International Journal of Agricultural Extension and Rural Development Studies
Vol.8, No.4, pp.53-61, 2021
Print ISSN: ISSN 2058-9093,
Online ISSN: ISSN 2058-9107)

ON FARM DEMONSTRATION AND PARTICIPATORY EVALUATION OF IMPROVED SORGHUM {SORGHUM BICOLOR (L.) MOENCH} VARIETIES AT SEYO, ANFILO AND LALO ASABI DISTRICTS OF WESTERN OROMIA

Bilisuma Kabeto[1*], Hika Tasfa[1] and Demeksa Umer[1]
Oromia Agricultural Research Institute, Haro Sabu Agricultural Research Center, P.O. Box 10, Haro Sabu, Ethiopia

ABSTRACT: *Pre-extension demonstration of sorghum varieties was carried out in Lalo Asabi, Seyo and Anfilo districts of Kellam and West Wollega zones during 2018/19 cropping season with the objective of evaluating best performing and preferred sorghum varieties under farmer's management condition. Three varieties of sorghum (Chemada, Gemadi and Lalo) were evaluated with full participation of FRG member farmers under their management condition. Different Participatory technology evaluation were employed to enable farmers select variety/varieties which suit their condition. The result obtained indicate that the yield of Lalo variety was significantly higher (P<0.05) compared Chemada and Gemadi varieties with magnitude of 3.54ton ha^{-1} followed by Gemadi and Chemada with magnitude of 2.995 and 2.688ton ha^{-1} respectively. Additionally, lodging percentage of Lalo variety was significantly higher with magnitude of 5.74% followed by Gemadi and Chemada with magnitude of 2.29% and 2.06 respectively. At maturity stage the varieties were evaluated jointly by farmers, agricultural experts, development agents and researchers. Seed color, marketability, home consumption, yield, thresh ability, seed size, stock, lodging, disease resistance was selection criteria used by farmers. The direct matrix ranking of variety by farmers gave the superiority of Gemadi variety as their first choice due its seed color, thresh ability, marketability, seed size, home consumption followed by Chemada variety. Based on farmer's preference, Gemadi and Chemada varieties were selected to be popularized on large scale on farmer's fields.*

KEY WORDS: participatory evaluation, farmers' feedback, sorghum, chemada, gemadi.

INTRODUCTION

Background and Justification

Sorghum (Sorghum bicolor L. Moench) thrive best under wide range of agro ecology including adverse environments (Fetene et al., 2010). It is the favorite crop in drier and marginal areas due to its drought tolerance. Among cereals under production in Ethiopia it ranks 5th in total production. Sorghum is one of major crop in Ethiopia in general and Oromia in particular (CSA, 2014). Currently sorghum is produced by 5million holders and

https://doi.org/10.37745/ijaerds.15

its production is estimated to be 4 million metric tons from nearly 2 million hectares of land giving the national average grain yield of around 2 tons per hectares (CSA, 2014).

Sorghum is an important cereal crop in Oromia Region, ranking 5th in total production to cereals with magnitude of 18.8 metric ton and out of which 73.79% was used for house hold consumption. Similarly, among cereal crops grown in West and Kellam Wollega zones, sorghum is widely produced next to maize with area coverage of 63,051.63 hectares in West Wollega and 37,426.25 hectares in Kellam Wollega zone with average yield of 2.9 ton ha^{-1} and 3.150 ton ha^{-1} in West and Kellam Wollega zones respectively (CSA, 2015/16).

Though considerable achievements have been made in developing improved varieties which are early maturing and drought tolerant sorghum varieties, there are still huge gap of sorghum production and management. since the establishment of the sorghum program more than 50 sorghum varieties have been released (Solomon et al., 2021). And the low level of improved sorghum technology adoption is attributed to the low availability of farmer preferred varieties in sorghum variety generation and dissemination endeavors.

Similarly, though sorghum is the major cereal crop grown in West and Kellam Wollega zones with high yield relative to other parts of the country, most of the farmers in the area use the local planting material. One of the reasons behind low productivity was lack of improved varieties in this locality. Therefore, demonstrating of improved sorghum varieties to farmers of the area has paramount importance to boost sorghum production. To this end, this activity was initiated with the following objectives.

Objectives.

- ✓ To demonstrate and evaluate the production and productivity of improved sorghum varieties under farmers' management condition.
- ✓ To improve farmers' knowledge, attitude and skill of use of sorghum technology (the packages).
- ✓ To enable farmers to evaluate and select well performed sorghum variety/varieties for their localities.

MATERIALS AND METHODS

Description of the study area

Anfilo

Anfilo district is located in the south Western part of Kellam Wollega zone at a distance of 42 km away from zonal capital (i.e. D/Dollo). Astronomically the district is located between 8^{0}17'-8^{0}49'N and 34^{0}13'-34^{0}46' E. The district generally lies within an altitudinal

"ECRTD-UK https://www.eajournals.org/
https://doi.org/10.37745/ijaerds.15

range of 500-2500masl. The major rainy seasons in the district includes spring (March-May), summer (June-August) and autumn (September-November). Average annual rainfall of the district is about 1736 mm.

Seyo
Seyo district is located in the south western part of Kellam Wollega zone. Astronomically the district is located between $8^0$12'-$8^0$44' N and $34^0$41'-$35^0$00'E. The district has a total area of 127,800 km^2 and generally lies within an altitudinal range of 1300-2000masl. The major rainy seasons in the district include spring (April-may), summer (June-August) and autumn (September-November).

L/Asabi district
The district is located in West Wollega Zone of Oromia national regional state at the distance of 23km to West of Zonal capital Ghimbi. Astronomically the district lies between the coordinate of 9° 5′ 0″ N, 35° 50′ 0″ E. The topography of the district is characterized by ups and down trains with the altitude range of 1500-1900masl. The agroecology of the district falls with the range of midland agroecology with annual average rainfall of 1737.5mm $year^{-1}$.

Site and Farmers Selection
Three AGP-II Beneficiary districts from Kellam and West Wollega zone were selected based on their sorghum production potential. These districts were ***Anfilo and Seyo*** from Kellam Wollega and ***Lalo Asabi*** from West Wollega zone. From Lalo Asabi district, two representative model kebeles were selected, whereas from Seyo and Anfilo one representative kebeles were selected for this demonstration. The kebele's were also selected based on their sorghum production potential.

One FRG (Farmer Research Group) was established in each operational kebeles which consists of 15-20 representative members. The FREG formed was gender inclusive (the participation of male, female and the youth group as well). Before starting the field work, selection of experimental farmers was done in collaboration with researchers, extension agents and the FREG members by taking in to consideration the farmers' interests and motivation, land ownership, and other important socio-economic aspects.

Field design and treatments
The trial was carried out on selected farmer's fields in such a way that three improved varieties were planted side by side on equal sized plots of 10m x 10m with a gross area of 100m^2. Three varieties of sorghum namely *Chemada, Gemadi and Lalo* were used with recommended rate of fertilizer for demonstration with participation of farmers. Sowing was done with spacing of 75 cm between rows and by drilling replicated by the number of

https://doi.org/10.37745/ijaerds.15

participant farmers. The spacing between plants was adjusted to 15cm during thinning time.

Technology evaluation and demonstration methods

Before implementing demonstration trial on farmers' field, training was given to the farmers on approaches and principles of FRG, the role and responsibility of the FREG members in managing the trial, necessary packages for sorghum production and management practices, and monitoring required for the trial. Mini-Field Day was organized in one representative potential Kebele in each district. During the field day important experience sharing among farmers of different level was done and farmers evaluation of sorghum varieties at different growth stage was done to enable farmers to select the well performed and preferred sorghum varieties among demonstrated varieties.

Method of data collection and analysis

Data were collected through observation of the field, checklist and focused group discussion. The collected data were analyzed using SPSS version 22 and illustration graph were done using sigma plot version 10.

RESULT AND DISCUSSION

Yield performance of varieties

Yield data and lodging percentage were objectively collected and analyzed to evaluate the performance of the varieties.

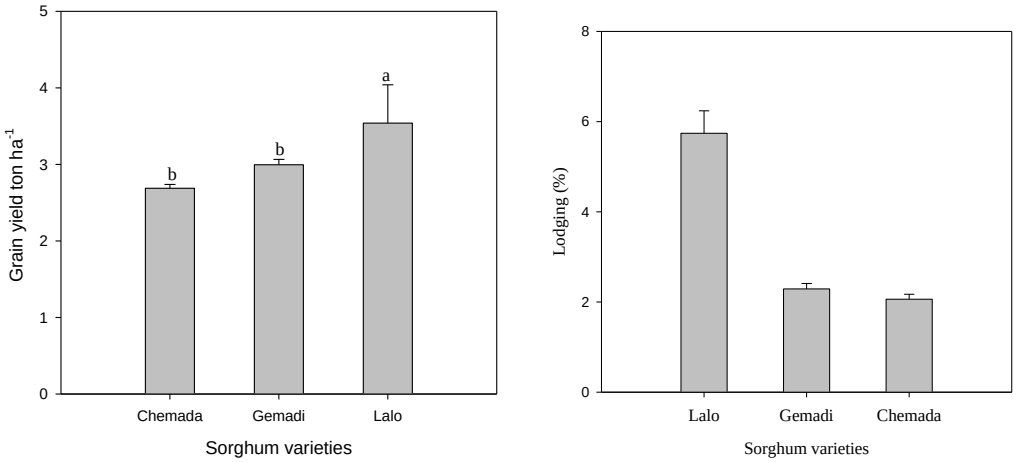

Figure 1 and 2 Grain yield (1) and lodging percentage (2) of demonstrated sorghum varieties. Each value was the mean of 12 replication. Different lower case indicates significant difference at (P<0.05).

"ECRTD-UK https://www.eajournals.org/
https://doi.org/10.37745/ijaerds.15

The figurative result of combined analysis of variance summarized in the above figure revealed the mean yield grain of Lalo variety was significantly highest among demonstrated sorghum varieties with magnitude of 3.54ton ha^{-1} while Gemadi and Chemada gave 2.995, 2.688-ton ha^{-1} respectively. The finding of this study was concordance (Mengistu et al., 2013;) which reported the yield of Chemada and Gemadi 2.5 and 2.8ton ha^{-1} respectively on farmers field. However, the potential yield of Chemada and Gemadi varieties on research station were 3.2ton ha^{-1} and 3.3ton ha^{-1} (Mengistu et al., 2013). The analysis again revealed that Lalo variety has highest lodging percentage with 5.74% fallowed by Gemadi and Chemada with magnitude of 2.29% and 2.06 percentage.

Participatory evaluation and Farmer's preference

One of the most important parts of this demonstration was evaluation, selection and preference of farmers toward these varieties. Farmers were strongly inclined to improved agricultural technologies. This in turn helps the breeders to develop the desired quality/traits of particular crop. Again, this hasten the rate of adoption of technologies as well reduce time and energy of technology generation (Asresie et al., 2015). Accordingly, different stakeholders participated on evaluation of these varieties at different time and selected the best trait of varieties according to their importance to them and ordered the varieties according to their preference.

Table 1. Pair wise ranking of sorghum traits by farmers

Code	Variety Trait	Consumption	Marketability	G/Yield	D/Resistance	S/Color	Lodging	Stalk	Thresh ability	Seed size	Frequency	Rank
0	Consumption	X									6	3rd
2	Marketability	0	X								5	4th
3	G/Yield	0	2	x							4	5th
4	D/Resistance	4	4	4	x						8	1st
5	S/Color	5	5	5	4	x					7	2nd
6	Lodging resistance	0	2	3	4	5	x				1	8th
7	Stalk	0	2	3	4	5	6	x			0	
8	Thresh ability	0	2	3	4	5	8	8	x		3	6th
9	Seed size	0	2	3	4	5	9	9	8	x	2	7th

According to the pair wise ranking of farmers the most important trait farmers preferred were tolerance to disease followed by seed color, consumption, marketability, yield, thresh ability, seed size, and lodging resistance respectively in order of their importance to them.

Table 2. Direct matrix ranking of varieties

"ECRTD-UK https://www.eajournals.org/
https://doi.org/10.37745/ijaerds.15

Number	Variety	Rank	Traits
1	Gemadi	1	Seed color, thresh ability, marketability, seed size, home consumption and grain yield
2	Chemada	2	Seed color, home consumption, seed size, low thresh ability, marketability, stock
3	Lalo	3	Grain yield, stalk, thresh ability, taste (not good for consumption), high lodging, and low market price

The direct matrix ranking of variety by farmers gave the superiority of Gemadi as their first choice due its seed color, thresh ability, marketability, seed size, home consumption followed by Chemada variety. This was in accordance with the Mengistu et al., 2013 which found farmers preference to these varieties due to their creamy color and resistance to weevil attacks. Though the yield of Lalo variety was significantly higher compared to other varieties, farmers disliked the variety due its high lodging percentage, difficult of thresh ability and not juicy and creamy for house hold consumption.

Lesson learned

It is undeniable fact that farmers do have best indigenous knowledge of their environment and farming practice. Thus, demonstration of these sorghum varieties gave farmers, Researchers and agricultural experts considerable knowledge of sorghum production in different ways. Farmers aware the traits of Chemada and Gemadi varieties while researchers got farmers preference to different traits of sorghum technologies which will provide the base for future technology generation.

Training

Training, mini field and farmer's technology evaluation were among the tools used to capacitate stakeholders about sorghum production and management with especial attention to *Chemada and Gemadi* sorghum varieties. Multi-disciplinary team composed of researchers, experts, development agent were participated on the above listed events to share their experience and aware about Chemada and Gemadi sorghum production

Training was as a means to improve the knowledge and capacitate farmers on sorghum production and management. Accordingly, it was given in Seyo, L/Asabi and Anfilo districts were a total of 96 stakeholders participated on training out of whom 80 were male and 16 were female.

https://doi.org/10.37745/ijaerds.15

Table 1: Participant of training on production and management of demonstrated sorghum Varieties

District	Participant	Male	Female	Total
Anfilo	Farmer	15	2	17
	Expert	1	-	1
	DA'S	2	1	3
Seyo	Farmer	15	5	20
	Expert	2	-	2
	DA'S	1	2	3
L/Asabi	Farmer	36	4	40
	Expert	3	1	4
	DA'S	5	1	6

Mini field

Mini field was a tool used to evaluate and share knowledge among the different level farmers, development agents, Agricultural experts and researchers. Accordingly, a total of 64 stakeholders out of whom 54were male and 8 were female participated on varieties evaluation at green stage.

Table2: Mini field day participant

District	Participant	Male	Female	Total
Anfilo	Farmer	15	2	17
	Expert	1	-	1
	DA'S	1	1	1
L/Asabi	Farmer	30	4	34
	Expert	2	-	2
	DA'S	5	1	6

"ECRTD-UK https://www.eajournals.org/
https://doi.org/10.37745/ijaerds.15

CONCLUSION AND RECOMMENDATION

In this study it was understood that in-terms of grain yield and lodging percentage Lalo variety was highest among demonstrated sorghum varieties. However, the demonstrated varieties Chemada and Gemadi possess special trait which attracted farmers over the standard check (Lalo). These characteristics were disease resistance, seed color, consumption, marketability, thresh ability, seed size and comparable grain yield. Accordingly, Gemadi, Chemada and Lalo were selected first, second and third respectively. Therefore, based on farmers preference not on objectively measured trait varieties Gemadi and Chemada varieties were selected to be scaled up/out to address many more farmers and popularize these varieties in mid altitude of West and Kellam Wollega zones provided that farmers should have to produce these varieties on cluster-based production in order to escape the risk of bird attack.

Acknowledgment
This research was funded by Agricultural Growth Program II (AGP-II) and Oromia Agricultural Research Institute (IQQO). We are very grateful to the project and institute for financing this study for betterment of our farmer's livelihood.
Declaration of conflict of interest
The authors confidently declare that there is no any conflict of interest between authors.

Reference

Agency, C. S. (2013/14). Agricultural sample survey. Report on area and production of major crops. Volume I, VII and VIII. *Statistical Bulletin*, *I*, 578.

Asresie Hassen, Alemu Worku, Molla Tafere, Abel Ahmed, Seferew Dagnew, Yihenew G.Sellasie, D. M. and T. A. (2015). *Best Fit Practice Manual for*.

CSA. (2015/16). *The Federal Democratic Republic of Ethiopia Central Statistical Agency Agricultural Sample Survey. Report on Area and Production of Crops Statistical Bulletin No. 586. Addis Abeba, Ethiopia*.

Fetene, M., Okori, P., Gudu, S., Mneney, E. E., & Tesfaye, K. (2010). *Proposal iki call-Delivering new sorghum and finger millet innovations for food security and improving livelihoods in Eastern Africa*. *November 2010*, 1–52. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.831.8758&rep=rep1&type=pdf

Mengistu, G., Lule, D., Desalegn, K., Daba, C., Feyisa, H., & Gerema, G. (2013). *Registration of " Chemeda and Gemedi " Sorghum Varieties 4 . Yield Performance 5 . Stability of Performance / Adaptation Varietal Evaluation Origin / Pedigree and Agronomic Characteristics and Morphological 6 . Reaction to Major Diseases 7 . Quality Analy*. *7*(December 2018), 61–62.

Solomon, H., Miruts, F., Seyoum, A., & Endalamaw, C. (2021). Promotion of Improved Sorghum Technologies through Large-Scale Demonstration in Gololcha Woreda,

Arsi Zone of Oromia Regional State, Ethiopia. *American Journal of Plant Sciences*, *12*(03), 366–375. https://doi.org/10.4236/ajps.2021.123023