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On-farm demonstration of improved faba bean varieties in bale and west arsi zones, southeastern oromiya, Ethiopia

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A B S T R A C T

On-farm demonstration of improved faba bean varieties was conducted in Adaba and Dodola districts of West Arsi Zone and Sinana, Goba and Agarfa of Bale Zone. The main objective of the study was to demonstrate and evaluate recently released Aloshe variety along with standard check. The demonstration was under taken on single plot of 10m x 10m area for each variety with the spacing of 40 cm between rows and recommended seed rate of 180 kg ha^{-1} and fertilizer rate of 100 qt ha^{-1} NPS. Mini-field day involving different stakeholders was organized at each respective site. Yield data per plot was recorded and analysed using descriptive statistics, while farmers' preference to the demonstrated varieties was identified using focused group discussion and summarized using pair wise and simple ranking methods. The demonstration result revealed that Aloshe variety performed better than the standard check of Mosisa variety with an average yield of 35.97 qt ha^{-1}, while that of the standard check was 28.50 qt ha^{-1}. Aloshe variety had 26.21% yield advantage over the standard check. This variety was selected by farmers in Adaba, Dodola and Agarfa. Thus, Aloshe variety was recommended for further scaling up in the area it was selected.

Keywords: Demonstration, Farmers' preference, Faba bean, Aloshe, Selection criteria

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Introduction

Faba bean, *Vicia faba* L. is mainly grown in the highlands (1800-3000 m.a.s.l) of Ethiopia (Yohannes, 2000). It is a valuable crop used as the cheap source of protein in most Ethiopian diet. It also plays a significant role in soil fertility restoration and in export market (Endale *et al.*, 2014). Faba bean production ranks the 1st among pulse crops in area and volume of production in the country. From 1,598,806.51 hectares of land allocated for pulse in 2017-2018 production season, faba bean covered 437,106.04 hectares of land from which 9,217,615.35 quintals of grain was produced with the productivity of 21.09 qt ha^{-1} (CSA, 2018).

In Bale, 15,347.32 ha of land was covered by faba bean and 372,559.31 quintals of grain was produced with the productivity of 24.28 qt ha^{-1} (CSA, 2017). Faba bean has ecological and economic importance and used for food (rich in protein), income source and foreign currency (attractive market price), soil fertility restoration (NP) and food security. Bale and West Arsi Zones are characterized by integrated (mixed) farming systems in which most of the crop areas were under cereal based mono-cropping (Bekele, 2011). Crop diversification can be a means to stay in sustainable crop production in the study zones. Faba bean are the best break crops for wheat production. Bread wheat grown after these crops gave higher grain yield than after cereal crops with a yield advantage of 15% (SARC, 2014).

Developing high yielding, disease tolerant and stable varieties that can meet increasing food demand of the growing human population, improve the income and livelihood of farmers are very important. Consequently, Aloshe variety has recently released by SARC with yield potential of 35-50 qt ha^{-1}. The yield advantage of Aloshe over standard and local checks is 20.39 % and 35.08%, respectively.

The two-way feedback between farmers and researchers is indeed vital component of high yielder and disease and pest resistant varietal development process (Getachew *et al.*, 2008). Thus, undertaking participatory demonstration, evaluation, validation and dissemination of improved faba bean varieties with the participation of farmers and other stakeholders for sustainable production and productivity is paramount.

Objectives

- To evaluate the yield performance of faba bean varieties under farmers' condition in Bale and West Arsi zones.
- To create awareness on the importance of faba bean varieties among farmers, DAs, SMSs and other participant stakeholders.
- To collect farmers' feedbacks on faba bean varieties for further development of faba bean technologies.

Methodology

Description of the study area

The research was carried out at Adaba and Dodola districts of West Arsi Zone and Goba, Sinana and Agarfa districts of Bale zone, Oromiya National Regional State (ONRS), Ethiopia. Bale and west Arsi zones are among the 20 Administrative zones located in south eastern parts of Oromiya, Ethiopia.

Site and farmers selection

On-farm demonstration of improved faba bean varieties was carried out at Adaba and Dodola districts of West Arsi Zone and Goba, Sinana and Agarfa districts of Bale zone. Purposive sampling methods were employed to select the districts based on the potential of the crop. One PA from Adaba, two PAs from Dodola, Goba, Agarfa and Sinana were selected based on accessibility or vicinity to the road. Similarly, two-trial farmer from each PA of Adaba and Dodola districts and one trial farmer from each PA of Goba, Sinana and Agarfa districts were used to carry out the demonstration process considering each farmer's field as replication of the trial. The activity was done on a total of 12 trial farmers.

Materials used and field design

Improved faba bean variety (Aloshe) was demonstrated and compared with standard check Mosisa. The demonstration was under taken on simple plot design of 10 m x 10 m area for each variety. Full packages were applied. In addition, twice hand weeding was done on time.

SARC was the source of all agricultural inputs. Farm preparations were carried out by trial/hosting farmers, whereas land leveling, planting, first and second weeding, follow up and visit, harvesting, threshing were handled and managed by SARC.

Data collection

Both qualitative and quantitative data were collected using appropriate data collection methods such as direct field observation/ measurements, key informant interview and focused group discussion (FGD). Yield data per plot in all locations were recorded. Farmers' preference to the demonstrated varieties was identified.

Data analysis

Descriptive statistics was used to analyze the yield data. Pair wise ranking and simple matrix ranking were used to compare traits of demonstrated varieties.

Results and Discussion

Training

Training was given to farmers, DAs, and agricultural experts on faba bean crop production techniques and management packages, agro-chemical applications and safety precautions. Stakeholders such as zone and district level agriculture development office, zone and district level cooperative promotion offices, zone and district level agricultural inputs regulations and quarantine experts were invited and participated during consultation meeting and training.

Yield performance of demonstrated varieties

The mean yield obtained from Adaba, Dodola, Goba, Sinana and Agarfa were summarized in the chart below.

Table 1. Yield Performance of demonstrated varieties.

No	Variety	Yield obtained (Qt ha^{-1})						Yield advantage over standard check
		Dodola	Adaba	Goba	Sinana	Agarfa	Mean	
1	Aloshe	35.50	34.00	40.68	36.85	32.80	35.97	26.21%
2	Mosisa	30.50	29.50	27.75	26.14	28.60	28.50	-

The newly released faba bean variety Aloshe performed better than the standard check Mosisa all over the locations. It is the high yielder at all demonstration sites. Aloshe variety gave a mean yield of 35.50 qt ha^{-1}, 34.00 qt ha^{-1}, 40.68 qt ha^{-1}, 36.85 qt ha^{-1} and 32.80 qt ha^{-1} at Dodola, Adaba, Goba, Sinana and Agarfa districts, respectively with overall mean yield of 35.97 qt ha^{-1}. Similarly, Mosisa variety gave a mean yield of 30.50 qt ha^{-1}, 29.50 qt ha^{-1}, 27.75 qt ha^{-1}, 26.14 qt ha^{-1} and 28.60 qt ha^{-1} at Dodola, Adaba, Goba, Sinana and Agarfa districts, respectively with overall mean yield of 28.50 qt ha^{-1}. The yield performance at all sites is much greater than average production of Oromiya region, which is 22.70 qt ha^{-1} (CSA, 2017). It also has 26.21% yield advantage over the standard check. The cost benefit ratio reveals that the new variety has higher net profit (1.94) than the standard check (1.38). This shows that, this improved variety can improve farmer's productivity than the existing varieties.

Table 2. Cost-Benefit analysis of the demonstrated varieties.

No	Variables	Varieties	
		Aloshe	Mosisa
1	Yield obtained (qt ha^{-1})	35.97	28.50
2	Sale price (ETB/qt)	1800	1800
3	Gross returns (Price X Qt) TR	64746	51300
4	Total variable costs TVC (ETB ha^{-1})	14030	13540
5	Fixed cost (FC)	8000	8000
6	Total cost (TC)	22030	21540
7	Net return (GR-TC)	42716	29760
8	Benefit cost ratio (NR/TVC)	1.94	1.38

Table 3. Result of independent sample t-test.

	Test for Equality of Variances		t-test for Equality of Means				
	F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Equal variances assumed	1.285	0.290	4.808	8	0.001	7.47	1.55

Farmers' preference of variety traits were identified and presented by pair wise ranking. Accordingly, yield, early maturity, drought tolerance, adaptability to the environment and disease tolerance were the top five-priority concern given by farmers (Table 3). As shown above (Table 3), there was statistically significant difference between the yield of Aloshe and Mosisa varieties. There was also a mean difference of 7.47 qt ha^{-1} between both varieties.

Table 4. Pair wise ranking result to rank variety traits in order of importance.

No	Variety traits	A	B	C	D	E	F	G	H	I	J	K	Frequency	Rank
1	A												6	5th
2	B	A											4	6th
3	C	A	B										4	6th
4	D	A	D	C									4	6th
5	E	E	E	E	E								7	4th
6	F	A	B	C	D	E							2	9th
7	G	A	B	C	D	E	F						0	11th
8	H	A	B	C	D	E	F	H					1	10th
9	I	I	I	I	I	I	I	I	I				8	3rd
10	J	J	J	J	J	J	J	J	J	J			9	2nd
11	K	K	K	K	K	K	K	K	K	K	K		10	1st

A= Disease tolerance, B= Pod/plant, C= Seed/plant, D= Tiller, E= Adaptability, F= Seed size, G= Plant height, H= Marketability, I= Drought tolerance, J= Early maturity, K= Yield.

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

No	Varieties	Rank	Reasons
1	Aloshe	1st	High yielder, pod plant^{-1} (30), seed plant^{-1} (59), more tolerant to disease, tiller (3-4), more adaptable to the environment, more adaptable to the soil, big seed size, good plant height, more marketable, more resistant to drought
2	Mosisa	2nd	Low yielder, pod plant^{-1} (20), seed plant^{-1} (46), less tolerant to disease, tiller (3-4), less adaptable to the environment, less adaptable to the soil, small seed size, shorter plant height, less marketable, less resistant to drought

Table 5. Rank of the varieties based on farmers' selection criteria at Sinana district.

No	Varieties	Rank	Reasons
1	Aloshe	2nd	Late mature, tiller (3-4), plant height (long),moderate tolerant to frost, seed pod^{-1}, pod plant^{-1}, tiller (3-5), but more tolerant to disease
2	Mosisa	1st	Early mature, good plant height (medium height), seed pod^{-1} (2-4), pod plant^{-1} (15-28), tiller (3-6)

Conclusions and Recommendations

On-farm demonstration and evaluation of faba bean varieties was carried out on twelve (12) representative trial farmers' fields. Improved variety viz. Aloshe was demonstrated along with Mosisa variety, which is the standard check. Accordingly, Aloshe gave higher yield than Mosisa variety.

Moreover, Aloshe was selected by participant farmers in Adaba, Dodola, Goba and Agarfa due to high yielder, pod plant^{-1} (30), seed plant^{-1} (59), more tolerant to disease, tiller (3-4), more adaptable to the environment, more adaptable to the soil, big seed size, good plant height, more marketable, more resistant to drought. Similarly, farmers selected Mosisa variety in Sinana district due to early mature, good plant height (medium height), seed pod^{-1} (2-4), pod plant^{-1} (15-28), tiller (3-6). Based on these facts, Aloshe variety was recommended for further scaling up in the area it was selected.

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