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PRIMARY PRODUCTION VARIABLES OF *Brachiaria* GRASS CULTIVARS IN KENYA DRYLANDS

[VARIABLES DE PRODUCCIÓN PRIMARIA DE CULTIVARES DE PASTO *BRACHIARIA* EN ZONAS ARIDAS DE KENIA]

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SUMMARY

The study was conducted to evaluate the primary production variables of *Brachiaria* grass cultivars in semi arid regions of Eastern Kenya. *Brachiaria* cultivars *B. decumbens* cv. Basilisk, *Brachiaria* hybrid Mulato II, four *Brachiaria brizantha* cultivars Marandu, Xaraes, Piata, MG4 and *Brachiaria humidicola* cv Llanero were assessed with reference to their field establishment and growth rates. *Chloris gayana* cv. KATR3 and *P. pupureum* cv. Kakamega I were included as controls. Plant numbers, heights, spread, plant tiller number and plant cover were monitored for the initial 16 weeks following seedling emergence. A standardization cut was done on all the plots at week 16 and dry matter yields determined. All growth parameters measured varied significantly (p<0.05) among the cultivars. *Chloris gayana* cv. KATR3 recorded the highest plant numbers (48plants/m^2). Llanero recorded highest plant spread (146.9 cm) and tiller number (31tillers/plant). Napier had the highest plant height (103.8cm), cover (94.9%) and average dry matter yields (5430kg /ha). The results demonstrate that *Brachiaria* grasses are capable of establishing themselves in the semi arid regions of Eastern Kenya. It is recommended that the experiment be conducted for a longer period of time to determine their growth capacity during dry spells and pests and diseases that can hinder establishment and production.

Keywords: *Brachiaria*; grass; Livestock production; Climate change; Forages; Establishment.

RESUMEN

El estudio se realizó para evaluar las variables de producción primaria de cultivares de pasto *Brachiaria* en las regiones semiáridas de Kenia Oriental. Los cultivares *B. decumbens* cv. Basilisk, *Brachiaria* híbrido Mulato II, cuatro cultivares de *Brachiaria brizantha* Marandu, Xaraes, Piata, MG4 y *Brachiaria humidicola* cv Llanero fueron evaluados con referencia a su establecimiento de campo y las tasas de crecimiento. *Chloris gayana* cv. KATR3 y *P. pupureum* cv. Kakamega se incluyeron como controles. Número de plantas, altura, propagación, el número de hijos de las plantas y la cubierta vegetal fueron controlados durante los primeros 16 semanas siguientes emergencia de las plántulas. Un corte de normalización se realizó en todas las parcelas en la semana 16 y los rendimientos de materia seca fueron determinados. Todos los parámetros de crecimiento medidos variaron (p <0.05) entre los cultivares. *Chloris gayana* cv. KATR3 registró el número de plantas más altas (48 plantas / m^2). Llanero registró la mayor propagación (146.9 cm) y el número de hijos (31 hijuelos/planta). Napier registró la mayor altura (103.8cm), cobertura (94.9%) y rendimiento de materia seca (5430 kg/ha). Los resultados demuestran que los pastos *Brachiaria* son capaces de establecerse en las regiones semiáridas de Kenia Oriental. Se recomienda que el experimento se lleve a cabo durante un período de tiempo más largo para determinar su capacidad de crecimiento durante los períodos secos y las plagas y enfermedades que pueden obstaculizar la producción y establecimiento.

Palabras clave: *Brachiaria;* pasto; producción ganadera; cambio climático; establecimiento.

INTRODUCTION

Livestock form an important avenue for rural development and provide the bulk of meat consumed in Kenya. One of the most important constraints on livestock production is nutrition, especially during the dry season when forage quality and quantity is low (Orodho, 2007). Grazing systems are most affected by climate change because of their dependence on climatic conditions, their natural resource base and their limited adaptation opportunities (Aydinalp and Cressor, 2008). Climatic impacts are expected to be more severe in arid and semi arid grazing systems at low latitudes where higher temperatures and lower rainfall are expected to reduce yields on rangelands and increase land degradation (Thornton, 2010). Current weather projections for East Africa indicate that temperature will increase between 1.3ºC and 2.1^{0}C depending on climate models by 2050 (Waithaka *et al.*, 2013). The rise in temperature will increase evaporation and cause loss of soil moisture hence increasing the plant moisture requirements (Waithaka *et al.*, 2013). Impacts on livestock production systems include productivity losses due to temperature increase, change in water availability and alteration in fodder quality and quantity. Prolonged droughts often leave many livestock keepers poorer and unsure of reliable livestock feed source. A drought experienced in 2008/9 in the country affected approximately 10 million people; a third of the country's population with massive losses in livestock occurring in the Northern Frontier (Gullet *et al.*, 2011).

Grass is one of the most important sources of nutrients for domesticated ruminants during a large part of the year (Taweel *et al.*, 2005) and is more easily accessible, better in taste and quicker in digestion than shrubs and trees (Quraishi, 1999). Animals do not compete with humans for grasses as food and they are therefore a cheap and economical feed source. According to Herrera (2004), pasture turn out to be an appropriate source of food for ruminants, mainly in countries of tropical climate such as Cuba due to the high number of species that can be used and the possibility of cultivating them throughout the year. The developmental morphology of plants defines their architectural organization, influences their palatability and accessibility to herbivores, and affects their ability to grow following defoliation (Briske, 1986). Tillers increase the chance of survival and the available forage resource of grasses and tiller numbers are an indicator of resource use efficiency by different grass species (Laidlaw, 2005).The weight of a plant's tillers will determine its productivity (Nelson and Zarrough, 1981). Plant cover on the other hand is important because it chokes weeds and also serves to protect the soil from erosion agents. Pasture species which grow fast and tall are more efficient in use of resources and therefore, are more competitive. Such species eventually shade out the other species if planted in mixed stands thereby, suppressing their growth (Opiyo, 2007; Mganga, 2009; Ogillo, 2010).

There is a great potential to improve pastures through breeding by increasing diversity through germplasm introductions to the Kenyan environment to boost the forage resource base for livestock (Orodho, 2007). Forage grasses commonly found growing in the semi arid regions of Kenya include Buffel grass (*Cenchrus ciliaries*), Rhodes grass (*Chloris gayana*), *Panicum maximum*, Masai love grass (*Eragrostis superba*), Horse tail (*Chloris roxbhurgiana*) and *Enteropogon machrostachys* (Orodho, 2007). These grasses' nutritional and yield status decline with changing climatic conditions in the year making them incapable of meeting the needs of livestock (Gitunu *et al.*, 2003). Napier grass which is the most commonly grown fodder grass by dairy farmers has been encountering disease and pest attacks that are rendering it vulnerable (Orodho, 2006). The *Brachiaria* grass spp. is a perennial grass native to East and Central Africa and has been introduced into humid tropical regions of Latin America, Southeast Asia, and northern Australia where it has revolutionized grassland farming and animal production. Whereas their potential in their native land remains largely unexploited, in their adopted homes in South America and Asia, there have been several research and development efforts to improve the productivity, nutritive values and other agronomic characteristics of these grasses (Ndikumana and de Leeuw, 1996).

The study sought to examine the primary production variables of seven *Brachiaria* grass cultivars in Semi arid Kenya. These included four *Brachiaria brizantha* cultivars namely; MG4, Xaraes, Piata and Marandu; *Brachiaria* hybrid cv. Mulato II; *Brachiaria humidicola* cv. Llanero and *Brachiaria decumbens* cv. Basilisk. *Chloris gayana* cv KATR3 and Napier grass (Kakamega I) were grown alongside these cultivars to serve as controls.

MATERIALS AND METHODS

Site

The study was conducted at the KARI (Kenya Agriculture Research Institute) now KALRO (Kenya Agriculture and Livestock Research Organisation (KALRO) Katumani- Machakos, Kenya (10 58´S, 370 28´E). Elevation is 1600m above sea level and the mean temperature is19.60C (Njarui *et al.*, 2003). The soils are Luvisols, low in nitrogen and phosphorus with a PH of 6.5 (Aore and Gitahi, 1991). The mean annual rainfall is 717 mm, with a bimodal pattern, the long rains (LR) occurring from March-May and the short rains (SR) from October-December with two dry seasons (June-September; January-February). During the time of the experiment, the total rainfall recorded was 571 mm. This figure includes rainfall data collected in February and March, 2014. Average temperature ranged between 15.30C -26.20C.

Experimental design and treatment

The experiment was run within the period of October, 2013 at the onset of the short rainy season to March 2014 at the onset of the long rainy season. Site selection and laying of plots was done in October whereas sowing of seed was done on 11th November, 2013. Data collection begun at 4 weeks post seedling emergence and ended at 16 weeks post seedling emergence. *Brachiaria brizantha* cv. Marandu, *B. brizantha* cv. Xaraes, *B. brizantha* cv. Piata, *B. brizantha* cv. MG4, *B. decumbens* cv. Basilisk, *B. humidicola* cv. Llanero, *Brachiaria* hybrid cv. Mulato II, *C.gayana* cv. KATR3 and Napier grass were tested for field establishment, growth and thereafter for dry matter yields. The experimental design was a randomized complete block design with 4 replications. Individual plot sizes were 5m x 4m with a 1m path between plots and 1m path between the blocks. The seeds were drilled in furrows of about 2cm deep on a well prepared seedbed at an inter row spacing of 0.5m, giving 10 rows in each plot. Triple super phosphate (TSP, 46 % P) fertilizer was applied to the soil prior to sowing of the seed at the rate of 50.8kg P/ha in the planting rows. Sowing was done manually by placing the seeds in the furrows and covering them with a thin layer of soil. The grass seed was sown at rates of 5kg/ha. For Napier grass 3 splits were planted at intervals of 1m apart in holes dug 15cm deep after adding TSP at the rates of 50.8kg P/ha. The trials were kept weed free throughout the experiment by hand weeding and slashing inter row spaces to reduce weed competition within the replications. Standardization cuts were carried out in the sixteenth week at the onset of the long rains and dry matter yields established.

Data collection

Plant attributes (Plant height, plant counts, tiller numbers, plot cover and plant spread) were recorded at week 4, 8, 12 and 16 after seedling germination. A standard cut was done at week sixteen at the onset of the long rainy season (March-May) and dry matter yields established.

Plant counts: Number of plants was determined by counting plants in a 1m x 1m fixed quadrat placed over two rows.

Plot cover: Percentage plot cover was established by using a quadrat of 1m x1m subdivided into 25 squares of 0.2m x 0.2m as described by (Njarui and Wandera, 2004). The percent canopy cover of Napier grass was determined using the dot method as described by (Sarrantonio, 1991).

Plant spread: For spread, the plant diameter was measured from one edge to the other of each of 4 randomly selected and tagged plants. This was done using a metre ruler.

Plant height: Plant height was measured on the primary shoot from the soil surface to the base of the top-most leaf using a metre rule as described by (Rayburn and Lozier, 2007).This was done on the same four plants tagged.

Number of tillers: The number of tillers for the same 4 tagged plants was counted and recorded. Total tiller number per tuft on each measurement occasion was defined as the sum of total tiller number at previous measurement and number of tillers formed after previous measurement.

Standardization: The onset of the long rainy season (March-May, 2014) marked the end of the establishment and primary production period. This was at week16 post seedling emergence. After recording plant counts, plant cover, plant height, tiller numbers and plant spread, the grasses were cut to a stubble height of 5cm in a randomly selected area of 4m^2 within the plots as described by (Tarawali *et al.*, 1995). A fresh weight of all the harvested material was recorded after which sub samples of these were weighed and recorded. The sub samples were dried in an oven for 72 hours at temperatures of 65^{0}C after which the dried sample weights were recorded. The oven-dry weights were used to calculate dry matter (DM) yield per plot which was then extrapolated to kg/ha. These oven dried samples included the leaves and stems harvested at 5cm stubble height.

Statistical analyses

Data on agronomic parameters and dry matter yields of forage samples were subjected to ANOVA based on the model designed for a randomized complete block design (RCBD) according to (Gomez and Gomez, 1984).To compare significant differences in response variables, ANOVA analysis was done using SAS package (SAS, 2001). Duncan's Multiple Range Test was carried out for subsequent comparison of means as described by (Steel and Torrie, 1986).

RESULTS

Climatic data

Figure 1 below shows the rainfall data for the site recorded during the period of January 2012–June 2014 presenting 5 rainy seasons: long rains (March–May), short rains (October–December), short dry season (January–February) and long dry season (June–September). Rainfall for the long rains in 2014 is given for 3 months, March– May. During the short rainy season of 2013, maximum rainfall was experienced in the month of December. During the long rainy season of 2014, maximum rains were experienced in March which was also above the Short Term Average (STA). The months of April and May recorded lower rainfall which was also below the short term average. The temperatures in almost all months were similar to the short term average (Fig.2).

Plant population

Changes in plant numbers over time are shown in table 1. Plant population means for all the cultivars were significantly ($p<0.05$) different. At week 16, *Chloris gayana* (Kat R3) recorded highest plant numbers at 48.5plants/m^2. MG4 (27.3 plants/m^2), Mulato II (23.8 plants/m^2), Marandu (20.8plants/m^2) and Basilisk (24 plants/m^2) recorded similar plant population. Plant population for Xaraes (12 plants/m^2), Piata (8.3 plants/m^2) and Llanero (16 plants/m^2) were lowest but similar ($p>0.05$).

Plant spread

Table 2 shows the mean values for spread for the cultivars. Mean plant spread for the cultivars were significantly different ($p<0.05$) and increased progressively from week 4 (4.1 cm) to week 16 (65.8 cm). At week 16 Plant spread for Llanero was highest at 146.9cm and lowest for Mulato II at 40.7cm. Napier (72.2cm) recorded second highest mean plant spread which was similar to mean plant spread for MG4 (58.6cm), Basilisk (60.4cm) and *C.gayana* KATR3 (60cm). Initially at week 4, Marandu showed highest mean spread at 10cm but by week 12 it was among the lowest in spread. Mulato II maintained the lowest mean plant spread throughout this period (2.3 - 40.7cm).

Plant cover

Plot cover generally increased for all the cultivars as shown in Table 3. Cover means were significantly different for the cultivars ($p<0.05$) during this period. All the cultivars except Piata and Xaraes recorded high and similar plot cover at week 16. Only Piata had less than 50% plot cover at week 16.

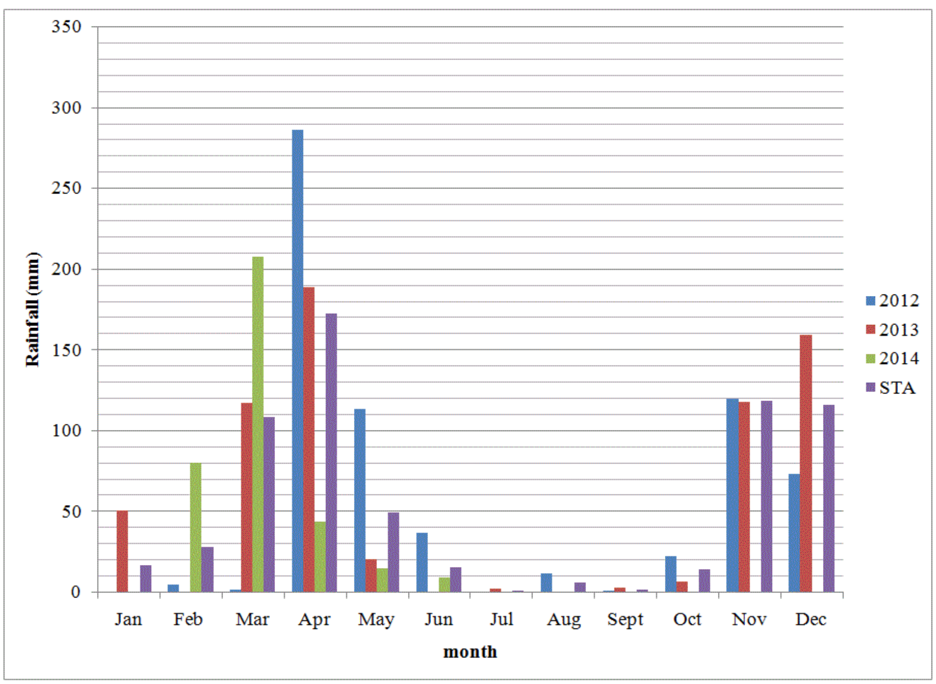

Figure1: Monthly rainfall recorded data at experimental site from January, 2012 to June, 2014

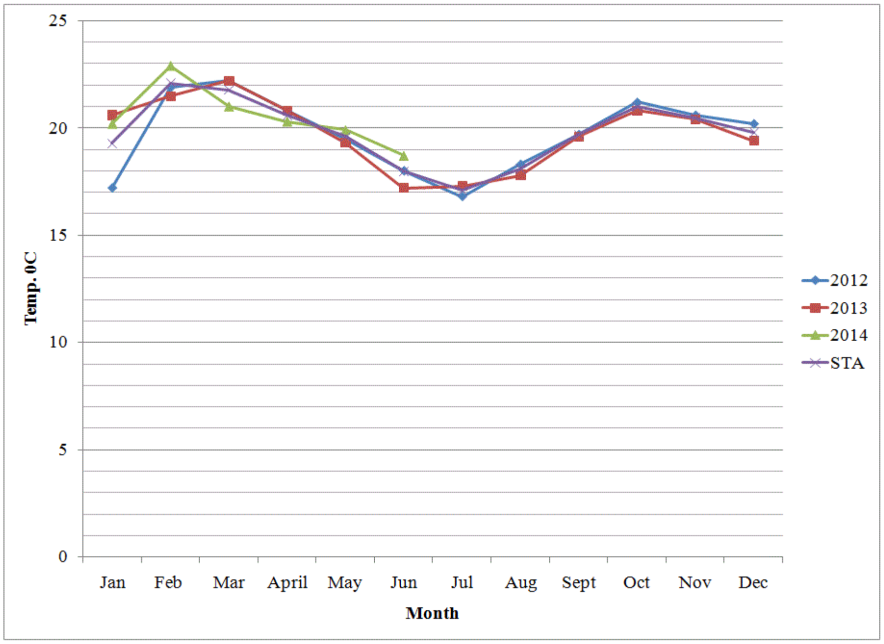

Figure 2: Mean monthly temperature at experimental site from January 2012 to June 2014

Table 1: Mean plant population (plants/ m2) of the grass cultivars during field establishment and growth

Cultivar	Week4	Week 8	Week 12	Week 16
Llanero	14^{bac}	17^{ced}	17^{cbd}	16^{cbd}
MG4	22.3^{a}	27.3^{b}	27.3^{b}	27.3^{b}
Marandu	16.5^{ba}	20.8^{cbd}	21.8^{cb}	20.8^{cb}
Piata	7.3^{c}	8.3^{fe}	8.3^{ed}	8.3^{ed}
Xaraes	10.5^{bc}	11.8^{fed}	12^{ced}	12^{ced}
Mulato II	19.5^{ba}	23.8^{cb}	23.8^{b}	23.8^{b}
Basilisk	18^{ba}	19.5^{cbd}	24.0^{b}	24.0^{b}
Kat R3	22.5^{a}	48.5^{a}	48.5^{a}	48.5^{a}
Napier	-	4^{f}	4^{e}	4^{e}
Mean	16.3	20.1	20.7	20.5
SE	±1.0	±1.0	±1.2	±1.2

Column means with similar superscripts are not significant ($p<0.05$)

Table 2: Mean plant spread (cm) of the grass cultivars during field establishment and growth

Cultivar	Week4	Week 8	Week 12	Week 16
Llanero	3.6^{b}	49.4^{a}	107.7^{a}	146.9^{a}
MG4	4.8^{b}	16.3^{b}	38.1^{cb}	58.6^{cb}
Marandu	10.0^{a}	12.1^{b}	29.2^{cb}	49.7^{cd}
Piata	3.0^{b}	10.0^{b}	31.2^{cb}	56.4^{c}
Xaraes	3.6^{b}	12.1^{b}	29.4^{cb}	47.4^{cd}
Mulato II	2.3^{b}	9.8^{b}	24.5^{c}	40.7^{d}
Basilisk	3.2^{b}	10.1^{b}	36.6^{cb}	60.4^{cb}
Kat R3	2.3^{b}	13.5^{b}	34.7^{cb}	60.0^{cb}
Napier	-	16.3^{b}	47.1^{b}	72.2^{b}
Mean	4.1	16.6	42.1	65.8
SEM	±0.6	±0.8	±2.1	±1.5

Column means with the same superscript are not significantly different ($p<0.05$).

Table 3: Mean Plant cover (%) of the grass cultivars during field establishment and growth

Cultivar	Week4	Week 8	Week 12	Week 16
Llanero	8.0^{bc}	25.0^{bac}	71.5^{a}	81.0^{ba}
MG4	13.0^{a}	32.0^{ba}	51.3^{ba}	74.0^{ba}
Marandu	10.0^{ba}	19.0^{bac}	47.0^{bc}	74.0^{ba}
Piata	5.0^{bc}	16.0^{c}	34.0^{bc}	49.0^{c}
Xaraes	8.0^{bc}	25.0^{bac}	39.0^{bc}	62.0^{bc}
Mulato II	8.0^{bc}	18.0^{bc}	45.0^{bc}	70.0^{ba}
Basilisk	13.0^{a}	33.0^{a}	31.0^{bc}	71.0^{ba}
Kat R3	9.0^{b}	13.0^{c}	44.0^{bc}	69.0^{ba}
Napier	-	15.8^{c}	24.5^{c}	84.9^{a}
Mean	9.3	21.9	43.0	70.5
SEM	±0.4	±1.5	±2.6	±2.0

Column means with the same superscript are not significantly different ($p<0.05$)

Plant tiller number

Mean tiller number increased progressively for all cultivars and there were significant differences among the cultivars ($p<0.05$) as shown in Table 4. The *Brachiaria* spp recorded generally higher tiller numbers than both *C.gayana* and Napier throughout the growth period. Mean tiller numbers were highest for Marandu, MG4 and Basilisk at week 4. At week 16, Llanero (30.5tillers/plant) recorded highest tiller numbers but Marandu (16.8 tillers/plant) was among the lowest in tiller recruitment. MG4 (24.5tillers/plant), Piata (25.5tillers/plant), Xaraes (25.5tillers/plant), Mulato II (23.8tillers/plant) and Basilisk (20.5tillers/plant) also recorded high and similar tiller numbers with Llanero at week 16.

Plant height

Mean plant heights for the cultivars generally increased and were significantly different ($p<0.05$) throughout the growth period as shown in Table 5 below. At week 16, Napier recorded the highest mean plant heights (103.8cm) and Llanero lowest at 6cm. Among the *Brachiaria* cultivars MG4 (63.4cm) recorded higher plant heights and although second after Napier (103.8cm), it's height was not significantly different ($p>0.05$) from *C.gayana* cv. Kat R3 (52.8cm).

Dry matter yields

Figure 3 shows the dry matter yields of the cultivars at week 16. Dry matter yields at week 16 represented primary production There were significant differences ($p<0.05$) between the cultivars for dry matter yields. Napier (5430KgDM/ha) recorded highest dry matter yields followed by MG4 (4583.4 Kg DM/Ha) and Mulato II (4050.2 Kg DM/Ha). The lowest yields were recorded for Llanero at 2282 Kg DM/Ha though this value was similar to that of *C.gayana* KATR3 (2741 Kg DM/Ha), Marandu (2596 Kg DM/Ha) and Xaraes (2335 Kg DM/Ha).

Table 4: Mean plant tiller number of the grass cultivars during field establishment and growth

Cultivar	Week4	Week 8	Week 12	Week 16
Llanero	3.5^{b}	9.5^{ba}	16.5^{ba}	30.5^{a}
MG4	4.8^{a}	12.3^{a}	16.8^{a}	24.5^{ba}
Marandu	4.8^{a}	8.0^{bc}	11.8^{bc}	16.8^{bc}
Piata	2.0^{c}	5.5^{c}	12.8^{bac}	25.5^{ba}
Xaraes	3.3^{b}	9.3^{ba}	14.3^{ba}	25.5^{ba}
Mulato II	3.2^{b}	8.5^{bc}	14.8^{ba}	23.8^{ba}
Basilisk	4.0^{ba}	7.8^{bc}	12.3^{bac}	20.5^{bac}
Kat R3	3.4^{b}	6.8^{bc}	11.8^{bc}	17.8^{bc}
Napier	-	8.0^{bc}	8.3^{c}	10.6^{c}
Mean	3.6	8.4	13.2	21.7
SEM	±0.1	±0.4	±0.5	±1.2

Column means with the same superscript are not significantly different ($p<0.05$).

Table 5: Mean Height (cm) of the grass cultivars during field establishment and growth

Cultivar	Week4	Week 8	Week 12	Week 16
Llanero	2.3[c]	3.3[b]	3.9[d]	6.0[f]
MG4	5.0[a]	4.5[b]	37.3[b]	63.4[b]
Marandu	4[ba]	3.4[b]	10.2[dc]	20.4[de]
Piata	2.9[bc]	3.3[b]	14.6[c]	29.8[dc]
Xaraes	3.9[ba]	4.3[b]	12.6[dc]	24.9[dce]
Mulato II	2.1[c]	3.0[b]	7.9[dc]	14.3[fe]
Basilisk	4.6[a]	3.7[b]	12.8[c]	34.9[c]
Kat R3	2[c]	2.3[b]	7.3[dc]	52.8[b]
Napier	-	44.4[a]	67.3[a]	103.8[a]
Mean	3.3	8.0	19.3	38.9
SEM	±0.1	±0.4	±0.9	±1.4

Column means with the same superscript are not significantly different ($p<0.05$).

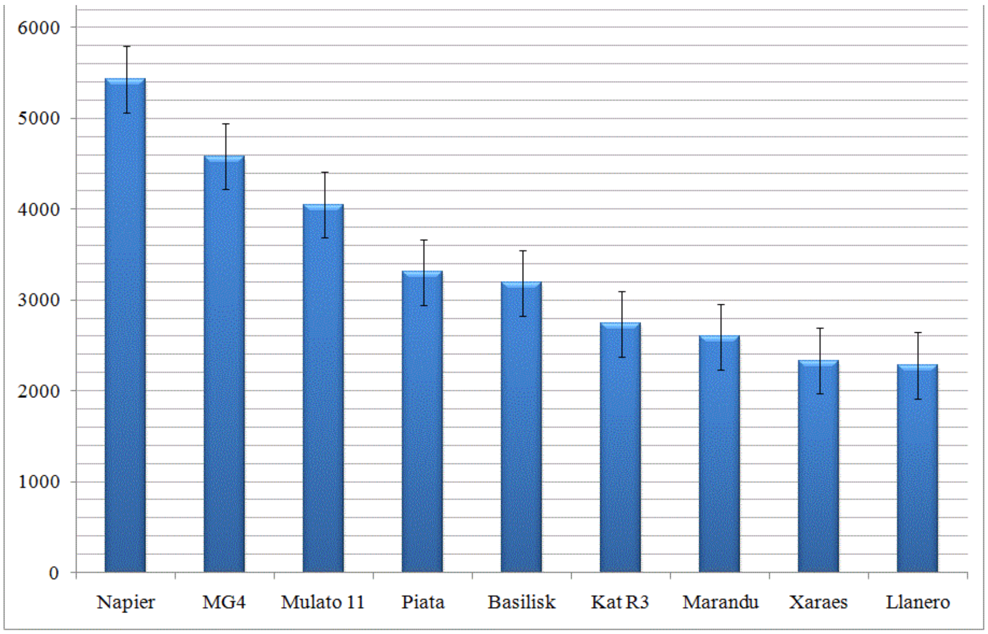

Figure 3: Dry matter yields in Kg/ha at primary production

DISCUSSION

The study demonstrated considerable variation in establishment of the grass cultivars. The differences in plant population can be attributed to species differences in seed germination rates, seedling establishment and survival. Plant numbers were highest for *C. gayana* KATR3. According to (Cook *et al.*, 2005), *Chloris gayana* is likely to have the greatest number of seed (7 250 000 to 9 500 000 per kg of seed). This explains the higher plant counts for *C.gayana* as compared to the other cultivars. Seed proportion of *C.gayana* has been shown to have a significant effect on agronomic traits (Yisehak, 2008). Higher plant populations for *Brachiaria brizantha* cultivars MG4 and Marandu, can be explained by their higher germination percentages and accompanying seedling vigour (Nguku, 2015).

Vegetative growth (height, spread and tiller number) generally increased for all the cultivars and can be attributed to the morphological and physiological differences among the cultivars. The rapid spread of the cultivars indicates that they can play an important role in quick soil stabilization for erosion control and can be utilized in the stabilization of terrace banks in semi-arid areas. Plant spread can be attributed to individual growth habits of the cultivars. *Brachiaria humidicola* is a strongly stoloniferous and rhizomatous perennial grass, forming a dense ground cover and *B. decumbens* has good ground cover, aggressive growth and decumbent habit as reported by ook *et al* (2005). Napier being a fodder crop and gigantic in nature would naturally out do the other grasses when it comes to spread. Cook *et al* (2005) further report that the ability of *C .gayana* to spread is because it produces stolons which creep over the ground, developing roots at the nodes and that Marandu has some allelopathic effect which even reduces seedling recruitment of its own seed. This can explain the initial high spread of Marandu and the decreased vigour in this attribute relative to other cultivars by week 16.

MG4 and Napier were taller than the other plants and also produced high dry matter yields at week 16. Studies by Tessema *et al* (2003) concur that increasing foliage height in Napier grass increased biomass yield. *Chloris gayana* KATR3 on the other hand has a higher proportion of stem relative to leaf by week sixteen which could be the reason for lower dry matter yields. The vertical growth habit of Napier, MG4 and *C. gayana* cv. KATR3 explain why they are tallest by week 16 relative to other cultivars. (Opiyo, 2007; Mganga, 2009 and Ogilo, 2010) report that, pasture species which grow fast and tall are more efficient in use of resources and therefore, are more competitive. Such species eventually shade out the other species if planted in mixed stands thereby, suppressing their growth. *Brachiaria humidicola* cv. Llanero's decumbent habit explains why it is the shortest at week 16.

All cultivars but Piata attained over 50% plant cover by week 16. The high plant cover for both *B. brizantha* and *B. decumbens* cultivars could be attributed to their growth habits. *Brachiaria brizantha* is more tufted in terms of growth habit and *Brachiaria decumbens* more decumbent and this makes them form a dense plant cover (Cook *et al.,* 2005). Mulato II on the other hand produces vigorous cylindrical stems, some with a semi-prostrate habit capable of forming roots at the nodes when they come into contact with the soil (Vendramini *et al.,* 2011) making them attain high plot cover (70%). Studies in Honduras indicate that Mulato II establishes rapidly, and was able to achieve 85% ground cover at 2 months (Cook *et al.,* 2005). Cook *et al* (2005) further report that Llanero has a strongly stoloniferous growth habit and this causes it to have good ground cover. Napier on the other hand is a tall, tufted, rhizomatous perennial, very coarse and robust, in dense clumps. Its giant nature naturally makes it occupy a larger area relative to the other grasses hence the higher plot cover (Bogdan, 1977). *Chloris gayana* is a tufted perennial that also has a stoloniferous growth habit making it have a high plot cover. It produces stolons which creep over the ground, rooting at the nodes, and also produces abundant seed to give rise to new plants (Cook *et al.,* 2005).

Llanero, MG4, Mulato II, Piata, Basilisk and Xaraes had higher tillering ability than the rest of the cultivars. This is an indication of the ability of the cultivars to recover faster after defoliation. Hiernaux *et al* (1994) found that plant tillering early in the life of the stand compensated for low plant density that resulted from drought or intense grazing. Marandu was not able to maintain a high tiller recruitment which could be attributed to allelopathic effect exhibited by the cultivar (Cook *et al.,* 2005). Cook *et al* (2005) further reports that tillering in Llanero can be attributed to its growth habit. According to Halim *et al* (2013) taller varieties of Napier tend to have fewer tillers but produce higher DM yields compared with shorter varieties which recruit higher tiller numbers and have higher nutritive values.

There were differences in dry matter yields among the grasses which can be attributed to their genotypic and phenotypic differences. Despite low plant numbers in some cultivars all the grasses persisted during the duration of study. On the basis of dry matter yield the best is Napier grass whereas the most promising among the *Brachiaria* cultivars is MG4. Napier out yielded the other grasses confirming studies by Humphreys (1994) and Skerman and Riveros (1990) of its potential for high dry matter yields relative to other tropical grasses. Herbage yield of Napier grass may however be affected by the harvesting day after planting. Generally, as grass ages, herbage yield is increased due to the rapid increase in the tissues of the plant (Minson, 1990). Mulato II was second to MG4 among the *Brachiaria* grass cultivar in dry matter yields. Dry matter yields for Mulato II can be largely attributed to its large size leaves (15-2" long) and thick stems (1-1.5" width) (Guiot and Meléndez, 2003). Mean primary dry matter yields for *C. gayana* though low were found to be similar to *Brachiaria* cultivars Piata and Basilisk which ranked third and fourth respectively in primary production. Although Marandu had high establishment rates this did not parallel its dry matter yields at primary production as reported by studies by Rao *et al* (1998) of rapid establishment accompanied by high DM production.

A longer period of study is recommended for evaluation of the *Brachiaria* cultivars for age at senescence and subsequent productivity.

CONCLUSION

The grass cultivars depended solely on the short rains with no irrigation water added. All the species established and persisted for the duration of the study.

Although *C. gayana* KATR3 is superior in terms of plant population and Napier grass superior in plant cover and height, the *Brachiaria* species perform better in terms of spread, plant cover, plant tiller number and even height and The *Brachiaria* species performed better in plant attributes like spread (Llanero), plant cover (MG4, Xaraes, Llanero) and tiller recruitment (MG4 and Xaraes). Napier and MG4 are both tall varieties and also produced comparatively higher dry matter yields compared to the other cultivars demonstrating their potential to utilize available plant resources. The tillering and spreading ability of Llanero is an added advantage for soil cover and protection as well as being an animal feed. This is also true for all the *Brachiaria* cultivars in this study.

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