

Pre-Scaling Up of Improved Tef Varieties at Adola Rede District, Guji Zone, Southern Oromia, Ethiopia

Basha Kebede*, Dembi Korji* and Girma Amare*

Bore Agricultural Research Center, Bore, Ethiopia

***Corresponding Author:** Basha Kebede, Dembi Korji and Girma Amare, Bore Agricultural Research Center, Bore, Ethiopia.

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Abstract

The activity was conducted in Adola Rede District in Guji Zone. It was aimed to increase production and productivity of tef variety by providing improved seed in the study area. From district four kebeles were selected based on the potential of tef production. The selected 54 farmers were obtained improved tef variety of Boset and Tseday variety during 2017 and 2018 production seasons. Trainings, exchange visit and field day were given for farmers for the promotion of tef variety in the district. 400 Kg of seed (200 Kg of Boset and 200 Kg of Tseday) was freely distributed for the selected farmers. On average the yield 1324 Kg/ha for Boset and 1303.70 Kg/ha for Tseday variety was obtained by participated farmers. The pre scaling up of improved tef varieties were profitable for farmers in Adola Rede district. It was very important for dissemination of improved tef technologies in the midland area of Guji Zone. Participating farmers generated higher return of 17276ETB from Boset and 16837ETB from Tseday variety. The return from tef helped many farmers in maintaining their food self-sufficiency, increased bargaining power and asset accumulation. Further dissemination of the two improved tef varieties should be scaled out to many kebele by Agricultural office. Since Boset and Tseday had high yield and return, farmers should plant these tef varieties in their tef production. Farmers provide their feedback on tef production that they produce two times a year. Therefore, Research Center should be identified short (Late April) and main (September) season variety.

Keywords: *Tef; Pre Scaling Up; Adola Rede; Guji*

Introduction

Teff [*Eragrostis tef* (Zucc) Trotter, is the majority food crop in Ethiopia. Nowadays, it is annually cultivated on top of more than three million hectares of land, used for over six million of farmers and more than 50 millions of people used as staple food [1].

Teff (*Eragrostis teff*) is a self-pollinated and warm season cereal crop originated in Ethiopia and have been domesticated and used throughout the world due to its excellent nutritional value as grains for human consumption and as forage for livestock [2]. Ecologically, teff is adapted to diverse agro-ecological regions of Ethiopia and grows well under stress environments better than wheat, barley and other cereals known world-wide [3].

It tolerates low moisture conditions and often considered as a rescue crop that survives and grows well in the season when early planted crops fail due to moisture stress. Because of this, it is said to be a "low-risk" crop for farmers. For better performance, it requires an altitude of 1700 - 2400 meter above sea level [4], annual rainfall of 750 - 850 mm and a temperature range of 10 - 27°C [5].

Grain of teff in our country is mainly adopted for food after baking the ground flour into pancake-like soft and sour bread, "injera", which forms the major component of the most favorite national dish. It is also consumed in the form of porridge, and somewhat fermented or un-fermented non-raised breads ("kita" and "anebbero"), native beer, "talla" and more alcoholic cottage liquor, "katikalla" or "araki" [6].

Teff has both cultural and economic value for Ethiopian farmers. In recent days it is among the cash crops and has been attracting an export market due to its nutritional value and is believed to be gluten free. Teff straw, besides being the most appreciated feed for cattle, is also used to reinforce mud and plaster the walls of house and local grain storage facility called gotera [4,5,7]. The teff straw is highly preferred by cattle over the straw of other cereals and demands high prices in the markets. It also serves to reinforce mud and plaster the wall in local house construction [8].

Teff is the main crop produced in the midland areas of Guji Zone. Usually the crop is sown after other crops (maize and haricot bean) are harvested. The crop is produced for both household consumption and cash crop. Teff could be produced in both seasons (meher and belg) hence the crop is used for double cropping purpose which increases farmers' production and income. The straw of teff is used for construction of house and used as the main feed resource for cattle during drought. Despite the importance of teff the yield of this crop is low in the midland areas of Guji Zone due to lack of improved seeds, drought tolerant and low application of the recommended packages of teff [9]. During demonstration, Boset and Tseday were selected by farmers for further scaling up. Thus, this activity was initiated with objectives of promoting improved teff varieties and thereby to increase production and yield of tef in the study area.

Methodology

Description of the study area

Adola Rede district is 470 KM away from the Addis Ababa to the South. The district is bordered by Ana Sora district in the North, Wadera district in the South and Odo Shakiso in the West and Girja district in the East directions. The district has altitude range of 1350 - 2340 meter above sea level, mean annual rainfall of 1000mm and annual average temperature of 28°C. Mixed farming, mining and forest product production are the major livelihood of Adola Rede farmers. Adola district has diverse agro-ecologies which are suitable for production of different crops. The rainfall pattern of the district is bimodal for lowland and midland areas and uni-modal for highland parts. Sandy, clay and silt are the major soils of Adola Rede district. The major crops produced in the area includes tef, maize, haricot bean, chat, coffee and the others. Tef can be produced twice (late April and September) in a year.

Farmers selection procedures

Participated farmers were selected based on the objective of disseminating improved tef varieties where farmers' roles in disseminating teff varieties were highly expected. The farmers were selected by Adola Rede Agriculture and Natural Resource Management Office. During 2017 production season a total of 30 farmers from two kebeles and in 2018 production season 24 farmers from two kebeles were selected and sown improved tef varieties. Out of 54 farmers of four selected kebeles 12 were female farmers who participated on pre scaling up and enhanced the dissemination of teff varieties in the study area.

Implementation and technology dissemination methods

Boset and Tseday improved tef varieties were used for pre scaling up purpose in Adola Rede district. All the selected farmers were obtained both improved tef varieties. Four hundred (400 Kg) of tef (200 Kg of Tseday and 200 Kg of Boset) were distributed 3 kg of each variety was freely distributed for selected farmers. Each variety was sown on 0.25 hectare of farmers land. Thus, 27 hectare of the district was covered by pre-scaling up of improved tef varieties (Boset and Tseday) in the selected kebeles. Other agricultural inputs (fertilizer and chemicals) were purchased and applied by farmers themselves based on the recommended rate. But for further promotion of chemicals, for instance, Pallas OD-45 was freely given for farmers where field day was arranged.

For proper technology dissemination in the rural areas, capacity building is needed for farmers, Development Agents and experts on technology dissemination. This is important to increase farmers' knowledge that sustains the production of improved varieties on their farm. In our case we used training, exchange visit and field days for tef dissemination method in the study area. 155 farmers (118 male and 37 female), 7 Development Agents and 12 Experts were trained on methods and packages of tef production. Exchange visit was organized among the producers (15) of pre scaling up of tef varieties to share experience on their field.

The activity was monitored with collaboration of Adola Rede Agricultural and Natural Resource Office to see the production of tef by farmers and discuss strengthen and weakness of farmers on tef production.

For further scaling up of tef technologies (information and improved tef varieties) to the larger community field day was needed and thus arranged at Dole kebele. The participants of the field day include farmers (132), 30 DAs and experts and other (30) key agricultural stakeholders were observed the performance of pre scaling up of tef on selected farmers field. Besides popularizing tef in the community, the field day enhanced linkage between research center and agricultural offices. Other agriculture related problems (chemical, weeds, inputs, demand of other technologies, etc.) in the district were discussed with participants of field day and future research topics were deliberated with participants.

Data collection and analysis methods

Observation and measurement was used to collect the data. Simple descriptive statistic and narrative description was used to analysis the data.

Results and Discussion

Yield performance of improved tef varieties on farmers' field

The yield of pre scaling up of Tseday and Boset tef variety was 1303.70 and 1324.52 Kg/ha respectively. However, the yield of this pre scaling up of improved tef varieties were less than their adaptation in the midland areas of Guji Zone which was 1582 Kg/ha and 1561 Kg/ha for Tseday and Boset respectively [10] but greater than the demonstration of Tseday and Boset which was 1295 Kg/ha and 1118 Kg/ha respectively [9] and less than national tef yield (1748 Kg/ha) in Ethiopia [11]. This yield gap was mainly due to all farmers were not using all recommended packages of tef as the same to the adaptation on research station. Gobicha kebele farmers obtained the highest yield from both varieties while the lowest yield was obtained from Dole kebele farmers. The yield difference between the selected kebeles was due to variation in application of recommended agronomic management practices (land preparation, weeding, harvesting and threshing) of farmers on their tef production. Farmers who applied all the recommended packages of tef obtained the higher yield and vice versa.

| Variety | Average yield of improved tef varieties from each kebele (Kg/ha) | | | | | |
|---------|--|-----------------|------------------|---------------|---------|----------|
| | Bilu (N = 16) | Derartu (N = 8) | Gobicha (N = 15) | Dole (N = 15) | Mean | Sd. Dev. |
| Tseday | 1238.75 | 1280 | 1625.33 | 1064 | 1303.70 | 87 |
| Boset | 1311.56 | 1340 | 1690.67 | 964 | 1324.52 | 72.27 |

Table 1: Yield performance of distributed varieties.

A significance value of .808 (greater than .05) indicates that there is no significant difference between the two group means. Therefore, it concluded that there was no significant difference between Boset and Tseday in yield per hectare (Table 2).

| | | Levene's Test for Equality of Variances | | | | |
|-------------------|-----------------------------|---|------|-------|---------|-----------------|
| | | F | Sig. | t | df | Sig. (2-tailed) |
| Yield per hectare | Equal variances assumed | .098 | .755 | -.244 | 106 | .808 |
| | Equal variances not assumed | | | -.244 | 105.582 | .808 |

Table 2: Independent t test result.

Net income obtained from disseminated pre scaling up of tef varieties

High yielder variety does not necessarily mean high return for farmers. Cost of tef production was collected from farmers to calculate the profitability of pre scaled tef varieties. In Adola Rede district 1 Kg of tef was sold by 17.78ETB during harvesting. Total revenue was obtained by multiplying the yield of varieties by farm gate price. Variable costs (ploughing, fertilizer, sowing, weeding, harvesting, threshing, etc.) were considered for the tef production. In the study area there were two seasons to produce tef. This pre scaling up was sown during the main season (September only). Therefore, on average the cost of land was considered for one season only which was 2025.93ETB. Gross Margin was obtained by deducting Total Variable Costs from Total Revenue. Profitability of improved tef varieties were obtained by deducting cost of land from Gross Margin of respective varieties. The pre scaling up of improved tef varieties were profi-

table for farmers in Adola Rede district since calculated cost of production was less than the returns from varieties (Table 3). For farmers Boset variety had generated more return (17276ETB) than Tseday (16837ETB).

| Parameters | N | Mean | Std. Deviation |
|--------------------------------------|----|----------|----------------|
| Yield of Tseday variety (Kg/ha) | 54 | 1303.70 | 87 |
| Yield of Boset variety (Kg/ha) | 54 | 1324.52 | 72.27 |
| Farm gate price of 1 Kg of tef (ETB) | 54 | 17.78 | 2.00 |
| Total Revenue of Tseday | 54 | 23085.93 | 7506.80 |
| Total Revenue of Boset | 54 | 24208.89 | 8956.10 |
| Land cost | 54 | 2025.93 | 181.38 |
| Cost of ploughing | 54 | 1159.94 | 254.58 |
| Fertilizer cost | 54 | 1012.00 | 230.10 |
| Sowing cost | 54 | 546.52 | 123.77 |
| Weeding cost | 54 | 85.09 | 35.80 |
| Harvesting cost | 54 | 735.56 | 200.00 |
| Threshing cost | 54 | 694.57 | 197.63 |
| Others cost | 54 | 22.24 | 39.65 |
| Total Fixed Cost | 54 | 2025.93 | 181.38 |
| Total Variable Costs | 54 | 4241.11 | 569.21 |
| Total Cost | 54 | 6267.04 | 574.51 |
| Gross Margin of Boset variety | 54 | 19292.22 | 7327.10 |
| Gross Margin of Tseday variety | 54 | 18844.81 | 7476.58 |
| Profitability of Boset variety | 54 | 17276.33 | 7352.60 |
| Profitability of Tseday variety | 54 | 16837.41 | 7511.10 |

Table 3: Net return obtained from pre scaling up tef varieties.

The income obtained from the pre scaling up of improved tef varieties helped many farmers in improving their household consumption, purchasing other necessary inputs (livestock, crop) for agricultural activity, house construction, asset accumulation, etc. The following case study explained the importance of pre scaling up tef from selected farmer.

The case study of farmer Tesema Robe on pre scaling up improved tef varieties

Tesema Robe was a model farmer in Gobicha Kebele, Adola Rede district, Guji Zone. By providing his land he was conducting the demonstration of improved tef varieties. The yield of tef demonstration helped him for further multiplication of tef varieties in his kebele. For further continuity of research system he was reselected for pre scaling up tef varieties. Being an example, he has done all the recommended packages of tef on his land. Six kilogram of improved variety Boset and Tseday (three kilogram of each variety) was given for Tesema. He trained and advised the knowledge and skills obtained from researchers and development agents for his family on ploughing, sowing, weeding, harvesting and threshing of tef. He harvested 2400 Kg/ha of Boset and 2000 kg/ha Tseday during 2017 production season. He shared (in exchange with other crops, selling in cash) the yield of improved tef varieties to neighboring farmers to disseminate varieties in his community. From the selected farmers Tesema sold his yield at peak season with minimal price that all farmers could purchase (16ETB) and made other farmers to have improved tef seed and sown tef varieties in their kebele. He obtained a return of 32200ETB/ha from Boset and 25800ETB/ha from Tseday variety. The yield of tef helped Tesema and his family to maintain their household consumption by making injera from tef varieties. Beyond household consumptions the return generated from tef helped the farmer to bought fertilizer, seeds and chemicals used for his agricultural production. This helped the farmer bargaining power for agricultural inputs that enhance and improve his farm production. He also bought one ox and constructed a house for his family from the pre scaling up of improved tef varieties.

Farmers' feedback on pre scaled up of disseminated tef varieties

Research is circular in which improved (new) varieties were released from research center and disseminated to farmers. In participatory research activities like sowing on farmers' field the farmers had sound feedback on what they obtained or observed improved varieties from researchers. This feedback goes back to research agenda for researchers. During the pre-scaling up improved tef varieties farmers provide constructive feedback for further research on tef variety. Each farmer had his/her own feedback on each Boset and Tseday variety sown. Tseday variety was early mature crop with less rainfall. But it had shattering characteristic in late threshing time. Boset has strong straw that used for livestock feeding and house construction. Both varieties had white color that demands a market. But Boset had more weight than Tseday variety. Even though it was difficult to conclude on specific feedback of each farmer for each variety the general feedback was the pre scaling up of tef varieties of Boset and Tseday was important to Adola Rede farmers that future tef research activities should be agenda of researchers in the study area. Since tef can be produced twice in a year different varieties for each season should be released by research center in order to increase production and productivity of tef in the study area.

Conclusions

Pre scaling up improved tef variety was very important for dissemination of improved tef technologies in midland area of Guji Zone. This pre scaling up increased the yield of tef production in rural areas. In Adola Rede district, on average the yield of 1324.52 Kg/ha and 1303.70 Kg/ha was obtained from the pre scaling up of Boset and Tseday variety respectively. In addition, participating farmers in the pre-scaling up of tef varieties generated higher return (17276ETB from Boset and 16837ETB from Tseday variety) from their tef production. The yield and return obtained from these varieties helped the selected farmers in maintaining their household consumption, increased bargaining power and asset accumulation.

Recommendations

To improve the production of tef in the district further dissemination of improved tef varieties should be scaled out to many kebeles by Agricultural office. Though the yield of Boset and Tseday was lower than the national farmers should use these varieties for main season until other improved/new varieties recommended for the area. The bimodal rainfall of the area made farmers the production of tef two times a year. However, farmers lacked improved varieties that were suitable for the main and short seasons. Therefore, it is important that early mature variety for the short (Late April) and main season (September) should be identified and provided for farmers.

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