Adaptability Evaluation and Selection of Some Improved tef (Eragrostis tef (Zucc.) Trotter) Variety’s in Bench Maji Zone South Western, Ethiopia

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Abstract
The experiment was conducted to identify, select and recommend adaptable, high yielding, Insect pest and disease resistant eleven released and one local variety at Bench Maji zone of SNNPR. Twelve varieties were evaluated in RCBD with three replication on station at South Bench, Guraferda and Sheko on main cropping season of 2015 and 2016. Analysis of variance revealed that except grain filling period at Guraferda woreda there were significant(p< 0.005) differences among genotypes for culm length, panicle length, plant height, days to heading, days to maturity, grain filling period, primary panicle brunch, grain yield, biomass yield and harvest index at South Bench, Guraferda and Sheko. Based on the obtained result, three improved tef varieties namely;kora, Boset and Dukem at South Bench; Quncho, Gimbechu and Enatit at Guraferda and also Dukem, Quncho and Gimbechu at Sheko showed better performance for most of the studied characters including grain yield. Therefore, these three varieties were selected and recommended for the study area and similar ecologies of Bench Maji Zone.On the other hand Magna at South Bench, Degatef at Guraferda and local variety showed lowest grain yield.

Keywords: Adaptability, Grain yield Tef and varieties

Introduction
Tef (Eragrostis tef (zucc.)Trotter) is ancient and an important cereal crop in Ethiopia, where domestication took place before the birth of Christ (CSA, 2014). According to Stallknecht (1997), tef originated in Ethiopia around 4000-1000 BC. It was probably cultivated in Ethiopia even before the ancient introduction of emmer wheat and barley (Tadesse Ebba, 1975). The fact that several cultivated and wild species of Eragrostis, some of which are considered the wild relatives of tef, are found in Ethiopia and the genetic diversity existing in Ethiopia, indicates that tef originated and was domesticated in Ethiopia. Vavilov (1951) has identified Ethiopia as the center of origin and diversity of tef.

In Ethiopia; the five major cereals (tef, wheat, maize, sorghum and barley) occupy almost three-quarters of total area cultivated, and represent almost 70 percent of total value added in recent years (ATA, 2011). Tef is adaptable to a wide range of ecological conditions in altitudes ranging from near sea level to 3000 masl and even it can be grown in an environment unfavorable for most cereal, while the best performance occurs between 1100 and 2950 masl in Ethiopia (Hailu T, 2000).

Tef is predominantly grown in Ethiopia as a food crop and not as a forage crop. However, when grown as a food, farmers highly value the straw of tef and it is stored and used as a very important source of animal feed, especially during the dry season. Farmers feed tef straw preferentially to lactating cows and working oxen. Cattle prefer tef straw to the straw of any other cereal and its price is higher than that of other cereals (Seyfu Ketema, 1997).

It is mainly produced in Amhara and Oromia, with smaller quantities in the Tigray and SNNP regions. However last 50 year’s many research can done to improve tef in Ethiopia with a primary focus on yield but this con not include whole country; it is only few main tef producing area of the country. In southern nation nationalities and people of regional stat (SNNPR) there are eleven zones and eight special weredas that produce tef. But in south west part of Ethiopia at Bench Maji zone of the in South Bench, Guraferda and Sheko woreda tef cannot be produced and no research was under taken and hence, the adaptability trial of varieties was not takes placed. Therefore, the present study was conducted to evaluating and selecting adaptable, high yieldingimproved tef varieties for South Bench, Guraferda and Sheko woreda.

MATERIALS AND METHODS
Description of the study area
The experiment conducted at three locations of Bench Maji zone, namely South Bench, Guraferda and Sheko woreda during 2015 and 2016 main cropping season. The geographical study areas are characterized as semi tropical type with acidic nature of nitosol soil type. The average annual rain fall of the area is wet moist for most months of the year with relative dry season in end of December up to beginning of March.

Experimental materials
About 11 released tef varieties and one local that expected to perform better in the areas were used for this study.
The varieties are selected based on average yield performance and agro ecological adaptation. The verities were obtained from Debrezyet Agricultural Research center.

**Experimental Design**

The experiment was laid out in RCBD with three replications and the plot size will be 2mx2m. The spacing was 1m between plots and 1.5m between adjacent blocks. Each genotype was sown at seed rate of 25 kg/ha by row planting. A recommended fertilizer rate 100kg/ha DAP and 53kg/ha urea were applied. All other trial management activities were carried out as deemed necessary.

**Data collection**

The following quantitative data were recorded from field observation1:

- a) Day from planting to heading
- b) Days to maturity
- c) Days to grain fill period
- d) Culm length (cm)
- e) Panicle length (cm)
- f) Plant height (cm)
- g) Number of primary branches per plant
- h) Grain yield per plot (kg)
- i) Biomass yield per plot (kg)
- j) Harvest index (%)

Harvest index (HI) = Seed yield/plot (kg)

\[ \text{Total biological yield/plot (kg)} \]

**Statistical Analysis**

The data was subjected to analysis of variance using SAS software v 9.1.3 (SAS, 2004). The significant difference among genotypes was tested by ‘F’ test at 1% and 5% levels of probability.

**RESULTS AND DISCUSSION**

The analysis of variance revealed that there were highly significant (p<0.01) difference among varieties for culm length, primary panicle branch, grain yield, biomass yield and harvest index and significant (5%) different in panicle length, plant height, days to heading, days to maturity and grain filling period at South Bench. These results are further supported by Chondie YG, Bekele A (2017) who reported considerable variation in the days to maturity, plant height and panicle length, days to heading and grain yield of different teas varieties when planted over years. Similarly, AiyiKedir (2016) reported that significance differences between varieties for the characters like days to maturity, panicle length, plant height days to heading, days to maturity, grain yield. Grain yield of tested varieties at tested locations which was ranged from 496 Kg/ha (Magna) to 1955 Kg/ha (kora) with mean value of 1340 Kg/ha (Table 1). Korawas among the highest yielding cultivars followed Boset (1827 Kg/ha) and Dukem (1750 Kg/ha) however; statistically there is no significance difference. On the other hand lowest grain yield was recorded by Magna (490 Kg/ha) at South Bench. In agreement with the current study, AiyiKediret et al. 2016 reported that Boset, showed better performance for most of the studied characters including grain yield.

**Table 1. Mean and Range values for different agronomic traits for 12 cultivars at South Bench in 2015 and 2016**

<table>
<thead>
<tr>
<th>Varieties</th>
<th>CL (cm)</th>
<th>PL (cm)</th>
<th>PH (cm)</th>
<th>DE (days)</th>
<th>DH (days)</th>
<th>DM (days)</th>
<th>GFP (days)</th>
<th>PPB</th>
<th>GY (Kg/ha)</th>
<th>BM</th>
<th>HI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>58.33</td>
<td>50.83</td>
<td>68.13</td>
<td>9.46</td>
<td>8.09</td>
<td>7.25</td>
<td>58.16</td>
<td>35.5</td>
<td>2400</td>
<td>2</td>
<td>125</td>
</tr>
<tr>
<td>Range</td>
<td>32.48-60.83</td>
<td>82.03-25.86</td>
<td>95.13-8.09</td>
<td>5.39-72.12</td>
<td>41.15-113.27</td>
<td>25.63-36.3</td>
<td>57.5-58.1</td>
<td>25.7-60.83</td>
<td>2300-1955</td>
<td>2</td>
<td>125</td>
</tr>
<tr>
<td><strong>DZ-Cr-354</strong></td>
<td>57.5</td>
<td>31.36</td>
<td>88.7a</td>
<td>5.04</td>
<td>73.0a</td>
<td>114abc</td>
<td>31.2bcd</td>
<td>1424abc</td>
<td>1.6abc</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>DZ-01-899</strong></td>
<td>36.76</td>
<td>30.96</td>
<td>87.6abc</td>
<td>5.33</td>
<td>72.3abc</td>
<td>112.6abc</td>
<td>40.3bcd</td>
<td>24.3b</td>
<td>1200b</td>
<td>1.3abc</td>
<td></td>
</tr>
<tr>
<td><strong>DZ-01-196</strong></td>
<td>61.8b</td>
<td>32.4abc</td>
<td>94.3a</td>
<td>5.69</td>
<td>73.3a</td>
<td>109.3c</td>
<td>36.3</td>
<td>16.9c</td>
<td>900d</td>
<td>3.1bcde</td>
<td></td>
</tr>
<tr>
<td><strong>DZ-01-2675</strong></td>
<td>50.8e</td>
<td>31.2b</td>
<td>82.0c</td>
<td>5.66</td>
<td>72.3abc</td>
<td>118.6a</td>
<td>46.3a</td>
<td>19.8bc</td>
<td>925c</td>
<td>6.4ab</td>
<td></td>
</tr>
<tr>
<td><strong>DZ-Cr-438</strong></td>
<td>68.1a</td>
<td>25.8d</td>
<td>94.0a</td>
<td>5.03</td>
<td>73.0abc</td>
<td>110.0c</td>
<td>37.4d</td>
<td>26.8a</td>
<td>1955a</td>
<td>5.1a</td>
<td></td>
</tr>
<tr>
<td><strong>Ha-Cr-136</strong></td>
<td>60.4b</td>
<td>32.6abc</td>
<td>93.06a</td>
<td>7.06</td>
<td>69.0cd</td>
<td>113.3b</td>
<td>44.3ab</td>
<td>15.8d</td>
<td>960c</td>
<td>2.0a</td>
<td></td>
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<tr>
<td><strong>DZ-Cr-387</strong></td>
<td>58.06bcd</td>
<td>37.0ab</td>
<td>95.1a</td>
<td>4.33</td>
<td>73.3ab</td>
<td>111.6c</td>
<td>38.3de</td>
<td>25.5a</td>
<td>1620ab</td>
<td>2.8bcd</td>
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<tr>
<td><strong>DZ-Cr-409</strong></td>
<td>58.1bcd</td>
<td>33.7abc</td>
<td>91.9d</td>
<td>4.6d</td>
<td>68.0d</td>
<td>111.6c</td>
<td>43.6ab</td>
<td>22.6a</td>
<td>1827a</td>
<td>2.2bcd</td>
<td></td>
</tr>
<tr>
<td><strong>DZ-01-1285</strong></td>
<td>52.5d</td>
<td>31.8abc</td>
<td>84.3bc</td>
<td>8.0a</td>
<td>75.6a</td>
<td>117.3ab</td>
<td>41.6bcd</td>
<td>16.4cd</td>
<td>1220b</td>
<td>2.8bcd</td>
<td></td>
</tr>
<tr>
<td><strong>DZ-01-255</strong></td>
<td>53.8d</td>
<td>37.4a</td>
<td>91.2a</td>
<td>3.6</td>
<td>71.8bcd</td>
<td>114abc</td>
<td>43abc</td>
<td>20.6b</td>
<td>1040c</td>
<td>2.24cd</td>
<td></td>
</tr>
</tbody>
</table>

CL=Culm length, PL=panicle length, PH=plant height, DH=days to heading, DM=days to maturity, GFP=grain filling period, PPB=primary panicle branch, GY=grain yield, BM=biomass yield, HI=harvest index. Mean within a column followed by the same letter(s) within a column are not significantly different from each other at 5% by DMRT.

At Guraferda, the analysis of variance indicated that there were highly significant (P<0.01) difference among varieties in plant height, days to emergency, grain yield and biomass and significant (P<0.05) in culm length, panicle length, days to heading, days to maturity, primary panicle branch, and harvest index. Grain filling period is only character that show non significance. Grain yield of tested varieties ranged from 950 Kg/ha (Degatef) to 1723 Kg/ha (Quencho) with mean value of 1279 Kg/ha. High grain yield was recorded by variety...
Quñcho1723 Kg/ha followed Gimbichu (1650 Kg/ha) and Enatit (1630 Kg/ha). However, there is no statically different between them. Earlier workers also reported that Quñcho and Gimbichu for its short maturity period and its higher grain yield for Hosanna areas relatively (Chondie YG, Bekele A., 2017). Lowest grain yield was recorded by Dega tef (950 Kg/ha) (Table 2).

At Sheko, the analysis of variance indicated that there were highly significant (P<0.01) difference among varieties in culm length, plant height, days to emergency, days to heading. Panicle length and Grain filling period and significantly different in days to maturity, primary panicle brunch, grain yield, biomass yield and harvest index. A wide range of variability was recorded for grain yield among genotypes (Table 3). It’s ranged from 790 Kg/ha (local) to 1733 Kg/ha (Dukem) with mean value of 1130 Kg/ha. Dukem (1730 Kg/ha) followed Quncho (1650 Kg/ha) and Gimbechu (1630 Kg/ha) were among the highest yielding cultivars at Sheko(Table 3).

Lowest grain yield was recorded by local variety (791 Kg/ha). In agreement with the current finding, Chondie reported that higher grain yield and easily adaptability Quncho and Gimbichu variety for Hosanna areas.

Conclusions and Recommendation

The tef adaptation trial was conducted at three locations representing mid-land agro-ecologies of Bench Maji Zone, SNNPR 2015 and 16 cropping season to evaluate and select adaptable, high yielding, early maturing, diseases resistant varieties. Grain yield is an important character to be considered for variety selection to address the objective of the conducted activity. For this reason, three improved varieties i.e.kora, Bosing and Dukem at South Bench; Quñcho, Gimbichu and Enatit at Guraferda and also Dukem, Quñchoand Gimbechu at Dukem at South Bench; Quncho, Gimbichu and Enatit for Hosanna areas relatively (Chondie YG, Bekele A., 2017). Lowest grain yield was recorded by Dega tef (950 Kg/ha) (Table 2).

The authors have not declared any conflict of interests.
ACKNOWLEDGEMENTS
The authors would like to thank Mizan Tepi University for their financial support and Debrezeyt Agricultural Agricultural research center for contribution of seed.

REFERENCES