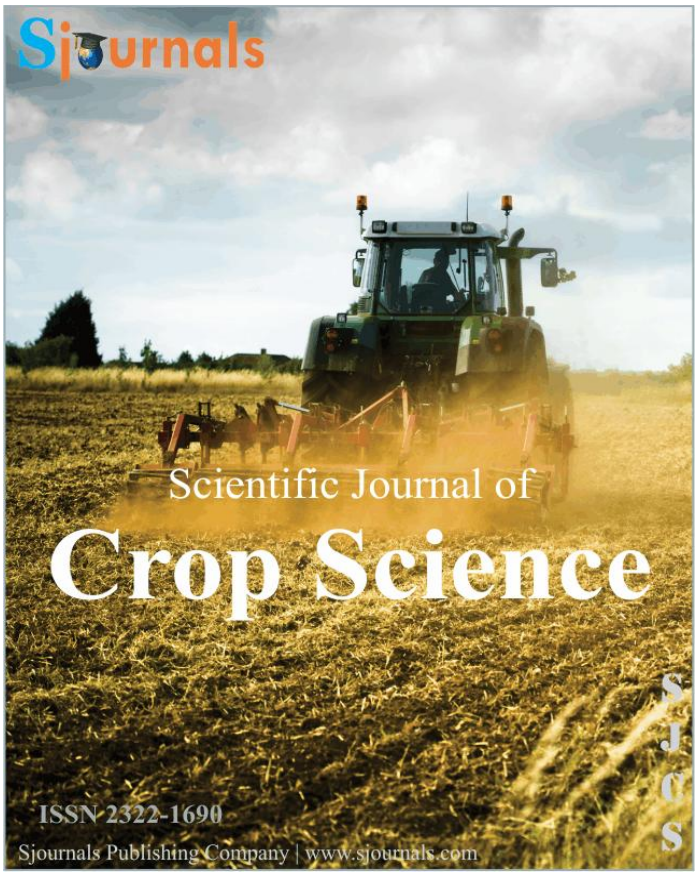


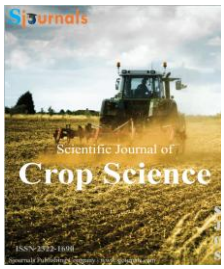
Scientific Journals

Scientific Journal of Crop Science (2018) 7(11) 363-370
ISSN 2322-1690
doi: 10.14196/sjcs.v7i11.2540

Contents lists available at Sjournals

Scientific Journal of **Crop Science**

Journal homepage: www.sjournals.com



Original article

Promotion of improved faba bean technologies through community based seed multipliers in Bale zone, Oromia National Regional State, Ethiopia

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ARTICLE INFO

Article history,
Received 10 October 2018
Accepted 11 November 2018
Available online 18 November 2018
iThenticate screening 12 October 2018
English editing 10 November 2018
Quality control 17 November 2018

Keywords,
Popularization
Dissemination
Walki
Gabalcho
Community based
Farmers' feedback
Yield

ABSTRACT

This scaling up/out activity was initiated with the main objective of popularizing and disseminating proven faba bean technologies as well as to serve as a break crop for malt barley production. Dinsho and Goba districts of Bale zone were selected purposively based on their potential for faba bean production. A total of 50qt Walki and 135qt Gabalcho were distributed to 274 farmers and planted on 103ha in 2016 and 2017 cropping season. The spacing of 40cm between rows with the recommended seed rate of 180 kg/ha and fertilizer rate 100 kg NPS was applied during row planting time. Training was given to more than 800 hundred farmers and other stakeholders on faba bean production and management packages. Field days and field visits were organized to evaluate the performance and to communicate on field progress of the varieties. A total of 466 individuals were participated on these promotional events during the project period. Yield data was recorded and analyzed using mean while farmers' feedback about the technology was assessed and interpreted using qualitative narration. The result of descriptive

statics revealed that the overall mean yield of Walki and Gabalcho were 36 and 33qt ha^{-1} respectively. All participant farmers were interested with the stands of the two varieties in terms of pods per plant, seeds per pod, seeds per plant, stem strength, good plant height, disease tolerance, relative yield advantage and seed size. The gross income/benefit obtained as a result of using the improved varieties of faba bean (Walki and Gabalcho) was 64,800.00 ETB and 59,400.00 ETB per hectare, respectively. But, the gross marginal profit was 45,830.00 ETB and 40,430.00 ETB for Walki and Gabalcho, respectively. Since, the varieties widely accepted by the target community (especially Walki on Vertisol), the Agricultural and Natural Resource office in all levels in collaboration with other stakeholders should focus on the extension and popularization of the varieties with the recommended full packages.

1. Introduction

Faba bean (*Vicia faba* L.), which is one of the most important cool-season food legumes grown in Ethiopia, is originated in the Near East and it is also one of the earliest domesticated legumes after chickpea and pea. China is currently the world's leading producer, accounting for approximately 60% of the total (FAO, 2014). Other important production regions are northern Europe, the Mediterranean, the Nile Valley, Ethiopia, Central and East Asia, Oceania and the Americas. Ethiopia is considered as the secondary center of diversity and also one of the nine major agro-geographical production regions of Faba bean. It is grown as field crops throughout the highlands and is most common in mid altitude between the altitudes 1800 m.a.s.l and 3000 m.a.s.l (Asfaw et al., 1994).

Ethiopia ranks 2nd in area coverage in legume production next to china and 4th in productivity in the world. Faba bean production ranks the 1st among pulse crops in area and volume of production in the country. 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).

While access to and availability of seed has the potential to greatly improve smallholder productivity, there is currently a substantial gap between the country's production of commercial seeds and farmers' demand for, knowledge of, access to, and usage of these seeds. The annual supply of improved seed through the formal seed system is only 10% to 20% (Dawit et al., 2010). Informal seed production (farmer-based seed multiplication and farmer-to-farmer seed dissemination mechanisms) started before 10 years after political, economic and social reforms in Ethiopia in 1991 (Minilek et al., 2012). It accounts for 90% of the seed and the share of improved seed is less than 10% (Zawdie et al., 2008). This middle sector increases the supply of seed to smallholder farmers in terms of kind, quantity, quality and access (at right time, place and reasonable price) in their locality.

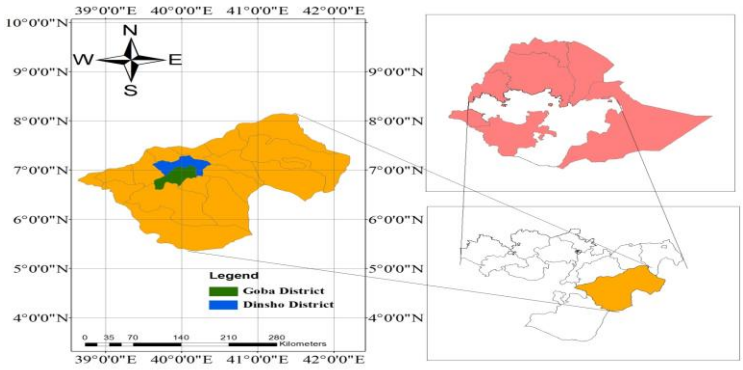
Bale zone is characterized by integrated (mixed) farming systems in which most of the crop areas were under cereal production. Faba bean are the best break crops for cereal production. Bread wheat grown after faba bean gave higher grain yield than after cereal crops with a yield advantage of 15% (Sinana ARC Profile, 2014). Cognizant of this, since 2015, ICARDA project has implemented faba bean production as a break crop for malt barley production meant for agro-processing industries.

Consequently, promotion, popularization and dissemination of improved faba bean technologies activity was initiated by the project with the objectives of improving farmers' knowledge, skill and attitude through multidisciplinary participatory training on faba bean production and management packages, strengthening stakeholders' linkage, to break mono-cropping problem and increase production and productivity in the study area.

2. Materials and methods

2.1. Description of the study area

The research was carried out in Dinsho and Goba districts of Bale zone, Oromia National Regional State (ONRS), Ethiopia. The districts were selected purposively based on their potentiality to faba bean production. 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. Stakeholder analysis (SA), and roles and responsibility sharing among actors

In enhancing faba bean technologies dissemination, the SARC was closely working and has made frequent consultation with its respective stakeholders. Scaling up/out activity should be done by different actors in partnership and collaborative approach. So, SA is highly important for institutional arrangement (who does what?) before embarking on the activity. Thus, SA was undertaken to identify potential stakeholders. Points such as: Who are the stakeholders? How big is their stake? How much they are closer to the project? What are their roles, duties and responsibilities in implementing the activity? How does the synergy support the opportunities to bring the required impact? Finally the roles, duties and responsibilities of each actor were clearly stated and shared for implementing the activity.

Table 1
Stakeholder roles and responsibilities in implementing the activity (2016 and 2017).

Stakeholders	Roles and responsibilities
Sinana Agricultural Research Center (SARC)	✓ Coordination and facilitation ✓ Provision of faba bean (Walki and Gabalcho) technologies ✓ Provision of training ✓ Technical backstopping ✓ Organize field days and ✓ Supervision and joint monitoring and evaluation with zone and district agricultural development office ✓ Follow up the revolving seed
ICARDA project	✓ Purchasing of faba bean (Walki and Gabalcho) technologies ✓ Purchasing of inorganic fertilizer (NPS and Bio-fertilizer)
Agriculture Development Office (at Zone, district and kebele level)	✓ Assist in site and participant farmers' selection ✓ Follow up day to day activities from zone to kebele level ✓ Assist in providing training ✓ Facilitate seed distribution ✓ Jointly organize and participate on field days

Individual farmer (faba bean growers) and group of farmers Cost sharing	✓ Allocate land and perform required agronomic practices ✓ Actively participate in the training for capacity building (on knowledge, skill and attitude) ✓ Jointly organize and participate on field days ✓ Share skills and experiences to neighboring farmers ✓ Transfer produced seed to surrounding farmers and ✓ Finally, supply excess produced seed to cooperatives
Cooperatives/Unions OSE Bale branch	✓ Agricultural input supply ✓ Facilitate seed marketing

2.3. Site and farmers selection

Pre-scaling up of improved faba bean technologies were undertaken in the main season (Bona) for consecutive two years (2016 and 2017). Goba and Dinsho districts of Bale zone were selected purposively as study sites based on their potential for faba bean production. Two potential faba bean growing kebeles, namely, Abakara and Mi'o from Dinsho district and Walta'i Kubsa and Fasil Angaso/Walta'i Azira kebles from Goba districts were selected for the activity.

Before starting the field work, selection of farmers were carried out in collaboration with crop extension experts from woreda Agriculture and Natural Resource Office and development agents (DAs). Farmers were selected based on land ownership, ease for cluster, their interest and motivation in carrying out the recommended management practices, and their commitment to deliver/share the technologies to other farmers by considering the gender disaggregation and other socio-economic variables. A group of farmers was formed for community based seed production purpose by considering clustering approach.

2.4. Material used and field design

Two recently released improved faba bean varieties Walki and Gabalcho were selected and validated by participant farmers during demonstration phase. 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 field work. The spacing of 40cm between rows was used. The recommended seed rate of 180 kg/ha was used by drilling in the prepared rows. The recommended inorganic fertilizer rate 100kg NPS was applied during planting time. Depending on weed infestation, two effective weeding were done; the first with cultivation at one month after sowing and the second at two months after sowing of improved faba bean varieties. All farm operations land preparation, planting, first and second weeding, cultivation, agro-chemical spray (fungicide for chocolate spot), harvesting, threshing were carried out by hosting farmers with close supervision of researchers and Agricultural experts with practical orientation prior to planting until harvesting of the crop.

2.5. Training

The effectiveness of the work is measured in terms of the changes brought about in the knowledge, skill and attitude, and adoption behavior of the people but not merely in terms of achievements of physical targets. Hence, training was given to farmers, DAs, and agricultural experts on faba bean production techniques and management packages, agro-chemical applications and safety precautions. Stakeholders such as zone and district level agriculture development office, unions, private service providers, Arsi-Bale Plant Health Clinic office, zone and district level agricultural inputs regulations and quarantine experts were invited and participated during consultation meeting and training.

2.6. Field day

Field day is a method of motivating people to adopt new practices by showing what has already achieved under field conditions. In other words, it is to show the performance and profitability of new practices/technologies/innovation and to convince about the applicability. Thus, mini field days were organized at each site in order to involve key stakeholders and enhance better linkage among relevant actors. Discussion session and result communication forum were also organized.

Field visit was also arranged to create awareness and farmers shared experience and knowledge. Regular joint monitoring and evaluation (follow up actions) and provision of technical advice were undertaken at different

crop stages based on necessary emerging knowledge/skill and technical advice needs.

2.7. Data type, method of data collection and analysis

Amount of input distributed, harvested yield, total number of farmers participated on training, field visits and field days were recorded by gender composition. Farmers' feed-back (likes and dislikes, which is the base for plant breeding process and perceptions towards the performance of the technologies) was identified. The data collection method employed were field observation and focus group discussion with experts, hosting farmers and group of farmers. Descriptive statistics was used to calculate the mean yield harvested.

3. Results and discussion

3.1. Input distributed and yield obtained

The following Table describes the amount of seed distributed to farmers in the study areas. The distributed initial seed was used as revolving seed to reach other farmers in the area. This system is a relatively good low-cost system that can maintain kind, quantity, quality and access (at right time, place and reasonable price) of the seed to a level satisfactory to neighboring farmers locally. The amount of input distributed and total yield harvested in the two years of project duration was summarized in the following Table.

Table 2
Amount of seed distributed and yield harvested in the 1st and 2nd years (2016 and 2017).

Year	Cropping season	Locations	Variety	Total seed (qt)	Farmers	Total Area (ha)	Yield obtained (qt)
1	2016	Dinsho	Walki	25	40	14	212.5 (from 8.5ha) 5.5ha lost by frost
		Goba	Walki	25	39	14	225 (from 9.6ha) 4.4ha lost by frost
2	2016	Bio-fertilizer purchased for faba bean CBSM 520pkt					
	2017	30 qt Walki revolved seed			60	16.7	601.2
	2017	Dinsho	Gabalcho	69	93	38.3	987.5
		Goba	Gabalcho	66	102	36.7	957.5
	2017	Bio-fertilizer purchased for faba bean CBSM 800pkt					

3.2. Economic return obtained by the participant farmers

The scaling up/out process of Walki and Gabalcho varieties through Community Based Seed Multipliers (CBSM) has shown change in helping the improvement of the annual income of hosting farmers in the target areas. The economic gain obtained as a result of using the technology was calculated at hectare base and summarized in the Table below.

Table 3
The economic return obtained by the participant farmers from a hectare of land.

No	Variety	Mean yield obtained (qt/ha.)	Market price (birr/qt)	Total revenue or TR (Total output x Unit price)	Total variable cost or TVC (ETB/ha)	Gross Marginal Profit or GMP (TR-TVC)
1	Walkii	36	1800.00	64,800.00	18,970.00	45,830.00
2	Gabalcho	33	1800.00	59,400.00	18,970.00	40,430.00

NB: The price is the prevailing price obtained from the study areas.

As it is revealed in the above Table, the gross income/benefit obtained as a result of using the improved varieties of faba bean (Walki and Gabalcho) was 64,800.00 ETB and 59,400.00 ETB per hectare, respectively. But, the gross marginal profit was 45,830.00 ETB and 40,430.00 ETB for Walki and Gabalcho, respectively. The production cost per hectare (total variable cost) calculated for faba bean production included seed cost, fertilizer cost, ploughing, cost for two times weeding and cultivation, cost of Mancozeb 80% WP, labour cost for spray, cost of harvesting, threshing, transporting and cost of bag for store.

3.3. Training for capacity building

Participatory training was given by SARC multidisciplinary team in the participant districts of Bale zone. The training was given at Robe town. The title of the training was on available improved pulse crops technologies and utilization, faba bean (both in quantity and quality) production and management packages, seed multiplication techniques, major faba bean diseases and their control measures, agro-chemicals utilizations (time, rate, etc.) and safety precautions, the importance of crop rotation to break cereal based mono-cropping practices in the project area through pulse crops (commodity) integration, the importance of community based seed multiplication, how to establish and implement, how to do seed as a business venture and the concept of seed and grain value chain. During 2016 and 2017, a total of 800 participants (772 farmers, 16 DAs and Supervisors, 12 agricultural experts and 8 researchers) were participated on this training, out of which 30% was women farmers.

3.4. Field day organized

Field days were organized at each district at physiological maturity stage of the crop in which a total of 382 participants (350 farmers from all category, 12 DAs, 4 Supervisors, 12 agricultural experts and cooperative leaders and 4 researchers) were participated on this extension/promotional event. Participants were shared their best experiences especially how to preserve the quality seeds of faba bean varieties (by manual harvesting and other seed cleaning and preservation mechanisms).

In addition, participant farmers were shared information on the local seed exchange system (informal) and the types of available improved faba bean varieties at their hand and ways to exchange and preserve them. Finally, fruit-full discussion was undertaken among farmers and researchers especially on cereal crops based mono-cropping practices and faba bean diseases problems in the area.

3.5. Feedback through focused group discussion (FGD)

Walki was well performed on vertisol than Gabalcho. Due to the indeterminate nature of faba bean, both 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. All participant farmers were very interested with the stands of Walki and Gabalcho especially: 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. Furthermore, faba bean has ecological and economic importance and used for food, improve soil fertility, income source and attractive market price food security. FGD result showed that the problem of pulse crop production in the area is lack of machinery technologies that ease the burden (labour intensive) and difficulty of faba bean harvesting and threshing. Good awareness and confidence were created among stakeholders about Walki and Gabalcho varieties (demand pull). Lessons that learned through this activity, on-farm seed production and seed dissemination system for pulse crops through community based seed multiplier was improved. The scaling up/out program under ICARDA project has contributed significant role in improving the access of recently released faba bean varieties/seeds to the smallholders since 2015. It served as the main source for the majority of faba bean varieties (seed) that are currently in production in the target areas. This activity has increased the availability of faba bean seeds for farmers in their locality and enabled farmers to produce faba bean seeds which informally transferred to the surrounding farmers through seed exchange, gifts, sells and borrowing. Besides, clustering and group approach were enhanced during implementation period. Since the activity was accompanied by trainings, awareness creation activities like field days, frequent joint supervisions and on field advisory programs; farmers in target areas have been equipped with the skills and knowledge of faba bean seed and grain production and management practices.

4. Conclusion

Walki and Gabalcho were the varieties popularized and transferred to the producers since 2015. The average yield of the two varieties was 36 and 33 quintal per hectare, respectively. Capacity of farmers and agriculture experts (DAs and SMSs) has been built through trainings, awareness creation and field days in 2015 to 2017. The activity requires concentrated involvements of different stakeholders (multi-stakeholder approach) and other approaches including analysis of existing situation. Our farmers should not only be seed receivers but also seed growers. Thus, community based seed multiplication and dissemination mechanism is the best way with close supervision of DAs, agricultural experts and researchers.

Acknowledgments

This improved faba bean technologies promotion work in Bale zone was accomplished by the financial support of ICARDA project. The authors acknowledged the project funding stakeholders (USAID and others) for the support. We are greatly indebted to Oromia Agricultural Research Institute (OARI), Sinana Agricultural Research Center (contributed vehicles and other facilities for successful completions of this work), multidisciplinary team of SARC researchers (Breeder, Agronomist, Weed Scientist, Pathologist, Entomologist, Economist and Extensionist) and other collaborating stakeholders found at zone and district level for giving us all round supports during the research work.

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How to cite this article: Biftu, A., Tadese, T., Dargie, R., Teshome, E., 2018. Promotion of improved faba bean technologies through community based seed multipliers in Bale zone, Oromia National Regional State, Ethiopia. Scientific Journal of Crop Science, 7(11), 363-370.