Assessment of improved crop seed utilization status in selected districts of Southwestern Ethiopia

Kassa Tarekegn and Merkine Mogiso

Abstract: In Ethiopia, seed is a key input for improving crop production and productivity. Despite its role, several improved crop seeds have been limitedly used by the majority of farmers in Southwestern Ethiopia. Thus, the objective of this study was to assess the status of improved crop seed utilization in the selected districts of southwestern Ethiopia. Data from 120 sampled farmers were selected by multistage sampling producers and analyzed by descriptive statistics. Based on a field survey, the major crop seeds like wheat, maize, and common bean were utilized in the study area. With regards to land allocations, only 30% out of a land under major crops were allocated for improved seeds. The result also reveals that about 35% per hectare loss in productivity due to the utilization of local seed. Unaffordable prices of improved seed, limited financial capacity, lack of improved seed timely, and lack of credit seeds and fertilizer were the major constraints affecting utilizing improved seed in the study area. Therefore, the concerned bodies should focus on increasing the availability of improved seeds on time and affordable prices. Also adjusting credit facility and strengthen the overall seed system to meet the huge demand is suggested.

About the Author

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Public Interest Statement

Seed is one of the most economical and efficient inputs to agricultural development for improving crop productivity. Increasing the quality of seeds can increase the yield potential of the crop by significant folds in Ethiopia. Different seed sources available and farmers get access to them through formal government systems and purchase from market and farmers to farmer exchange informal systems. The improved seeds highly increase the productivity per hectare. Enhanced seed availability through formal or informal or both system will improve smallholder farmer’s access to seed and enhance improved seed utilization. However, accessing and utilization of improved seed is constrained by its high price, unavailability of needed time and amount, and lack of credit to access it. Thus, increasing its availability before the cropping season at a reasonable price and adjusting credit to increase the utilization of the improved seed are the alternative options.
1. Background and problem justification

Food security issues facing Ethiopia year on year, there is a sense of urgency underlying the need for improvements in both output and yields. A range of policies and investments have been pursued by the Ethiopia government to boost agricultural production and productivity, particularly concerning the food staple crops that are critical to reducing poverty in the country (World Bank Report, 2008). Crop production is one of the mainstays of the rural population in Ethiopia. However, due to biophysical and socioeconomic challenges and inadequate technological interventions, the output of the sector was very low (MoA (Ministry of Agriculture), 2015).

Generation and transfer of improved technologies are critical prerequisites for agricultural development for Ethiopia (Alemu et al., 2008). Improved seed, chemical fertilizers, and extension services are the available inputs supplied to increase the productivity (Araya & Sung-Kyu, 2019). Among the interventions, a seed is a key input for improving crop production and productivity. Given the significant role of the improved seed, a sustained increase in crop production and productivity is dependent to a large extent on the development of the improved crops varieties and an efficient system for the timely supply of these seeds to farmers (Girma & Amanuel, 2017). As a result, new seed sector development strategy has been formulated by the Ethiopian Agricultural Transformation Agency (ATA) where systemic bottlenecks have been identified and key interventions have been formulated. Among the strategies, newly released crop varieties need to be multiplied and made available to farmers as quickly as possible for farmers to access and benefit from the genetic gain of the crop improvement programs (Abebe et al., 2017).

Despite the release of several improved crop varieties, there has been limited use of improved seeds by the majority of farmers in Ethiopia (Mekonnen, 2012). Unavailability of improved seeds at the right place and time coupled with poor promotion system due to the inefficiency of the seed systems are the key factors accounting for limited use of improved seeds in Ethiopia (Temesgen, 2019). Meanwhile, there are several seed companies, the agricultural input sector in Ethiopia is currently not able to satisfy the demand for improved seed (Todd et al., 2014). Deficiencies have been also observed in improved seed supply due to untimely delivery of the demanded seed varieties and with required quantities (Alemu et al., 2010).

The Ethiopian seed system has been evolving in an attempt to ensure the availability of seed in the required quantity at affordable prices and time (MoA (Ministry of Agriculture), 2015). The system in the country represents the entire complex organizational, institutional, and individual operations associated with the development, multiplication, processing, storage, distribution, and marketing of seed (Abebe & Lijalem, 2011). The seed sector in Ethiopia is broadly categorized into the formal system and informal system which are operating simultaneously in the country and difficult to demarcate between them (Abebe & Lijalem, 2011; Alemu et al., 2010; Louwaars et al., 2013). Later, ATA has classified the seed system the country into three categories namely formal, informal, and intermediary (ATA [Ethiopian Agricultural Transformation Agency], 2015).

The formal seed system is a system that involves a chain of activities leading to certified seed of released varieties. This system is guided by scientific methodologies for plant breeding and multiplication and operated by public or private sector specialists, and significant investments have been made throughout the process (Louwaars & De Boef, 2012). The research system or certified multipliers produce and distribute basic seed. Suppliers of basic seed are public seed enterprises and a few licensed private seed companies. Regulatory agencies, along with all actors involved in the seed chain, supervise the production and distribution of certified seed (Christine, 2015).
According to Dawit et al. (2017); Bishaw et al. (2008), the major actors of the formal systems in Ethiopia are National Agricultural Research System (NARS) that comprised of Ethiopian Institute of Agricultural Research (EIAR), Regional Agricultural Research Institutes (RARIs), and higher learning institutions (HLIs); Ministry of Agriculture (MoA) that includes Regional bureau of agriculture (BoAs) includes regional; Ethiopian Seed Enterprise (ESE), and Regional Seed Enterprises (RSEs) in Amhara, Oromia, Southern nation nationality region (SNNPR) and Somali; private seed companies specializing on specific crops like Pioneer; farmer cooperatives and smallholder farmers. The Ethiopian Seed Enterprise under the supervision of the MoA is expected to support the rural development strategy and the improvement of the seed supply to smallholder farmers in particular, by filling the gap for economically important crop varieties (Thijssen et al., 2008). All actors have inter-dependent roles in the system and the inefficiency of one actor will automatically affect negatively the performances of the rest of the actors (Maredia et al., 1999).

The informal system is extremely important for seed security in the context of Ethiopia since the bulk of seed supply is provided through this system, implying its importance in national seed security (Bishaw & Louwaars, 2012; Yonas, 2012). In Ethiopian the majority of farmers show a tendency of depending on the informal system because it is relatively cheaper and readily available in the farmer's villages at the required time and it allows the use of seeds after testing on primary adopter farmers (Abebe & Lijalem, 2011). In the informal seed system, 90 percent of the seed used by smallholder farmers was through either self-saved seed or farmer-to-farmer seed exchange (CSA [Central Statistical Agency], 2015).

Federal, as well as regional governments, have given high priority to the step-up of the rural economy through the development of the agriculture sector by improving the seed system (Girma & Amanuel, 2017). As seed is the fundamental input to agriculture comprehensive effort is looked-for to ensure the availability of quality seeds to farmers through ESE at the national level (ISSD [Integrated Seed System Development], 2014). According to Shimelis (2015), southern seed enterprise was established by the regional government to meet the demand for improved seeds by producing certified seeds obtaining basic seeds from research centers or imported from abroad thereby enhance agricultural development. The mission of the enterprise was production and supply of demand-oriented improved and clean seeds of various crops, vegetables, and fruits of the right type, at the right time, at the right place, and a reasonable price to the users in collaboration with other stakeholders.

According to the Bureau of agriculture and natural resources [SNNPRBoA] (2015), the demand for improved seeds was assessed through the zonal departments of agriculture based on the area sown by different crops and seed replacement rates achieved in each zone. Demand for certified seed is first collected from individual farmers at kebele (the smallest administration level in Ethiopia) by development agents and summarized for each district by the office of agriculture. Aggregated data from the districts will pass on to zonal and then on to regional offices. The demand for regional states will be also submitted to the federal MoA to get additional crop seed that is not available in the region (Abebe et al., 2017).

However, seed shortage in quantity which results in farmers’ plant grains rather than seeds, sustaining yield reductions of at least 30 percent in Ethiopia (Mezgebo, 2019). Many farmers still fail to access the improved seeds from the formal seed supplies as many of the released varieties have never been widely distributed and made available in time and affordable prices (ISSD [Integrated Seed System Development], 2014). These problems are more or less the same in SNNPR and the study area.

On the other hand, supplying of seed through private and SSE actors in the region, the demand for improved seed is still increasing rapidly from time to time. To satisfy the seed demand, SSE, SARI, and private seed producers with coordination of regional BoA were working to supply seed to the farmers. However, both public and private seed producers mainly concentrate on a few cereal
crops, particularly hybrid maize and bread wheat (Shimelis, 2015). Moreover, they also do not satisfy the diversified seed demand of farmers (Bishaw & Louwaars, 2012). In relation to the low level of improved seed utilization and low level of adoption in improved crop seeds, the productivity of the agricultural sector is very low in southwestern zones of SNNPR. Therefore, the study aimed to assess improved crop seed utilization status and its constraints in selected districts of southwestern zones, southern Ethiopia.

2. Methodology

2.1. Description of the study area
Study was undertaken in the southwestern part of Ethiopia specifically in the Kafa, Bench Maji, and Sheka zones (Figure 1), where a coffee-spice based farming system is dominant with dense forest resources (Abdu et al., 2016). The estimated total area of the three zones is about 32,702.73 km², which is about 30.9 percent of the total area of the region (Abiyot & Assaye, 2019). The three zones have a well-distributed sufficient rainfall, with only a short period of a dry spell, as well as a warm to hot temperature (Gemedo et al., 2019). The annual mean temperature of the zones ranges from 10.1 to 27.5°C, whereas the average annual rainfall varies between 400 and 2200 mm (Chilalo, 2011). The zones are classified into three major climatic categories namely: temperate tropical highlands, semi-temperate and semi-arid constituting 11.4, 26.4, and 62.2% of the administrative zone. This wide range of agro-climatic zone allowed the area to produce different types of products including cereals, pulses, fruits, and cash crops like coffee (Ermias et al., 2014).

2.2. Sample size and sampling techniques
For this study, a multi-stage sampling technique was implemented. In the first stage, Gimbo, Shey Bench, and Yeki districts were purposively selected on the basis on the extent of improved supply and utilization in each zone. Next, two rural kebeles were randomly picked from each district. Finally, 120 households were selected, proportional to the size of crop-producing farmers using simple random sampling technique during the survey year (Table 1).

2.3. Data types, methods of data collection and analysis
Both primary and secondary data were collected for this study. The primary data were collected using a checklist for key informants interviewed (KII), focus group discussions (FGD), and semi-structured questionnaires for household interviews. For this study data collection was administered by trained enumerators in September and October 2018. Although this study principally employed primary data, secondary data were also collected from relevant sources such as the
agriculture offices of the districts and zones to verify the cross-sectional data. In addition to these, the study used literature review and observation for supplementing the collected information. The collected data were analyzed using descriptive statistics and presented by tables and graphs.

3. Results and discussions

3.1. Distributions of improved seed

Improved seed dissemination involves the mechanisms through which seed and information about it are moving from one to the other actor. The data collected from the agriculture and natural resources departments of Kaffa, Bench Maji, and Sheka zones, in (Figure 2) indicated that the seed of wheat was a highly disseminated crop among other crops. Next to wheat, maize was highly disseminated seed crop in the three zones. Whereas the seed of improved rice varieties and potato from root crops were only distributed in Bench Maji and Sheka zone, respectively.

With regards to varieties, BH-140, BH660, BH661, BH-540, and Pioneer from maize, Ogoicho from wheat and Nasir and Hawassa dume from common bean were the mostly distributed seeds in the study area. While, the amount of improved seeds disseminated showed a decreasing trend for crops like teff and barley. However, the demand for faba bean and wheat showed an increasing trend as per the key informant interview. Among the root crops, the seed of improved Irish potato (Belete and Jelena) was highly distributed in Sheka zone due to a long tradition for potato production.

The supplied seed in these zones comes from both the informal and formal seed systems. Of the formal sources, Southern seed enterprise (SSE), agricultural research centers and farmers cooperatives are the main ones. The SSE as the regional formal seed sector takes a major role as producer and supplier of improved seeds for over years. Even though the enterprise is also playing the leading role for the advent of organized seed production and supply in the region, the improved seed supply remained far behind the demand in the region. The key informant interview result revealed that the demanded and supplied seed have a huge gap. To fill this demand,
Southern Agricultural Research Institute (SARI) assigned additional duty from regional government to multiply improved seed based on specific crop excellency. Besides there were also different seed-producing farmers’ cooperatives and private investors in the region that produce and supply improved seed to the region bureau of agriculture. The SNNPR bureau of agriculture through its input supply unit assess the demand of the farmers from each kebeles of the region and disseminate the available improved seed according to the assessed seed demand.

3.2. Proportion of area allocated for major improved crop seeds
Result revealed that, the amount of land size allocated for local crop varieties was higher than that of an improved one presented in (Table 2). This shows that only a small area of land was covered by improved seed. According to the survey result, in the study area only 29.83 percent of the land was allocated for improved seed from out of a land under major food crops in the three zones. However, the land allocated for wheat and maize were relatively better than other crops in the study area. This may be due that the two crops are popular and the extension system largely focus on the dissemination of them. Even though the demand for pulse crops such as field pea and fab bean was highest especially in Kaffa zone, the size land allocated for improved seed was very low.

3.3. Productivity level of major crops in Kaffa, Bench Maji, and Sheka zones
The survey result showed that there was a huge productivity difference between local and improved seed users (Figure 3). Especially the maize and wheat productivity between the two groups was higher than other crops in the study area. The overall productivity difference in the study area for improved seed utilizers about 35 percent per hectare. These indicated that a lot of loss in the study area due to the utilization of local seed. Why the farmers is not using improved crop seeds? The reasons were discussed in detail in the next section.

3.4. Access and source of improved crop seed
The result indicated that smallholder farmers used different sources of seed for cropping across the zones (Figure 4.). The major identified sources of improved seed are government through agricultural office (37.5 percent), own stock (28.5 percent), market (19.5 percent), and farmers to farmer seed exchange (14.5 percent). This indicates that the government was a major source of seed in the study area. This research finding was in line with the finding of Bassa et al. (2018) that stated government and farmers themselves are the major sources of improved seed in central zones of SNNPR. Even though the formal government sector takes a larger share of improved seed dissemination, still most of the farmers used seed from informal seed systems, including own-saved seed, exchanges with neighbors, and local seed markets. A study by Tebeka et al. (2017) also identified three seed sources namely formal, informal, and farmer based one in central rift valley Ethiopia.

3.5. Main reason for not using improved crop seed
Even though the improved seed has better productivity, disease, and pests resistance advantage over local ones, some farmers were not willing to use it in the study area. As a result, those farmers who do not use improved crop seed were asked about why they do not utilize the improved seed. The survey result revealed that there were different reasons raised for not using improved crop seeds. According to Figure 5, the high price of improved seed (27 percent), fear of DAP and urea cost which is given side by side to the improved seed (15 percent), limited financial capacity (13 percent), no supply of seed on needed time (12 percent), poor quality of seed (11 percent), and no supply of the required amount (9 percent) were the top five reasons raised by farmers for not using improved crop seeds in the study area. This result finding is in line with the result of Adefris et al. (2012), Bassa et al. (2018), and Kutoya and Kebede (2019) which confirmed that unaffordable seed price, unavailability of the required quantity of seeds at the right place and time are the key factors affecting improved seeds utilization.
| Crop type  | Variable                              | Mean   | Std. Dev. | Min  | Max   |
|------------|---------------------------------------|--------|-----------|------|-------|
| Maize      | Total area under the crop             | 0.58   | 0.32      | 0.11 | 3.00  |
|            | Area under local variety              | 0.33   | 0.28      | 0.25 | 1.50  |
|            | Area under improved varieties         | 0.25   | 0.17      | 0.11 | 3.00  |
|            | Yield obtained from local             | 18.48  | 9.65      | 6.4  | 48.00 |
|            | Yield obtained from improved          | 33.11  | 9.17      | 12.00| 64.00 |
| Wheat      | Total area under the crop             | 0.36   | 0.14      | 0.06 | 2.50  |
|            | Area under local variety              | 0.19   | 0.12      | 0.13 | 1.75  |
|            | Area under improved varieties         | 0.17   | 0.18      | 0.06 | 2.50  |
|            | Yield obtained from local             | 13.45  | 4.65      | 4.80 | 24.00 |
|            | Yield obtained from improved          | 14.73  | 4.29      | 13.80| 28.60 |
| Common bean| Total area under the crop             | 0.32   | 0.10      | 0.03 | 1.00  |
|            | Area under local variety              | 0.25   | 0.11      | 0.13 | 1.00  |
|            | Area under improved varieties         | 0.07   | 0.09      | 0.03 | 0.50  |
|            | Yield obtained from local             | 11.35  | 6.97      | 4.00 | 40.00 |
|            | Yield obtained from improved          | 18.60  | 8.65      | 6.00 | 36.00 |
| Barley     | Total area under the crop             | 0.24   | 0.08      | 0.05 | 1.25  |
|            | Area under local variety              | 0.19   | 0.15      | 0.13 | 1.25  |
|            | Area under improved varieties         | 0.05   | 0.04      | 0.05 | 0.87  |
|            | Yield obtained from local             | 9.61   | 4.35      | 6.00 | 20.00 |
|            | Yield obtained from improved          | 17.67  | 5.74      | 10.56| 22.37 |
Table 2. (Continued)

| Crop type | Variable                            | Mean | Std. Dev. | Min | Max  |
|-----------|-------------------------------------|------|-----------|-----|------|
|           | Total area under the crop           | 0.20 | 0.06      | 0.13| 1.38 |
| Teff      | Area under local variety            | 0.14 | 0.07      | 0.13| 1.38 |
|           | Area under improved varieties       | 0.06 | 0.04      | 0.12| 1.36 |
|           | Yield obtained from local           | 10.29| 4.58      | 4.00| 17.20|
|           | Yield obtained from improved        | 15.54| 4.23      | 11.50| 28.75|
| Faba bean | Total area under the crop           | 0.15 | 0.12      | 0.15| 0.50 |
|           | Area under local variety            | 0.10 | 0.11      | 0.15| 0.50 |
|           | Area under improved varieties       | 0.04 | 0.13      | 0.12| 1.74 |
|           | Yield obtained from local           | 9.69 | 4.60      | 4.80| 20.00|
|           | Yield obtained from improved        | 14.56| 3.86      | 9.97| 16.87|
| Sorghum   | Total area under the crop           | 0.16 | 0.08      | 0.03| 0.75 |
|           | Area under local variety            | 0.10 | 0.10      | 0.13| 0.75 |
|           | Area under improved varieties       | 0.05 | 0.04      | 0.03| 0.50 |
|           | Yield obtained from local           | 15.46| 10.69     | 2.70| 40.00|
|           | Yield obtained from improved        | 22.67| 20.35     | 4.00| 48.00|

Source:—Survey result, 2018.
Moreover, the farmers during the FDG session confirm that DAP and urea distributed in the study area are not based on farmers demand that affecting the utilization of improved seed. During the distribution of improved seed, the agricultural office also distributed the chemical fertilizer side by side especially for maize, wheat and teff which is not based on farmers demand. Conversely, the farmers say that fertility status of the study area is different from other parts of the country, applying the recommended fertilizer will affects the productivity level of crops. As a result of these perceptions, most farmers are not willing to use chemical
fertilizers and also affects the utilization of improved crop seed. The late delivery of fertilizers and the absence of offering fertilizer in smaller packages that could be used by smallholders are the additional reason for not using fertilizer that indirectly affects the utilization of improved seed. The FGD result confirms that fertilizer arrived after planting affects the utilization of improved seed due to fertilizer delay problem since most of the crops (maize, wheat and teff) are sown with it. However, some of the farmers in the study area are not demanding the chemical fertilizer (DAP and urea) for specific crops like potato, faba bean, field pea, and haricot bean. A study by David et al. (2011) also confirms that the timely deliverance of the packages (fertilizers and seed) at the same affects the utilization of the improved seed due delays of cropping session in Ethiopia. For instance, late delivery of fertilizer are the main problems in the study area that indirectly affects utilization the improved seed.

Furthermore, the seed quality is one of the problem raised from extension and farmers side for especially for maize crop. Theoretically, seed quality is determined not only by the seed genotype and physical characteristics, such as size, shape, appearance, and moisture content but also by farmer customers’ expectations about and experience with the genotype and the characteristics (Almekinders et al., 2019; Shimelis et al., 2018). While, means of the input distribution in the study area is mostly cash-based. Thus, those farmers with sufficient resources only can purchase of fertilizer and seed. Thus, the government should subside unaffordable seed prices and providing seeds on the credit base. The farmers also raised that supplying seed on requested time and amount, and supplying seed varieties based on agro ecology for betterment in dissemination and utilization of improved seeds in a sustainable way. This finding is in line with Adefris et al. (2012).

4. Conclusions and recommendations
Maize, wheat, and haricot bean are the major distributed improved seed in Kaffa, Bench Maj, and Sheka zones. The major sources the improved crop seed for these zones were government, market, and farmers themselves. The amount of land allocated for local crop varieties was higher than that of improved one in the study area indicating that only a small portion of land is covered by improved seed. About 30 percent of the land was allocated for improved seed from out of a land under major crops in the three zones. With regards to the productivity of improved seeds, the result reveals that about 35 percent per hectare overall productivity difference was estimated in the study area for improved seed users. These indicated that there is a lot of loss of production in the study area due to the problem of improved seed utilization. The major challenge for not utilizing improved seed in the study area were the unaffordable price of improved seed, fear of DAP and urea cost which is given side by side to the improved seed, limited financial capacity, lack of improved seed on needed time, poor quality of seed, and lack of seeds in form of credit.

Therefore, the study result recommended that understanding the farmers’ seed demand and supplying the improved seeds that align with farmers’ needs enhance the utilization of improved seeds and their subsequent diffusion. There is a lack of awareness in availability of improved seeds in the area. As a results, farmers were resistant to utilize a new seed variety without sufficient access to seed or knowledge of proper multiplication methods. Thus, increasing the availability of seeds and creating farmers awareness is crucial. Even if the regional seed enterprises expand and optimize their production from year to years, it is unlikely that they can satisfy the seed demand of all farmers in the region. To ensure the supply of improved seed of the demanded crops, contributions of the private sector will be needed. Thus, simultaneously research and extension side (public sector) need to provide necessary support on improved varieties, land and loan provision to private seed multiplier, and model farmers to meet the demand. Even if the microfinance institutions (MFIs) are already serving many farmers but they are still far from being universal. Without a credit facility, a rise in seed supply will hardly benefit the majority of the farmers. Therefore, MFIs need to provide credits to the farmers.
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