Promotion of Advanced Teff Technologies Using Large-Scale Demonstration Approach in Potential Areas of West Shewa Zone, Oromia Region, Ethiopia

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Abstract: The study was designed to promote and disseminate improved teff varieties both in West Shewa and South west Shewa Zones six districts and Ambo town, Oromia region Ethiopia during 2020 – 2022 cropping season. The selection of Districts, kebeles and host farmers were done together with districts Agriculture Office and the extension team. Potential Kebeles were selected in order to conduct the large-scale demonstration activity two potential Kebeles from the districts and participant farmers were selected based on their interest and availability of adjacent farm plots with a minimum 0.25 ha per head. Thus, 15 clusters were formed, 241 farmers (Male 201 and female 40) directly participated in these demonstrations, and 132 ha of land was covered by improved teff technologies. Before implementing the pre-scaling up activity in all selected areas, capacity building was carried out for stakeholders. Among the participants, training was provided to 342 farmers, 46 DAs, and 27 Experts who worked in both zones and Ambo town. Three improved teff varieties (Dagim, Quncho and Boset), those preferred and selected by farmers during PED were used with their full recommended practices. As a result, in every clustered district, the yields from those varieties outperformed the local variety of an identical crop. The Dagim variety yielded an average of 2.2 tons/ha from the cluster, Quncho 1.9 tons/ha, and Boset 2.25 tons/ha respectively. These yields exceeded the Zone's yield advantage of 2.128 tons/ha, higher above the average for the region (1.34 tons/ha) and the country (1.914 tons/ha) respectively based on CSA data of 2021. In order to fulfill the intended goal of providing the variety to a sufficient number of farmers and enhancing the productivity and output of the commodity in other places, it is imperative that the relationships between actors and important prospective stakeholders be strengthened.

Keywords: Dagim Variety, Linkages, Productivity, West Shewa Zone

1. Introduction

Cereal crops are the main agricultural product that Ethiopians rely on for their daily nourishment. Cereals make up the majority of food crops in Ethiopia, accounting for 95% of total agricultural production and 86.68% of grain [6]. This is true both in terms of area covered and production volume.

For most Ethiopians more than 65% of the population who live in the highlands, teff is the primary staple crop [12]. The creation of high yielding cultivars would be highly advantageous, as the average national yield of teff is 1.914 tons per hectare [1]. Teff is valued for home consumption and as cash crop due to its higher price per kilogram as compared other cereals [7].

Approximately 20% of all cultivated area in Ethiopia is occupied by teff [2] Oromia produces about 48% of teff nationally followed by Amhara with 39%. There has been an increase in teff production over the past few decades, which has been attributed to the increase in the amount of land planted with teff [4]. Moreover, the economic contribution of teff indicates that real Teff output on average accounted for 6.1% of the real GDP, while growth in real Teff output accounted for 6.4% of the total growth in real GDP i.e., 0.67% of the 10.7 percent growth in real GDP [13].

Ecologically, teff is adapted crop in the diverse agro-ecological areas of Ethiopia and grows well under stress environments better than wheat, barley and other cereals known world-wide [8].

Therefore, it's critical to develop enhanced crop types that yield well and can last in such a hazardous and [3]. Because of the low yield potential of the current teff cultivars, yield stagnation is still a concern.

To solve this challenge and improve production and productivity several improved teff production technologies, mainly improved teff varieties including Quncho, Dagim and other varieties have been generated and disseminated by Debre Zeit Agricultural Research Center to the farmers over the last decades; but, the numbers of adopted improved teff varieties are limited to a few [5]. As part of its effort to improve production and productivity of teff technology Ambo Agricultural Research Center has also conducted popularization and scaling up activities in the past three years in two Zones. The popularized areas from West Shewa Zone: Ambo, Liban jawi and Dandi and from South West Shewa Zone: Dawo, Becho and Wolliso districts additionally Ambo town (Urban agriculture) was selected for implementation of pre scaling up. Therefore, this demonstration in large scale was initiated to pre-scale up these improved varieties (Dagim, Quncho and Boset) using cluster approaches at selected districts.

Objectives

1. To promote high yielder Tef varieties in West Shewa and South-West Shewa Zones potential districts
2. To create farmers' awareness on newly released teff varieties
3. To assess farmers' selection criteria for improved Teff varieties

2. Research Methodology

2.1. Description of the Study Areas

The pre scaling up activity was conducted during 2020-2022 cropping season in West Shewa Zone (Ambo, Liban jawi, Toke kutaye and Dandi) and from South West Shewa Zone, (Dawo, and Becho) districts additionally Ambo town (peri-urban agriculture) was selected for implementation of pre scaling up. Both Zones and districts were purposively selected based on agro-ecological zone as the target population for this cluster farming [9, 10]

2.2. Site and Farmers Selection

From both Zones, totally six districts and one Ambo town for peri-urban agriculture were selected purposively based on their potential for demonstration of the crop production and accessibility for supervision. The selection of Districts, kebeles and host farmers were done together with districts Agriculture Office and the extension team. Potential Kebeles were selected in order to conduct the large-scale demonstration activity. two potential Kebeles from the districts and participant farmers were selected based on their interest and availability of adjacent farm plots with a minimum 0.25 ha per head. Thus, 15 clusters were formed, 241 farmers (Male 201 and female 40) directly participated in these demonstrations, and 132 ha of land was covered by improved teff technologies.

2.3. Demonstration Design

In the selected Districts three improved teff varieties (Dagim, Quncho and Boset), those preferred and selected by farmers during PED were used with their full recommended practices [11]. Planting was done at a seed rate of 20-25 kg ha^{-1}. Fertilizer was applied at a rate of 100/150 kg ha^{-1} NPS and UREA, respectively. Plowing, weeding, and other management practices were applied based on the research recommendation

2.4. Data Collection Method

Data such as total amounts of inputs distributed for participant farmers, total number of farmers participated in the training and field day by gender, other stakeholders in technology dissemination, yield data and farmers perception were collected using checklists through interview and discussions.

2.5. Method of Data Analysis

The collected data were entered in to SPSS and analyzed using simple descriptive statistics and narrating the qualitative explanation of the farmers.

3. Result and Discussion

3.1. Wider Awareness and Capacity Building on Teff Technologies Pre-Scaling Up

Before implementing the pre-scaling up activity in all selected areas, capacity building was carried out for stakeholders. From the participants 342 farmers, 46 DAs, and 27 experts who worked in both zones and Ambo town received training. To raise awareness about enhanced improved teff technologies among farmers and equip them and others with knowledge and skills about the technology management packages, the major strategies in this respect were training on knowledge, skill, and attitude. In order to do this, Ambo Agricultural Research Center has formed a multidisciplinary team to provide training and to support teff technology extension initiatives. The members of the team included agronomists, pathologists, breeders, socio-economists, and others.

Table 1. Number of participants on teff production and Management training.

Participants	West Shewa		S/W/Shewa		Ambo town	
	Male	Female	Male	Female	Male	Female
Farmers	152	23	84	31	44	8
DA	16	8	12	6	1	3
Expert	6	2	6	3	8	2
Total	174	33	102	40	53	13

Source: Own data, 2022

3.2. The Setting Up of Clusters and Host Farmers on the Teff Technologies

For this study purpose both West Shewa Zone and South West Shewa Zone potential districts are purposively selected. From West Shewa Zone, four districts namely Ambo, Dandi, Toke kutaye and Liban jawi, and from South West Shewa Zone two districts namely, Dawo and Becho selected based on their potential in teff production. Additional Ambo town (Pre urban agriculture) was selected to encourage urban agriculture farming system. Totally 15 teff producing kebeles from all districts were selected and, 241 host farmers (Male 201 and Female 41) with gender consideration in collaboration with the respective district office of agriculture was done (Table 2). Accordingly, 15 teff technology demonstration clusters were established on 132 ha of land and 241 farmers have directly participated in the activity.

***Table 2.** LSD participants' and area coverage for Teff Cluster.*

No.	Zone	Districts	No. of Kebeles	Variety used	Land size of cluster (ha)	Participant farmers	
						M	F
1	West Shewa Zone	Ambo	2	1,2	22	23	14
		Dandi	2	1,2	20	42	2
		Liban jawi	2	1	20	19	6
		T/Kutaye	3	1,2	20	36	1
2	South West Shewa	Dawo	2	2	20	48	2
		Becho	2	3	20	22	8
3	Ambo town	Ambo (urban)	2	2	10	11	7
		Total	15		132	201	40

Source: Own data computation (Note: 1=Dagim, 2=Quncho, 3=Boset)

3.3. Input Provision

In all selected Districts the amount of agricultural input is well distributed based on the area coverage (Table 3). Improved teff seed and fertilizers (NPS and urea) provided for host farmers based on the amount of cropland included in each district.

***Table 3.** Input distribution for Teff cluster.*

No.	Districts	Area coverage (ha)	Host farmers		Amount of Input distributed				
			M	F	Seed (Qt)	NPS (Qt)	UREA (Qt)	Chemical (Lt)	Lime (Qt)
1	Clustered districts	132	201	40	33	132	132	-	-
	Total	132	201	40	33	132	132	-	-

Source: Own data computation 2022

3.4. Yield Performance of the Varieties

The following table 4 describes the yield performance of the three varieties during this pre-scaling up phase. The yield data was collected from different randomly selected areas of cluster as well as varieties in each cluster. The yields obtained across the location for the distributed varieties were varied from location to location. However, the yield obtained from those varieties performed better than the local variety of similar crop in all study area. Based on teff productivity potential and CSA data, an overview of the LSD activity yield performance is provided. Table 4, showed that the average yield obtained from the cluster for Dagim variety was 2.2 tons/ha, Quncho 1.9 tons/ha and Boset 2.25 tons/ha which is more than the yield advantage using CSA data in the Zone, which is 2.128 tons/ha [1]. This yield exceeds both the national average (1.914 tons/ha) and the regional average (1.34 tons/ha). The variations of yield were due to soil fertility and management techniques may be the source of yield performance variability within the study cluster.

***Table 4.** Yield performance at clustered districts from 2020-2022 crop season.*

District	Variety	Area (ha)	Potential yield (tons/ha)	Demonstration yield (tons/ha)	Farmers Yield (tons/ha)	% Yield increases over farmers practices
All clustered Districts	Dagim	52	18-23	2.2	1.4	57.14
	Quncho	60	17-19	1.9	1.2	58.3
	Boset	20	14-18	2	1.5	40.0
	Mean			2.06	1.4	51.81
Total		132				

$$\% \text{ age yield increase} = \frac{Demonstration\ yield(tons/ha) - farmers\ practices(yield)\ (tons/ha) \times 100}{Farmers\ practices(yield)\ (tons/ha)}$$

Note: Potential yield sources: MoA, 2006 (Quncho), 2013 (Dagim), 2016 (Boset)

3.5. Farmers' Preference on Demonstration

The most important factors in choosing and expanding technology types are the desires of farmers. According to this instance, a greater yield of the Dagim, Boset and Quncho teff varieties respectively boosts their desire to cultivate teff varieties that are suggested and enhanced for farmers in the selected Districts.

3.6. Field Day

One method for stakeholders to exchange experiences was the field day. As a result, mini field days were held in the selected districts to encourage experience sharing among agricultural stakeholders. There were 1560 stakeholders present on field day, 1367 of them were men and 193 were women.

***Table 5.** Participants on teff technologies field day.*

No.	Participants	No. of participants		
		Male	Female	Total
1	Farmers	1010	112	1122
2	Higher officials (Zone level)	9	1	10
3	Experts	261	55	316
4	Researcher	30	2	32
5	Development agent (DA)	57	23	80
	Total	1367	193	1560

Source: Own data computation 2022

4. Conclusion and Recommendation

Cluster based Pre-scaling up of different varieties of teff technologies were conducted in two zones and six districts and Ambo town. The pre scaling up covered a total of 132 ha by participating 241 farmers (201 males and 40 female). Before implementing the pre-scaling up activity in all selected areas, capacity building was carried out for stakeholders. Among the participants, training was provided to 342 farmers, 46 DAs, and 27 Experts who worked in both zones and Ambo town. In the selected Districts three improved teff varieties (Dagim, Quncho and Boset), those preferred and selected by farmers during PED were used with their full recommended practices. As a result, in every clustered district, the yields from those varieties outperformed the local variety of an identical crop. The Dagim variety yielded an average of 2.2 tons/ha from the cluster, Quncho 1.9 tont/ha, and Boset 2.25 ton/ha respectively. These yields exceeded the Zone's yield advantage of 2.128 tons/ha, higher above the average for the region (1.34 tons/ha) and the country (1.914 tons/ha) respectively based on [1].

In order to fulfill the intended goal of providing the variety to a sufficient number of farmers and enhancing the productivity and output of the commodity in other places, it is imperative that the relationships between actors and important prospective stakeholders be strengthened.

Abbreviations

CSA: Central Statistics Agency
PED: Pre Extension Demonstration
LSD: Large Scale Demonstration

Conflicts of Interest

The authors declare no conflicts of interest.

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