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Evaluation of Adaptability and Improvement of Tef [*Eragrostis Tef (Zucc.) Trotter*] Varieties in Western Part of Ethiopia

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ABSTRACT

Thirty six Tef varieties including local check were evaluated with the objective of Evaluation of Adaptability and Improvement of Tef [*Eragrostis Tef (Zucc.) Trotter*] in Western Part of Ethiopia during 2016/17 G.C cropping season at Assosa Agricultural Research Center, Tongo and Begi sub-site; Benishangul Gumuz Regional Sate of Ethiopia.

This trials were put into trial at Assosa Agricultural Research on station,Tongo and Begi sub-site. The trial was conducted in Randomized Complete Block Design with three replications. The size of the plot was 1.2m x 2m with gap of 1m between plot and 1.5m between blocks. Various character data were collected such as days to heading, days to maturity, above ground biomass, grain yield, and plant height and panicle length. Data was subjected to analysis of variance and there was highly significant difference ($p<0.01$) among the varieties and other agronomic traits. The combined analysis of variance indicated that there were highly significant yield difference between the local check and the released Tef varieties over three locations. Tseday, Boset, Simada, Amarach and Lakech gave the highest grain yield; 1892.1, 1752.5, 1709.7, 1664.5, and 1653 kg/ha respectively. Therefore, based on objectively measured traits (days to heading, days to maturity, above ground biomass, grain yield, plant height and panicle length), Tseday and Boset were recommended for wider cultivation in three locations of western part of Ethiopia while varieties Simada, Amarach and Lakech, showed specific adaptability.

INTRODUCTION

Tef [*Eragrostis Tef (Zucc.) Trotter*] is an annual grass crop and important cereal harvested for grain in Ethiopia where not only the origin of Tef but it is also the center of diversity [1]. Tef is adaptable to a wide range of ecological conditions in altitudes ranging to 3000 m above sea level and it can be grown in an unfavorable environment condition, while the best performance occurs between 1100 and 2950 m above sea level in Ethiopia. [2]

Tef is grown in 2,404,674 hectares and the production is about 24,377,495 quintals annually [3]. Its flour is preferred in the production of enjera, a major food staple in Ethiopia. It is also grown on a limited basis for livestock forage in other parts of Africa, India, Australia, and South America. In the U.S small acreages of Tef is grown for grain production and used to Ethiopian restaurants [4]. In Benishangul Gumuz Regional State, the main Tef producing zones were Metekal, Assosa, and Mao komo leyu wereda. The region covered with 19,389.08 hectares by Tef crop and 246, 591. 44 quintals were grown by 45,457 stakeholders [5].

This crop is important for human consumption, straw for animal and plastering compounds for construction purposes. Tef can be produced under adverse environmental condition such as water lodging, drought, pests and disease which makes this crop very important. Still the production is minimum (11.5quntals/ha) in Western part of Ethiopia due to lack of improved Tef varieties, on- adoption of improved technologies, disease and pest management.Tef varieties were released by federal research center (Debre Zeyit Agricultural Research Center) in Ethiopia. However; most of genetic resources have not been evaluated in western part of the country.

Therefore; the objective of this study was to evaluate improvement of Tef varieties which are adaptable, high yielding and stress tolerant to insect, pests and disease management in western part of Ethiopia

MATERIALS AND METHODS

Study area

The experiment was conducted at Assosa Agricultural Research Center; Assosa on Station, Begi and Mao-Komo sub-site between end of August and early September 2016/17 cropping season.

Assosa is located at 1547 m above sea level 10° 002'.922" N latitude and 34° 33 '.868" E longitude. Assosa Agricultural Reaserch Center is far from Addis Ababa 660 km and has uni modal rainfall distribution which starts at the end of April and extends to mid-November. The total annual average rainfall of Assosa is 1141.26 mm. The mean annual air temperature is 23 °C [6].The dominant soil type of Assosa area is Dystric Nitosols and Fluvisols [7].

Mao Komo site is also situated in Benishangul-Gumuz at 9° 23 '.165"N latitude and 34^0 24 ' .380" E longitudes at an altitude of 1820 m above sea level. The study area is located east of Assosa Agricultural Reaserch Center and west of Addis Ababa about 125 km and 685 km distance respectively. MaoKomo sub-center is also characterized by uni-modal rainfall which starts in April and extends to end of November with maximum rainfall received in June, July, August, September, and October. The total annual average rainfall of Maokomo is 1316.00 mm. The mean annual air temperature from 2009 to 2010 is 20 °C varies from 13 °C to 26 °C [6]. The major soil types found in the experiment area is Eutric Nitisols followed by Orthic Acrisols and Eutric Fluvisols [7].

Thirty six Tef varieties namely, Enatit, Asgori, Walankomi, Magna ,Menagesha , Melko, Gibe, Dukam, ziquala,Koye,Kuncho,Tsedey,Gerado,keytena,Kora,Simeda,Boset,Gimbichu,Amarach,Holetakey,Ambotoke,Gemechis,Gola,Genete,Zobe,Mechere,Lakech,Yilmana,Etsb,Dima,Guduru,Kena,Ajora,Dega tef and Woriye were collected from Federal Research Institute Debre Zeyt Agricultural Research Center. These trials were put into trial at Assosa Agricultural Research on station, Tongo and Begi sub-site. The trial was conducte in Randomized Complete Block Design with three replications. The size of the plot was measured 2.4 m^2 (1.2m x 2m) with the gap of 1m between plot and 1.5m between blocks. Sowing was done by row planting at seed rate of 15 kg/ha within the last week of August and first week of September in 2016/17 cropping season. All other recommended agronomic practices were kept normal and uniform to ensure normal plant growth and development. Seed yield of each plot was recorded and then converted into kg/ha. Data on plant height, panicle length, days to heading, days to maturity and grain yield were collected and subject to statistical analysis using SAS statistical software [8].

RESULT AND DISCUSSION

The analysis of variance showed that there were highly significant difference ($p<0.01$) among varieties for all traits evaluated (days to heading, days to maturity, above ground biomass, grain yield, plant height and panicle length (Table 1). These results were also supported by the findings of Ashamo et al [9] who evaluated 22 Tef genotypes at four locations and reported significant variations in grain yield of Tef at all test locations and Chondie YG, Bekele A (2017) [10] evaluate eight Tef varieties planted with one local check at Areka and Hossana stations of Areka Agricultural Research Center in the Southern region of Ethiopia. Varieties like Tseday, Boset, Simada, Amarach, Lakech should be score the highest grain yield 1892, 1752.5, 1709.7, 1664.5 and 1653 kg/ha than local check respectively. Those mentioned above had yield advantage of 274, 134.4, 91.6, 46.4 and 34.9% over the local check respectively. (Table 1).

Table 1: Mean grain yield and agronomic data of Tef varieties tested combined over location (Assosa,Tongo and Begi)

	Varieties	DH	DM	AGB	GY	PH	PL	% yld adv /L
1	DZ-01-354(Enatit)	42.5556	98.2222	2474.4	1329.7	100.658	44.004	-
2	DZ-01-99(Asgori)	42.5556	94.5556	2866.7	1327.1	93.9	41.258	-
3	DZ-01-787(Walankomi)	43.7778	98.4444	2788.9	1367.4	103.867	45.389	-
4	DZ-01-196(Magna)	42.4444	94.5556	2711.1	1220.5	102.711	40.291	-
5	DZ-Cr-44(Menagasha)	41.8889	96.3333	3055.6	1461	102.313	42.018	-
6	DZ-Cr-82(Melko)	42.5556	98.6667	1966.7	1140.2	103.311	42.316	-
7	DZ-Cr-255(Gibe)	40.7778	96.4444	2822.2	1467	98.578	40.144	-
8	DZ-01-974(Dukem)	42.5556	96.7778	3155.6	1570.6	109.378	45.491	-
9	DZ-Cr-358(Ziquala)	44	98.3333	2377.8	1329.1	96.878	43.022	-
10	DZ-01-1285(koye)	42.6667	98.4444	2655.6	1331.9	96.178	41.111	-
11	DZ-Cr-387/RIL-355(Quncho)	43.4444	95.7778	3066.7	1440.9	112.533	47.091	-
12	DZ-Cr-37(Tseday)	36.8889	93.7778	2822.2	1892.1	87.189	33.949	274
13	DZ-01-1281(Gerado)	41.2222	97.3333	2766.7	1429.2	98.311	40.591	-
14	DZ-01-1681(kayt-ena)	41.6667	95.7778	2633.3	1203	93.322	40.084	-
15	DZ-Cr-438(kora)	43	95.2222	3088.9	1478	111.4	43.744	-
16	DZ-Cr-385 RIL 295(Simada)	36.8889	93.5556	2811.1	1709.7	78.678	30.022	91.6
17	DZ-Cr-409/RIL 50d(Boset)	39.5556	93.7778	2833.3	1752.5	86.344	32.256	134.4
18	DZ-01-899(Gimbchu)	42.4444	95.7778	2311.1	1237.8	95.778	39.289	-
19	Ho - cr-136(Amarach)	39.1111	92.8889	2788.9	1664.5	86.333	33.2	46.4
20	DZ-01-2053(Holeta key)	41.3333	93.3333	2666.7	1141.7	84.929	34.889	-
21	DZ-01-1278(Ambo toke)	42.2222	94.3333	2777.8	1370.4	97.34	40.351	-
22	DZ-Cr-387 RIL# 127(Gamechis)	42.3333	93.8889	2655.6	1552.5	97.111	39.878	-
23	DZ-01-2054(Gola)	42.3333	95.3333	3144.4	1587.8	105.624	44.731	-
24	DZ-01-146 (Genete)	43.2222	96.1111	2488.9	1338.7	102.058	43.589	-
25	DZ-01-1821 (Zobe)	42	96.3333	2744.4	1371.9	102.644	43.947	-
26	Acc.2055953(Mechere)	42.2222	97.2222	2677.8	1374.4	98.689	41.333	-
27	SR-RIL-273 (Lakech)	43.2222	97.1111	3322.2	1653	105.856	41.391	34.9
28	DZ-01-1868(Yilmana)	41.1111	97.4444	2755.6	1447.2	98.056	39.678	-
29	DZ-01-3186 (Etsb)	42.7778	98.1111	3000	1588.6	106.089	43.913	-
30	DZ-01-2423 (Dima)	40.5556	97.7778	2966.7	1508	93.547	34.878	-
31	DZ-01-1880 (Guduru)	42.4444	96.2222	3444.4	1485	112.622	47.542	-
32	23-tafi-adi-72(kena)	42.3333	95.3333	2911.1	1243.5	101.022	40.213	-
33	PGRC/E205396 (Ajora)	39.1111	93.5556	2777.8	1560.1	99.756	40.491	-
34	DZ-01-2675 (Degatef)	41.4444	97.4444	2588.9	1057.8	100.844	40.456	-
35	21476A (Woriye)	41	94.3333	2777.8	1521.5	101.978	41.844	-
36	Local check	40.8889	92.8889	3166.7	1618.1	94.444	37.789	-
	Mean	41.6821	95.87346	2801.759	1438.121	98.8964	40.6162	
	R-square	0.864731	0.964437	0.926824	0.655796	0.80303	0.81417	
	CV (%)	3.959066	1.860404	16.84263	17.73907	5.95433	6.81853	
	LSD (5%)	1.5334	1.6573	438.48	237.05	5.4717	2.5733	

Keys: DH=days to heading, DM=days to maturity, AGB=above ground biomass, GY= grain yield, PH= plant height, PL=panicle length, %yl d adv/L=percentage of yield advantage over local variety

The maturity period of all selected varieties indicated specific difference compared to local check except Lakech which was 97days (Table1) which is the same with the findings of Bakala N, Taye T, Idao B 2018. In western part of Ethiopia the production is still 1150 kg /ha due to lack of improved Tef varieties, non- adoption of improved technologies, disease and pests. However, the study shows that some varieties such as Tsedey, Boset. Simeda, Amarach and Lackech had good adaptability and performance than local variety in terms of grain yield. We believe that the production and productivity of this area will be increased if those verities were used instead of local variety.

CONCLUSION AND RECOMMENDATION

The combined analysis of variance for three test site showed that varieties were significantly different for all traits evaluated. Tsedey and Boset had the same days to maturity (day length to mature) but different days to heading and score the highest grain yield.

Therefore, based on researcher's idea and mean grain yield of released Tef varieties evaluated, it was concluded that Tsedey and Boset were recommended for wider cultivation whereas Simeda, Amarach and Lakech are specifically recommended for western part of Ethiopia

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