

Demonstration and Evaluation of Improved Sorghum Varieties in Selected District of West Shewa Zone, Oromia Region, Ethiopia

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Abstract: Demonstration and participatory evaluation of improved sorghum variety was done at selected Peasant associations of Abuna Ginde beret district of West Shewa Zone during 2018-2020 cropping season with objective of demonstrating and promoting improved variety of Sorghum, evaluating the performance of improved Sorghum variety along with management practices. Sites were selected based on production potentiality of sorghum at selected areas. Five PAs from the district and eighteen target farmers and five FTC were purposively selected on the ground that they are the leading producer of Sorghum in the area. One variety of sorghum (Melkam) with local cultivar were evaluated with full participation of FRG member farmers under their management condition. Different Participatory technology evaluation was employed to enable farmers select variety/varieties which suit their condition. Capacity building was given to enhance awareness for participant stakeholders (Farmers 24, DAs 15 and Experts 10) at different production stages of the technology. Field day was arranged by inviting different stakeholders totally Male 120 and 41 females were participated. The technology demonstrated at the selected areas was evaluated by participants due to its high yielder, striga resistant, well adaptation and its productivity. Thus, it is important to further scale up/out the variety in all demonstration sites and similar agro ecologies.

Keywords: Demonstration, Participatory Evaluation, Sorghum, Potentiality, Scale up

1. Introduction

In terms of planted area and production volume, cereals are the most significant food crop in Ethiopia's overall grain crop, according to data from the study [4]. They are grown in greater quantities than other crops since they serve as the main sources of food. All around the world, different amounts of cereal are farmed. In Ethiopia, grains were grown on about 81.19% of the country's land (10,538,341.91 ha).

From those, the area used for grain crops was occupied by sorghum on a 12.94% basis (1,679,277.06 hectares). According to [3], 88.36% (or 302,054,260.58 quintals) of the grain production was contributed by cereals in terms of production. According to [10], 13.22% of the grain production or 45,173,502.18 quintals was sorghum. With relative area coverage of 676,075.00 ha, 597,440.83 ha, and 232,636.49 ha, it is mostly produced in the Oromia, Amhara, and Tigray regions. More than 500 million people, especially

in developing countries, depend on sorghum as their primary source of carbs, vitamins, protein, and minerals [6].

In terms of the overall number of growers, area covered, and grain production, sorghum is Ethiopia's third-most important food cereal, behind only maize and tef. Injera, a regional bread, as well as tela and areke, two regional drinks, are frequently produced with it. Sorghum is also utilized as construction material, animal feed, and industrial raw material. Production of the sorghum crop is hampered by biotic, socioeconomic, and abiotic restrictions [6].

Significant progress has been made in Ethiopia in the creation of types of sorghum that mature early and are resistant to drought. Since the start of the sorghum program, more than 50 sorghum varieties have been published, and farmers are now planting improved lowland varieties at a rate of 28%, according to [9]. According to [2], referenced in [8], the inadequate availability of farmer-preferred varieties in sorghum variety generation and dissemination efforts is to

blame for the low degree of improved sorghum variety adoption [5].

To enhance the adoption of improved sorghum varieties, pre-extension demonstration of improved Sorghum technologies has been conducted in collaboration with Ambo agricultural Research Center, agricultural extension research team and agricultural office of Abuna Ginde beret District of West Shewa zone which is one of the major sorghum growing areas in the Zone.

To this end, in 2018-2020 production seasons, participatory variety selection trial was conducted in Moisture stressed sorghum growing areas of Abuna Ginde beret District of West Showa Zone, Ethiopia, using newly demonstrated Sorghum variety called Melkam and well-known local variety. Therefore, this study was proposed with an objective of demonstrating and promoting improved variety of Sorghum, evaluating the performance of improved Sorghum variety along with management practices under farmers' perception and to enhance awareness of farmers about the variety in the study area.

2. Materials and Methods

2.1. Descriptions of Study Districts

The study was carried out in Abuna Ginde beret District of West Shewa Zone in 2018 – 2020 cropping seasons. The district is potential for Sorghum production. The altitude of the district is ranging from 1900 and 1910 masl. Generally, the district has a total area of 178,102 hectares and is classified into two agro-ecologies, the midland and the lowland with a share of 25% and 75% respectively [1]. The average temperature of the district is 35°C and the average rainfall is 900 mm/year. The main rainy season of the district is in April, May, June, July, August and September. The soil type of the district is silt and sandy soil. Major crops produced in the district include Teff, Maize, Sorghum, Teff and Groundnut [7].

2.2. Site and Farmers Selection

The district was purposively selected and Five peasant associations (Pas) from the district and 24 target farmers and at 5 FTC were purposively selected based on their production potentiality of the crop. The district agricultural office experts and Development Agents had also taken part in the implementation process from theoretical training to the actual implementation of the planned activity. Farmer's research and extension group (FREG) approach was followed to select farmers and group under trial farmers.

An interdisciplinary team composed of researchers from Ambo Agricultural Research Center (Plant protection, Extensionist, Breeder, and Agronomist), district agricultural experts, and development agents was established to implement the activity successfully. The trial farmers were selected based on their willingness to contribute a land size of 0.25 ha per variety at each PAs. Packaged production technologies (seed rate, seed treatment, spacing, fertilizer

management and weed management) recommended for Sorghum production were used. Plots were kept free of weeds [11].

Table 1. Demonstration participant farmers and plot size.

Peasant Association (PAs)	Plot size (ha)	Participant farmers	
		Male	Female
Debeka	0.75	2	1
Chafe hareri	1	4	
Dogoma	1.25	4	1
Yagot	1	4	
Gitire	0.75	3	-
Mogora	1.25	4	1
Total	6ha and in 5 FTC	21	3

Source: Own data 2020

2.3. Planting Materials and Design Used

An improved Sorghum variety (Melkam) with one local variety was planted on selected farmers' land with plot of each 0.25 ha in the main cropping season. The planting materials (Seed) were acquired in advance from Melkasa Agricultural Research Center and local variety from selected farmers in the study area. The varieties were treated with full recommended Sorghum production and management packages. All agronomic practices like land preparation-ploughing three to four times using oxen plough, planting, weeding, leveling, harvesting, threshing) were carried out by FRGs member farmers.

2.4. Technology Demonstration and Evaluation

For the sake of enhancing efficiency and effectiveness, participatory approach was followed. To this end, FRG members and other follower farmers were encouraged to participate on different extension events organized at each trial site. These were mechanisms used to enhance farmer-to-farmer learning and information exchange such as trainings, field day, joint monitoring and evaluation like regular field visit by extension agents and extension counterparts, at different crop stages etc.

2.5. Data Collection and Analysis Method

Both qualitative and quantitative data were collected. Grain yield, costs and income gained were collected using data collection sheets. Total number of farmers participated on training, field visits and mini field day were recorded by gender composition. Farmers feedbacks were collected using checklist by conducting group discussions and key informant interviews.

2.6. Yield Advantage

The yield advantage of improved maize technology over commercial is calculated in the following formula.

$$\text{Yield advantage \% of Melkam} = \frac{\text{Yield of new variety} - \text{Local} \times 100}{\text{Local}}$$

2.7. Variety Preference Ranking

The variety preference ranking was conducted using group discussions. The farmers were let to observe and set selection criteria at the maturity stage of the crop. The selected criteria were then used to select the preferred variety.

2.8. Data Analysis

Descriptive statistics were used to analyze the yield data. Pair wise ranking was used for traits of demonstrated varieties and simple ranking method was used to compare varieties.

3. Result and Discussion

3.1. Yield Performance of Demonstrated Varieties

In the study District all farmers use local varieties which is less in productivity than improved varieties. Melkam variety with local check was demonstrated at five PAs checked for two consecutive years. Single plot design 0.25ha was used with recommended Seed and fertilizers respectively. The result of Sorghum variety demonstration revealed that, the newly released Melkam variety performed better than the standard check local variety at all demonstration sites.



Figure 1. Yield Performance of Demonstrated Varieties.

3.2. Farmers' Preference Analysis

Farmers' participation in the variety selection process has a paramount role to identify farmers' preferred traits in promoting improved Sorghum varieties. As shown in Table 3, discussion was held with farmers to help them in identifying selection criterion like spike length, number of tillers, earliness, frost resistance, striga resistance and productivity are the identified selection criteria for best sorghum varieties. Farmers' preferences toward the demonstrated varieties were assessed by enhancing them to reflect their preference to varietal attributes by setting their own varietal selection criteria. During the demonstration of Sorghum, farmers provide constructive feedback for further research on improved varieties of Sorghum production and they are preferred improved Sorghum variety as their first choice than local based on different criterion.

In general, in all over selected PAs, Melkam variety gave higher yield (71.4 %) than local variety which gave an average 16.34 qt/he in the district (Table 2). However, the mean yield of pre-extension demonstration of improved Melkam variety were found to be less than the national average yield of Sorghum, more ever comparatively, the average productivity of sorghum in Ethiopia is 2.1 tons/hectare, which is far below the global average of 3.2 tons/hectare due to the problems of drought, striga, insect pests, diseases, soil fertility decline, inadequate adoption of existing improved varieties, lack of high yielding etc.

This yield difference could be associated with rainfall shortage occurred at the critical stage of the crop during production year, disparities in management practices and the fertility status of the soil. Yet the demonstrated improved variety of sorghum still had an extra 71.4 % yield advantage than the local check as indicated in Table 2.

Table 2. Yield advantage of improved Sorghum Variety over local check.

Varieties	Yield (qt/he)	Yield advantage of improved variety over the local (%)
Melkam	28	71.4
Local	16.34	

Source: Own data 2020

Table 3. Rank of the varieties-based selection criteria.

Variety	Criteria for preference	Rank
Melkam	Resistant to striga, high yielder, disease tolerant, early mature, high weight, marketable, drought tolerant	1
Local	Susceptible to disease, good yield, relatively less weight, high lodging, and low market price	2

Source: Own Data, 2020

3.3. Capacity Building for Participants

Capacity building for stakeholder was given for selected farmers, Development agents and Agricultural experts on the technologies and agronomic practices of improved varieties. Follow up; technical support and super vision were done.

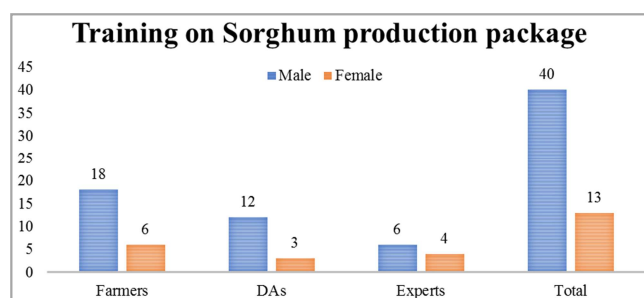


Figure 2. Training given on sorghum production package.

Evaluation of the varieties periodically the performance of improved newly released variety by method of Participatory technology evaluation.

3.4. Field Day

Farmers' field day was done across the PAs to evaluate best performing varieties, to enhance farmers' knowledge on Sorghum production and management and to collect feedback from all relevant stakeholders to suggest the way forward.

Table 4. Participants on Field Day.

Participants	Male	Female
Farmers	174	22
Agricultural Experts	12	4
Development Agents	18	9
Researchers	8	2
Technical staff	11	4
Total	223	41

Source: Own Data, 2020

3.5. Feedbacks Received from Farmers and Agricultural Experts

3.5.1. Feedbacks from Farmers

During the field day, farmers said, "The performance of the crop was interesting so that we will continue to plant this variety if we have market demand or linkage". Lack of improved variety was our major problems to popularize the technologies. They said that, before this year they did not get enough yields as they expected the reason was low production and productivity due to less availability of improved sorghum variety, striga weed problem and soil acidity were major problems. After they saw the yield of improved Sorghum variety, they are promised to further scaling up due to its high yield.

3.5.2. Feedbacks from Experts

Experts said that, the improved variety is a high yielding variety and also the improved practice helped farmers to increase production and productivity among them. Those agricultural experts are responsible to expand the technology to other potential PAs. Planting improved variety increases the adoption status of smallholder farmers and can improve the problem regards with shortage of improved seed in the study area.

4. Conclusion and Recommendation

This activity was implemented at Abuna Ginde beret District. Before starting the activities, participatory training was given by multidisciplinary team of Ambo Agricultural Research Center researchers (Breeder, Agronomist, Pathologist and Agricultural Extension Researcher) to farmers, experts and DAs in the study area. Field day and field visit was arranged by inviting different stakeholders at maturity stage of the crop.

From Sorghum technologies, the variety called Melkam was demonstrated at study district and acceptable in terms of different criteria during field day and evaluated by participant farmers, DAs and Experts. Generally, through this participatory evaluation and demonstration process, farmers became aware of the importance and quality of technologies as compared to the local one. The demand for the variety was also created. Demonstration result showed that the Melkam variety was recorded high yielder than local at all location. It was also preferred by participant farmers for its better agronomic performance. Based on these facts, Melkam variety was recommended for further scale up and scale out for other similar areas.

Conflicts of Interest

The authors have not declared any conflict of interest.

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