



Ethiopian Biodiversity Institute (EBI)

Best Practice on: Improved Farmers' Varieties to Enhance Ecosystem Services

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Background

Agricultural systems are valued mainly for their provision services such as food, fiber, fuel. However they can also contribute to other types of ecosystem services. These services are produced either within the agricultural ecosystem itself or they may depend on the supporting features of the environment surrounding the agricultural production system. Ecosystem services can be influenced by agrobiodiversity such as when human nutrition increases as a result of crop diversity and when plant biomass increases as a result of crop diversity which results in the improvement of water quality and decreased runoff (Wood, et al., 2015).

Intensive agriculture focuses on few high yielding varieties and has excelled in food production. This has resulted in the loss of traditional crop species and varieties which contribute to the decline in provisional, regulating and cultural services. Low input cropping systems which often utilizes farmers' varieties can contribute to ecosystem services such as better carbon sequestration, lower nitrate leaching to waters and less phosphorus runoff from soil. Compared to high yielding varieties, farmers' varieties have better provisional, regulating and cultural services. Regarding provisional services, farmers' varieties give better and stable yield and use resources efficiently especially under non optimal conditions. In terms of regulatory services, they show better resilience to climate change effects, pests and diseases (Sing & Agrawal, 2021)

Crop genetic diversity is a raw material for new variety development for both intensive and low input agriculture. Gene banks that conserve crop genetic resources have a role in crop improvement and biodiversity conservation. Gene banks provide access to crop genetic resources to breeders which may then be delivered to farmers in the form of improved variety. Often, the breeding process does not take in to consideration the local farmer's need and their farming practices though farmers may be engaged at the final stages of the breeding process. In high input breeding scheme, the chance to benefit from advantageous genetic differences suitable for low input agriculture is lost and hence it is recommended to engage local farmers to achieve sustainability in low-input agricultural systems (Ceccarelli, 1996).

Need for the initiative

Access to improved and locally adapted varieties is critical for resilient agricultural systems, which could have positive impact on ecosystem services. However, farmers' access to diverse genetic



material from genebanks is minimal. Community seed bank (CSB), restoration of local varieties and participatory variety selection are means of creating linkage between a genebank and farmers. In Ethiopia, the attempt to link the national genebank and farmers started in the 1990s with the establishment of CSBs. CSBs are primarily managed by local farmers and they serve as a major source of local varieties. Currently there are 42 CSBs in Ethiopia. So far, the activity of the CSBs supported by EBI has been limited to:

- Conservation of local farmers varieties on farmer's fields,
- Creating access to seeds (distributing seeds to CSB member farmers)

The recent efforts of restoring gene bank material on farmers' fields and selection of farmer preferred variety are activities that are aiming towards improving farmers' access to gene bank material and select varieties suitable for low input agriculture. According to the Millennium Ecosystem Assessment, use of technologies that could increase the production of food per unit area without excessive use of water, nutrients and pesticides would reduce the pressure on other ecosystem services significantly (MEA, 2005).

Participatory variety selection

Participatory variety selection is selection of farmer preferred varieties under target environment. It allows the development of varieties better adapted to local environmental and management conditions, since the selection process involves best performing accession with farmer's preferred traits. It also helps in identifying additional farmer-preferred varieties for the target locality resulting in the increase of varietal diversity.

Among the 42 community seed banks currently operating in Ethiopia, 19 are administered by the Ethiopian Biodiversity Institute (EBI) and, the Ginir and Goro community seed banks are among the CSBs that are implementing variety selection with a positive result in sight. Engagement of CSBs in this activity enables farmers to have access to genetic resources with high provisioning and regulatory services because of their resilience under sub-optimal farming conditions.

Researchers from EBI took the initiative to engage CSB member farmers in participatory variety selection. After consultation with the members and ranking of crops requested by the farmers to be used in this pilot variety selection process, bread wheat was selected by the farmers at Ginir



CSB and black cumin was selected by the farmers at Goro CSB. A team of farmers that will participate in the variety selection were chosen; the selection team encompasses elders, women and young farmers (Figure 1). This way, women's perception from cultural provision of the farmer's varieties (cooking quality, taste, colour etc.) were included in the selection process.



Figure 1. Some members of the Ginir CSB and researchers that participated in the variety selection.

Eighty accessions of each crop which were originally collected from the woreda or the surrounding localities were accessed from the genebank and sown on sites in the respective woredas. Released varieties were included to be used as checks. Representative farmers along with researchers from EBI, and Ethiopian Institute of Agricultural Research and the Woreda's Agriculture office were part of the selection team.

Different variables were recorded, including agronomic traits, preference for consumption, yield, market value etc. Farmers rank the different accessions for different features of performance of each accession (Figure 2). Through this process, 20 accessions were selected for each of the crops.

The 20 selected varieties were sown the following season for further evaluation and six varieties of bread wheat and five varieties of black cumin that ranked top with the selection criteria were

chosen (Figure 3). The selected varieties currently are under multiplication to be distributed to CSB members.



Figure 2. Farmers at assessing and ranking a wheat accession.

Process of participatory selection in CSBs

- Consultation with CSB members
- Determining the crop to be used in the variety selection
- Accessing genebank material and planting
- Formulating a representative group that participate in the selection process (elders, women, young farmers, researchers)
- Farmers' training
- Selection of best performing varieties (Farmer's preferred variety)
- Multiplication of the selected varieties
- Distribution of the selected varieties to CSB members
- Making selected varieties as an income source by selling seeds to nonmember farmers (optional)

Achievement

- For both crops the selected accessions gave comparable yield with the improved variety used as control. On the experimental field wheat gave a yield of 40-60 qt/ha which is higher than the average bread wheat yield in the country (~30 qt/ha) (CAS, 2019). Black cumin gave 18-20 qt/ha which is also higher than the recently released variety which gave 12-18 on farmer's field (MOA, 2019).
- The farmers appreciated this initiative as they were able to select varieties suitable for the environmental and soil condition specific for their locality. They are satisfied with the progress made so far and they are eager to receive farmers varieties of other species and select those that are suitable for their locality.
- The woreda Agriculture offices has shown an interest to have access to the selected varieties, so that they could multiply and distribute to the local farmers.
- Since these varieties are selected by the farmers, it is expected that they will have good adoption rate and continuing the use of FVs will reduce harmful environmental impacts since they are suitable for low input agriculture.



Figure 3. Farmers with the selected wheat varieties (left) and Black cumin varieties (right)

Creating access to farmer to improved crops has the potential to increase the resilience of the farming system especially in response to climate change. Until recently, the activities of the CSBs under the support of EBI have been limited to on farm conservation of local varieties and seed distribution to member farmers. This initiative showed that if farmers get access to diverse genetic resources and the required support, they will be able to develop a variety suitable to their local

condition. Low cost production with increased production, and other desirable traits encourage low input agriculture system which intern contribute to support ecosystem services.

Participatory variety selection in CSBs is important to:

- to create access to seeds for farmers for FVs collected from their locality
- encourages continuous use of farmers
- identify local varieties that perform well in the target environment that satisfy farmers' needs
- increase crop yields without harmful environmental impacts
- increase local diversity by multiplying and distributing selected varieties to member farmers
- increase adoption of selected varieties (farmer-preferred varieties)
- generate income to CSB members from seed sales

Scale up

Community seed banks already have the awareness regarding the benefits of farmers' varieties. Expanding this activity to other CSBs could be used as a good scaling up approach for enhancing farmers' access to the genebank and crop diversity and enable them to go beyond maintaining seeds for local use. If the CSBs get a strong support, they also have the potential to build it into economically sustainable local seed source/enterprises/.

Challenge

Even though there is a high demand for using the selected farmers' varieties, there is shortage of land for multiplication of the selected varieties. This will hinder a fast and wider adoptability of the varieties.

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