Utilizing Alfalfa as an Alternative Nitrogen Source in Improving Bermudagrass Grazing Systems in the Southeastern United States

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A stocker steer grazing alfalfa-bermudagrass mixtures in Tifton, GA. Photo by Shauni Nichols.

The environmental conditions of the Coastal Plains region of the United States provide livestock producers with unique forage production opportunities that may not be experienced nationwide. While these conditions are favorable for forage production and longer growing seasons, the rising costs associated with livestock production have producers seeking alternative ways to increase productivity while also reducing external input costs, particularly those related to feeding livestock. Earn 0.5 CEUs in Crop Management by reading this article and taking the quiz at https://web.sciencesocieties.org/Learning-Center/Courses.

Abbreviations:

- **ADG** – average daily gain
- **BG** – bermudagrass monoculture pastures receiving no nitrogen fertilizer
- **BGA** – bermudagrass pasture interseeded with 'Bulldog 805' alfalfa
- **BGN** – bermudagrass monoculture pastures receiving nitrogen
- **CP** – crude protein
- **LWG** – liveweight gain
- **TDN** – total digestible nutrients

In the Coastal Plains region of the United States, pastures are dominated by warm-season perennial forages, with bermudagrass being one of the most common. Bermudagrass is typically grown for either stored forage, such as dry hay, or grazing pasture for livestock. While bermudagrass is a desirable long-lived perennial forage, it has a high nitrogen (N) fertility requirement for optimal production, and the increased cost for synthetic N sources in recent years has resulted in producers seeking alternative N sources (Beck et al., 2017; Quinn, 2022).

Additionally, the nutritive value of bermudagrass for crude protein and energy is moderate at best (Ball et al., 2015). The crude protein (CP) of bermudagrass ranges from ~8–12%, and the total digestible nutrients (TDN), or energy, ranges from ~50–58%. These nutritive value parameters may require producers to supplement other feedstuff to their livestock, depending on the class of the animals (Ball et al., 2015; NASEM, 2016).

When N prices start to rise, so does the interest in legume–grass mixtures to help alleviate the need for supplemental N and improve the nutritive value of the forage base (Biermacher et al., 2012; Rouquette & Smith, 2010). While growing legume–grass mixtures is not a novel concept, there are limited perennial forage legume options that are viable long-term within a warm-season perennial grass system. Many of the forage legumes commonly used in the southeastern United States are cool-season annual species, making them suitable for incorporation with winter annual grasses. However, these legumes typically do not contribute throughout the growing season. Although there are few warm-season legume options to use, a cool-season perennial legume, such as alfalfa (*Medicago sativa*), is a potential option.

Alfalfa blooms in an alfalfa–bermudagrass mixture in Tifton, GA. Photo by Justin Burt.

Typically, throughout the United States, alfalfa is grown in a monoculture. However, in the southeastern United States, alfalfa is an excellent complementary forage for bermudagrass swards. The development of alfalfa cultivars that are tolerant to the climate, disease, and pests of the region has aided in alfalfa–bermudagrass (ABG) mixtures being successfully used for stored forage (Hendricks et al., 2020).

In addition to the alfalfa cultivars that are tolerant to the environmental conditions of the region, some have also been selected for grazing tolerance (Bouton, 1998; Bouton & Gates, 2003). Previous research has shown that these alfalfa cultivars are successful when incorporated into bermudagrass in grazing scenarios, regardless of the bermudagrass cultivar being used (Beck et al., 2017a-d; Rushing et al., 2020). When appropriately managed, the alfalfa can be productive throughout the hot summer months and contribute to the overall seasonal herbage accumulation (Hendricks et al., 2020).

While ABG mixtures have been successful in other parts of the region, data are limited on grazing alfalfa interseeded into 'Tifton 85' bermudagrass specifically. Tifton 85 has a vigorous growth habit (Baseggio et al., 2015; Hanna & Anderson, 2008; Mandebvu et al., 1999) and greater fiber digestibility, resulting in greater cattle gains (Hill et al., 1993; Mandebvu et al., 1999). Additionally, there is limited research comparing ABG mixtures to bermudagrass monoculture in relation to system performance.

Therefore, the objective of this study was to evaluate the agronomic and economic potential of 'Bulldog 805' alfalfa–Tifton 85 bermudagrass mixed pastures with Tifton 85 bermudagrass monoculture pastures with or without the application of synthetic nitrogen when grazed by stocker cattle in the U.S. Southeast.

Table 1. Mean seasonal animal and forage performance for stocker steers rotationally stocked on bermudagrass pastures supplemented with or without synthetic N or alfalfa–bermudagrass mixed pastures for the 2018–2019 grazing seasons in Tifton, GA.

	Treatments[b]			
Item	BG	BGN	BGA	SEM
Seasonal average daily gain (lb/animal)	1.50b	1.46b	1.72a	0.07
Seasonal gain per acre (total lb LWG/ac)[a]	69b	85b	123a	12.7
Crude protein, (%)	12.5c	13.9b	18.2a	56.1
Total digestible nutrients (%)	49.7b	49.8b	52.0a	38.7

Note: Table is adapted from Burt et al., 2022.

a LWG, liveweight gain.

b Within a row, means without a common letter differ ($p \leq 0.05$). Abbreviations: BG, bermudagrass without nitrogen; BGA, bermudagrass interseeded with alfalfa; BGN, bermudagrass supplemented with nitrogen (80 lb/ac); SEM, standard error of the mean.

Conclusion and Future Work

The results of this study indicated that the utilization of alfalfa–bermudagrass mixtures compared with bermudagrass monoculture pastures fertilized with or without synthetic N improves the overall agronomic production of this grazing system. Additionally, this evaluation determined that longer rest periods may be required, specifically in extreme environmental conditions, such as drought.

Current research is focused on determining the optimal harvest management strategies associated with this mixture. This work is focused on comparing stored forage production, grazing, and a combination of stored forage production and grazing of ABG mixtures in a simultaneous evaluation.

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1. **Typically, in bermudagrass, crude protein ranges from ________, and energy ranges from ________.**
    a. 15–18%; 65–70%
    b. 7–10%; 43–48%
    c. 8–12%; 50–58%
    d. 22–25%; 75–77%

2. **Alfalfa is known as what type of forage?**
    a. Cool-season annual legume.
    b. Warm-season annual grass.
    c. Warm-season perennial legume.
    d. Cool-season perennial legume.

3. **'Tifton 85' bermudagrass has a.**
    a. vigorous growth habit and greater fiber digestibility
    b. slow growth habit with greater fiber digestibility
    c. vigorous growth habit with lower fiber digestibility.
    d. slow growth habit with higher fiber digestibility.

4. **The average daily gain of the stocker cattle in this study was greatest in which treatment?**
    a. BG
    b. BGN
    c. BGA

   d. Average daily gain was the same among all treatments.

5. **When appropriately managed, alfalfa can be productive throughout the summer months.**
   a. True.
   b. False.

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