

Research Article

Adaptability Study of Finger Millet (*Eleusine Coracana*) Varieties for Midland of Guji Zone, Southern Oromia, Ethiopia

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Abstract

One small seed cereal crop that grows in semi-arid tropical and subtropical regions of the world with little rainfall and rain-fed conditions is finger millet (*Eleusine coracana*). Because of a number of production-related issues, including a lack of improved varieties and a slow uptake of existing technology, finger millet productivity is poor in South Ethiopia, particularly in the Guji midlands. Therefore, the purpose of this study was to introduce small-holder farmers in the area to new technologies in finger millet production by choosing finger millet varieties that are disease- and insect-resistant, well-performing, adaptive, and high yielding. For two years, the experiment was carried out at three different places in Adola and Wadera: the Adola sub-station station, K/Sorsa, and the Wadera farmers field. On a 2.4 m × 3 m plot, nine enhanced Finger Millet cultivars were assessed using an RCBD design with three (3) replications. The study's findings showed that yields and agronomic characteristics varied significantly among types across the regions. Compared to other types, Bako 09 and Addis 01 had higher yields, according to the combined analysis of the data. Thus, two finger millet varieties Bako 09 and Addis 01 are chosen and suggested for locations with similar agro-ecologies.

Keywords: Finger millet; Local; Improved varieties

Introduction

Finger millet (*Eleusine coracana*) is a tiny seed cereal that grows in semi-arid tropical and subtropical regions of the world with minimal rainfall. It is a resilient crop that can produce a respectable amount of grain when other crops produce very little. Often included in plans for ensuring food security, finger millet is a staple crop in regions of the world vulnerable to drought. Small-scale farmers in Africa grow finger millet, which is frequently interplanted with other grains, legumes, or vegetables. It is a crucial staple food in East and Central Africa, where it is a crop for both food security and subsistence. Additionally, it is significant due to its nutritional and cultural worth, particularly in conventional low-input agricultural systems centered on cereals [1]. Among the underutilized cereal crops, finger millet is still the most significant plant genetic resource that could be vital to the nutritional demands and sources of revenue for millions of impoverished farmers in Ethiopia and other developing nations [2,3]. Ethiopia, Uganda, Kenya, Tanzania, Rwanda, Burundi, Democratic Republic of the Congo, Sudan, and Somalia are among the Eastern African countries that produce it [4].

Finger millet is mostly farmed in Ethiopia as a solitary crop in rotation with other annual crops, ideally legumes. Data from

the Ethiopian Central Statistical Authority for the years 1995–2017–18 indicated an overall increase in the area used for finger millet cultivation and output. For example, during the 2017–18 rainy season, finger millet covered approximately 456,057.31 ha (4.5%) of the total land area (80.71%) under cereals, yielding 10,308,23.15 tons of grain yields [5]. Tigray, Amhara, Oromiya, Benishangul-Gumuz, Southern Nations and Nationalities and Peoples (SNNP), and the Gambela regional states are among those that produce the grain.

Oromia is responsible for 21.3% of the nation's overall production and 20.6% of its total cultivable land (5). All administrative zones in the Oromia National Regional State save the high land area are home to finger millet plants. High in nutrients, finger millet grain is frequently eaten as porridge, bread, enjera, and native drinks like tela and areki. The most significant grain crop in the Guji zone is finger millet, which is also utilized as animal fodder, thatching, and weaving. The issues with finger millet, despite its importance and significance, is that its production methods, farmers' difficulties, and lack of better varieties have resulted in a recent national average yield of only 2.2 t ha⁻¹. Regardless the reported yield potential in the range of 4-5.0 t

ha-1 [6,7], this yield is even lower than the regional (Oromia) average grain yield of 2.3 t ha⁻¹ [5]. Despite the fact that numerous cultivars have been made available by national and regional research organizations, smallholder farmers in remote areas of Oromia, such as the Guji zone, have not been able to access these technologies. Because of this, finger millet productivity and production are extremely poor in this region, mostly due to a lack of better varieties and a low uptake of suggested improved varieties.

Materials and Methods

About nine released improved finger millet varieties (Tadese, Bareda, Gute, Gudatu, Adis-01, Bako-09, Padet, Tesema) brought from BARC and MARC for evaluation alongside local check varieties. In the Guji Zone, Southern Oromia, at the Adola districts, the materials were assessed for their suitability to the mid-land agro-ecology both on-site and during the main cropping season. A 2.4 * 3 m plot with three replications was used in the RCBD design of the trial's layout. Block, plot, row, and plant spacing were, in order, 0.40, 0.1, 1.0, and 1.5 meters. Drilled seeds were subsequently trimmed to the standard spacing. There was a 15 kg/ha seed rate applied. For finger millet cultivation, fertilizer, additional inputs, and other agronomic techniques were used as advised.

Data Collection and Analysis

In this study, information was gathered on the following parameters: number of fingers per plant, days to maturity, plant height (cm), finger length (cm), days to heading, and grain yield (kg/ha). The data that were recorded were analyzed using GenStat 18th edition and ANOVA, as recommended by Gomez & Gomez (1984). At five percent significance levels, mean separation was performed via Least Significant Difference (LSD).

Result and Discussion

An study of the combined data revealed that there were notable differences across the tested varieties for the assessed parameter. All finger millet characteristic varied significantly, with the exception of the number of tillers per plant.

Table 1: Combined mean performance of tested Finger Millet varieties for growth and yield parameters.

Variety	GY (kg ha ⁻¹)	DTH	DTM	PH (cm)	FL (cm)	NTPP
Local	754 ^c	91.54 _c	167.9 ^{ab}	81.85 ^{ab}	6.165 ^{cd}	4.852
Bonaya	759 ^c	90.71 _c	163.8 ^{ab}	77.94 ^{abc}	6.214 ^{cd}	4.081
Tedesse	1163 ^{bc}	91.79 _c	149.6 ^{bc}	66.27 ^c	5.63 ^d	4.603
Bereda	1555 ^{ab}	94.88 _b	167.4 ^{ab}	84.02 ^a	7.616 ^b	4.208
Tesema	1217 ^b	94 ^b	170.7 ^a	77.33 ^{abc}	6.888 ^{bc}	4.478
Gute	1414 ^b	99.04 _a	182.2 ^a	82.74 ^{ab}	9.22 ^a	4.603
Adis 01	1590 ^{ab}	94.25 _b	163.2 ^{ab}	73.05 ^{abc}	5.991 ^{cd}	4.096
Bako 09	1978 ^a	90.92 _c	162.9 ^{ab}	74.24 ^{abc}	5.603 ^d	4.881
Padet	1481 ^b	97.12 _a	138.1 ^c	80.2 ^{ab}	6.928 ^{bc}	4.311
Gudatu	1409 ^b	91.58 _c	164.8 ^{ab}	71.7 ^{bc}	5.763 ^d	3.949
Mean	1332.14	93.58	163.0	76.93	6.60	4.41
LSD (5%)	435.26	2.139	20.8	11.93	1.00	NS
CV (%)	14.4	2.80	15.8	19.2	18.7	19.8

Where: GY=grain yield, DTH=days to heading, DTM=days to maturity, PH=plant height, FL= finger length and NTPP= number of tiller per plant

Date of Heading

Varieties differed significantly in terms of the character date of heading. Variety Bako 09 (90.92) and Bonaya (90.71) were the first to reveal the early heading, followed by Local (91.54). But variety Gute leads late, with padet variety following.

Plant Height

Bareda and Gute are the two examined types with the longest heights, while Tadese and Gudatu have the shortest heights. This conclusion was consistent with 8 and 9, which mentioned the existence of genetic diversity in related finger millet variety features.

Days to Maturity

According to the study's findings, there are no appreciable differences in the examined varieties' dates of maturity across all locations. However, taking this trait into account while choosing varieties is essential if you want to choose early maturing types for various agro-ecologies.

Finger Length

According to the study's findings, there was a substantial variation in finger length amongst the tested cultivars at each study location, ranging from 5.6 to 9.2. As a result, variation Gute, followed by Bareda, has the longest fingers, while variety Bako 09, followed by Tadese, exhibits the shortest. Similar findings were published by [10,11], who observed that finger millet cultivars exhibit genetic diversity in production and yield-related characteristics.

Grain Yield (GY)

In terms of grain yield qt/ha, which ranged from 7.54 to 19.78 qt/ha with a mean value of 13.32 qt/ha, there was a considerable amount of variation among the tested varieties across the testing locations. After Addis 01 (15.90qt/ha), Bako 09 had the highest mean grain yield (19.78). On the other hand, Bonaya produced a higher yield (7.59 qt/ha) than the local yield (7.54 qt/ha). The two types that performed the best and were chosen for the study are Bako 09 and Addis 01, based on this fact. In a similar vein, [12] found that superior finger millet varieties outperformed local types grown by most farmers in terms of production and performance. According to research by another author [12], the best finger millet types for producing and disease tolerance are those that have been released and modified. According to [13] various finger millet types had varying grain yields, which is consistent with this outcome.

Conclusion and Recommendations

Despite the fact that finger millet producing methods are important and significant. However, farmers in the Guji zone of Oromia have difficulties due to the lack of enhanced finger millet, and their current productivity is significantly lower than both its potential yield and the output of research fields. The main factors influencing the low productivity of this crop in the region are the scarcity of improved varieties and the limited uptake of suggested improvements. In order to investigate this issue, an experiment involving the evaluation, selection, and recommendation of high-yielding, early-maturing modified finger millet varieties for mid-land agro-ecology was carried out in many Guji zone districts. Each of the studied varieties demonstrated a considerable variance for phenological, growth, yield, and yield-related features, according to the study's findings.

Bako 09 and Addis 01 performed better for the assessed attributes among the tested cultivars. As a result, two varieties—Addis 01 and Bako 09—that performed better than the other kinds under evaluation were chosen and advised for use in research regions and agro-ecologies that were comparable. To boost finger millet production and to solidify the recommendation, more research should be done, using several recently released cultivars.

Author Statements

Competing Interest

The authors have declared that no competing interest exists.

Data Availability

All relevant data are within the paper and its supporting information files.

References

1. Dida MM, Wanyera N, Harrison Dunn ML, Bennetzen JL, Devos KM. Population structure and diversity in finger millet (*Eleusine coracana*) germplasm. *Tropical Plant Biology*. 2008; 1: 131-141.
2. Kassahun T, Solomon M. Phenotypic characterization of Ethiopian finger millet accessions for their agronomically important traits. *ACTA Universitatis Sapientiae, Journal of Agriculture and Environmental Science*. 2017; 9: 107-118.
3. Asfaw Z, Fekede G, Mideksa B. Pre-scaling up of improved finger millet technologies: The case of Daro Lebu and Habro districts of west Hararghe, Oromia, Ethiopia. *International Journal of Agricultural Education and Extension*. 2018; 4: 131-139.
4. Oduori C, Kanyenji B. Finger millet in Kenya: Importance, advances in R&D, challenges and opportunities for improved production and profitability. *Finger Millet Blast Management in East Africa. Creating opportunities for improving production and utilization of finger millet*. 2005; 10.
5. Central Statistical Agency (CSA). *Agricultural Sample survey Volume I: Report on area and production of major crops (private peasant holdings, Meher season)*. Statistical Bulletin 586. April 2018, Addis Ababa, Ethiopia. 2018.
6. Kebede D, Dagnachew L, Girma M, Kasa M, Geleta G, Chemada B, et al. Registration of "Gudetu Finger millet (*Eleusine coracana* sub spp. *Coracana*) variety. *East African Journal of Science*. 2016; 10: 71-72.
7. Mulatu T, Debcllo A, Gutema Z, Degu E. Finger millet [*Eleusine coracana* (L.) Gaertn]: A potential crop in Ethiopia. In *Proceeding of Workshop Organized to Re-establish Sorghum and Millet in Eastern and Central Africa*. 6-9 November 1995, Kampala, Uganda. 1995; 5: 124-132.
8. Tsehaye T, Kebebew F. Morphological diversity and geographic distribution of adaptive traits in finger millet (*Eleusine coracana* (L.) Gaertn. [Poaceae]) populations from Ethiopia. *Ethiopian J Biol Sci*. 2002; 1: 37- 62
9. Fentie M. Participatory evaluation and selection of improved finger millet varieties in north western Ethiopia. *International Research Journal of Plant Science*. 2012; 3: 141-146.
10. Bezawele K. Genetic diversity of finger millet [*Eleusine coracana* (L.) Gaertn] landraces characterized by random amplified polymorphic DNA analysis. *Innov Syst Des Eng*. 2011; 2: 207–218.
11. Wolie A, Belete K. Genetic divergence and variability studies in some Ethiopian finger millet germplasm collections. *J Agric Sci*. 2013; 3: 110-116.
12. Geleta N. Adaptation study of released Finger millet Varieties in Western Oromia, Ethiopia. *Journal of Biology, Agriculture and Healthcare*. 2019; 9: 63-68.
13. Simion T, Markos S, Samuel T. Evaluation of finger millet (*Eleusine coracana* (L.) Gaertn.) varieties for grain yield in lowland areas of southern Ethiopia. *Cogent Food & Agriculture*, 6(1), p.1788895. *Science*. 2020; 1: 67-72.