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Research Article

Improving the Livelihood of Smallholder Farmers through Scaling out of Improved Chickpea Variety with its Production Package in Vertisols Areas of North Shewa Ethiopia

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Abstract

Chickpea (Cicer arietinum) is an ancient crop that belongs to the legume family and high-value pulse adapted to deep black soils in the cool semi-arid areas of the tropics, sub-tropicsas well as the temperate areas.The paper implied the contributions of pre scaling up of improved chickpea technologies in high potential chickpea growing areas. The activity was conducted in the vertisols areas of North Shewa of Amhara Region to increase farmers' capacity in chickpea production and productivity. Moretina jiru woreda was selected purposively based on the production potentials of the areas. Two kebeles were selected from this woreda and more than 207 farmers were selected from both kebeles in area clustering approach. The improved variety of "Habru" and recommended bio-fertilizer were delivered for selected farmers in seed revolving base. Training was given for farmers and agriculture experts on chickpea seed and grain production package, post harvest handling, marketing and nutrition. Field day was arranged for wider demand creation and further promotion of the crop at the potential areas. Habru improved chickpea variety with improved agronomics practices gave yield up to 3.5tons per hectare at farmer's field which is more than three folds compared to the local variety with local management. More than 61 ha of land were covered by the Habru chickpea variety with bio-fertilizer during the production year. The improved chickpea variety was accepted and attracted the attention of farmers, administrative bodies and union leaders during field day due to high productivity and large seed size for exporting purpose. As a result, farmers in Moretina jiru wereda and similar potential vertisols areas of the zone should use Habru variety of chickpea with integrated management option in order to increase their chickpea production and generate more income for their livelihood as well as for home consumption to improve family nutrition status.

Keywords: Chickpea, Variety, Habru, Training and Field day

INTRODUCTION

Chickpea (*Cicer arietinum*) is an ancient crop that belongs to the legume family. Chickpea is a high-value pulse crop that is adapted to deep black soils in the cool semi-arid areas of the tropics, sub-tropics as well as the temperate area. It has been grown in Africa, the Middle East and India for centuries and is eaten as a dry pulse or green vegetable. Chickpea hasthree major importance like Source of human food and animal feed (protein (19%), carbohydrates (60%), minerals (phosphorus, calcium, and iron) (Ibrikci *et* al., 2003). It returns a significant amount of residue nitrogen to the soil and adds organic matter that improves the fertility of the soil (Pande *et* al., 2005) as well as rotation crop with several cereals like tef or wheat. Chickpea is the most important leguminous food grain in the diets of people **(Figure 1)**. It is grown on about 10.3 million hectares worldwide and its annual production averages 7.9 million tones (Monyo, and

Figure 1. Leaflet about improved chickpea production and home consumption.

Figure 2. Field performance of the improved chickpea variety of Habru.

Gowda, 2014). Ethiopia is the largest producer of chickpeas in Africa and is ranked number seventh globally.Ethiopia's chickpea productivity and yield gain is the highest in top ten producing countries of the world (FAOSTAT, 2012-14.) Thoughchickpea is produced throughout Ethiopia, production is concentrated in the Amhara and Oromia Regions, which together account for over 95% of chickpea production. Low production in the other regions is due to a combination of unsuitable agro-climatic conditions, poor access to improved varieties, limited market access leading to less commercialization, and low population density (Working Strategy Chickpea Value chain, 2013).

There are two main commercial classes of chickpea: Kabuli and Desi. Kabuli have large seed, cream colored, round seeds. They are used for salads vegetable mixes. Plants are 2 to3 feet tall with white flowers stay firm after canning are the most marketable types for domestic use **(Figure 2)**. The Dessi types are shorter plants than Kabuli, have smaller leaves, and the seeds come in a variety of colors.As a country whose economy is predominantly dependent on agriculture, Ethiopia's trade is highly dependent on the export of wide varieties of agricultural products. The country has earned 48,625,586.00 USD by exporting chickpea in 2013. In Ethiopia chickpea is a widely grown multipurpose crop across the country. It is valued for its nutritive grain with high protein content, 25.3-28.9 % (Hulse, 1989). The growing demand in both the domestic and export markets provides a source of cash for smallholder producers. It increases livestock productivity as the residue is rich in digestible crude protein content compared to cereals. Chickpea seeds are eaten fresh as green vegetables or added to salads, parched, fried, roasted, and boiled; as snack food, sweet and condiments. In other countries like Asians, seed flour can be used as soup and to make bread; prepared with pepper, salt and lemon it is served as a side dish for snacks and sweetmeats (Saxena, 1990). Young plants and green pods are eaten like spinach. Chickpea is one of the main pulse crops grown in Ethiopia next to fababean and haricot bean. It covers 1.77% of crop share in production and its productivity is 1.71 tons per hectare.

The association of Rhizobium and pulse plants helps in improving fertility of soil and it is a very low cost method of nitrogen fertilization in legumes. Chickpea could be inoculated with a specific Rhizobium strain for Cicer species to ensure effective nodulation and nitrogen fixing activity **(Figure 3)**. Chickpea has the ability to fix 60-80% of its nitrogen requirements through fixation. Kabuli chickpeas are excellent nodulators and nitrogen fixers (Wani *et* al., 1995). Desi chickpeas are good nitrogen fixer under ideal conditions but may be a little sensitive to adverse environmental conditions (Saskatchewan pulse growers, 2018). The traditional Desi varieties used by most of the producer farmers are small-seeded and are mainly traded locally because international markets favor larger-seeded Kabuli varieties. The potential of vertisols areas in North Shewa Amhara for early planting of chickpeaweremore than 26.24% which were covered by local chickpea varieties with local management practices of late planting, broadcasting and no inoculants which resulted low productivity of below 1.3 ton ha^{-1}(office of agriculture, 2016). The average yields are low, but higher than those in the rest of Africa, perhaps due to the good soils and growing conditions for the crop in the highlands of Ethiopia (Shiferaw *et* al., 2004). The activity was implemented based on the participatory evaluation results of previous worksin 2017 production year. The purposes of this activity were to create wider demand on chickpea technologies and strengthen linkages on the potential actors to enhance technology dissemination.

Figure 3. Farmers and experts participation in Field day and field monitoring.

MATERIALS AND METHODS

Area description

The activity was conducted at Moretina jiru woreda of North shewa Zone of Amhara Region for one year. The area is characterized by a unimodal rainfall pattern and receives an average annual rainfall of 929 mm. The annual average maximum and minimum temperatures are 21.4 and 9.0 °C, respectively. Vertisols are the dominant soil type in the areas. The crops widely grown in the study area are wheat, tef, faba bean and lentil, whereas chickpea has low area

coverage and mostly grown on residual soil moisture at the end of the rainy season. The altitude of the woreda is 2600 masl for all intervention areas.

Map of Study Area

Approach followed during the implementation of these activities

Planning work shop was coordinated for announcement and responsibility sharing by inviting concerned zone and woreda experts and leaders, union and NGOs coordinators before starting to implementeach year plan.The concerned researchers and center director from research center present the past and future activities**.** The woreda experts selected intervention kebeles and then arranged training, input delivery and planting date action plan forming task force group and they presented their group work on the workshop. Memorandum of understanding (MoU) was signed between the research centers and implementing woreda complied and responsibility sharing was undertaken as follows:

- Farmers selection and land clustering, seed distribution, planting, seed repayment is to be done by woreda and kebele experts;
- Training and seed provision, field day preparation etc is to be done by research center;
- Monitoring and evaluation is to be done by both research center and office of agriculture.

A participatory and multi-disciplinary extension approaches were used to disseminate and popularize the new technologies easily. Area clusteringwas done by team of researchers and woreda agricultural experts. Trainings were given for Development Agents (DAs) and farmers by researchers about the full production package, seed system, market linkage creation and seed business concepts. Seed and other inputs (like bio-fertilizer) were delivering to participant farmers from research center. Continuous monitoring and evaluation were done by a team of researchers, agricultural experts and farmers. Field level seed inspections were carried out by inviting regulatory bodies from Dessie seed quarantine and certification center. Field day was organized by inviting different stake holders from zone, woreda and kebele expert and leaders, concerned bodies from University, union, media and farmers. Farmers'feedback and yield advantage data collectionwas done through exploratorysurvey. Initial seed delivered for farmers was collectedafter harvest for revolving seed purpose.

RESULTS AND DISCUSSIONS

Capacity Building of Stakeholders

Capacity building of various stakeholders has vital role in transferring of innovations among farming community by the extension system. During the training we were addressing a total of 3069 (27 female) farmers and experts. The training mainly focused on full production packages, post-harvest like storage, value addition and market linkage for both seed and grain purpose. In addition to theoretical training, field level practical training and field visit were done during the vegetative stage of the crop. Continuous monitoring and evaluation was done together with farmers, woreda expert and other stakeholders so that last year achievements, identifying major constraints and potential opportunities in early stage were done.Experience sharing and training of seed experts and cooperative leaders were done more than two times on seed production quarantine, business, marketing and chickpea produce value addition and cooperatives internal control mechanism. During this experience sharing and training, 6 experts and 4 cooperative leaders were participated at Debre-Birhan town. The intervention woreda and kebeles have high potential for chickpea production due to large coverage of vertisols.

Extension materials

Extension folders / leaflets were another most important tool used to present and transfer agricultural information to farmers and other extension clients. Leaflets help to address those farmers who are able to read and write so that a brief and concise extension leafletwas prepared on full production packages of chickpea and totally 453 sheets were disseminated for farmers and other shareholders during training and field day.

Input delivery

Habru improved chickpea variety was used for the pre-scaling up according to farmers' preference. A total of 8.5 tons of seed wasdeliveredfor selected farmers and more than 61 haof land was covered by improved variety stated above. A total of 207 (12 female) farmers were addressed through dissemination of improved chickpea seed directly by the research center.To implement the activities in best way and increases productivity, a complementary production package like bio-fertilizer wasused. During the last production of chickpea, about 1300 pack of rhizobium were distributed to improve the productivity of chickpea.

Field days and stake holders' feedback assessment

The other way through which chickpea pre-scaling up activity has to be widely accepted and further disseminated isachieved through field days. Field day has a vital role in technology diffusion and adoption process to popularize technologies and innovations in a wider scale. At maturity stage of the crop, field day was organized by inviting different stake holders from Zone and woreda agriculture experts and administrative bodies, Debre Birhan University, Unions, ILRI, Mass media from woreda, Fana FM, Ethiopian Broadcasting Corporation (EBC), Amhara Radio and Farmers so that more than 110 (19 female) were participants of the field day event. The field day program includes field visit, detail discussion on the field, farmers and stake holder's

reflection on the performance of the varieties. Moreover, future direction on seed exchange system, seed collection and marketing were settled by concerned participants.

Farmer's reflection and opinions during field day

During the field day farmers said, "even if it was affected by wilt and root rot (locally called *Abrik*) the performance of the crop wasinteresting so that we will continue to plant this variety". Lack of sufficient market for chick pea produce and human pest on green chick pea pod were our major problems and we tried to address market problem through cooperatives and human pest by sowing chickpea in large scale". In addition farmers said "improved variety had better advantage for us in different forms in which introduced variety was frost and inset tolerant than the local one. The productivity of the improved variety was high (more than 3.5 ton ha^{-1}) compared to local (which is 1.2ton ha^{-1}). Early planting of the improved varieties by draining the soil through Broad Bed Furrow (BBF) helps the crop to mature fully due to sufficient moisture".

Experts and administrative body feed back

Experts said that, the improved variety hasa great yield compared to local variety and also the improved practice help farmers to increases production and productivity of chickpea in our locality. The early planting helps the crop to escape from frost and terminal moisture deficits. The Kabuli types have high demand for international market so that all yields were required for both seed and grain purpose. They also added that, we are responsible to expand the technologies to other potential woredas and kebeles. Researchers also advice to bring green pod markets to access the required for the consumers as green pod (locally called Eshet). Chickpea is important for food security crop and improving nutrition which were the major problem that leads to child stunted growth.

Certification of the seed by regulatory bodies and seed marketing

This activity has a dual purpose as technology diffusion and seed production. To produce quality seed that is going to be used in formal seed system, field level inspection were done by regulatory bodies at field level. The produced seed wascollected by seed cooperatives and enterprises and used for seedand grain purpose. Participant farmers were benefited from the production and marketing of seed. About 10.5 tons of chickpea seed was collected and sold to the users and a total of 315,000.00 Birr was generated from the seed business. The remaining seed was exchanged from farmer to farmer to improve production and productivity.

Lessons learned

- Institutional linkage and intensive communication between all stakeholders are important for technology scaling up to promote easy access of farmers to improved seeds;
- The role of multi stake holder approach is effective for technology dissemination;
- Mass media and primary cooperatives are important for technology promotion;
- The role of Seed Producers and Marketing Cooperatives (SPMCS) is vital for technology diffusion and improving seed production and marketing system.

Challenges

- All inspected and produced seed were not used in formal seed system resulted from poor market and information linkages out of the intervention areas to integrate the buyers and low seed demand in the locality.
- Disease and pest infestation like root rot and Africa Bollworm occurrence.
- Frost problem for some of the late planted areas.
- Lackof recommended and effective chemicals for bollworm control.
- Human pest.
- Chick pea root rot damages on those water logged areas which was not properly drained and wilt.

CONCLUSION AND RECOMMENDATION

The production and productivity of chickpea has increased in the intervention areas due to the introduction of improved varieties with improved production package like fertilizer, inoculants and chemicals in area clustering approach**.** The improved variety of chickpea was disseminated in wider areas through farmers to farmer's seed exchange (in cash, in kind and in different ways) and formal seed system through seed cooperatives, union and enterprise. Chickpea produce was used as dietary for local farmersin different forms, seed and sale for market. As a result, the consumption of chickpea was increased which help to improve the quality of nutrition for the local farmers. To improve the production and productivity of chickpeas at the vertisols of North Shewa zone there is a need to integrate management option for chickpea root rot and wilt must be introduced in short period of time;due to the prevalence of new pests like stem and pod borer, further research must be done in chickpea production potential areas; expanding the technologies in large scale through different programs to boost the production and making bargaining power for exporting the crop is essential and postharvest training on the preparation of different food typesfromchickpea that helps for food security and nutrition is important.

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