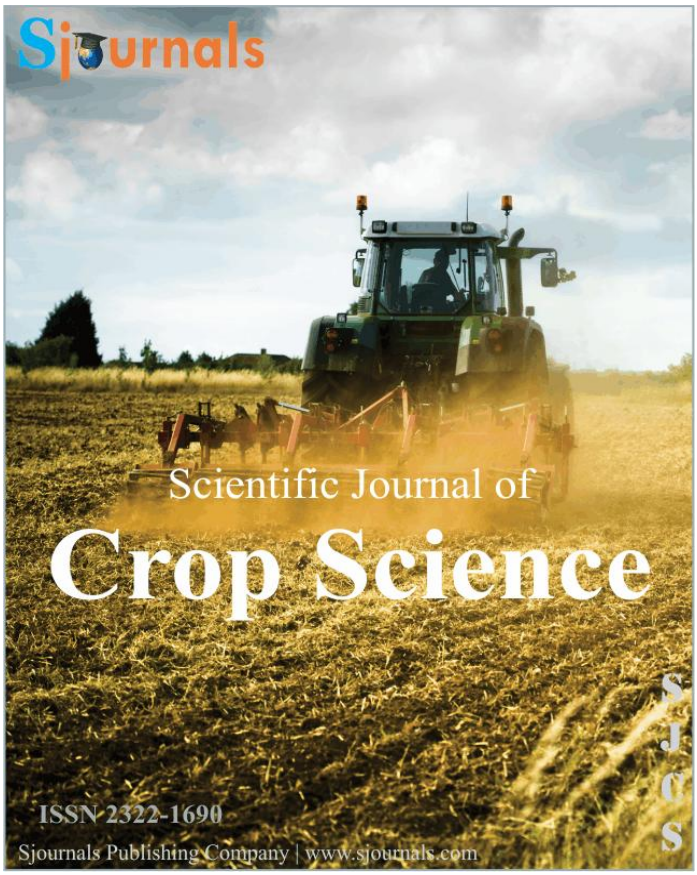

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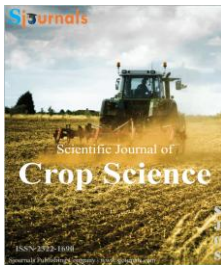

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Original article

Pre-extension demonstration of improved faba bean technologies in Bale zone, Oromia National Regional State, Ethiopia

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ABSTRACT

On-farm participatory demonstration of improved faba bean technologies was carried out in Dinsho and Goba districts of Bale zone in 2017 production season. The objectives of the study were to demonstrate and evaluate improved faba bean technologies in order to enhance farmers to select the best fit variety/ies for their localities based on farmers' selection criteria. Recently released faba bean varieties, namely, Dosha, Gora and Moti were planted at two kebeles of Dinsho district (for Nitosol area) where as Didea, Hachalu and Walki were planted at two kebeles of Goba District (for Vertisol area) with recommended packages. The demonstration was undertaken on single plot design of 10m x 10m area for each variety with the spacing of 40cm between rows and recommended seed rate based on the size of the seed and 100 kg/ha NPS fertilizer rate. Mini-field day was organized at each respective site on which different stakeholders were participated, participatory evaluation of the varieties was made and experiences were shared. Yield data per plot was recorded and analysed using descriptive statistics. Farmers' preferences were identified using focused group discussion and summarized using pair wise and simple ranking methods. At Dinsho, the mean yield of Dosha variety was 23.75qt/ha and had 31.94% yield advantage over the check. It is also preferred by the farmers. At Goba, the mean yield of Didea variety was 20.6qt/ha and had 4.04% yield advantage over the check. It is also preferred by the farmers. Participant farmers were

enhanced to set their own selection criteria and the most important were tillering capacity, pod per plant, seed per plant, seed size, well adapted to the environment, disease free and has no loading problem. Thus, Dosha variety (for Nitosl) and Didea variety (for Vertisol) were recommended for further scaling up/out activity in all demonstration sites and similar agro-ecologies.

1. Introduction

Due to its high nutritive value and other merits, faba bean (Vicia faba L.) is among the most important food legumes in the world. It has ecological and economic importance and used for food (rich in protein 17-25%), income source and foreign currency in export market, improving soil fertility by fixing atmospheric nitrogen and soil health as well, and food security. Faba bean production ranks the 1st among pulse crops in area and volume of production in Ethiopia. The crop is grown in several areas of the country at altitude of 1800-3000 masl and receiving annual rainfall of 700-1000mm (ICARDA, 2006). From 1,652,844.19 hectares of land allocated for pulse in 2015/2016 production season, faba bean covered 443,966.09 hectares of land from which 8,486,545.69 quintals of grain was produced with the productivity of 19.12 qt/ha (CSA, 2016). In Bale, 16,471.36 ha of land was covered by faba bean and 388,302.53 quintals of grain was produced with the productivity of 23.57 qt/ha (CSA, 2016).

Bale zone is characterized by integrated (mixed) farming systems in which most of the crop areas were under cereal production. The current cereal monoculture practiced in the cereal-based cropping systems put sustainable crop production system of the area at risk. It may, lastly, result in serious agricultural problems, yield reduction, often common incidence of persistent pests (diseases, weeds and insect pests) and soil borne diseases, and total crop loss unless corrective measures are taken in coordinated efforts. Thus, crop diversification can be a means to stay in sustainable crop production in the study zone. Faba bean is the best break crop for wheat production. Research result revealed that bread wheat grown after these crops gave higher grain yield than after cereal crops with a yield advantage of 15% (Sinana ARC Profile, 2014). In general, pulses seem important break-crops compared to continuous mono-cropping of cereals after cereals and after linseed, (Genene and Habtamu, 2001).

The research system have been making continuous and unreserved endeavors in varietal development and seed/variety replacement to ensure the sustainability of early generation seed source for both formal and informal seed multipliers and distributors. In this endeavor, more than thirty (30) high yielding faba bean varieties have been released and/or registered in Ethiopia to satisfy the growing production demands of the farmers in the country. Among these, Dosha and Gora for Nitosol, and Didea and Hachalu for Vertisol were recently released with full recommended packages for production. Thus, participatory demonstration, evaluation and validation of the varieties with the participation of farmers and other stakeholders were undertaken with the financial support of ICARDA project. The study objectives:

- ✓ To demonstrate and evaluate improved faba bean technologies in Bale zone and recommend the preferred one
- ✓ To create awareness on the importance of improved faba bean technologies
- ✓ To collect feedback on the performance of the technology/ies

2. Materials and methods

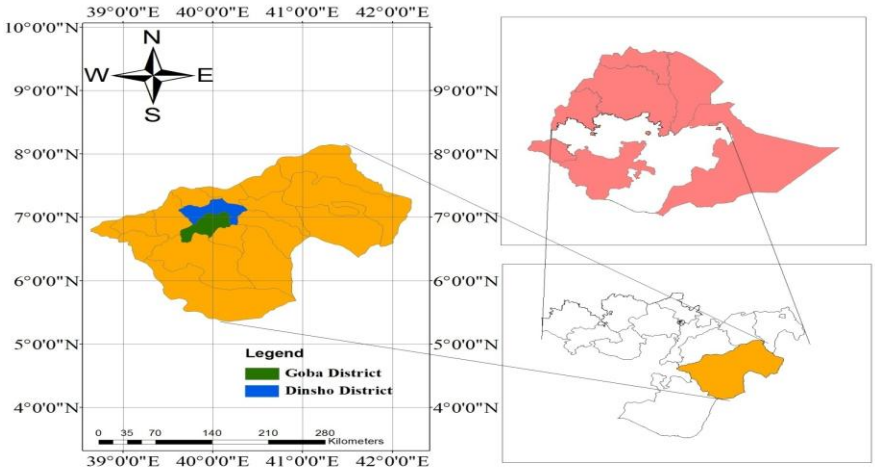
2.1. Description of the study area

2.1.1. Bale zone

Bale zone has eighteen (18) rural and two (2) town districts, out of which nine (9) rural districts are found in the highlands and suitable for crop production. The other nine (9) rural districts are found in the mid and low lands, and agro-pastoralists and pastoralists. Robe town is the capital town and the administrative center of the zone and located at 430km from Finfinne/Addis Ababa. The total area of Bale zone is about 63,555km^2 (6,355,500

hectars), which is 16.22% of Oromia region. About 95% of the population is engaged in agriculture. The altitude ranges from 300m to 4377 m.a.s.l. The agro-ecological zones of the zone are extreme highland (cold) 0.04%, highland (14.93%), midland (21.5%) and lowland (63.53%). The mean annual temperature of the zone is found between 3.5 °C and 32 °C, respectively. The minimum and maximum rainfall is 400mm and 2500mm, respectively. Bale zone has bimodal rainfall patterns and two distinct seasons, namely, Belg (in Afan Oromo called 'Ganna' by referring to the harvesting time) extends from March to July and Meher (in Afan Oromo called 'Bona' by referring to the harvesting time) extends from August to January. The zone is bounded by West Arsi and Arsi zones to the North, Guji zone to the South, by West Hararghe zone and Somali National Regional State to the East and West Arsi zone to the West (BZANRO, 2017).

The research was carried out in Dinsho and Goba districts of Bale zone. The altitude of Dinsho district is 2444m - 4250 m.a.s.l, receives 965.03 - 1314 mm annual rainfall, the minimum and maximum temperature is 7.07 °C and 15.33 °C, respectively. The dominant soil type is Nitosol and Cambisol. Whereas, the altitude of Goba district is 1517m - 4378 m.a.s.l, receives 937.3 - 1342.44 mm annual rainfall, the minimum and maximum temperature is 6.53 °C and 19.58 °C, respectively. The dominant soil type is Pellic Vertisol (Sinja Area) and Chromic Luvisols (Adamu, 2018).



Source: Own sketch

2.2. Site and trial farmers' selection

The activity was conducted at ICARDA project intervention districts on a total of four sites (two sites at Dinsho for Nitosol and two sites at Goba for Vertisol). Two kebeles were selected from each district based on their accessibility and production potential of the crop. Kebeles were considered as replication, i.e. the demonstration activity was replicated on two kebeles per district.

Selection of trial farmers were based on good history of compatibility with groups and genuineness, having suitable and sufficient land to accommodate the trials, accessibility for supervision of activities (vicinity), initiatives to implement the activity in high-quality, good in field management, willingness and transparency to share innovations to others. Besides, resource rich, medium and poor category of farmers including men, women and youth farmers was considered during trial farmers' selection.

2.3. Implementation design

2.3.1. Materials used and field design

Recently released faba bean varieties, namely, Dosha and Gora with one standard check (Moti) were planted at two kebeles of Dinsho district (for Nitosol area) where as Dida'a and Hachalu with standard check (Walki) were planted at two kebeles of Goba District (for Vertisol area) with recommended packages on selected farmers' land with simple plot design (10m x 10m) in 2017 main cropping season. Sinana Agricultural Research Center was the source of all agricultural inputs (seed of improved varieties and fertilizer-NPS).

The varieties were treated with full recommended faba bean production and management packages. Row planting method and other crop management practices were employed during the research work. The spacing of

40cm between rows was used. The recommended seed rate of 120 - 180 kg/ha based seed size of the varieties was used by drilling in the prepared rows. Shallow planting of 5cm depth was used in the presence of sufficient soil moisture. The recommended inorganic fertilizer rate 100 kg/ha NPS was applied during planting time. Depending on weed infestation, two effective weeding were done; the first at one month after sowing with cultivation and the second at two months after sowing of improved faba bean varieties.

Farm operations (land preparation-ploughing four to five times using oxen plough) were carried out by trial/hosting farmers, whereas activities such as land leveling, planting, first and second weeding, cultivation, harvesting, threshing, cleaning and other laboratory works were handled by SARC researchers and technical assistants.

2.4. Technology demonstration and evaluation techniques

The target beneficiaries of improved agricultural technologies are strongly inclined to their preferences. Thus, consulting the intended end users to assess which quality/ies of a particular variety they desire (to be considered in plant breeding program) is highly important. Because, it will not only be resource saving in terms of preferred variety promotion/dissemination, but also time saving and fast adoption (Dan, 2012).

Farmers in the project area were encouraged to participate on participatory selection of demonstrated varieties. A total of 112 participants from two districts (92 farmers, 14 DAs and supervisors and 6 experts) and 3 researchers were participated on the selection of the varieties at maturity stage of the crop. First, the evaluators were grouped in to small manageable group (one group had 10 members, including one group leader and one secretary). At each demonstration kebele, brief orientation was given to the evaluators on how to integrate researchers' criteria to their own criteria to select the demonstrated varieties in order of their importance, how to carefully assess each variety by considering each criteria and using rating scale, how to organize collected data, how to make group discussion and reach on consensus, and finally report through their group leader at the end.

2.5. Data type and method of data collection

Both qualitative and quantitative data were collected using appropriate data collection methods such as direct field observation/measurements and focused group discussion (FGD). Agronomic data such as heading date, disease score, maturity date, stand, tillers per plant, pods per plant, seeds per plant and yield data per plot in all locations were recorded. Farmers' preference (likes and dislikes, which is the base for plant breeding process) to the demonstrated technologies was identified.

2.6. Data analysis

SPSS was used as statistical package (descriptive statistical technique such as percentage was used to analyze the data). Pair wise ranking matrix was used to rank the varieties in order of their importance. Pair wise Ranking was used as a tool to summarize farmers' preference towards important variety traits (Boef and Thijssen, 2007). The agronomic data were analyzed using GENSTAT computer software.

3. Results and discussion

3.1. Yield performance and farmers' preference of the demonstrated varieties

Dosha shows the highest yield than Gora and Moti at Dinsho sites. At Dinsho, the mean yield of Dosha variety was 23.75qt/ha and had 31.94% yield advantage over the check. Moreover, the result is presented in Table as shown below.

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

Table 1
Comparison of yield advantage of demonstrated improved faba bean varieties at Dinsho.

District	Mean yield of standard check (qt/ha)	Mean yield of improved chickpea varieties (qt/ha) and yield advantage over the check			
	Moti	Dosha	%	Gora	%
Dinsho	18.0	23.75	31.94	18.25	1.39

Table 2
Rank of the demonstrated varieties based on farmers' selection criteria at Dinsho.

P #	Varieties	Rank	Reasons (all sites)
1	Dosha	1st	Average tillering 5, pod per plant 46, seed per plant 137, well adapted, disease free, no loading
2	Gora	2nd	Average tillering 5, pod per plant 41, seed per plant 119, big seed size, disease free, no loading, sweet green pod
3	Moti	3rd	Average tillering 4, pod per plant 37, big pod and large seed size, seed per plant 115, disease and loading problem

The FGD result showed that the participant farmers ranked the demonstrated varieties based on their preferences and degree of satisfaction after they made detail discussions and debates on the variety traits. Thus, the farmers' preference summary result shows that Dosha variety was preferred by the farmers at Dinsho sites.

Table 3
Statistical analysis result of the demonstrated varieties at Dinsho.

Varieties	Tillers per plant (count)	Pods per plant (count)	Seeds per plant (count)	Mean yield (Quintal/ha)
Dosha	5.5	46[a]	136.5[a]	23.75[a]
Gora	4.5	40.5[b]	119[b]	18.25[b]
Moti	4	37[b]	115[b]	18.00[b]
$LSD_{0.05}$	ns	3.9	5.4	1.7
CV (%)	12.4	3.0	1.4	2.6

The one way ANOVA with no blocking result showed that tillers per plant is not significant while pods per plant, seeds per plant and mean yield were significant among the demonstrated varieties**.**

Didea more yielder than Hachalu and Walki at Goba sites. Moreover, the result is presented in graph as shown below.

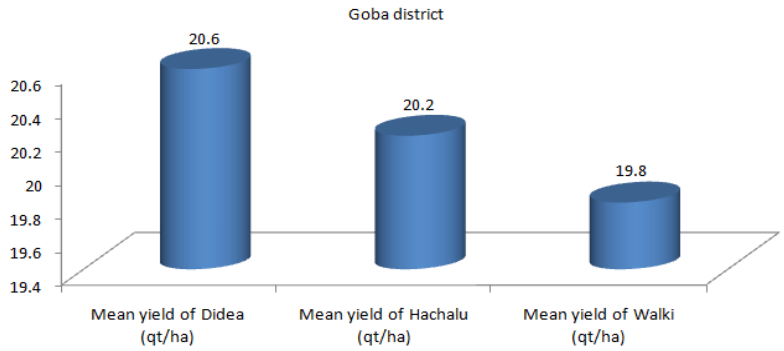


Table 4
Rank of the demonstrated varieties based on farmers' selection criteria at Goba.

P #	Varieties	Rank	Reasons (all sites)
1	Didea	1st	Average tillering 6, pod per plant 56, seed per plant 168, strong straw, disease free, no loading
2	Hachalu	2nd	Average tillering 6, pod per plant 52, seed per plant 156, disease and loading problem
3	Walki	3rd	Average tillering 7, pod per plant 49, big pod size and has more seed per plant 196, disease and loading problem

The FGD result showed that the participant farmers ranked the varieties based on their preferences and degree of satisfaction after they made detail discussions and debates on the variety traits. Thus, the farmers' preference summary result shows that Didea variety was preferred by the farmers at Goba sites.

4. Conclusion

Due to the indeterminate nature of faba bean, all demonstrated varieties had more vegetative growth with low pod setting because the rainfall amount was high in 2017 production season. This resulted in low yield harvested in the season. Suitable and accepted faba bean variety/ies for the target areas were identified and ranked based on participant farmers assessment and grain yield data. The analysis result indicated that the highest mean yield was obtained from Dosha (23.75 qt/ha) at Dinsho while Didea and Hachalu yielded 20.6 qt/ha and 20.2 qt/ha, at Goba district, respectively. Thus, among the demonstrated varieties Dosha has performed well than Gora and commercial variety (Moti) in all parameters at Dinsho district on Nitosol. The mean yield of Didea is slightly differing from Hachalu and commercial variety (Walki) at Goba district on vertisol.

Thus, Dosha (for Nitosol), and Didea and Hachalu (for Vertisol) were recommended for wider scaling up/out activity in Dinsho and Goba districts, respectively. Gora, Moti and Walki will be maintained by Breeders for the merits to be used for breeding purpose. The selection criteria set by the farmers were tillering capacity, pods per plant, seeds per pod, seeds per plant, stem strength - resistant to lodging and good for nutrients translocation, good plant height, disease tolerance, relative yield advantage, seed size and colour for attractive market. Commodity integration (crop rotation) should be practiced for the sustainability of production system in the target areas.

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