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Pre-Extension Demonstration of Common Bean (*Phaseolus vulgaris*) Technology in Sankura and Mareko Special District, Central Ethiopia

[1,2]*Abdirazak Abdala*

[1]*Central Ethiopia Agricultural Research Institute, Durame, P.O. Box 200, Ethiopia*

[2]*Worabe Agricultural Research Center, Worabe, P.O. Box 21, Ethiopia*

ABSTRACT

Background and Objective: In Sub-Saharan Africa, especially in Ethiopia, common beans (*Phaseolus vulgaris*) are essential for food security and nutrition. The study aimed to demonstrate improved common bean technology in a cluster scenario. **Materials and Methods:** This study was conducted in Sankura and Mareko Special District during the main season 2023/2024. Two kebeles from each district were selected to avoid gender bias in the farmer selection process; both male and female farmers were included. Accordingly, training was given to 21 and 18 participants in the Sankura and Mareko Special Districts, respectively. The SER-125 variety with a standard check was used. A plot size of 0.25 ha per variety per farmer was used. The recommended rate of seed (100 kg/ha), NPS (100 kg/ha), and UREA (50 kg/ha) was applied. The spacing between rows and plants was 40 and 10 cm applied, respectively. The number of field day participants was male 22 female 9 and a total of 31. **Results:** The study results suggested that in the Sankura District, the SER-125 grain yield was 2320 kg/ha, while the standard check yield was 1670 kg/ha. The grain yield of the SER-125 variety was 1650 kg/ha, and the standard check was 1430 kg/ha in the Merako Special District. Farmers ranked the varieties based on their preference criteria like earliness, seed color, pod per plant, seed per pod, marketability, disease tolerance, and grain yield. Farmers was ranked the SER-125 variety first over the standard check. **Conclusion:** Therefore, SER-125 variety is recommended with its full packages for scaling up and out in the study area and similar agro-ecology.

KEYWORDS

SER-125, stakeholders, standard check, *Phaseolus vulgaris*, cluster

INTRODUCTION

Common bean (*Phaseolus vulgaris*) is one of the most extensively produced bean species worldwide[1]. It is a key pulse crop known as the "Grain of Hope" and accounts for a significant portion of African subsistence agriculture[1]. According to Namugwanya *et al.*[2], common beans in Sub-Saharan Africa (SSA) are an essential food security and nutrition crop. It has a tremendous dietary influence, supplying proteins, essential nutrients, and vitamins to both rural and urban households. It is estimated that the crop meets more than half of the dietary protein requirements of households in Sub-Saharan Africa. Low-income persons have a greater annual per capita intake because they cannot afford to acquire healthful foods like

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meat and fish. A common bean is grown in Ethiopia's lowlands to mid-altitude sub-humid areas and grows best in warm climates at temperatures of 18 to 24°C[3]. This bean's cultivation practice is increasing in Ethiopia now a day[2]. In the country, this crop is widely produced next to the faba bean (*Vicia faba* L.), occupying 19.7% of the cultivated area of pulses, with 16.8% of the total annual pulses production. Common bean is becoming an essential legume of the Ethiopian diet and a means of foreign earnings[4]. It is the most vital grain legume for direct human consumption and has high diversity as seen in its morphological variability, uses, and growth habits and patterns[4].

Farmers in Ethiopia harvest common beans with low grain yields, despite the enormous potential of newly released better varieties. The enhanced variety' potential is around 4.0 ton/ha. Common bean farmers collect no more than 1.7 ton/ha[1,5]. According to studies, farmers who use better varieties and recommended agronomic procedures can increase their grain output of common beans. Miruts *et al.*[5] reported a 27% increase in common bean grain output when farmers used the recommended technology. The national lowland pulse research program, in collaboration with other universities, reached a significant milestone. For decades, the program has recorded exceptional grain yields and disease-resistant cultivars. To further understand this, an experiment on participatory evaluation of enhanced common bean types was done.

Common bean plays an important role at the household level as a source of cash, a nutrient-dense food crop ("poor man's meat") due to its high protein content, which compensates for potential deficiency in a low-income population, and a nitrogen fixer to replenish soil fertility[1]. It can grow in a variety of soil types, from light sands to heavy clays, but friable, deep, and well-drained soils are ideal. For a very long time, it has been grown as a field crop. The main issue in the cultivation of common beans is a lack of high-yielding and disease-resistant varieties[6]. Taking into account the above considerations, this study was proposed to demonstrate common bean technology in the Sankura and Mareko Special District.

MATERIALS AND METHODS

Description of the study area: This study was carried out at Sankura and Mareko Special Districts of the Central Ethiopia Regional State during the main season June, 2024. Sankura District is one of several districts in the Silte Zone. It is bounded on the West by the Hadiya Zone, on the North by Wulbareg, on the Northeast by Dalocha and Lanfuro, and on the Southeast by the Halaba Zone. The administrative hub of the Sankura District is Alem Gebeya. According to the Central Statistical Agency Census, this district has a total population of 84,736, with 42,480 men and 42,256 women; 3,656 people, or 4.32%, live in cities. Mareko Special District is one of the Districts in the Central Ethiopia Regional State. The administrative headquarters of this Special district is Koshe. Mareko Special District is 110 km South of Addis Ababa and 10 km South-East of Butajira. The district has a total population of 64,512, with 32,730 men and 31,782 women; 6,880 people, or 10.67% of the population, live in urban areas.

Site and farmers selection: This investigation was conducted in the Mareko Special District and the Sankura District. The districts were specifically picked for their ability to produce and yield common beans. Potential peasant associations were identified after talking with the district agriculture Office and the extension department. Two possible Kebeles from each Woreda were chosen. Worabe Simbita and Manizo Peasant Association (PA) from Sankura, and Didamidore and Didalibo Peasant Association (PA) from Mareko Special District, were chosen in that order. Peasant association (PA) extension agents contacted each peasant association, and five farmers and one FTC were chosen based on their willingness and availability of land. Gender balance in each district was closely observed. Farmer and site selection were collaborative among development agents, researchers, and professionals. In the end, 12 ha of both Sankura and Mareko Special Districts were covered. Farmers' research and extension groups (FREGs) in each peasant association (PA) with five members (three males and two females). The FGERs were made up of participating farmers from the relevant peasant association.

Stakeholder capacity building: Before beginning the research trial, awareness was raised through training and conversations, including farmers, development agents, researchers, and specialists. Both theoretical and practical training were provided to raise awareness and increase job performance after closing the knowledge, skill, and attitude gap (KSA). Participants in the course included district-level agriculture office professionals, farmers, and development agents. The instruction focused on the agronomic and management methods of common bean technology.

Agricultural practices: The improved SER-125 variety with standard check was planted in the study area. The row planting method was adopted, with 40×10 cm spacing between rows and plants. In the presence of appropriate soil moisture, the recommended 100 kg/ha seed rate is planted at a depth of 5 cm. The intervention was conducted using 50 kg/ha urea and 100 kg/ha of nitrogen, phosphate, and sulphur (NPS). NPS was applied once at planting time, but urea/nitrogen was applied in three parts: One-third at planting and two-thirds during the crop's tillering stage, implying that urea was applied 15-21 days after sowing and again 35-45 days later. The trials were weeded twice: Once one month after seeding and again two months later for enhanced common bean types. Farm activities like soil preparation, such as ploughing four to five times with a tractor and oxen plough, land levelling, planting, first, and second weeding, harvesting, and threshing were done.

Responsibility sharing and follow-up: Worabe Agriculture Research Center shares the responsibility by supplying logistics and inputs delivery; extension researchers were involved in the proposal's development and implementation, providing training and raising farmer awareness. Finally, district experts and development agents contributed by selecting possible peasant association (PA) and model farmers. Following the sowing, detailed follow-up with the appropriate stakeholders began. Farmers were responsible for land preparation, planting, agronomic management, and harvesting, while the farmers' research extension group members, in collaboration with development agents from the individual peasant association (PA), provided farmers with periodic follow-up and support from land preparation to final harvesting. Furthermore, the farmer's research extension group members were accountable for actively participating and conducting business together with the team.

Monitoring and evaluation: Researchers, farmers, development agents, and district professionals monitored and evaluated the activity during the three important periods. Monitoring and evaluation of varieties occur throughout the flowering, germination, and harvesting periods of time. However, Fig. 1 was taken while a researcher was evaluating activity at the maturity stage.

Fig. 1: Researcher evaluating activity at plant maturity state
Source: 2024

Field days play an important part in the display of new technologies because they allow farmers to learn by observing and sharing their experiences in the field. Thus, in order to extensively demonstrate common bean developments, a mini field day was organized by inviting relevant stakeholders (farmers, development agents, researchers, and specialists).

Methods of data collection: Data such as grain yield were collected from the total area. The total number of farmers who participated in extension/promotional events such as training, field visits, and field mini-field days was recorded based on gender. Feedback assessment on farmers' preference for the technology (likes and dislikes) and farmers' choice for the technology's performance was also identified by ranking the average.

Data analysis methods: The collected data were analyzed using SPSS V.26. Descriptive statistics like minimum, maximum, mean, and standard deviation were used. A Likert scale, which assumes farmers' preference ordinal measure scale from poor to excellent, was used to analyze farmers' preference. Each Likert scale response contains a number used to measure farmers' preferences. Each of the 5 responses would have a numerical value used to measure the preferences under investigation.

Different stakeholders were developed awareness about common bean agronomic practices, weed management, disease, income, nutritional relevance, and post-harvest management. So, there were a total of 21 participants: 12 farmers, 4 researchers, 3 development agents, and 2 experts with a total of 18 participants in the Sankura District. The training was attended by twelve farmers, two researchers, two district administrators, and two experts from the Mareko Special District, as shown in Table 1.

Field day organized: Field days play an important role in transferring technology and popularizing it among farmers on a larger scale. At the crop's maturity stage, a field day was held with the participation of many stakeholders like district-level experts, farmers, development agents, and researchers. As a result, 22 farmers (male 15 and female 7), 4 researchers (male 4 and no female), 2 experts (male 2 and no female), and 3 Development agents (male 1 and female 2) took part in the field day as shown in Table 2.

During the field day, farmers reflect and share their thoughts about the technology. Lack of sufficient market demand was one of the primary challenges, and we attempted to address it through cooperatives, but they were ineffective. Furthermore, farmers stated that "the improved variety was highly productive and pest-tolerant in the study area". As a result, the common bean technology used in the study region produces a high yield. Experts and administrative bodies provide feedback. According to experts, the upgraded variety is a high-yielder compared to the standard check, and the improved practice has also helped farmers increase the production and productivity of common beans in their area.

Table 1: Number of participants during training at Sankura and Mareko Special District

		Gender		
Number	Participants	Male	Female	Total
A	Sankura District			
1	Farmers'	8	4	12
2	Experts	2	-	2
3	Development agent	1	2	3
4	Researchers	4	-	4
Total		15	6	21
B	Merako District			
1	Farmers'	8	4	12
2	Experts	2		2
3	Development agent	2	-	2
4	Researchers	2	-	2
Total		14	4	18
Grand total		29	10	39

Source: 2024

Table 2: Field day participants at Sankura District

Number	Participants from	Participants by gender		Total
		Male	Female	
A	Sankura District			
1	Researcher	4	-	4
2	Experts from Woredas	2	-	2
3	DA	1	2	3
4	Farmers	15	7	22
Total		22	9	31

Source: 2024

RESULTS AND DISCUSSION

This section reviewed the results of grain yield, yield advantage, and farmers' preferences and feedback on common bean technology. The yield estimation was determined using the grain yield from the total plot per variety. This plot-based grain yield of the technique was altered to a quintal per hectare basis. According to the descriptive statistics shown in Table 3, the average grain output of the SER-125 variety was 2350 kg/ha. In contrast, the average grain yield of the standard check was 1670 at the farmers' farm in Sankura District. Similarly, the grain yield at the farmer's training center SER-125 Variety was 2200 kg/ha, and the standard check was 18500 kg/ha in Sankura District, as shown in Table 3. The mean grain yield of the SER-125 variety was 1685 kg/ha, and the mean grain yield of the standard check was 1420 at the farmers' farm in Mareko Special District. Furthermore, the grain yield at the farmer's training center increased by 1550 kg/ha for the SER-125 variety and 1100 kg/ha for the standard check, as shown in Table 3. These findings are consistent with the findings of on the state of Common Bean (*Phaseolus vulgaris* L.) diseases, grain yield, and farmers' preferences in the study area[6-10]. Similar findings were also reported by Gemechu and Sime[11]. The disparities in yield at the farmers' farms were caused by variances in management and the farmers' experiences. The above result implies that the variety SER-125 was well performed better than the standard check in the study area. This is due to the application of the recommended rate of full packages (seed, NPS, and urea) and agronomic practices. Therefore, the improved variety SER-125 is recommended in the study area and in a similar agro-ecology as well. The limitation of this research was, it did not reach more farmers and had limited area coverage due to resource limitations.

Yield increase, advantage, and yield gap: The yield advantage was calculated using the formula suggested by Rajashekhar *et al.*[7]:

$$\text{Yield advantage (\%)} = \frac{\text{Yield of improved variety (kg / ha) - Yield of standard check (kg / ha)}}{\text{Yield of standard check (kg / ha)}} \times 100$$

The SER-125 showed a 750 kg/ha yield increase and a 40.77% yield advantage over the standard check at Sankura District and 265 kg/ha yield increase and a 15.7% yield advantage at Mareko Special Woreda (Table 4). The yield gap of the demonstration is 20.02-15.45 = 4.57 quintal-1quintal-1. This might be due to low adoption of high-yielding varieties and improved production technologies. The higher yield gap (4.57 quintal/ha) indicates a strong need to mobilize the farmers for adoption of improved technologies over their local practices, as shown in Table 4.

Farmers' preference ranking: Farmers were asked to respond from 1-5 on each crop attribute, with indicating, 1 = Very poor, 2 = Poor, 3 = Good, 4 = Very good, and 5 = Excellent; for the shown technology based on the seven criteria listed below. After scoring, each value of the score was summed and divided by the number of parameters supplied by the farmers to get the mean score and the results at the two locations. The average score at the two farmer's field locations indicates that farmers favoured improved common bean technology that was close to perfect (Table 5).

Table 3: Grain yield of common bean technology (kg/ha) in Sankura and Mareko Special district

	Yield of common bean in Sankura District (N = 10)		Yield of common bean in Mareko Special District (N = 10)	
	Variety		Variety	
Participants	SER-125	Standard check	SER-125	Standard check
F1	2550	1950	1850	1550
F2	1900	1500	1800	1500
F3	2500	1600	1500	1500
F4	2400	1500	1600	1250
F5	2200	1700	1700	1350
F6	1950	1850	1750	1425
F7	2500	1750	1550	1525
F8	2100	1800	1600	1400
F9	2500	1500	1800	1500
F10	2600	1550	1700	1200
FTC	2200	1850	1550	1100
Maximum	2600	1950	1850	1550
Minimum	1900	1500	1500	1200
Mean	2320	1670	1685	1420
SD	2.6	1.8	1.1	1.2

Source: 2024. F1: Farmer 1, F2: Farmer 2, F3: Farmer 3, F4: Farmer 4, F5: Farmer 5, F6: Farmer 6, F7: Farmer 7, F8: Farmer 8, F9: Farmer 9 and F10: Farmer 10

Table 4: Yield advantage and yield increases

	Yield (kg/ha)		Yield increase (kg)	Yield advantage (%)
District	SER-125	Standard check	SER-125	SER-125
Sankura	2320	1670	750	40.77
Mareko special	1685	1420	265	15.70
Mean	2002	1545	508	28.24

Sources, 2024

Table 5: Farmer preference ranking of common bean varieties in Sankura and Merako Special District

Variety	EM	PP	SP	SC	M	DT	GY	T	AV	R
Farmers preference ranking in Sankura District (Worabe Simbita PA)										
SER125	4	4	4	4	5	5	5	31	4.4	1st
Local	3	3	3	3	3	3	3	21	3.0	2nd
Farmers preference ranking in Manizo PA										
SER125	4	4	5	4	4	5	4	30	4.2	1st
Local	4	3	3	3	3	3	3	22	3.1	2nd
Farmers preference ranking of Merako Special District										
Farmers preference ranking Didamidore PA										
SER125	4	4	4	4	4	4	5	27	3.9	1st
Local	3	3	3	3	2	2	3	19	2.7	2nd
Farmers preference ranking in Didahalibo PA										
SER125	5	4	4	4	4	4	4	29	4.1	1st
Local	4	3	3	3	3	3	4	23	3.3	2nd

Source: 2024. SC: Seed color, EM: Early maturity, PP: Pod per plant, SP: Seed per pod, DR: Disease tolerance, M: Marketability, GY: Grain yield; Scores 1: Very poor, 2: Poor, 3: Good, 4: Very good and 5: Excellent

Lessons learned: Farmers and researchers learned through two different methods. Researchers transfer the scientific knowledge about the whole package of technology, while farmers share their indigenous wisdom with the researchers. Farmers learned about the amount of input utilized per hectare and the spacing between plants and rows. Furthermore, they learned about the general techniques of land preparation and harvesting, as well as the study area's planting and harvesting times. Following these processes, the lessons learned from the demonstration were successful, as evidenced by the high output. Farmers were requested to provide input on the shown technology. Farmers reported improved grain yields. The SER 125 has the potential to produce higher yields than previously employed.

In short, institutional linkage and intensive communication among all stakeholders are important for technology scaling up to promote easy access of farmers to improved seeds; the multi-stakeholder approach is effective for technology dissemination; mass media and primary cooperatives are important for technology promotion; and the role of seed producers and marketing cooperatives (SPMCS) is vital for technology diffusion and improving seed production and marketing.

CONCLUSION

In general, the intervention showed promising results in the Sankura and Mareko Special District. Due to training the farmers, development agents, and expert's awareness and demand about the technology were developed. Farmers have learned essential knowledge and skills via training and field days, allowing them to adopt and deploy this technology on their farms successfully. Furthermore, the program promoted knowledge sharing and collaboration among farmers, extension workers, and researchers. The demonstration increased the linkages between many players in the agriculture sector by providing a venue for the exchange of ideas, experiences, and best practices, fostering innovation and long-term growth. Based on the descriptive analysis results of the improved common bean variety, SER-125 gave a higher grain yield than the standard check in both districts. It also showed the high yield advantages over standard check-in in all the study locations. Therefore, the district-level Agricultural Office extension should scale up and out the improved SER-125 variety in the study area and related agro-ecosystems.

SIGNIFICANCE STATEMENT

The common bean is an important food crop in Ethiopia. The study aimed to demonstrate improved common bean innovation in a pre-extension demonstration scenario. Here, the most important point of the common bean variety 'SER-125' is the high performing variety in the study area. It also showed the high yield advantages over standard check in all the study locations. Therefore, the District level Agricultural Office extension should scale up and out the improved SER-125 variety in the study area and related agro-ecosystems.

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REFERENCES

1. Ejara, E., W. Mohammed, B. Amsalu, Z. Misgana, M. Gabisa and G. Tasama, 2017. Performance evaluation of grain yield and yield related traits in common bean genotypes at Yabello and Abaya, Southern Ethiopia. J. Aridland Agric., 3: 28-34.
2. Namugwanya, M., J.S. Tenywa, E. Otabbong, D.N. Mubiru and T.A. Masamba, 2014. Development of common bean (*Phaseolus vulgaris* L.) production under low soil phosphorus and drought in Sub-Saharan Africa: A review. J. Sustainable Dev., 7: 128-139.
3. Dembi, K., K. Basha and A. Girma, 2021. Pre-extension demonstration of improved haricot bean technologies at Midland Districts of Guji Zone, Southern Oromia, Ethiopia. Int. J. Food Sci. Agric., 5: 285-292.
4. Oshone, K., S. Gebeyehu and K. Tesfaye, 2014. Assessment of common bean (*Phaseolus vulgaris* L.) seed quality produced under different cropping systems by smallholder farmers in Eastern Ethiopia. Afr. J. Food Agric. Nutr. Dev., 14: 8566-8584.
5. Miruts, F., S. Hashim, T. Fekadu and B. Roba, 2024. On-farm potentials of common bean and its contribution for smallholder farmers' livelihood and income. Asian J. Res. Crop Sci., 9: 15-21.

6. Degu, T., W. Yaregal and T. Gudisa, 2020. Status of common bean (*Phaseolus vulgaris* L.) diseases in Metekel Zone, North West Ethiopia. J. Plant Pathol. Microbiol., Vol. 11. 10.35248/2157-7471.20.11.494.
7. Rajashekhar, M., T.P. Reddy, K.M. Chandrashekara, B. Rajashekar and M.J.M. Reddy *et al*., 2024. Evaluation of integrated pest management module for pink bollworm, *Pectinophora gossypiella* (Saunders) and its economic analysis under farmer's field conditions. Int. J. Pest Manage., 70: 1212-1220.
8. Gurmu, F., 2012. Assessment of farmers' criteria for common bean variety selection: The case of Umbullo Watershed in Sidama Zone of the Southern Region of Ethiopia. Ethiopian e-J. Res. Innovation Foresight, Vol. 4.
9. Delele, T.A., D.H. Gebre and Y.F. Simachew, 2021. Evaluation of newly released improved haricot bean (*Phaseolus vulgaris* L.) varieties under smallholder famers' condition in Metekel Zone, Northwestern Ethiopia. J. Nat. Sci. Res., 12: 17-23.
10. Abate, B., A. Chala and K. Dabi, 2018. Participatory variety selection of common bean (*Phaseolus vulgaris* L.) released varieties for productivity and resistance to major diseases in Halaba Special District, Southern Ethiopia. Ethiop. J. Appl. Sci. Technol., 9: 55-65.
11. Gemechu, F. and N. Sime, 2024. Participatory evaluation and demonstration of improved haricot bean varieties in Daro Lebu & Habro Districts of West Hararghe Zone, Oromia, Ethiopia. Reports, 4: 10-14.