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Evaluation of Bracharia grass Cultivars for their Agronomic Performance in Midland Areas of East Guji Zone, Southern Oromia, Ethiopia.

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Abstract

The study was conducted with the objective to identify adaptability, high survive rate and dry matter yielder of Bracharia grass. Four Bracharia grass Brachiaria mutica Dzf No 18659 (Dzf 483), Brachiaria Decum bens Dzf No 194, Brachiaria mutica 6964 (Dzf No 484) and Bracharia mulato were evaluated in randomized complete block design (RCBD) with three replications. The result revealed that plot cover, fresh biomass, dry matter yield and plant height were highly significantly (P<0.001) differ among the treatments. The highest value of plant height (170 cm) was measured from *Brachiaria mutica* 6964 Dzf No 484 cultivar flowed by (160 cm) *Brachiaria mutica* Dzf No 18659 (Dzf 483) cultivar, while the shortest (90 cm) plant height was recorded from Decumbens Dzf No 194 cultivar. The highest dry matter yield (11.95t/ha) was obtain from Brachiaria mutica 69 64 Dzf No 484 cultivar, followed by (11.82t/ha) Brachiaria mutica Dzf No 18659 (Dzf 483 cultivar. The highest survi ve rate (95.5%) was measured from Brachiaria mutica Dzf No 18659 (Dzf 483) cultivar, followed by (87%) *Brachiaria mutica* 6964 Dzf No 484) cultivars. The result implies that *Brachiaria mutica* Dzf No 18659 (Dzf 483) an d *Brachiaria mutica* 6964 (Dzf No 484) were well performed in agronomic parameters. Thus it could be possible to conclude that the Bracharia grass should be recommended for improving the constraint of feed shortage in midland agro ecologies of Guji zone and similar areas.

Keywords: Bracharia, Midland, Cultivars, Agronomic performance

1. Introduction

Livestock production is an integral part of the farming systems in all parts of Ethiopia. The sector has a share of 12-16% of the total Gross Domestic Product (GDP) and 30-35% of agricultural GDP (Ayele *et al*, 2002).

It contributes to the livelihoods of 60-70% of the Ethiopian population. Moreover, it ensures the availability of food, creates jobs, transportation and income to the farming community, serve as a source of agriculturalinputs such as draft power and organic fertilizer as a direct contribution for crop production (Ayele *et al*, 2002).

One of the reasons for low productivity of the livestock sector in Ethiopia is shortage of feed and low quality of available feeds, particularly in the dry seasons. Low adoption and promotion of cultivated forages (Tolera *et al*, 2019).

Bracharia grass is one of the most important tropical grasses distributed throughout the tropics especially in Africa (Renvoize *et al*., 1996).

Bracharia plays important roles in soil erosion control and ecological restoration. Brachiaria species have been important component of sown pastures in humid low lands and savannas of tropical America with current estimated acreage of 99 million hectare in Brazil alone (Jank*et al*., 2014).

*Bracharia*as a forage grass has been used in crop pasture intergraded systems where the grass seed is over sown on maize crop planted earlier favoring the production of high quality forage in the off season (Maia *et al*.,2014).

The accompanying advantages include reduced degradation of pastures, improved chemical, biological and physical properties of the soil and yield potential of grain forage and silage (Silva *et al*, 2010).It has high biomass production potential and produces nutritious herbage thus increase livestock productivity **(**Holmann *et al*., 2 004).Brachiaria is adapted to drought and low fert ility soils, sequesters carbon through its large roots system, enhance nitrogen use efficiency and subsequently minimize eutrophication and greenhouse gas emissions (Subbarao *et al*., 2009; Arango *et al*., 2014; Moreta *et al*., 2014; Rao *et al*., 2014).

Brachiaria grasses are productive warm-season perennial grasses with superior nutritive value to other warm-season grasses (Vendramini *et al.*, 2014), and can be used for grazing (Inyang *et al*., 2010a) or harvested and conserved for feeding when needed (Vendramini *et al*., 2010).

Adaptation of Bracharia grass is improve feed and nutrition security, income and livelihood of smallholder farmers in region through improved livestock productivity.

In East Guji zone, low access to improved forage grasses, poor extension services on livestock forages and feed scarcity are the major constraints in livestock production. The farmers are used crop residues, local grasses, and natural pasture to feed their livestock in the area. To improve availability of livestock feed in terms of quantity and quality, it is better to cultivate Bracharia grass forage that have better dry matter yield and nutritional quality. Therefore, this study was aimed to evaluate performance of Bracharia grass cultivars and select best adaptable, higher herbage yield among four cultivars under midland areas of Guji zone.

2. Materials and Methods

2.1. Description of the study area

The experiment was carried out at Adola sub-site of Bore Agricultural Research Center, Adola district, Guji Zone southern Oromia. Adola district is located around at a distance of 470 km from Addis Ababa and 120 Km from the zonal capital city, Negele Borena. It is an area where mixed farming and Sami- nomadic economic activity takes place, which is the major livelihood of the local people. The total area of the district is 1254.56km^2. The district is situated at 5o44'10" - 6o12'38" N latitudes and 38o45'10" - 39o12'37" E longitudes. The district is characterized by three agro- climatic zones, namely highland 11%, mid-land 29% and low-land 60% respectively. The major soil type of the district is tools (red basaltic soils) and orthic Acrosols.

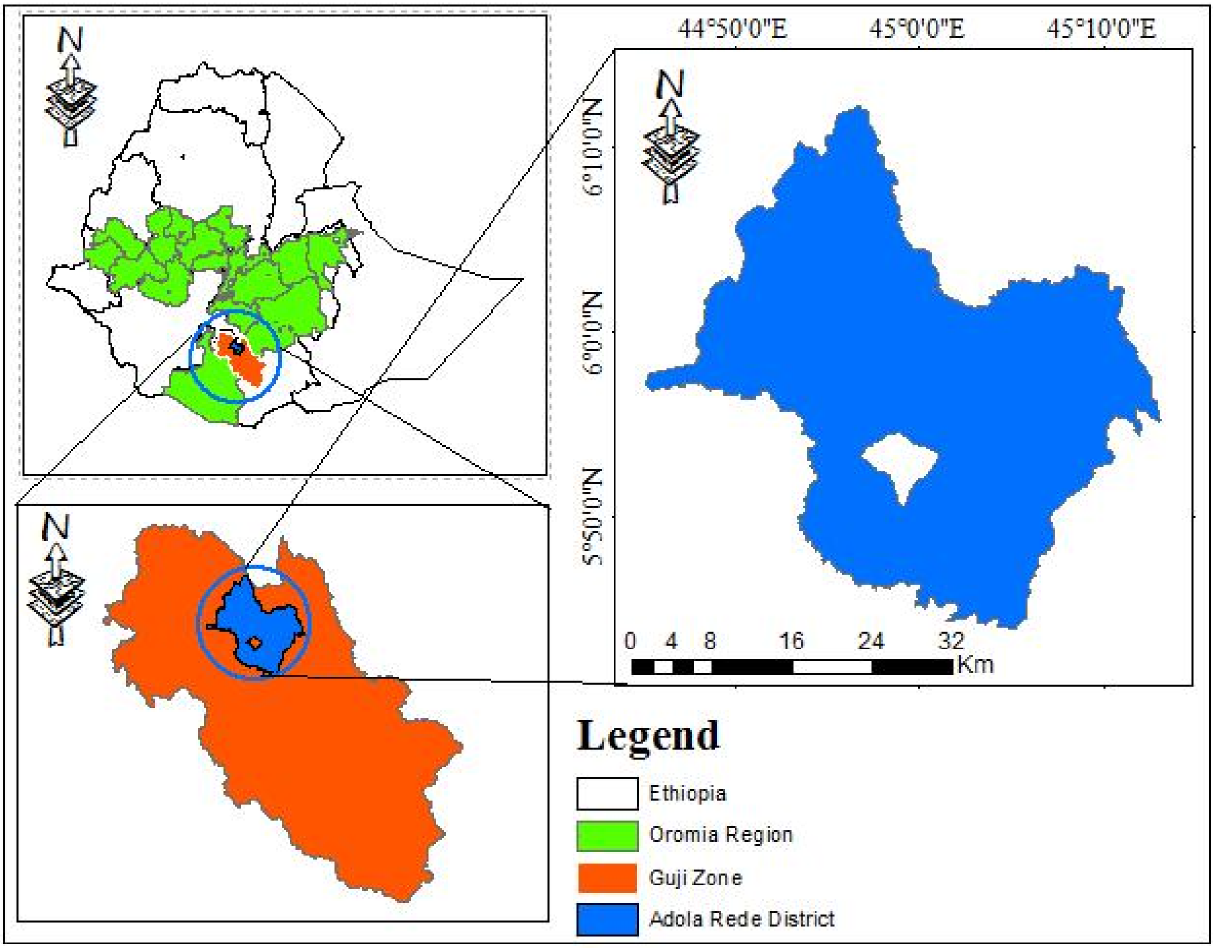

Figure 1. Map of study area.
Source: Own computational GIS data.

2.2. Experimental treatments and design

The experiment was conducted at Bore Agricultural Research center during 2019 and 2020 cropping season. Four Bracharia grass cultivars (Brachiaria mutica Dzf No 18659 (Dzf 483)), Brachiaria decumbence Dzf No 194, Brachiaria mutica 6964 Dzf No 484, and Bracharia mulato) roots were brought from Ethiopian Institute of Agricultural Research, Debrezeite Agricultural Research Center (DZAC) and Oromia Agricultural Research, Mechara Agricultural Research Center (McARC) in randomized complete block design (RCBD)with three replications. The prepared experimental land was divided into three blocks which totally contain about 12plots with each plot size area 7.5m^2. The Bracharia cultivar were spitted on plot size 2.5m length m x 3m width within space between rows and plants were 50 cm, 20cm and 1mbetween plots and replication respectively. Inorganic fertilizer of 100kg/ha of NPS and 50Kg/ha of urea were applied during the establishment.

2.3. Data collection

All data on morphological parameters and dry matter yield of forage were like plants height, fresh biomass, dry matter yield, leaf to steam ratio, survive rate, plot cover and vigor were recorded.

Plant survival rate was calculated as the ratio of the number of alive plants per plot to the total number of plants planted per plot and then multiplied by 100.

Plant height: Plant height was measured on the primary bud from the soil surface to the base of the top-most leaf using a meter designated by (Rayburn *et al*., 2007). It was based on five plants was randomly selected in each plot, measured using a steel tape from the ground level to the highest leaf. For determination of biomass yield, genotypes were cutting at 5-10cm from the ground level from two central rows.

*Dry matter yield (*DMY*):* After harvesting the middle four rows, the total biomass yield was determined using sensetive balance from each plot at each harvesting date. The dry matter yield (DMY) was determined at the end of every harvesting day. Based on fresh biomass yield from the sample area of each plot were used to calculate total dry matter yields for each plot, thereafter, converted to metric tons per hectare (Gelayenew*et al*., 2019).The harvested fresh sample was measured right in field by sensitive weight balance and 300g subsample per plot was brought to Bore Agricultural Research Center and sampled sample was placed to oven dried for 72 hours at a temperature of 65c^{o}for dry matter determination.

Then dry matter yield (t/ha) was calculated by James *et al*., 2008) formula.

The dry matter yield (t/ha) = TFW × (DWss /HA × FWss) ×10

Where TFW = total fresh weight kg/plot,
DWss = dry weight of subsample in grams,
FWss = fresh weight of subsample in grams,
HA = Harvest plot area in square meters and 10 is a constant for conversion of yields in kg/m^2 to t/ha.

Leaf to stem ration, the morphological parts were separately weighed to know their sample fresh weight, oven dried for 72 hours at a temperature of 65oC and separately weighed to estimate the proportions of these morphological parts.

2.4. Statistical analysis.

All collected data were analyzed using the general linear model procedure of SAS (SAS 2002) version 9.1. Mean were separated using least significant difference (LSD) at 5% significant level.

The statistical model for the analysis data was: Yijk= μ + Aj + Bi + eijk

Where; Yijk= response of variable under examination, μ = overall mean,

Aj = the jth factor effect of treatment/ cultivar,
Bi = the ith factor effect of block/ replication and
eijk = the random error

3. Results and Discussion

3.1. Performance of Bracharia grass genotypes

The performances of Bracharia grass cultivar were shown inTable 1. The result indicated that the tested cultivars were varied non-significantly (p>0.05) on survive rate percentages. The highest survive rate percentages were recorded from*Brachiaria mutica* Dzf No 18659 (Dzf 483) (95.5%) followed by Bracharia mulato (82.5%) cultivars. The lowest survive rate percentage was recorded from Brachiaria *Decumbens* Dzf No 194 (70.3%).

The result of plot cover was indicated highly significance difference (P<0.001) among Bracharia grass cultivars. This result indicated that the potential adaptability and productivity of cultivars were different. The rapidly and highly potential of plot cover were recorded from

Brachiaria mutica 18659 Dzf No 483 (94.4%) and *Brachiaria mutica* 6964 Dzf No 484(87%) cultivars. This result was lower than (Birmaduma Gadisa *et al.*, 2020) who reports the plot cover for *Brachiaria grass* is (96-98) %.

This result is good indication for adaptability Bracharia grass with soil, water and environment of study area(Clara M (2013)) 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 mean average of plants height at study area were show highly significant ($P<0.01$) different between treatments.

3.2. Plant height (cm)

The analysis of variance for plant height in this study was indicated highly statistically significance difference ($p<0.001$) among cultivars.

The highest plant height was recorded from *Brachiaria mutica* 6964 Dzf No 484 (170cm) cultivar whereas, the lowest plant height was recorded from Brachiaria Decumbence Dzf No 194 (90cm) cultivars. This result is agreement with Clara M (2013) who reported that 91 cm height for Bracharia hybrid (Mulat II) in Kenya and higher than 50-70 cm in Northern Ethiopian (Wassie *et al.*, 2017).

3.3. Leaf to stem ratio

The analysis of variance for leaf to stem ration in this study was not indicated statistically significance difference($p>0.05$) among cultivars. However, the least square mean values of leaf to stem ratio was indicated numerically difference among cultivars. The highest leaf to stem ratio was recorded from *Brachiaria mutica* 18659 Dzf No 483 (0.82) cultivar and the lowest value was recorded from Brachiaria Mutica 6964 Dzf No 484 (0.4). However, this result agreement with (Aldava *et al.*, 2017) who reports the leaf to stem ratio for *Brachiaria brizantha* is 0.4 in Mexico.

3.4. Fresh biomass yield (t/ha)

The fresh biomass yield (t/ha) result among cultivars were shown statistically highly significance difference ($p<0.01$).The highest fresh biomass yield value were recorded from *Brachiaria mutica* 18659 Dzf No 483 (33.52t/ha) which is followed by *Brachiaria mutica* 6964 Dzf No 484 (33.6 t/ha) cultivar.This finding was not comparable with (Birmaduma Gadisa *et al.*, 2020) 45.8 t/ha for Bracharia mulato in West Hararghe Zone, Eastern Oromia, Ethiopia. This much yield of fresh biomass production used as a discriminator of drought tolerant and unsusceptible genotypes for disease and adaptability to the area.

Table 1. Over all location mean agronomic performance of Bracharia grass cultivars in Midland agro-ecologies of areas.

cultivars	SR%	Pc%	Vg%	FBM (t/ha)	LSR	PH (cm)	DMY t/ha
Brachiaria mutica Dzf No 18659 (Dzf No 483)	95.5	94.4[a]	92.5	33.52[a]	0.82	160[a]	11.82[a]
Brachiaria Mutica 6964 (Dzf No 484)	74.7	87[a]	88.8	33.6[a]	0.4	170[a]	11.95[a]
Bracharia mulato	82.5	62.9[b]	57.1	28.13[b]	0.53	92[b]	10[a]
Brachiaria Decumbence Dzf No 194	70.3	48.1[b]	70.3	25.85[b]	0.74	90[b]	6.33[b]
Mean	80.8	73.1	77.2	30.28	0.62	128.2	10.02
CV	14.8	12.3	31.9	6.6	43.8	12.7	12.2
LSD (5%)	ns	**	ns	**	ns	**	**

[a,b,c] Mean in a column within the same category having different superscripts differ significantly ($p<0.05$) PH (cm)=plant height in centimeter, Pc%=plot cover percentage, LSR=leaf to steam ratio, Vg%=vigor percentage, SR%=survive rate percentage, FBM t/ha= Fresh biomass tone per hectare, DMY t/ha =dry matter yield tone per hectare, CV=Coefficient of variation, LSD= Least significant difference, **= highly significant, ns= None significant different.

3.5. Dry matter yield (t/ha)

The dry matter yield (t/ha) result among cultivars were shown statistically highly significance difference ($p<0.01$). The highest dry matter yield value were recorded from *Brachiaria mutica* 6964 Dzf No 484 (11.95t/ha) followed by *Brachiaria mutica* 18659 Dzf No 483 (11.82t/ha) cultivars.This result is lower than (Wassie *et al.*, 2017) who report that37.75 t/ha from Eth.

13809 Bracharia cultivars in Northern Ethiopia and also lower than the result compared with that obtained by (Hare et al., 2007) (16.3 t/ha DM yield).Variations in dry matter yield production across the cultivars can be attributed to differences in growth rate and growth habit, which are mediated through the genotypic and phenotypic differences.

4. Conclusions and Recommendations

The result implies that *Brachiaria mutica* Dzf No 18659 (Dzf 483) and *Brachiaria mutica* 6964 (Dz f No 484)were well adapted and being productive regarding the plant height, biomass yield and Dry matter yield which, is hopeful to fill the g ap of low quality and quantity ruminant feed supply of the community.

The current study indicated that *Brachiaria mutic a* Dzf No 18659 (Dzf 483) and *Brachiaria mutica* 6964 (Dzf No 484) cultivars were good agronomic performance at study area.

Therefore, based on its adaptability, plant height, biomass yield and dry matter yield and survive rat e *Brachiaria mutica* Dzf No 18659 (Dzf 483) and *Brachiaria mutica* 6964 (Dzf No 484) cultivars is recommended for further promotion in the midland of Guji and similar agro-ecologies.

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