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Approaches toward Sustainable Forage-Livestock Systems: Strip-Planting a Legume into a Warm-Season Perennial Grass Pasture

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Introduction

Despite the demonstrated potential of rhizoma peanut (*Arachis glabrata* Benth.; RP) for grazing in the southeastern USA (Ortega-S. *et al.* 1992), high establishment cost and removal of land from production during establishment have limited its use to primarily hay production systems. The premise of this experiment is that strip-planting RP in existing bahiagrass (*Paspalum notatum* Flügge) pastures offers the opportunity to use grass forage during the legume establishment phase so that land need not be totally removed from grazing, while allowing successful establishment of the legume.

Methods

Experiments were conducted for 2 years (2010 and 2011) at the University of Florida Beef Research Unit (29°43′ N, 82°21′ W) near Gainesville, FL. The area was selected because of existing well-established (at least 10 year)s bahiagrass pastures and because nearby RP pastures have persisted for over 30 years.

'Florigraze' RP rhizomes were planted in 8 rows within a 4 m wide strip (Fig. 1) using a conventional sprig planter at a rate of 1000 kg/ha to 5 cm depth. Planting was done in March 2010 and April 2011. A new area was established each year. Irrigation was applied during April and May each year to equal the 30-year average weekly rainfall (~20 mm). Initiation of defoliation was targeted for the end of the RP sprout emergence period (~11 weeks after planting), based on research conducted in Florida (Williams 1993).

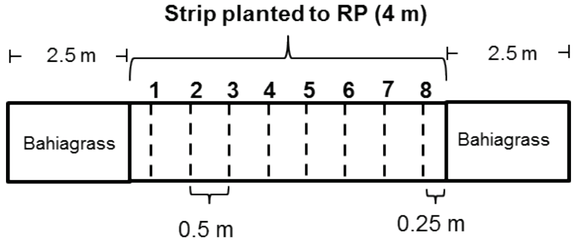

Figure 1. Experimental units were 9 m x 15 m. The width consisted of a 4 m-wide strip planted to rhizoma peanut (RP) bounded on each side by a 2.5 m bahiagrass sod strip. Rhizomes were planted in the 8 rows.

Data were analyzed as repeated measures using mixed model methodology (SAS Institute, 2010). Collection date was considered as a repeated measurement with an auto-regressive covariance structure. Year and block were considered random effects. Year was considered random because a new set of plots was established each year. Defoliation strategies were fixed effects.

Defoliation strategies were: (1) control (no defoliation of the planted RP strip, with the adjacent bahiagrass harvested for hay production every 28 d to 10 cm stubble height; (2) hay production (RP strip and adjacent bahiagrass mowed every 28 d to 10-cm stubble height; (3) simulated continuous stocking (pastures grazed weekly to 15 cm bahiagrass stubble height); and (4) rotational stocking (pastures grazed every 28 d to 15 cm bahiagrass stubble height). The grazing methodology was mob stocking. Animals used were 350 kg yearling cross-bred beef heifers (*Bos* spp.).

A 1 m^2 quadrat (0.5 m by 2 m), divided into 100 (10 by 10 cm) squares, was placed in the centre of the RP strip at 2 permanently marked locations to visually estimate RP canopy cover every 28 d. Frequency of RP was determined on the same dates as cover. Presence or absence of RP was determined in 20 stratified 10 by 10 cm squares in each of 2 quadrat locations, so that frequency was calculated as the percentage of the total number of cells assessed where RP was present. Spread of RP into the bahiagrass sod was estimated by measuring the distance from the outer row of RP to the farthest point where RP plant parts were found.

Results

From July through the remainder of the establishment year, grazing (rotational or simulated continuous stocking) reduced RP canopy cover and frequency, compared to control and hay production treatments (Fig. 2). Measurements taken in June of the year after establishment followed the same pattern.

Spread was minimal (<10 cm) in the first year for all treatments. The simulated continuous stocking treatment suffered a loss of plants in the outer row, resulting in a reduction of spread.

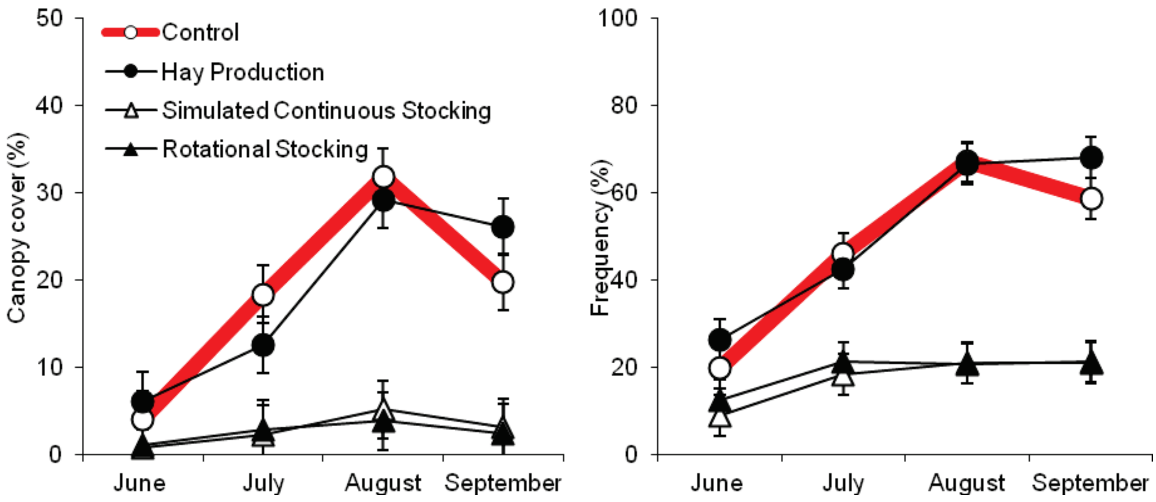

Figure 2. Canopy cover and plant frequency of rhizoma peanut planted in strips into existing bahiagrass pastures under 4 different management systems. Data are means across 2 years. Error bars represent treatment means (*n* = 6) ± one standard error

Discussion

Lower RP canopy cover and frequency in the grazing treatments could be attributed to animal preference for RP and other herbage components present in the strip planted to RP. When entering the pasture, animals first closely grazed the RP strips before commencing grazing the adjacent bahiagrass. Thus, while physical separation of the legume and grass components of a mixture provided advantages for managing plant competition, animal selection behaviour offset these advantages and negatively affected legume establishment.

Additional research is needed to evaluate longer rest periods between grazing events, the termination of grazing based on RP stubble height in the planted strip (instead of adjacent bahiagrass), and adaptation of the strip-planting approach to other RP cultivars with growth habits that range from prostrate to erect.

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