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Pre-extension Demonstration of Improved Teff Technologies in Selected Districts of Western Oromia

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Abstract

The study was conducted in Jimma Arjo, Jimma Geneti, and Chaliya districts of western Oromia, during the 2020 cropping season year. The objective of the study was to demonstrate a recently released teff variety to the farmers. A new variety (Jitu) was planted along with a standard check (Dursi) on 100 m^2 adjacent plots, adhering to all agronomic recommendations. Both qualitative and quantitative data were collected and analyzed for this study. At maturity, participatory variety evaluation was done by using qualitative and quantitative traits/criteria set by the farmers to select the best variety for future use. Grain yield, disease tolerance, lodging tolerance, pest tolerance, and seed color were the first five most important criteria considered by the farmers in their order of importance. The new variety was ranked first on the basis of these criteria and was selected as the first option for future use by the farmers. An independent sample t-test was used to analyze quantitative data, while qualitative data were qualitatively analyzed and described. The mean grain yield performance of the varieties (q ha^{-1}) was 19.87 ± 0.6 for Jitu and 17.76 ± 1.01 for Dursi variety. The new variety, accordingly exhibited a yield advantage of 12.22% over the standard check. The technology gap and technology index for Jitu were 5.43q and 21.46%, respectively while the values for Dursi were 6.24q and 26% witnessing more stability and feasibility of the new variety to the farmers. The financial analysis conducted reveals also that the net gain (47833.33 ETB ha^{-1}) was higher for Jituthan for Dursi (40028.33 ETB ha^{-1}) witnessing more profitability of the new variety compared to its counterpart. The new variety, has consequently, met the farmers' demand both in terms of qualitative and quantitative traits including financial benefits than the standard check. This calls for wider dissemination of the variety with its full package to the farmers in the study area and those with similar agro-ecological conditions.

Keywords

Dursi, Jitu, Participatory Evaluation, Technology Index, Technology Gap, Variety

1. Introduction

Teff (Eragrostistef (Zucc.) Trotter) is a warm season annual cereal crop and the major staple food crop grown in Ethiopia. It is the most important cereal, both in terms of production and consumption in Ethiopia. Being the most liked cereal based crops by better off families, more specifically urban residents, teff fetches comparatively better price in the market, making it preferred cash crop to farmers. In its relative term teff is resistant to many biotic and abiotic challenges and can be grown in different agro-ecological conditions, with ranges from lowland to highland areas. It can also be stored for many years without being seriously damaged by common storage insect pests [1, 2].

Teff production keeps its first rank in terms of area coverage among the other cereal crops which accounts about 30%

of the land allotted to cereal production followed by maize (23%), sorghum (18%), and wheat (17%) [3]. However, it is the lowest in its productivity which is only one third of the average wheat productivity of the nation [3]. Today, nearly three million hectares of land are covered annually by teff and more than six million small scale farmers are involved in teff cultivation in the country. Supporting more than 60-75% of Ethiopia's population as staple food teff is believed to serve as a traditional medicine especially for diabetic problems in vast areas of the country. In Ethiopia, teff is mostly utilized in the form of fermented flattened bread nationally termed as injera [7].

Tef is likely to remain a favorite crop of the Ethiopian population and the crop is also gaining popularity as a health food in the western world. Studies show that tef is a gluten free crop, which makes it is suitable for patients with celiac disease [4]. CSA data over the past few years show that teff ranked first in terms of area coverage (accounting for 28% of the area) and is second to maize in terms of volume of production among cereals, accounting for about 20% of the total produce in the category [7]. Additionally, it is locally processed in the form of local alcoholic beverages like local beer known as tella and local sprit traditionally called katikala or areke and porridge, and its straw is used as dry season animal feed and also used as component of construction material [9].

Teff is an economically superior commodity in Ethiopia. Its price often exceeds a market price of maize two to three times, though maize is the largest in terms production in Ethiopia [5]; thus making teff a reliable cash crop for producers [6]. Teff is among the most important cereals on which the livelihood of many farmers is based. It has the potential to augment commercialization of smallholder agriculture and tackle food security problems in the country. In Ethiopia, *Teff* is mainly produced in Amhara and Oromia National Regional State [7; 3] and it is estimated to be the most important crop in Ethiopia's agricultural and food economy. Based on the increasing number of health-conscious consumers, worldwide, teff has begun bring in a similar event with quinoa, the nutritious crops indigenous to South America for global prominence [8]. Consequently, teff production is gaining attention in other parts of the world. Those countries include accordingly, Australia, Cameroon, Canada, China, India, Netherlands, South Africa, the UK, Uganda and the USA are among those countries that have shown interest in teff production [6]. Yet, inclusive statistics on the teff production, utilization and trade are inadequate in those countries. Being an economically superior cereal in Ethiopia, teff often commands a market price two to three fold higher than maize [9].

Despite the momentous importance of teff to Ethiopia, productivity is regarded very low and even declining in some cases. This is due to several technical and socio-economic constraints. Weed competition, low or declining soil fertility, diseases, in appropriate use of agronomic practices such as seeding rate, sub-optimal fertilizer application and herbicide use. Limited supply of seeds of improved varieties, high price and unavailability of augmenting technologies like fertilizer and herbicides in required quantity and at required time, and inadequate cash or credit for purchase of inputs are the major socio-economic constraints [10].

However, due to continuous efforts to improve and disseminate different varieties, the grain yield performance of teff is showing an increasing trend during the past decades [11, 12]. For instance, in Ethiopia teff productivity, which was only 0.7 t/ha in 1995, when the seed supply of the improved cultivars was limited, reached 1.76 tone/ha in 2018.This success is initiating more researchers to work on improvement of the crop across the country. Accordingly, the National Agricultural Research System (NARS) has been making tremendous efforts over last ten years to develop and release large numbers of improved teff varieties and associated production technologies for diversified agro ecology of Ethiopia. More specifically, Bako Agricultural Research Center (BARC) has been endeavoring to release improved teff varieties to agro-ecologies under its mandates. As part of this effort, Bako Agricultural Research Center (BARC) released an improved teff variety known as Jitu, having 10 % yield advantage over its predecessor, and exhibiting better agronomic characteristic. Given the potentiality of western Oromia for teff production, increased demand for improved varieties and availability of the options, it is due time to demonstrate these varieties to farmers in potential agro ecologies of teff production under BARC's mandate. This, activity, therefore was initiated with objectives of demonstrating improved teff technologies so as familiarize the farming communities with the new teff varieties which in turn will facilitate the adoption process and bridge the productivity gap.

1.1. Objectives

- To demonstrate and evaluate improved teff technologies;
- To evaluate on-farm grain yield performance and profitability of the variety;
- To create awareness on the importance of the improved teff technologies;
- To collect feedback from the participants for further research design and the way for ward.

2. Methodology

2.1. Site and farmer selection

A three-stage sampling was used to undertake the activity. In the first stage, three districts (one from East Wollega, one from HorroGuduru Wollega and one from west Shawa zones) were purposively selected based on their accessibility

and potentiality for teff production. On the second stage, one potential and representative farmers' Association (FA) was selected in each of the identified districts. Finally four hosting farmers were selected with the help of Development Agents (DAs) of the respective FAs selected earlier. Accordingly, Jimma Arjo, Jimma Geneti and Chaliya districts were used for the activity. In each district one FRG unit comprising of 15 farmers was established Out of the FRG members, 4 of them were hosting farmers whereas 11 were follower farmers. Accordingly, a total of 12 hosting farmers were selected and participated on the activity.

2.2. Stakeholders' training

Following the establishment of FRGs and identification of hosting farmers, both theoretical and practical training was given to farmers, Development Agents and experts of the respective districts. The training provided covers areas such as teff production, management, and post-harvest procedures including seed quality maintenance. The aim of training was to enhance awareness of farmers, Development Agent and district experts on improved teff technologies.

2.3. Stakeholders responsibility share

The success of the current work and the guarantee for the successive works ahead cannot be exclusively handled by the researchers alone. Consequently, identification of key stakeholders and making agreement on roles and responsibilities was an essential part of the activity. On this basis, the following four stakeholders, FRG member farmers, researchers, Development Agents and district agricultural experts were identified and shared roles and responsibilities. List of the stakeholders, their roles and responsibilities is depicted in Table 1.

Table 1. Stakeholders' roles and responsibilities

Actors	Their role and responsibility
Farmers	Providing land free of rents Provide Labor for all field activities (land preparation, planting, weeding, harvesting and threshing) Follow up of the activities Evaluate and select the best variety/ies
Researchers	Providing improved seeds and fertilizer Technical backup for the farmers Follow up all the field activities Organizing field days Making strong linkage with concerned stakeholders Farmer selection and group (FRG) formation. Writing useful information produced from the technology demonstration
District experts	Organizing farmers in group with cooperative office Organizing training for farmers Organizing field days and experience sharing forum among the GRGs and other farmers Coordinating all the field activities
Development Agents	Select appropriate field Select appropriate farmers Collaborate in FRG formation Follow up the FRGs and the fields Communicate with researchers about status of the field Collaborate organizing field visits/ field days

2.4. Treatments

The plots were properly ploughed and made ready for planting ahead of the planting date. **One** newly released improved teff (**Jitu**) was planted along with a standard check (Dursi) on 100 m^2 adjacent plots each. A seed rate of 10 kg ha^{-1} was used while fertilizer was applied at the rate of 100 kg ha^{-1} NPS, and 50 kg ha^{-1}urea. Urea was applied in a split form i.e. 25kg at planting and the rest 25kg at 25days after planting. An inter-row spacing of 20cm was used, and planting was done by drilling. The fields were periodically supervised to check the status and identify gaps.

2.5. Data collection

Both qualitative and quantitative data were collected for this activity. The quantitative data collected includes yield data, total number of farmers participated on training, total number of farmers, DAs and district experts participated on

field visits, costs of production and income accrued to the farmers. Farmers' perception on the attribute of the technology was the qualitative data collected for the study.

2.6. Data analysis

Quantitative data were subjected to SPSS software and were analyzed using simple descriptive statistics such as mean and standard deviation (SD). An independent sample t- test was used to analyze mean, to check if there is significant yield difference between the two varieties. Qualitative data collected were qualitatively analyzed and described. Besides; score ranking technique was used to evaluate and select best variety/ies and /or technology/gies and to rank their criteria and parameters according to real situation of the area. Finally, gross margin analysis was done to calculate cost of production and income accrued to the farmers. Gross margin analysis is an essential tool in instances where fixed capital forms a negligible part of production. Thus; it is the difference between gross income and the total variable cost (Mohammed *et.al*, 2016). Furthermore; technology gap and technology index were calculated using the following formula.

$$\text{Technology gap} = \text{Potential yield (q ha}^{-1}\text{)} - \text{Demonstration yield (q ha}^{-1}\text{)}$$

$$\text{Technology index} = \frac{\text{Potential yield - Demonstration yield}}{\text{Potential yield}} * 100$$

3. Result and Discussion

3.1. Participatory Variety Evaluation and Selection

Despite many informal evaluations made at different plant growth stages, final joint evaluation was done when the crop was at its maturity stage. Accordingly, mini field day was arranged in which FRG member farmers, neighboring farmers, researchers, DAs and district experts participated. This was a special platform for participatory variety evaluation and selection accompanied by acquainting other farmers with the technologies. At this platform farmers and researchers listed evaluation criteria at random, which was then ordered using pair-wise technique. The evaluation criteria were ordered in such a way that the trait with highest score was ranked 1st, and was considered as the most important criteria, while the lowest score denotes criteria of lower importance in the order. Each variety, then, was evaluated against the ordered criteria.

To this end, FRG members scored each variety for individual traits they considered important. For each measurable trait grading was again done on a scale of 1-5 units, 1 being very poor and 5 being the highest score representing superiority. At the end of the evaluation process, result of the evaluation was displayed to the evaluators, and discussion was made on the way ahead. The variety/ies selected, accordingly, were proposed for further scaling up. The evaluation criteria suggested by the participating farmers at random were yield, early maturity, lodging tolerance, insect-pest tolerance, seed color, seed size, tillering capacity, spike length and disease tolerance. On this basis, one can learn from the data in (Table 2) that grain yield performance, disease tolerance, lodging tolerance, pest tolerance, and seed color were the first five most important criteria considered by farmers in their order of importance. This indicates that these criteria are the traits that researchers should seriously consider for future breeding design and way forward to develop farmer preferred variety/ ies. Of the listed criteria/ traits, early maturity received less attention for selection of varieties. This is mainly because in Western Oromia the intensity and distribution of rain fall and early termination of precipitation is not a problem.

[13] also used these criteria for evaluation of improved teff varieties at WayuTuka, Guduru, Jardega-Jarte, Jimma-Rare and Gida Ayana districts of western Oromia. During their evaluation, disease tolerance was given the first rank followed by insect pest tolerance, grain yield performance and seed color. This might be due to the fact that disease and pest infestation were more severe than other problems in those specific locations and specific cropping season. Similarly, [14] used similar evaluation criteria to evaluate an improved teff variety, "Dagim" in Ambo and Dendi districts, west Shewa zone of Western Oromia. However, additional criteria of straw biomass and straw strength were given attention as a proxy for lodging tolerance and dry season animal feed, respectively. [15] have demonstrated and evaluated Dagim and Tesfa teff varieties at midlands of Guji zone, where they considered stem strength and early maturity as important criteria in addition to grain yield performance. Elaborating the importance of these traits, the authors explained the importance of early maturity as an important trait to escape the hazard of early termination of precipitation in their study area and the importance of strong stem for house construction. During the course what have been learnt was that the farmers' selection criteria are beyond yield and most of the farmers gave priority for qualitative traits such as resistance to disease- pest, lodging tolerance and seed color (marketability) in addition to grain yield performance. Based on overall mean score and rank, Jitu was selected first where Dursi was selected on the second position.

3.1.1. Varietal score ranking

Varietal score ranking across locations is depicted in (Table 3). According to the collective ranking, the highest score was recorded for Jitu variety, (4.41), followed by Dursi (3.74). Consequently, Jitu variety was ranked as the first option in all of the locations followed by Dursi. However, farmers were highly attracted to the straw biomass mass of Dursi variety which is expressed in two major ways. This trait is important to farmers as they can use it for dry season feed for animals, and plastering of walls mixed with mud. On the other hand the new variety, Jitu was better than Dursi in maturing earlier and tolerating lodging, despite the fact that less attention was given to the former trait as early termination of precipitation is not problem in most of the high land areas of western Oromia. However, comparable yield could be obtained from the two varieties except the non significant yield advantage the new variety (Jitu) showed over the standard check (Dursi) but their major differences mainly stems from the other traits discussed above for selection of the best variety that suits the need of the farmers and most preferred by the farmers' at large.

Table 2. Pair-wise matrix ranking format for the varieties

Crit.	1	2	3	4	5	6	7	8	9	Freq.	Rank
1		1	1	1	1	1	1	1	1	8	1st
2			3	4	5	6	7	8	9	0	-
3				4	5	3	3	3	9	5	4th
4					4	4	4	4	9	6	3rd
5						5	5	5	9	4	5th
6							6	8	9	2	6th
7								7	9	2	6th
8									9	2	6th
9										7	2nd

Criteria: 1= yield, 2=early maturity, 3= lodging tolerance, 4= Insect-pest 5=seed color, 6=seed size, 7=Tillering capacity, 8=spike length, 9= disease tolerance

Table 3. Varietal score ranking in the respective locations

variety	Jimma Arjo			Jimma Geneti			Chaliya		Overall mean	Overall rank
	Total score	Mean Score	Rank	Total score	Mean score	Rank	Total score	Mean score		
Jitu	38	4.22	1st	38	4.22	1st	43	4.78	4.41	1st
Dursi	29	3.22	2nd	35	3.89	2nd	37	4.11	3.74	2nd

Table 4. Varietal ranking based on farmers' selection criteria

No	Varieties	Rank	Reasons
1	Jitu	1st	Higher yielder, Higher disease tolerance, higher pest tolerance, higher lodging tolerance, best seed color
2	Dursi	2nd	Relatively high yielder, Disease tolerant, moderate pest tolerance, moderate lodging tolerance, good color

3.2. Grain yield performance of the varieties

The grain yield performance of the varieties is depicted in (Table 5). In spite of the inevitable variability in performance between and even within locations, a yield performance of the varieties was promising. The variability in yield performance might have stemmed from difference in the status of soil fertility, and prior cultivation history that might impose difference between fields and locations. The combined grain yield performance (q ha^{-1}) of the varieties demonstrated is summarized in (Table 5) below. Accordingly; a mean grain yield of 19.87 ±0.6 and 17.76 ±1.01, respectively was recorded for Jitu and Dursi varieties. The mean grain yield difference between the two varieties, however, was not statistically significant. From the above result one can deduce that on farm mean yield performances for the varieties is

nearly similar. Information on grain yield performance of the varieties under consideration is scanty as they are new to the area. The new variety, Jitu, was demonstrated for the first time and there is no information on the grain yield performance and other traits pertaining to this variety. Similarly, the standard check, Dursi was demonstrated only once and there is no published work on this variety, too. Discussion, thus, will be made comparing the performance difference for the same commodity but different variety. The mean grain yield performance of the new variety in the current study is greater than that reported by [13]. According to these authors, the mean on-farm grain yield performance was 18.39 q ha^{-1}, 13.26 q ha^{-1} and 15.25 q ha^{-1} for Dursi, Kena and Guduru varieties, respectively. Comparing the grain yield performance of the standard check, Dursi, the yield obtained from the current trial is a bit lower than (17.76 q ha^{-1}) that reported by [16].This might be due to the fact that an increase in number of years a given variety is under production, the more will be the chance of intermingling with other varieties with a resultant decrease in productivity. On the other hand, [15] reported a significantly lower on- farm yield performance of three improved teff varieties, vizQuncho, Guduru and Ziquala at HawaGelan and Dale Sedi districts of Western Oromia. This is mainly due to the pervasive acidity nature of the soils of West and Kellem Wollega zones where the authors conducted the trial.

Table 5. Mean yield of the varieties across the districts

Variety	Mean	SD	Min	max
Jitu	19.87 ±0.6	3.03	16.86	22.14NS
Dursi	17.76 ±1.01	1.9	13.46	23.5

NS= Non significant

Table 6. Analysis of Variance Table for variety

Source	**DF**	**SS**	**MS**	**F**	**P**
District	2	30.28	15.14	2.04	0.17 NS
Farmer	3	0.67	0.22	0.03	0.99 NS
Error	12	88.94	7.41		
Total	17				
Grand Mean	18.46				
CV	14.75				

NS= Non significant

3.3. Yield Advantage

Calculating yield advantage of the varieties helps: to show the extra benefit in percentage that the farmers obtain from producing improved variety. Besides, it is used to recommend based on the relative yield advantage over other varieties. Accordingly, Jitu had yield advantage of 12.22% over Dursi. Yield advantage is calculated using the following formula:

$$\text{Yield advantage (\%)} = \frac{\text{Yield of new variety - Yield of standard check}}{\text{Yield of standard check}} * 100$$

$$= \frac{19.87 \text{qt } ha^{-1} - 17.76 \text{ q } ha^{-1}}{17.76 \text{qt } ha^{-1}} * 100 = 12.22\%$$

3.4. Technology gap and Technology index

Technology gap indicates the gap in the demonstration yield over potential yield. The observed technology gap is attributed to dissimilarities in fertility, acidity, rainfall and other natural calamities. The yield gaps can further be categorized into technology index which is used to show the feasibility of the variety at the farmer's field. The lower the values of technology index the more the feasibility of the varieties. Accordingly, the technology gap and index of demonstrated varieties were calculated using the underlying formulas and presented in below table.

$$\text{Technology gap} = \text{Potential yield (qt } ha^{-1}) - \text{Demonstration yield (qt } ha^{-1})$$

$$\text{Technology index} = \frac{\text{Potential yield (qt } ha^{-1}) - \text{Demonstration yield (qt } ha^{-1})}{\text{Potential yield}} * 100.$$

Technology index can also be expressed as (Technology gap/potential yield/ **Potential** yield)*100

Technology gap: The technology gap for the two varieties was calculated as shown below and was summarized in (Table 6). As can be seen in the table, the technology gap for the varieties was 5.43 quintal and 6.24 quintal, respec-

tively. Comparing the two varieties for this parameter, the gap is a bit higher for Dursi as compared to the new variety (Jitu), though not significantly wider. This indicates that the relatively lower gap was observed on Jitu variety which in turn shows the demonstration yield is very close to the potential yield. This might be due to the fact that the standard check was under production and the consequential contamination (impurity) which is one factor, among others, that contribute to yield reduction.

Technology gap for: Jitu= 25.3(q ha^{-1}) -19.87(q ha^{-1}) =5.43 q

Dursi= 24 (q ha^{-1}) -17.76 (q ha^{-1}) =6.24 q

Technology index:

The demonstrated grain yield performance of the two varieties and their respective potential yield were compared to estimate the yield gaps which were further categorized in to technology index. The technology index for the two varieties was calculated as indicated below and was summarized in (Table 7). The result shows that the value was 21.46 for Jitu (the new variety) while it were 26 for the standard check (Dursi).The average value of the index (23.73%) reveals that the varieties are feasible to the farmers in the study area and other similar agro-ecologies. However, as lower value of the index denotes more feasibility of the technology to farmers, it can be learned that it is more feasible to produce Jitu variety than to produce Dursi variety under farmers' condition.

$$\text{Technology index for: Jitu} = \frac{5.43q}{25.3\ q} * 100 = 21.46$$

$$\text{Dursi} = \frac{6.24\ q}{24q} * 100 = 26$$

Table 7. Yield advantage, technology gap and technology index of the varieties

Variety	Potential yield (q ha-1)	Demo yield (q ha-1)	Technology gap (q)	Technology index	Yield advantage (%) of the new variety over check
Jitu	25.3	19.87	5.43	21.46	17.76
Dursi	24	17.76	6.24	26	

q ha^{-1}=Quintal per hectare, q= Quintal

3.5. Financial analysis

In terms of profitability and returns that could be gained from each of the varieties, financial analysis result of the study was summarized and presented in (Table 8). On average a net profit of 47833.33 ETB ha^{-1} and 40028.33 ETB ha^{-1} were gained from Jitu and Dursi varieties, respectively. As can be seen from (Table 8), variety wise analysis reveals that the highest profit was gained from Jitu variety as compared to Dursi variety. Consequently, the return on investment (ROI) was higher (2.73) for Jitu variety compared to that of standard check (2.23). The result from the financial analysis as depicted in (Table 8) reveals that farmers could gain an additional 7805 ETB ha^{-1} while they produced Jitu variety. On the other hand, location wise analysis indicates that the highest average net gain per hectare (49787. 5 ETB) was accrued to the farmers at Chaliya, while the least average gain per hectare was accrued to the farmers at Jimma Geneti (36855 ETB).The lowest gain for the farmers at this site was due to the relatively low performance of the variety exhibited at this specific location that lowered the total revenue accrued from sale of the variety. At Chaliya, both the varieties performed almost similarly resulting in a very low gain difference (875 birr) between producing Jitu and the standard check (Dursi), while the gain difference for the two varieties was the highest (13440ETB ha^{-1}) for Jimma Geneti. One can learn from the financial that the demonstrated variety (Jitu) exhibited better yield performance, hence greater net gain for the producers.

3.6. Training of farmers, Experts and DAs

Stakeholders participated on teff production and management across the districts is depicted in (Table 6). As indicated in the table, a total of 84 participants from the four districts have taken part in the training. Accordingly, 9 district experts, 12DAs, 3 supervisors, and 80 farmers took the training.

3.7. Field Visit/Mini field days

Field visit was also arranged across the districts so as to evaluate/select best performing varieties, to enhance farmers' knowledge on teff production and management and to collect feedback from all relevant stakeholders' for further way

forward. On the field visit event organized a total of 120 participants; 92 (75 M and 17 F) farmers, 16 (14 M and 2 F) DAs and Supervisors and 12 (11 M and 1 F) agricultural experts participated across the districts.

Table 8. Financial analysis for the varieties across the districts

	Jimma Arjo		Jimma Genet		Chaliya	
	Jitu	Dursi	Jitu	Dursi	Jitu	Dursi
Yield qt/ha (Y)	20.2	17.6	18.45	14.61	20.35	20.1
Price(P) perquintal	3500	3500	3500	3500	3500	3500
Total Revenue (TR) = TR = Y*P	70700	61600	64575	51135	71225	70350
Variable costs						
Seed cost	4000	4000	4000	4000	4000	4000
Fertilizer cost	4000	4000	4000	4000	4000	4000
Labor cost	6000	6000	6000	6000	6000	6000
Total Variable costs (TVC)	14000	14000	14000	14000	14000	14000
Fixed costs						
Cost of land	3500	3500	3500	3500	3500	3500
Total fixed costs (TFC)	3500	3500	3500	3500	3500	3500
Total cost (TC) = TVC+TFC	17500	17500	17500	17500	17500	17500
Gross Margin (GM)=TR-TVC	53200	44100	47075	33635	53725	52850
Profit=GM-TFC	49700	40600	43575	30135	50225	49350
Return on investment (RIO) =(TR/TC)*100	2.84	2.32	2.49	1.72	2.87	2.82

NB: all costs and incomes were calculated in ETB (Ethiopian Birr); 1 ETB=0.021USD

Table 9. Comparison of net gain from Jitu and Dursi varieties across locations (birr)

Jimma Arjo			Jimma Genet			Chaliya		
Gain(J)	Gain(D)	Diff.	Gain(J)	Gain(D)	Diff.	Gain(J)	Gain(D)	Diff.
49700	40600	9100	43575	30135	13440	50225	49350	875

Gain (D) = net gain from Dursi; Gain (J) = net gain from Jitu; Diff. = gain difference

Table 10. Stakeholders training participants by district and gender

Participants	Jimma Arjo	Jimma Geneti	Chaliya	Total
Experts	3	3	3	9
DAs	4	4	4	12
Supervisors	1	1	1	3
Farmers	20	20	20	60
Total	28	28	28	84

Table 11. Participants of mini field day by district and gender

Participants' category	Number of participants		
	Male	Female	Total
Experts	6	3	9
DAs	8	4	12
Farmers	75	17	92
Total	89	24	113

3.8. Farmers' perception on tef technology

The farmers' have appreciated the selected teff variety for the following merits; perceived better yielder than the commercial varieties, perceived better resistance to disease, perceived better Seed color, tillering capacity and marketability. Apart from these traits the farmers liked the higher biomass and leaf to stem ratio of the improved variety (Jitu) that is an important characteristic as a dry season animal feed and other benefits like thatching roof making and plastering materials. Moreover, teff straw is an important cash source in addition to the importance mentioned earlier.

4. Conclusion and recommendation

The current study was conducted in Jimma Genet, Jimma Arjo and Chaliya districts of Western Oromia aiming at demonstrating a recently released improved teff variety, Jitu to farmers in the districts. The variety was planted with a standard check, adhering to all the production packages generated with the variety. At maturity, participatory variety evaluation was conducted in collaboration with district experts, Development Agents, FRG member farmers and other neighboring farmers. Evaluation criteria were collectively set and the varieties were evaluated against the criteria ordered according to their weights. The result of participatory evaluation reveals that the new variety excelled the standard check interms of both qualitative traits (disease tolerance, early maturity, lodging tolerance, insect-pest tolerance, seed color) and quantitative parameters/criteria (grain yield, seed size, tillering capacity, spike length) considered. Consequently, the participants appreciated the new variety for its performance and other important traits, creating demand for the new variety. Furthermore, the financial analysis revealed that the highest net return was secured from the new variety as compared to the standard check planted along with it. Based on the result of the participatory variety evaluation, the farmers appreciated the new variety and showed keen interest for future large scale production. The better financial gain from the new variety further signifies the importance of scaling up the new variety to as many farmers as possible in the coming season. Based on these facts, Jitu variety was recommended for further scale up to demonstration districts and scale out to other similar agro ecologies within the districts and beyond.

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