

Participatory on farm performance evaluation of improved Tef (*Eragrostis tef* L) varieties in East Belessa, north western Ethiopia

Molla Fentie^{1 2}, Nigus Demelash² and Tsedalu Jemberu²

¹ Technical university of Munich, Germany

² Gondar Agricultural Research Center
P.O. Box 1337, Gondar, Ethiopia

Abstract

Nine tef varieties including local check were evaluated with the objective of selecting adaptable and best performing tef varieties for moisture stress areas with full participation of farmers. The trial was conducted during 2006 and 2007 cropping seasons at East Belessa woreda of north Gondar Administrative zone of Amhara region. The design was randomized complete block design with three replications. In 2006, the mean yields of all improved varieties were relatively higher than the local check. Varieties Dukem and Dz-01 899 gave the highest grain yield (1143kg/ha) and (1120kg/ha) respectively. Similarly during 2007 cropping season, all improved varieties gave relatively better yield than the local check. Variety Dukem and Gerado gave the highest grain yield (1691kg/ha) and (1578 kg/ha) respectively. The combined analysis of variance over years revealed that varieties were significant difference for days to heading and maturity, plant height, spike length and grain yield. The mean values of grain yield ranged from local check (1080 kg/ha) to Dukem (1417 kg/ha). Varieties Dukem and Tseday had a grain yield advantage of 31%, and 17% over the local check respectively. Tseday matured earlier than among improved varieties and relatively higher grain yield. Farmers' selection criteria were grain yield, maturity date and seed color. Based on their selection criteria, farmers selected Dukem for grain yield, Tseday for its short maturity period and grain yield, and Magna for its very white seeded color. Based on quantitatively measured traits (grain yield and early maturity) and farmers' visual observation, varieties Dukem and Tseday are recommended for production with their full packages in East Belessa and similar Moisture stress agro ecologies.

Key words: farmers' evaluation, tef, moisture stress area, grain yield.

INTRODUCTION

Tef [*Eragrostis tef* (Zucc.) Trotter] is the most important indigenous cereal of Ethiopia. Its production area is increasing at unprecedented scale due to increased market demand (both local and foreign) and many other desirable characteristics, including higher nutritional value, low incidence of damage by insects, better adaptation to drought, adaptive to poor drainage and high straw value (Seyfu, 1997). The germ plasm base of tef limits spectacular jump in its yielding ability. However,

because of the facts that tef is culturally deep entrenched in the food-habit of the Ethiopian population, it is mainly a cash crop, it covers more than 2.5 million of land, and Ethiopia has long been in food deficit, the "little" tef-yield Increment contributes in the strive towards food security (Hailu and Getachew, 2006).

It is adaptable to a wide range of ecological conditions and can be grown in conditions where the environment is unfavorable for most cereal in Ethiopia. It can be grown in altitudes ranging from near sea level to 3000ms, but the best performance occurs between 1100 and 2950 masl (Hailu and Seyfu, 2000).

Even though some varieties of tef have been released in Ethiopia, most of them were not evaluated

around drought prone areas of north western Ethiopia and farmers were not participated in varietal development and evaluation process. Farmers' participation in varietal selection has significant value in technology evaluation and dissemination. According to Getachew et al. (2008) and Chianu et al. (2006), the two way feedback between farmers and researchers is indeed vital component of highly client-oriented breeding programs in locally important and traditionally cultivated crop. Therefore, the objective of this study was to evaluate the performance of improved tef varieties under drought prone areas of north western Ethiopia with the full participation of farmers.

MATERIALS AND METHODS

The experiment was conducted during 2006 and 2007 cropping seasons at East Belessa. The experimental site has an altitude of 1680m.a.s.l. and annual rainfall of 597 mm and 823 mm during 2006 and 2007 cropping seasons, respectively. The dominant soil type is light vertisol. The temperature was ranged from 13.84-28.04°C during 2006 and 13.07-26.75°C during 2007. Eight improved varieties of tef namely, RIL-355(Quncho), DZ-01-196 (Magna), DZ-01-37(Tseday), DZ-cr-358(Ziquala), DZ-cr-255(Gibe), DZ-01-899, DZ-01-974(Dukem), DZ-01-1281(Gerado) and one local check were tested for their adaptability with full participation of farmers in the study areas. The trial was laid out in randomized complete block design with three replications. The spacing between plots and blocks were 1.0 m and 1.5 m respectively. Each experimental plot had 4 m x 4 m with a gross area of 16 m². Planting was done by broadcasting at seed rate of 30 kg ha⁻¹. Fertilizer was applied at the rate of 40/60 kg/ha N and P₂O₅ respectively. Half of the total nitrogen and total phosphorus were applied at the time of planting while the remaining nitrogen was applied at the time of tillering. Twice hand weeding and plowing and other management practices were done as required. Data on 50% days to heading and maturity, and grain yield (kg/ha) on plot basis while plant height (cm) and spike length(cm) on plant basis were collected and subject to statistical analysis using SAS statistical software (SAS,2002).

RESULTS AND DISCUSSION

In 2006, the analysis of variance revealed that there were highly significant ($p<0.01$) difference among varieties for days to maturity, plant height and panicle length, and significant ($p<0.05$) difference for days to heading and grain yield. Dukem gave the highest grain yield (1144 kg/ha) followed by Dz-01-899 (1120 kg/ha) during 2006 cropping season. Varieties Dukem and Dz-01-899 had yield advantage of 36% and 33% over the local check

respectively. Local variety matured in short period of time compared to all improved varieties (Table 1).

In 2007, the analysis of variance indicated that there were significant ($P<0.01$) difference among varieties for days to heading and maturity, and grain yield. However, varieties didn't show significant difference for plant height and panicle length. Variety Dukem gave the highest grain yield (1691kg/ha) followed by Gerado (1579 kg/ha). Dukem and Gerado had yield advantage of 28% and 19% over the local check respectively. Local variety was found to be the earliest in maturity which was (67.2 days) (Table 2). Grain yield was generally higher during 2007 than during 2006, (1444 kg/ha) and (1010 kg/ha) respectively (Table 1&2).The most likely reason for the high mean grain yield during 2007 may be due to conducive weather conditions, enough amount and uniform distribution of rain fall and optimum temperature.

The combined analysis of variance over years among varieties revealed that there were significant difference for 50% days to heading and maturity, plant height, spike length and grain yield. Varieties by year interaction indicated that there was highly significant ($p<0.01$) difference for panicle length and significant ($p<0.05$) difference for days to heading and maturity. However, significant difference was not observed in plant height and grain yield. Varieties Dukem and Gerado gave the highest grain yield (1417kg/ha) and (1341 kg/ha) respectively. Dukem gave the highest grain yield in both years and performed consistently over years. The high yielding and consistence performance of Dukem was reported by (Yifru and Hailu, 2005).They also further argued that the high grain yielding potential of Dukem may be due its tallest plant height compared to other improved varieties. Tseday had the shortest maturity period among all improved varieties and relatively good performance over years. Dukem and Gerado gave yield advantage of 31.21% and 24.18 % over the local check respectively. The local and Tseday varieties took (78.50) and (81.08) days to mature respectively (Table 3).

Farmers participated in varietal selection at stage of maturity. Accordingly, farmers set selection criteria of grain yield, maturity period and seed color. Based on their selection criteria, farmers selected Dukem for grain yield, Tseday for its short maturity period and grain yield, and Magna for its very white seeded color. Therefore, based on quantitatively measured agronomic traits (grain yield and maturity date) and farmers' visual observation at field, Dukem and Tseday are recommended for production in east Belessa of north western Ethiopia and similar agro ecologies.

CONCLUSIONS AND RECOMMENDATION

The combined analysis of variance revealed that varieties

Table1. Mean values of different agronomic characters for tef varieties grown at East Belessa during 2006.

Varieties	Days to heading	Days to maturity	Plant height(cm)	Panicle length (cm)	Grain Yield (kg/ha)
Quncho	44.0 ^{bc}	82.7 ^{ab}	96.9 ^a	56.3 ^a	1021 ^{ab}
Magna	42.7 ^{bc}	82.7 ^{ab}	76.5 ^b	44.1 ^{cd}	1026 ^{ab}
Tseday	40.0 ^c	81.5 ^b	68.5 ^c	40.2 ^d	1109 ^a
Ziquala	45.3 ^{ab}	83.7 ^{ab}	79.2 ^b	45.4 ^{cd}	1015 ^{ab}
Ghibe	44.7 ^{ab}	82.3 ^{ab}	82.4 ^b	47.1 ^{bc}	925 ^b
DZ-01-899	48.3 ^a	84.3 ^a	77.4 ^b	43.7 ^{cd}	1120 ^a
Dukem	41.3 ^c	82.2 ^{ab}	93.8 ^a	51.7 ^{ab}	1144 ^a
Gerado	48.7 ^{ab}	84.2 ^{ab}	77.4 ^b	41.2 ^{cd}	1057 ^a
Local	39.3 ^c	74.8 ^c	67.9 ^c	32.4 ^e	838 ^b
Mean	43.9	82.1	80.0	44.6	1010.6
CV (%)	11.89	3.64	6.44	11.55	17.59
LS	*	**	**	**	*

* Significant at 5% probability level, ** Significant at 1% probability level, NS=Non significant, LS=level of significance

Table 2. Mean values of different agronomic characters for tef varieties grown at East Belessa during 2007

Varieties	Days to heading	Days to maturity	Plant height(cm)	Panicle length (cm)	Yield (kg/ha)
Quncho	51.5 ^a	76.7 ^a	111.2	44.4	1437 ^{bcd}
Magna	48.8 ^{bc}	78.5 ^a	108.0	41.6	1314 ^d
Tseday	43.5 ^e	68.7 ^b	108.8	41.0	1415 ^{bcd}
Ziquala	46.7 ^d	78.3 ^a	98.0	39.5	1530 ^{abc}
Ghibe	47.0 ^{dc}	79.7 ^a	112.5	43.0	1347 ^{dc}
DZ-01-899	47.5 ^{dc}	80.7 ^a	106.8	45.3	1367 ^{dc}
Dukem	49.7 ^{ab}	78.0 ^a	123.4	44.7	1691 ^{ab}
Gerado	47.0 ^{dc}	78.7 ^a	108.1	44.6	1579 ^{ab}
Local	43.0 ^e	67.2 ^b	102.9	42.2	1323 ^d
Mean	47.2	76.3	109.2	43.1	1445
CV (%)	3.47	6.06	11.91	9.35	10.72
LS	**	**	NS	NS	**

*Significant at 5% probability level, **Significant at 1% probability level, NS=Non significant

Table 3. Mean values agronomic characters for tef varieties grown at East Belessa - combined over years (2006 and 2007)

Varieties	Days to heading	Days to maturity	Plant height(cm)	Panicle length(cm)	Yield (kg/ha)
Quncho	47.8	79.7	104.1	50.3	1229
Magna	45.8	80.6	90.8	43.1	1150
Tseday	41.8	73.6	84.6	40.6	1262
Ziquala	46.0	81.0	88.6	42.5	1272
Gibe	45.8	81.0	96.1	45.2	1094
DZ-01-899	47.9	82.5	92.1	44.5	1244
Dukem	45.5	80.1	108.6	48.2	1417
Gerado	47.8	81.4	92.7	42.9	1341
Local	41.2	71.0	79.6	35.7	1080
Mean	45.5	79.0	93.6	43.9	1232
CV (%)	9.00	4.98	10.41	11.33	13.73
LSD (trt)	3.32	3.49	8.22	4.23	138.69
LS(trt*y)	*	*	NS	**	NS

*Significant at 5% probability level, **Significant at 1% probability level, NS=Non significant Y=year and trt=treatment.

are significant for days to heading and maturity, panicle length, plant height and grain yield. The mean values of varieties for grain yield ranged from local check (1080 kg/ha) to Dukem (1417 kg/ha). Varieties Dukem, Gerado and Tseday had a grain yield advantage of 31%, 24% and 17% over the local check respectively. Tseday was found to be the earliest maturing variety with higher grain yield. Farmers' main selection criteria were grain yield, maturity date and seed color. Based on their selection criteria, farmers selected Dukem for grain yield, Tseday for its short maturity period and its higher grain yield and Magna for its very white seeded color. Therefore, based on quantitatively measured traits and farmers' preference, varieties Dukem and Tseday are recommended for production in East Belessa and similar agro ecologies.

REFERENCE

- Chianu J, Vanlauwe B, Mukalama J, Adesina A, Sanginga, N (2006). Farmer evaluation of improved soybean varieties being screened in five locations in Kenya: Implications for research and development. *African J. Agric Res.* 1: 143-150.
- Getachew B, Hailu T, Anteneh G, Kebebew A, Gizaw M (2008). Highly client-oriented breeding with farmer participation in the Ethiopian cereal tef [*Eragrostis tef* (Zucc.) Trotter]. *African J. Agric Res* Vol. 3 (1), pp. 022-028.
- Hailu T, Seyfu K (2000). Production and importance of tef in Ethiopia Agriculture. In: Hailu Tefera, Getachew Belay and Mark Sorrels (Eds) *Narrowing the Rift: Tef research and development- Proceedings of the international Tef Genetics and improvement*, 16-19 October 2000, Addis Ababa Ethiopia.
- Hailu T, Getachew B (2006). *Eragrostis tef* (Zuccagni) Trotter. In *Plant Resources of Tropical Africa 1. Cereals and pulses..* (Eds M. Brink and G. Belay). Prota Foundation, Wageningen/ Backhuys Publishers, Leiden/ CTA, Wageningen, Netherlands. pp. 68-72.
- SAS Institute (2002). *SAS System for Windows Release 9.2.* Inc, Cary, NC, USA.
- Seyfu K (1997). Tef, *Eragrostis tef* (Zucc), Trotter: Promoting the Conservation and Use of under Utilized and Neglected Crops. p.12. Institute of Plant Genetics and Crop Plant Research; Gater Sleben/Int. Plant Genetic Research Institute (IPRRI), Rome, Italy.
- Yifru T, Hailu T (2005). Genetic improvement in grain yield potential and associated agronomic traits of tef (*Eragrostis tef*). *Euphytica* 141: 247-254.