

Participatory Demonstration and Evaluation of Common Bean Technologies in Lowlands of Borana, Oromia National Regional State, Ethiopia

Feyissa Desiso

Oromia Agricultural Research Institute, Yabello Pastoral and Dryland Agriculture Research Center, Yabello, Ethiopia

Email address:

feyissa2013@gmail.com

To cite this article:

Feyissa Desiso. Participatory Demonstration and Evaluation of Common Bean Technologies in Lowlands of Borana, Oromia National Regional State, Ethiopia. *Journal of Plant Sciences*. Vol. 11, No. 3, 2023, pp. 93-97. doi: 10.11648/j.jps.20231103.18

Received: April 6, 2023; **Accepted:** June 15, 2023; **Published:** June 27, 2023

Abstract: The study was conducted in Yabello district of Borana zone with the objectives of demonstrating and evaluating the productivity and profitability of haricot bean varieties, creating awareness, improving farmers' knowledge and skill and enhance linkage among the relevant stakeholders for the two consecutive years, 2020-2021. A total of fourteen (14) trial farmers were selected from two potential haricot bean growing peasant associations. Two Farmers Research Group (FRG) having 30 farmers were established at each peasant associations. Two improved haricot bean varieties, Gofta and SER-119 and one local variety were planted each on a plot size of 10m×10m. Trial farmers were used as replication. Training on which a total of 40 participants took part was organized at Yabello Pastoral and Dryland Agriculture Research Center. Haricot bean varieties were evaluated based on their yield, storability and disease tolerance. Agronomic and yield data were collected and analyzed using descriptive statistics. Based on the yield data, 20.2 qt/ha, 13.7qt/ha and 14.1 qt/ha were obtained from Gofta, SER-119 and local (Kulo) varieties, respectively. Gofta has 43.2% yield advantage over local check. Thus, Gofta ranked first at both sites and is therefore recommended for pre-scaling up in the study area in particular and other similar agro-ecologies in general.

Keywords: Common Beans, Gofta, SER-11, Demonstration

1. Introduction

Common bean (*Phaseolus vulgaris* L.) is one of the most important pulse crops grown in Ethiopia in terms of both area and quantity produced. The crop is cultivated in different parts, mainly Oromia, Amhara, and Southern Nations Nationalities and Peoples Region (SNNPR). Their share of the national common bean production is 51% for Oromia, 24% for Amhara, and 21% for SNNPR [4]. Almost all common beans are produced under rain-fed conditions by smallholder farmers on less than 0.5 hectares [9]. The crop is one of the most important cash crops and sources of protein and good in mitigating iron deficiency for farmers in many lowlands and mid-altitude zones. It is also widely intercropped with maize and sorghum to supplement farmers with additional income and to maintain soil fertility [10, 11, 14]. Common bean farmers preferred the crop because of its fast maturing characteristics that enable households to get the

cash income required to purchase food and other household needs when other crops have not yet matured [2].

The area under haricot bean production in Ethiopia in general and in Oromia in particular during the 2020 cropping season was 140,541.7 and 110,597.54 hectares and the production of the crop was 2,427,735.5 and 2,065,813.29 respectively. In the meantime, the average productivity of the crop was 17.5 and 18.78 qt/ha respectively [3]. Ethiopian agriculture accounts for 85% of employment [7]. On the other hand, the population of the country is increasing alarmingly than ever before. As a result, farm size would be rapidly decreasing, increasing the need for agricultural intensification [13]. Therefore, increasing the productivity of smallholders through newly improved technology has become a policy priority for development partners and the Ethiopian government.

In the Yabello district, Common bean is the second major staple food crop grown by agro-pastoralists next to teff. The

crop production system has been tempted by various factors like a weed, insects, diseases and lack of improved seed besides its infant experience and environmental stress [8, 16]. Based on these problems, the Pulse and oil research team of Yabello Pastoral and Dryland Agriculture Research Centre has undertaken adaptation trials on newly released varieties for the two consecutive years and recommended Gofa and SER-119 for moisture stress of Borana zone, and the study was limited to on-station only. Therefore, to fill this research gap agricultural extension research team has proposed to demonstrate and evaluate these varieties under farmers' conditions.

2. Research Methodology

2.1. Research Design

Two common beans varieties, Gofa and SER-119, and one local check (Kulo) were planted each on a plot size of 100m² (10m x 10m) on farmers' fields. A seed rate of 80kg/ha and 100kg NPS/ha were used with a line spacing of 40cm and 10cm between rows and plant respectively.

2.2. Technology Evaluation and Demonstration Methods

The evaluation and demonstration of the activity were conducted on farmers' fields to create awareness about the importance of improved haricot bean and its full package. The demonstration of the research was followed the result demonstration approach by involving FRG, development agents, and experts throughout the stage of the crop. Finally, the activity

was jointly monitored and evaluated by FRG, development agents, experts, and multidisciplinary research team.

2.3. Data Collection

Both quantitative and qualitative data were collected through appropriate data collection methods of an individual interview, focus group discussion by using checklists and datasheet. The types of quantitative data collected were yield performance, the total number of farmers who participated in FRG, training and field visits, and stakeholder's participation while qualitative data were varieties selection criteria, agro pastoralists' perception towards the newly introduced technologies, and awareness created during demonstration process.

2.4. Method of Data Analysis

Quantitative data were analysed by simple descriptive statistics (Mean, Frequency and Percentage) using SPSS version 20 while qualitative data were analysed using narrative explanation, description, Pair-wise ranking tools as suggested by De Boef and Thijssen [5]. Moreover, a simple knowledge test was used to compare participant agro-pastoralists knowledge levels before and after the demonstration period related to improved haricot bean varieties [12]. Yield advantages of the demonstrated varieties over the local check were calculated as suggested by Sumaiet *al.* [15]. technology gap and technology index were calculated using the following formula.

$$\text{Yield advantage\%} = \frac{\text{Yield of new variety (qt/ha)} - \text{Yield of commercial variety (qt/ha)}}{\text{Yield of commercial variety (t/ha)}} \times 100$$

3. Results and Discussions

The mean grain yield data for the two improved haricot bean and one local check varieties collected from both PAs (Peasant Associations) and trial farmers were analysed and summarized as shown in Figure 1 below. Accordingly, highest mean yield of 20.2 qt/ha, 13.7 qt/ha and 14.1qt/ha

was obtained from Gofa, SER-119 and local check (Kulo) varieties respectively. The average mean yield obtained from this research is less than the findings of Dembi et al. [6]. who found the average yield of improved common bean variety of Ibado to be 23 qt/ha and similar with the local check 12.4 qt/ha. The difference in the mean yield regarding the improved variety could be justified by the drought occurred during the research activity.

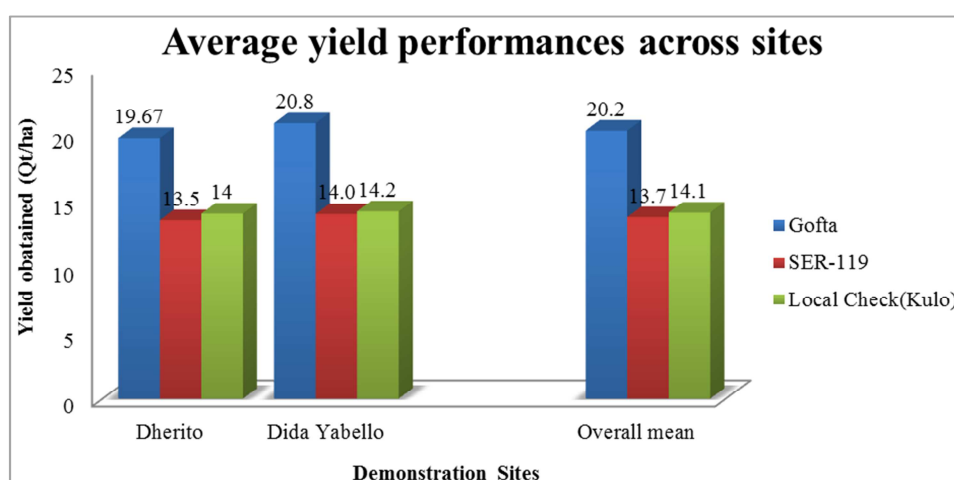


Figure 1. Yield performances of demonstrated varieties across Peasant Associations.

3.1. Comparison of Yield Advantage of Improved Varieties

$$\text{Yield advantage\%} = \frac{\text{Yield of new variety (qt/ha)} - \text{Yield of commercial variety (qt/ha)}}{\text{Yield of commercial variety (qt/ha)}} \times 100$$

Table 1. Comparison of yield advantage of improved varieties.

Demonstrated varieties	Yield obtained (Qt/ha)	Yield advantage over local variety
Gofta	20.2	43.2
SER-119	13.7	-0.03
Kulo	14.1	-

Among the demonstrated haricot bean varieties Gofta gave the highest yield (19.67 qt/ha and 20.8 qt/ha) at Dherito and DidaYabello respectively while SER-119 and Kulo (local check) gave the lowest yield in both locations. The Gofta variety had a 43.2% of yield advantage over local check under agro-pastoralist farm conditions.

3.2. Training Provided to Agro-Pastoralists, Development Agents (DAs) and Experts

Intensive knowledge and skill-based training was given to the target group from the start of the activity up to harvesting.

A total of 40 trainees of which 28 are agro-pastoralists, 4 are DAs, and 4 are experts were have participated in theoretical and practical training. Out of the trained participants 15 (37.5%) were females while the remaining 25 (62.5%) were males. The training has been given by a multidisciplinary team on haricot bean production, productivity, management, input utilization and application method, disease, insect and their controlling mechanisms as well as its information exchange. Fifteen extension manuals were prepared and delivered to the participants.

Table 2. Number and participants of target group given training on the importance of haricot bean varieties.

Peasant Association (PAs)	Participants	Sex		Total
		Male	Female	
DidaYabello	Agro pastoralists	8	4	12
	Subject Matter Specialists	2	2	4
	Development Agent (DA's)	2	2	4
Subtotal		12	8	20
Dherito	Agro pastoralists	9	3	12
	Subject Matter Specialists	2	2	4
	Development Agent (DA's)	2	2	4
Subtotal		13	7	20
Grand Total		25	15	40

Source: Own computation, 2020

3.3. Participatory Variety Evaluation and Selection

Farmers have an extensive and well-developed knowledge based on their environments, crops, and cropping patterns built up over many seasons and even generations. As a result, they have their criteria to select any new and improved technologies from their farming experience and repeated practices [1]. During participatory variety traits selection a total of 20 household heads 10 (ten) males and 4 (four) females from FRG and 4 (four) males and 2 (two) females from non-FRG members have participated to set their selection criteria for the demonstrated haricot bean varieties. The criteria set by agro-pastoralists were ranked using pair-wise ranking while scoring and ranking were done on consensus and resolved by the discussion as suggested by De Boef and Thijssen [5]. The evaluation was carried out during demonstration and after harvesting. Before leading the participant stakeholders (agro-pastoralists, development agents, and experts) a brief orientation was given to them on why participatory variety evaluation and selection is necessary for a research process.

Thus, the evaluators were organized into small and manageable groups selecting one group leader and one secretary and encouraged to set their criteria for selecting the demonstrated varieties in order of their preference, how to evaluate each variety by considering each criteria using a rating scale, organize collected data, how to conduct group discussion and reach on a common agreement and finally report through their respective leaders.

The major criteria and attributes set by agro-pastoralists to evaluate the demonstrated haricot bean varieties were yield, disease tolerance, maturity, marketability, cook-ability, seed color, and taste. According to the pair-wise ranking result, marketability is the first important trait that agro-pastoralists perceived for selecting the demonstrated varieties followed by yield and disease tolerance. Based on these criteria, Gofta variety was ranked first followed by a local check (Kulo) in both peasant associations (PA's) for its marketability, yield, early maturity, and seed color (golden) as shown in table 3. While SER-119 ranked 3rd and preferred for home consumption.

Table 3. Pair-wise ranking result to rank variety traits at Dherito and DidaYabello PA's, 2019/20.

Code no	Traits	Yield/ha	Disease tolerant	Maturity	Marketability	Cookability	Seed color	Taste
1	Yield/ha	1	1	4	1	1	1	1
2	Disease tolerant		3	4	2	2	2	2
3	Maturity			4	3	3	3	3
4	Marketability				4	4	4	4
5	Cookability					6	6	7
6	Seed color						6	6
7	Taste							6

Table 4. Summary of matrix ranking of agro pastoralists' selection criteria.

S. No	Traits	Frequency	Percentage (%)	Rank
1	Yield/ha	5	23.8	2 nd
2	Disease tolerant	4	19.0	3 rd
3	Maturity	3	14.3	4 th
4	Marketability	6	28.6	1 st
5	Cookability	0	0.0	7 th
6	Seed color	2	9.5	5 th
7	Taste	1	4.8	6 th
	Total	21	100.0	

Table 5. The rank of the varieties based on agro pastoralists' selection criteria.

No	Crop varieties	Rank	Reasons
1	Gofta	1 st	Demanded by the market, high yielder, Disease tolerant, early maturity, seed color, taste, and cook-ability
2	Kulo	2 nd	Demanded by the market, Disease tolerant, early maturity, seed color, taste and cook-ability
2	SER-119	3 rd	Not demanded by the market, Disease tolerant, early maturity, seed color, taste, and cook-ability

3.4. Agro Pastoralists' Knowledge Level Before and After the Trial Period

Knowledge level and skills of experimental agro pastoralists' on various aspects of improved Haricot bean production technologies before conducting the demonstration and after implementation was measured and compared. A simple yes or no question was designed and agro-pastoralists were asked to rate their level of knowledge before and after the demonstration period. Agro pastoralists were subjected to the same questions on both occasions. The questions were

asked during the training period before starting the experiment and after the experiment. According to the findings, before the experiment only 28.6%, 35.7%, 14.3%, and 21.4% of the agro-pastoralists had information about improved haricot bean; know about the importance, appropriate spacing between plants and row and weeding and pest management practices respectively. However, after the intervention, all participants agro-pastoralist have responded as they have understood the importance, recommended space between plants and rows, weeding and pest management practices (Table 6).

Table 6. Agro pastoralists' knowledge before and after the demonstration.

Statement	Before trial		After trial	
	Yes (%)	No (%)	Yes (%)	No (%)
Had information about an improved haricot bean	4 (28.6)	10 (71.4)	14 (100)	0 (0)
Know about importance of haricot bean varieties	5 (35.7)	9 (64.3)	14 (100)	0 (0)
Know spacing between plants and rows	2 (14.3)	12 (85.7)	14 (100)	0 (0)
Know weeding and pest management practices	3 (21.4)	11 (78.5)	14 (100)	0 (0)

Source: Own survey result, 2019-2020

4. Conclusions and Recommendations

Two varieties of haricot bean varieties Gofta and SER-119 and one local check (Kulo) were demonstrated and evaluated with the objective of evaluating the productivity and profitability and identifying the best performing haricot bean varieties with full package. It was carried out on two established FRGs during 2019 and 2020 cropping season in

Dherito and DidaYabello Peasant Association of Yabello district. In an effort of bridging knowledge and skill gaps of agro pastoralists was changed through intensive training especially on the importance of newly introduced haricot bean production and on using its full recommended packages. Knowledge and skill of development agents and agricultural experts was also enhanced through training and extension visits. Significant numbers of farmers were persuaded and information was disseminated to relevant stakeholders that

might pave the way for the demand driven technology and further popularization. Based on the yield data 20.2 qt/ha, 13.7qt/ha, and 14.1 qt/ha were obtained from Gofta, SER-119 and local (Kulo) varieties, respectively. Gofta had 43.2% yield advantage over local check. Thus, Gofta is recommended for pre-scaling up in the study area and with similar agro ecologies.

Acknowledgements

The author would like to thank the Oromia Agricultural Research Institute (OARI), Yabello Pastoral and Dryland Agriculture Research Center (YPDARC) for financing and providing working facility of the research study. Many thank also goes agro-pastoralists who are actively participated in research and provide their lands for free.

References

- [1] Bänziger M, Edmeades GO, Beck D, Bellon M (2000). Breeding for Drought and Nitrogen Stress Tolerance in Maize: From Theory to Practice. Mexico, DF: CIMMYT.
- [2] Berhanu Amsalu, Kassaye Negash, Tigist Shiferaw, Kidane Tumssa, Dagmawit Tsegaye, Rubyogo Jean Claude, and Clare Mugisha Mukankusi. 2018. Progress of Common Bean Breeding and Genetics Research in Ethiopia. Ethiop. J. Crop Sci. Special Issue Vol. 6 No. 3.
- [3] Central Statistical Agency (2020). Agricultural Sample Survey 2019/2020 (2012 E.C.), Report on Area and Production of Crops (Private Peasant Holdings, Meher Season), Statistical Bulletin 587, Addis Ababa.
- [4] CSA (Central Statistics Agency) (2018). Report on Area and Crop Production of Major Crops (Private Peasant Holdings, Maher Season). Statistical Bulletin 586. Issue I. Addis Ababa, Ethiopia, 19.
- [5] De Boef, W. S., & Thijssen, M. H. (2007). *Participatory tools working with crops, varieties and seeds. A guide for professionals applying participatory approaches in agrobiodiversity management, crop improvement and seed sector development*. Wageningen UR Centre for Development Innovation.
- [6] Dembi, K., Basha, K., & Girma, A. (2021). Pre-Extension Demonstration of Improved Haricot Bean Technologies at Midland Districts of Guji Zone, Southern Oromia, Ethiopia.
- [7] Dercon, S., Hoddinott, J., & Woldehanna, T. (2012). Growth and chronic poverty: Evidence from rural communities in Ethiopia. *Journal of Development Studies*, 48 (2), 238-253.
- [8] DirribaM, AdisuH, KibretK, TehaM (eds) (2018). Proceedings of Review work shop on Completed Activities of Agricultural Economics held at Adami Tulu of Agriculture Research Center, Adami Tulu, Ethiopia.
- [9] Ephrem Terefe. (2016). Review of Haricot bean Value Chain in Ethiopia Review of Haricot bean Value Chain in Ethiopia. Journal of Asian and African S, 24.
- [10] Gifole G, Sheleme B, and Walelign W (2011). The Response of *Phaseolus vulgaris* L. to Phosphorus Application on Ultisols at Areka. Southern. Journal of Biology, Agricultural and Healthcare. Vol. 1 Num 3: 38-50.
- [11] IBC (Institute of Biodiversity Conservation). 2012. Third country report on the state of plant genetic resources for food and agriculture, Ethiopia. October 2012, Addis Ababa, Ethiopia.
- [12] Lin, H., and Lee, G. (2004). Perceptions of senior managers towards knowledge-sharing behavior. *Management Decision*, 42 (1), 108-125. <http://doi.org/10.1108/00251740410510181>
- [13] Oshone, K., Gebeyehu, S., & Tesfaye, K. (2014). Assessment of common bean (*Phaseolus vulgaris* L.) Seed quality produced under different cropping systems by smallholder farmers in eastern Ethiopia. *African Journal of Food, Agriculture, Nutrition and Development*, 14 (1), 8566-8584.
- [14] Petry N, Boy E, Wirth JP, Hurrell, RF (2015). The Potential of the Common Bean (*Phaseolus vulgaris*) as a Vehicle for Iron Biofortification. *Journal of Nutrients*. Vol. 7: 1144-1173.
- [15] Samui SK, Maitra S, Roy DK, Mondal AK, Saha D (2000). Evaluation of front line demonstration of groundnut (*Arachis hypogaea* L.) in Sundarbans. *J Indian SocCoastalAgric Res*, Vol. 18 Number 2: 180-183.
- [16] Zerhun G, Tewodros T, Adane H (2017). Determinants of Varietal Replacement of Haricot Bean by Farmers in Boricha District, Southern Ethiopia. *Journal of Science & Development*.