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Research Article

Early maturing sorghum technology promotion in selected Agricultural Growth Program-II districts of Harari region and Dire Dawa City Adminstration rural areas

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Abstract

Pre-extension demonstration and evaluation of early maturing sorghum varieties with the objectives of promoting and popularize improved lowland sorghum technologies and to create awareness, improving farmers knowledge and skills through giving training and to improve farmers' livelihood and enhance stakeholders participation. A total of fifteen (15) trial farmers were selected from two potential sorghum growing kebeles of Dire Dawa administration council and one from Harari region. Three FREG having 45 farmers were established each kebele. Three improved sorghum varieties (Tashale, Misikir and Mako) were replicated on the plot of 40mx40m. Training on which a total of 36 participants and field day on which 101 participants took part were organized at Dire Dawa and Harari region. Lowland Sorghum varieties were evaluated based on their early maturity, yield, Disease tolerance, seed color, seed size, biomass, and stock, and food test. Agronomic data and yield data were collected and analyzed using descriptive statistics, based on the yield data 21.4qt ha ,23.3 qt ha and 23.4 qt ha were obtained from Misikir, Tashale and Mako respectively. Mako has 9.3% yield advantage over Misikir and Tashale has 8.9% yield advantage over Misikir. Thus Mako ranked first by yield, Tashale second and Misikir third, However Misikir andMako recommended to scale up because of feed stalk farmers prefer them than Tashale (low stock).

Introduction

Sorghum is one of the most important cereal crops grown in arid and semi-arid areas of the world, receiving 400 to 800 mm of rainfall annually. Such areas are characterized by moisture deficit stress that affects the cultivation of the crop [1,2]. It is an indigenous crop to Ethiopia. The origins of its domestication is Ethiopia and the surrounding countries, beginning around 4000-3000 B. C. Numerous varieties of sorghum were created through the practice of disruptive selection, where selection for more than one level of a particular character within a population occurs [3]. In Ethiopia, sorghum is a staple food crop widely cultivated in different agro-ecological zones, predominantly in dry areas where other crops can survive least and food insecurity is widespread. These areas cover nearly 66% of the country [4,5]. In 2011/12, Ethiopian main rainy season (*Meher*), 39512942.36 quintals of sorghum grain is produced on 1923717.49 ha of land [6]. This shows that the productivity of the crop is still low, estimated to be 2054 kg ha -1 [7], which is considerably lower than experimental yield that reaches up to 3500 kg ha-1 on farmers' fields in major sorghum growing regions of the country [4].

Moreover, sorghum (sorghum bicolor) is the fifth most important cereal globally and feeds around 500 million people. It is especially important for rural people in arid regions. It provides food for household consumption and produces larger

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amounts of fodder to support their livestock than other grains [8]. So the contribution of improved varieties of sorghum is almost negligible mainly due to poor participation of farmers in the selection process, poor intervention of improved agricultural technologies (absence of improved varieties), birds damage to early maturing varieties, diseases (grain mold, head smut, anthracnose) and insect pests (shoot fly and stalk borer) [9].

To solve the problems, Fedis Agricultural Research center (FARC) has conducted adaptation trials and evaluated and promoted a number of early maturing and striga resistance variety in in some districts of East Hararghe Zone. Yet local sorghum variety which is easily affected by drought and striga infestation is under production in Harari and Dire Dawa administration. Local variety needs higher amount of rain fall and it takes 7-8 months to mature. This result in low production in drought areas like Harari and Dire Dawa. Improved early maturing varieties give better yield with minimum possible moisture. These nature of improved early maturing sorghum varieties escapes under the impact of natural factor. Therefore, to address the problems demonstration and evaluation of these improved sorghum varieties under the farmers' condition through different mechanism is important. Thus, this activity aimed on disseminating those technologies at farmers' field there by demonstrating those selected technologies to the end users. These in turn envisioned increasing household income and contributing more to food security so as to alleviate food shortage.

Specific objectives

To evaluate the productivity and profitability of technology under farmers condition.

To create awareness among farmers, developmental agents, subject matter specialists and other participant stakeholders on improved sorghum production technologies.

To build farmers' knowledge and skill of production and management of the enterprise

To strengthen linkage among stakeholders

Materials and methods

The activity was conducted in the selected Agricultural growth program-II districts of Harari Region and Dire Dawa administration. Harari regional state is located on distance of 526 km from capital city Finfinne in the eastern parts of the bordered by Oromia region and hosts one capital town of Oromia Regional state's zone that is East Hararghe. The climatic condition of the region includes highland, midland and lowland; the soil type exist in the region is different in different ecologies of the region that is clay, loam, sandy and black types. These selected districts are where the potentiality of the program will be succeeded in consideration of residents' problems, potential succession of the technologies these fit problems and solve; including the outcomes prevailed in AGP-I.

Dire Dawa Administration is located on distance of 515kms from capital city Finfine in direction of county's Eastern part; it is bordered by Somali, and Oromia regions in all directions. Dire Dawa Administration has both urban and rural set governance system. The climatic condition of Dire Dawa is almost dry land with the maximum and minimum temperature 38^{oc} and 25^{oc} respectively (EBC broadcasting on metrology allocated time). These selected districts are where the potentiality of the program will be succeeded in consideration of residents' problems, potential succession of the technologies these fit problems and solve; including the outcomes prevailed in AGP-I.

Site and farmers selection

Adada, Wahil and Dujuma kebeles from Dire Dawa and Kile from Harari Region were selected based on their sorghum production potential and accessibility to the road for regular field monitoring .Farmers were selected purposively based on their interest, innovation he/she has, land provision for this pre-extension demonstration, interest in cost-sharing, willingness to share experiences for other farmers, and studying their profile with the participation of Development Agents. The selected farmers were grouped in Farmers Research and Extension Group (FREG) with the member of 15 farmers per Kebele in consideration of gender issues (women, men and youth). In the establishment of FREG in the study areas total of 3 FREGs (One FREG/ kebele) from one PA 15 farmers and a total of 45 farmers were grouped in 3 FREG. In the FREG 5 farmers were trial farmers (3 male trial farmers and 2 female trial farmers) and 10 farmers worked with trial farmers.

Implementation design

Misikir, Tashale(standard check) and Meko varieties were used for demonstration in both districts. The input source was Fedis Agricultural research Center (FARC). The varieties were planted on the selected farmers' plot of 40mx40m in rain-fed season. The variety was planted with early maturing sorghum production recommendation or agronomic recommendation practices. Therefore, based on farmers' variety need, those selected varieties were procured to hosting farmers and planted by drilling at seed rate of 10kg/ha. Spacing used between row and plant is 75cm and 25cm respectively. Fertilizers were applied at the rate of 100kg/ha DAP and 50kg/ha Urea while weeding and other management practices were applied as per recommendation required.

Training, field visit and Filed-day organized

Multidisciplinary research team; crop, extension and socio-economic research team and other stakeholders (Offices of Agriculture and Natural Resource) were actively participated by sharing their experience and knowledge. Development agents, experts and farmers were participated on the training given on sorghum production and management, post-harvest handling and information marketing. Field day was organized for more awareness creation.

Data collection and analysis method

Both quantitative and qualitative data were collected. Collected quantitative data were subjected to analysis using SPSS software version 20 (frequency, mean, standard deviation and range) while qualitative data collected using group discussion and key informant interviews, field observation and focus group discussion were analyzed using narrative

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explanation and argument. Finally data from different sources were triangulated to get reliable information.

Result and discussion

Training of target group (Farmers, DAs and Experts)

The training was organized at both regions. It was given on the topics of agronomic practices (crop weed and disease management), stakeholders' linkage and extension approach and market and information linkage. At Harari region, 34 (28 male and 6 female) farmers, 2 male development agents and 2 experts were participated while at Diredawa, 27 (20 male and 7 female) farmers, 5 male development agents and 4 experts were participated.

Yield performance across districts

The yield performances for different varieties were different. The grain yield performance of the improved varieties (Misikir,Tashale and Meko) were ranges from18.1, 18.9, and 20.1quintals/ha at Adada,22.3, 22.1 and 24.9quintals/ha at Kile,20.9,25.9 and24.1quintals/ha at Dujuma and 24.4,26.3 and 23.9quintals/ha at Wahil.The average grain yield performance of Misikir and Tashale higher (24.4,26.3quintals/ha) at wahil but Mako variety was higher at 24.9 at kile in the production season. The yield performance of Tashale variety was higher than and Misikir and Makoat Dujuma and Wahil. However, the grain yield performance of Meko was highier at Adada(20.1quintals/ha) and Kile(24.9quintals/ha) .These varieties gave 37, 37 and 32 quintal per hectare on station at Fedis Agricultural research Center which is higher than at farmer's condition. The yield difference might be due to farmers land striga infestation, poor land and low crop managements. However, improved sorghum varieties were more advantages than the local one especially in case of severe drought in which farmers remains with some stalks Figure 1.

Field day organized and farmers' perception toward the varieties

40 farmers (32 male and 8 females), 5 DAs and 4 experts participated on mini field day organized at Kile kebele. During the field day participant farmers were let to selecte best performing varieties. Thus 7 farmers (2 female and 5 male) selected both Tashale and Mako. Twenty three farmers (6 female and 17 male) selected Tashale based on early maturing and yield .Both are similar according to farmers' preferences by stack and drought tolerance. More over at Dire Dawa Mini field day and training was organized at Adada on which 27 farmers (20 male and 7 female), 5DAs and 4 Subject matter specialists were participated and at Wahil (Dujuma) PAs. 40 farmers (32 male and 8females), 5 DAs, 4 experts and 3 journalists participated on mini field day organized at Dujuma PAs.

Farmers' in the study area selected the best performing improved lowland sorghum varieties by using their own criteria. Farmers set this criteria after having know-how about the variety and using those criteria they could select the varieties at harvest time. The opinion of those farmers on varietal preference was collected from participating farmers during variety demonstration. The major criteria used by farmers were maturity, yield, Disease tolerance, seed color, seed size, performance throughout growing stage, biomass, palatability of stalk feed, nutritional value and food test.Based on the above criteria; farmers evaluated the varieties and ranked first Misikir followed by Mako. Both varieties were well appreciated by farmers as compare to the Tashale in the areas. Overall the varieties are well accepted and suggested to widely promote and make farmers beneficials through the Office of Agriculture and Natural Resource of the Zone Tables 1&2.

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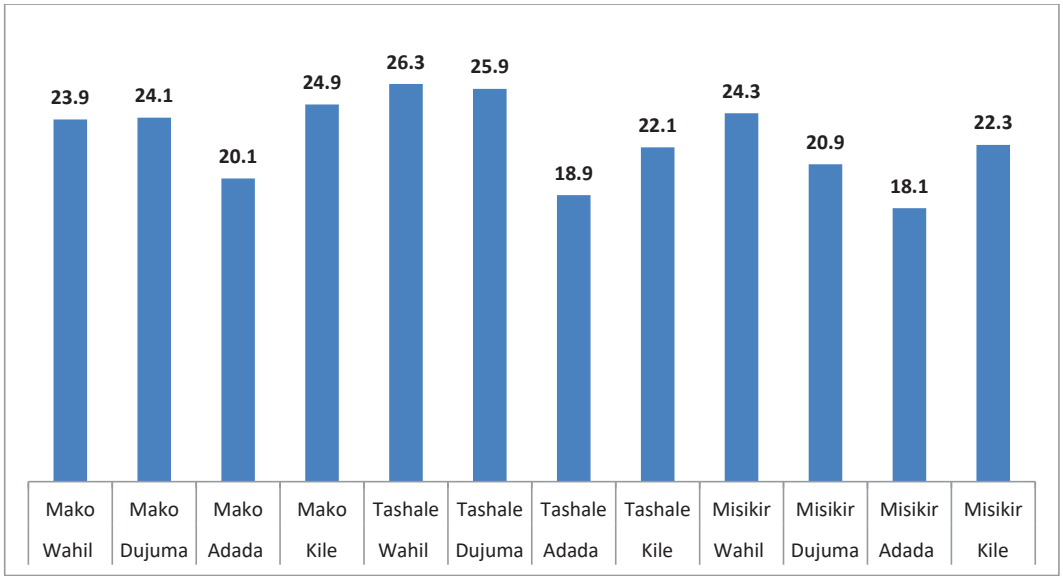

Figure 1: Yield performance of improved lowland sorghum varieties across districts on Farmers land.

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Conclusion and recommendation

In the study area, rainfall shortage is the most problems that influencing sorghum production. The participatory demonstration created an opportunity for the farmers to observe and judge the best practice with respect to the sorghum production. Suitable and widely accepted improved early maturing sorghum varieties for the study areas were identified and ranked based on farmers set criteria (Early maturity, yield, Disease tolerance, Food test, Palatability and biomass). Furthermore, linkage was strengthened and opportunities were created for experience and knowledge transfer among stakeholder .Awareness on advantage of early maturing sorghum varieties were increased through promotion in this demonstration. The results obtained from demonstration plot were also encouraging.The result indicated that yield performance for Tashale was better than Misikir and Mako but it has poor food test and low feed stalk palatability Therefore, using Misikir and Mako varieties are more advantageous for farmers than using Tashale (Standard check). As a result, both Misikir and Mako varieties are recommended for more promotion in the area and other similar agro-ecological situation to reduce the problem of food insecurity.

Table 1: Ranks of the varieties based on farmers selection criteria.

Crop varieties	Farmers rank	Reasons
Misikir	1st	Early mature, Good in yield, Disease tolerance, Good seed color, Good seed size, Very good performance throughout growing stage, Very good biomass yield, Very good palatability of stalk feed, Very good nutritional value and food test
Mako	2nd	Relative to early maturity, Good in yield, Relative to disease tolerance, Very good seed color, Very good seed size, Good performance throughout growing stage, Good biomass yield, Relative to good palatability of stalk feed, Relatively good nutritional value and food test
Teshale	3rd	Relative to early maturity, Very good in yield, Relative to disease tolerance, Poor seed color, Low seed size, Poor performance throughout growing stage, Good biomass yield, Poor in palatability of stalk feed, poor nutritional value and food test

Table 2: Pair-wise ranking matrix result to rank variety traits.

Code no.	Traits	Early maturity	Overall yield	Disease tolerance	Seed color	Seed size	Palatability of stalk for feed	performance	Biomass	Nutritional test
1	Early maturity		1	1	1	1	6	1	8	1
2	Overall yield			2	2	2	6	7	2	2
3	Disease tolerance				3	3	3	3	3	3
4	Seed color					5	6	4	8	9
5	Seed size						6	5	5	9
6	Palatability of stalk for feed							6	6	9
7	performance								8	9
8	Biomass									9
9	Nutritional test									

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