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Vegetable Seed Systems of Ethiopia

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Abstract **– Quality seed is the fundamental unit of any production systems and the legal and regulatory environment is a significant factor impacting the availability and accessibi--lity of improved seed.Although national and regional frameworks governing seed have been established in Ethiopia, implementation of the vegetable seed system is a critical challenge.The two systems seem to suggest that the formal and informal systems have historically overlapped and there is potential for a mixed system combining aspects of the two systems to emerge, with more relevance to the realities of smallholder farmers.The informal vegetable seed system is established with farmers to farmers exchange while the formal system is highly limited to the seed business companies. Seed business companies are dependent on importation and distribution which incurred significant amount of foreign currency. This paper provides an overview of the existing vegetable seed systems in Ethiopia.**

Keywords **– Formal, Informal, Seed System, Vegetable.**

I. INTRODUCTION

In Ethiopia vegetables are produced throughout the year under rain fed and irrigated conditions. The range of vegetables grown in Ethiopia are diverse but the most common types produced by smallholder farmers and private commercial growers are tomato, capsicum(hot pepper and chilli pepper), alliums (onion, garlic, shallot), brassica (kale, cabbage, lettuce, cauliflower, broccoli, Swiss chard), cucurbits (pumpkin, cucumbers, watermelon, squash and melons), green beans, carrot, beet root, celery, eggplant and asparagus. The high demand for vegetable products, availability of suitable agro-ecology, and increasing irrigation schemes development focusing on vegetable production, have resulted in increased demand for quality seeds of improved varieties of various vegetable crops so as to serve further boost in local production, albeit with increased investment.

Research has been under taken over years on different vegetable crops of local and export values with introduction and collection of germplasms from different sources. Now50 open pollinated (OP) vegetable varieties that fit to the different production practices have been released by research centers and supplied to beneficiary. Improved edible and seed production packages have been developed. Production guidelines, leaflets and comprehen- -sive research reports have been produced. Similarly more than100 commercial hybrid vegetable varieties have been registered by seed business companies for local marketing by importing seeds. However, the accessibility the seeds of vegetables fluctuate in terms of seed types and costs.

Vegetable seed system in Ethiopia represents the entire complex organizational, institutional, and individual operations associated with the development, multiplication, processing, storage, importation, distribution and marketing of seed in the country. Farmers, particularly smallholder ones, are involved in multiple kinds of seed systems, which can guarantee them in obtaining the quantity and quality of seeds they need and to market their produce (Abebe, 2010).

Van Amstel et al. (1996), apart from providing a comprehensive definition of the seed system, recognize two distinctive, but interacting seed delivery systems: the formal and the informal sectors. Similarly seed systems in Ethiopia can be divided into two broad types: the formal system and the informal system (local or farmers seed system). The formal seed system referring to the organized seed sector including institutionalized seed producers and companies, be it private or public. The informal seed part is non-organized, encompassing seed saving, seed exchange and seed production by farmers and is often highly localized (Dawit, 2011). The two 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. There is also a system referred to as integrated seed system. Other forms of seed systems operating in both systems also exist such as community based seed production. Commercial seed systems, as part of the formal system, are also operating in the country by importing and distributing the recommended and registered commercial vegetable seed crop varieties.

II. FORMAL SEED SYSTEM

The formal seed system in Ethiopia is called formal because it is mainly government supported system and public institutions are also involved on it. The major actors of the formal system are: Agricultural Research Institutes (Federal &Regional), Private seed business Companies like Greenlife PL and Markos PLC, Federal and Regional Seed Enterprises and Ministry of Agriculture. The formal seed system is composed of several interrelated components, namely: (i) variety development, evaluation, registration and release; (ii) seed production, processing and storage; (iii) seed marketing and distribution; and (iv) seed quality assurance. It is a highly interdependent chain of operations whose overall performance can be measured by the efficiency of the different linkages in the chain (Pray and Ramasawmi, 1991). In general it is a vertically organized (Louwaars, 2002), large-scale operation, mostly with commercial interests.

Research centers are responsible for variety development and supply of initial seed, and Ethiopian Seed Enterprise (ESE) and Regional Seed Enterprises (RSEs) are playing key roles in mass production of improved seeds. Ministry of agriculture is also involved in variety release, multiplication, certification and distributi- -on of seeds in the country. Private seed companies and other farmer institutions such as unions and cooperatives are also playing key roles in importation, multiplication and distribution of different seeds (Amsalu *et.al,* 2014). Legal institutions such as variety release procedures, intellectual property rights,

certification programs, seed standards, contract laws, and law enforcement are also an important component of the formal seed system of any country. They help determine the quantity, quality, and cost of seeds passing through the seed system (Maredia, et al., 1999).

The Ethiopian government has enabling policy framework for agricultural research and technology generation and is fully supporting the research system by allocating appropriate resources. Therefore, the country's agricultural research system (NARS) has developed and released more than 50 varieties different vegetable types. Private seed business companies have requested and registered more than 100 varieties for different vegetable crops (Variety Release Booklet, 2018).

In Ethiopia, the public seed enterprises i.e. Ethiopian Seed Enterprise (ESE), Oromia Seed Enterprise (OSE), Amhara Seed Enterprise (ASE), South Seed Enterprise (SSE), and Somali Seed Enterprise (SoSE) are all largely involved in grain crops, cereals, pulses and oilseeds seed production while SoSE largely deals with forage crops seeds. But, virtually none of these seed enterprises is involved in vegetable seed production locally or via imports, although vegetable seed production and importation is within their mandates and business objectives. It has also been confirmed that the technical know-how in vegetable seed production is inadequate compared to production of seeds of field crops (in both formal and informal seed sectors) (Getachew and Mohammed, 2012).

Therefore, the vegetable formal seed system is largely depending on private seed business companies in adaptation, registration, importation and distribution across the country.

III. The Ethiopian Variety Release System

Crop improvement has been an important strategy for the development of the agricultural sector in both developed and developing countries. Modern crop varieties, the results of science-based breeding, are the backbone of the seed industry and indisputably the most critical output of investments in agricultural research. These varieties should be made available to farmers through an efficient, effective and transparent release system to benefit producers and to realize the impacts from investments in plant breeding and variety development. The procedures described below presents the requirements applicable to varieties developed through formal plant breeding by the public and private sectors some of which could be of limited relevance to those emerging from participatory approaches (Zewdie and Anthony, 2000).

The Ethiopian variety release encompasses a broadly interrelated series of activities, from identifying promising lines for further testing to release a new variety and making available breeder seed for further multiplication and the activities may include: (i) identifying promising lines with preferred traits for further evaluation from advanced variety trials; (ii) testing of new promising lines for registration (Distinctness, Uniformity, Stability = DUS); (iii) approval of the new varieties for production by National Variety Release Committee (NVRC); (iv) inscription of the varieties in the national catalogue; and (v) making available breeder seed of new varieties for further seed production and distribution (National Seed Industry Agency, 2000).

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In many countries, the private sector plays an important role in plant breeding as part of product development strategy. In contrast, in Ethiopia, the public agricultural research sector predominates and has sole responsibility in setting the national research and crop improvement strategies and priorities. The government support public over private sector plant breeding and may restrict the development of both domestic and foreign private sector operations (Tripp and Louwaars, 1997). However, the multinational seed companies apply and carry out the adaptation and verification trials of commercial hybrid vegetable which are released and registered in other countries. The adaptation and verification task is done for one season at six locations for DUS and evaluated and approved for registration by NVRC. Then seeds of registered varieties would be commercialized in Ethiopia by importing from other countries which earn significant amount of hard currency. With this approach F1 hybrid vegetable varieties have been registered for commercial use in Ethiopian.

It is important for governments to encourage public-private collaboration and partnership in agricultural research and plant breeding (Morris and Ekasingh, 2002) to exploit synergy and make available a wider choice of varieties to different sectors of the farming community.

Table 1. List of Major Vegetable Varieties Recommended, Registered and Released to be produced in Ethiopia

No	Vegetable Crop	No of Varieties			Total
		Released	Registered	Recommended	
1	Tomato	19	22	23	**64**
2	Pepper (Hot, Chili, Sweet)	13	12	5	**30**
3	Onion	6	17	10	**33**
4	Green Beans	4	8	13	**25**
5	Okra	1	1		**2**
6	Cabbage (Headed, White, Chinese)	5	11	9	**25**
7	Cauliflower		3	7	**10**
8	Broccoli		2	3	**5**
9	Lettuce	1	11	3	**15**
10	Watermelon		6	4	**10**

11	Muskmelon		1	11	**12**
12	Green Corrugate		1		**1**
13	Yellow Corrugate		1		**1**
14	Sweet Corn		1	2	**3**
15	Carrot		1	10	**11**
16	Beet Root		1	4	**5**
17	Eggplant		1	3	**4**
18	Celery			5	**5**
19	Cucumber			12	**12**
20	Leek	1		5	**6**
21	Summer Squash			2	**2**
22	Spinach			8	**8**
23	Radish			3	**3**
24	Swiss Chard			3	**3**
	Sum	**50**	**100**	**145**	**295**

Source: Summarized from Variety Release booklet (2018) and list of vegetable varieties recommended for production in Ethiopia (unpublished), Ministry of Agriculture.

IV. Informal Seed System

In developing countries, over 80 percent of crops are sown from seed stocks selected and saved by farmers or exchanged and traded locally (Alemkinders and Louwaars, 1999). The informal seed system operates at local level (Cromwell, Friis-Hansen and Turner, 1992), and may depend on indigenous knowledge of plant and seed selection, sourcing, retention, management and local diffusion mechanisms (Bishaw, 2004). Apart from farmer or community practices it also includes various local level seed production initiatives organized by farmer groups or NGOs, or both, working outside the regulatory regime of the organized seed sector.

The informal seed system, also known as local system or sometimes as "farmers" system, is called informal because it operates under non-law regulated and characterized by farmer-to-farmer seed exchange. The informal system is traditional, semi-structured, operate at the individual community level, uses a wide range of exchange mechanisms, and usually deal with small quantities of seeds often demanded by farmers.

Among the common type of vegetables, onion seed is successfully produced in Ethiopia and the seed system is more of informal. The farmers once adopted the onion seed production techniques then produce onion seed for themselves and local markets. The seed is easily marketed and exchanged from farmer to farmer by irregularly means for many seed generations.

On the other hand there is an observation that some farmers have prepared seed from hybrids tomatoes (i.e. F_2) for themselves and for local marketing, this may be due to high cost of hybrids (F_1) or know how of farmers.

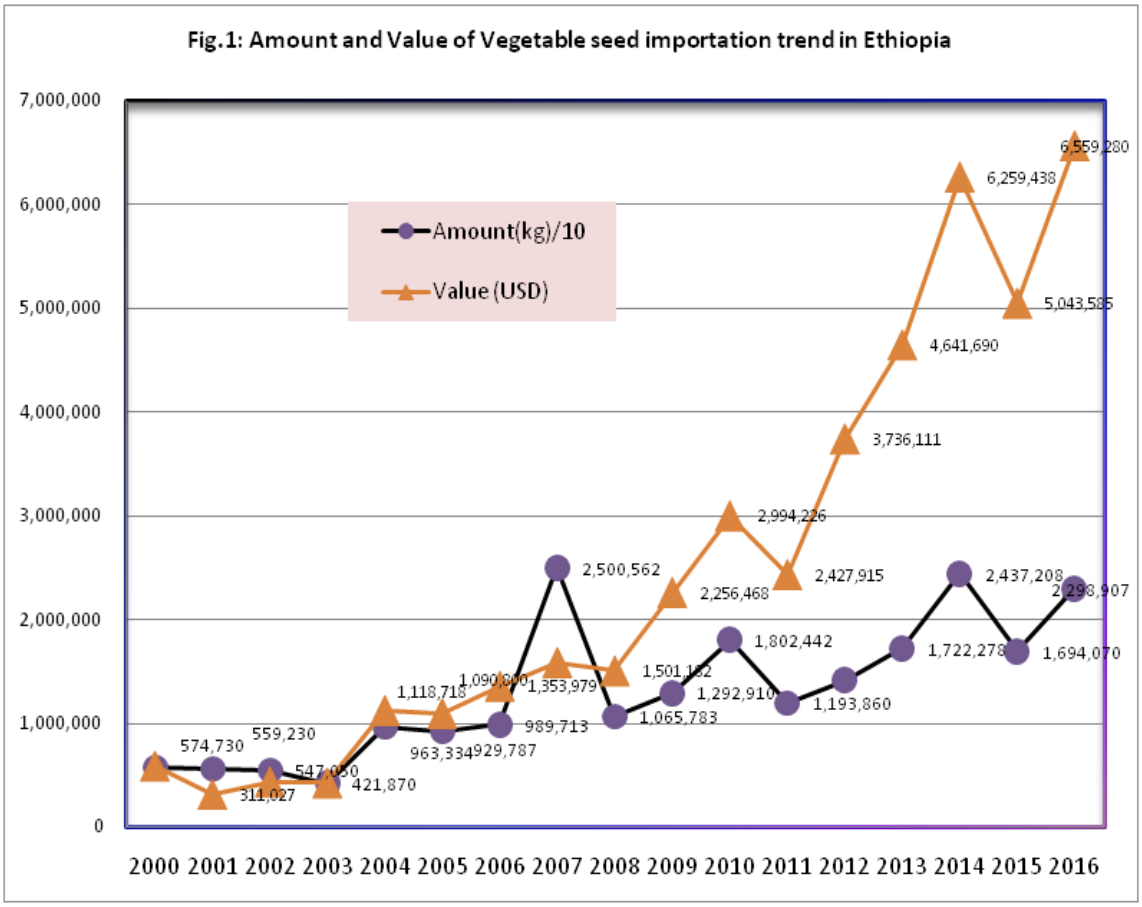
V. Supply Chain of Vegetable Seeds

The entire seed supply of a country comes from different sources, including off farm from commercial sources such as the public or private sector (formal sector) or farm saved or through local exchange and trading (informal sector). In recent times the concept of seed system has been broadened to include the role of the 'informal' sector in seed provision. A farmer may have adopted a modern variety from the formal sector, but may decide to save seed from their own harvest or exchange through social networks for the next season's planting: seed that is produced informally (Bishaw, 2004).

Vegetable growers have realized the economic advantage of producing vegetable crops in homestead and large plots, over cereals. It has been demonstrated that successful production of vegetable crops is very much dependent upon a satisfactory supply of good quality seed. However, the seed industry is lagging far behind the actual need of the producers. In the last few years, open pollinated vegetable varieties have been developed and research on seed production techniques have been attempted on onion; tomatoes, pepper and promising results have been obtained. On the other hand commercial hybrid vegetable varieties have been registered with different seed business companies.

Since there is limited organization involved in the multiplication and distribution of vegetable seeds (OP), quality seed availability of these crops is very limited. So far there are attempts for developing local seed production experiences, are very negligible when compared to its national demand. Due to the increasing demand of vegetable seeds in Ethiopia, importation of commercial vegetable seed for sowing increased from 57,473 in 2000 to 243,720.8 kg in 2014, in terms of value from 583,983 to 6,259,437.9 USD, respectively (ECRA, 2016).

Despite the enormous potentials of the vegetable sub-sector, its expansion has been gripped by complex of constraints. Among these production and distribution of good quality vegetables seeds is very critical. Quality seed is a prerequisite for development of vegetable sector but unfortunately the annual vegetable seed production in Ethiopia is negligible for the requirement of the country. Most of the vegetable seed requirements are met through imports from Europe, India and USA. Thus vegetable seed production is not only important for development of vegetable sector but also will earn/save scarce foreign exchange. Ethiopia is the largest seed importer in Eastern Africa region as it is the region's smallest seed producer yet it has the highest potential for agriculture.



Source: Summarized from Ethiopian Custom and Revenue Authority (ECRA), 2000-2016.

VI. Conclusion and Recommendation

There is a general increasing trend for development of the vegetable sector due to increasing demand emanated from increasing population, urbanization, increased awareness of the nutritional and health importance of vegetables. This has triggered increased demand for good quality seed. The demand for agro-processing and export of vegetables is also quite substantial.

There are profound structural changes and emerging trends in the seed industry, including globalization of agricultural research, shifting to private-sector plant breeding, increased investment in biotechnology, liberalization of seed trade, emergence of private seed companies, entry of multinational seed companies, greater attention to the informal sector, and debate of regulatory and trade agreements. These changes call for establishing an effective, efficient and transparent variety release system to serve the needs of diverse economies. Many countries in both developed and developing countries require comprehensive and mandatory tests for registration and performance testing for new varieties to be released for commercial seed production and use by farming communities.

The vegetable seed system is different from other crop seeds that the governmental organizations involvement is limited to multiply and distributed the released varieties from research centres. It is carried out by farmers to farmers exchange informally once they have got from agricultural research centers. The other concern of vegetable seed is that the demand is shifted to hybrid seed in major vegetable production areas and the seed system is highly dependent on vegetable seed business companies. Increasing number of international and local private agents are introducing, testing and registering commercial vegetable varieties in Ethiopia, which in turn, is increasing the chance of boosting vegetable production using high yielding improved varieties.

Since there are a number of stockiest in different parts of the country, the imported seed is easily distributed to the major vegetable producing areas and respond easily to the vegetable seed demand. However, good quality seed is still lacking due different factors: limited policy imple- - mentation capacity (e.g., facilities such as laboratory, logistics, and budget) and capability (knowledge and skill gap). Similarly, there is limited capacity of public sector vegetable breeding program to develop and release seeds that are more adapted to specific agro-ecologies in the country as well as for effective vegetable seed production and distribution, extension services and weak linkages and integration among value chain actors. A number of opportunities and constraints influenced the development of vegetable seed system and vegetable production and marketing in Ethiopia. Fully exploiting the opportunities may result in minimizing the underlying challenges. The findings of the review have the following implications to enhance the supply of quality vegetable seed and substantially contribute to increase.

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