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EFFECTS OF DIFFERENT LEVELS OF NITROGEN APPLICATION AND CUTTING INTERVALS ON THE DRY MATTER YIELD OF MULATO (*BRACHIARIA* HYBRID) AND TANNER (*BRACHIARIA ARRECTA*) GRASSES

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ABSTRACT: One of the methods identified for increasing forage production and the carrying capacity of the land is via the introduction of new and improved grass species. In keeping with this method, a factorial arrangement in a randomised complete block design was used to compare the effects of different levels of nitrogen (N) and cutting intervals on the dry matter (DM) yield of an improved grass, Mulato (*Brachiaria* sp.) to that of a local grass, Tanner grass (*Brachiaria arrecta*). At land preparation, agricultural limestone, triple super phosphate and muriate of potash were applied at rates of 1,000 kg/ha, 100 kg /ha and 100 kg/ha, respectively. The area was rotovated immediately after this application and plots (9 m × 3 m) were cut. Tanner was planted from cuttings of mature plants. Mulato seeds were sown. Seventy-seven days after planting, all plots were cut back to six inches by using a motorized brush cutter and N was applied according to treatment, signaling days zero of the regrowth (RG). Harvesting began according to treatment, three, six and nine weeks thereafter. After each harvest, plots were cut back. Harvesting continued for seventy-two weeks. Fresh and dry weights were recorded. Data was analyzed by using Genstat Release 11.1 statistical software and Minitab 15 statistical software. Analysis of the data shows that at 0 kg N application, the three-week RG between species varied significantly ($P<0.01$) with Mulato and Tanner yielding 58,846 kg DM and 46,448 kg DM, respectively, over the 72-week period. However, with N applications of 100 kg/ha/yr and 200 kg/ha/yr, yields within and between species were statistically not different. Where no N was applied and the RG was harvested at six weeks, no differences were observed. At 100 kg N application, the yield of Mulato (49,385 kg DM) was higher ($P<0.05$) than that of Tanner grass (41,885 kg DM). Increasing N application to 200 kg bears no significant benefit ($P>0.05$) in terms of dry matter yield between or within species. With regard to dry matter yield at nine weeks RG, there was a significant response ($P<0.05$) by Tanner grass when fertiliser was applied at the 200-kg N level when compared to DM yields at 0 and 100 kg N. The highest dry matter yields for both grasses were obtained in the three-week regrowth with N applications of 200 kg. Yields were 68,479 kg DM for Mulato over the study period and 54,177 kg DM for Tanner.

Keywords: Forage, Mulato, Tanner, Dry matter

INTRODUCTION

Most of the grasslands in the tropics are found in marginal areas with low fertility status and are invaded by non-palatable species which dominate the area with increased grazing pressure (Moog, 1991). Moog (1991), citing Humphreys (1972), further noted that protein deficiency is very common in tropical grasses, particularly in the native species. These are characteristics of most pastures in Trinidad and Tobago. As a result, most farmers have become dependent on commercial concentrate feed to meet the nutrient requirements of their ruminant stock, with forage being used as a supplement. However, the consequence is an increase in the cost of production.

In an attempt to promote and increase forage production in Trinidad and Tobago, CARDI has identified an improved grass species Mulato (*Brachiaria* Hybrid – CIAT 36061) and is in the process of evaluating and comparing this species with the most commonly used grass forage in Trinidad, also a *Brachiaria* species, Tanner (*Brachiaria arrecta*). Holmann et al. (2004) noted that the process of adopting pasture technology is quite different from that of adopting crop technology. Holmann et al. (2004) stated further that the adopting and establishing of new pastures and farms is a long term, highly complex decision that requires previous analysis and involves numerous biological and economic risk factors. The most basic determination required is that of dry matter yield (DMY). DMY of forage is usually used as an indicator of the carrying capacity of the land. Nutrient composition is also reported in the context of the dry matter.

In Trinidad and Tobago, the common practice is to cut or graze forage at six-week intervals. There is a dearth of information relating to dry matter yield of pastures when grazed over an extended period and cut at six-week intervals. This paper reports on work done to compare the dry matter yields of Mulato and Tanner grasses when cut at three-six-and nine-week intervals over two growing seasons with applications of 0, 100 and 200 kg N/ha/yr. This information will assist farmers in on-farm forage budgeting and will ensure the optimum use of forage resources for ruminant livestock production.

MATERIALS AND METHODS

A factorial arrangement in a randomized complete design was developed (Figure 1) to evaluate the effects of different levels of nitrogen (N) and cutting intervals on dry matter yield of mulato *(Brachiaria* hybrid) and Tanner *(B. arrecta*) grasses. Soil pH was determined before land preparation. The land was ploughed. Limestone, triple super phosphate, and muriate of potash were applied at rates of 1,000 kg/ha, 100 kg /ha and 100 kg/ha, respectively. The area was rotovated immediately after this application and plots (9 m × 3 m) were cut. Tanner was planted from cuttings of mature plants. Mulato seeds were sown.

Seventy-seven days after planting, all plots were cut back to six inches using a motorized brush cutter, and N was applied according to treatment, signaling days zero of the regrowth (RG). Harvesting began according to treatment, three, six and nine weeks thereafter. Harvesting continued for seventy-two weeks.

Samples were collected by throwing a 40 cm × 40 cm quadrant onto plots while facing in the opposite direction (one sample per plot). The respective grass species within the quadrant was cut at a height of six inches above the ground by using a grass knife. The fresh weight of each sample was recorded, after which procedure samples were placed in an oven (105^0) for 24 hours. The dry weight was recorded and dry matter percentage and yield were calculated.

Data was analyzed using Genstat Release 11.1 statistical software and Minitab 15 statistical software.

Figure 1. Randomised block design for 18 treatments and three replicates

	Design Layout																	
Plot_Number	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18
Reps	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Treatment	9	12	7	4	17	6	2	8	10	16	3	13	15	11	1	14	5	18
Plot_Number	P19	P20	P21	P2	P2	P2	P2	P2	P2	P28	P29	P30	P31	P32	P33	P34	P35	P36
Reps	2	2	2	2	3	4	5	6	7	2	2	2	2	2	2	2	2	2
Treatment	9	13	11	2	2	2	2	2	2	6	2	16	14	15	12	18	17	4
				3	8	1	5	7	10									
Plot_Number	P37	P38	P39	P4	P4	P4	P4	P4	P4	P46	P47	P48	P49	P50	P51	P52	P53	P54
Reps	3	3	3	0	1	2	3	4	5	3	3	3	3	3	3	3	3	3
Treatment	17	9	12	3	3	3	3	3	3	1	16	15	4	2	18	5	6	10
				13	14	11	3	7	8									

Treatment key

Treatment labels	Factor Grass species	Factor Fertiliser application rate	Factor Cutting interval
1	1	1	1
2	1	1	2
3	1	1	3
4	1	2	1
5	1	2	2
6	1	2	3
7	1	3	1
8	1	3	2
9	1	3	3
10	2	1	1
11	2	1	2
12	2	1	3
13	2	2	1
14	2	2	2
15	2	2	3
16	2	3	1
17	2	3	2
18	2	3	3

Factor species: 1-Mulato 2- Tanner
Factor fertiliser application rate: 1) 0 kg/ha/yr; 2) 100 kg/ha/yr; 3) 200 kg/ha/yr
Factor cutting interval: 1) three-week interval; 2) six-week interval; 3)- nine-week interval

RESULTS

Soil pH was determined to be 5.4 (0 to 15-cm depth) and 4.82 (15 to 30-cm depth) at land preparation. At 0 kg N application, the three-week RG between species varied significantly (P<0.01) with Mulato and Tanner yielding 58,846 kg DM and 46,448 kg DM, respectively, over the 72-week period (Table 1). However, with N applications of 100 kg/ha/yr and 200 kg/ha/yr, yields within and between species were statistically not different. This finding suggests that the initial RG occurs more rapidly for Mulato than for Tanner grasses. Nitrogen is not crucial at this early stage but applications of 100 and 200 kg/ha/yr are indeed helpful to increase yield.

Table 1. Effect of nitrogen application on dry matter yield of Mulato and Tanner grasses over 72 weeks- three weeks regrowth.

Nitrogen application	Mulato Dry matter yield (kg)	Tanner Dry matter yield (kg)	
	Mean ± SEM	Mean ± SEM	
0 kg N/ha	58,846 ± 853	46,448 ± 1,800	**
100 kg N/ha	61,646 ± 2,552	50,975 ± 4,371	NS
200 kg N/ha	68,479 ± 3,731	54,177 ± 4,368	NS
	NS	NS	

SEM- standard error of mean, NS: non significant (P>0.05), *P<0.05, **P<0.01, ***P<0.001

Where no N was applied and the RG was harvested at six weeks, no differences were observed (Table 2), as by this time the tanner grass may have begun to rapidly develop stolons, the stems of which are high in dry matter content. At 100-kg N application, the yield of Mulato (49,385 kg DM) was higher (P<0.05) than that of Tanner grass (41,885 kg DM). Increasing N application to 200 kg bears no significant benefit (P>0.05) in terms of dry matter yield between or within species.

Table 2. Effect of nitrogen (N) application on dry matter yield of Mulato and Tanner grasses over 72 weeks- six weeks regrowth.

Nitrogen application	Mulato Dry matter yield (kg) Mean ± SEM	Tanner Dry matter yield (kg) Mean ± SEM	
0 kg N/ha	45,375 ± 4,570	39,000 ± 3,063	*
100 kg N/ha	49,385 ± 2,010	41,885 ± 1,593	*
200 kg N/ha	49,781 ± 3,941	48,146 ± 6,221	NS
	NS	NS	

SEM- standard error of mean, NS: non significant (P>0.05), *P<0.05

With regard to dry matter yield at nine weeks RG, there was a significant response (P<0.05) by Tanner grass when fertiliser was applied at the 200-kg N level when compared to DM yields at 0- and 100-kg N. There was no significant response (P>0.05) of Mulato to increasing levels of fertiliser application at the nine weeks RG; however, the DM yield of Mulato (48,802 kg DMY) was significantly (P<0.05) greater than that of Tanner (31,656 kg DMY) at 200 kg N (Table 3).

Table 3. Effect of nitrogen application on dry matter yield of Mulato and Tanner grasses over 72 weeks- nine weeks regrowth.

Nitrogen application	Mulato Dry matter yield (kg) Mean ± SEM	Tanner Dry matter yield (kg) Mean ± SEM	
0 kg N/ha/yr	40,323 ± 2,844	40,771 ± 2,372	NS
100 kg N/ha/yr	41,177 ± 2,089	44,521 ± 2,630	NS
200 kg N/ha/yr	48,802 ± 3,516	31,656 ± 3,083	*
	NS	*	

SEM- standard error of mean, NS: non significant (P>0.05), *P<0.05

With no N application, dry matter yield of the three weeks RG of Mulato was higher (P<0.05) than that at six or nine weeks (Table 4). This was not observed in tanner grass. The three-week RG for tanner was higher than at six or nine weeks but of no statistical significance (P<0.05). Between species, significance (P<0.01) was observed only in the three weeks RG with Mulato yielding the higher levels of dry matter.

Table 4. Effect of cutting interval on dry matter yield of Mulato and Tanner grasses over 72 weeks- 0 kg N/ha/yr applied.

Cutting interval	Mulato Dry matter yield (kg) Mean ± SEM	Tanner Dry matter yield (kg) Mean ± SEM	
Three weeks regrowth	58,846 ± 853	40,771 ± 2,372	NS
Six weeks regrowth	45,375 ± 4,570	44,521 ± 2,630	NS
Nine weeks regrowth	40,323 ± 2,844	31,656 ± 3,083	*
	*	NS	

SEM- standard error of mean, NS: non significant (P>0.05), *P<0.05

At applications of 100 kg N/ha, the greatest yield of dry matter for both species was obtained at three weeks RG. However, statistically important differences occurred only for Mulato (Table 5). Between species, differences occurred only at the six weeks RG (P<0.05).

Table 5. Effect of cutting interval on dry matter yield of Mulato and Tanner grasses over 72 weeks- 100 kg Nitrogen/ha/yr applied.

Cutting interval	Mulato Dry matter yield (kg) Mean ± SEM	Tanner Dry matter yield (kg) Mean ± SEM	
Three Weeks Regrowth	61,646 ± 2,552	50,975 ± 4,371	NS
Six Weeks Regrowth	49,385 ± 2,010	41,885 ± 1,593	*
Nine Weeks Regrowth	41,177 ± 2,089	44,521 ± 2,630	NS
	**	NS	

SEM- standard error of mean, NS: non significant (P>0.05), *P<0.05, **P<0.01

Applying 200 kg N/ha (Table 6) resulted in significant differences within specie for both Mulato (P<0.05) and Tanner (P<0.05). Differences were also observed between species at nine weeks (P<0.05) RG but none in the three- (P>0.05) and six-weeks RG (P>0.05).

Table 6. Effect of cutting interval on dry matter yield of Mulato and Tanner grasses over 72 weeks- 200 kg N/ha/yr applied.

Cutting interval	Mulato Dry matter yield (kg) Mean ± SEM	Tanner Dry matter yield (kg) Mean ± SEM	
Three weeks regrowth	68,479 ± 3,731	54,177 ± 4,368	NS
Six weeks regrowth	49,781 ± 3,941	48,146 ± 6,221	NS
Nine weeks regrowth	48,802 ± 3,516	31,656 ± 3,083	*
	*	*	

SEM- standard error of mean, NS: non significant (P>0.05), *P<0.05

CONCLUSIONS

The highest dry matter yields for both grasses were obtained in the three-week regrowth with N application of 200 kg/ha/yr. Yields were 68,479 kg DM for Mulato over the study period (72 weeks) and 54,177 kg DM for Tanner. Performance is a result of genetic and environmental effects. In this experiment the environment was the same for both grasses; therefore, differences obtained can only be attributed to genetic sources.

On the basis of the results, it can be deduced that Mulato grass is superior to Tanner grass. However, it must be noted that although it is important to determine the dry matter yield of a forage, this is not the only consideration when selecting a pasture species. Whiteman (1980) rightly proffered that production of large quantities of dry matter of low nutritive value may be of little use on animal production. Essentially, the animal will be starving with only its dry matter requirement being met.

One other factor to consider is crude protein content. John and Hosein (2008) found no differences (P>0.05) in crude protein content between Mulato and Tanner in a study where four forage species were compared. Also, with regard to Whiteman's (1980) suggestion that persistence, associative ability and ease of propogation of the species are some other factors to consider, John and Hosein (2008) observed that Mulato seemed to be more persistent than Tanner over time and cutting back at eight-week intervals. They also found that Mulato is more likely to be compatible with forage legumes. However, Tanner grass was easier to establish than Mulato.

Further work required will be to determine nutrient composition and animal performance.

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