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RESEARCH

Effects of Fertilizer Types and Spacing on Biomass Yield and Chemical Composition of *Brachiaria* Hybrid Mulato II Grass Grown in Semi-Arid Zone in Sri Lanka

M.G.I.D Munasingha [1] , T.T.K Peiris [2] and B. S Bandusekara [1] *

[1] *University of Colombo Institute for Agro-technology and Rural Sciences, 82004, Weligatta New Town, Hambantota, Sri Lanka;*
[2]*Department of Soil Science, Faculty of Agriculture, University of Peradeniya, 20400, Peradeniya, Sri Lanka.*

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B. S Bandusekara
https://orcid.org/0000-0002-6382-1071

* Corresponding author- * supun@uciars.cmb.ac.lk

ABSTRACT

Brachiaria species have gained widespread usage in the tropics and subtropics. *Brachiaria* Mulato II, a recently introduced hybrid cultivar within the *Brachiaria* genus, has not undergone comprehensive agronomic evaluation in Sri Lanka. This experiment was conducted to evaluate the effects of fertilizer types (U625-control: 17-12-14-0-0, commercial mixture-CM1: 14-8-12-1-7, and CM2: 14-6-20-1-7; N-P-K-S-Mg) and plant spacings (15×50 cm and 30×50 cm) on dry matter yield (DMY), morphological characteristics (plant height-PH, leaf-to-stem ratio-LSR, and number of tillers per plant-NTPP), and chemical composition (ash, crude protein-CP, Neutral detergent fiber-NDF, and acid detergent fiber-ADF) of Mulato II grass. The experiment was conducted in Hambantota district Sri Lanka under irrigated conditions. The experimental design was a factorial layout (3×2) in a randomized complete block design with four replications. PH, NTPP, LSR, DMY, and ASH content are significantly different within fertilizer types while all the parameters except ASH are significantly different within spacing. Overall, the highest PH, DMY, and ADF were shown by close spacing while wide spacing showed high NTPP, LSR, CP and NDF. Treatments CM1 (11.2 t/ha) and CM2 (11.7 t/ha) recorded the highest and statistically similar DMY values, which were significantly greater than that of the control (9.6 t/ha). It can be recommended that Mulato II has the potential to be cultivated using CM1 and CM2 having competitive DMY, CP, NDF, and ASH content compared to commonly used improved grasses in the dry zones of Sri Lanka. The research indicates that close spacing increases the forage DMY while wide spacing increases the forage quality.

INTRODUCTION

Livestock production in the dry zone of Sri Lanka is constrained by chronic feed scarcity, largely due to the heavy dependence on low-quality natural pastures and crop residues. These feed resources, including commonly available species such as *Brachiaria brizantha*, often fail to meet the nutrient requirements of ruminants during most periods of the year. Introducing high-quality improved forages is therefore essential to overcome the limitations of existing grasslands. Among these, *Brachiaria* hybrid Mulato II has shown strong potential due to its superior nutritive value, drought tolerance, and adaptability to tropical environments. However, information on its performance, suitability, and productivity under Sri Lankan dry-zone conditions remains limited. This study was therefore undertaken to evaluate the growth, yield, and agronomic adaptability of Mulato II as a promising forage option for the region.

Brachiaria grass, recognized as one of the foremost tropical grass species, is extensively distributed across continents, including Africa, South America, Asia, the South Pacific, and Australia (De Souza-Kaneshima *et al*., 2010; Maass, 1996). Renowned for its high biomass production potential, *Brachiaria* grass plays a pivotal role in enhancing livestock productivity by providing nutritious herbage (Holmann *et al*., 2004). Among its notable varieties, *Brachiaria* hybrid Mulato II grass stands out, boasting a protein content ranging from 12-16% and an in-vitro dry matter digestibility (IVDMD) of 55-62% (Argel *et al*., 2006). The excellent qualities of this hybrid grass species, like its high nutritional content, capacity to adapt to different environmental circumstances, and increased cattle productivity, have made it extremely popular among livestock farmers (Jayasinghe *et al*., 2023).

Beyond its significance as a valuable livestock feed resource, *Brachiaria* grass exhibits multifaceted environmental benefits. The extensive root system of this grass species facilitates significant carbon sequestration, while concurrently enhancing nitrogen use efficiency and mitigating greenhouse gas emissions. Furthermore, its contributions extend to reducing nutrient losses from soils, controlling soil erosion, and fostering ecological restoration (Arango *et al*., 2014). These ecological services position *Brachiaria* grass as a valuable component in sustainable agricultural systems.

Addressing the pressing challenges of feed scarcity, *Brachiaria* grass emerges as a promising solution due to its exceptional forage yield per unit area and the reliability of regular forage supply attributed to its multi-cut nature (Bulo *et al*., 1994; Stur *et al*., 1996). Particularly, *Brachiaria* hybrid Mulato II grass, well-suited for intensive management, demonstrates robust performance at altitudes up to 1800 meters above sea level and under rainfall conditions of 700 mm (Maass, 1996). Particularly in tropical and subtropical areas, Mulato II grass is well known for its capacity to adapt to a variety of weather conditions. Because of its adaptability to various temperatures, it is an important source of fodder for raising animals. The ideal weather for Mulato II grass, including temperature, rainfall, and other climatic elements that support its effective cultivation throughout the year was discussed by Mekonnen *et al*. 2022.

In Sri Lanka, diverse climatic regions across Sri Lanka have allowed the successful introduction of high-yielding European cattle breeds into cooler areas. However, the potential of these breeds is restricted by the scarcity of arable lands available for grass cultivation. As a consequence, exploring the possibility of expanding the cultivation of highly productive grass types becomes imperative to meet the escalating feed demands, particularly in the context of raising improved cattle breeds. With 60% of the total cattle population concentrated in the dry zone, character-

ized by ample arable lands, there exists a significant opportunity to harness the potential of highly productive grass types. This research aims to investigate the feasibility of expanding the cultivation of such grasses, addressing the feed requirements not only for the local cattle breeds present in the dry zone but also for the improved European breeds.

Forage management practices play a pivotal role in optimizing the productivity of *Brachiaria* grass varieties. Factors such as fertilizer application and plant spacing are widely recognized as key determinants of dry matter (DM) yield and overall forage quality (Zewdu *et al*., 2002). Effective management is therefore essential to fully harness the potential of *Brachiaria* particularly the Mulato II hybrid in meeting livestock nutritional requirements and supporting sustainable agricultural systems. Although research on Mulato II has expanded globally, information on its agronomic performance under Sri Lankan dry-zone conditions remains scarce. In particular, the effects of different fertilizer levels and cultural practices on its growth and yield have not been systematically evaluated. Sri Lankan farmers also lack clear management guidelines for optimizing Mulato II cultivation, and commonly used grasses such as Napier offer comparatively lower nutritional quality and DM yield. Therefore, the present study was undertaken to assess the growth performance of Mulato II under varying fertilizer levels and management practices in the arid zones of Sri Lanka, with the aim of generating evidence-based recommendations to enhance forage production in the country.

METHODOLOGY

Experimental location

The experiment was conducted at the University of Colombo Institute for Agro-technology and Rural Sciences (UCIARS) teaching farm located in Hambantota District. The mean annual rainfall is 750 mm. The altitude is 12 meters above sea level and the mean temperature is 32.7°C.

Experimental layout, Design, and Treatments

The experiment was conducted using a factorial randomized complete block design (RCBD) with two factors: fertilizer type (3 levels) and plant spacing (2 levels). Treatments arrangement consisting of two intra-row spacings 15 cm (equivalent to 24 plants m^{-2}) and 30 cm (equivalent to 12 plants m^{-2}) combined with three fertilizer applications: U625 (control), Commercial Mixture 1 (CM1), and Commercial Mixture 2 (CM2). This resulted in six treatment combinations. The design included four replications arranged across four blocks, each containing six plots, giving a total of 24 plots. Each plot measured 2 m × 2 m, with an inter-row spacing of 50 cm maintained across all treatments. Blocks were separated by 2 m, and individual plots within blocks were spaced 1 m apart.

Planting material (seeds) was sourced from the University of Colombo Institute for Agro-Technology and Rural Sciences (UCIARS) teaching farm. Seeds were first germinated in nursery trays, and three-week-old seedlings were transplanted into the field, placing one seedling per planting hole. Before transplanting, the experimental field was cleared of weeds and then prepared through a sequence of ploughing followed by harrowing, performed three times to achieve a fine tilth, after which the land was subdivided into blocks and plots.

The nutrient ratios of the fertilizer mixtures were as follows: U625 (17-12-14 N-P-K), CM1 (14–8-12-1-7 N-P-K-Mg-S), and CM2 (14-6-20-1-7 N-P-K-Mg-S). U625 is the standard fertilizer mixture commonly used for forage grasses in Sri Lanka, whereas CM1 and CM2 are cost-effective fertilizer formulations originally developed for maize cultivation in the dry zone and widely adopted by commercial farmers. Fertilizer was applied at a total rate of 32 g per plot (4 m^2), equivalent to 160 kg/ha. The application was split into three stages: two basal applications accounting for

35% each of the total amount, followed by a top-dressing supplying the remaining 30%.

Data collection

The morphological data and yield parameters were collected after three months of planting at the vegetative stage. In each plot, five plants were randomly selected to record the number of tillers per plant (NTPP), Plant height (PH), and leaf-to-stem ratio (LSR). The heights of five randomly selected plants were measured from the base of the plant to the tip of the tallest leaf. The PH was recorded in centimeters, and the mean values of five plants for each plot were determined. The NTPP were counted from the randomly selected sample of five plants of each plot to calculate the mean value. The LSR was calculated by measuring the fraction of the weight of the leaf of plants sampled to the weight of stem of plants sampled.

Dry matter percentage (DM %) and dry matter yield (DMY) were determined by harvesting in the central portion of the plot using 2 m^2 quadrant and the plants were cut at a height of 5 cm from the ground level; harvesting was done 3 months after planting. The samples were weighed fresh using a spring balance; then sub-samples of about 750 g fresh plants were taken from the sample and weighed fresh after which they were oven-dried (60 – 65 ^{0}C) to have DMY and DM. DM indicates the weight after removing of moisture content from the samples. After drying, samples were ground to pass a 1-mm Wiley mill screen and stored in airtight containers pending for chemical analyses. CP and Ash content was analyzed according to the procedure described by the Association of Official Analytical Chemists (AOAC, 2004). Acid Detergent Fiber (ADF) and Neutral Detergent Fiber (NDF) were analyzed by following Van Soest *et al*. 1991.

Data analysis

Data on agronomic parameters and quality of forage samples were subjected to Analysis of Variance (ANOVA) based on the General Linear Model (GLM) designed for a factorial design. To compare significant differences in response variables, ANOVA analysis was done using SAS package (SAS version 7.2). Duncan's Multiple Range Test was carried out for subsequent comparison of means. Means were compared using a significant level of 5%.

RESULTS AND DISCUSSION

Overall performances of *Brachiaria* hybrid Mulato II

The interaction effects of fertilizer type and plant spacing on nine agronomic and nutritional traits of *Brachiaria* cv. Mulato II are presented in Table 01. The mean values recorded in the present study; plant height (72-77 cm), number of tillers (16-25/plant), dry matter yield (9.6-11.7 t/ha), and crude protein (9.9-10.6%) were generally lower than those reported for Mulato II in Northwest Ethiopia, where Yiberkew *et al*. (2020) observed plant heights of 90–120 cm, tiller numbers of 25–35/plant, DMY of 12–18 t/ha, and CP values of 11–14%. These differences likely reflect the higher altitude, cooler climate, and more fertile soils in Ethiopia. In contrast, the present results closely match those from semi-arid Kenya, where Nguku (2016) reported plant heights of 80–110 cm, tiller numbers of 18–30, and DMY values of 8–12 t/ha, indicating similar performance under dry tropical conditions. Likewise, the DMY observed here aligns with values reported in Australia (Tadesse *et al*., 2021), where Mulato II yields typically range between 10–13 t/ha per cut. Nutritional parameters in the present study also fall within global ranges: Overall, the comparison confirms that although some growth variables were slightly lower than those observed in more favorable environments, the perfor-

mance of Mulato II in Sri Lanka is well within internationally reported ranges and suitable for dry-zone production systems.

Analysis of variance showed significant interaction effects ($p < 0.05$) for plant height, number of tillers, dry matter yield (DMY), and ash content, indicating that fertilizer type and spacing jointly influenced these traits. Such interactions are common in *Brachiaria* hybrid Mulato II, as growth responses depend strongly on nutrient spacing synergy (Tadesse *et al*., 2021). The interaction plots (Figure 01) reveal clear tendencies where combined treatments modified plant structural and yield traits. Overall, the combination of conventional manure fertilizers (CM1/CM2) and wider spacing (30 × 50 cm) tended to enhance biomass-related traits, whereas narrower spacing increased tillering potential. These patterns agree with earlier observations in Sri Lanka's fodder systems, where spacing determines shoot proliferation and canopy structure (Houwers *et al*., Sri Lanka Fodder Report, 2015).

Morphological Characteristics and Dry Matter Yield (DMY)

Plant height varied significantly across treatments ($p < 0.05$), ranging from 70.3 cm in U625 to 77.6–77.4 cm in CM1 and CM2. The interaction with spacing showed that the 30 × 50 cm arrangement produced taller plants (77.7 cm) than the 15 × 50 cm spacing (72.5 cm), likely due to reduced competition for light interception and root-zone nutrients. This trend agrees with De Barros *et al*. (2023), who reported that wider spacing enhances vegetative growth in *Brachiaria* hybrids through improved canopy development.

Tiller production exhibited the highest variability (CV 35%) and responded significantly to both fertilizer and spacing. The widest spacing (30 × 50 cm) resulted in the highest tiller number (25.1/plant), while U625 recorded the lowest (16.0/plant). This pattern reflects the influence of plant density on axillary bud activation and light penetration within the canopy, findings consistent with Mulato II evaluations in semi-arid Kenya (Nguku, 2016). The leaf-to-stem ratio (LSR), although not significantly affected by the interaction, remained higher under CM1 and CM2 (1.14–1.13), indicating improved foliage proportion under enhanced nutrient availability. Such LSR values are desirable for fodder quality and align with previous records for Mulato II under improved fertility regimes.

Table 1. Mean values of the morphological characteristics and biochemical composition parameters of *Brachiaria* hybrid Mulato II grass as affected by fertilizer type and plant spacing

Parameter	Factors					CV	Interaction effect
	Fertilizer type			spacing			Fertilizer type × Spac-
	U625	CM1	CM2	15×50	30×50		

							ing
PH(cm)	70.3±2.0^{b}	77.6±4.5^{ab}	77.4±1.3^{a}	77.7±1.9^{a}	72.5±2.3^{b}	6.0	0.00*
NTPP(count)	16.0±1.9^{b}	21.1±2.2^{a}	20.3±1.9^{ab}	21.1±1.2^{b}	25.1±1.3^{a}	35.0	0.00*
LSR	0.98±0.01^{b}	1.14±0.05^{a}	1.13±0.05^{a}	1.01±0.05^{b}	1.11±0.07^{a}	8.9	0.12
DMY(t/ha)	9.6±0.3^{b}	11.2±0.5^{a}	11.7±0.4^{a}	11.3±0.5^{a}	10.6±0.6^{b}	21.7	0.02*
DM %	88.7±0.4^{b}	89.9±0.3^{a}	90.1±0.2^{a}	90.1±0.2^{a}	89.2±0.4^{b}	0.8	0.48
CP%	9.9±0.2	10.4±0.3	10.5±0.3	9.8±0.3^{b}	10.6±0.2^{a}	6.2	0.28
ADF%	29.6±0.4	28.9±0.3	29.5±0.7	30.1±0.4^{a}	28.5±0.3^{b}	2.5	0.93
NDF%	61.7±0.7	61.6±0.7	62.1±0.9	60.1±0.8^{b}	62.6±0.5^{a}	2.1	0.22
ASH%	1.54±0.04^{b}	1.69±0.02^{a}	1.65±0.04^{a}	1.51±0.12	1.61±0.11	13.1	0.00*

Different superscripts within a parameter and between factors are significantly different ($p<0.05$), SEM=Standard error mean, CV= coefficient of variation, PH=plant height, NTPP=Number of tillers per plant, LSR=Leaf to stem ration, DMY=Dry matter yield, CP=Crude protein, ADF=Adid detergent fiber, NDF=Neutral detergent fiber, ASH=Ash.

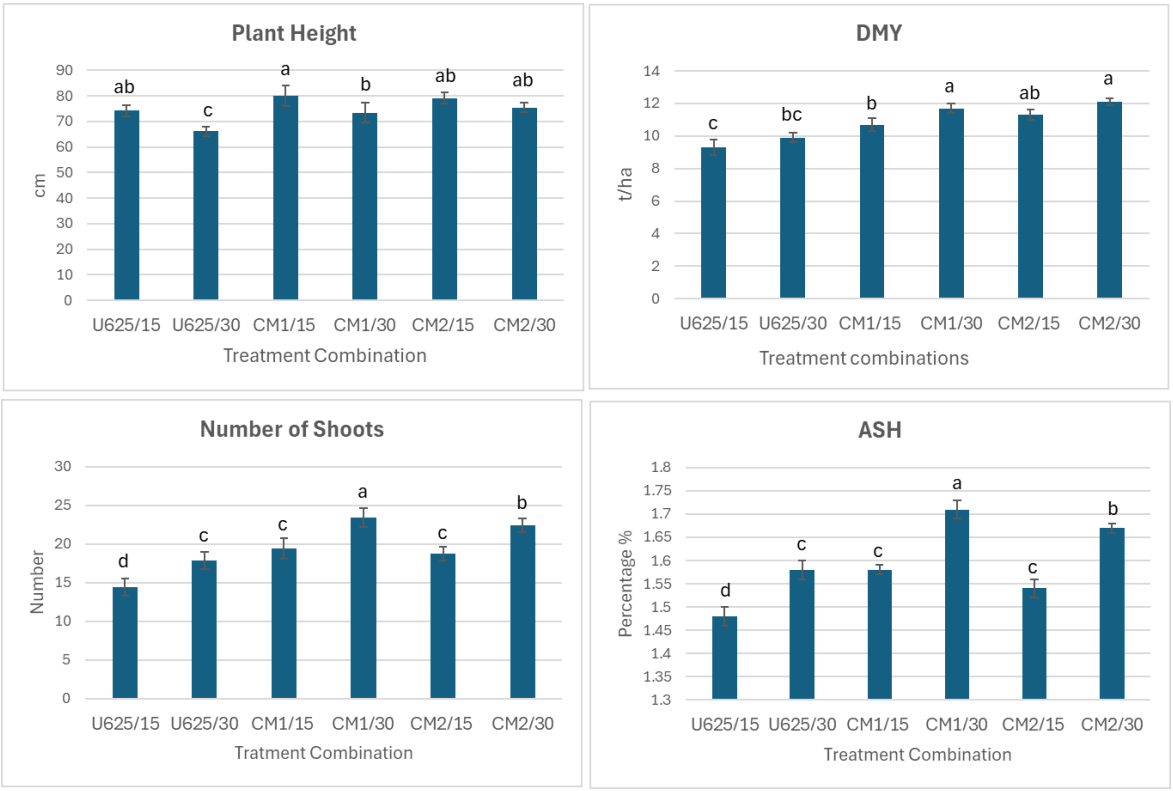

Figure 01: Interaction effects of fertilizer type and plant spacing on Plant Height, Dry Matter Yield (DMY), Number of shoots and Ash content of Mulato II forage grass [1]

[1] U625 - fertilizer mixture (control); CM1 - Commercial mixture 1; CM2 – Commercial mixture 02; 15 - 50 cm × 15 cm spacing; 30 - 50 cm × 15 cm spacing.

Dry matter yield also showed a significant interaction ($p < 0.05$), with values ranging from 9.6 t/ha (U625) to 11.7 t/ha (CM2). The highest yield was recorded in the CM2 × 30 × 50 cm treatment, suggesting that nutrient-rich organic amendments combined with wider spacing optimize biomass partitioning. The overall yield range observed (9.6–11.7 t/ha) is comparable to findings in Kenya (8–12 t/ha; Nguku, 2016) and Brazil (10–13 t/ha; Tadesse *et al*., 2021), demonstrating that Mulato II performs reliably under tropical dry-zone conditions. Enhanced yields under CM1 and CM2 treatments can be attributed to improved nitrogen availability, which plays a central role in chlorophyll synthesis and leaf area expansion. Collectively, the morphological responses confirm that optimized spacing and fertilization significantly enhance growth vigour and forage yield, consistent with international studies on tropical forage grasses.

Chemical Composition (CP, ADF, NDF, DM%, ASH)

Dry matter percentage remained highly stable across treatments (CV 0.8%), ranging from 88.7–90.1%, and showed no significant interaction effects. These values fall within the expected range for mature *Brachiaria* hybrid Mulato II and indicate good conservation potential due to moderate structural development. Crude protein levels varied between 9.8% (narrow spacing) and 10.6% (30 × 50 cm), with fertilizer types producing slight improvements under CM1 and CM2. Although differences were not statistically significant, all values exceeded the minimum threshold required to sustain rumen microbial activity (>9%). These results are consistent with the CP range of 9–12% reported for Mulato II in Kenya (Nguku, 2016), confirming its suitability for dairy feeding under Sri Lankan conditions.

Fiber fractions were similarly unaffected by the interaction treatments, with ADF values ranging between 28.5–30.1% and NDF values between 60.1–62.6%. The slightly lower ADF observed at wider spacing indicates improved digestibility, while the higher NDF at 30 × 50 cm reflects greater structural biomass associated with taller plants. These values align with globally reported ranges for Mulato II ADF (28–34%) and NDF (58–65%) and reflect optimal fiber characteristics for ruminant feeding, particularly at vegetative to early reproductive harvest stages (Tadesse *et al*., 2021).

Ash content exhibited a significant fertilizer × spacing interaction ($p < 0.05$), with CM1 and CM2 recording higher ash levels (1.65–1.69%) compared to U625. This trend suggests enhanced mineral uptake under organic amendments, consistent with the documented nutrient acquisition efficiency of *Brachiaria* hybrids. The ash values reported here correspond well with international findings (1.5–2.0%) from Kenya and Brazil, further confirming that the mineral composition of Mulato II grown in Sri Lanka is within globally acceptable thresholds.

Correlation among morphological characteristics and chemical composition of *Brachiaria* hybrid Mulato II grass

The simple linear correlation analyses among morphological characteristics and chemical composition of *Brachiaria* hybrid Mulato II grass are presented in Table 2. Dry matter yield is positively correlated with plant height, number of tillers per plant, crude protein, ash, and neutral detergent fiber with each other, but negatively correlated with acid detergent fiber. Crude protein content is positively correlated with plant height and neutral detergent fiber while negatively correlated with acid detergent fiber. Acid detergent fiber negatively correlated with neutral detergent fiber, crude protein, and plant height while neutral detergent fiber showed a positive correlation with plant height, dry matter, and crude protein content. The pre-

sent study is the first documented evaluation of *Brachiaria* hybrid Mulato II in Sri Lanka and therefore provides baseline information on its growth performance and nutritional composition under dry-zone agro-ecological conditions. The mean values of key growth traits including PH, DMY, NTPP, and CP were comparatively lower than those reported in earlier studies conducted in the lowlands of Northwest Ethiopia (Yiberkew *et al*., 2020). Such variation is expected because environmental factors including soil type, soil fertility status, temperature regimes, rainfall distribution, and management practices strongly influence the morphological and chemical attributes of tropical forage grasses.

In the Sri Lankan forage context, hybrid Napier varieties (CO-3, CO-4), Clone-13 Napier, Guinea grass (*Panicum maximum*; VRI-435, TD-58, Hamil) and several *Brachiaria* species are commonly used to meet the roughage requirements of dairy cattle (Seresinhe, 2008). The current study demonstrates that Mulato II can produce an average DMY of 10.8 t/ha per harvest under good management. Given its approximately four-month cutting interval, the projected annual yield is 30–40 t/ha/year, placing Mulato II within the yield range of high-performing fodder grasses already cultivated in Sri Lanka. This annual productivity is higher than most Guinea grass cultivars (10–15 t/ha/year) and comparable to *Brachiaria* species (8–15 t/ha/year), although it remains slightly lower than Napier hybrids, which typically produce 30–60 t/ha/year under optimal conditions (Seresinhe, 2008). It should be noted that the current study reports the first harvest from seedling-established plants, and *Brachiaria* hybrids are known to exhibit higher productivity in subsequent harvests once root systems are fully established. Therefore, total annual yield potential in Sri Lanka may be even greater than the current projections.

Comparisons with historical Sri Lankan data further validate Mulato II's strong performance. Perera *et al*. (1990) reported pre-flowering DMY values of 1.24–1.55 t/ha for *P. maximum* cultivars, 7.88 t/ha for *B. brizantha*, and 7.18 t/ha for *S. sphacelata*, all of which fall below the DMY observed for Mulato II in the present study. Similarly, CP content in earlier research ranged from 8.17–19.17% in *P. maximum*, 7.29–12.25% in *B. brizantha*, and 5.35–15.65% in *S. sphacelata*. In comparison, the present study recorded a mean CP of 10.2%, placing Mulato II comfortably within the optimal protein range reported for tropical forage grasses. This reinforces the suitability of Mulato II as a medium-protein fodder capable of meeting maintenance and moderate production requirements in dairy cattle.

Importantly, the findings of Yiberkew *et al*. (2020) confirm that Mulato II performs exceptionally well in tropical and sub-tropical climates with mean annual temperatures of 30–32 °C and rainfall between 1000–1200 mm. These environmental parameters closely resemble the dry zone conditions of Sri Lanka, especially in the Hambantota and Monaragala districts where fodder cultivation is expanding. The current results therefore demonstrate that Mulato II has substantial potential to thrive and contribute to Sri Lanka's fodder demand, particularly in regions characterized by water scarcity and high temperatures. This is consistent with Sri Lankan fodder development priorities, which emphasize drought-tolerant, high-biomass grasses (Houwers *et al*., Sri Lanka Fodder Study, 2015) Overall, this pioneering Sri Lankan study confirms that *Brachiaria* hybrid Mulato II is a highly promising fodder option, capable of producing competitive yields while maintaining good nutritional quality. The species shows strong adaptability to local dry-zone environments and performs within internationally reported ranges. Considering its high annual yield potential, moderate CP content, acceptable fiber fractions, and favor-

able leaf-to-stem ratio, Mulato II can be recommended as a viable alternative or complementary grass to existing improved fodder species. Future studies should evaluate its multi-cut performance, seasonal variability, animal feeding responses, and long-term persistence under Sri Lankan field conditions to strengthen its adoption in national dairy production systems.

Table 2. Correlation analysis of morphological parameters and chemical composition of *Brachiaria* hybrid Mulato II

	PH	*NTPP*	*LSR*	*DMY*	*DM%*	*CP*	*ADF*	*NDF*	*ASH*
PH	1								
NTPP	0.17	1							
LSR	0.52	0.90	1						
DMY	0.91	0.33	0.67	1					
DM%	0.94	0.17	0.57	0.92	1				
CP	0.84	-0.35	0.05	0.73	0.81	1			
ADF	-0.68	0.18	-0.15	-0.70	-0.68	-0.86	1		
NDF	0.72	-0.32	0.09	0.77	0.79	0.88	-0.71	1	
ASH	0.64	0.86	0.97	0.73	0.61	0.17	-0.27	0.13	1

PH=plant height, NTPP=Number of tillers per plant, LSR=Leaf to stem ration, DMY=Dry matter yield, CP=Crude protein, ADF=Adid detergent fiber, NDF=Neutral detergent fiber, ASH=Ash.

CONCLUSION

This study confirms that *Brachiaria* hybrid Mulato II performs well under dry-zone conditions in Sri Lanka. Commercial fertilizer mixtures (CM1 and CM2) produced higher plant height, tiller number, leaf-to-stem ratio, ash content, and dry matter yield compared to U625, while ADF, NDF, and CP remained unaffected by fertilizer type. Spacing significantly influenced all traits except ash: close spacing (15 × 30 cm) improved DMY and height, whereas wider spacing (30 × 50 cm) enhanced tillering, LSR, CP, and NDF, indicating better forage quality. Significant interaction effects for PH, NTPP, DMY and ASH highlight the importance of optimizing both fertilizer and spacing. Overall, Mulato II is highly suitable for dry-zone cultivation, offering good yield and stable nutritional quality with commercial fertilizer mixtures and appropriate spacing management.

ABBREVIATIONS

PH Plant height
LSR Leaf to stem ratio
NTPP Number of tillers per plant
DMY Dry matter yield
CP Crude protein
ADF Acid detergent fiber
NDF Neutral detergent fiber

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