Establishment and Early Growth of Improved Brachiaria Cultivars in Different Agro-Ecological Zones of Kenya

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Establishment and early growth of improved Brachiaria cultivars in different agro-ecological zones of Kenya

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Introduction

Livestock feed scarcity is a salient feature in East Africa (Njarui *et al*., 2011) and it is a major constraint to livestock productivity particularly during the dry seasons. The recent interest in livestock development in Kenya fueled by rising demands of animal products has led to research in identifying drought tolerant, productive and persistence forages to support livestock productivity. Brachiaria grasses have shown a great potential in South America and Australia as livestock feed. It is the most widely cultivated forage in tropical America, with estimated acreage of 99 million hectares in Brazil alone (Jank *et al*., 2014), supporting a highly vibrant beef industry. Although the Brachiaria genus is native to East and Central Africa, its potential as livestock feed has not been exploited in the region because of limited research on its benefits. Several Brachiaria cultivars selected and improved in South America were introduced in East Africa and are being assessed for their contribution to livestock feed base in Kenya and Rwanda. This paper reports on preliminary results on establishment and early growth of eight Brachiaria cultivars under different climatic and soils in Kenya.

Materials and Methods

Site: The experiment is being conducted at Mtwapa (coastal lowlands), Katumani (mid-altitude eastern region) and Ol joro Orok (central highlands) in Kenya. The elevation ranges from about 15 to 2400 m above sea level, with mean annual rainfall of 700-1300 mm (Table 1). All the sites experience bimodal rainfall, with a long rainy season from March to May and a short rainy season from October to December.

Table 1: Location, elevation, temperature, rainfall and soils at experimental sites

Description	Sites		
	Mtwapa	**Katumani**	**Ol joro Orok**
Latitude	3° 56'S	1° 35'S	0° 04'S
Longitude	39° 44'E	37° 14'E	36° 06'E
Altitude (masl)	15	1600	2400
Mean temperature (°C)	26.0	19.6	13.9
Annual rainfall (mm)	1200	710	988
Soil type	Sandy roam	Chromic luvisols	Luvisols
Agro-ecological zone*	CL3	LM4	UH2-3
*CL=Coastal lowland, LM=Lower Midlands, UH=Upper Midlands			

Treatments and design: Eight Brachiaria cultivars (*Brachiaria brizantha* cvs. Marandu, MG4, Piatã and Xaraes, *B. decumbens* cv. Basilisk, *B. humidicola* cvs. Humidicola and Llanero, and *B. hybrid* cv. Mulato II) are being evaluated. Rhodes grass (*Chloris gayana* cv. KAT R3) and Napier (*Pennisetum purpureum* cv. Kakamega 1) were included as controls.

The design of the experiment was randomized complete block with three replications. The plot sizes are 4 m by 5 m with 1 m between plots and replications. The land was ploughed and harrowed to a fine tilth followed by hand sowing of the seeds in furrows of about 2 cm depth at inter-row spacing of 50 cm in November 2013. A seed rate of 5 kg/ha was used for all the grasses except Napier. For Napier, a single root split was planted per hole dug at 30 cm depth at 1 x 1 m spacing. Triple super phosphate (TSP) fertilizer was applied during planting at a rate of 40 kg P/ha. The plots are hand weeded as necessary.

Data collection and statistical analysis: The data recorded included; number of plant, tiller numbers, plant height and spread at every 4 weeks and dry matter (DM) determination at end of establishment phase (16 weeks after seedling emergence). Plant numbers, spread, height, tillers and plot cover were measured using procedure described by Njarui and Wandera (2004). The data on plant numbers, spread and height was analyzed using analysis of variance procedure of SAS (SAS, 1991).

Results and Discussion

Only the results at 16 weeks after seedling emergence are reported. The cv. Humidicola was excluded from the results due to poor seedling emergence. There were significant (P<0.05) interaction between grasses cultivars and sites for plant numbers, spread and height. The highest plant numbers were recorded at Katumani and lowest at Ol joro Orok. Basilisk and MG4 attained the highest number at Katumani (>25 plants/m^2) while Mulato II and Xaraes had the lowest plant numbers at Ol joro Orok (<9 plants/m^2) (Table 2). Generally the grasses were tallest and attained greatest spread at Mtwapa, and were shortest and had lowest spread at Ol joro Orok. Llanero attained the greatest spread at Katumani (147 cm) and spread more than the other grasses including the controls, Rhodes and Napier grasses in all the sites (Table 2). The hybrid Mulato II and cvs. Piata and Xaraes were the tallest at Mtwapa although they were shorter (P<0.05) than both controls (Table 3). The fast growth at Mtwapa was attributed to relatively high temperature while the slow growth at Ol joro Orok was due low temperature for the Brachiaria. The high spread for Llanero was attributed to its prostrate growth habit compared with the other erect grasses.

Table 2: Plant numbers and spread of Brachiaria grass cultivars across three locations at 16 weeks after seedling emergence

	Plant number/m^2			**Plant spread (cm)**		
Grasses	**Katumani**	**Mtwapa**	**Ol joro Orok**	**Katumani**	**Mtwapa**	**Ol joro Orok**
Brachiaria decumbens cv. Basilisk	26.0	14.8	10.0	60.4	77.8	83.6
B. humidicola cv. Llanero	-	-	-	146.9	72.9	67.8
B. brizantha cv. Marandu	16.5	11.8	10.3	49.7	67.8	35.4
B. brizantha cv. MG4	27.3	20.8	10.8	58.6	61.9	57.2
B. hybrid cv. Mulato II	19.5	9.5	7.8	40.7	61.7	20.8
B. brizantha cv. Piata	8.3	16.5	10.0	56.4	67.5	37.2
B. brizantha cv. Xaraes	11.8	13.0	8.8	47.4	61.9	33.4
Chloris gayana cv. KAT R3	22.5	29.0	12.0	60.0	105.2	111.8
Pennisetum purpureum cv. Kakamega I	-	-	-	72.2	34.6	84.9
LSD (P <0.05)		17.5			24.0	

Table 3: Plant height of *Brachiaria* grass cultivars across three locations at 16 weeks of seedling emergence

Grasses	**Katumani**	**Mtwapa**	**Ol joro Orok**
	Plant height (cm)		
Brachiaria decumbens cv. Basilisk	35.6	53.0	22.3
B. humidicola cv. Llanero	6.0	46.0	4.7
B. brizantha cv. Marandu	13.2	48.7	7.2
B. brizantha cv. MG4	63.4	57.7	25.2
B. hybrid cv. Mulato II	14.2	71.9	4.0
B. brizantha cv. Piata	29.8	65.5	8.2
B. brizantha cv. Xaraes	24.9	67.0	6.6
Chloris gayana cv. KAT R3	52.2	107.4	67.5
Pennisetum purpureum cv. Kakamega 1	103.8	73.5	103.3
LSD (P <0.05)		22.0	

There were significant (P<0.05) interaction between grasses and sites for the DM yield. Generally, DM yields were highest at Mtwapa with most of the Brachiaria cultivars attaining over 6 t/ha. Xaraes had the highest yield (9.6 t/ha) at Mtwapa and out yielded Llanero and the controls (Figure 1). At Katumani all the Brachiaria cultivars yielded less than 5 t/ha of DM. At Ol joro Orok, only Basilisk and Xaraes attained over 8 t/ha, the rest had less than 5 t/ha but they all produced less yield than the controls at that site. The high DM yield at Mtwapa was attributed to higher rainfall than in the other sites.

The correlation between DM yield and plant growth attributes is given in Table 4. Highly significant correlation was observed between plant spread and DM yield (r=0.251; *P*<0.01), between plot cover and DM yield (r=0.548; *P*<0.01) and between plant height and DM yield (r=0.536; *P*<0.01). This means that as spread, height and cover increased, DM yield also increased.

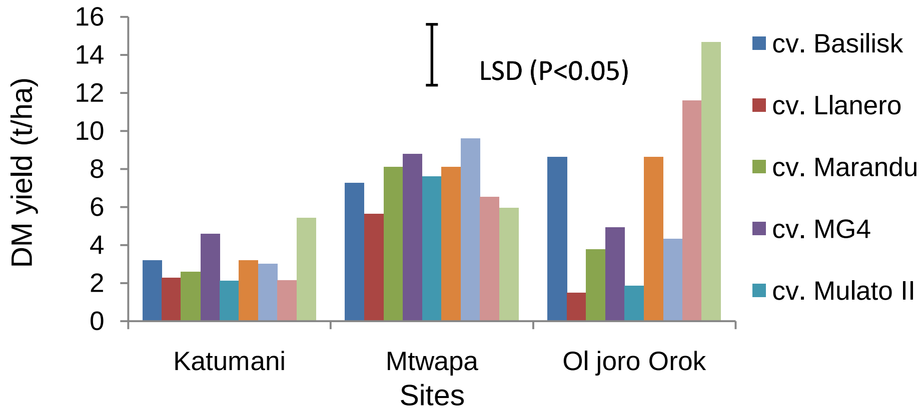

Fig. 1: Dry matter yield of Brachiaria cultivars across three locations at 16 week after seedling emergence

Table 4: Correlation between herbage dry matter yield and plant growth attributes of Brachiaria grass cultivars

	DM yield	Plant population	Plant spread	Tiller numbers	Plot cover	Plant height
DM yield	1					
Plant population	-0.0493	1				
Spread	0.2506**	0.1468	1			
Tiller numbers	0.1328	0.3537**	0.1573	1		
Plot cover	0.5483**	0.3783**	0.3803**	-0.1104	1	
Plant height	0.5364**	0.4144**	0.2957*	-0.1948	0.5768**	1
Correlation significant at *P*<0.01** and at *P*<0.05*						

Conclusion

There were differences in establishment and growth among Brachiaria cultivars with Xaraes out yielding the controls at Mtwapa. There is need to continue monitoring these grasses for more seasons to ascertain their persistence, productivity and nutritive value.

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