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Full Length Research Paper

Effect of Quality seed of tef (*Eragrostis tef* Zucc [Trotter]) on Yield and yield related traits

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Abstract

The experiment “Effect of Quality seed of tef (*Eragrostis tef* Zucc [Trotter]) on Yield and yield related traits was conducted at Yilmana Densa and Simada and Debre Tabore Weredas. Six experimental materials which are (three of them certified (C1) seeds of tef varieties taken from Amhara Public Seed Enterprise and three of them are their correspondence farmers’ saved seeds) were tested. The varieties were namely: -Kuncho, Etsub and Kora. The experimental design for test was RCBD (Randomized Complete Block Design) with four replications. The plot size was 2.5m X 1.2m. Spacing between plots and blocks were 0.5m each respectively. Data collected include plant height, panicle length, biomass yield and grain yield. The experiment was done at four locations from three Weredas (two locations from Yilmana Densa and two locations from Simada and Debre Tabore wereda). The experiment was done in 2019 for one year. The data collection included plant height, panicle length, days to maturity, shoot biomass and grain yield. The data was analyzed using SAS statistical software. In the analysis of variance (ANOVA) of individual locations there was highly significant difference between varieties and quality levels at all locations. But interaction of variety with quality is highly significant at Adet on farmer only. But there is no significant difference between replications at all locations. In the analysis of variance (ANOVA) of combined locations table it is clearly observed that there was highly significant difference between varieties, environment, and environment by variety interaction, quality, quality levels, variety and quality interaction. Environment variety and quality interaction was significantly different. But interaction of replication environment was not significantly different. But there is no significant difference between replications at all locations. Using certified (C1) seed of Etsub, Kuncho and Kora has increased yield of 19.94%, 13.86%, 16.47% respectively. Using certified (C1) seeds of varieties has increased yield by 14.51%, 17.14%, 12.57% and 23.09% at Adet on station, Adet on farmer, Simada and Debre Tabore respectively. From the experiment we can conclude that tef quality seeds of Kuncho, Etsub and Kora are different in yield and yield related traits not only among themselves but also with their corresponding farmers’ saved varieties (C3) at both individual locations and combined over all locations. Using quality seed of tef increased yield of tef on average by 16.72%. Hence, it is highly recommended to use quality seeds of tef than farmers saved seeds.

INTRODUCTION

Background

Tef (*Eragrostis tef* [Zucc.] Trotter) is the major food crop in Ethiopia where it is annually cultivated on more than three million hectares of land (CSA, 2017). Ethiopia is the origin and center of diversity for tef (Vavilov, 1951), harboring landraces with a wide array of phenotypic diversity, and also wild progenitors and related wild species. Compared to other cereals, tef is more tolerant to extreme environmental conditions especially to water-logging.

Most of the Ethiopian farmers use traditional landraces

of tef and these are distributed all over the country. Local cultivars such as Gea-Lamie, Dabi, Shewa-Gimira, Beten and Bunign, which are early maturing varieties, are cultivated in relatively less rain fall areas (Demissie, 1991).

Productivity increment (i.e. yield per hectare as measured in ton per hectare) relies on, among other inputs, continuing use of quality seed of newly developed crop varieties. Seed is one of the least expensive but most important factors influencing yields. Indeed, many lines of evidence (References) indicate that the use of quality seed of improved crop variety contributes substantially to productivity increment.

OBJECTIVE

To study the increment of yield and yield related traits using quality seed of teff over their corresponding farmers' saved varieties.

MATERIALS AND METHODS

Site description

The experiment was conducted at Yilmana Densa and Simada and Debre Tabor Weredas. Yilmana Densa is one of the 15 districts of West Gojam Administrative Zone, bordered by Bahir Dar Zuria and South Gondar in the north, Quarit and Sekela in the south, Gonji-kollela in the east and Mecha districts in the west. Adet is the district administrative town. The district has 33 rural and 3 town kebeles and the total population of the district was 214,852, of which 195,683 were living in rural and 19,169 in different towns (CSA, 2017).

Geomorphologically, the district is 12% lowland, 64% midland and 24% highland, while its topographic features are 56% undulating, 20% mountainous, 8% gorge, and 16% plateau. Total land size is estimated to be 99,180 hectare, out of which 46,097 hectare (ha) is used for annual and 109.09 ha for perennial crops production. Grazing land, forest land, bush and water bodies constitute 4,367.83, 3,697.69, 3,066.69 and 1,572.43 ha, respectively. About 1,397.95 ha are under constructions, 2,302.08 ha is potentially cultivable land, 36,299.27ha is noncultivable and 269.97ha land is others. The soil of the district is red, black and brown with the proportion of 65%, 20% and 15%, respectively (YD-BoA, 2017).

Altitude ranges from 1800 to 3200 m.a.s.l. The average rainfall of the district is between 1051.8 and 1488.2 mm. The mean annual temperature ranges from 8.8-25.2oC. Major crops grown in the districts are teff (*Eragrostis tef*), wheat (*Triticum aestivum L*), maize (*Zea mays L*), barley (*Hordeum vulgare*), potato (*Solanum tuberosum*), field pea (*Pisum sativum*), faba bean (*Vicia faba*), finger millet (*Eleusine coracana*) and the like (YD-BoA, 2017).

Debre Tabor is found in the South Gondar Administrative Zone of Amhara National Regional State, North Central Ethiopia, about 100 kilometers Southeast of Gondar and 50 kilometers east of Lake Tana. The surface area of Debre Tabor city is about 31.87 km². The study area extends between 11.83°N to 11.87°N latitude and 37.98°E to 38.03°E longitude. Topographically, the city is characterized by undulating terrain with significant elevation variation. The southern and southwestern parts of the town are more of higher ground including Mount tabor. The climate of Debre Tabor is based on its altitude which ranges between 2447 m and 2838 m is Dega. Climatically, the study area enjoys moderate temperate climatic conditions. The mean annual rainfall is 1553.7 mm. The maximum rainfall occurs in July or August (Source: office of Agriculture).

Simadais one of the woredas in the Amhara Region of Ethiopia. Part of the Debu Gondar Zone, Simada is bordered on the southeast by the Bashilo River which separates it from the Debu Wollo Zone, on the southwest by the Abay River which separates it from the Misraq Gojjam Zone, on the west by Misraq Este, on the north by Lay Gayint, and on the northeast by Tach Gayint. Part of this woreda's boundary with Este is defined by the Wanka, a tributary of the Abay. The major town in Simada is Wegeda.

This woreda has been topographically described as 10% highland, 30% mid-highland and 60% lowland. A rough dry-weather road 53 kilometers long connects Wegeda to the main Debre Tabor - Nefas Mewcha all-weather highway.

Based on the latest national census conducted by the Central Statistical Agency of Ethiopia (CSA-2017), this woreda has a total population of 228,271, an increase of 21.55% over the 1994 census, of whom 113,322 are men and 114,949 women; 10,304 or 4.51% are urban inhabitants. With an area of 2,244.96 square kilometers, Simada has a population density of 101.68, which is less than the Zone average of 145.56 persons per square kilometer.

Methods of Study

Six experimental materials which are (three of them certified (C1) seeds of teff varieties taken from Amhara Public Seed Enterprise and three of them are their correspondence farmers' saved seeds) were tested. The varieties were namely: -Kuncho, Etsub and Kora. The experimental design for test was RCB (Randomized Complete Block Design) with four replications. The plot size was 2.5m X 1.2m. Spacing between plots and blocks were 0.5m each respectively. Data collected include plant height, panicle length, biomass yield and grain yield. The experiment was done at four locations from three Weredas (two locations from Yilmana Densa and two locations from Simada and Debre Tabor wereda). The experiment was done in 2019 for one year.

Data analysis

The data collection included plant height, panicle length, days to maturity, shoot biomass and grain yield. The data was analyzed using SAS statistical software.

RESULTS AND DISCUSSION

Anova individual location

In the analysis of variance (ANOVA) of individual locations table it is clearly observed that there is highly significant difference between varieties and quality levels at all locations. But interaction of variety with quality is highly significant at Adet on farmer only. But there is no significant difference between replications at all locations.

Combined locations

In the analysis of variance (ANOVA) of combined locations table it is clearly observed that there is highly significant difference between varieties, environment,

Table 1. ANOVA of individual locations:

Source	DF	Mean Square			
		Adet on Station	Adet on farmer	Simada	D/tabor
Variety	2	71.35**	98.51**	28.45**	17.23**
Quality	1	97.13**	17.52**	0.78**	0.43 **
Variety*Quality	2	26.31ns	31.47**	2.14ns	0.3ns
Replication	3	17.16ns	2.73ns	0.17ns	0.24ns
Error	15	9.41	5.92	1.23	0.91
CV		17.31	14.21	6.14	5.54

In the analysis of variance (ANOVA) of individual locations table it is clearly observed that there is highly significant difference between varieties and quality levels at all locations. But interaction of variety with quality is highly significant at Adet on farmer only. But there is no significant difference between replications at all locations.

Table 2: ANOVA of combined locations.

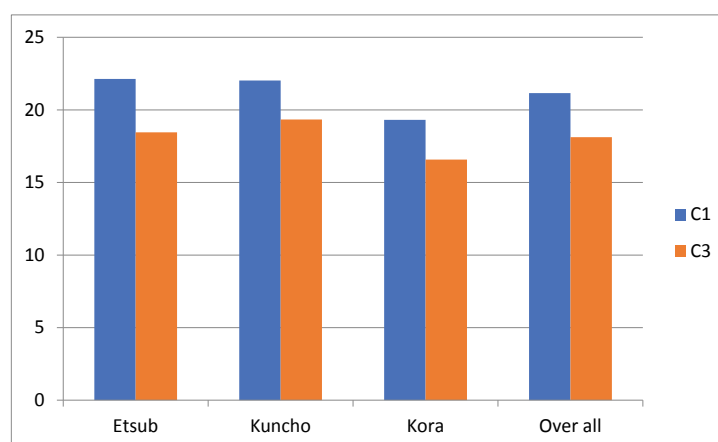
Source	DF	MS
Variety	2	51.28**
Environment	3	114.31**
Environment*Variety	6	46.17**
Quality	1	105.13**
Variety*Quality	2	42.49**
Environment*Quality	3	38.25**
Environment*Variety*quality	6	8.56*
Replication*Environment	9	5.62ns
Error	54	4.84
CV		9.75

In the analysis of variance (ANOVA) of combined locations table it is clearly observed that there is highly significant difference between varieties, environment, and environment by variety interaction, quality, quality levels, variety and quality interaction. Environment variety and quality interaction was significantly different. But interaction of replication environment was not significantly different. But there is no significant difference between replications at all locations.

Table 3: Yield advantage of quality seeds over farmers' saved seeds.

Variety	Yield per hectare		Yield advantage
	C1	C3	
Esub	22.13	18.45	19.94**
Kuncho	22.02	19.34	13.86**
Kora	19.31	16.58	16.47**

Using basic seed of Esub, Kuncho and Kora has increased yield of 19.94%, 13.86%, 16.47% respectively.

**Figure 1:** Yield advantage of quality seeds over farmers' saved seeds.

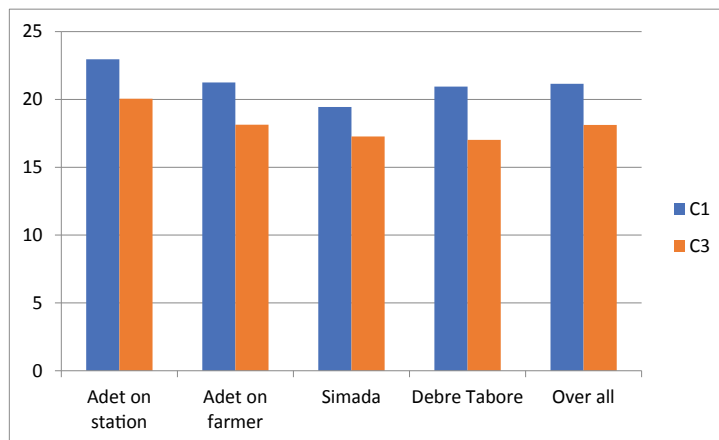


Figure 2: Yield advantage of quality seeds over farmers' saved seeds across locations.

Table 4: Yield advantage of quality seeds over farmers' saved seeds across locations.

Sites	Seed Classes		Yield adv.%
	C ₁	C ₃	
Adet on station	22.96	20.05	14.51
Adet on farmer	21.25	18.14	17.14
Simada	19.44	17.27	12.57
Debre Tabore	20.95	17.02	23.09

Using basic seeds of varieties has increased yield by 14.51%, 17.14%, 12.57% and 23.09% at Adet on station, Adet on farmer, Simada and Debre Tabore respectively.

and environment by variety interaction, quality, quality levels, variety and quality interaction. Environment variety and quality interaction was significantly different. But interaction of replication environment was not significantly different. But there is no significant difference between replications at all locations.

Yield advantage of varieties

Using basic seed of Etsub, Kuncho and Kora has increased yield of 19.94%, 13.86%, 16.47% respectively.

Yield advantage of quality seed

Using basic seeds of varieties has increased yield by 14.51%, 17.14%, 12.57% and 23.09% at Adet on station, Adet on farmer, Simada and Debre Tabore respectively.

CONCLUSION AND RECOMMENDATION

From the experiment we can conclude that tef quality seeds

of Kuncho, Etsub and Kora are different in yield and yield related traits not only among themselves but also with their corresponding farmers' saved varieties at both individual locations and combined over all locations. Using quality seed of tef increased yield of tef on average by 16.72%. Hence, it is highly recommended to use quality seeds of tef than farmers saved seeds.

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