

Research Article

Demonstration of Improved Elephant/Napier grass (*Pennisetum purpureum*) Technologies for Animal Feed Resources in Dire Dawa and Harari Region rural areas

Abdulaziz Teha Umer* and Ibsa Aliyi Usmane

Oromia Agricultural Research Institute, Fedis Agricultural Research Centre, P.O. Box 904, Harar, Ethiopia

Received: 27 May, 2020

Accepted: 04 June, 2020

Published: 05 June, 2020

*Corresponding author: Abdulaziz Teha Umer, Oromia Agricultural Research Institute, Fedis Agricultural Research Centre, P.O. Box 904, Harar, Ethiopia, Tel: +251924661459; E-mail: abdulaziztaha@gmail.com; usmanealiyibsa@gmail.com

Keywords: Biomass yield, Forage; Elephant grass varieties; Demonstration

<https://www.peertechz.com>



Abstract

Two Elephant grass IRL14983 and local check varieties were demonstrated and evaluated for their biomass traits under diverse environmental conditions of Harari and Dire Dawa. The study was conducted in four kebeles Dodota and Kile from Harari and Wahil and Bishan Bahe from Dire Dawa. From each kebele ten (10) farmers in total of forty (40) farmers participated in this research activity. This research found that there was biomass yield statistically significance difference at ($P < 0.01$) among the demonstrated varieties. And the yield of IRL14983 ranged from 6.7 to 12.9 t/ha with a mean of 9.8 t/ha whereas local variety gave the 4.3ton/ha and 9.1 ton/ha biomass yield across the sites as comparison. In addition, Elephant/Napier grass varieties responded differently across the demonstrated environments due to differential responses of the climatic and biotic factors. The highest record was at Dodota (10.62 t/ha) followed by Wahil (9.61 t/ha) in comparison with the rest sites Kile and Bishan Bahe because of field management and other climate conditions. Therefore, it is better to promote to other similar agro-ecology with these sites by Government, Non-government and other stakeholders through their programs.

Introduction

Sustainable livestock production is highly dependent on the availability of quality feed and forage resources. Napier grass, also known as elephant or Uganda grass, is one of the most important tropical forage crops. It is widely used in cut and carries feeding systems [1] and is of growing importance in other agricultural systems. Napier grass possesses many desirable characteristics, including high yield per unit area, tolerance to intermittent drought and high water use efficiency making it forage of choice. It has the ability to withstand repeated cutting and will rapidly regenerate, producing palatable leafy shoots [2]. Agriculture is back bone of Ethiopian economy and accounts for 46% of Gross Domestic product and, livestock sector contributes 30% to 35% and more than 85%

of cash income. The subsector also accounts for 19% export earnings [3].

Despite this fact feed shortage and poor quality of available feeds are the major constraints to increase livestock productivity in Sub Saharan Africa particularly Ethiopia [4]. Sowing a new pasture or improving an existing natural pasture requires a reliable source of seed or vegetative material or species recommended and adopted for the area [5]. Inadequate nutrition and feeding are major constraints to livestock production in sub-Saharan Africa (SSA). Feeds (usually based on fodder and grass) are either unavailable in sufficient quantities due to fluctuating weather conditions or are available but in a poor quality that they do not provide adequate nutrition [6]. These constraints result in low milk and meat yields, high



mortality of young stock, longer inter calving intervals and low animal weights [7].

Use of improved forages would reduce pressure on natural pasture, improve soil fertility and erosion of marginal lands, improve carbon sequestration to mitigate climate change, support system substantially and enhance natural assets and system reliance [7,8], for instances some of improved forage species can be used for these above services are desho grass, elephant grasses, *sesebainiasaban*, Rhodes, oats, cow pea and others [3]. Therefore, to overcome this livestock production loss using alternative feed resources like Napier/Elephant grass is indispensable. Having this in consideration this research activity was developed to improve feed security of livestock in Dire Dawa and Harar rural areas through Napier/ Elephant grass demonstration on farmers land/degraded land and Farmers Training Center with the following objectives.

Objectives

- To evaluate the productivity of Elephant grass on degraded land and under farmers' condition practice.
- To build farmers' knowledge and skill on elephant/ Napier grass production importance for animal feed and management practice.
- To strengthen stakeholders linkages and collaboration among stakeholders in line with animal feed and livestock production.

Materials and methods

This research activity was undertaken in selected districts of Dire Dawa and Harari region.

Site and farmers selection

The Kebeles as research sites were selected purposively based on the potentiality, appropriateness of the area by considering lodging, slop's land escape, access to road, suit for repeatable monitoring and evaluation in progress of sowing to harvesting, accordingly, Kile and Dodota from Harari and Wahil, and Bishan Bahe from Dire Dawa were selected. And also, farmers were selected based on their interest, innovation he/she has, land provision for this demonstration, interest in cost-sharing, willingness to share experiences for other farmers, and studying their profile Table 1.

Research design and implementation

Elephant/Napier grass cuttings (two varieties IRLI14983 and local check were selected for this demonstration purpose, because IRLI14983 variety was being adaptable in these environment when its adaptation trial on research station was conducted. Then, cuttings of Elephant grass were prepared in form of at least 5cm–8cm (in number 300–400 cuttings per kebeles in total of 12000–16000 cuttings) were planted on the contour in respect to 80cm between cuttings and 100cm between rows according to availability of contour structure or watershed areas in addition on Farmers Training Centers.

Data collection

Both quantitative data sheet were collected by data sheet and qualitative through personal field observation, individual interview, Focus Group Discussion by using checklist.

Data analysis

Quantitative data was analysed using simple descriptive statistics (Mean, Frequency and Percentage) while the qualitative analysed by was analyzed using narrative explanation.

Results and discussion

Training of farmers and other stalk holders

Multidisciplinary research teams: crop, extension and socio-economic researchers and other stakeholders (Offices of Agriculture and Natural Resource) actively participated by sharing their experience and knowledge, journalists for the sake of publicity of the work done, Development Agents, Experts and farmers were participated on the training entitled Elephant/Napier grass production and management Table 2.

Table 1: Summary of selected site and farmers with area coverage of the experiment.

District	PAs	No. of trial farmers	FTCs	Area covered
Dire Dawa	Wahil	10	1	20mx 20m for each plots
	Bishan Bahe	10	-	
	Dodota	10	-	
Harari	Kile	10	-	
Total		40	1	

Table 2: Participants on the elephant/Napier grass training at Research Sites.

NNo.	Participants	Male	Female	Total
1	Farmers	39	10	49
2	DAs	4	1	5
3	District experts	4	2	6
4	Journalists	3	0	3
Total		50	13	63

Source: Own computation 2018/19.

Among the participant stakeholders, 77.7% were farmers whereas 20.4% were female farmers' participant. Different extension materials were utilized and distributed for the participants these were 35 leaflets and 20 manuals on the technology that are organized in Afaan Oromoo (local language) and English were distributed.

Agronomic and yield performance

The following table describes the yield performances of the demonstrated Elephant/Napier grass varieties across the study site. The yield performance of the improved varieties (IRLI14983 and local) were 10.62, 8.20, 8.87, 9.61 and 7.27, 5.60, 6.13, 6.19 ton/ha at Dodota, Sofi, Bishan Bahe Wahil respectively Tables 3,4.



Yield advantage

The result indicated that IRLI14983 variety has better yield (58.12 ton/ha) when compared with local check (55.07ton/ha). Accordingly, the yield advantage of the IRLI14983 variety over the local check was 48.17% under farmer condition Table 5.

Yield advantage of the demonstrated varieties was calculated using the following formula.

$$\text{Yield advantage \%} = \frac{\text{Yield advantage of new variety} - \text{Yield advantage of st; check}}{\text{check}} \times 100$$

Yield advantage of standard check

Farmers' Opinion/perception

Farmers set criteria after having know-how about the variety and by using those criteria they gave ranks for the varieties with reasonable remarks during variety demonstration that were: biomass, survival, adaptability, palatability by livestock, and drought tolerant. As a result, most of the farmers selected IRLI14983 variety to reuse on their farm for the future as depicted in following Table 6.

Discussion

The highest average yield of the IRLI14983 Elephant/Napier grass were recorded at Dodota 10.62 ton/ha and Wahil 9.61 ton/ha as compare to local varieties across the sites. This indicates that this variety is very adaptable and suit with the existing environmental conditions in these sites. And there was yield difference of the varieties across the research sites due to rainfall, soil type and other climatic conditions. In addition there was yield advantage of IRLI14983 variety over local check that is 48.17% as depicted in Table 5 since there was yield of 3.03 ton/ha in comparison and statistically significance different at $p < 0.01$.

Moreover, farmers evaluated these two varieties (IRLI14983 and local) at different stages based at farm level based on their own criteria: good biomass, good survival, adaptable, good palatability and drought tolerant, accordingly, ranked IRLI14983 variety on first rank as compare to local as shown on Table 6, and even evaluated these criteria by pair-wise ranking, as result, ranked biomass first with the rest as on Table 7. Based on these above result and discussion the following conclusion recommendations were derived.

Table 3: Yield performance of improved elephant grass varieties across districts on Farmers land.

PA	Varieties	N	Std. Deviation	Mean (ton/ha)	Maximum	Minimum
Dodota	IRLI14983	10	1.887	10.62	12.90	7.70
	Local	10	1.174	7.27	9.10	5.50
Sofi	IRLI14983	10	1.529	8.20	11.10	6.50
	Local	10	.915	5.60	7.00	4.30
Bishan Bahe	IRLI14983	10	1.172	8.87	10.90	7.00
	Local	10	1.454	6.13	8.20	4.00
Wahil	IRLI14983	10	1.379	9.61	11.20	6.70
	Local	10	1.113	6.19	8.00	4.70
Total			2.143	7.81	12.90	4.00

Table 4: Independent t-test.

	Test for equal variances		t-test for equality of means				
	F	Sig.	T	df	Sig. (2-tailed)	Mean difference	Std. Error Differences
Equal variances assumed	4.58	.035	8.92	78	.000	3.03	.339

Statistically significant difference 1% probability level

Table 5: Summary of yield performance in study areas.

Varieties	Average yield ton/ha	Yield difference ton/ha	Yield advantage over the local check (%)
IRLI14983	9.32	3.03	48.17
Local check	6.29		

Source: Own computation 2018/19.

Table 6: Ranks of the varieties based on farmers' selection criteria.

Varieties	Farmers rank	Reasons	Remarks
IRLI14983	1 st	Good biomass, good survival ,adaptable, good palatability and drought tolerant	Biomass was measured by Balance in ton, counting the tinted and matured cuttings(survival measurement), gave to livestock(palatability measurement) and produced with existing rainfall
Local	2 nd	Good biomass, good survival ,adaptable, good palatability drought tolerant	

Table 7: Pair-wise ranking matrix result to rank variety traits.

Code no.	Traits	Biomass	Survival	Adaptability	Palatability	Drought tolerant	Frequency	Rank
1	Biomass		1	1	1	1	4	1 st
2	Survival			2	2	2	3	2 nd
3	Adaptability				3	3	2	3 rd
4	Palatability					4	1	4 th
5	Drought tolerant						0	5 th

Conclusion and recommendation

The yield performances of the demonstrated elephant grass varieties across the study sites were 9.32to/ha for (IRLI14983) and 6.29 ton/ha for local variety with 3.03ton/ha yield difference in which IRLI14983 has more yield advantage 48.17% over local variety. As a result, farmers selected IRLI14983 variety on first rank due to its good biomass, good survival, and adaptable, good palatability and drought tolerant because in these areas there is an opportunity of underground water availability, suitable soil, and other suit climate conditions they can produce this Elephant/Napier grass IRLI14983 variety in these agro-ecology.

Therefore, from this research finding it is recommended to promote further IRLI14983 Elephant/Napier grass variety in similar agro-ecology is very important by government, Nongovernment and other stakeholders through their program to small holder farmers for enhancement of food security for human and feed forages for livestock .



Acknowledgements

The author thanks World Bank and partners donors for funding through Agricultural Growth Program-II, Oromia Agricultural Research Institute for work facilitation and individuals participated in data collection and comments in full write up of this research paper.

Contributions of authors

Abdulaziz Teha-collected data, analyzed data, wrote final report.

Ibsa Aliyi-collected data, entered and analyses partially and edited the final report.

References

- Lukuyu BA, Gachui CK, Lukuyu MN, Lusweti C, Mwendia S (2012) Feeding Dairy Cattle in East Africa. East Africa Dairy Development Project Nairobi Kenya. [Link: https://bit.ly/3094sTM](https://bit.ly/3094sTM)
- Kabirizi J, Muyekho F, Mulaa M, Msangi R, Pallangyo B, et al. (2015) Napier Grass Feed Resource: Production, Constraints and Implications For Smallholder Farmers in Eastern and Central Africa. The Eastern African Agricultural Productivity Project: Naivasha, Kenya. [Link: https://bit.ly/2XwMER2](https://bit.ly/2XwMER2)
- Jimma A, Tessema F, Gemiyo D, Bassa Z (2016) Assessment of Available Feed Resources, Feed Management and Utilization Systems in SNNPRS of Ethiopia. Journal of Fisheries & Livestock Production 4: 3. [Link: https://bit.ly/2ABr98A](https://bit.ly/2ABr98A)
- Orodho AB (2011) The Role and Importance of Napier Grass in the Smallholder Dairy Industry in Kenya. Food and Agriculture Organization: Rome, Italy 2011. [Link: https://bit.ly/3eLp2xF](https://bit.ly/3eLp2xF)
- Worku A (2009) Animal fattening in watershed, Training Manual, Holetta, Ethiopia
- Ishii Y, Hamano K, Kang DJ, Kannika R, Idota S, et al. (2013) C4-Napier grass cultivation for cadmium phytoremediation activity and organic livestock farming in Kyushu, Japan. J Agric Sci Technol 3: 321. [Link: https://bit.ly/30957oe](https://bit.ly/30957oe)
- ILRI (International Livestock Research Institute) (2009) Forage Seed System in Ethiopia: Fodder round Table meeting, Workshop held on International Livestock Research Institute. Addis Ababa, Ethiopia. [Link: https://bit.ly/2U7mJx6](https://bit.ly/2U7mJx6)
- Akah N, Onweluzo J (2014) Evaluation of water-soluble vitamins and optimum cooking time of fresh edible portions of Elephant Grass (*Pennisetum purpureum* L. Schumacher) shoot. Niger Food J 32: 120-127. [Link: https://bit.ly/3gTAQ2T](https://bit.ly/3gTAQ2T)

Discover a bigger Impact and Visibility of your article publication with Peertechz Publications

Highlights

- ❖ Signatory publisher of ORCID
- ❖ Signatory Publisher of DORA (San Francisco Declaration on Research Assessment)
- ❖ Articles archived in worlds' renowned service providers such as Portico, CNKI, AGRIS, TDNet, Base (Bielefeld University Library), CrossRef, Scilit, J-Gate etc.
- ❖ Journals indexed in ICMJE, SHERPA/ROMEO, Google Scholar etc.
- ❖ OAI-PMH (Open Archives Initiative Protocol for Metadata Harvesting)
- ❖ Dedicated Editorial Board for every journal
- ❖ Accurate and rapid peer-review process
- ❖ Increased citations of published articles through promotions
- ❖ Reduced timeline for article publication

Submit your articles and experience a new surge in publication services (<https://www.peertechz.com/submit>).

Peertechz journals wishes everlasting success in your every endeavours.

Copyright: © 2020 Umer AT, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

0017

Citation: Umer AT, Usmane IA (2020) Demonstration of Improved Elephant/Napier grass (*Pennisetum purpureum*) Technologies for Animal Feed Resources in Dire Dawa and Harari Region rural areas. Glob J Ecol 5(1): 014-017. DOI: <https://dx.doi.org/10.17352/gje.000013>