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Demand and Supply Status of Improved Seed and Factor Governing It in Ethiopia

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Abstract
Seed is among the most key input for improving crop production and productivity. The use of improved, high yielding crop varieties is an important way for reducing hunger and food insecurity in developing countries. Increasing the quality of seeds can increase the yield potential of the crop by significant folds. Hence, access to and uses of seeds are critical factors for the ability of smallholder farmers to increase agricultural production and productivity, for improving livelihoods. The Ethiopia seed system has undergone tremendous changes. But, still the sector is unable to guarantee farmers' access to seed of improved varieties, in the right quantity, of the right quality, and in a timely manner, mainly because of the absence of linkage and integration among the stakeholders; there is a substantial gap exists between the production and supply of commercial seed and farmers' demand. On average, 12 million hectares of land is cultivated by major food crops over the last five years in Ethiopia, of which 10,979,645 hectares was covered by non-improved local seeds. Which of the total annual arable land coverage by major food crops, 96.5% is covered by local seed and 3.5% is by improved seeds. The annual average seed demand for cereals and pulses is estimated to be over 400,000 tons. Demand for improved seed is still increasing rapidly from time to time over the last years. So, improve basic facilities, infrastructure, improve productivity gaps, establish strong coordination between producer, processor and delivery is compulsory.
Keywords: Seed, demand, supply, improved
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1. INTRODUCTION

Ethiopia is predominantly an agrarian country with the vast majority of its population directly or indirectly being involved in the production of crop and livestock. Hence, agriculture plays a vital role in Ethiopian economy. According to (Astatkie *et al*., 2012) Agriculture in Ethiopia contributes about 45% of the GDP, 85% of the total exports and more than 85% of employment. But, still the sector is not yet adequately commercialized to bring about rapid change in production in line with increasing population pressure (Alemu, 2012). The problem is not that Ethiopia is poorly endowed with agricultural resource; instead the problem is that new technologies have not been permitted to make any inroads into Ethiopian agriculture.

As (Atilaw, 2010) states that Agriculture in Ethiopia is caught in a low input-low output trap, due in part to low levels of investment, low technology application, and low capacity. The solution needs to involve a structural change, for which major capacity development is needed, including a quantum change in human capacity, input supply, technology adoption, and provision of infrastructure. Specially, in order to increase the production and productivity of agricultural output, the use of modern agricultural technologies are vital, out of which fertilizer and high yielding variety of crops are the most important technologies to increase the level of crop production.

Seed is one of the most key input for improving crop production and productivity (Beyene, 2010; Mugonozza, 2001). Increasing the quality of seeds can increase the yield potential of the crop by significant folds and thus, is one of the most economical and efficient inputs to agricultural development (FAO, 2006).

Despite the release of several technologies, particularly of improved crop varieties, there has been limited use of improved seeds by the majority of farmers (CSA, 2010) and the presence of several seed companies, the agricultural input sector in Ethiopia is currently not able to satisfy the demand for improved seed in the country (MOA, 2013). Deficiencies have been also observed in improved seed supply due to the seed varieties demanded and quantities required, and untimely seed delivery (Bishaw and Turner, 2008; Sahlu *et al.,* 2008).

Generation and transfer of improved technologies are critical prerequisites for agricultural development particularly for an agrarian based economy such as of Ethiopian. Among others, unavailability of quality seeds at the right place and time coupled with poor promotion system, is one of the key factors accounting for limited use of improved seeds, which further contributing for low agricultural productivity. Poor availability and promotion of improved seeds is due to inefficiency of the seed systems of the country.

Sustainable seed system will ensure that high quality seeds of a wide range of varieties and crops are produced and fully available in time and affordable to farmers and other stakeholders. However, in Ethiopia like in many

developing countries farmers have not yet been able to fully benefit from the advantages of using improved seed. So, the objectives of this paper are: To review the demand and supply Status of improved seeds in Ethiopia and to identify the factors that influences the improved seeds.

2. LITERATURE REVIEW

2.1 Seed production in Ethiopia

In Ethiopia the role of cooperatives in seed multiplication is increasing from time to time. They are already engaged in seed production, cleaning and trading of Quality Declared Seeds (QDS) of OPV. However, the supply of seeds of adapted improved crop varieties is in shortage for such program (Alemu, 2010).

It is expected that the emergence of regional seed enterprises will promote the production of seed for crops that are not so far produced through the formal system. For instance, the Amhara and Oromiya Seed Enterprises (ASE) has promoted Farmers' Based Seed Multiplication Scheme (FBSMS) immediately after its establishment in early 2009 with a focus on potential areas for seed multiplication and clustering approach. The major challenges in the FBSMS are the limited capacity of the seed enterprise both ESE and regional SE to purchase timely from farmers, limited capacity of facilities like harvesting and threshing, cleaning and grading facilities, and storage(Alemu, 2010).

In Ethiopia Only 2.9% of the farmers reported to use improved seed in 2011 (CSA and MOFED, 2011: 20). The contribution of the formal seed sector as a percentage of cultivated land was only 5.4% in 2011, with considerable variability among different crops (Spielman *et al.,* 2011). Low technology adoption rates can have many reasons (Degu *et al*., 2000; Feder and Umali, 1993). One important reason is the substantial lack of improved seed (MOA, 2013).

Seed multiplication by ESE focused mainly on two cereal crops (wheat and maize) and annual supply of improved seed by the enterprise doesn't exceed 20,000 tons (Marja *et al*., 2008, Atilaw 2010). Wheat and maize constitute about 85% of the total output of the enterprise.

Table 1 Area cultivated by major crops from 2013/14 to 2016/17 cropping season

Crops	Cropping seasons				
	2013/14	2014/15	20015/16	2016/17	2017/18
Cereals	8,072,561	8,463,080	8,730,001	8,770,118	9,233,025
Pulses	1,292,063	1,517,662	1,517,662	1,585,236	1,489,308
Oil crops	796,397	740,847	707,059	855,147	780,916
Vegetable	117,578	162,125	119,091	95,194	138,393
Root crops	168,836	188,917	184,329	145,742	212,208
Other annuals	77,554	97,677	84,977	69,103	63,418
Permanents	767,582	823,121	1,039,313	906,518	53,086
Total	11,292,571	11,787,775	12,382,432	12,493,989	11,970,354

Source: CSA, 2013-2017

It is reported that over the last five years (2013-2018), on average more than 12 million hectare of land are cultivated by the major food crops (Table 1). These are: cereals, legumes, oilseeds, root crops and horticultural crops.

Table 2 Area covered by improved seeds during 2013/14 to 2017/18 cropping season

Crops	Cropping season				
	20013/14	2014/15	2015/16	2016/17	2017/18
Cereals	429,536	335,369	412,629	430,937	322,819
Pulses	5,224	5,025	6,309	14,918	12,912
Oil crops	1,833	4,056	2,273	2,328	9,139
Vegetable	779	559	501	1,899	2,788
Root crops	813	2,114	2,251	799	3,721
Other annuals	70	102	-	-	-
Permanents	9,681	11,742	5,828	13,120	9,852
Total	447,936	358,967	429,791	464,001	361,231

Source: CSA, 2013-2017

2.2 Economic importance of improved seeds

2.2.1 Higher yields

According to (CSA,2016) improved seed gives a significantly higher yield, and better quality of crop products compared to locally produced variety of seeds. Higher yields are achieved when seed heads produce more seeds per head or bigger seeds; but plants with tall stalks cannot always support the added weight. In the 1960s, as India was facing famine, the American agronomist Norman Borlaug developed dwarf wheat varieties with stalks that

could support larger seeds and brought them to Punjab. By 1970, wheat yields in Punjab had tripled, provided the seeds were given sufficient water and synthetic fertilizer (Nelson *et al.* 2007; Van Breusegem *et al,.*1999 a, b)

2.2.2 Improved nutrition

To make diets more nutritious, the first is to promote varieties of seed that have been bred to be more nutritious. Since 70 to 80 percent of the developing world's diet consists of carbohydrates, the idea is to pack more nutrients into the staple crops. For example international agricultural research, works on boosting micronutrients in seven staple crops the people of Asia and Africa most eat cassava, maize, rice, wheat, sweet potato, beans and pearl millet. Iron, zinc and vitamin A are the micronutrients usually lacking in the diets of millions of people.

2.2.3 High germination rate and vigor

Germination is reported as the percentage of seed producing normal seedlings. Normal seedlings are those that produce a vigorous set of primary and secondary roots; have a healthy hypocotyls, epicotyls, and cotyledon; and produce a healthy shoot meristem. Abnormal seedlings would not be counted in the total percent germination for that sample. Seed vigor is the property that gives seed the potential for rapid and uniform emergence and development of normal seedlings under a wide range of field conditions.

2.2.4 High quality

Seed quality describes the potential performance of a seed lot. Trueness to variety; the presence of inert matter, seed of other crops, or weed seed; germination percentage; vigor; appearance; and freedom from disease are important aspects of seed quality. High-quality seed lots should meet minimum standards for each of these characteristics. The standards of official certification agencies are usually accepted as the minimum requirements for high quality seed.

2.3 Concept of Seed systems in Ethiopia

The Ethiopian seed system has been evolving in attempt to ensure the availability required type of seed in the required quantity and quality at affordable price and time. Seed system in Ethiopia represents the entire complex organizational, institutional, and individual operations associated with the development, multiplication, processing, storage, distribution, and marketing of seed in the country (Abebe and Lijalem, 2011).

Seed systems in Ethiopia can be divided into two broad types: the formal system and the informal system (sometimes called local or farmers seed system). Both systems are operating simultaneously in the country and difficult to demarcate between the two. There is however, a fact that the formal system is the original source of improved seeds in the informal system (Maredia*, et al*., 1999).

According to Bishaw et al. (2008), the Ethiopian formal seed system was introduced five decades ago with the activities of crop improvement research by the existing research and higher learning institutes; nevertheless, it has not developed as expected due to multiple reasons (Yonas, 2012) related to lack of organizational set up, inadequacy of on trained manpower and limited private participation.

The major actors of the formal systems in Ethiopia are, NARS, MoA, ESE and private seed companies specializing on specific crops like Pioneer. Recently, regional seed enterprises (RSE) were also established as public seed enterprises. All actors have inter-dependent roles in the system and inefficiency of one actor will automatically affect negatively the performances of the rest of the actors (Maredia, *et al*., 1999).

In the context of Ethiopia, the informal system is extremely important for seed security. The bulk of seed supply is provided through the informal system, implying its importance in national seed security. The informal seed system (either self-saved seed or farmer-to-farmer seed exchange) accounts for 90% of the seed used by smallholder farmers (Belay, 2004), while the share of improved seed is less than 10% (FAO-CDMDP, 2010).

As stated in Abebe and Lijalem (2011) the key reasons why the majority of Ethiopian farmers show a tendency of depending on the informal system are; it is relatively cheaper and readily available in the farmer's villages at required time and it allows use of seeds after testing on primary adopter farmers.

Table 3 Area coverage of informal and formal seed system during 2005/06-2009/10

Seed system	2013/14	2014/15	2015/16	2016/17	2017/18
Informal	10,821,810	11,427,794	11,927,093	12,010,042	10,136,744
Formal	447,936	358,967	429,791	464,001	361,231
% informal	96.03	96.95	96.52	96.28	96.56
% formal	3.97	3.05	3.48	3.72	3.44

Source: CSA, 2013-2017

2.4 Seed demand and supply in Ethiopia

Seed security is one of the most important sociological, political, economic and scientific challenges in the country. Securing the supply of quality seed and planting materials of the most important food crops is the most effective way to sustain food security (Marja H. *et al*., 2008).

Seed demand is increasing from time to time in Ethiopia. The public seed production is dominated by Ethiopian Seed Enterprise (ESE) and since 2008 regional seed enterprises (RSEs) have come into the picture, at

present there are two RSEs, Oromiya Seed Enterprise (OSE) and Amhara Seed Enterprise (ASE) (Alemu, 2010). The establishment of Ethiopian Seed Enterprise's led to advent of organized seed production and supply system in the country and remained the main supplier in the formal sector (Abebe and Lijalem, 2009).

In the country, the supply of improved seeds never fulfilled the need of producers. But for the last two years with the shift in seed multiplication strategy, the production of improved seeds especially hybrids maize and wheat were considerably improved.

In 2011/12, seed supply covered only 51% of stated demand for barley, 24% for wheat, 16% for rice, 30% for millet and 60% for fababean. The supply of maize, wheat and teff seeds has improved considerably over the last years. But still, only 20% of the area cultivated with maize, 4% of the wheat area and less than 1% of the teff area are cultivated with seed from the formal sector (CSA, 2012).

Table 4 Difference between supply and demand of improved seed of various crops

Crops	Difference between demand and supply in quintals (2011/12)	% of demand not met
Wheat	200,720	21
Teff	10,211	11
Maize	39,666	9
Barley	101,924	49
Sorghum	16,433	92
Rice	13,638	84
Millet	967	70
Fababean	19,918	40
Field pea	47,769	84
Chick pea	11,035	63

Source: MoA (2013)

Table 5 Demand and supply of hybrid and non-hybrid seeds from 2015-2016

Production year	Hybrid seed			Non-hybrid seed		
	Demand	Supply	%Supply	Demand	Supply	%Supply
2007/08	123,777	35,244	28.47	62,9422	205,680	32.68
2008/09	143,847	86,787	60.33	841,458	246,051	29.24
2009/10	193,079	95,735	49.58	737,992	278,353	37.71
2010/11	333,249	193,123	57.65	723,588	433,049	59.85

Source: MoARD, 2016

2.5 Seed distribution and marketing system

Seed dissemination involves the mechanisms through which seed and information about it are moving from one to the other actor. Informal social networks serve as a means to share information. Understanding the preference of seed producers is useful to establish a sustainable seed supply system and influence the perception of seed producers and users favorably (Beyene, 2010).

Seed marketing is a vital link between the seed producers and the farmers that ultimately use the seeds. Although significant public resources are invested in the public plant breeding and multiplication, the products are not reaching farmers. Open pollinated variety seed that is available is often stockpiled in farmer unions and cooperatives, and ineffective distribution mechanisms hinder the reach of existing seed (Alemu, 2010).

Distribution of seed currently happens only through existing institutions, such as cooperatives and farmer unions, and is a constraint to the meaningful development of the private seed sector. Based on the demand planning process, MoARD instructs ESE on the type and quantity of seed to be delivered to cooperative unions, who in turn provide the seed to the primary cooperatives and farmers under them. This centralized system leaves cooperatives and farmers with relatively little flexibility in determining the type of seed they get, when they get seeds or choice of suppliers (Alemu, 2010)

2.6 Factors that governs improved seeds in Ethiopia

Low crop productivity in sub-Saharan Africa (SSA), including Ethiopia, is due to limited use of seeds of improved varieties by smallholder farmers. The supply of improved seeds of grain crops in Ethiopia is estimated to be about 10% of the annual seed planted (Spielman *et al.,* 2010).

Seed is a divisible and scale-neutral technology that can be adopted by different types of farmers from resource poor to rich (Feder *et al.,* 1985). However, deficiencies of improved seed supply due to high prices, the seed varieties demanded and quantities required, and untimely seed delivery (Bishaw and Turner, 2008; Sahlu *et al.,* 2008).

As outlined in recent FAO reports, over 90% of the fields in Ethiopia are still planted with farmers' varieties and farm saved seeds. In the informal seed system, individual farm households carry out all seed functions,

including variety selection, multiplication, processing and marketing.

The extent of farmers seed use is influenced by several factors such as availability, finance, pricing, timing and awareness and factors like shortage combined with institutional factors related to transportation and distribution of seeds.

According to (Dawit Alemu, 2011), about 80% (including both regular and irregular users) used seed of improved wheat varieties though the proportion of regular users was limited only to 33.7% in the past five years.

Irregularities in seed use are attributed to shortage of supply (29%), lack of finance (24%), high seed price (22%), untimely supply (12%), lack of awareness on seed of improved varieties (12%), and lack of trust on quality of improved seed or suppliers (12%).

Table 6 Reasons that hindered utilization of seeds of improved varieties

Reason raised by irregular users	Oromiya N=311	Amhara N=210	SNNP N=235	Total N=756
Shortage of supply	28.0	33.3	27.6	29.4
Lack of finance	24.4	26.2	21.7	24.1
High price	22.0	22.0	22.5	22.1
Untimely supply	16.7	18.6	20.0	12.3
Lack of awareness/Interest	9.0	12.4	16.6	12.3
Lack of trust on (improved seeds and suppliers)	10.0	13.0	14.5	12.2

Journal of Biology and Agriculture, 2015

*N=Number of farmers sampled for interviewed

2.6.1 Poorly developed infrastructure

Long distances between farmers' fields and seed outlets, poorly maintained roads, high transportation costs and inadequate storage arrangements have a negative impact on seed production, quality and affordability (Abraha, 2013).

2.6.2 Inadequate extension services

In many countries, including Ethiopia, extension services are not readily available or easily accessible (Spielman *et al*., 2011). Farmers often need such services to guide their decision making on production and use of quality seeds and to understand the benefits.

2.6.3 Policy and regulatory constraints

The national seed policy and relevant laws and regulations have not been revisited and amended to keep up with new developments in the industry. A number of articles need to be amended, particularly with regard to seed quality standards, which are very high for some crops.

The Seed Law No. 206/2000 demands conformity with these standards for any commercial seed. It proved impossible to achieve such standards at the current stage of development in the seed sector. This concern was noted by the responsible agency but no practical action is taken yet (Bishaw *et al*., 2008).

2.6.4 Inconsistent demand planning and target setting

The government's methods for estimating seed demand from farmers and subsequent seed production targets are inconsistent and inaccurate, leading to both over and under-estimation of demand. The allocation process is also slow, contributing to delivery delays; thus, there is a need for more reliable information about farmer seed demand to calibrate projections, including a better database of local and regional needs (Abraha, 2013).

Furthermore, planning is currently favorable to high potential areas, yet the low-potential areas are also a source of demand for improved seed. There is a case for GOE to play a stronger role in these areas (Abay F, 2011).

2.6.5 Lack of coordination between production, processing and delivery

The current processing, cleaning, testing and storage facilities are not aligned to major seed producing areas. Key resources remain concentrated in specific areas, increasing logistics costs and slowing delivery to remote areas (Food science and quality management, 2015).

2.6.6 Low participation of private sector in seed industry

For a sustainable national seed industry development, it is necessary that private seed sector participation flourishes. However the private seed sector is still undeveloped in the country. Special attention and support should be offered by the government particularly in making the working environment more encouraging to the private sector.

3. SUMMARY AND CONCLUSION

In Ethiopia almost the entire seed supply is based on rain fed seed production system. These are the key factors contributing for shortage of improved seed supply in the country. The major factor in the formal system, ESE is focusing mainly on two cereal crops, wheat, and maize; seeds of other crops are entirely supplied by the informal system (farmer-to-farmer seed exchange).

The majority of Ethiopian smallholder farmers are largely dependent on informal system, since system it providing cheaper and readily available in the farmers‟ village at the right time of seed is needed as a result of this farmers show a tendency of on the system.

The role of improved seed, in alleviating poverty has been outlined the social and economic impact of improved varieties in where they have been widely grown. Because improved seed embodies a plant's genetic potential, it determines the upper limits on yield and even the productivity of other inputs.

Despite the importance of improved seed for bettering the welfare of small-scale farmers, access to this invaluable technology can be constrained by many factors, including an underdeveloped seed industry. A seed industry essentially consists of all enterprises that produce or distribute seed.

The review show that despite extensive varietal development by the public research systems, dissemination of improved varieties to farmers remains limited. Thus result in a limited seed market competition, insufficient supply of seed relative to demand, limited choice in the few varieties and excessively high costs of improved seed production.

There is a key role to be played by the private sector to bridge the gap between the supply and demand of seed, and make quality seed available to farmers in their villages in the right amount, at the right time and place. It is expected that the increased supply will also reduce prices, making the technology available to the poorer farmers.

Formal seed system is not yet developed. On the other hand, the informal (farmers') seed system is operating with limited resources from the farmers without significant support. Special attention and support should be offered particularly in making the working environment more encouraging , effective seed demand assessment, open involvement of farmers/users during planning, every seeds produced must be channeled into the seed system.

Development of irrigation capacity should be given the priority. Providing opportunities for capacity building, basic facilities, infrastructure, improve productivity gaps, establish strong coordination between producer, processor and delivery and launching clear and simple institutional and functional linkages between research and seed producing institutions; Capacitate experts and extension agents that can strengthen the adoption of improved seed.

So, that improved seed and quality couldn't be compromised; without significant structural and organizational change to the seed system, these market and institutional failures will continue to hinder small holder access to improved varieties developed for the farmers.

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