On-farm evaluation of released Andean bean varieties with farmer participation in mid-altitude areas of Gedeb Zuria, Gedo Zone

ABSTRACT

Participatory variety selection (PVS) trials were carried out in the income Gedebwereda of the Gedio zone in the southern region of Ethiopia during the 2012 mehere season to assess farmers' selection criteria for beans and to assess the performance of newly released Andean common bean i(Phaseolus vulgaris L.) varieties. This assessment helped to identify the pertinent standards used by farmers for upcoming bean improvement work in the area. For the investigation, seven different kinds were employed. The trials were repeated among farmers using a mother-and-child design. The two best genotypes were Gegeba and Ibado, however, most farmers prioritised qualitative features over quantitative traits because their selection criteria extended beyond production. Farmers thus ranked five qualitative characteristics as the greatest criteria that are superior to production. These include seed size, marketability, maturity duration, pest and disease resistance, the ability to tolerate cool temperatures, and seed colour. Due to its large, red-speckled seeds, great market demand, upright growth habit, early maturity (90 days), and reasonably high yield (>2 tons ha-1), Gegeba was favored by almost all farmers in the research area. Due to the colour of its seeds and marketability, the red-flecked cultivar Ibado was also ranked second. Therefore, the focus of our future bean development programme should be on promoting the chosen varieties and creating new kinds that meet farmers' preferences, particularly for adaptation to the mid-highlands, domestic consumption, local markets, and export markets.

Key words: common bean, PVS, selection criteria.

1. INTRODUCTION

The major pulse crops grown in Ethiopia include Faba bean, common beans, chickpeas, haricot beans, lentils, mung bean, and vetches. According to CSA (2016), 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 one of the major grain legumes widely cultivated by 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 a large proportion next to faba bean and field pea (CSA, 2016).

The crop plays an important role in the livelihoods of the rural people of Sidama zone, in which 'Enset' [Enseteventricosum (Welw.) Cheesman] and maize are dominant. Enset is a perennial root crop that is used as a food crop only in Ethiopia and is mostly grown in the courtyard with other crops such as coffee, common bean, and maize. A food prepared from Enset (i.e., 'Kocho') is consumed alone or by mixing with different crops such as boiled beans and maize. It is an important income source; its straw serves as feed for livestock and also improves soil fertility by taking advantage of nitrogen fixation in the cropping system. Although the potential yield of beans is as high as 5 tonnes ha1 (Graham and Ranalli, 1997), the average yield of local bean varieties in the study area is about 1.7 tonnes ha1, which is very (CSA, 2018). This is attributed to the combined effects of edaphic, climatic, disease, and pest problems. Of course, lack of improved varieties in different market classes and agro-ecologies and lack of awareness about newly released varieties are some of the top problems for low productivity and production in Ethiopia (Gurmu, 2013).

Moreover, not all the released and high-yielding varieties were equally accepted by farmers due to differences in farmers' preferences 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. (2004), 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. The other reason is that 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-environment interactions (Ceccarelli and Grando, 2006).

Gemechu et al. (2002) 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 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 that are adapted not only to the physical environment but also to the socio-economic environment in which they are utilized. According to Ashby (2009), 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 (2009) 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.

Therefore, the objectives of this study were to:

To evaluate and select the best-performing released Andean common bean varieties for mid-highland adaptation
Assess farmers' selection criteria for common bean varieties in the mid-highland with farmer participation.
Identify the most important criteria for future bean improvement work in the areas and the region as well.

2. MATERIAL AND METHODS / EXPERIMENTAL DETAILS / METHODOLOGY

[The experiment was carried out in Gedeb district, Gedion Zone, SNNPR Region. The area has an altitude of 2200 m.a.s.l., with 1200 mm of annual rain. It also has a sandy-loam soil texture. The area is dominantly growing enste, maize, barley, wheat, potato, faba bean, and field pea. It also has bi-modal rainfall, which is used to grow grain crops for both Mehere and Belg.

The mother trial of the experiment was conducted at Gedio Zone, GedebWereda. With seven released Andean bean varieties (Ibado, Gegeba, Tatu, Remeda, Wajo, Awash-2, and Batu) with Randomised Complete Block Design (RCBD), The total plot size was 12.8 m2, using four rows of two metres in length with a spacing of 40cm between rows and 10cm within a row. 100 kg of NPS/ha fertiliser were applied. All the necessary agronomic practices (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 given one kilogramme of two varieties based on their own preferences and

managed by them. The experiment was planted in 2012 and harvested in July 2012.

3. RESULTS AND DISCUSSION

Researcher's evaluation

Researchers' evaluated the common bean PVS trial at Gedeb 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 Gegeba as the highest grain yield 2500 kg ha-1, but Batu (1300 kg/ha) was a variety with 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 Gedeb in 2012/2013(Table 1).

From the mother trial Ibado and Gegeba 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.

In the mid-highland areas, the main legumes are faba bean and field pea therefore common bean also will be considering an alternative legumes crops.

Table 1. Mean yield (Qt /ha) with farmers preference rank at Gedeb 2012/13

No.	Varity	Market class	Yield kg/ha	Farmers Preference	
				Male (15)	Female(5)
1	Ibado	Large Red mottled	2000	2	1
2	Tatu	Large Red mottled	2300	3	4
3	Batu	Large White	1700	6	6
4	Gegeba	Large Red mottled	2500	1	2
5	Awash-2	Large White	1900	7	7
6	Wajo	Large White	2000	5	5
7	Remeda	Red Kidney	2200	4	3
Cv(%)			24		

Farmers Evaluation

Farmers attended the participatory variety evaluation and selection had diversified selection criteria to accept and reject bean variety (Table2). This diversity during selection is an indication of the complexity Representative farmers from the study area were participated in the baby trials and evaluated the PVS trial. The evaluated farmers were most interested in some of the parameters like Pods load,Earliness, yield, seed size, red color, market value, seed shape, maturity period, diseases resistance, Insect resistance, pod appearance and green leaf (Table 2). During the evaluation common bean genotypes for adoption, out of the fourteen different traits farmers chose traits that they often use. Therefore, while farmers consider many traits, there are a few traits that they often use and these need to be identified. Earlier studies by Gurumu (2013) working on common bean and Wondimu (2016) is working on common beans reported similar findings of farmers using a combination of a few traits when evaluating new genotypes. At flowering, maturity stage and at harvest, the farmer evaluated PVS trials at Gedeb, generally farmers responded positively to the common bean varieties they have assessed. In the study common bean varieties farmers' evaluation showed that there was a matching with researchers need. Moreover, farmers 'evaluations and testing farmers field both show variance. Table 2 Farmers' entire evaluation indicates that variety Gegeba, Ibado and Tatu were the top from the test common bean varieties. The Batu variety has showed poor performance and least preferences by farmers in most cases.

Table 2. Trait (selection criteria) used by farmers with preference rank at Gedeb 2012/13

Trait (Selection criteria)	Remeda	Ibado	Gegeba	Batu	Awash-2	Wajo	Tatu
Pods load	4	6	5	2	5	1	3
Earliness	4	6	5	2	1	3	5
Yield	5	6	5	1	3	1	3
Seed/pod	3	6	4	2	3	3	2
Seed size	2	6	5	2	5	2	1
Red color	3	2	5	3	3	2	6
Market value	4	3	6	1	4	1	4
Seed shape	4	6	6	1	5	1	4
Maturity period	3	4	6	1	2	1	3

Disease Resistance	6	5	2	1	4	1	1
Insect Resistance	5	6	4	1	3	1	1
Pod appearance	1	5	6	2	3	1	1
Green leaf	6	1	5	1	3	1	4
Mean Preference rating	3.85	4.77	4.92	1.54	3.38	1.46	2.92
Rank	3	2	1	6	4	7	5

Table 3. Rank of The best preferred criteria used by men and women farmers at Gedeb, 2012/13

Selection criteria	Men	Women
Pod loading	4	3
Number of seed /pod	5	6
Pod abortion	8	7
Diseases resistance	6	5
Seed size & pod length	7	8
Seed color	3	4
Maturity	2	2
Growth habit	8	8
Yield	1	1

4. CONCLUSION

The most preferred genotypes identified by the farmer's discussion through PVS and researchers' analysis result were Gegeba and Ibado. 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 two varieties (Gegeba and Ibado) 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.

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 mid-highland from Andean genotypes to release new Varity for the area.

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