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# Participatory Evaluation and Pre-Extension Demonstration of Improved Finger Millet Varieties with Its Full Package in Selected Districts of Debub Omo Zone, Southern Ethiopia

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**Abstract**

The study was conducted during 2018/19 production season in four purposively selected kebeles in Debub Omo Zone. The main objective of this study was to evaluate and introduce the improved finger millet technology at farmers' condition in the areas. A total of 20 participant farmers were selected purposively. Individual interview by using likert scale, farmers' research and extension group discussion and weight measurements tools were used to collect all necessary data. Simple descriptive statistics such mean and percentages were used to analysis quantitative data and three point likert-scale ranking was used to rank farmers' preferences data. Based on the pre-selected farmers' evaluation criteria, the field performances evaluation of improved finger millet variety was showed better field performances in drought tolerance, resistance to logging and diseases, spike length and plant height over the local cultivator. The yield performances of the improved variety under both farmers' management condition and on FTCs managed by researchers were 6.73% and 18.8% of yield advantage respectively over the local cultivator. Therefore, introducing the improved finger millet technologies at large scale enhances its adoption rate and increase productivity of finger millet in the vicinities and areas with similar agro-ecologies.

**Keywords**:
Pre-extension, Demonstration, Finger millet, Technology

## 1. Introduction

Finger millet (*Eleusine coracana*) is a climate-resilient crop with highly nutritious and antioxidant properties (Gupta et al., 2017). It is grown low rainfall areas and widely adaptable to drought-prone area. Finger millet serves as a food security crop because of its high nutritional value, excellent qualities and as a low input-requiring crop (Dida et al., 2008). In Ethiopia, it is the sixth most important cereal crop mostly cultivated by traditional small holder farmers (Amare *et al*., 2019). Finger millet, which is considered as a poor man's crop, is being grown by the rural poor farmers in marginal lands with low yielding potential, mainly in Amhara and Oromia regions (Adugna et al., 2011; Ayalew, 2015). In the country, finger millet cultivation covers about 456,057.3 ha of land and its yield accounts about 2.26 ton/ha. Likewise, it covers about 4,485.63 ha area of land with the average yield productivity of 1.606 ton/ha in SNNP region, which is outlying below the national average productivity (CSA, 2018).

In the region, finger millet is used as staple food in the form of bread, injera, porridge and used to prepare local drinks such local beer '*chaqqa'* and distilled spirits (Areke) for both home consumption as well as income source mainly for substance small holder farmers. Beside to food security, it is also preferred by smallholder farmers in the areas due to storability up to for a decade without deteriorated and weevil damage. However, its production and productivity is become very low mainly due to lack of stable and improved varieties, and diseases (Dagu et al., 2009; Dagnachew et al., 2015). Lack of attention and priority in generating improved varieties, enhancing adoption of finger millet technologies by research and agricultural extension also contributed to low production and productivity of the crop (Andualem, 2008; Degu *et al*., 2009; Molla, 2010; Altaye, 2012; Tafere and Melak, 2013).

Despite of the above aforementioned facts, Jinka agricultural research center (JARC) has selected highly adapted and better yielding finger millet varieties with associated agronomic practices in moisture stress areas of Debub Omo zone under rain feed condition. But, due to lack of access to information on improved new finger millet varieties as well as improved agronomic practices, farmers in the areas have being used the low yielding local cultivators and tradition production system. Hence, this study was carried out to enhance adoption of improved finger millet (kako-1) variety with its associated agronomic practices. Moreover, the participatory demonstration was conducted to evaluate both field and yield performances of the finger millet technology under farmers' management condition and to improve farmers' practical skill on finger millet production technology.

Objectives:

The objectives of this study focused on;

Evaluating and introducing the improved kako-1 finger millet variety under farmers' condition with its full packages.

Assessing farmers' preferences towards finger millet technologies.

Enhancing farmers' and stake holders' awareness and knowledge on improved finger millet production technologies.

## 2. Materials and Methods

Description of the Study Area

Bena-Tsemay woreda is situated between 5°01' and 5°73' North latitude & 36°38' and 37°07' East longitude with altitude of 588 meter above sea level. The rainfall distribution of the area is bimodal with main rainy season extends from January to May and the second cropping season, from July to October. It receives annual average rainfall of 876.3 mm and the monthly average minimum and maximum and minimum temperatures of 18.2 and 37.3 ° C, respectively. Whereas, Debub Ari woreda is located at 50.67'-60.19' N &360.30'-360.73'E and it is bordering with Semen Ari woreda in north, Magonational Park in South, Salamago woreda in west, Malle woreda in east and BenaTsemay woreda in South East. The altitude of the woreda ranges between 500m a.s.l and 3000 mater a.s.l. The traditional agro-ecologies; Dega, woina-dega and kolla are 30, 65 and 5 percent respectively of the total areas. The woreda has a rain fall pattern of bimodal type / Belg = February – April and Meher = July – September /. The mean annual rainfall ranges between 601- 1600 mm. The mean annual temperature ranges between 10-10 c and greater than 27.50C.

**Sites and participant farmers' selection methods**

The demonstration of improved finger millet technology was carried out in four finger millet growing Kebeles such as; Kayisa and Arkisha from Debub Ari district, and Kako and Chali from Bena-Tsemay districts. Selection of sites were conducted purposively based on the high potential for growing finger millet access to suitable land in FTCs of the respective kebeles to undertake practical skill training through participatory demonstration. Finally, total of 20 participant farmers were selected purposively based on their willingness to participate, access to suitable land, and willingness to perform timely field management practices. Both farmers and sites selection were undertaken by Jinka Agricultural Research Center (JARC) with jointly coordinated by the respective districts agricultural extension experts, kebele level development agents and administrative bodies.

**Implementation procedures**

**Organizing multi-disciplinary team and group**

One technical team consists of five members was organized to conduct demonstration of finger millet technology in the area. It was composed of agronomist, breeder, pathologist and PED researchers were established. The team members had shared duties and responsibilities of; providing training to farmers and key stakeholders, conducting follow up and monitoring throughout implementation of the activity to final harvesting. Totally four participatory farmers' research and extension groups (FREGs) (one at each *kebele*) consisting of 78 members (males =58 and females =20) were established in the *kebeles*. FGERs were composed of participant farmers, model farmers, DAs and administrative bodies of the respective *kebeles*. Land preparation, plantation, conducting recommended agronomic managements and yield harvesting activities were undertaken by host farmers, while FREG members jointly with DAs of the respective *kebeles* conducted periodic follow up and support to farmers throughout the practices of land preparation to final harvesting. Besides, the FREG' members were responsible for actively participating and conducting demonstration activities jointly with the team at Farmers' Training Centers (FTCs) in the targeted kebeles.

**Training**

Prior to implementing the demonstration trial on both farmers' field and FTCs, the technical team organized both theoretical and practical trainings to participant farmers, FREG members and kebeles administrators. Totally, 62 farmers 8 DAs and 8 administrators of the respective *kebeles* were participated in the trainings. The major areas of the training focused on; creating awareness on the objectives of research demonstration work, role of finger millet

production with full package and importance agronomic and disease management practices**.** Practically, on-farm training was given to FREGs members through enabling them to participate in the demonstration conducted at each FTC in the selected kebeles.

**Field day demonstration**

A field day is a group extension event used to convince the farmers about applicability of new practice/ technology in their own situation. Hence, field day demonstration was organized by Jinka Agricultural Research Center (JARC) in collaboration with key Stakeholders of the respective Zone and conducted at seed maturity period of the finger millet at FTC of Kaysa Kebele in Debubi Ari district. Field day participants were selected based on willingness to participate and share new practices, idea and information to their neighbours and colleagues, better farming status and works in the area of agricultural development sectors. Totally, 130 participants were invited and among them about 100 farmers, 10 kebeles' DAs, 6 SMS from office district and Zonal Agriculture and NRM and 14 kebeles', districs' and Zonal administer were actively participated on the extension event.

**Planting materials and agronomic practices**

The best adapted and better yielding improved finger millet (kako-1) variety and one local cultivator were sowed at all participant farmers' farm land as well as the respective kebele's FTCs demonstration field in both districts. The varieties were planted on adjacent and equal plot size of 0.25ha of land for each variety at all participant farmers' and FTCs' demonstration fields, whereas the selected host farmers and FTCs were used as replication. The recommended seed rate of 10 kg/ha and 45 cm spacing between rows were applied during seed sowing. The amount and types of fertilizers applied were 100kg/ha of NPS and Urea whereas Urea was applied two times, half during planting and the remaining was applied at growth stage.

**Data types, source and methods of data collection**

Primary data were collected on farmers' preferences of the finger millet technology and grain yields. All-important feedbacks were collected from participant farmers, FREG members and key stake holders participated in the demonstration practices in the areas. Data on the crop grain yields wer collected from 15 selected farmers' fields using the area of a 1 x 1 meter square from three selected quadrant from each demonstration fields and recorded in Microsoft excel 2010 subjected to statistical data analysis. Individual interview was conducted to collect farmers' preferences data by using a six-item likert scale. Feedbacks were collected from discussion of FREGs, and key stakeholder, and field observation.

**Method of data analysis**

The grain yields data were analyzed using simple descriptive statistics such as mean and percentage , and also a three point Likert-scale ranking assigned values 3(good), 2(moderate) and 1(poor). A midpoint of 2.0 was obtained and decision rule was that statements with mean score of 2.0 and above have good performance while those with mean score less than 2.0 have poor field performance technology attributes of the crop. Whereas, feedbacks on important technology attributes were qualitatively summarized.

## 3. Results and Discussion

### 3.1 Farmers' selection criteria

Prior to undertake evaluation of the given technology, identifying evaluation criteria were paramount important. Besides, sets of criteria on attributes of finger millet varieties were selected and ranked based on the importance by active participation of farmers in the area. The selected attributes of the technology were used to select best performed varieties of finger millet variety/ies in the area. The result of pairwise ranking in (table 1) below revealed that resistance to disease is rated as the fist most important criteria, whereas resistance to moisture stress and higher grain yielders were rated equally as the second important farmers' selection criteria next to disease resistance. Moreover, farmers reported that resistance to logging; good spike length, early maturity and good plant height were ranked as $3^{th}$, $4^{th}$, $5^{th}$ and $6^{th}$ important preference criteria for finger millet growing farmers respectively in the area.

### 3.2 Farmers' preferences towards field performances of finger millet varieties

Most of the respondents preferred kako-1 due to its good spike length, better drought tolerant, less susceptible for logging and less vulnerable to disease compared to local check. But it is late in maturity period. Generally, out of the 24 respondents, about 70% of them agreed that kako-1 variety is preferred for most attributes as compared to the local check (Table 2).

Table 1. Per-wise ranking matrix on farmers' preference criteria for finger millet

| Characteristic finger millet technology | | A | B | C | D | E | F | G | T.score | Rank |
|---|---|---|---|---|---|---|---|---|---|---|
| A | Early maturity | | A | C | D | E | F | G | 1 | 5th |
| B | Plant height | | | C | D | E | F | G | 0 | 6th |
| C | Grain yield | | | | C | C | CF | G | 5 | 2rd |
| D | Spike length | | | | | E | F | G | 2 | 4th |
| E | Resistance to logging | | | | | | F | G | 3 | 3th |
| F | Resistance to moisture stress | | | | | | | G | 5 | 2nd |
| G | Diseases resistance | | | | | | | | 6 | 1st |

Source: field survey, 2020

Table 2. Farmers' preference towards field performance attributes of finger millet varieties

| No. | Likert scale items | Mean of preference ranking, where (N=24) | | | | | |
|---|---|---|---|---|---|---|---|
| | | Kako-1 | | | Local check | | |
| | | Poor | Moderate | Good | Poor | Moderate | Good |
| 1 | Early mature | 6 | 14 | 4 | 3 | 8 | 13 |
| 2 | Plant height | 0 | 3 | 21 | 0 | 12 | 12 |
| 3 | Spike length | 0 | 6 | 18 | 16 | 5 | 3 |
| 4 | Logging resistance | 4 | 0 | 20 | 12 | 6 | 6 |
| 5 | Drought tolerant | 0 | 0 | 24 | 8 | 11 | 5 |
| 6 | Resistance to diseases and pests | 3 | 7 | 14 | 10 | 8 | 6 |
| | Average | 2.17 | 5 | 16.83 | 8.17 | 8.33 | 7.5 |
| | % of respondents | 9.04 | 20.83 | 70.13 | 34.04 | 34.7 | 31.25 |
| | 1=disagree, 2=indifferent and 3= agree | | | | | | |

Source: field survey, 2020

**3.3 Yield performance of the finger millet varieties on participant farmers' field**

In this demonstration, yield performances of the demonstrated finger millet varieties were evaluated to identify the higher yielder variety under farmers' management practices in the area. According to the result of (Table 3) below, the mean grain yield (22.22qt/ha) of the improved (Kako-1) variety was higher than the local one (20.8qt/ha), and also the lower minimum and maximum yield were recorded for the local variety in the farmers' demonstration farm. Whereas, the mean yields of 2.78 and 2.34 $tha^{-1}$ were obtained from the improved kako-1and local check respectively under managements of researcher at FTCs. There is 18.8% yield advantage of kako-1 over the local check in the area (table 4).

Table 3. Yield performance of finger millet varieties on farmers' demons field

| No | Variety | Grain yield in t/ha | | |
|---|---|---|---|---|
| | | Minimum | Maximum | Mean |
| 1 | Local check | 1.45 | 2.75 | 2.08 |
| 2 | Kako-1 | 1.75 | 2.8 | 2.22 |

Table 4. Yield performance of finger millet varieties on FTCs' demons field

| No. | Variety | Grain yield in t/ha | | | | |
|---|---|---|---|---|---|---|
| | | Minimum | Maximum | Mean | Yield increase in t/ha | % of yield advantage over local check |
| 1 | Local check | 2.1 | 2.7 | 2.34 | - | - |
| 2 | Kako-1 | 2.78 | 3.1 | 2.78 | 0.44 | 18.8 |

Note that: yield advantage % $= \frac{\left(\text{Yield of new variet}\frac{t}{ha} - \text{yield of local check}\frac{t}{ha}\right) X\ 100}{\text{yield oflocal check}\frac{t}{ha}}$

**4. Conclusion and Recommendations**

The study showed that involvement of farmers and key stakeholders on varieties performance evaluation and demonstration enhances awareness of the participants on the technology. Farmers and key stakeholders learnt by directly participating on stepwise finger millet technology demonstration (from land preparation to final harvesting) which helped them to acquire knowledge and technical skill on improved agronomic and management practices of finger millet crop. Likewise, they had actively involved in field performance evaluation of finger millet varieties in the demonstration sites. Based on the farmers' selection criteria, the improved variety was selected for its better field performances of spike length, plant height, drought tolerance, resistance to disease and pest and grain yield compared to the existing local cultivator. Therefore, use of the improved finger millet (kako-1) variety with its associated agronomic practices significantly improves production and productivity of finger millet in the area. It also improves the problem of access to improved seed shortage in the area. Hence, concerned agricultural extension practitioners, Zonal/regional agriculture and natural resource offices, and NGOs should further disseminate and scale up the improved varieties in the areas with similar agro-ecologies.

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