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APPLICATION OF OVERSEEDED TROPICAL LEGUMES FOR ENHANCED UTILIZATION OF SUMMER GRASS PASTURE IN THE DEEP SOUTH REGION OF THE USA

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ABSTRACT

While bermudagrass [*Cynodon dactylon* (L.) Pers.] and bahiagrass (*Paspalum notatum* Flugge) pastures are usually productive, their nutritive value is not always adequate to support actively growing beef cattle. There have been efforts to enhance the nutrient value of these grass pastures by application of high rates of nitrogen fertilizer. Due to fluctuating nitrogen fertilizer prices and several environmental issues, this approach may no longer be considered to be sustainable for beef cattle production in this region. Since legume crops have the ability to fix atmospheric nitrogen and produce highly nutritious forage, the incorporation of warm-season annual legumes into perennial warm-season grass pastures might be justifiable. A field demonstration was conducted on a commercial beef cattle operation with a bahiagrass pasture overseeded with the tropical legumes, cowpea (*Vigna unguiculata*) and mung bean *(Vigna radiata*). Grazing was initiated when the overseeded legume crops reached the late vegetative stage and lasted for 42 days. Overseeded legume crops enhanced biomass production of the bahiagrass pasture and the nutrient value of the forage. For maximum utilization of the warm-season legume crops, it may be necessary to investigate more intensive grazing management strategies.

INTRODUCTION

Summer perennial grass-based pastures have traditionally been the major forage resource for most beef cattle operations in the Deep South region of the USA. Beef cattle production in this region involves mostly cow-calf operations that rely on these pastures to provide productive and nutritious forage. However, data accumulated from many years of laboratory forage quality analysis have revealed that warm-season grass species such as bermudagrass [*Cynodon dactylon* (L.) Pers.], bahiagrass (*Paspalum notatum* Flugge), and other mixed warm-season grasses usually do not contain adequate levels to meet the protein and energy requirements of actively-growing young beef cattle (Han, et al., 2007; Han and Twidwell, 2014).

As indicated in Han and Twidwell (2014), contents of total digestible nutrients (TDN) in warm-season grass hays frequently fall to the levels below the energy requirements of full grown non-pregnant beef heifers. One option available to beef cattle producers to enhance the forage quality of these warm-season grass species is to apply high rates of nitrogen fertilizer. There are reports addressing positive relationships between nitrogen fertilizer and forage nutrient values in warm-season perennial grass species (Johnson et al., 2001). Fluctuating commercial nitrogen fertilizer prices and soil nutrient leaching due to excessive nitrogen fertilizer applications have become issues that may limit the practical use of this strategy for sustainable beef cattle production.

Tropical annual legumes such as cowpea (*Vigna unguiculata*) and mung bean *(Vigna radiata*) can fix atmospheric nitrogen into plant tissue, and therefore, these legumes can serve as alternative forage options during the summer grazing period without additional nitrogen fertilizer input. Mung bean and cowpea have been cultivated as annual legume crops serving high quality protein for human consumption in Asia, Africa, and South America. Utilization of these legumes in the USA is more likely to be used as cover crops for row crop production or for use in grazing by livestock. However, research information is limited with forage utilization aspects, especially the overseeding of these legume crops into perennial warm-season grass pastures. Since legume forages can grow without nitrogen fertilization and are able to provide high levels of crude protein (CP) forage for livestock, growing tropical legumes in relatively low quality summer-grass pastures may be of great benefit to cow-calf producers in the Deep South region. Mung bean and cowpea can produce biomass ranging from 1.2 ton/acre in the southern Great Plains (Rao and Northup, 2009) to near 4.1 ton/acre in the northern Great Plains (Boe et al., 1991). Rao et al (2009) reported the potential of mung bean and cowpea as alternative legume forages because of their high CP concentration and high digestibility which meets the nutrient requirements of actively growing yearling beef cattle.

A field demonstration was conducted on a commercial beef cattle operation located near Folsom, LA with a bahiagrass pasture overseeded with the legumes cowpea and mung bean.

METHODS

This demonstration was conducted on a commercial beef cattle operation near Folsom, LA by overseeding a mixture of cowpea (cv. Chinese red) and mung bean (cv. Erkins) into an existing bahiagrass pasture on July 26, 2008. Equivalent amounts of cowpea and mung bean seeds were mixed in a seed box installed on no-till drill planter and the target population of legumes was about 300,000 plants per acre. The overseeded pastures were divided into six, one-acre size paddocks using existing permanent fences and electric fences (Figure 4). A bahiagrass pasture that was not overseeded with either legume species was used as a comparison. Initial grazing began with paddock #1 on September 10, 2008 with eight steers weighing about 700 lbs each (Figure 5). Legume height was about 12 to 14 inches tall at the initiation of grazing. After 7 days of grazing, steers were moved to an adjacent paddock for another 7-day grazing period. A total of 6 paddocks were used in this demonstration. Forage samples were collected from the paddocks using multiple quadrat samples pre-grazing (before) and again post-grazing (after). These samples were used to measure dry matter forage yield, pasture species composition (grass and legume) and forage quality analysis. Using wet chemistry, samples were analyzed for acid detergent fiber (ADF) and CP, and TDN was estimated from the ADF content in the forage. Forage utilization rate for each of the grazing paddocks was calculated using the following equation:

Forage utilization rate = (pre-grazing biomass – post-grazing biomass/pre-grazing biomass) x 100

RESULTS

Forage production from the legume-overseeded bahiagrass pasture was about 4000 lbs /acre at the initiation of grazing, and continued to increase up to 9000 lbs/acre (Figure.1).

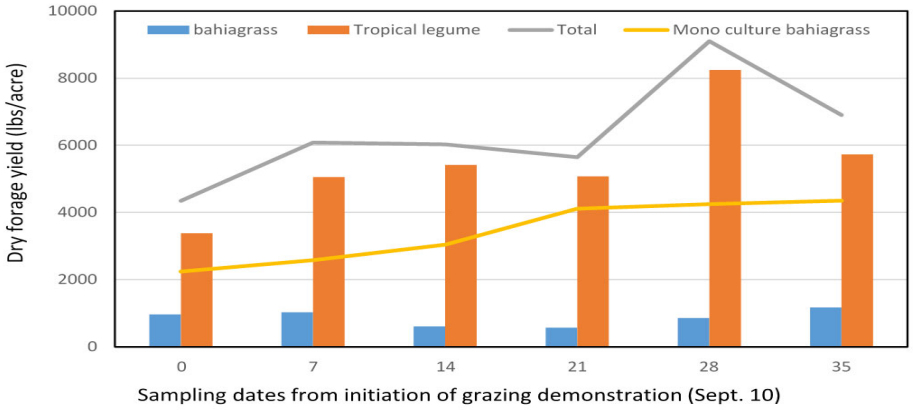

Figure. 1. Dry forage yield (lb/acre) trends of bahiagrass and tropical legumes during the grazing demonstration period (Significance of species × date, P < 0.039).

When compared with monoculture bahiagrass, dry forage yields of the legume-overseeded pastures were up to twice as much throughout the grazing period. The distribution of cowpea and mung bean demonstrated some variation in the divided paddocks and those legumes obviously shaded the bahiagrass. Legume biomass was up to 960% higher than dry bahiagrass forage on several sampling dates, indicating suppression of bahiagrass growth by dominant legume growth.

Pasture utilization rate ranged from 39 to 73% depending on development of legume growth stage (Figure. 2).

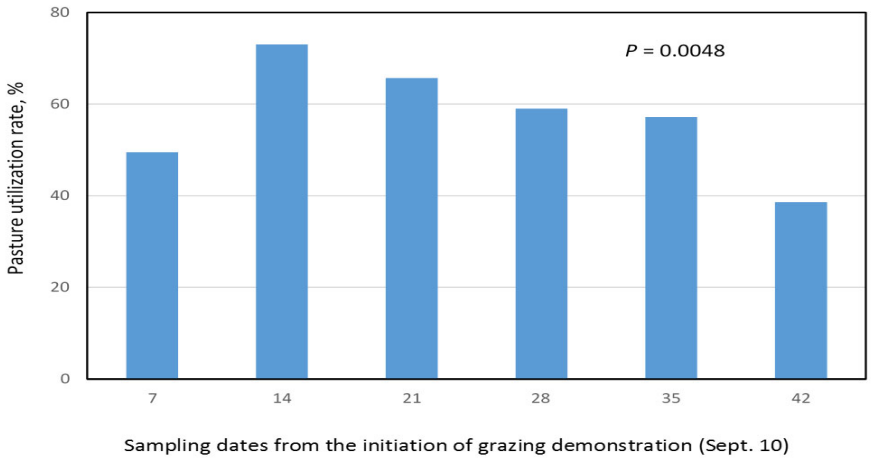

Figure. 2. Change of pasture utilization rate during the grazing demonstration period.

Increased legume proportion in forage samples recovered from post-grazing pastures indicated slightly reduced legume consumption along with the development of legume maturity (Figure. 3).

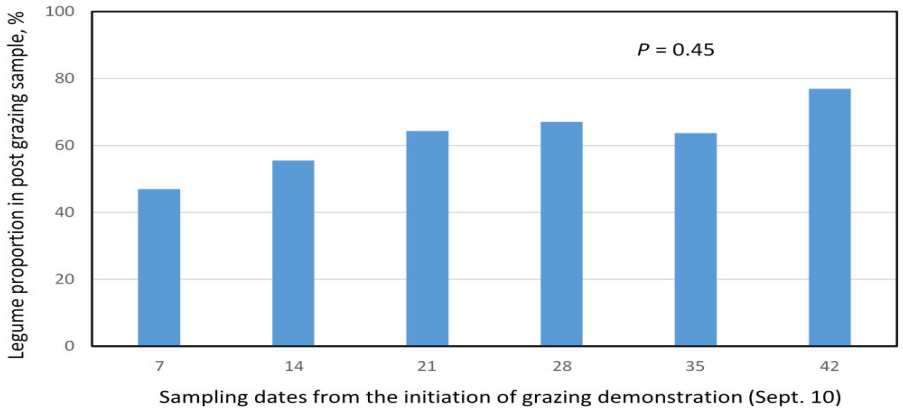

Figure. 3. Legume proportion changes between pre-grazing and post-grazing forage samples during the grazing demonstration period.

This is probably due to more stem elongation of the legumes as they matured from vegetative to flowering stages.

Figure 4. Electric fences are a useful tool for making grazing management decisions.

Figure 5. Beef steers moved to a fresh paddock after finishing a seven day grazing period on an old paddock (left side).

The species effect was significant for CP and TDN ($P < 0.001$) while sample collection date was not significant for the two nutrient values ($P > 0.05$), (Table 1). Individual forage component analysis indicated that the CP and TDN contents in the tropical legumes were up to 1.9%, and 10.9% higher than those in bahiagrass, respectively. Due to the major contribution of the legume biomass to total forage production, CP and TDN contents of forage in the combined overseeded pasture were close to those of the tropical legumes only (Table 1).

	Bahiagrass	Tropical legume	Combined forage		Bahiagrass	Tropical legume	Combinded forage
Day[1]	CP, %DM				TDN, %DM		
0	12.8	14.5	14.1		52.1	58.2	56.5
7	13.2	15.1	14.2		49.7	56.2	53.8
14	13.4	13.3	13.2		50.3	59.1	58.0
21	13.6	12.7	12.8		51.8	56.1	55.7
28	12.6	14.5	14.3		49.0	59.9	58.6
35	12.4	12.8	12.7		49.6	56.0	55.5

Table 1. Crude protein (CP) and total digestible nutrient (TDN) in pre-grazing bahiagrass, tropical legume, and combined forage samples collected during the grazing demonstration periods ([1] Days from initiation of grazing, Sept. 10).

Figure 6. Pastures showing before (right side) and after (left side) grazed tropical legume overseeded summmer pasture. Photo shows amount of unconsumed forages after seven days of grazing.

DISCUSSION

The CP and TDN contents of the two legume species did not change much during the grazing demonstration period. Rao et al. (2009) reported the digestibility of soybean (*Glycine max* L.) forage maintained lower levels than mung bean and cowpea in the southern Great Plains. This may be one of the major advantages of utilizing these legumes for the overseeding application compared with soybean. Pasture utilization in our current grazing demonstration was near 50%. It was observed that the cattle preferred the tropical legume leaves over the stems (Figures 5 and 6). This observation may be due to the selective grazing by cattle on legume leaves rather than on the whole crop, since 50% of biomass accumulation of mung bean and cowpea is due to leaf biomass (Muchow et al., 1993). Since forage utilization was only 50%, additional grazing research or demonstrations using higher animal stock densities are warranted to investigate the possible enhanced utilization efficiency of this tropical legume overseeding practice.

Due to enhanced total forage production and greater CP and TDN contents in the forage, overseeding cowpea and mung bean into perennial permanent warm-season grass pastures may serve as an attractive grazing option for beef cattle producers in the Deep South region of the USA.

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