Advances in Crop Science and Technology
ISSN: 2329-8863
Research Article Open Access

# Participatory Variety Selection of Bi-fortified Released Bean Varieties for Low land Areas of Halaba Zone Goba Wereda

**Fitsum Alemayehu***
*Ethiopian Institute of Agricultural Research, Ethiopia*

## Abstract

In 2013 mehere season Participatory variety selection (PVS) trials were conducted in Goba wereda of Halaba zone in the Southern region of Ethiopia to evaluate the performance of released Bio-fortified common bean (Phaseolus vulgaris L.) varieties and to assess farmers' criteria for bean variety selection and thereby identify the relevant criteria used by farmers for upcoming bean improvement work in the region. Ten varieties were used for the study. Mother and baby design was employed and the trials were replicated over farmers. Tafache –SAB-632 was the best variety followed by Ibado, but the farmers' selection criteria were beyond yield and most farmers gave priority for qualitative traits. Accordingly, five qualitative traits were ranked by farmers as the best criteria that are better than yield. These are seed color, maturity period, adaptability of warm weather, disease and pest resistance, marketability and seed size. Almost all farmers in the study area preferred Tafache –SAB-632 as a number one variety due to its seed color (Sugary bean), seed size (large), demand in the market (high), Erect growth habit, early maturity (<90 days) and relatively good yield (>3 tons ha-1). The red speckled variety Ibado also was ranked second due to its seed color and marketability. Therefore, our future bean improvement program should target promotion of the selected varieties and developing varieties that fulfill farmers' preferences especially for Lowland adaptation, home consumption, local and export market.

**Keywords:** Common bean; PVS; Selection Criteria

## Introduction

The major pulses grown in Ethiopia include Faba bean Common beans, Chickpeas, Haricot beans, Lentils, Dry peas, Mung bean and Vetches. According to CSA, Common bean (Phasoulies vulgaris L.) is the most important pulse crop in both area coverage and volume of annual production in Ethiopia. The crop is also of the major grain legumes widely cultivated by the smallholder farmers in the Southern Nation, Nationalities and People's Region (SNNPR). Legumes are the major sources of protein in Ethiopia where common bean (Phaseolus vulgaris L.) takes large proportion next to Faba bean and Field pea. Common bean is important Food (high protein, Irion and Zinc content), Feed (animal Fodder), Income source of farmers & Foreign currency (>200 million USD /year), N2 fixation from the atmosphere (Improve soil fertility) [1].

The crop plays an important role in the livelihoods of the rural people of Halaba Zone, in which Teff, Finger Millet and maize are dominant. It is an important income source; its straw serves as feed for livestock, and also improves soil fertility by its advantage of nitrogen fixation in the cropping system. Although the potential yield of beans is as high as 4 tons $ha^{-1}$, the average yield of local bean varieties in the study area is about 1.7 tons $ha^{-1}$, which is very low. This is attributed to combined effects of edaphic, climatic, disease, and pest problems. Of course, lack of improved varieties in different market class & agro-ecologies and lack of awareness about newly released varieties are some of the top problems for low productivity and production in Ethiopia [2].

Micronutrient malnutrition affects more than half of the world population, particularly in developing countries. This is a huge issue today with millions of people falling sick and health issues that are easily solved if they had the nutrients they needed. 'Deficiencies in micronutrients such as zinc, iron and vitamin A can cause profound and irreparable damage to the body blindness, growth stunting, mental retardation, learning disabilities, low work capacity, and even premature death. This is where bio fortification of staple food crops plays a huge role in benefiting future generations and people in third world countries and even today. 'Bio fortification is a process of increasing the density of vitamins and minerals in a crop through plant breeding, transgenic techniques, or agronomic practices'. It links agriculture, nutrition and public health all together and this ensures that crops are nutrient rich, highly effective and meet the demands of farmers and consumers. Bio fortification is already helping populations in third world countries today and has many advantages that make it a science and practice of the future [3].

Moreover, not all the released and high yielding varieties were equally accepted by farmers due to differences in farmers' preference for the varieties in different localities. This was because the varieties were developed through conventional breeding that didn't consider farmers criteria. According to Gemechu et al. the rate of adoption of most of the varieties developed by the conventional breeding approach is believed to be far below expectations. They claim that farmers should participate in the research process right from the beginning, because farmers have their own selection criteria regardless of the yield potential of varieties [4]. The other reason is the selected varieties are likely to perform well in environments similar to the research stations, but not in environments that are very different. This is because of genotype x environment interactions [5].

Gemechu et al. reported that farmers and researchers have their own unique and common know how, which should be effectively exploited in the research process. It is based on the idea that farmers

***Corresponding author:** Fitsum Alemayehu, Ethiopian Institute of Agricultural Research, Ethiopia, Tel: +251932593220; E-mail: fishalm@yahoo.com

**Received:** 27-Jun-2022, Manuscript No: acst-22-67826, **Editor assigned:** 29-Jun-2022, PreQC No: acst-22-67826 (PQ), **Reviewed:** 13-Jul-2022, QC No: acst-22-67826, **Revised:** 20-Jul-2022, Manuscript No: acst-22-67826 (R), **Published:** 27-Jul-2022, DOI: 10.4172/2329-8863.1000522

**Citation:** Alemayehu F (2022) Participatory Variety Selection of Bi-fortified Released Bean Varieties for Low land Areas of Halaba Zone Goba Wereda. Adv Crop Sci Tech 10: 522.

as well as professional plant breeders have important knowledge and skills that could complement one another. Participatory variety selection (PVS) is broadly defined as a range of approaches that involve a mix of actors (including scientists, breeders, farmers and other stakeholders) in plant breeding stages. Because the objective is to produce varieties, which are adapted not only to the physical but also to the socio-economic environment in which they are utilized. According to Ashby, the outcome of PVS is that more farmers adopt PVS varieties over wider areas, leading to increased food and income benefits. Another impact is increased research efficiency due to more relevant and desirable research products. Ashby highlighted the impact of PPB and PVS on various crops in different countries by citing different authors. These are cassava in Brazil and Colombia; pearl millet in Namibia and India; beans in Colombia, Tanzania, Ethiopia and Rwanda; tree species in Burundi; potatoes in Rwanda, Bolivia, Peru and Ecuador; rain fed rice in India; paddy rice in Bangladesh, India and Nepal; maize in Mali, India, Ethiopia, Honduras and Brazil; and barley in Syria, Morocco and Tunisia. It is an important source of nutrients for more than 300 million people, representing 65% of total protein consumed, 32% of energy, and a major source of micronutrients e.g., iron (Fe), zinc, thiamin, and folic acid. It is known as the "poor men's meat," due to its high protein, minerals, and vitamins content. Fe is an essential micronutrient for almost all living organisms therefore using released Bio-fortified varieties of common bean is very important to combat deficiency of Iron and zinc [6].

In Ethiopia, efforts have been made to develop and popularize common bean varieties through both PPB and PVS. However, the farmers' selection criteria for common bean varieties were not adequately assessed and well documented especially in the southern region of Ethiopia.

## Objective

- To evaluate the bio-fortified released varieties for areas with participation of farmers.
- To recommend the best selected Varity for the Low land area of Halaba.

## Material and Methods

The experiment was carried out at Goba district, Halaba Zone in SNNPR Region. The area have an altitude of 1700 m.a.s.l., with 1200 mm annual rain fall. It has also sandy loam soil texture. The area crops dominantly growing maize, Barley, wheat, Potato, Finger millet. It has also Bimodal rain fall which use to grow grain crops for both mehere and Belg [7].

The mother trial of the experiment was conducted at Halaba zone, Goba Wereda With ten released Bio fortified varieties (DAB-96, Ado, SER-125, Awash Tafache, Bio-fort large seeded, Tafache –SAB-632, Wajo, Tatu, Gegeba and Ibado) with Randomized Complete Block Design (RCBD). The total plot size was 12.8 $m^2$ used four rows of two meter length with a spacing of 40cm between rows and 10cm within a row. 100kg NPS/ha fertilizer were applied [8]. All the necessary agronomic practice (weeding, cultivation and others) were applied as per recommendation. All phonological, agronomic and yield traits were taken. Twenty surrounding farmers were selected for the baby trials. Farmers were taken one kilogram of two varieties based on their own preference and managed by them. This experiment was planted at 2013 mehere and was harvested 2014 September [9].

## Result and Discussion

### Researcher's evaluation

Researchers' evaluated the common bean PVS trial at Guba district based on grain yield (Table 1). The varieties revealed a distinct statistical variation in grain yield and also there was significant difference among the common bean varieties. As it is indicated in Table 1 Tafache –SAB-632 as the highest grain yield 3354 kg ha-1, but (3141 kg/ha) and also SER-125 was give 3042kg/ha with the third rank [10]. Gegeba was a variety with 2065 low grain yield. In other words, the analysis result for PVS trial showed that there was significant difference among the varieties for grain yield at Guba in 2013/2014 (Table 2).

From the mother trial Tafache –SAB-632, Ibado and SER-125 were selected by seed size, earliness, pod length, disease resistance and yield, by both men's and women's farmers. In addition the selected varieties are early maturing it uses for double cropping especially in Belg season (Table 3) [11].

## Conclusion

The most preferred genotypes identified by the farmer's discussion through PVS and Researchers analysis result were Tafache SAB-632 and SER-125. These genotypes need to be demonstrated on big plot size in pre-extension demonstration (PED) and finally to recommend the varieties for up scaling through participatory seed production. The first

**Table 1:** Mean yield and hundred seed weight of pvs varieties at Halaba 2013/14.

| Trt. | Varieties | kg/ha | Tsw (gm) | Farmers rank | |
|---|---|---|---|---|---|
| | | | | Male | Female |
| 1 | DAB-96 | 3101 | 47.9 | 3 | 4 |
| 2 | Ado | 2872 | 47.3 | 4 | 3 |
| 3 | SER-125 | 3042 | 51.5 | 1 | 2 |
| 4 | Awash Tafache | 2792 | 30.8 | 8 | 7 |
| 5 | Bio-fort large seeded | 2294 | 41.0 | 7 | 8 |
| 6 | Tafache –SAB-632 | 3354 | 43.2 | 2 | 1 |
| 7 | Wajo | 2663 | 38.5 | 10 | 10 |
| 8 | Tatu | 2960 | 51.8 | 9 | 9 |
| 9 | Gegeba | 2065 | 43.9 | 6 | 5 |
| 10 | Ibado | 3141 | 42.7 | 5 | 6 |
| CV (%) | | **20.8** | **28.8** | | |
| | Lsd (0.05) | **1005.1** | **21.5** | | |

**Trt** (treatments), **Kg/ha** (kilogram/hectare), **Hsw** (Hundred seed weight) and **PVS** (participatory Varity trial)

**Table 2:** Partial Budget of common bean productivity and profit.

| Item | Amount used | Unit price (birr) | Total price |
|---|---|---|---|
| **Input** | | | |
| Seed | 100(NPS)/ha | 4.7 | 4700 |
| Fertilizer | 100kg/ha | 4.5 | 4500 |
| Packaging | 40Bags | 10 | 400 |
| Chemical | | | |
| Insecticide | 2.5 liter/ha | 1000 | 2500 |
| Pesticide | 1 liter/ha | 1000 | 1000 |
| Herbicide | 1 liter/ha | 1000 | 1000 |
| **Labor** | | | |
| Land preparation | | 60 | 10,800 |
| Planting | 40 man-days | 60 | 2400 |
| Weeding | 60 man-days | 60 | 3600 |
| Harvesting | 40 man-days | 60 | 2400 |
| Threshing | 30 man-days | 60 | 1800 |
| Cleaning | 60 man-days | 60 | 3600 |
| sum | | | 38,700 |

**Table 3:** Revenue vs profitability of each of the varieties evaluated.

| Trt. | Varieties | kg/ha | Unit price/qt | Revenue | Production cost | Net Profit |
|---|---|---|---|---|---|---|
| **1** | **DAB-96** | **3101** | **3000** | **93300** | **38,700** | **54,600** |
| **2** | **Ado** | 2872 | 3000 | 86160 | 38,700 | 47,460 |
| **3** | **SER-125** | 3042 | 3000 | 91,260 | 38,700 | 52,560 |
| **4** | **Awash Tafache** | 2792 | 3000 | 83,760 | 38,700 | 45,060 |
| **5** | **Bio-fort large seeded** | 2294 | 3000 | 68,820 | 38,700 | 30,120 |
| **6** | **Tafache –SAB-632** | **3354** | **3000** | **100,620** | **38,700** | **61,920** |
| **7** | **Wajo** | 2663 | 3000 | 79,890 | 38,700 | 41,190 |
| **8** | **Tatu** | 2960 | 3000 | 88,800 | 38,700 | 50,100 |
| **9** | **Gegeba** | 2065 | 3000 | 61,950 | 38,700 | 23,250 |
| **10** | **Ibado** | **3141** | **3000** | **94,230** | **38,700** | **55,530** |

two varieties Tafache SAB-632 and SER-125 were also identified by Researcher as the most preferred varieties for yield and other desirable traits. The study indicates that to assure the quality and quantity of data enough resources have to be made available to capacitate experts and farmers at grass root level in future.

## Recommendations

From the findings, we need to carry out:

- Promotion of selected varieties with their agricultural practices in trials implemented sites
- Designing seed multiplication and distribution technique to make seeds of these varieties sustainability available to farmers
- New Varity development has to be initiated for the Lowland areas of the zone as well as similar agro-ecologies

### Acknowledgements

The authors would like to thank farmers for their cooperation and for providing land for laying out PVS trials and their whole hearted participation in the evaluation of common bean varieties. We also thank Hawassa Research Center technical staffs namely Ato Ahemed Mohamed and W/ro Zewditu Mulugeta for the field data collection and close follow up. Furthermore we are grateful to South Agricultural Research Institute for providing fund for conducting this work is duly acknowledged.

### References

1. Ashby JA (2009) The impact of participatory plant breeding. Food and Agriculture Organization, Rome, Italy pp: 649-671.
2. Ceccarelli S (2012) Participatory Plant Breeding: Training Manual. ICARDA, Aleppo, Syria.
3. Ceccarelli S, Grando S (2006) Decentralized-participatory plant breeding. pp: 145–156.
4. Schwartz HF, Corrales MAP (1989) Bean production problems in the tropics. Centro Internacional de Agricultura Tropical (CIAT), Cali, CO. pp: 655-725.
5. CSA (2010) Crop production forecast sample survey, 2010/11 (2003 E.C.). Report on area and crop production forecast for major grain crops (for private peasant holding, meher season). Central Statistical Agency of Ethiopia, Addis Ababa, Ethiopia.
6. CSA (2011) Agricultural sample survey 2010/2011 (2003 E.C.) Central Statistical Agency of Ethiopia, Addis Ababa, Ethiopia.
7. Gurmu F (2007) Participatory Varietal Selection of Haricot Bean (*Phaseolus vulgaris L.*) Varieties in Umbullo Wacho and Beresa Watersheds in the Southern Region. In: Operational Research and Capacity Building for Food Security and Sustainable Livelihoods. Proceedings of Irish Aid Supported Operational Research Review Workshop 11-13 January 2007. Hawassa University, Awassa, Ethiopia.
8. Gemechu K, Asgelil D, Hussein H, Fasil K (2004) The Potential of Participatory Research in Agriculture in the country. The case of Participatory Plant Breeding. Project at Awassa Agricultural Research Centre. In: Participatory Research in Action. Ethiopian Experience. Proceedings of participatory workshop pp: 89-99.
9. Gemechu K, Yohannes G, Kiflu B, Chilot Y, Asgelil D (2002) Towards Farmers Participatory Research. Attempts and achievements in the Central High lands of Ethiopia. In: Proceedings of Client-Oriented Research Evaluation Workshop pp: 16-18.
10. Graham PH, Ranalli P (1997) Common bean (*Phaseolus vulgaris L.*). Field Crops Res 53:131-146.
11. Joshi A, Witcombe JR (1996) Farmer participatory crop improvement. II. Participatory varietal selection, a case study in India. Exp Agric 32(4):461-477.