

Strengthening seed delivery system for enhanced adoption of improved sorghum varieties among smallholder farmers in Malawi, Mozambique and Zambia

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Abstract. Many improved sorghum varieties and hybrids have been developed by public research institutions in Malawi, Mozambique and Zambia. However, the seeds are not readily available to small-scale farmers in remote rural areas. The non-availability of improved seed is due to various reasons, including low demand for certified seed and therefore, low profitability. Sorghum has been unattractive to large seed companies, and hence is not taking up production and distribution of these improved sorghum varieties to farming communities leading to low adoption. As a result, a seed system strengthening project was initiated to enhance seed delivery in remote rural areas that cannot access seeds easily. The project is in the first year stage and is being implemented in fourteen districts of Malawi, Mozambique and Zambia. The project activities include early generation seed production of selected sorghum varieties, the establishment of promotional demonstration fields, building the capacity of seed producers and farmers in seed production through training and creating a platform for players in the sorghum seed value chain. The specific objectives are: (i) to improve the availability of sufficient quantities of early generation seed to seed producers, (ii) to strengthen the capacity of sorghum seed value chain players involved in the promotion of released sorghum varieties, and (iii) to promote the use of sorghum certified seed by small scale farmers. The research outputs so far achieved are 250 farmers have been trained in seed production, 10 tons of basic seed of selected varieties have been produced and 144 sites have been established.

Keywords: food security, Malawi, Mozambique, sorghum varieties, Zambia.

1. Introduction

Sorghum (*Sorghum bicolor*) is one of the most essential traditional cereal crops of the hotter and drier regions of the tropics and subtropics [1]. This plant species is the second most important cereal crop in sub-Saharan Africa [2]. Global sorghum is the second most important cereal after maize with 22% of the total area of cereals [3]. The demand for sorghum has been increasing as reflected in the trend for the increasing area under sorghum production in Africa over the last fifty years [3].



Unfortunately, crop production and productivity has not kept pace with increasing demand due to several limitations: i) insufficient availability of improved seed, ii) lack of information dissemination, iii) few alternative end uses, iv) poor marketing strategies, v) poor grain quality, and vi) lack of fertilizer use as observed by Mbulwe [4]. Macauley [3] also observed that crop productivity had not kept pace with this increasing demand due to both a lag in crop improvement efforts in the crop and the extreme environmental conditions and the low agricultural input under which this crop is grown. Thus it is immediately evident that crop improvement efforts combined with improved agronomic practices, are a must for this crop in Africa, especially because of the reducing arability of land. Interventions of the Bill and Melinda Gates Foundation-supported HOPE project (harnessing opportunities for productivity enhancements) for sorghum and millets (<http://hope.icrisat.org>) that started in 2009, have demonstrated that yield gains from as low as 17 to as high as 141 per cent for sorghum is possible through the use of improved varieties and associated improved agronomic practices (<http://hope.icrisat.org>).

Additional support is required to enable the strengthening of the crop improvement process, seed production and delivery systems for improved varieties [3,5]. Due to its excellent adaptation to semi-arid and arid climates, the proportion of total grain production represented by the sorghum in semi-arid countries of Africa is very high. In 2011, Zambia accounted for 12% of the regional sorghum production that stood at 213.336 tons [6], which was lower than that produced by Malawi and Mozambique.

In Zambia, sorghum ranks third in terms of importance as staple cereal food crop after maize and rice [7] and contributes highly to national food security. In Zambia, the major sorghum producing areas are southern and western provinces and to a lesser extent eastern, central, northwestern and Luapula provinces [7]. In Mozambique, sorghum is a major cereal grain with a cultivated area of 27 million of hectares, and it is considered as a food security crop in most of the provinces in the country, especially in regions where rainfall is a limiting factor for maize and rice production.

Since the early 1980s, a total of 16 improved sorghum varieties have been developed [8] and released by Zambia Agriculture Research Institute (ZARI), but the seed of these varieties is not readily available at farmer level. Past public investments in sorghum research in Malawi, Mozambique and Zambia resulted in the release of a number of sorghum varieties with superior agronomic performances. However, the seed is not available to small-scale farmers in remote rural areas.

The formal seed sector through seed companies is expected to be the channels for production and distribution of these improved sorghum varieties to farmers. However, this sector has been reluctant to engage in seed production and marketing of sorghum, primarily because of its low profitability and erratic seed demand. This constraint has highly contributed to the low uptake of the improved sorghum varieties. In the 2000s, there has been a renewed effort to improve seed accessibility with focus on supporting private sector (small and medium enterprises) and also the establishment of seed business-friendly regulations across the region such as harmonized seed regulations [9]. Despite these efforts as observed by Mbulwe [4], seed companies that were tasked to be conduits of government released varieties have failed to deliver citing low demand and the high cost of distributing the seed in far-flung areas. This has been cited as one of the many contributing factors to the low adoption of these varieties. Most seed companies have continued to focus more on profitable crops such as maize.

In Zambia, most smallholder farmers involved in sorghum production source their seeds mainly from informal channels such as farm-saved seeds leading to low productivity and production of the crop. When small seed dealers are capacitated and linked to readily available sources of improved crop varieties, these channels could play a significant role in the increased adoption of varieties of less attractive crops such as sorghum. These small seed companies could play a catalytic role in the adoption of these crop varieties. The small seed dealers are highly decentralized, and therefore, more appropriate channel for the diffusion of improved varieties to small scale farmers is needed. Interventions, such as capacity building of decentralized seed dealers through training, improve linkages to sources of improved sorghum varieties, provision of adequate quantity and quality of foundation and certified seeds, provision of market information on improved varieties to the

surrounding farmers and beyond, will improve accessibility of improved adoption of improved sorghum varieties and increase sorghum production.

The adoption of the released improved varieties in sorghum growing areas of Mozambique has been minimal and mostly unknown because of the inadequacies of the seed system. Lack of seed and poor distribution of improved sorghum varieties has been pointed as the main constraints for the farmers to increase their production and productivity. As a result, farmers continue to use their local varieties which have low productivity. In Malawi, the seed system for sorghum is challenged by lack of a mechanism in place to increase the production of certified seed of improved sorghum varieties to be taken by farmers. Also there is a limited partnership in the sorghum value chain to enable and motivate farmers' access certified seed of improved varieties.

Several sorghum farmers in Malawi have continued to use local varieties, although there are some improved sorghum varieties such as Pilira1, Pilira 2 and PN3, which have been developed and released by the breeding program. In part, this has been due to unavailability of basic seed for the production of certified seed and farmers' lack of knowledge of the existence of improved sorghum varieties. Kasinthula Research has been multiplying seed of these improved varieties to make seed available to farmers. In order to enhance the adoption of improved sorghum varieties in sorghum growing areas, the demonstration plots of improved sorghum varieties were established on lead farmers' fields. Establishment of field demonstration plots of improved sorghum varieties aimed to popularize the varieties to farmers around the sorghum growing area. The demonstration plots to be managed by the farmers with the supervision of the extension and research staff will serve to promote improved sorghum varieties among farmers.

The overall goal of the project is to increase sorghum production through the promotion of accessibility to and availability of adequate quantities of seed of improved sorghum varieties by small scale farmers. Specifically, the project aims at: (i) improving availability of sufficient quantities of early generation seed (basic seed) of improved sorghum varieties for supply to seed producers; (ii) strengthening the capacity of sorghum seed value chain players, including small seed companies, agro-dealers, and farmer cooperatives involved in the promotion of improved sorghum varieties; (iii) promoting the use of improved sorghum varieties and certified seed by small scale farmers.

2. Materials and methods

2.1. Improving the availability of sufficient quantities of early generation seed to seed producers

The primary seed was produced by the free seed producers and distributed to small and emerging seed producers on a cost-recovery basis with the supervision of the breeders and seed certification authority. The primary seed was then made available to seed producers, for the production of certified seed. This activity was done through formal seed sector involving emerging seed companies and informal seed sector through community-based organizations with supervision from extension and seed certification authority staff in order to ensure and assure adherence to recommended seed quality production standards.

2.2. Strengthening the capacity of sorghum seed value chain players involved in the promotion of improved sorghum varieties

Relevant training sessions have been organized at a smallholder farmer level in aspects of the quality of seed production, processing and storage (Figure 2). This activity is expected to entail training and supervision of farmers to ensure adherence to quality standards. All participating farmers' cooperatives were provided with small scale seed processing equipment such as seed graders, blowers, and seed packaging to be used at the farm level. The agro-dealers were also trained and linked to the seed producers.

2.3. Promoting the use of sorghum certified seed by small scale farmers

In order to enhance the adoption of improved sorghum varieties in sorghum growing areas, the demonstration plots of improved sorghum varieties have been established on lead farmers' fields. The

demonstration plots were managed by the farmers with the supervision of the extension and research staff. The demonstration plots served as a means of promoting improved sorghum varieties among farmers. They are also channels for communicating other agronomic practices, such as the use of herbicides, time of planting, spacing, and weed management. At an appropriate period, field days were organized in order for farmers to share experiences and knowledge gained through the project activities on the farm.

3. Results and discussion

3.1. Increased availability of sorghum basic seed

Through the project interventions the availability of, and accessibility to a certified seed of improved sorghum varieties to smallholder farmers are enhanced. So far, ten tons have been produced per participating country (Figure 1). The availability of primary and certified seed will be increased to 20 tones for each country by 2019.



Figure 1. Sorghum foundation seed multiplication field.

3.2. Enhanced capacity of farmers groups and local seed dealers through specialized skills and knowledge

A total of 6 farmer groups, each comprising 20 farmers and at least ten seed dealers per project site has received training in seed production, processing and marketing. Through the project interventions, especially capacity enhancement activities, local and decentralized seed dealership will be improved in the project sites (Figure 2).



Figure 2. Farmers and extension staff are receiving seed production training.

3.3. Increased number of decentralized seed dealers in the seed delivery of improved sorghum varieties

The project has managed to create awareness among seed dealers about the opportunities that exist in sorghum trade. Most dealers have accepted to include sorghum on their shelves. The project is promoting the model where the foundation and certified seed of improved variety are produced and marketed within the same area. This model enhances the accessibility of the seed. Through the support of the project, the number of seed dealers in the project sites is projected to be increased by 10 per project site.

3.4. Increased number of small scale farmers using improved sorghum varieties

Through promotional activities such as field demonstrations of improved sorghum varieties and increased participation of decentralized seed dealers and awareness creation on the benefits of using improved sorghum varieties and certified seed, more improved sorghum varieties will be availed to the local farmers. For each project site, a total of 250 farmers are estimated to be using improved sorghum varieties by year 3 of the project. The number of farmers showing interest in sorghum production has sharply increased due to market opportunities highlighted through the sorghum value chain players' platform as well as companies in the brewing industry showing interest to buy sorghum grain.

3.5. Increased number of improved sorghum varieties promoted in the project areas

Currently, in year two, on average three improved varieties are being used by farmers in each site. Most farmers have lost their local varieties, hence they have switched to improved ones in order for them to continue growing sorghum. Through field promotional demonstrations of improved sorghum varieties, the number of varieties being utilized by small scale farmers will be increased by more than three varieties in each site.

4. Conclusions

The interventions of the project have already started showing positive results in the increased amounts of foundation seed being produced, a number of farmers adopting improved sorghum seed, agro-dealers marketing sorghum seed, and farmers and staff undergoing to training. These results clearly show that the intended project objectives will be achieved.

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