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TROPICAL LEGUMES TO AUGMENT FORAGE YIELD IN THE EASTERN CARIBBEAN

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Abstract

Little information is available on the contribution of tropical legumes to forage yield in the eastern Caribbean. This study assessed the effects of three grazing cycles (GC; 5, 10 and 15-wk) on seasonal dry matter (DM) yield of binary mixtures of the tropical legumes glycine (*Neonotonia wightii*) and desmanthus (*Desmanthus virgatus*) with “Bambatsi” (*Panicum coloratum*) and “Mottgrass” (*Pennisetum purpureum* Shum.). Plant responses were assessed by mob-grazing with sheep (12-24 hrs; to average stubble height of 15-cm) for each GC. Grazing cycles affected yield of both the legume and grass component (P<0.05). At GC of 5-weeks, forage DM ranged from 1.5-2.0 Mg ha^{-1} in both years. Forage yield increases at10 and 15-wk for both grass and legume were two-fold. Legume yield contribution ranged from 12-32 percentage by weight in 1997 and 33 to 58% in 1999. Desmanthus dominated bambatsi swards. Glycine associated well with both bambatsi and Mottgrass. Because of its aggressive shrub-growth habit, Desmanthus is better suited for use as hedgerows in native pastures. Glycine is more compatible to use as binary mixtures with grasses to increase yield and nutritive value in the eastern Caribbean.

Keywords: Grazing cycles, mob-grazing; sheep, binary mixtures, desmanthus, glycine

Introduction

Naturalized guineagrass (*Panicum maximum* Jacq.) pastures are popular in the eastern Caribbean islands, but quantity and quality are limited during the dry season (DS) of April-August (Oakes, 1973; Adjei, 1995). Grass clipping studies of new grass cultivars (i.e., ‘Bambatsi’ and ‘Mottgrass’) show potential for increased DM yield during the DS. Glycine and desmanthus are tropical legumes adapted to heavy clay soils and semi–arid conditions (Pitman et al., 1990; Adjei, 1995) and also maintain active green-growth during the DS (E. Valencia, personal observations). Attributes of these new grass and legume cultivars allows development of stable grass-legume mixtures for DS feeding in the Caribbean. Compatible mixtures of tropical grasses and legumes have been limited by their physiological differences (Mott, 1983). Monzote and Garcia (1988), however, reported compatible mixtures of glycine and tropical grasses after 3-yr of grazing (low and high stocking rates). Botanical composition of glycine-bermudagrass [*Cynodon dactylon* (L.) Pers.] and *Cenchrus* spp were maintained at 47%. Glycine-guineagrass (38%) and the other grasses were favored by low stocking rate. Desmanthus has been used as protein banks (short-term grazing) and cut-carry systems in the Caribbean, but little information is available on the plant response to grazing (Pitman et al., 1990). Our objective was to determine the effects of three grazing cycles on seasonal distribution of yields of binary mixtures of desmanthus-Mottgrass, desmanthus-bambatsi, glycine-Mottgrass and glycine-bambatsi.

Material and Methods

This study was conducted on the west-end of St. Croix (17° 43' N, 64° 48' W), U.S Virgin Islands. Soil type was a midly alkaline (pH 7.8) Fredensborg clay (fine carbonatic, isothermic, Typic Rendoll Mollisols). Annual rainfall in 1997 and 1998 was 739 and 1867 mm, respectively. Plant responses were assessed by the mob-grazing technique described by Mislevy et al. (1983).

Experimental design was a randomized complete block with two replications in a split-plot arrangement. Grazing cycles of 5, 10 and 15-wks were the main plots and sub-plot treatments consisted of well-established 21 m^2 plots of desmanthus-Mottgrass, desmanthus-bambatsi, glycine-Mottgrass and glycine-bambatsi. Each grazing cycle consisted of a grazing period of 12-24 hrs plus a rest period between grazing. Sheep were removed from plots when an average stubble height of 15-cm was observed. Prior to mobgrazing, forage from a 0.92 m^2 area in the center of each plot was hand-clipped to a 15-cm height. Sample was hand-sorted into grass and legumes and DM yield of each component was determined. Statistical analysis of total and component (legume and grass) were performed following the procedures of GLM in SAS (SAS, 1989). Mean comparison were made with an F-protected LSD ($P<0.05$).

Results and Discussion

Annual rainfall in 1997 (769 mm) and 1998 (1867 mm) varied from the 20-yr norm (1060 mm). There was a grazing cycle effect ($P<0.05$) on yield of the legume and grass component in both years (Table 1). Grazing cycles of 5-wk affected yield of both the legume and grass component and ranged from 1.5 to 2.0 Mg ha^{-1}. At grazing cycles of 10 and 15-wk, increases in yield of both the grass and legume were two-fold in 1997. Similar response of the legumes were observed in 1998, but the grass component yield was lower than in 1998. Rainfall in 1998 was twice the amount received in 1997. Despite a better rainfall distribution, the grass yield (0.60 Mg ha^{-1}) at the 5-wk grazing cycle was lower than the legume (0.70 Mg ha^{-1}). Desmanthus (shrub-growth habit) dominated bambatsi and competed with Mottgrass for light and space by year two (Table 2). Also, the sheep flock was observed to strip the leaves, small twigs and avoid stems. This allowed for a faster regrowth of desmanthus and favored competition with the grasses. Glycine (twinning growth habit) contributed (18-25 percentage by weight) in 1997, and increased in 1998. With the shorter growing bamabtsi, glycine contributed 50 percentage by weight in 1998. Season effects were observed in 1997 ($P<0.05$), only. Legume yield averaged 0.76 Mg ha^{-1} during the dry season compared to 0.58 Mg ha^{-1} in the wet season. These data indicate that glycine is more compatible for use with bamabtsi and Mottgrass and can contribute to DM yield and also increase nutritive value (data not shown). Desmanthus aggressive growth habit suggests that this legume would be suited for incorporation in hedgerows in existing native pastures.

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Table 1 - Mean yield (Mg ha^{-1}) of legume-grass components at St. Croix, U.S. Virgin Islands as affected by grazing cycles of 5, 10 and 15-wk in 1997 and 1998.

	1997		1998	
	Legume	Grass	Legumes	Grass
Grazing Cycle	Mg ha^{-1}			
5	0.45	1.80	0.70	0.60
10	1.10	4.30	1.60	2.30
15	1.10	4.40	1.60	2.60
LSD (0.05)	0.31	0.88	0.39	0.77

Table 2 - Mean yield of binary mixtures of desmanthus-Mottgrass (D-M), desmanthus-bambatsi (D-B), glycine-Mottgrass (G-M) and glycine-bambatsi (G-B) at St. Croix, VI in 1997 and 1998.

	1997		1998	
	Legume	Grass	Legumes	Grass
Binary Mixtures	Mg ha^{-1}			
D-M	0.50 (12)†	4.20 (88)	0.90 (40)	1.60 (60)
D-B	0.75 (32)	1.30 (66)	2.30 (58)	1.30 (42)
G-M	0.90 (25)	2.95 (75)	0.85 (33)	2.20 (67)
G-B	0.35 (18)	1.65 (82)	0.80 (50)	0.80 (50)
LSD (0.05)	0.32	0.91	0.43	0.52

†Numbers in brackets represent percentage by weight of the legume and grass component.