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Impact of Grazing Summer Annual Grasses on Livestock Performance

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ABSTRACT

Warm-season annual grasses are an important part of summer forage production following cool-season annual grasses, such as annual ryegrass or small grains. It is important to keep in mind that summer annual grasses are just temporary solutions to summer forage needs. A demonstration was conducted at Mississippi State University in the summer of 2009 to determine late-season forage yield of summer annual grasses, forage utilization, and animal performance when forages were planted late in the season. The five forages utilized in the study included ‘Hay King BMR’ sudangrass, ‘Piper’ sudangrass, ‘Cowvittles II’ forage sorghum, ‘Greengrazer V’ sorghum-sundagrass, and ‘FGS 300’ pearl millet. Utilization and animal performance varied depending on the time of year these forages were grazed. ‘Greengrazer V’ had higher yield during the first grazing period, while ‘FGS 300’ had higher yield during the second grazing period. Despite yield differences, Piper and Hay King BMR produced greater animal gains per acre during the first and second grazing periods, respectively.

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INTRODUCTION

There are more than 154,000 acres of warm-season annual forages planted in Mississippi every year for summer grazing and hay production (Lemus 2012). Producers are always looking for summer forages that could be incorporated into the forage system to reduce the amount of fallow land available until the next fall before resuming annual ryegrass establishment. Traditional summer forage production in Mississippi depends on poorly managed perennial pastures, such as common bermudagrass (*Cynodon dactylon*) and bahiagrass (*Paspalum notatum*), that result in reduced performance due to lower pasture quality (Rivera and Lemus 2013).

Adapted warm-season annual forages can generate significant amounts of forage in a short period of time during the summer. Depending on the species, yields can range from 1,500 to 3,500 pounds of dry matter per acre (White et al. 2014). Summer annuals are generally higher in energy than perennial grasses and are capable of increasing rates of gain (McCartor and Rouquette 1975).

Warm-season annual grasses should be utilized as temporary solutions to summer forage needs due to the need of establishment each year. Summer annual grasses can be expensive to establish and difficult to manage, and there is always room for possible animal health problems associated with nitrates and prussic acid. Despite these disadvantages, warm-season annual grasses are capable of rapid vegetative growth, have excellent drought tolerance, and respond well to fertilization (especially nitrogen). The most efficient and economical use of these grasses is in an intensive management situation involving a rotational grazing strategy.

There are several summer annual grasses that livestock producers can utilize in the South when forage supply is limited. These grasses include sudangrass (*Sorghum bicolor*), sorghum-sudangrass hybrids, pearl millet (*Pennisetum americanum*), and forage sorghum (*Sorghum bicolor*). Sudangrass is a rapidly growing warm-season grass that can produce good-quality forage if managed properly. It usually grows between 3 and 8 feet high. True sudangrass usually has fine stems and grows rapidly after grazing. Sudangrass develops only fibrous roots and does not have rhizomes. It usually contains lower levels of prussic acid than sorghum-sudangrass hybrids, but it is also lower yielding (White et al. 2014).

Sorghum-sudangrass hybrids are taller, have larger stems (stalks), and produce greater DM yields than sudangrass (White et al. 2014). Some of the new varieties contain the Brown Midrib (BMR) genetic trait that produces less lignin. This trait has shown a decrease in lignin concentration (40–60%), an increase in forage palatability (15–30%), and, therefore, an increase in digestibility (Cherney et al. 1990). The BMR hybrids have greater yield potential compared with traditional sorghum-sudan hybrids.

Millets have smaller stems and greater leaf biomass than forage sorghum, sudangrass, and sorghum-sudangrass hybrids. Millets include several types, such as browntop, foxtail, and pearl. Pearl millet does not produce prussic acid, but it is not as drought tolerant as some of the other summer annual grasses. Pearl millet is better adapted to sandy, acid soils than most forage sorghums, and it will regrow after harvest if a 5-inch stubble height is left (White et al. 2014).

Forage sorghums are best adapted to fertile, well-drained soils that have good water-holding capacity. It is the most drought tolerant of the warm-season annuals. Forage sorghums have improved leafiness, better seedling vigor, and excellent yield potential. Most of the growth (90%) occurs in June, July, and August (Lemus 2014).

To optimize grazing potential of summer annual forages, high stocking rates along with a rotational grazing system should be implemented. Using high stocking rates combined with managing plant heights (6–8 inches) that can be grazed in short periods (10–15 days) is the most commonly recommended practice (Fritz and Fjell 2008). To maximize forage utilization, the planting dates can be staggered to provide a sequential grazing rotation.

This grazing management strategy could provide 70 to 90 days of grazing and could allow a stocking rate of two to six yearlings steers (approximately 500–600 pounds per steer) per acre. Applicable research in grazing summer annuals is limited. Hancock et al. (2014) indicated that animal daily gains of 1.4 to 2.0 pounds per day can be achieved. It is important to keep in mind that animal performance can vary depending on forage species, variety, livestock size, animal condition, soil type, fertilization, temperature, moisture, grazing management, the number of days in the grazing period, and other environmental factors.

Selecting a type or variety of summer annual should be based on the needs of individual livestock programs. Summer annual grasses have different growth characteristics that influence how they are best used. There are also large differences in yield and quality among species, varieties, and hybrids. The objective of this demonstration was to determine late forage yield, utilization, and animal gains of Hay King BMR when compared to other sudangrass, forage sorghum, and sorghum-sudan grass.

PROTOCOL

A demonstration was conducted in summer 2009 at the Henry H. Leveck Animal Research Farm (33°24’38.65”N, 88°47’42.47”W, elevation 340 feet) at Mississippi State University to evaluate the use of summer annual forages on livestock. The soil type is an Oktibbeha fine sandy loam, thick solum variant, 5–8% slopes, and eroded (Very-fine, smectitic, thermic Chromic Dystruderts).

The demonstration consisted of six paddocks planted in five summer annual forages (Figure 1). Each paddock was 5 acres in size. The five forages used in the study were ‘Hay King BMR’ sudangrass (two paddocks), ‘Piper’ sudangrass, ‘Cowvittles II’ forage sorghum, ‘Greengrazer V’ sorghum-sundagrass, and ‘FGS 300’ pearl millet. All forage species were planted in prepared seedbeds using a Tye seed drill (Shaffer Manufacturing and Sales, Indianola, Nebraska) with 7.5-inch row spacing at a rate of 30 pounds per acre, with the exception of forage sorghum, which was planted at a rate of 10 pounds per acre. Selected seeding rates were based on recommended rates for the South (Ball et al. 2008). Summer annual forages were sowed at a 1-inch planting depth.

Figure 1. Layout of warm-season forage grazing demonstration in 2009 at Starkville, Mississippi. Retrieved from https://maps.google.com/maps?ll=33.41027,-88.79537&z=16&t=h&output=classic&dg=brw (Google Earth Pro 7.1., 2013).

The demonstration was planted using a staggered planting management to allow for better utilization of the forage across the summer (Figure 1). The first planting date was June 9, in which Hay King BMR, Piper, and Greengrazer V were established and grazed from July 27 to August 10, 2009. The second planting occurred on June 24, in which Cowvittles II, FSG300, and Hay King BMR were established and grazed from August 11 to August 25, 2009.

Phosphorus was applied at 35 pounds of P per acre, and potassium was applied at 40 pounds of K per acre at planning based on soil test recommendations. All paddocks were fertilized with 200 pounds of 15-5-10 at planting as a starter fertilizer. Ammonium nitrate (34-0-0) was applied at a rate of 60 pounds of N per acre after plants had reached 5 inches tall.

Due to drought conditions during the summer of 2009, there was not sufficient forage regrowth to support further grazing for each of the planting dates. No irrigation was implemented because it is not a common management practice for beef cattle production in the South. Only one grazing cycle was achieved in each paddock for each planting date.

Ten random forage samples were collected in each paddock before and after each grazing period to estimate forage availability and harvest efficiency using a 3-square-foot PVC quadrant where biomass was harvested at 6-inch stubble height. Harvest efficiency is the percentage of forage actually ingested by the animals from the total amount of forage produced. It was calculated from the total forage harvested at 6-inch stubble height at the beginning and the end of the grazing cycle, [(Initial total forage production – Final total forage production)/Initial total forage production)*100].

Samples were separated between leaf and shoot, weighed, and oven-dried at 160 °F for 2 days to estimate dry matter yield. A subset of 20 random tillers were collected from each paddock, dried, ground to pass a 1-mm screen, and used for forage quality analysis. Samples were analyzed for nutritive value (CP = crude protein; ADF = acid detergent fiber; NDF = neutral detergent fiber; TDN = total digestible nutrients) using a Foss NIR-6500 (Foss North America, Eden Prairie, Minnesota) using the hay equation of the NIRS Forage and Feed Testing Consortium (Hillsboro, Wisconsin).

A set of 36 crossbred steers (average body weight = 800 pounds) was used per grazing period. All 36 animals used per grazing period were weighed, stratified, and sorted into three groups of similar body weight before being assigned to a paddock to achieve an approximate stocking rate of 1,900 pounds per acre per paddock. All animals were grazing bermudagrass before this study. Animals had access to water and free-choice minerals as needed.

Each grazing period started when plants were 24–30 inches and removed when plants were grazed to 6 inches. Animals were weighed at the end of the grazing cycle to calculate average grain weight. Average daily gain (ADG) was calculated as total pounds gained divided by the head-days (number of animals x days grazing) of grazing. No statistical analysis was performed because it was not a replicated trial.

RESULTS

Due to drought conditions during summer 2009, there was not sufficient forage regrowth to support further grazing for each of the planting dates. No irrigation was implemented because it does not represent a common management practice for beef cattle production in the South. Only one grazing cycle was achieved in each paddock for each planting date.

The ideal time for establishment of these warm-season grasses is between May 15 and June 15. In May, precipitation was 6 inches above the normal, which delayed planting towards the end of the planting season. Also, due to the heavy clay soil type at the site, excessive moisture further delayed planting by preventing equipment from entering paddocks (Figure 2). Temperatures in July and August were also below normal. The delay in planting, along with forage trampling and cooler temperatures, could have negatively impacted forage regrowth, restricting forage production to one grazing cycle.

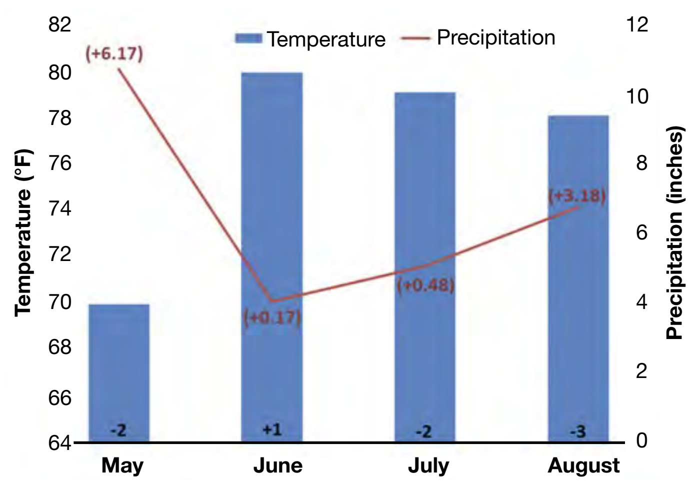

Figure 2. Temperature and precipitation in 2009 in Starkville, Mississippi, during the duration of the grazing demonstration. Bold numbers inside bars represent temperature deviation from the 30-year normal. Numbers in parenthesis represent precipitation departure from the 30-year normal (Anonymous, MSU Climatology Laboratory, 2009).

Table 1. Forage production and estimated parameters of animal performance for five summer annual forages in Starkville, Mississippi.[1]					
Forage species	**Forage yield**	**Leaf**	**Harvest efficiency**	**ADG**	**Gain**
	lb/A	*%*	*%*	*lb/d*	*lb/A*
July 27–August 10 Grazing Cycle					
Greengrazer V	1,141 (+13%)	67 (+31%)	78 (+8%)	1.86 (+5%)	67.0 (+5)
Hay King BMR	1,007	51	72	1.77	63.8
Piper	894 (-11%)	56 (+10%)	84 (+17%)	2.04 (+15%)	73.6 (+15%)
August 11–August 25 Grazing Cycle					
Cowvittles II	828 (+4%)	59 (-11%)	72 (-1%)	2.14 (-24%)	70.0 (-31%)
FGS 300	1,007 (+27%)	54 (-18%)	58 (-21%)	1.94 (-31%)	77.2 (-24%)
Hay King BMR	794	66	73	2.82	101.4

[1]ADG = Average Daily Gain. Note: Numbers in parenthesis represent increase or decrease in percent compared with Hay King BMR within each grazing cycle.

During the first grazing period (July 27 to August 10), pregrazing forage yields were 13% and 28% higher with ‘Greengrazer V’ forage sorghum when compared with ‘Piper’ sudangrass and ‘Hay King BMR’ sorghum-sudangrass, respectively (Table 1). Greengrazer V had less forage growth but was leafier with a larger number of tillers compared with the other two varieties.

On the other hand, Piper had a 7% and 14% greater harvest efficiency when compared with Hay King BMR and Greengrazer V, respectively. Despite Piper’s lower leaf percentage and biomass production, gain per acre was higher. Piper had less trampling in the paddock than the other two forages. It also had much smaller stalk diameter than the other two varieties, which can positively impact intake and forage digestibility.

Lamb et al. (2002) indicated that longer retention times were associated with forage fractions that were more resistant to microbial and mechanical breakdown. They indicated that stems of sudangrass are resistant to particle size reduction.

During the second grazing period (August 11 to August 25), pregrazing forage yields were 27% and 21% higher for ‘FGS 300’ pearl millet when compared with Hay King BMR sudangrass and ‘Cowvittles II’ forage sorghum, respectively (Table 1). Similar harvest efficiency was observed between Hay King BMR and Cowvittles II. Hay King BMR showed a tendency to greater ADG compared with the other two forages. These advantages were not observed during the first grazing cycle.

Forage quality samples collected before grazing began and at the end of the grazing cycle are presented in Table 2. There was a decline in nutritive value in both grazing periods by the end of the grazing cycle. During the first grazing cycle (July 27 to August 10), Hay King BMR and Piper had greater CP and lower ADF and NDF than Greengrazer V. During the second grazing cycle (August 11 to August 25), Hay King BMR had higher nutritive value compared with Cowvittles II ad FGS 300. Forage quality remained above the nutrient requirements for stocker beef cattle in both grazing periods.

Table 2. Forage quality parameters for warm-season grasses at the initial and final phase of each grazing period.[1]

Forage species	**Initial DM**				**Final DM**			
	CP	**ADF**	**NDF**	**TDN**	**CP**	**ADF**	**NDF**	**TDN**
	%	%	%	%	%	%	%	%
July 27–August 10 Grazing Cycle								
Hay King BMR	17.59	34.91	63.09	63.06	12.90	34.88	65.78	61.94
GreenGrazer V	16.68	38.37	66.00	59.75	11.07	34.33	65.34	61.72
Piper	17.89	37.78	63.68	60.45	14.40	31.63	62.41	64.80
August 11–August 25 Grazing Cycle								
Cowvittles II	16.14	37.33	66.10	60.78	14.00	33.23	63.80	63.03
Hay King BMR	17.08	36.00	62.58	62.06	13.07	34.24	66.01	62.16
FGS 300	13.12	37.52	67.18	60.82	12.65	32.22	62.71	63.68

[1]CP = Crude Protein; ADF = Acid Detergent Fiber; NDF = Neutral Detergent Fiber; TDN = Total Digestible Nutrients.

SUMMARY AND CONCLUSIONS

The data collected does not permit for direct comparison from animal gains from the summer annuals since the data was derived from two different grazing periods with different forage species. Although forage subsamples were taken to account for the degree of utilization, the gain per acre does account for the degree of selective grazing and trampling that could have occurred. Muldon (1985) indicated that a decrease in leaf percentage will affect the ability to sustain live weight gain. This means that DM yield associated with more mature forages might be less likely to promote optimum live weight gains. Selecting a type or variety of summer annual should be based on the needs of individual livestock program, along with seasonal distribution that could optimize utilization.

The use of these warm-season annual grasses could have an impact on maintaining stocker cattle or increasing weaning weights of yearling calves. The use of these forages can be part of a pinpoint grazing system to transition acres planted in annual ryegrass to summer grazing instead of allowing them to remain fallow. It is important to keep in mind that utilizing these annual forages requires a high level of management to have a return on investment. The use of summer annuals depends on the livestock operation, weather conditions, and the needs, abilities, and preferences of the livestock producers. A replicated grazing study that will measure the summerlong grazing potential of these warm-season annual forages, along with forage quality, animal performance, and economic impact, will be needed to make further recommendations.

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