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Research Article

# Participatory Demonstration of Improved Variety of Faba Bean with its Full Packages in Gamo Gofa Zone, SNNPRs, Ethiopia

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## Abstract

Participatory pre extension demonstration of faba bean were conducted in Bonke and Chencha Woreda, Gamo gofa zone in three Kebele and 24 farmers field on 10*10= 100m2 area of demonstration plots. All necessary inputs were delivered to farmers from Arbaminch Agricultural research center. Farmers were trained and well capacitated by relevant researchers. After the provision of training, farmers sown on their farm and regular follow up were undertaken by research centers. For the sake of to promote the technology to large the large farmers in large scale, field days were organized and farmer was select the variety according to their preference criteria and rank Dosha variety as better over the local variety. The yield performance showed that Dosha gave better yield (25.5 quintal per hectare) than local variety (21.2 quintal per hectare). Finally, it was recommended that in order to enhance diffusion and adoption of the variety, it is better to scale up Dosha variety.

**Keywords:** Yield; Farmers; Farmers Preferences; Field Day

## Introduction

Faba bean (*Vicia faba* L.) is also referred to as broad bean, horse bean and field bean and it is the fourth most important pulse crop in the world [1]. The crop as a multipurpose use and is consumed as dry seeds, green vegetable, or as processed food. Its products are a rich source of high-quality protein in the human diet, while its dry seeds, green haulm and dry straw are used as animal feeds [1]. Faba bean seeds are used for human nutrition. The grain of faba bean contains a high protein content of 24-33% [2]. Faba bean is a diploid (2n = 12 chromosomes) crop which is one of the most vital food legumes standing in the world fourth after garden pea, chickpeas and lentil. It is cultivated in the temperate and subtropical regions of the world [3].

Ethiopia is the world's second largest producer of faba bean next to China; its share is only 6.96 % of world production and 40.5% within Africa (Chopra., *et al.* 1989). Farmers who adopted the new faba bean technologies, whether the full package or individual components, obtained significantly higher yields. Simply replacing traditional varieties with improved ones led to gains of 18% in Egypt, 8% in Sudan and 42% in Ethiopia (ICARDA, 2008). Faba bean (*Vicia faba* L.) is among the most important pulse crop in the highlands and mid-highlands of Ethiopia. It was the first crop among the pulses grown in the country both in terms of area coverage and volume of annual production. Currently, they occupy about 443,107.88 hectares of land with an annual national production of 8,389,438.97 tones with an average yield of 1893 kg $ha^{-1}$.

Faba bean serves as a daily food and as cash crop in many parts of the country (Hawtin and Hebblethwaite, 1983). This crop is a multipurpose crop. It is vital for soil fertility, human nutrition, animal feeding and industry purposes. The pulses production and productivity are constrained by several biotic and abiotic stresses, of which lack of improved varieties, shortage of certified seeds, diseases such as rust, powdery mildew and root rot, insect pests such as aphids and low soil fertility are the major ones and becoming a major challenge to food security. In addition to this, its production in Ethiopia is limited and fails to face the increasing local consumption of seeds due to gradual decreases in its average yield. So, increasing crop production is the major target of the national agriculture policy and can be achieved growing high yielding and stable cultivars under favorable environmental conditions.

In Ethiopia, the productivity of faba bean is far below its potential due to the aforementioned factors (Mussa., *et al.* 2008). Winch [2] reported that, the productivity of faba bean in Ethiopia is quite lower (15.2 qt/ha) [4], as compared to in UK, which is about 30 qt/ha). In Ethiopia, there are about 29 improved faba bean varieties which are adapted to different agro-ecology and have different disease reaction (Crop variety register issue No.17, 2014). Farmers in the Ethiopia commonly used to cultivate local varieties (Thijssen., *et al.* 2008). Therefore, growing of high yielding varieties of faba bean is crucial to ensure the sustainability of the crop and food security [5-9].

Even though faba bean is important crop as national and internationally, the production and productivity of faba bean in Southern

Ethiopia is low 1.64 t/ha due to poor participation of farmers in the selection process, lack of improved varieties, poor agronomic practice, diseases and insect pests. Some improved faba bean varieties has been released by the different regional and federal research centers but farmers are still stress on few local faba bean varieties. Farmers have little information about the released varieties both agronomic practice and their economic importance because the varieties were released without the involvement of farmers and the released varieties had not yet scientifically demonstrated in the study area. Therefore, growing of high yielding varieties of faba bean is key to guarantee the sustainability of the crop and food security. This can be attained by continuous pulse research to develop high yielding, pest resistance/tolerant, excellent in other agronomic traits, high quality, and widely adapted varieties that go with different cropping systems and farming conditions. Moreover, adequate seeds of released varieties should be made available to the farmers and participatory demonstration of the variety to enhance technology adoption and diffusion.

### Objectives

- To demonstrate the faba bean variety to enhance rapid diffusion and adoption
- To evaluate farmers preferences and feedback information
- To study direct cost benefit analysis of the demonstration plots.

## Materials and Methods

### Selection of participant farmers

For conducting participatory pre extension demonstration of faba bean varieties three Kebeles were selected from Chencha Woreda (2 Kebeles) and Bonke woreda (1 Kebele) purposively based on the relevant agro-ecology for the specific commodity, twenty four (24) participant farmers (beneficiaries) from all kebele were screened based on the willingness to participate and the availability of sufficient farm land for demonstration. Farmers research group (FRG) were organized and capacitated through different trainings and experience sharing.

### Implementation procedure

Ten by ten (100m$^2$) plot size area was prepared for each variety (Dosha and local) by inter and intra spacing of 40cm and 10cm respectively and 100kg/ha seed rate were used and 100 kg NPS fertilizer applied. The varieties were tested for their adaptation to our area by Arbaminch Agricultural Research Center (AMARC). The seeds were supplied by the project and distributed by AMARC in collaboration with the woreda experts and Development Agents of the respective kebeles. As part of the intervention activities, training on agronomic practices was given to farmers, DAs and experts. Farmers evaluate the demonstration plots three times during crop stages (at seed emergency, at flowering, maturity stages). Finally, in order to evaluate the performance and final outputs of the varieties and share the lessons with different stakeholders', field days were organized in the fields of beneficiary farmers and technologies were promoted to mass.

### Data collection methods

Both primary and secondary data were collected from various sources using different methods. The agronomic data were collected by the researchers directly from the field. The data on grain yield of the varieties were taken from 10*10 (100m$^2$). The data were collected from all plots of the beneficiary farmers. In addition, perception data were collected using focus group discussion during evaluation periods. The respondents were responding their perception level on the relative advantage of each characteristics of the variety compared to local/previously introduced varieties. Secondary information was also collected from the kebele, woreda experts from Office of Agriculture and Rural Development.

### Data analysis

All data were collected and the collected data were analyzed by simple descriptive statistics and farmers preferences by matrix rankings.

## Results and Discussions

### Yield performance

### Yield performance of farmers field

Yield data was collected from 24 farmers' field and the mean yield performance of farmers field at Ginko kebele was 22.81qt/ ha and 19.59 qt/ha of dosha and local respectively. From Zolo Kebele the mean yield of 33 qt/ha and 27.56 qt/ha of dosha and local respectively obtained. Finally, 20.48 qt/ha and 16.44 qt/ha of dosha and local were obtained.

| Location | Variety | |
|---|---|---|
| | Dosha (qt/ha) | Local(qt/ha) |
| Ginko (mean yield) | 22.81 | 19.59 |
| Zolo (mean yield) | 33 | 27.56 |
| Yela (mean yield) | 20.48 | 16.44 |
| Grand Mean | 25.5 | 21.2 |

**Table 1:** Yield performance of farmers field. Note: 1 Qtl=100 k.g.

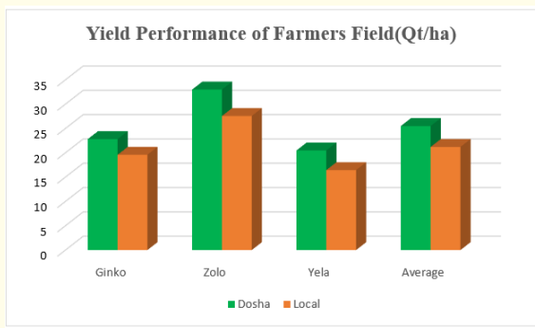


**Figure 1**

On average, 25.5 quintal per hectare and 21.2 quintal per hectare of Dosha variety and local respectively were obtained from both chencha and bonke woreda.

### Yield performance of FTCs

| Location | Variety | |
|---|---|---|
| | Dosha(qt/ha) | Local(qt/ha) |
| Ginko | 23 | 28.5 |
| Zolo | 37.5 | 34 |
| Yela | 31 | 25 |
| Mean | 31 | 29 |

**Table 2:** Yield performance of FTCs.

The average yield that were obtained from all FTCs from Dosha variety were 31 quintal per hectare and that of local were 29 quintals per hectare. Improved variety shows better performances in both FTCs except Ginko Kebele.

### Yield increase and advantage

| Location | Yield Increase(kg) | | Yield Increase | Yield Advantage (%) |
|---|---|---|---|---|
| | Dosha | Local | Dosha | Dosha |
| Ginko | 2281 | 1959 | 322 | 16.44 |
| Zolo | 3300 | 2756 | 544 | 19.74 |
| Yela | 2048 | 1644 | 404 | 24.6 |
| Mean | 2550 | 2120 | 423.4 | 20.25 |

**Table 3:** Yield Increase and Advantage.

Dosha shows 322 kg yield increase and 16.44% yield advantage over local variety in Ginko Kebele. In Zolo Kebele Dosha variety shows 544 yield increase and and 19.74% yield advantage over local variety over local and finally in yela Kebele, Dosha showed 404 kg yield increase and 24.6% yield advantage over local variety. Generally, Dosha shows 423.4 kg or 4.234 quintal yield increase and 20.25% yield advantage over local variety.

Farmers pair-wise ranking selection criteria were conducted thoroughly. Before beginning of the selection process, selected farmers from the districts were asked to set their priority selection criteria. Selection criteria of farmers in the study area were based on an extensive discussion and agreement and farmers set criteria during seed emergency, flowering, and maturity stage of the crop and shown as below. The criteria that farmers used in identifying the best suitable and productive varieties depends on the existing constraints and opportunities farmers faced in their location. Accordingly Seed emergency, height of the variety, pod number, seed number, earliness, disease and pest resistance, stem strength, seed size, yield and marketability are identified farmers criteria.

### Farmers preference ranking

| Selection Criteria | A | B | C | D | E | F | G | H | I | J | Total | Rank |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | | A | A | A | E | F | G | H | I | J | 3 | 6 |
| B | | | B | D | E | F | G | H | I | J | 1 | 7 |
| C | | | | C | E | F | G | H | I | J | 1 | 7 |
| D | | | | | E | F | G | H | I | J | 1 | 7 |
| E | | | | | | F | E | E | I | E | 7 | 2 |
| F | | | | | | | F | F | I | F | 8 | 1 |
| G | | | | | | | | H | I | J | 4 | 5 |
| H | | | | | | | | | I | J | 5 | 4 |
| I | | | | | | | | | | I | 8 | 1 |
| J | | | | | | | | | | | 6 | 3 |

**Table 4:** Pair wise matrix ranking. Seed emergency (A) Height of the variety (B) Pod number (C), Seed number (D), Earliness (E), Disease and pest resistance (F), Stem strength (G), Seed size (H) Yield (I) Marketability (J).

Farmers ranked the selection criteria depending on the relative importance'. Disease and pest resistance issues, high yielding potential of the variety, earliness of the variety is the foremost criteria for farmers in the demonstration areas.

Farmers preference criteria were conducted and they compare and rank improved variety with standard checks by 10 different criteria (see table 4). Farmers who participated and evaluated the demonstration plots were representative to the area and having long experience in farming.

| Variety | Location | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Zolo | | | Ginko | | | Yela | | | |
| | Total score | Mean score | Rank | Total score | Mean score | Rank | Total score | Mean score | Rank | Over all |
| Dosha | 36 | 3.6 | 1 | 32 | 3.2 | 1 | 35 | 3.5 | 1 | 1 |
| Local | 27 | 2.7 | 2 | 31 | 3.1 | 2 | 25 | 2.5 | 2 | 2 |

**Table 5:** Farmers preferences.

Farmers ranked each variety for individual traits considered important by them and ranking of varieties were done on a scale of 1-4, 4 being the highest score representing very good and 1 being very poor.

According to the above ranking and scoring (see table 4) of Faba bean variety, the highest score was recorded for Dosha variety (3.6 in Zolo and 3.5 in yela) and the lowest score was recorded for local check. Farmers ranked Dosha variety by its earliness, disease and pest resistance, its high yielding potential and its quality seed for market.

### Direct cost-benefit analysis

Cost benefit analysis is the tools to identify the incomes incurred and the costs for obtaining the net benefits. Net benefit is calculated through reducing the gross benefit less the total costs. (Net Benefit= Total Revenue-Total Cost).

| Items | Quantity/ Unit | Unit price/cost | Dosha | Local |
|---|---|---|---|---|
| Average yield (kg/hectare) | Kg | ETB | 3100 | 2900 |
| Adjusted yield (-10%) | -10% | | 2790 | 2610 |
| | In ETB | 10ETB | 27,900 | 26,100 |
| Total gain in birr(A) | | | 27,900 | 26,100 |
| Fertilizer costs in kg | NPS | 100 kg | 1200 | 1200 |
| Seed cost | 100 kg | ETB (Dosha=20, Local=10) | 2000 | 1000 |
| Land preparation | Ha | ETB | 1000 | 1000 |
| Labor costs per day | Sowing | 1day*10person*50birr | 500 | 500 |
| | 1st and 2nd Weeding | 2day*10person*50birr | 1000 | 1000 |
| | Fertilizer application | 1day*10person*50birr | 500 | 500 |
| | Harvesting and threshing | 1day*10person*50birr | 2000 | 2000 |
| Transporting Cost | | | 1000 | 1000 |
| Total costs(B) | | | 9200 | 8200 |
| Net Benefit(A-B) | | | 18,700 | 17,900 |

**Table 6:** Cost benefit analysis.

The net benefits that were obtained from Dosha variety after harvesting were 18,700 ETB and that of local was 17,900 ETB. Relatively Dosha gave better net benefits than Local variety.

According to CIMMYT 1988, the yield obtained initially were adjusted at -10% because the adjusted yield for a treatment is the average yield adjusted downward by a certain percentage to reflect the difference between the experimental yield and the yield farmers could expect from the same treatment. Experimental yields, even from on-farm experiments under representative conditions, are often higher than the yields that farmers could expect using the same treatments. Because of:

- **Management:** Researchers can often be more precise and sometimes timelier than farmers in operations such as plant spacing of the plant, weed control or fertilizer application.
- **Plot size:** Yields estimated from small plots often overestimate the yield of an entire field because of errors in the measurement of the harvested area and because the small plots tend to be more uniform than large fields.
- **Harvest date:** Researchers often harvest a crop at physiological maturity, whereas farmers may not harvest at the optimum time. Thus, even when the yields of both researchers and farmers are adjusted to constant moisture content, the researchers' yield may be higher, because of fewer losses to insects, birds, rodents, ear rots, or shattering.
- **Form of harvest:** In some cases, farmers' harvest methods may lead to heavier losses than result from researchers' harvest methods. This might occur, for example, if farmers harvest their fields by machine and researchers carry out a more careful manual harvest.

## Conclusion

Two varieties of faba bean (Dosha and local variety) were demonstrated on 24 farmers' fields and at three different FTCs on 100m2 areas by seed rate of 100kg/hectare, 40cm*10cm of inter and intra spacing. Finally, field day was organized and the demonstration plots visited by Kebeles and neighbor kebeles farmer, Kebeles development agents, and Woredas personnel. Yield data were collected and obtained 25.5 Quintal/hectare of Dosha and 21.2 Quintal/hectare of Local variety. Generally, farmers were select dosha variety as best by evaluating the variety through different criteria.

It was recommended that, it is better to disseminate disease and pest resistant and high yielder varieties through scaling up to enhance dissemination and diffusion. It is better to train farmers on agronomic practices from production to post harvest handling to boost the production and to maximize yields.

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