptine and methylergonovine) in ammonium citrate buffer (PH 6.7, 37°C, 90 min). Samples were centrifuged (10,000 g for 10 min) and supernatant was analyzed by UPLC-ESI- MS/MS for quantification of unbound alkaloid. Within each alkaloid, adsorption difference between MIP and NIP interacted

( $P < 0.05$ ) with alkaloid concentration and crosslinker ratio. For most comparisons at 1x crosslinker ratio, adsorption was greater ( $P < 0.10$ ) for NIP than MIP. In contrast, for the few differences ( $P < 0.10$ ) detected for 2x and 4x crosslinker ratios, MIP exceeded NIP adsorption. For both MIP and NIP, adsorption was generally greater for 2x and 4x, as compared with the 1x crosslinker ratio. Differences in adsorption between alkaloids varied with alkaloid concentration and product (alkaloid x concentration x product;  $P < 0.05$ ). In most cases, adsorption was seen in the order ergotamine > bromocriptine > methylergonovine. Products with 4x crosslinker ratios gave the greatest adsorption, and therefore those means are used for comparison of products and alkaloids. Averaged across the different alkaloid concentrations, the respective adsorption for MIP and NIP was 91% and 86% for ergotamine, 75% and 69% for bromocriptine, and 26% and 15% for methylergonovine. Differences in adsorption properties among the six products could be explained by differences in functional groups and conformation, which are altered by template or cross linkers. Cross reactivity with related alkaloids exists due to similarities in structure and functional groups. Future in vitro and in vivo studies are required to determine stability of the polymer-alkaloid complexes, and applicability of polymers as adsorbents in livestock to counteract alkaloid toxicoses.

**Key Words:** adsorbent, MIP, alkaloid

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#### 1100 (T113) Silage and hay of *Stylosanthes Campo Grande* associated or not to corn silage:

##### Nutrient intake and performance of beef cattle.

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The conservation of *stylosanthes Campo Grande* as silage or hay is an alternative to the use of corn as it increases the crude protein level of the diet and improves the soil fertility by nitrogen fixation. The nutrient intake and animal performance of Nellore cattle fed diets containing different roughage sources were evaluated. Experimental treatments were: T1 – corn silage (CS); T2 – silage of *stylosanthes Campo Grande* (StS); hay of *stylosanthes Campo Grande* (StH); T4 – 50% of CS + 50% of StS; T5 – 50% of CS + 50% of StH. Diets were isonitrogenous (12.5% of CP on DM basis) and consisted of 50:50 roughage:concentrate ratio. A total of 40 non-castrated cattle with initial average body weight of 360 kg were assigned into a completely randomized design with five treatments and eight replicates per treatment. The experiment was divided into four periods with a 15 d of adaptation followed by three

periods of 28 d each totalizing 99 days of experimental period. Means was compared by orthogonal contrasts and the initial body weight was used as a covariate at the statistical analysis of the data. Statistical analysis was performed by using SAS. Animals fed CS had lower ( $P < 0.05$ ) intake of DM, EE, NDFap and NDFi than those fed StS, 50% of CS + 50% of StS, and 50% of CS + 50% of StH. The diet containing CS also decreased ( $P < 0.05$ ) the intake of CP and NFC compared to diets containing StH or StS associated to CS. Despite of the lower DM intake, cattle fed diets containing CS had greater TDN intake ( $P < 0.05$ ) compared to those fed StS. The average daily gain was greater ( $P < 0.05$ ) in cattle fed CS compared to those fed diets with StS or StH as the only roughage source. However, no difference was observed for animal body weight gain ( $P > 0.05$ ) among diets with CS and StS or StH. These data suggests that the mixture of corn silage with silage or hay of *stylosanthes* seems to be a great alternative to the use of corn silage for diets of beef cattle at the finishing phase. Sponsored by FAPEMIG, CNPq and INCT-CA.

**Key Words:** average daily gain, feed conversion, legume silage

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#### 1101 (T114) Evaluation of nutrient intake, in situ disappearance, and fermentation characteristics of fermented Chaffhaye with alfalfa hay and prairie grass hay in steers. K. K. Guatam\*, B. S. Obeidat, S. J. Trojan, and M. A. Ballou, Texas Tech University, Dep. of Animal and Food Sciences, Lubbock.

The aim of this study was to investigate the nutritive value, fermentation characteristics, and in situ disappearance of Chaffhaye and compare it to an isonitrogenous alfalfa and grass hay diets. Each of the three Holstein (mean  $\pm$  SD, 533  $\pm$  38.2 kg) and 3 Jersey (622  $\pm$  60.5 kg) rumen fistulated steers were arranged randomly in a replicated 3 x 3 latin square design with a 2-wk adaptation period followed by a 1-wk collection period. Isonitrogenous diets consisted of Chaffhaye (fermented alfalfa hay and molasses, Chaffhaye, Inc, Dell City, TX), alfalfa hay diet (92.6% alfalfa hay plus 6.4% cottonseed meal) and prairie grass hay diet (72.9% prairie hay plus 27.1% cottonseed meal). There was no difference ( $P > 0.181$ ) in ad libitum DMI or the intake of CP. There was a tendency ( $P = 0.104$ ) for steers on the grass hay diet to consume more NDF. In situ NDF disappearance at the 12 and 24 hour incubations were greater ( $P \leq 0.0001$ ) for both the Chaffhaye and alfalfa hay diets compared to the grass hay diet, but at the 96-hr incubation the NDF disappearance for the Chaffhaye was greater ( $P = 0.024$ ) than the alfalfa hay. The CP disappearance of the Chaffhaye was greater ( $P \leq 0.043$ ) than the alfalfa hay diet, which was greater ( $P \leq 0.003$ ) than the grass hay diet at the 0, 6, and 24 hour incubations. Furthermore, at the 48 hour incubation the CP disappearance of the Chaffhaye and alfalfa hay was greater ( $P \leq 0.001$ ) than the grass hay diet. Methane production was reduced ( $P \leq 0.024$ ) in the grass hay when com-

pared to the Chaffhaye and alfalfa hay diets. The rumen pH of Chaffhaye fed steers was slightly greater ( $6.73 \pm 0.062$ ;  $P \leq 0.040$ ) than either the alfalfa hay (6.56) or grass hay (6.47) diet. These data indicate that Chaffhaye has an improved NDF digestibility compared to a prairie grass hay diet and that the soluble CP fraction is greater when compared to an isonitrogenous alfalfa hay or prairie grass hay diet.

**Key Words:** digestibility, forage, neutral detergent fiber

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#### 1102 (T115) Ruminal fermentation characteristics of beef steers grazing grass monocultures versus low- and high-tannin grass-legume mixtures.

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Ruminal fermentation characteristics were investigated with 36 Angus crossbred steers grazing 4 treatments: 1) tall fescue (TF) with no fertilizer (TF-NF), 2) TF with N fertilizer (TF+NF), 3) TF-alfalfa mixture (TFALF), and 4) TF-birdsfoot trefoil mixture (TFBFT). Treatments were tested in a randomized complete block design with 3 pasture replicates, 4 paddocks per pasture, and 3 steers per pasture. Replicated 0.47-ha paddocks were grazed with beef steers from May through September in 2013 for total of 16 wk. Steers grazed for 7 d per paddock on a 28-d rotation interval. Pasture forage samples were collected at 4-wk intervals throughout the experiment. Ruminal fluid samples were obtained from all steers using a Geishauser probe at wk 4, 8, 12, and 16 to measure pH and analyze VFA profiles and ammonia-N ( $\text{NH}_3\text{-N}$ ) concentration. Concentration of CP in pasture forages was greater ( $P < 0.01$ ) in mixtures than grass monocultures at wk 4 (12.8 vs. 7.89%), but it was similar after wk 4. In contrast, NDF concentration was lower ( $P < 0.05$ ) in mixtures compared with grass monocultures throughout the grazing season. Ruminal pH was maintained at 6.54 or higher and did not differ across treatments. Starting at wk 8, total VFA concentration increased ( $P < 0.05$ ) in steers grazing the mixtures compared to those grazing monocultures. However, the VFA concentration was not different between TFALF and TFBFT. Acetate proportion increased with mixtures at wk 12, but propionate proportion decreased due to grazing mixtures, resulting in increased acetate-to-propionate ratio at wk 12 ( $P < 0.05$ ). Concentration of  $\text{NH}_3\text{-N}$  was highest with TF+NF at wk 8 and 12, whereas at wk 16, it was highest in steers grazing mixtures followed by TF+NF ( $P < 0.05$ ). Steers grazing grass-legume mixtures resulted in enhanced ruminal fermentation evidenced by increased VFA concentration likely due to greater concentration of nonfiber carbohydrates, which may have supported increased growth performance compared to those grazing grass monocultures. Therefore, grass-legume mixtures for grazing steers can replace N fertilization of TF,

and thus it can be a sustainable approach to improve pasture utilization for finishing beef steers.

**Key Words:** grass-legume mixtures, grazing beef steers, ruminal fermentation

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#### 1103 (T116) Agronomic assessment and beef cattle nutrition suitability of 31 forage type annual crops in the Peace region of Alberta.

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There is increasing use of forage type annual crops for swath grazing, bale grazing and silage for back grounding and finishing beef cattle in the Peace region of Alberta. There is therefore a need for continued effort for recent data (on agronomic adaptation, forage yield and quality, and animal performance) as new forage type annual crop varieties become available for possible inclusion into the forage based cropping systems of the region. A set of 31 annual crop varieties (16 barley, 3 oat, 5 triticale, 3 soybean, 2 field peas, 1 millet and 1 sorghum) were tested in order to identify crop varieties with superior forage yield and quality for beef cattle production. Forage dry matter (DM) yield varied ( $P < 0.05$ ) from 4162 kg ha<sup>-1</sup> (forage sorghum) to 10769 kg ha<sup>-1</sup> (AC Ranger barley). Only 6 of the 31 tested crops had  $> 10.0$  t ha<sup>-1</sup>. Forage crude protein (CP) was unaffected ( $P > 0.05$ ) and was generally  $> 10.0\%$  for all crops. The 5 legumes included in the test all had significantly ( $P < 0.05$ ) higher forage Ca content than cereal crops. Forage total digestible nutrients (TDN) generally varied ( $P > 0.05$ ) from 60 to 67%. Crops which produced lower DM also had lower CP DM yield (DM x CP%). All crop varieties exceeded the suggested CP, Mg, K and TDN values for a dry gestating beef cow in the mid- and late-pregnancy stages. But the recommended Ca, P and Na values have not been consistently met by all crop varieties. Conducting cluster analysis procedures on the 31 crop varieties tested, using DM yield, forage chemical composition (7 parameters), energy (4 parameters), estimated digestibility (4 parameters), CP DM yield and Ca:P, hierarchical cluster analysis classified the crops into four distinct clusters of 8, 16, 6, and 1 crop varieties with, respectively, excellent, good, regular and poor degree of agronomic adaptation in the region and suitability for beef cattle.

**Key Words:** annual crop; forage; nutritive value; beef cattle; cluster analysis