



Pre Scaling up of Tef Variety at Midland Districts of Guji Zone, Southern Oromia, Ethiopia

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Abstract: Tef is staple crop food in Ethiopia. However, many farmers were not food secured and only few model farmers used tef for their daily local food. This is due to the use of low yielder varieties. On the other hand, improved tef varieties were not disseminated for surplus production. Therefore, it is important to find the way of improved tef varieties were disseminated in potential areas of Guji zone. This activity was conducted to popularize improved Dagim tef variety, strengthen stakeholders' linkage and to improve farmers' income. Purposively, Adola Rede, Odo Shakiso and Wadera were selected based on their tef potential and suitable for monitoring. Seven (7) kebeles were selected from the selected districts. Totally, 83 farmers were selected for pre scaling up tef at the midlands of Guji zone. In addition, four FTCs were used as multiplication site as a seed source for the next season. 400kg of Dagim variety was distributed. Each farmer was obtained 4.5kg Dagim variety and sown it on 0.25ha. Training was used to enhance farmers' knowledge and skills on Dagim production and field day was used to motivate farmers to grow Dagim tef variety. The stakeholder had participated during training and field day to strengthen linkage on seed, agricultural inputs and information. Hand weeding and herbicide was used to control weed. Yield, cost of production and farmers perception were collected by interview method. Data was analyzed by descriptive statistics, net income and narration. The yield performance of Dagim variety was 9.82 qt/ha which low compared to national and demonstration stage due to lack of rainfall during 2020 and 2021/22 year. The result of net income showed that production of Dagim variety generated a return of 15735.72 ETB/ha. More net income (17551.63 ETB/ha) was obtained at Odo Shakiso district followed by Adola Rede district (16503.36 ETB/ha). There was a good yield and income at some farmers who sown Dagim variety at mid of September month. Dagim variety should be disseminated in the midland districts of Guji Zone. Since tef can be produced twice in a year provision of tef variety and fertilizer for farmers should available based the seasons.

Keywords: Pre Scaling up, Tef, Dagim, Guji

1. Introduction

Tef (*Eragrostis tef*) is an ancient tropical cereal crop that has its center of origin and diversity in the northern Ethiopian highlands from there it is believed to have been domesticated [1]. It is a staple food grain in Ethiopia mainly used to make injera as a traditional fermented Ethiopian pancake. In other countries like Australia, South Africa, and the United States it is predominantly used as a forage crop for animal feed [2, 3]. It is also getting popularity across the globe as it is a gluten-free and healthy food [4, 5]. Tef is a nutritionally rich crop and contains essential and important nutrients like

carbohydrates, protein, fat, fiber, and minerals [6]. It is also rich in some minerals like iron which is significantly higher than the amount that we can get from bread wheat [7, 8].

The wide smallholder farmers in the country favor producing the crop because it is greatest adaptable to a wide range of environmental conditions can produce well in marginal areas and is extremely tolerant of drought and other constraints [9]. The crop is less susceptible to diseases and insects and rich in nutrients [10]. Tef is the most important indigenous cereal crop in Ethiopia, which is the leading crop in terms of the area of production that is 2,928,206.26 million hectares, and the third in total production (55,099,615.14 quintals) next to wheat (57,801,305.96 quintals) and maize

(105,570,935.92 quintals) [11]. But, the average productivity of tef is lower compared to other cereals [12, 13]. Tef production in Ethiopia is facing immense production constraints that affect the yield potential of the crop, including lodging, low inputs, inappropriate sowing method, post-harvest losses, and using low yielding local varieties [7].

Tef 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. Tef could be produced in both seasons (*meher* and *belg*) hence the crop is used for double cropping purpose which increases farmers' production and income [14]. Despite double cropping of tef in the area many farmers were not food secured and only few model farmers used tef for their daily local food while other farmers were intended to sale their existing low product to the market rather than for household consumption. This is due to the use of low yielder varieties and lack of climate smart varieties (drought tolerant and early mature varieties) which can produce surplus production for farmers [15]. However, improved tef varieties were not disseminated for surplus production. Therefore, it is important to find the way of improved tef varieties were disseminated in potential areas of Guji zone.

Ethiopian government is promoting the adoption of several agricultural technologies to improve the productivity of the agricultural sector [16]. In Ethiopian agricultural system most agricultural research technologies reach the end user in different ways [17]. Currently extension system of the country is employing pre extension demonstration, pre scaling up/out and large scale demonstration as a tool for technologies/varieties promotion in rural/urban farming. Their difference is based on the scope of participants on the activity, land size and the intended objective. In pre extension demonstration, few participants will done research on small areas and based on the result of pre extension demonstration, further research will be conducted in the form of pre scaling up/out and the large scale demonstration will be followed for anticipated objective of released agricultural research technologies. In addition, the impact of pre-scaling up was greater than demonstration that ensures the yield and benefit of improved varieties for farmers. Thus, this activity was initiated to pre scale up Dagim Tef variety in midlands of Guji zone.

Objectives of the Activity

- 1) To popularize Dagim Tef variety and strengthen stakeholders linkage.
- 2) To improve farmers' income.

2. Methodologies

2.1. Description Study Districts

Adola Rede district is 468KM away from the Addis Ababa to the South. The district has altitude range of 1350-2340 meter above sea level, annual mean of 1000mm rainfall and annual average of 28°C of temperature. 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 unimodal for highland parts. Sandy, clay and silt are the major soils of Adola Rede district. The major crops produced in the area include maize, tef, haricot bean, chat, coffee and the others [18]. Natural minerals are mainly found at Odo Shakiso district. Farmers of the district practiced mixed farming (crop and livestock). Tef, maize, haricot bean and coffee were the major crop production in the area. The district is also known by different fruits and vegetables. Most rural youth of Odo Shakiso district engaged on extraction of different minerals. Wadera district is one of agro pastoral areas of Guji zone. The district is well known by livestock rearing and livestock production is the major farming activity of the district. Tef, maize, haricot bean crops were mainly produced in the district [17].

2.2. Site Selection/Sample Size

Three districts were selected from the midlands of Guji zone. Purposively, Adola Rede, Odo Shakiso and Wadera were selected based on their tef potential and suitable for monitoring. Seven (7) kebeles were selected from the selected three districts based on their tef production status. From each kebele, 11-16 farmers were selected. Totally, 83 farmers were selected for pre scaling up tef at the midlands of Guji zone. In addition, four FTCs were used as multiplication site where the yield obtained from the FTCs aimed to serve as a seed source for the next season.

2.3. Materials/Methods Used

Improved Dagim tef variety was used for pre scaling up purpose. The selected farmers obtained 4.5kg Dagim variety and sown it on 0.25ha. For further promotion of Dagim variety in the selected kebeles four FTCs were multiplied (26.5kg of Dagim on 1.5ha) to serve as a source of seed for the subsequent season. During 2020 (2013 E. C) and 2021/2022 (2014 E. C) production year 400kg of Dagim variety was distributed. During both years 20.75 hectare of farmers' land and 1.5ha of FTCs were covered by Dagim variety. NPS fertilizer was used at a rate of 121kg/ha. For promotion of Dagim variety training and mini field day was organized at each year. Hand weeding and herbicide (2-4-D) was used to control weed.

2.4. Data Collection and Analysis

Yield data was collected from selected farmers. Yield, cost of production and farmers perception were collected by interview method. Data was analyzed by descriptive statistics, net income and narration.

3. Results and Discussion

3.1. Number of Farmers Participated on Trainings and Field Day

For proper technology transfer effective extension method

is mandatory. For this activity training and mini field day were used to capacitate farmers' knowledge and skill. Training and mini field day was conducted both years. Accordingly, farmers, development agents and subject matter specialists were participated on the events. Training was used

to enhance farmers' knowledge and skills on Dagim production and field day was used to motivate farmers to grow Dagim tef variety by observing the performance of variety on the field.

Table 1. Number of participants on training and field day.

Extension methods	Farmers			Development Agents			Subject Matter specialist (SMSs)			Total participant
	Male	Female	Total	Male	Female	Total	Male	Female	Total	
Training	107	21	128	19	4	23	19	3	22	173
Mini Field day	89	21	110	15	2	17	10	1	11	138

3.2. Stakeholders' Linkage

Promotion of all agricultural technologies cannot be provided by a single organization. It needs multi stakeholders who had common goal for improvement of agricultural production [19]. Therefore, for this study the linkage between Bore Agricultural Research Center, District Agricultural offices, Development Agents, Agricultural Cooperatives and farmers were strengthened via seed distribution, provision of agricultural inputs (herbicides and fertilizers) and information flow for tef production. The stakeholder had participated during training and field day. Despite some seed were provided as starting for pre scaling up there is still high demand of tef and fertilizer from farmers' perspective. Therefore, the next scaling up should focus on sufficient distribution of Dagim and fertilizer based on farmers interest.

3.3. Yield Gained from Pre Scaling up of Dagim Variety

Adola Rede and Odo Shakiso districts were considered during 2020 year. Good yield was obtained during 2020 year. Wadera was included during 2021/2022 production year. Among the three districts higher yield was obtained from Odo Shakiso district (12.39 qt in 2020 year while lower yield was obtained from Wadera district (5.88 qt/ha) during 2021/2022 year. Lack of rainfall at both seasons had affected the yield of Dagim variety. The combined result of yield performance of Dagim variety was 9.82 qt/ha at midland districts of Guji zone (Table 2). This yield was result half the national tef productivity (18.82 qt/ha) in Ethiopia [11] and also lower than during its demonstration (19.06 qt/ha) at midland districts of Guji zone [17]. This showed that at the same area there was different rain fall which affect the yield performance of the crop.

Table 2. Yield gained from pre scaling up of Dagim variety.

Districts where pre scaling up was conducted		Yield obtained (qt/ha)		Combined
		2021/22 year	2020 year	
Adola Rede district	N	22	14	36
	Mean	11.17	9.29	10.44
	Std. Deviation	1.405	1.069	1.574
Odo Shakiso district	N	22	13	35
	Mean	12.39	8.62	10.99
	Std. Deviation	1.821	3.254	3.036
Wadera district	N	-	16	16
	Mean	-	5.88	5.88
	Std. Deviation	-	.719	.719
Total	N	44	43	87
	Mean	11.78	7.81	9.82
	Std. Deviation	1.722	2.432	2.890

3.4. Profitability Gained from Pre Scaling up of Dagim Variety

Net income was used to estimate profitability of pre scaling up of Dagim variety. Total Revenue was calculated as yield obtained multiplied by farm gate price. Total variable costs included were costs of seed, fertilizer, land preparation, weeding, harvesting and threshing. Fixed cost was cost of land. Straw of tef was important as livestock feed at the study areas. Therefore, it was included as benefit obtained from Dagim tef production. The revenue of straw was also calculated similar to tef yield revenue, amount of straw

obtained in quintal multiplied by price sold at production time. Therefore, total net income from this pre scaling up was the sum of net income from Dagim variety plus revenue obtained from straw. The result of net income showed that production of Dagim variety generated a return of 15735.72 ETB/ha at midland districts of Guji zone (Table 3). More net income (17551.63 ETB/ha) was obtained at Odo Shakiso district followed by Adola Rede district (16503.36 ETB/ha) and lower net income (10036.25 ETB/ha) was obtained at Wadera district (Table 4). This result of net income was lower than during its demonstration (38042.50 ETB/ha) at the same districts [17]. This was due to the low yield as a result of shortage of rainfall at pre-scaling up stage.

Table 3. Net income obtained from pre scaling up of Dagim variety.

Factors		N	Mean	Std. Deviation
Yield obtained (qt/ha)		87	9.82	2.890
Farm gate price		87	3536.78	392.995
Cost of fertilizer	a	87	2043.08	134.039
Cost of land preparation	b	87	2201.03	1434.285
Cost of weeding	c	87	288.10	79.087
Cost of harvesting	d	87	1261.03	372.562
Cost of threshing	e	87	1813.88	976.631
Cost of seed	f	87	1250.00	.000
Other costs	g	87	109.77	128.303
Total variable costs (a+b+...+g) (ETB/ha)		87	8966.95	2603.913
Fixed cost of land (ETB/ha)		87	10632.18	2151.878
Total Revenue of tef (yield * farm gate price)		87	33907.64	8191.092
Net income of tef= Total Revenue-TVC-FC...	h	87	14308.61	6730.289
Straw obtained (qt/ha)	i	87	52.11	24.284
Price of straw (ETB/qt)	j	87	29.23	9.745
Revenue obtained from straw sale (i*j)	k	87	1427.11	679.623
Total net income = h + k	l	87	15735.72	6904.599

Table 4. Net income gained from the districts (ETB/ha).

Districts where pre scaling was conducted		Total net income (Net income of tef + revenue of straw)
Adola Rede	N	36
	Mean	16503.36
	Std. Deviation	4099.473
Odo Shakiso	N	35
	Mean	17551.63
	Std. Deviation	8955.965
Wadera	N	16
	Mean	10036.25
	Std. Deviation	2923.855
Total	N	87
	Mean	15735.72
	Std. Deviation	6904.599

3.5. Farmers' Perception Regarding Dagim Variety

Despite lack of rain fall during Dagim production still farmers were interested to grow Dagim variety due to its early maturity and preference both market and household consumption. The color is white so that it had a good market demand.

4. Conclusions and Recommendations

Pre scaling up of Dagim was conducted at midlands of Guji Zone. Though the production was affected by lack of rainfall still there is no option for farmers to produce tef other than Dagim variety. There was a good yield and income at some farmers who sown Dagim variety at mid of September month. At the study areas tef was sown after maize was harvested. Farmers should early harvest maize as soon as it matured and sow tef at early September month where there could be enough rainfall. Climate situation is changing from time to time and affecting agricultural production. Tef is widely used for household consumption in most parts of Ethiopia. Therefore, developing new varieties based on agro-ecologies is expected from agricultural research centers. At midlands of Guji zone early mature tef variety was preferred due to there is moisture stress in the districts. Dagim variety

should be disseminated in the midland districts of Guji Zone. Farmers should use Dagim variety for their tef production. Since tef can be produced twice a year provision of tef variety and fertilizer for farmers should available based the seasons.

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