2021

# Proceedings of the 74th Southern Pasture and Forage Crop Improvement Conference

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# *Poster Session Abstracts*

## *The Effects of Grazing Cover Crops on Animal Performance, Soil Characteristics, and Subsequent Crop Production in East Central Mississippi*

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Integrated crop-livestock systems have been widely used throughout history, allowing for multiple agricultural practices on a single tract of land. With a growing awareness in recent years regarding soil health and agricultural sustainability, these systems have begun to be re-introduced into the southeastern U.S. Research for this project began in the fall of 2019 and will be continued over a 2-year period at the Coastal Plain Branch Experiment Station (CPBES) in Newton, MS evaluating the impact of cover crops on animal performance, soybean (*Glycine max*) yield, soil physical properties, and overall economic productivity. The following three cover crop treatments were planted in nine, two-acre paddocks in a randomized complete block design, on October 9th and 10th, 2019: (O) oats (*Avena sativa*), (OC) oats + crimson clover (*Trifolium incarnatum*), and (OCR) oats + crimson clover + daikon radish (*Raphanus sativus*). Grazing with commercial angus (*Bos taurus*) steers (± 510 lb) at 1020 lb/a stocking rate began on 1/9/20 and continued until 4/9/20 with steers being weighed after every 28-d. grazing event. Average daily gain was significantly less *(P*=0.0108) in the OCR treatment (2.69 lb/d) when compared to the treatments of O (3.67 lb/d), and OC (3.25 lb/d). Overall gain per acre was significantly greater (*P*=0.1063) in O (619.76 lb/a) than in the OCR treatment (478.04 lb/a). Average values for forage mass samples collected bi-weekly during the grazing events ranged from 2056.56 lb/a (O) to 1774.25 lb/a (OCR) (*P*≤0.05).

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# *Reduced-Lignin Alfalfa Cultivars in Oklahoma*

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Oklahoma's harvested area was 33.8% reduced, twice reduced compared to the national area; the lack of best management practices for reduced-lignin alfalfas contributed to this abrupt alfalfa area reduction. Research development on reduced-lignin alfalfa validating previous advantageous results in non-water limited environments may restimulate alfalfa production in water-limited conditions of western Oklahoma. This study's objective was to compare aboveground dry matter (ADM) yield and quality of a reduced-lignin with three reference alfalfas at three harvest intervals in the drylands of western Oklahoma. Experimental fields were established near Lahoma and Stillwater, OK in September of 2019. A split-plot design was arranged in 3x4 factorial with four replications, where harvest schedules (28, 35, and 42 days) were the main plots and cultivars were the subplots (54HVX41, 54VR10, DKA44-16RR, WL 356 HQ.RR). A sample of 1 $m^2$ was taken from the center of each subplot at its assigned harvest interval. Samples were dried at 55ºC until a constant weight was achieved, then weighed, and dry matter was determined. Samples were ground to pass through a 1-mm sieve. NIRS analysis was used to estimate forage quality factors of crude protein (CP), acid detergent lignin (ADL), and in vitro dry matter digestibility 48 hours (IVTDMD48). Although the ADM was not different between 35- and 42-day harvest intervals, the 35-day interval resulted in slightly higher forage quality. Alfalfa harvest at 28-day harvest interval accumulated the least ADM, which may be compensated by its higher forage quality. Additionally, the reduced-lignin cultivar was found to have less ADM, higher CP, IVTDMD48, and lower ADL than reference cultivars. Similar studies have found an 8% decrease in lignin accumulation, creating a 10% greater neutral detergent fiber digestibility. Our results found only a 1% decrease in lignin accumulation, resulting in a 2.5% increase in IVTDMD48. The first-year production of alfalfa stands naturally contains less lignin, explaining our deviated results. Continued research in our experimental fields may elucidate reduced-lignin alfalfa performance in water-limited environments. Thus, predicted animal gain models and economic analysis will be performed to identify the most profitable harvest management and the impacts of exchanging forage yield with forage quality.

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# *Analysis of Biochar Impact on Ruminal Fermentation of Several Different Quality Forages*

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Cattle and dairy production have been cited as major methane emission sources contributing to greenhouse gases. In addition to having an environmental impact, methane produced during ruminal fermentation results in a substantial loss of ingested energy. It has been found that different types of carbohydrate in cattle diets influence ruminal methane production by shifting the dominance of methane-producing microorganisms in the rumen. Previous research has studied the effectiveness of biochar to suppress methane production. Biochar is the product obtained after pyrolysis of biomass at a high temperature, with the temperature of pyrolysis known to affect the characteristics of the resulting biochar. A study was conducted to quantify the impact of biochar temperatures on ruminal gas production and digestibility of several different quality forages using a replicated factorial experiment. Low-quality bermudagrass (full heading stage), high-quality bermudagrass (vegetative stage), and alfalfa (pre-bud stage), were incubated after adding biochar produced at 662 or 2700°F. The mean in vitro true digestibility of zero biochar was greater than those of the two biochar treated hays by up to 7%. The hays incubated with the biochar produced at the two different temperatures did not differ among themselves in digestibility. The in vitro gas accumulation pattern interpreted using a repeated measure analysis indicated significance of linear and quadratic functions of the incubation time. The parameters of the gas accumulation curves ($y = \gamma + \alpha \times time + \beta \times time^2$), such as intercept, linear slope, and quadratic slope, were highly significant. The ruminal gas accumulation rates (slope) of forage incubated with lower temperature biochar consistently demonstrated a faster gas accumulation rate than high-temperature biochar. Based on the obtained results, applied biochar may suppress ruminal fermentation of forage, and biochar produced at different temperatures may suppress ruminal gas production in different patterns. Further analysis, including gas composition and various quality hays, will validate the obtained results.

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# *Forage Production Characteristics and Performance of Growing Beef Replacement Heifers Grazing Mixtures of Indiangrass, Big Bluestem, and Little Bluestem*

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Forage NWSG are adapted to the Southern region and offer drought tolerance, good summer growth, and the potential for reduced fertility inputs while still maintaining production potential. Mixtures of big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), and indiangrass (*Sorghastrum nutans*) are complementary in their growth habits and offer good palatability and nutritive value, which may provide a warm-season forage option for beef producers in the summer months. A 3-yr study was conducted at Black Belt Research and Extension Center in Marion Junction, AL to evaluate the effect of nitrogen (N) fertilizer application rate on forage production, canopy persistence characteristics and animal performance of beef heifers grazing a mixture of big bluestem, little bluestem, and indiangrass. Six, five-acre plots were randomly assigned to one of two treatments (0 or 60 lb N/acre applied annually in early April; n = 3 replications per treatment). In each year of the study, paddocks were continuously stocked with four weaned Angus × Simmental beef heifers from late May/early June through mid-to-late August, respectively. Put-and-take cattle were used to manage forage to a target canopy height of 15 inches. Forage mass and canopy heights were collected every two weeks during the trial. Visual ground cover ratings and canopy leaf area index were measured at the beginning and end of the trial in each year. Data were analyzed using the PROC MIXED procedure in SAS 9.4, and differences were declared significant when $P \leq 0.05$. There were no differences in beef heifer body weight, ADG (mean 0.94 lb/d), BCS (mean 5.7) or stocking density (mean 855 lb BW/acre) across forage N application rate treatments. Nitrogen-fertilized NWSG supported more grazing days per year than no N input (77 vs. 73 days, respectively), and greater canopy heights (17 vs. 14 days). However, there were no differences in forage mass or FA (mean 2,969 lb DM/acre and 3.7, respectively). Persistence of NWSG as measured by canopy cover was ~ 61% and did not differ across N-fertilization regimes over the 3-year study, illustrating no detected stand decline among treatments. Leaf area index decreased across the season for both treatments during the grazing season, with a greater decline in canopy cover for N-fertilized NWSG (-0.93 vs. -2.2 units). These data illustrate that NWSG systems may provide a viable grazing system in the summer months under reduced N inputs. End-of-season grazing management is an important consideration to ensure long-term NWSG persistence.

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# *Physiological and Behavioral Responses of Heifers that Graze Wild-type or Novel Endophyte-Infected Tall Fescue*

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Virginia's primary pasture forage, tall fescue (TF), typically contains a wild-type endophytic-fungus (WE) that produces toxic ergot alkaloids. In beef cattle, these toxins reduce blood flow to extremities increasing heat stress and reducing both production and reproductive success. Pasture renovation – replacing toxic TF with novel TF containing a non-toxic endophytic-fungus (NE) – can help overcome this issue. However, producers' adoption has been limited, mainly due to misperceptions about the effects of TF toxicity and costs associated with the renovation. This study aims to demonstrate the physiological and behavioral responses of heifers grazing WE and NE infected TF. Heifers ($n$=24) stratified by weight and coat color were randomly assigned to either WE or NE pastures for a 56-d grazing study. Heifers' ADG, intravaginal temperature, and degree of hair shedding were measured during the grazing period. Blood was collected via coccygeal venipuncture and hair was collected from the left rump via the shave-reshave method for cortisol analysis. Ear, tail switch, and fetlock temperature were collected using an infrared thermal imaging camera. Heifers that grazed NE fescue had greater ($P<0.01$) ADG and lower ($P<0.05$) plasma cortisol on D-28 than heifers on WE fescue. Heifers that grazed NE fescue had lower hair cortisol on D-28 ($P<0.05$), D-56 ($P<0.01$), and D-84 (post-study; $P<0.0001$) than heifers that grazed WE fescue. Heifers that grazed WE fescue had 0.4-0.7 °C hotter ($P\leq0.02$) intravaginal temperatures between 1100h-1600h than heifers grazing NE fescue. Heifers that grazed WE fescue had lower ($P<0.05$) extremity temperatures compared to heifers that grazed NE fescue. From 1200h-1700h each day, heifers on WE pasture spent 1.5 more ($P<0.005$) hours standing and 0.9 fewer ($P<0.05$) hours lying down than heifers on NE pastures. These results suggest that grazing NE pastures improved animal behavior and reduced physiological markers of heat stress resulting in significant improvement in animal performance.

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# *An Economic Evaluation of Feeder Calves Grazing Cool-Season Annual Forages in the Southeastern U.S.*

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The U.S. cattle industry looks to be entering a new high-cost environment. Over the last 8 months, many feedstuffs have increased in price by over fifty percent. As feedstuff costs rise, it costs more for feedlots to put additional weight on cattle. Thus, they are willing to pay more for additional weight added outside of feedyards. This provides an opportunity for many cattle producers to consider utilizing forages as a low-cost alternative to add additional weight to feeder calves prior to being marketed to feedlots. One of the best options available to producers in the southeastern U.S. to accomplish this is grazing feeder calves on cool-season annual forages during the late fall, winter, and spring. To help in the successful integration of this option a Microsoft Excel spreadsheet was developed to provide producers with a management tool to evaluate the agronomic, animal, and economic variables when grazing feeder calves on cool-season annual forges. The spreadsheet allows users to insert their individual projections and commutes the data to provide producers with detailed agronomic, animal, and economic outcomes for their operation. Some of the variables included in the evaluation were projected planting date, number of acres planted, number of grazing days, level of fertility applied, average daily gain, animal gain per acre, death loss, stocking rate, and cost of gain. For the 2020-2021 growing season, the developed spreadsheet was shared with a group of producers to implement into their operation. Producers that utilized the tool and developed a detailed cool-season annual forage plan for their operation projected that they were able to increase their number of grazing days by seven, improved animal performance by 0.10 pounds per head per day, reduced their cost of gain by $0.04 per pound, and were able to make more informed management decisions. The producers that participated in the initial rollout provided feedback that will help to increase future adoption of this management tool.

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# *Silage Corn Production under Living Mulch Systems in Response to Nitrogen Fertilization*

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Living mulch (LM) systems are the simultaneous growth of forage and cash crops. The use of legume as LM decreases the reliance on N fertilization, yet it is likely that legume LM alone will not provide sufficient N to ensure corn growth. The objective of this study is to determine the N fertilization requirement for silage corn grown under white clover (*Trifolium repens*) LM. It was hypothesized that LM will decrease requirements of N fertilization, while still being comparable to conventional systems. The study is being conducted at the Middle Tennessee Research and Education Center (MTREC) in TN during 2020 and 2021 growing seasons. There are six N treatments and three replications, totaling 18 experiment units in randomized complete block design. The N fertilization was applied in split application at establishment and V6 stage: (1) corn monoculture with 0 lbs of N/ $ac^{-1}$, (2) corn monoculture at 120 lbs of N/ $ac^{-1}$, (3) Corn in LM with 0 lbs of N/ $ac^{-1}$, (4) Corn in LM at 40 lbs of N/ $ac^{-1}$, (5) Corn in LM at 80 lbs of N/ $ac^{-1}$, and (6) Corn in LM at 120 lbs of N/ $ac^{-1}$. The LM was collected monthly by using a $0.1m^2$ quadrat to determine LM mass and botanical composition. Data was collected during 2020 growing season and it will be collected in 2021 growing season. Preliminary results show that LM accumulation is greatest in August before corn harvest for all treatments ($P < 0.0001$). No differences of LM accumulation throughout the growing season were observed in treatments 4, 5, and 6 ($P = 0.01$). A negative significant correlation in the botanical composition showed an exponential decrease of white clover mass from May to Aug, and a slight increase from Aug to Sept ($P < 0.0001$) opposite to weed biomass presence in the area. The silage production showed that adding 80 lbs/$ac^{-1}$ of N in LM system is equivalent to 120 lbs/$ac^{-1}$ of N without LM. Producers will be able to adopt LM system as a strategy to decrease N fertilization as well as protecting soil from environmental damages.

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# *Grazing Management Impacts on Forage Mass and Nutritive Value in Mississippi*

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Grazing management directly impacts stocking rate and density, and ultimately forage allowance and utilization efficiency. The implementation of intensive grazing management practices, such as rotational grazing or management intensive grazing, has claimed that longer rest intervals between grazing events results in greater forage mass (FM) and enhanced nutritive values, when compared to traditional continuous grazing systems. This can ultimately lead to greater carrying capacity and more efficient grazing utilization. However, without adjusting stocking rates, there remains concern as to whether increased grazing management impacts FM or nutritive values to levels which justify increased management. This experiment was designed to compare three grazing systems (main plots); continuous (CON), rotational (ROT), and management intensive grazing (MIG), and to assess the impacts each system has on FM and nutritive value (crude protein – CP; total digestible nutrients – TDN) during the 2020 growing season. The experiment was designed as a randomized complete block design with three replications where all paddocks were 2 ac in size. All paddocks were comprised of common bermudagrass (*Cynodon dactylon* L.) and were fertilized according to soil test recommendations, along with 100 lb N $ac^{-1}$ in a split application. Rotational paddocks were divided into 3 sub-paddocks (7 d rotations) and MIG paddocks were divided into 7 sub-paddocks (3 d rotations). All main plots were stocked at 1 hd $ac^{-1}$ (2 hd $paddock^{-1}$; commercial bred angus cows; 1,396 ± 70 lb). Forage samples were collected at the beginning and end of each grazing cycle within each paddock or sub-divided paddock. No significant differences were observed in FM between grazing treatments ($P = 0.9462$). However, FM did decline significantly for all treatments as the season progressed ($P < 0.0001$). In terms of nutritive value, CON had greater mean CP (10.2%) compared to MIG (9.5%) and ROT (8.9%). For TDN, MIG (47.7%) samples were significantly lower than CON (48.8%) and ROT (48.4%) values. These data suggest that enhanced grazing management without adjusting stocking rates does not necessarily result in greater FM or nutritive value. Additional data collection is required to fully comprehend the impacts of grazing management on moderately stocked bermudagrass pastures.

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# *Novel Pest Management Strategies to Control Smutgrass in Southern forage Systems*

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Smutgrass (*Sporobolus indicus*) can quickly outcompete bahiagrass (*Paspalum notatum*) because of its aggressive growth, prolific seed production, and rhizomatous growth. Total renovation of a bahiagrass pasture or hayfield is generally not a feasible or economically viable option for most producers. Therefore, controlling the continual spread of smutgrass will require an integrated pest management plan that incorporates multiple strategies. The objective of this experiment was to evaluate the interactive effects of herbicide and fertilizer applications for controlling smutgrass in low input bahiagrass systems. This research was conducted on mixture of Tifton 9 and Pensacola bahiagrass at the Alapaha Beef Station in Alapaha, GA. Plots were arranged in a three by four factorial design with six replications. Herbicide treatments included Indaziflam (Rezilon, PRE), Hexazinone (Velpar, POST), combination of pre + post-emergent herbicides (PRE + POST), and an unsprayed control. Fertilizer treatments included 50 units N/ac (ammonium nitrate, 34% N) + 50 lbs $K_2O$/ac, 50 units N/ac (N), and an unfertilized control. Preliminary results show that plots receiving PRE and POST emergent herbicides in addition to N and $K_2O$ resulted in an improved bahiagrass stand as timely weed suppression removed competition, while fertilizer provided essential nutrients for optimum growth to fill in the gaps. This work will be repeated in 2021 before final conclusions are made. Overall, this research will provide guidance to producers integrating weed management strategies for controlling smutgrass and bahiagrass. Specifically, it will provide foundational knowledge for utilizing indaziflam for controlling perennial weeds in bahiagrass, and a better understanding of the importance of fertilizer application with hexazinone.

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# *Liquid Urea and a Microbial Catalyst Effects on Biomass and Nutritional Value of cv. Mombasa*

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Little information is available on the use of liquid fertilizer N or a microbial catalysts effect on yield and nutritive value of improved guineagrass (*Megathyrsus maximum* Jacq.) cv. Mombasa in Puerto Rico. The objective of this experiment was to assess the effects of Generate® (a microbial catalyst), LiquiFert® (22-0-0) liquid urea (LU) at a rate of 150 lb/acre (in split applications), a mixture of LU + Generate and a control on aboveground and root biomass, crude protein (CP), neutral detergent fiber (NDF) and acid detergent fiber (ADF) and soil parameters on cv. Mombasa when harvested every 35-d (a total of six harvests). Treatment effects on aboveground biomass and roots were determined by collecting samples in quadrats to determine dry matter yield. A soil core sampler was used to sample plots at 6-inch depth, dried and used to assess organic carbon (OC) and organic matter (OM) at the beginning and end of the study. Dry matter yield of aboveground biomass differed ($P<0.05$) from other treatments. There was a two-fold increase in DMY with LU (2,108 lb/acre) applications compared to other treatments (mean 979 lb/acre). Crude protein was 10.1% and CP index was 4.70 lb per lb N, while NDF was 70 for the control and 74.2 % for LU, and mean of 40 % for ADF, suggesting that Mombasa may requires earlier harvests to improve quality. Overall, there were no significant effects of the treatments on OC and organic matter percentages. In conclusion, use of LU at 168 lb/acre improves DMY.

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# *The Effects of Cover Crops in an Integrated Livestock/Continuous Corn Cropping System in East-Central Mississippi*

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There is a growing interest within the agricultural industry on how cover crop systems affect soil health and economic productivity in integrated crop-livestock systems. This study investigates the combined effects of cover crop, tillage, and grazing in a continuous corn (*Zea mays*) production system in east-central Mississippi. This study consists of a randomized complete block design, with two tillage treatments (conventional and no-till), twelve cover crop treatments, and separate grazed and un-grazed plot areas. Cover crop treatments include mono- and polycultures of oats (*Avena sativa*), cereal rye (*Secale cereale*), crimson clover (*Trifolium incarnatum*), and radish (*Raphanus sativus*), along with a control. In the grazed area, bred heifers are used to graze cover crop treatments in a cafeteria style design. Data collection includes forage mass (FM), nutritive value (crude protein – CP; total digestible nutrients – TDN), and soil analysis (nutrient availability, compaction, bulk density, and moisture). Crude protein ranged between 11.5% to 14.9% across both experimental areas. Total digestible nutrients were significantly greater for the first sampling date compared to the final three sampling dates. The un-grazed area had significantly greater FM compared to the grazed area for all four sampling dates ($P<0.0001$). Mean organic matter was significantly greater for the grazed area (1.11%) compared to the ungrazed area (0.87%) ($P<0.0001$). There were no differences between grazed an un-grazed areas for mean soil compaction across all sampling depths ($P=0.0718$).

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