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Pre-extension Demonstration of Improved Tef Varieties with their Associated Management Practices in Tef growing areas of Ethiopia

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Abstract
The objectives of this on-farm demonstration were to create awareness on the availability and importance of the new tef varieties and to create wider demand pull by reaching large number of users over relatively wider geographical area. In addition to this the study aimed to enhance institutional and functional linkages with key players through joint actions and performances. Training and experience sharing events like field days were used to demonstrate the new improved tef varieties. For the on-farm demos seeds of the newly released varieties were provided to farmers at the rate of 10 kg/ha on a revolving seed loan basis. The plot size was 10 m x10 m at all locations. Data were collected through field observation and direct measurements. A field day was organized at maturity stage at all three sites, Adea, Akaki, Gelan and werejarso and a total of 1578 participants (1294 male and 284 females) *were participated on the event. All the demonstrations were perform well at each site and great awareness has been created on the availability and importance of the new tef varieties. In addition, good institutional linkages were established among the partners including district and zonal agriculture offices, seed producer companies and seed producing farmer cooperatives. This study recommend that, on-farmer and farmers' training center based demonstrations of improved new tef varieties would greatly enhance adoption and thereby production and productivity of tef along with minimizing the risks of failures of the newly released varieties at on farm level.*

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I. Introduction

Tef (*Eragrostis tef*), is an important and major staple cereal crop, playing apivotal role in the country's food security and farmers' lively hood in Ethiopia. It is extensively cultivated in many parts of Ethiopia (Fufa, *et al.*, 2011). With yearly main season acreage of 3.02 million ha and harvests of 5.283 million t (CSA, 2018), tef accounts for about 30% of the total acreage and 20% of the gross grain production of all cereals grown in the country. Since tef is an excellently adapted crop to the changing environments in the country, farmers face low risk of failure.

The nutritional status of tef grains is comparable to that of the other major world cereals (Melak-Hail, 1966). The grain of tef is used as whole flour mostly for processing "injera", a staple food for the majority of Ethiopians. In addition to traditional foods and beverages, tef grain is processed for gluten free markets, in infant foods and various snack bars as whole grain supplement to the diet. On the other hand, both the grains and straw fetch relatively high market prices in comparison to other cereal crops (Kebebew *et al*., 2013). Tef straw (*chid*) is the main source of feed for ruminants in various agro-ecologies of the country. According to the agricultural sample survey 2017/18 provided by CSA (2018), at the country level, about 6. 772 million Ethiopian farmers household grown tef on about 3.02 million ha (29.54 % of the total cereal crops area), while maize, sorghum and wheat took up 18.53% (about 2.135 million ha), 18.53% (1.896 million ha) and 16.58% (1.697 million ha) of the cereal crops area, respectively. As to production, tef made up 19.73% (5.283 million t) of the gross cereal grain production next to maize (30.94% of cereals with 8.286 million t).

The average productivity of tef on smallholder farmers' field is still low (1.75 t/ha) (CSA, 2018). So far, Debre Ziet Agricultural Research Center released about 26 tef varieties and recently three varieties (Filagot, Tesfa and Nigus were released with on station production of 2.3-3.2 t/ha and 2.0-2.8 t/ha respectively. Hence, there was a huge yield gap to be bridged in production, productivity and income of smallholder tef growers. Therefore, these improved varieties commands to be communicated through farmers training center (FTC) based together with their accompanying management packages so as to bring substantial improvement in the productivity of smallholder tef growers.

Objectives

- To create awareness on the availability and importance of the new tef varieties
- To enhance institutional and functional linkages with key players through joint actions and performances

II. Methodology

Research design and selection of farmers

Four districts were selected purposively based on growing potential. From these districts a total of 8 FTCs and 40 farmers were selected in collaboration with the crop production experts and development agents of the Bureaus of Agriculture of the respective districts. The criteria used to select target FTCs and farmers include: willingness to provide the required plots and labor; representativeness for the district and willingness of the experts to collaborate with researchers. The plots and labor for all the activities like land preparation, planting, weeding harvesting and trashing were given by farmer to conduct the demonstration trail. Plot size at FTCs was 10 m x 10 m (100 m^2) per variety and farmers 0.25he per variety at each location. Seeds were provided to the participating FTCs and farmers at the rate of 15kg/ha. Method demonstration was used to demonstrate the improved tef varieties. Training on agronomic practices (land preparation, sowing, weeding, harvesting and post-harvest handling) were given for farmers and experts by experienced researchers from the various disciplines/departments.

Farmers together with researchers and experts periodically evaluate the performance of each variety during group visit. Data on performances of the varieties and feedbacks from farmers and experts at different stage the crop were collected by researchers.

A field day was organized at maturity stage of the crop for wider dissemination of the project impact to other farmers and stakeholders. Participants of the field day were farmers, different stakeholders, kebele administration officials, district bureau of agriculture and natural resource and researchers.

Data collection and analysis

Grain yield per plots were measured at in all of the target demonstration locations and ranking matrix was used to compare the performance of the varieties in terms of panicle length, tillering, grain color and marketability (Table 1). Both farmers and experts from each of the four districts were participated in evaluating the performance of the varieties. Numbers of trained farmers on the availability and importance of the technology and their perception/opinion/feedbacks on improved tef varieties were recorded. The number of farmers participated in training, field visits and field days were also recorded.

III. Results and Discussion

3.1. Training of farmers and other stakeholders

Training on Tef production and management practices were given to demonstration forty host farmers and sixteen development agents who were working in the study site. This includes both theoretical and practical types of training. During regular visits, there were gaps identified by researchers. To fill the observed gap, field-level training was given by grouping farmers into small groups and discussed issues raised by farmers.

3.2. Yield Performance

For the study period from demonstration plots, yield data were collected from fourty farmer's field. The mean yield of Dagim variety was (24.25 qt/ha) which is found higher than that of Filagot (21.94 qt/ha), Kora (21.5 qt/ha), Nigus (19.94 qt/ha) and Tesfa (17.63 qt/ha) (figure 1).

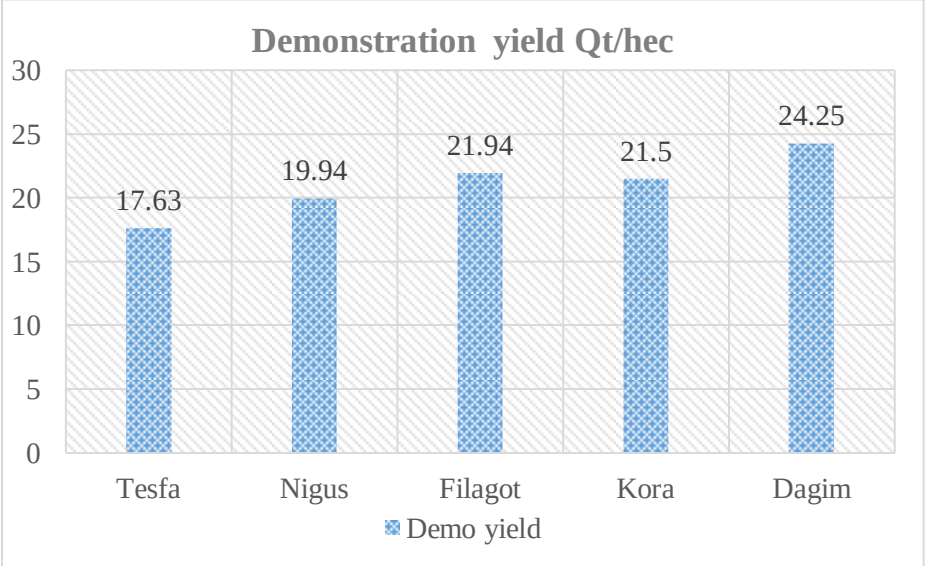

Figure 1: yield performance of Tef varieties

3.2. Yield gap and Advantage

The highest yield increment (5.37 qt/ha) was recorded by Dagim variety of a 28. 44% yield advantage over the regional productivity. Comparing with the regional productivity, all varieties except Tesfa have a yield advantage and yield increments; Filagot (3.06 qt/ha), Kora (2.26 qt/ha) and Nigus (1.06 qt/ha). The difference in yield between the demonstrations and potential yields of the varieties was also well noted (Table-1). The technology gap showed the difference between demonstration yields and potential yield. The highest gap was found in Kora variety (10.5 qt/ha) and the minimum difference found with Dagim variety (1.02 qt/ha). The technology gap could also be because of varying soil fertility, rainfall and unpredictable weather conditions. Generally, the varieties demonstrated yielded better to that of the control/ farmers practice except Tesfa Variety. From the demonstration result, it can be concluded that the adoption of high yielding improved varieties can result in improved productivity and food security.

Table 1: Productivity, technology gap and extension gap in Tef under on farm demonstration

Variety	Yield Potential	Demo Yield	Regional Productivity	Yield Increment	% Increase Over Control	Technology Gap (Qt/Ha)	Ext. Gap (Qt/Ha)
Tesfa	25	17.63	18.88	-1.25	-6.62	7.37	-1.25
Nigus	27.58	19.94	18.88	1.06	5.61	7.64	1.06
Filagot	25.4	21.94	18.88	3.06	16.21	3.46	3.06
Kora	32	21.5	18.88	2.62	13.88	10.5	2.62
Dagim	25.27	24.25	18.88	5.37	28.44	1.02	5.37

Preference ranking

The performance of the evaluated varieties were good and encouraging at all location. In addition to the grain yield ranking matrix at maturity stage was used to compare the performance of the varieties and to select the best varieties in the cropping season. Based on the ranking matrix by farmers and experts at maturity stage, Nigus variety was the first in grain color and marketability whereas Dagim was the first by panicle length, tillering capacity. The whitest variety among the evaluated varieties was Nigus. Filagot variety was the first in home consumption for taste as well as medicinal value (Table 2). Since Filagot variety is brown seeded, it is not demanded by market. Kora was found as it has lowest straw quality.

This study proved that, pre-extension demonstration is a best way to popularize the newly released tef varieties and to recommend the variety/ies suitable for the respective test locations. The report by Gezahegn *et al*., (2006) also revealed that agricultural demonstration is a best way for widespread the new technology and increase adoption.

Table 2: Farmers' preference ranking of the Tef varieties

	Panicle length and weight	Tillering	Grain color	Market preference	Home consumption	Straw quality	Frequency	Rank
Filagot	3	2	1	1	4	3	14	3
Tesfa	1	1	2	2	3	2	12	4
Nigus	3	4	4	3	0	3	17	2
Dagim	4	4	3	3	3	4	21	1
Kora	1	2	3	4	2	1	14	3




Field day and experience sharing events

A field day was organized at all locations to visit the fields of demonstrated varieties and a total of 1578 participants (1294 male and 284 females) attended the event (Table 3). Participants were researchers, seed producers (both private and community based), farmers from different districts, experts from district and Zones and & Oromia Bureau of Agricultural and Natural Resources (BoANR). Dagim and Nigus were selected as best variety by farmers and other stakeholders during the field day. The major lesson learnt from the event is that participating different stakeholders in the evaluation the varieties can help for easy acceptance and promotion of newly released varieties.

Table 3: Field day participant on tef variety evaluation

		Farmers		Development Agents		Experts		Youths	
No.	Districts	Male	Female	Male	Female	Male	Female	Male	Female
1	Adea	347	98	2	1	0	0	22	12
2	Akaki	504	76	2	2	0	0	0	0
3	Gelan	86	16	9	2	28	4	0	0
4	Worejareso	219	31	6	4	31	19	38	19
	Total	1156	221	19	9	59	23	60	31

IV. Conclusions and Recommendations

All the demonstrations were performed well at each of the locations and great awareness on the availability and importance of the new tef varieties was created. A wider demand pull was created by reaching large number of users over relatively wider geographical area though demonstration and field day events. In addition to this, good institutional linkage was developed between partners such as farmers, district and zonal agriculture offices, seed producer companies and seed producing farmers' cooperatives.

This study recommend that, demonstration of improved new tef varieties at FTC level is an excellent and effective working approach to enhance the promotion and the acceptance newly released tef varieties and thereby to increase the production and productivity of the crop. This is because of the fact that the FTCs are mostly visited by all farmers during the field days as well as during their own business. Working in collaboration with zonal and district agriculture offices and seed producers is a good for the sustainability of newly released improved varieties in production.

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