Participatory Evaluation and Yield Determination of Climate-smart Brachiaria Grasses for Improving Livestock Production among the Farmers in Embu and Meru Counties

Catherine Muriithi[1*], Beatrice Nganga[1], Eliud Kagete[1], Donald Njarui[1] and Alfred Micheni[1]

[1]*Kenya Agricultural and Livestock Research Organization (KALRO), P.O BOX 57811-00200, Nairobi, Kenya.*

Authors' contributions

This work was carried out in collaboration among all authors. Author CM managed investigation, writing- original draft preparation. Author BN wrote-reviewed and edited the manuscript. Author EK managed formal analysis writing-reviewing and editing. Authors AM and DN worked on the methodology. All authors read and approved the final manuscript.

Original Research Article

ABSTRACT

Aims: To introduce brachiaria grasses in Meru and Embu Counties to increase the range of fodder/forage varieties available to smallholders through the use of climate-smart brachiaria grasses for increased income. The project also aimed at identifying the best brachiaria varieties suitable for the target Agro-Ecological ones through evaluation by the farmers and yield assessment.
Study Design: Randomized Complete Block Design (RCBD)
Place and Duration of Study: The study was carried out in Embu and Meru Counties during the short rains of 2015.
Methodology: Three varieties of brachiaria were introduced in the short rains of 2015 in KALRO Embu, Geeto Igoji in Meru, and Embu County. These were *Brachiaria decumbense* -Cultivar

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*Corresponding author: E-mail: muriithicatherine16@gmail.com;

Basilisk, *Brachiaria brizantha*- Cultivar BRS Piata and *Brachiaria brizantha*- Cultivar Toledo. Plots of 5x5m were planted and replicated three times using Randomized Complete Block Design (RCBD) to increase the range of fodder/forage varieties available to smallholder and assess the yield and acceptability of the different brachiaria grasses varieties. The three varieties were planted in the mega demonstration sites. The grass performance was analyzed through pairwise ranking and the grass with the best attributes was selected. Yield data was also collected.

Results: After ranking, the results indicated that the rate of growth and the amount of biomass as the most important attributes followed by the animals' response after feeding and the rate of rejuvenation after harvesting respectively. Using the attributes, the group members concluded that *Brachiaria decumbense*- Cultivar basilisk was the best followed by *brachiaria brizantha*- Cultivar piata and finally *brachiaria brizantha*- Cultivar Toledo.

Conclusion: In conclusion, based on the attributes, the best brachiaria varieties for use in Embu and Meru Countries are *Brachiaria decumbense* –Cultivar Basilisk and *Brachiaria brizantha*- Cultivar Toledo. Based on yield, *Brachiaria brizantha*- Cultivar Toledo is the best in Embu County while *Brachiaria brizantha*- Cultivar Basilisk is the best in Meru County.

1. INTRODUCTION

Climate change is a global phenomenon which has impacted negatively to people especially in the developing countries [1]. Agriculture being the backbone of the Kenyan economy, most of the communities get their day to day livelihood from crops and livestock [2]. However, these two major activities face the challenge of being the most climate-sensitive. To overcome this, Climate-smart Agriculture is important to increase food and livestock feed in Kenya and Mt Kenya region in particular. Brachiaria grass species is a climate-smart grass because of its high productivity under intensive use, and its tolerance to low fertility and relative freedom from pests and diseases [3]. It is a valuable grass for erosion control as it covers the ground well. It withstands heavy grazing and establishes on poor and rocky soils [4]. The grass has been re-introduced to Africa due to its high quality, persistence, and productivity. The genotypes have been selected and improved in Latin America [5]. Data on nutritive value indicates that forage from *Brachiaria* is highly palatable to stock, leading to high intake, whether fed fresh or grazed *in situ* [6]. According to [7] brachiaria species adapt well in a wide range of soil types from low fertile to highly fertile soils. They perform much better on acidic soils than other grasses as well as in moderately fertile soils. The use of climate smart brachiaria results in increased animal productivity and generation of income [7]. Three varieties of brachiaria were introduced in the short rains of 2015 in the Kenya Agricultural and Livestock Research Organization (KALRO) Embu, Geeto Igoji in

Meru County through the effort of Bioscience for Eastern and Central Africa International Livestock Research Institute Hub (Beca-ILRI Hub), Nairobi and KALRO Katumani. The varieties included *Brachiaria decumbense* - Cultivar Basilisk, *Brachiaria brizantha*- Cultivar BRS Piata and *Brachiaria brizantha*- Cultivar Toledo. The most used cultivar as grazing pasture in the world is *Brachiaria decumbense* Cultivar Basilisk that was bred from seed introduced to Australia in 1930 from Uganda and approved for registration in 1973 [8]. The most common practice by most farmers in the two Counties is cut and carry system due to small pieces of land that do not support grazing.

2. MATERIALS AND METHODS

Three varieties of brachiaria were introduced in the short rain of 2015 in the KALRO Embu, Geeto Igoji in Meru County through the effort of Bioscience for Eastern and Central Africa International Livestock Research Institute Hub (Beca-ILRI Hub), Nairobi, and KALRO Katumani. The varieties included *Brachiaria decumbense* - Cultivar Basilisk, *Brachiaria brizantha*- Cultivar BRS Piata and *Brachiaria brizantha*- Cultivar Toledo. Plots of 5x5m were planted and replicated three times using Randomized Complete Block Design (RCBD). Seeds were drilled and later thinned to a spacing of 50x20cm. DAP Fertilizer was applied at planting at an application rate of 60kg/ha and later CAN was used in top dressing at an application rate of 60kgN/ha. The three varieties were later planted in the mega demonstration sites (Mweru Nkogwe SHG, Mariani SIMLESA Geeto innovation

platform, and Kyeni innovation platform) which are managed by the group members while each individual from the groups carried 50gram of seed to their farm. The same varieties were planted at KALRO Embu at the experimental site. Before the first harvest was done at the Mega Demo, evaluation of the grass performance was conducted. A pairwise ranking was done to pick out what the farmers considered as the most important attributes which were used as a parameter to rank the varieties. Yield data was collected for the fresh and dry biomass for the Igoji site and Kalro Embu research Centre.

3. RESULTS AND DISCUSSION

The group members brainstormed on the important attributes that fit a good grass. The attributes included, i) Rate of growth (RG) ii) Amount of biomass (BIO) iii) Response after feeding (RAF), iv) Rate of rejuvenation after harvesting (RRH) and Foliage characteristics (FLT). After ranking the result indicated rate of growth (RG) and amount of biomass (BIO) as the most important attributes followed by the animal response after feeding (RAF), rate of rejuvenation after harvesting (RRH) respectively. Though the foliage characteristics (size of the leaf and texture) had been mentioned as an attribute is was not a critical factor to be considered as indicated in Table 1.

Using the attributes in Table 1, the group members concluded that *Brachiaria decumbens* - Cultivar Basilisk as the best cultivar followed by *Brachiaria brizantha*-Cultivar Piata and *Brachiaria brizantha*-Cultivar Toledo respectively.

The results are in line with [9] who indicated that *Brachiaria decumbens* is high yielding and is palatable to the livestock. However, [10] indicated that *Brachiaria brizantha* is a great multi-purpose pasture with a high rate of productivity that can withstand a high stocking rate under continuous grazing.

The yield data collected in Geeto indicated that *Brachiaria decumbens*- Cultivar Basilisk had the highest weight of fresh biomass followed by *Brachiaria brizantha*-Cultivar Toledo and Piata. Toledo had a higher weight of dry biomass (28.3ton/ha) followed by Basilisk. Similarly at KALRO Embu, the result indicated that *Brachiaria brizantha*-Cultivar Toledo had the highest yield 107 t/ha fresh weight and 39.9 ton/ha dry weight followed by *Brachiaria decumbens*- Cultivar Basilisk which had 77.6 fresh weight 25ton/ha dry weight and *Brachiaria brizantha*-Cultivar Piata 76 ton/ha fresh weight and 21.6 ton/had dry weight respectively. *Brachiaria brizantha*-Cultivar Toledo seemed to perform well in the higher zone than in the lower zone as found in Geeto and KALRO Embu. *Brachiaria decumbens*- Cultivar Basilisk accumulated more water in Geeto than *Brachiaria brizantha*-Cultivar Piata and *Brachiaria brizantha*-Cultivar Toledo while in KALRO *Brachiaria brizantha*-Cultivar Toledo variety had more water accumulated than *Brachiaria decumbens*- Cultivar Basilisk and *Brachiaria brizantha*-Cultivar Piata varieties. *Brachiaria* brizantha-Cultivar Toledo indicated the highest percentage water loss while *Brachiaria decumbens*- Cultivar Basilisk was the highest in Geeto as indicated in Fig. 1.

Table 1. Pairwise ranking of most important attributes of brachiaria grass

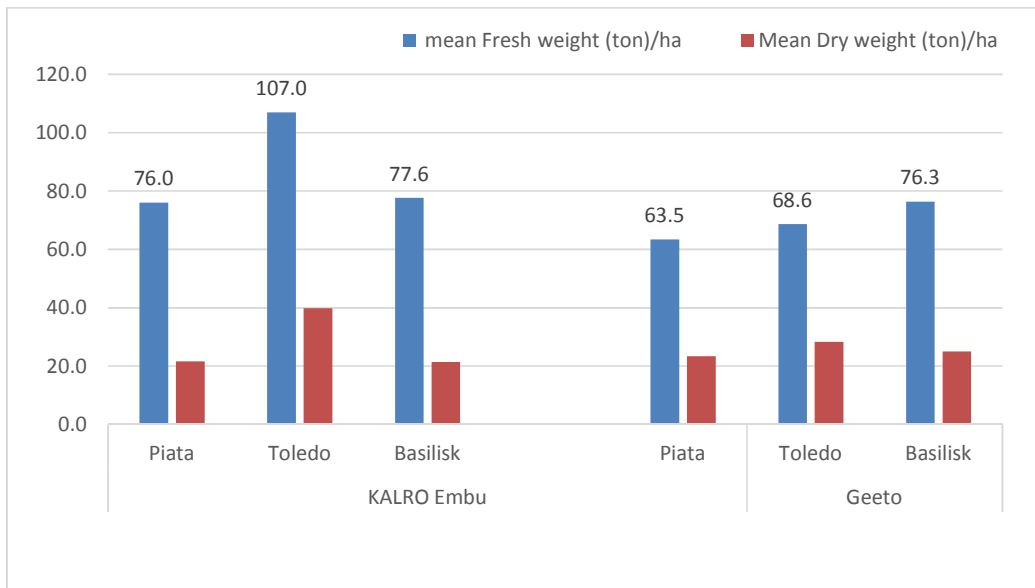|	RG	FLT	BIO	RRH	RAF	Total score	Rank
RG	xxxxxx xxxxxx	RG	BIO	RG	RG	3	1
FLT	RG	xxxxxx xxxxxx	BIO	RRH	RAF	0	5
BIO	BIO	BIO	xxxxxx xxxxxx	BIO	RAF	3	1
RRH	RG	RRH	BIO	xxxxxx xxxxxx	RAF	1	4
RAF	RG	RAF	BIO	RAF	xxxxxx xxxxxx	2	**3**

Fig. 1. Yield of climate smart brachiria at KALRO research and farmer managed

One year later after establishment, the results indicated that management was equally carried out by males and females. All members had fed the grass to the animals with 10% given to goats, 60% to cows while 30% was given to both goats and cows. The response after feeding indicated that 40% that grass was palatable while 60% reported it was very palatable without any waste. Ninety percent reported milk increase with an average of milk increase of 3-5lit/day from the previous milking. Some of the farmers (50%) had expanded the area under from the original 50 grams of the seeds provided which had been done through splits as earlier advised

4. CONCLUSION

In conclusion, the best brachiaria varieties for use in Embu and Meru Countries based on attributes (Rate of Growth, Rate of Rejuvenation after harvesting, amount of biomass) are *Brachiaria decumbense* –Cultivar Basilisk, and *Brachiaria brizantha*- Cultivar Toledo. Based on yield, *Brachiaria brizantha*- Cultivar Toledo is the best in Embu County while *Brachiaria brizantha*-Cultivar Basilisk is the best in Meru County. From the farmers' experiences, the brachiaria varieties were highly palatable and contributed to an increase in milk production. In recommendation, the brachiaria varieties should be introduced in other Kenyan counties with different Agro-Ecological zones.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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