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Evaluation of Bracharia Grass Genotypes at Mechara Research Station, West Hararghe Zone, Eastern Oromia, Ethiopia

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ABSTRACT

This experiment was undertaken at Mechara Agricultural Research center on- station for two consecutives of (2016-2017) cropping years. The aim of the study was to evaluate performance of Bracharial genotypes/lines and select best adaptable, higher herbage yield and forage potentiality in study area. Four Bracharia grass genotypes were evaluated in Randomized Complete Block Design (RCBD) with three replications and analyzed d with General Linear Model (GLM) procedure of SAS version 9.0. The results revealed that percentage of regeneration capacity, plant height and dry matter yield showed statistically significance difference ($p<0.05$) among genotypes. In contrast, the percentage of plot coverage, stand vigor, leaf to steam ratio and biomass yield did not show statistically significance difference ($p>0.05$) among the genotypes considered in the study. Based on the result, the highest mean value of dry matter yield was recorded from Brachiariamutica Dzf No 18659 (Dzf 483) (15.84t/ha) followed by Brachiaria decumbence Dzf No 194 (14.84 t/ha) genotypes. Variations in dry matter yield production across the genotypes could be attributed to differences in growth rate and growth habit, which are mediated through the genotypic and phenotypic differences. Numerically the highest least square mean value of fresh biomass yield was produced from Brachiariamulat (45.8 t/ha) which was followed by Brachiariamutica 6964 Dzf No 484 (40.51 t/ha) genotypes. Based on these agronomic results obtained during experiment conducted Brachiariamutica Dzf No 18659 (Dzf 483) and Brachiaria decumbence Dzf No 194genotypes were well adapted, performed and had superior fresh biomass and nutritional yield under Mechara condition. These selected Bracharia grass genotypes should be further demonstrated and scaled-up at Mechara on-farm condition and similar agro-ecologies of Hararghe areas.

Keywords: Bracharia grass, Dry matter yield, Hararghe, Genotypes, Leaf to stem ratio

Abbreviations: RCBD: Randomized Complete Block Design; GLM: General Linear Model; McARC: Mechara Agricultural Research center

INTRODUCTION

Livestock production is one of the most important agricultural land use systems in the world [1]. However, climate change is a threat to livestock production because of the impact on quality of feed crop and forage, water availability, livestock diseases, animal reproduction and biodiversity degradation. Similarly, in Ethiopia livestock production has been mainly constrained by inadequate supply and poor quality of available feed resources [2]. This feed shortage is leads to low production and productivity of livestock products [3,4]. Therefore, to improve production and productivity of the sector focusing on enhancing quality and quantity of animal feed is mandatory [5]. Nowadays, the most important livestock feed resource in Ethiopia are natural pasture, crop residues and grass hay. Natural pasture and crop residues provide the bulk livestock feed in Ethiopia are seasonally produced during only for particular months [1].

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Brachiaria grass has promising potential tropical forage of African origin with desirable attributes of agricultural and environmental significance to fill gap [6]. It is good palatable, nutritious and biomass forage that will support vibrant dairy and beef cattle industries while simultaneously reducing the carbon footprint of livestock production that increase milk and meat production, drought tolerant, adapted to low soil fertility, climate change, significant role in soil fertility improvement, soil conservation, increasing bio-diversity and minimizing greenhouse gas emissions and contribution to carbon sequestration [7,8]. The preliminary milk production data has shown a 15 to 40% increase in milk production in Kenya and an average increase of 36% in Rwanda though feeding Bracharia [6].

In West Hararghe zone, low access to improved forage grasses, poor extension services on livestock forages and feed scarcity are the major constraints in livestock production. Despite of this, best practice of livestock fattening (oxen and goat) and dairy cattle production are the major livestock production systems found in the area. The farmers are used industrial by product, crop residues, local grasses, and natural pasture to feed their livestock in the area. The experiences of cut and carry system is the major feeding system in the area due to absence of grazing land and land shortage in the area. The local grasses found from school, religious institutions, and communal government lands through purchasing by their own money.

The indigenous knowledge of farmers in the area observed that different types of forage grasses especially Napier grass are sow/plant on soil bunds, around their home and in uncultivated side of their farmlands. An indigenous knowledge is a base for scientific research in technology evaluations. Brachiaria grass is one of the different candidate forages that have multidimensional function in the farming systems of the tropics, including Ethiopia [1]. An undoubtedly climate change and variability threaten the present is a major challenge to livestock feed availability and livelihood in arid and semi-arid environment [8].

Hence, introducing/adapting Brachiaria grasses can help increase soil carbon stocks that would mitigate the adverse effects of climate change and have greater economic returns for beef and dairy cattle producers. It is possible that the different varieties will perform differently in different ecological zones, but information of this kind grass is lacking in Eastern Oromia. Therefore, this study was aimed to evaluate performance of Bracharial genotypes and select best adaptable, higher herbage yield and nutritive value among four genotypes in study area.

MATERIALS & METHODS

Description of study area

The study was conducted at Mechara Agricultural Research Center (McARC) for two years (2016 and 2017) during cropping seasons. Mechara Agricultural Research Center found at 40˚19' latitude and 08˚35' E longitude with an altitude of 1,700 m above sea level. It is located at 434 km to East of Addis Ababa in Daro Labu District, West Hararghe zone of Oromia National Regional State, and Eastern Ethiopian. The major soil texture of the center is sandy loam with reddish color and soil type is nitisol and pH are 6.7-7. The ambient temperature of the district (center) ranges from 14 to 26°C with the average of 20°C with average annual rainfall of 1094 mm/year **(Figure 1)**.

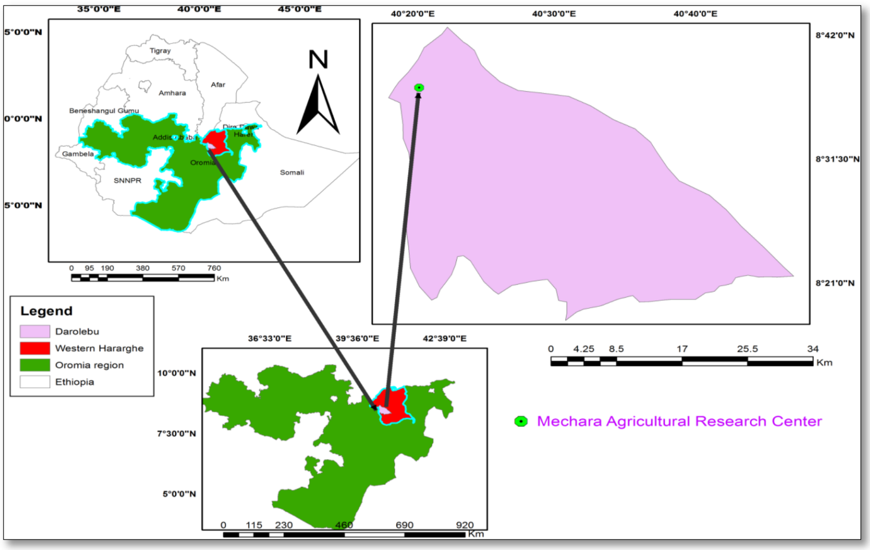

Figure 1. Map of study area.

Source: Own computational GIS data

EXPERIMENTAL MATERIAL AND DESIGN

The experiment was conducted at 2016 and 2017 cropping season. Four Bracharia grass genotypes (Brachiariamutica Dzf No 18659 (Dzf 483)), Brachiaria decumbence Dzf No 194, Brachiariamutica 6964 Dzf No 484, and Brachiariamulat) roots were brought from Ethiopian Institute of Agricultural Research, Debrezeite Agricultural Research Center (DZAC) and evaluate dat Mechara Agricultural Research Center (McARC) in randomized complete block design (RCBD)with three replications.The prepared experimental land was dividedinto three blockswhich totallycontain about 12plots with each plot size area 13.5m^2. The Bracharia genotypes brought from DZAC were spitted on 3 m length m x 4.5 m width within space between rows; plots and replication were 40 cm, 50 cm and 75 cm, respectively. Inorganic fertilizer of 100kg/ha of NPS and 50Kg/ha of urea were applied during the establishment.

EXPERIMENTAL MANAGEMENT

A total area of 232.5 m^2 was prepared for this experiment. The experimental land was plowed in February and harrowed in June, 2017. Planting materials of Brachiaria grass genotypes were collect from Debrezeite Agricultural Research Center, Bishoftu, Ethiopia were planted using vegetative root splits in rows. The spacing between rows and plants were 40 and 15 cm, respectively. Land preparation, plant splitting, weeding and harvesting were done according to the recommendations made by [9]. DAP and urea fertilizer were applied at planting and after establishment, respectively by the rate of 100 and 50 kg per ha for establishment and 25 kg/ha for maintenance. Weeding and related management practices were applied according to the grass's requirements.

DATA COLLECTION

The collected data for the trail included regeneration percentage, plot cover, stand vigor, leaf to stem ratio, herbage yield and dry matter yield was collected. Drying the samples for evaluate dry matter yield were measured in an oven at 105°C overnight.

STATISTICAL ANALYSIS

All data was analyzed with General Linear Model (GLM) procedure of SAS version 9.0 for least Square analysis of variance. The mean separation was carried out using least significance difference (LSD) test at 5% probability level. The statistical model for the analysis data was:

$Y_{ijk} = \mu + A_j + B_i + e_{ijk}$

Where;

Yijk= response of variable under examination
μ = overall mean
Aj = the jth factor effect of treatment/ lines
Bi = the ith factor effect of block/ replication
eijk = the random error

RESULTS & DISCUSSION

Performance of Bracharia grass genotype

The performances of Bracharia grass genotype were shown in **Table 1**. The result indicated that the tested genotypes were varied significantly (p<0.05) on regeneration percentages. The highest regeneration percentages were recorded from *Brachiaria mutica* Dzf No 18659 (Dzf 483) (100%) followed by Brachiariamutica 6964 Dzf No 484 (98.33%) genotypes. In contrast,the lowest regeneration percentage was recorded from Brachiariamulat grass (93.3%).

The result of plot cover was indicated significance difference (P≤0.05) among Bracharia grass genotypes. This result indicated that the potential adaptability and productivity of genotypes were different. The rapidly and highly potential of plot cover were recorded from *Brachiaria mutica* 6964 Dzf No 484 (93.33%) and Brachiaria decumbence Dzf No 194 (93.33%) genotypes. This result is good indication for adaptability Bracharia grass with soil, water and environment of study area. Clara [10] reported that ground cover is an important attribute of any vegetation, especially in relation to soil and water conservation support this study. It is also an important parameter in restoration of degraded areas, where moisture is the main limiting factor.

The result was indicated that the tested genotypes highly varied significantly (p <0.0) on plant height. The highest plant height was recorded from Brachiaria Mutica 6964 Dzf No 484 (157.33cm) genotype whereas, the lowest plant height was recorded from Brachiaria Decumbence Dzf No 194 (132.67cm) genotypes. This result is higher than Clara [10] who reported that 91 cm height for Bracharia hybrid (Mulat II) in Kenya and 50 -70 cm in Northern Ethiopian [1]. However, this result is comparable with Duncan [11] who report that CIAT 679 Bracharia ecotypes were recorded 154.4 cm and Amorim [12] describes that plant of *B. brizantha*cv. Xaraes can grow up to a height of 1.50 m.

The analysis of variance for leaf to stem ration in this study was not indicated statistically significance difference (p>0.05) among genotypes. However, the least square mean values of leaf to stem ratio was indicated numerically difference among genotypes. The highest leaf to stem ratio was recorded from Brachiaria decumbence Dzf No 194 (0.65) genotype and the lowest value was recorded from Brachiariamulat (0.5). However, this result higher than Aldava [13] who reports the eaf to stem ratio for *Brachiaria brizantha* is 0.4 in Mexico.

The fresh biomass yield (t/ha) result among genotypes were not shown statistically significance difference (p>0.05) however, numerically recorded difference value among genotypes. Numerically the highest least square mean value was recorded from *Brachiaria mulato* (45.8 t/ha) which is followed by *Brachiaria mutica* 6964 Dzf No 484 (40.51 t/ha) genotypes. This much yield of fresh biomass production used

Table 1. Agronomic performance of Bracharia genotypes at Mechara on station.

Treatment	R %	PC%	SV %	PH (cm)	LSR	BM (t/ha)	DMY(t/ha)
Brachiaria mutica Dzf No 18659 (Dzf 483)	100	90.89	2	151[ab]	0.51	32.33	14.84[ab]
Brachiaria Decumbens Dzf No 194	95.33bc	93.33	1.67	132.67[bc]	0.65	40.51	10.16[b]
Brachiaria mutica 6964 Dzf No 484	98.33ab	93.33	1.67	157.33[a]	0.52	30.55	15.84[a]
Brachiaria mulato	93.33c	87.22	2	116.33[c]	0.5	45.8	14.77[ab]
Mean	96.25	91.31	1.83	139.33	0.55	37.3	13.9
CV %	2	8.15	59.61	7.64	22.86	25.12	12.14
LSD	3.2	12.88	2.18	21.26	0.25	18.72	2.92
R^2	0.99	0.72	0.07	0.85	0.34	0.48	0.79

R%=Regeneration percentage, PC%=Plot coverage percentage, SV%=Stand vigor, PH (cm)=Plant height in cent meter, LSR=Leaf to stem ratio, BM (t/ha) =Biomass tone per hector, DMY (t/ha) =Dry matter Yield tone per hector

as a discriminator of drought tolerant and unsusceptible genotypes for disease and adaptability to the area.

The analysis of variance shown there were shown statistically significance difference ($p < 0.05$) on dry matter yield (t/ha) between genotypes. Variations in dry matter yield production across the genotypes can be attributed to differences in growth rate and growth habit, which are mediated through the genotypic and phenotypic differences. The highest mean value of dry matter yield was recorded BrachiariamuticaDzf No 18659 (Dzf 483) (15.84 t/ha) form followed by Brachiaria decumbence Dzf No 194 (14.84 t/ha) genotypes. This result is lower than Wassie [1] who report that37.75 t/ha from Eth. 13809 Bracharia cultivars in Northern Ethiopia.

Performance of four Bracharia grass genotypes during first and second year

Regeneration capacity (%): Regeneration capacities during first and second harvesting year of four Bracharia grass genotypes were shown on **(Figure 2)**. The result in figure indicated that the first and second harvesting had similar regeneration performance. This indicates that establishing Bracharia grass trough root splinting resulted rapidly and well regeneration even equal within regeneration from cutting cycle.

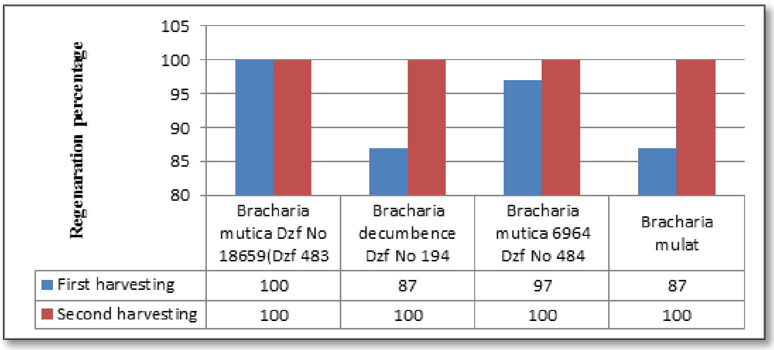

Figure 2. Regeneration (%) of Bracharia grass genotypes.

Plot cover percentage: Plot cover (%) during first and second harvesting of four Bracharia grass genotypes are shown on **(Figure 3)**. The result in the figure indicatedthat the first and second harvesting year had approximate similar plot coverage. Establishing, Bracharia grass trough root splinting had rapidly regeneration and covers the plot at limited stage of life span. During the second harvesting yearall genotypes covered all plot of land and develop tiller over plot of land.

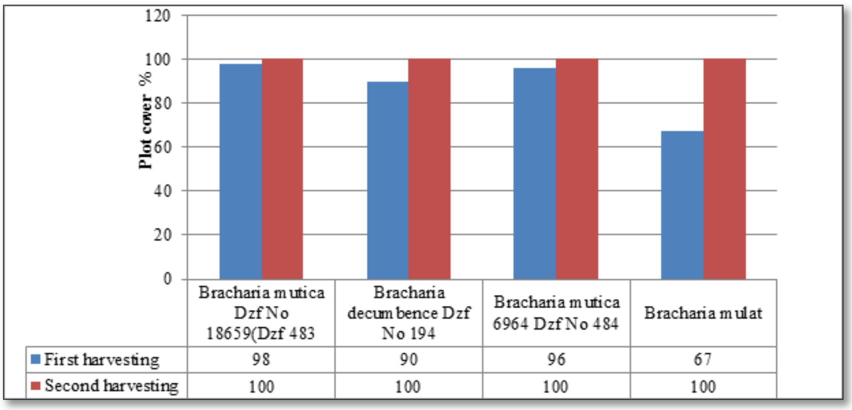

Figure 3. Plot cover (% of Bracharia grass genotypes).

Plant height (cm): Plant height (cm) during first and second harvesting dates of four Bracharia grass was shown on **Figure 4**. According to figure indicated, the second harvesting had higher plant height than first. This was happened due to the behavior of crop were rapidly growing before half lifetime. During the second (157 and 151 cm) and first (141 and 109 cm) plant height was produced from the lines Brachiariamutica6964 Dzf No 484 and BrachiariamuticaDzf No 18659 (Dzf 483), respectively.

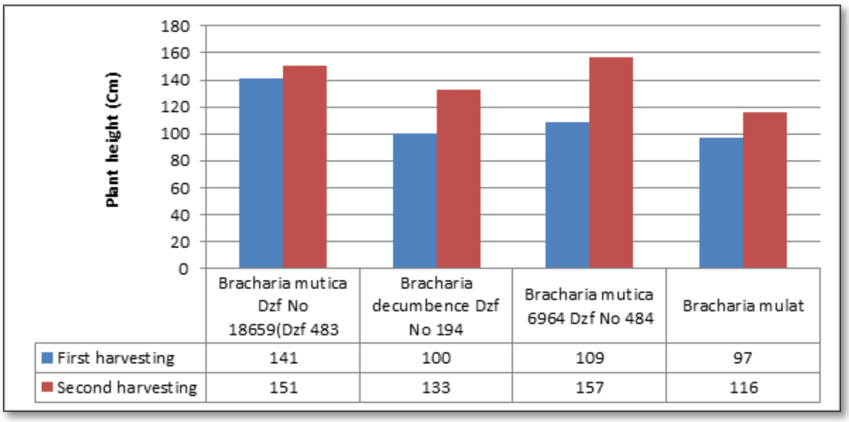

Figure 4. Plant height (cm) of Bracharia grass genotypes.

Biomass yield (t/ha)

The average of biomass (herbage) yield in first and second harvesting were shown in **Figure 5**. The greater biomass yield (t/ha) was produced at the second harvesting cycle than first cycle. This result was obtained due to tiller number increased up to optimum growth of plant tissue, however gradually the morphological performance is decreases. The finding was supported by Genet who reported the mean tiller number per plant of Desho grass.

CONCLUSIONS AND RECOMMENDATIONS

Brachiaria grass has promising potential tropical forage of African origin with desirable attributes good palatable and nutritious that will support vibrant dairy and beef cattle industries. In West Hararghe zone, low access to improved forage grasses, poor extension services on livestock forages, and feed scarcity are the major constraints in livestock production. This study was aimed to evaluate performance of Bracharial genotypes and select best adaptable, higher herbage yield among four genotypes. Planting materials of Brachiaria genotypes of *Brachiaria mutica* Dzf No 18659 (Dzf 483), *Brachiaria decumbens* Dzf No 194, *Brachiaria mutica* 6964 Dzf No 484 and *Brachiaria mulato* were used. The result revealed that percentage of regeneration capacity; plant height and dry matter yield were affected by genotypes. In contrast, percentage of plot coverage, stand vigor, leaf to steam ration and greenbiomass yield werenot affected by genotypes. The highest mean value of dry matter yield was recorded form *Brachiaria decumbens* Dzf No 194 followed by *Brachiaria mutica* Dzf No 18659 (Dzf 483) genotypes. Thus, among the tested genotype grasses *Brachiaria decumben*s Dzf No 194 followed by *Brachiaria mutica* Dzf No 18659 (Dzf 483) showed outstanding potential as a forage plant in study area and similar agro-ecologies.

Based on this conclusion the following recommendation was forwarded.

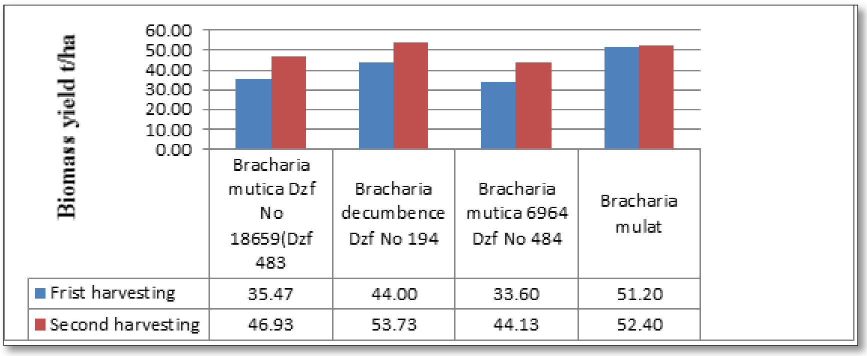

Figure 5. Biomass yield (t/ha) of Bracharia grass genotypes.

1. Selected Bracharia grass genotypes should be further demonstrated and scaled-up at Mechara on-farm condition and similar agro-ecologies of Hararghe areas.
2. Investigate chemical composition difference among genotypes in the study area.
3. Test the lines at different agro ecology of west Hararghe.

CONFLICT OF INTERESTS

The authors declared that there is no conflict of interest between authors and organization.

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REFERENCES

1. Wubetie W, Wassie WA, Berhanu AT, Asaminew TW, Bimrew AL (2017) Evaluation of morphological characteristics, yield and nutritive value of Brachiaria grass ecotypes in northwestern Ethiopia. J Agric Food Secur 7: 89.
2. Gelayenew B, Nurfeta A, Assefa G, Asebe G (2016) Assessment of livestock feed resources in the farming systems of mixed and shifting cultivation, Gambella Regional State, Southwestern Ethiopia. Glob J Sci Front Res 16: 1.
3. Abdi E, Kemal K, Yassin E, Muleta D (2013) Cattle production in west hararghe: An opportunity and constraints assessments in Darolabu, Odabultum, Gemechis and Chiro Districts, Oromia Regional State, Ethiopia. Inter J Livestock Prod Res 1: 01-15.
4. Fekede G, Kinde L, Tadesse M, Birmaduma G, Shimalis D, et al. (2016) Effect of climate change on agricultural production and community response in daro lebu & mieso district, west hararghe zone, Oromia Region National State, Ethiopia. J Nat Sci Res 6: 24.
5. Eyob E, Zewudu A (2016) Review on live animal and meat export marketing system in Ethiopia: Challenges and opportunities. Scient Innov Res J 5: 59-64.
6. Ghimire S, Njarui D, Mutimura M, Cardoso J, Johnson L, et al. (2013) Climate-smart Brachiaria for improving livestock production in East Africa: Emerging opportunities. Proceedings of 23rd International Grassland Congress 2015-Keynote Lectures.
7. Djikeng AJ, Rao IM, Njarui D, Mutimura M, Caradus J, et al. (2014) Climate-smart Brachiaria grasses for improving livestock production in East Africa. Trop Grasslands-Forrajes Tropicales 2: 38-39.
8. Hidosa D, Guyo M (2017) Climate change effects on livestock feed resources: A Review. J Fish Livestock Prod: 4-5.
9. Nguku S, Musimba N, Njarui D, Mwobobia R, Kaind E (2016). Effects of acid scarification on germination of the genus Brachiaria grass Cultivars. Int J Sci Res Innov Technol 3: 45-50.
10. Clara M (2013) Comparative study of the productivity of brachiaria hybrid Cv. Mulato II and Native Pasture Species in Semi-Arid Rangelands of Kenya. Msc. Thesis in University of Nairobi, Kenya.
11. Duncan C, Charles AOM, Johnnie VB, John AP, Zeyaur R K (2018) Genotypic responses of Brachiaria grass (Brachiaria spp.) Accessions to Drought Stress. J Agron 17: 136-146.
12. Amorim M (2014) Physiological responses of seeds of Brachiaria brizanthacv. MG 5 to humic acid treatment. Universidade Estadualdo Norte Fluminense Darcy Ribeiro, Brazil.

13. Aldava NJ, Casanova LF, Díaz EVF, Escobedo CA, Estrada MH, et al. (2017) Influence of Leucaenaleucocephala (Lam.) de Wit (Fabaceae) on the forage yield and forage quality of tropical grasses Brachiariabrizantha (Hochst. ex A. Rich.) Stapfand Panicum maximum Jacq. (Poaceae). Inter J Agric Sci 8: 133-137.