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Research Article

Using farmers evaluation criteria as an essential constituent of variety popularization: The case of improved finger millet variety demonstration in selected districts of East Wallaga Zone

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Abstract integral

The study was conducted in the Boneya Boshe, Wayu Tuqa, and Diga districts of western Oromia, during the 2020 main cropping season. The objective of the study was to demonstrate a recently released finger millet variety to the farmers in the study areas. A new variety (Bako-09) was planted along with standard checks (Gute and Gudetu) on 100 m^2 adjacent plots, adhering to breeder recommendations. Both qualitative and quantitative data were collected and analyzed for this study. At maturity, participatory variety evaluation was done using qualitative and quantitative traits/criteria set by the farmers to select the best variety for future use. Disease resistance/tolerance, grain yield performance, tillering capacity, number of fingers per head, 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 based on 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 (qt ha^{-1}) was 24.73±1.05, 20.23±0.73 and18.36±0.34 for Bako-09, Gute, and Gudetu, respectively which is statistically significant ($p<0.01$). The new variety, accordingly exhibited a yield advantage of 22.24% and 34.7%, respectively over Gute and Gudetu varieties. The technology gap and technology index for Bako-09 were 5.07 qt and 17.01%, respectively while the values were 14.77 qt and 42.2%; 4.4 qt and 20.17% for Gute and Gudetu, respectively, witnessing more stability and feasibility of the new variety to the farmers. The result of financial analysis also reveals that a net gain of 31755.83 ETB, 24073.33 ETB, and 20672.5 ETB were accrued from Bako-09, Gute and Gudetu varieties, respectively, evidencing more profitability of the new variety compared to the checks. The new variety, has consequently, met the farmer's demand both in terms of qualitative and quantitative traits including financial benefits than the standard checks. This calls for wider dissemination of the variety with its full package to the farmers in the study area and with similar agro-ecological conditions.

Introduction

Finger millet, (Eleusine coracana L.) Gaertn. ssp. Corsicana), is the second most widely grown millet on the continent of Africa and it is an important crop grown in low-input farming systems by resource-poor farmers in eastern and southern Africa [1]. Being indigenous to the highlands of Uganda and Ethiopia, finger millet is widely produced by small-scale landholders and consumed locally [2]. It is a climate-resilience quality such as adaptation to a wide range of ecological conditions, less irrigational requirements, better growth and productivity in low nutrient input conditions, less reliance on synthetic fertilizers, and minimum vulnerability to environmental stresses [3] crop with highly nutritious and antioxidant properties [4]. Finger millet is adapted to a wide range of environments and grown mainly by subsistence farmers in the drier regions of Africa and serves as a food security crop because of its high nutritional value, excellent storage qualities, and as low input-requiring crop [5].

It is extensively cultivated in the tropical and sub-tropical regions of Africa and India and is known to save the lives of poor farmers from starvation at times of extreme drought [6]. In Ethiopia, finger millet, which is considered a poor man's crop, is being grown by the rural poor farmers in marginal

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lands with low yielding potential, mainly in Amhara and Oromia regions [1,7]. Today, in response to increased drought and soil fertility degradation, a significant number of farmers in Ethiopia are opting for finger millet, and, consequently, the area under the crop is currently on a significant increase.

According to CSA 219, in Ethiopia cereals accounted for the largest share of grains in terms of both *area and volume of production. The report of CSA, 2019 reveals that it accounted for 81.4 % of the total area of grain crops and* 87.97 % of the total volume of production of the same. Finger millet, one of the cereals grown in the country accounted for 4.31 % and 3.73% of the total area and volume of production of cereals for the same production season, respectively [8]. *Its capacity to tolerate acidic soil conditions and thrive on low input has recently made the crop more preferable in mid and low land areas of western Oromia in general, and east Wollega in particular.* Low grain yield due to a lack of stable and high-yielding varieties with disease resistance is a major problem constraining widespread cultivation and use of finger millets in Ethiopia [9,10].

To curb these productivity bottlenecks, thus, developing and popularizing adaptable, stable, high-yielding, and disease-resistant varieties is currently gaining due importance. Consequently, during the past two decades, significant effort has been made by the national and regional research programs to develop improved finger millet varieties and promote the technologies to the end-users. More specifically, Bako agricultural research center (BARC) has been making tremendous efforts to release improved finger millet varieties to potential production areas under its mandates. Bako-09 variety was among those varieties recently released and recommended for suitable agro-ecologies under BARC's mandate. As this variety excels the local variety by more than two-fold, demonstrating it to the farming communities to create awareness and availing options to the farmers is the first step in technology scaling up. This activity, thus, was designed with the following objectives:

Objective

- To demonstrate and evaluate improved finger millet technologies;
- To evaluate the productivity and profitability of the technology under farmers' conditions;
- To create awareness of the importance of the improved tef technologies;
- To collect feedback from the participants for further research design and the way forward.

Methodology

Site and farmer selection

A three-stage sampling was used to undertake the activity. In the first stage, three districts were purposively selected based on their accessibility and potentiality for finger millet production. In 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, Boneya Boshe, Wayu Tuqa, and Diga districts were used for the activity. In each district one FRG unit comprising 4 hosting farmers and 11 follower farmers was established and managed. Accordingly, a total of 12 hosting farmers were selected and participated in the activity.

Training of stakeholders

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 finger millet production, management, and post-harvest procedures including seed quality maintenance. The training aimed to create awareness among farmers, Development agents, and district experts on improved finger millet technologies.

Stakeholder's responsibility to 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 agreeing on roles and responsibilities is 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. A list of the stakeholders, their roles, and responsibilities is depicted in Table 1.

Treatments

The plots were properly plowed and made ready for planting ahead of the planting date. One newly released improved finger variety (Bako-09) was planted along with two standard checks (Gudetu and Gute) on 100 m^2 adjacent plots each. A seed craft of 15 kg ha^{-1} was used while fertilizer was applied at the rate of 105 kg ha^{-}, and 65 kg ha^{-1} for NPS and urea, respectively. An inter-row spacing of 40 cm was used and planting was done by drilling. The fields were periodically supervised to check the status and identify gaps.

Data collection

Both qualitative and quantitative data were collected for this activity. The quantitative data collected includes yield date a, the total number of farmers participating in training, total number of farmers, DAs, and district experts participating in field visits, trainings, costs of production, and income accrued to the farmers. Farmers' perception of the attribute of the technology was the qualitative data collected for the study.

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

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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 on the activities • Evaluate and select the best variety/ies
Researchers	• Providing improved seeds and fertilizer • Technical backup for the farmers • Follow up on 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 the group with a cooperative office • Organizing training for farmers • Organizing field days and experience sharing forums among the GRGs and other farmers • Coordinating all the field activities
Development Agents	• Select appropriate fields • Select appropriate farmers • Collaborate in FRG formation • Follow up on the FRGs and the fields • Communicate with researchers about the status of the field • Collaborate in organizing field visits/ field days

used to analyze the mean, to check if there is a significant yield difference between the two varieties. Qualitative data collected were put in a narration form. Besides; score ranking techniques were used to evaluate and select the best bet variety/ies and / or technology/gies and to rank their criteria and parameters according to the real situation of the area. Finally, gross margin analysis was done is very useful in a situation where fixed capital forms a negligible portion of the production. Thus; it is the difference between gross income and the total variable cost (Mohammed, et al. 2016). Furthermore; the technology gap and technology index e were calculated using the following formula.

Technology gap= Potential yield (qt/ha) – Demonstration yield (qt/ha)

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

Result and discussion

Participatory variety evaluation and selection

Productivity trait is an important but not the only criteria farmers consider for evaluating and selecting a given variety from available options. Farmers also consider other qualitative traits putting grain yield performance at the center. Cognizant of this fact, listening to the farmers to elicit these qualitative traits is winning the attention of researchers that in turn helps look for technological options that suit the needs of the farming community. Despite many informal evaluations made at different plant growth stages, a final joint evaluation was done when the crop was at its maturity stage. Accordingly, a 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 were then ordered using the pair-wise technique. The evaluation criteria were ordered in such a way that the trait with the highest score was ranked 1st, and was considered the most important criteria, while the least score denotes criteria of lower importance in the order. Each variety was then evaluated against the ordered criteria. Accordingly; FRG members scored each variety for individual traits they considered important. For each measurable trait ranking was done on a scale of 1-5units, with 1 being very poor and 5 being the highest score representing superiority. At the end of the evaluation process, the 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 grain yield performance, disease tolerance; early maturity, lodging tolerance; the number of fingers per head; seed color; seed size; tillering capacity, and finger length.

Varietal traits pair-wise ranking

At maturity, farmers were invited to evaluate and rank the varieties based on the most important criteria/traits that enable them to select the best variety from all the demonstrated varieties. At outset, they were helped to jot down their selection criteria at random. Then the farmers evaluated the varieties' traits against the ordered criteria. The pair-wise ranking technique was used to order the criteria based on the weight attached. Disease tolerance, early maturity, lodging tolerance, number of fingers per head, seed color, seed size, tillering capacity, finger length, and grain yield were the most important criteria considered to select finger millet varieties (Table 2). As indicated in (Table 2), disease resistance/ tolerance, grain yield performance, tillering capacity, number of fingers per head, 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 the

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way forward to develop farmer preferred variety/ ies. Of the listed criteria/ traits, early maturity received less attention for the selection of varieties. This is mainly because in Western Oromia the intensity and distribution of rainfall may not be a problem. During the course what has been learned was that the farmers' selection criteria are beyond yield and most of the farmers gave priority to qualitative traits such as resistance to disease- pest, lodging tolerance, and seed color (marketability) of the varieties.

Varietal score ranking

Varietal score ranking of the varieties across locations is depicted in (Table 2). According to the collective ranking, the highest score was recorded for the Bako-09 variety, (4.65), followed by Gute (3.91) and finally Gudetu (3.89). Consequently, the Bako-09 variety was ranked as the first option in all of the locations followed by Gute and finally the Gudetu variety Tables 3,4.

Grain yield performance

Despite the inevitable variability in performance between and even within locations, yield performances of the varieties were still promising. The variability in yield performance might have stemmed from a difference in the status of soil fertility, and variability in rainfall intensity and pattern that slightly differs between locations. The combined grain yield performance of the varieties demonstrated is summarized in (Table 5) below. Accordingly; a mean grain yield of 24.73±1.05 qt ha^{-1}, 20.7± 0.73 qt ha^{-1}, and 18.36± 0.34, was recorded for Bako-09, Gute, and Gudetu varieties, respectively. Moreover, the result ANOVA (Table 6) reveals non-significant variation between farmers and districts for yield, but a highly significant (P<0.05) difference between the varieties. Accordingly, Bako-09 was found to be the highest followed by Gute about grain performance.

Yield advantage

Calculating the yield advantage of the varieties is helpful to reveal the extra benefit in percentage that the farmers obtained from producing improved varieties. Additionally, it is used to make recommendations based on the relative yield advantage of the demonstrated variety/ies over the commercial check. The result from the yield advantage calculation reveals that the new variety (Bako-09) had a yield advantage of 22.24% and 34.7% over the Gute and Gudetu varieties, respectively. Yield advantage is calculated using the following formula:

$$\text{Yield advantage } (\%) = \frac{\text{Yield of a new variety} - \text{Yield of standard check}}{\text{The yield of standard check}} \times 100$$

$$\text{Over Gute } = \frac{24.73 \text{ qt ha}^{-1} - 20.23 \text{qt ha}^{-1}}{20.23 \text{qt qt ha}^{-1}} \times 100 = 22.24\%$$

$$\text{Over Gudetu } = \frac{24.73 \text{qt ha}^{-1} - 18.36 \text{ qt ha}^{-1}}{18.36 \text{qt ha}^{-1}} \times 100 = 22.24\%$$

Technology gap and technology index

The technology gap indicates the gap in the demonstration yield over potential yield. The observed technology gap is attributed to dissimilarities infertility, acidity, rainfall, and other natural calamities. The yield gaps can be further categorized into the technology index which is used to show the feasibility of the variety in the farmer's field. The lower the values of the technology index the more the feasibility of the varieties. Accordingly, the technology gap and index of

Table 2: Pair-wise matrix ranking format for finger millet varieties

Criteria	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	9
3				4	3	6	7	8	9	2	6th
4					4	4	7	4	9	5	4th
5						5	7	5	9	3	5th
6							7	6	9	3	5th
7								7	9	6	3rd
8									9	2	6th
9										7	2nd

NB: 1-9= Farmers' selection criteria: 1= Disease Tolerance; 2= Early Maturity; 3= Lodging Tolerance; 4= No of fingers per head; 5= Seed color; 6= Seed size; 7= Tillering capacity; 8= finger length; 9= Yield.

Table 3: Varietal score ranking in the respective locations.

Variety	Bilo Boshe			Wayu Tuqa			Diga			Overall mean	Overall rank
	Total score	Mean score	Rank	Total score	Mean score	Rank	Total score	Mean score	Rank		
Bako-09	42.3	4.7	1st	42	4.67	**1st**	43	4.59	**1st**	4.65	1st
Gute	36.6	4.07	2nd	36	4	**2nd**	33	3.67	2nd	3.91	2nd
Gudetu	36.6	4.0	2nd	36	4	**2nd**	33	3.67	2nd	3.89	3rd

Table 4: Varietal ranking based on farmers' selection criteria.

No	Varieties	Rank	Reasons
1	Bako-09	1st	Higher disease tolerant, Higher yielder, many tillers, many fingers very good color
2	Gute	2nd	Disease tolerant, Moderate yielder, few tillers, relatively less fingers, good color
3	Gudetu		Moderately disease tolerant, low yielder, fewer tillers, relatively less fingers, good color

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demonstrated varieties were calculated using the underlying formulas and presented in the below table.

Technology gap = Potential yield (qt ha^{-1}) - Demonstration yield (qtha^{-1})

Technology gap for Bako-09= 29.8- 24.73= 5.07qt

Technology gap for Gute= 35-20.23= 14.77qt

Technology gap for Gudetu= 23-18.36= 4.4qt

Technology gap

The technology gap for the three varieties was calculated as shown above and was summarized in (Table 6). As can be seen from the table, the technology gap for the varieties was 5.07 qt, 14.77 qt, and 4.4 qt, for Bako-09, Gute, and Gudetu varieties, respectively. Comparing the three varieties for this parameter, the gap is relatively higher for Gute as compared to the Bako-09 and Gudetu varieties. This indicates that the relatively lower gap was observed on Gudetu and Bako-09 variety which in turn shows the demonstration yield is very close to the potential yield for these two. This might be because the Gute variety was under production for a longer time with likely consequential contamination (impurity) which is one factor, among others, that contribute to yield reduction.

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 into technology index. The technology index for the three varieties was calculated as indicated below and was summarized in (Table 6). The result shows that the value was 17.01% for Bako-09 (the new variety), while the value was 20.17 % and 42.2 % for Gudetu and Gute varieties, respectively. The average value of the index (18.82 %) reveals that the varieties are feasible to the farmers in the study area and other similar agro-ecologies. However, as the lower value of the index denotes more feasibility of the technology to farmers, it can be learned that producing the Bako-09 variety is more feasible than producing Gudetu and Gute varieties under farmers' conditions.

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

$$\text{Technology index forBako} - 09 = \frac{(29.8 \text{ qt ha}^{-1} - 24.73 \text{ qt ha}^{-1}) * 100}{29.8 \text{ qt ha}^{-1}} = \mathbf{17.01\%}$$

$$\text{Technology index for Gudetu} = \frac{(23 - 18.36)}{23} * 100 = 20.17$$

$$\text{Technology index for Gute} = (35 - 20.23 / 35) * 100 = 42.2\ \%$$

Financial analysis

In terms of profitability and returns that could be gained from each of the varieties, the financial analysis result of the study was summarized and presented in (Table 7). On average a net gain (ETB) of 31755.83, 24073.333, and 20672.5ha^{-1} were gained from Bako-09, Gute, and Gudetu varieties, respectively. As can be seen from (Table 8) variety wise analysis reveals that the highest gain (ETB) was from producing Bako-09 as compared to producing the standard checks. A summary of gain differences based on district and variety is depicted in (Table 9). Based on the inter-varietal gain comparison, farmers could gain an additional ETB 11083.33 if they produce Bako-09, sacrificing the Gute variety. Likewise, farmers could gain an additional ETB 7682.5 if they resort to producing Bako-09 instead of the Gute variety. On the other hand, location-wise analysis indicates that the highest average net gain per hectare (31755.833ETB) from the new variety was accrued to the farmers at Boneya Boshe, while the least average gain per hectare was accrued to the farmers at Diga (20672.5 ETB). The lowest gain for the farmers at this site was due to the relatively low performance the demonstrated variety (Bako-09) exhibited at this specific location. Further, the study result also revealed the highest returns to investment (2.76) were gained from Bako-09 followed by Gute (2.09), and finally from the Gudetu variety which was 1.80. One can learn from the current study that Bako-09, apart from the qualitative traits mentioned earlier, demonstrated both yield advantage and profitability as compared to the standard checks against which it was compared.

Table 5: T-test for yield performance of the varieties across the districts.

Variety	N	Mean	SD	SE	T	P-value
Bako-09	11	24.73	3.49	1.05	3.12	0.0053
Gute	11	20.73	2.41	0.73		
Bako-09	11	24.73	3.49	1.05	5.75	0
Gudetu	11	18.36	1.12	0.34		
Gute	11	20.73	2.41	0.73	2.95	0.008
Gudetu	11	18.36	1.12	0.34		

Table 6: Analysis of variance table for yield.

Source	DF	SS	MS	F	P
Variety	2	227.64	113.818	16.77	0.0000***
District	2	22.02	11.009	1.62	0.2176 NS
Farmer	3	1.24	0.414	0.06	0.9799 NS
Error	25	169.68	6.787		
Total	32				
Grand mean	21.23				
CV	12.27				

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

Variety	Potential yield (qt ha^{-1})	Demo yield (qt ha^{-1})	Technology gap (qt)	Technology Index (%)	Yield advantage (%)
Bako-09	29.8	24.73	5.07	17.01	
Gute	35	20.23	14.77	42.2	22.24
Gudetu	23	18.36	4.4	20.17	34.7

Training of farmers, experts and DAs

Stakeholders who participated in finger millet production and management across the districts are depicted in (Tables 10,11). As indicated in the table, a total of 84 participants from

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Table 8: Financial analysis for the varieties across the districts.

	B. Boshe			Wayu Tuqa			Diga		
	Bako-09	Gute	Gudetu	Bako-09	Gute	Gudetu	Bako-09	Gute	Gudetu
Yield qt/ha (Y)	24.67	19	18.67	26	22	18.5	23.5	20	18
Price(P) per quintal	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Revenue (TR) = TR = Y*P	43172.5	33250	32672.5	45500	38500	32375	41125	35000	31500
Variable costs									
Seed cost	2000	2000	2000	2000	2000	2000	2000	2000	2000
Fertilizer cost	2510	2510	2510	2510	2510	2510	2510	2510	2510
Labor cost	4000	4000	4000	4000	4000	4000	4000	4000	4000
Total Variable costs (TVC)	8510	8510	8510	8510	8510	8510	8510	8510	8510
Fixed costs									
Cost of land	3000	3000	3000	3000	3000	3000	3000	3000	3000
Total fixed costs (TFC)	3000	3000	3000	3000	3000	3000	3000	3000	3000
Total cost (TC) = TVC+TFC	11510	11510	11510	11510	11510	11510	11510	11510	11510
Gross Margin (GM)=TR-TVC	51970.6	33170	24162.5	42870.6	44090	23865	30440	24980	22990
Profit=GM-TFC	31662.5	21740	21162.5	33990	26990	20865	29615	23490	19990
Return on investment (RIO) =(TR/TC)*100	2.75	1.89	1.84	2.95	2.34	1.81	2.57	2.04	1.74

All costs and revenues in this table are in ETB, the Ethiopian currency called Ethiopian Birr 1 ETB= 0.02113647

the three districts have taken part in the training. Accordingly, 9 district experts, 12 DAs, 3 supervisors, and 60 farmers took the training.

Field visit/mini field days

A field visit was also arranged across the districts to evaluate/select best performing varieties, to enhance farmers' knowledge on teff production and management, and to collect feedback from all relevant stakeholders for the further way forward. On the field visit event organized, a total of 113 participants; 92 (75M and 17F) farmers, 12 (8M and 4F) DAs and Supervisors, and 12 (10M and 2F) agricultural experts participated across the districts.

Farmers' perception of the technology

The farmers have appreciated the selected finger millet variety for the following merits; perceived better yielder than the commercial varieties, perceived better disease resistance, perceived better Seed color, tillering capacity, and marketability.

Conclusion and recommendation

The current study aimed at demonstrating a recently released improved finger millet variety, Bako-09 to farmers in selected districts of western Oromia. The variety was planted along with a standard check, Gute and Gudetu varieties; on a plot size of 100m² each, adhering to recommended agronomic practices. A total of 12 farmers were involved in the activity. At maturity, the varieties were jointly evaluated by researchers, farmers, Development agents, and district agricultural experts. The cost-benefit analysis was also done considering the cost of production and revenue from the sale of the produce. The result of participatory evaluation revealed that the new variety beat the standard checks in terms of the traits considered (yield, disease tolerance; early maturity; lodging tolerance; No of fingers per head; seed color; seed size; tillering capacity, and finger length). Furthermore, the result of the financial(cost-benefit) analysis revealed the highest net return from the new variety as compared to the standard checks planted along with it. The farmers appreciated the new variety and showed keen

Table 9: Variety wise comparison of net gain across districts (in ETB).

B.Boshe			Wayu Tuqa			Diga		
Gain (B)	Gain (Gut)	Gain (Gud).	Gain (B)	Gain (Gut)	Gain (Gud).	Gain (B)	Gain (Gut)	Gain (Gud).
31662.5	21740	21162.5	33990	26990	20865	29615	23490	19990

Gain (B): Net gain from Bako-09; Gain (Gut)= Net gain from Gute; Gain (Gud)= Net gain from Gudetu
ETB= Ethiopian Birr i.e.; 1 ETB= 0.02113647

Table 10: Training of participants by district and gender.

Participants	Boney Boshe	Wayu Tuqa	Diga	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

DAs= Development Agents.

Table 11: Field day participants by district and gender.

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

DAs= Development Agents

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interest in future large-scale production. Based on these facts, the Bako-09 variety was recommended for further wider scale dissemination in the demonstration districts and other similar agro-ecologies within the districts and beyond. To sustain the activity of large scale dissemination, however, a relay type of extension system should be in place in such a way that the district experts and Development gents of the respective districts should handle the technology(the variety and the whole package) with a profound sense of ownership and go for further large scale dissemination

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