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Review on Progress, Success, and Challenges in Ethiopian Vegetable Seed System

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Abstract
Vegetable production plays crucial role in the Ethiopia economy. It also has got due policy attention from the government. As a result there is steady increase in vegetable production over the last years. Much of the increased production comes as a result of area expansion and increase in small scale irrigation, enabling two or more production/year. But the implementation of the policy on seed system development, variety development, seed multiplication and distribution and quality control is weak or lacking. The vegetable seed system is mainly based on informal system where farmer saved seeds are used for own production for some of the vegetables for which improved varieties are not available. Research released varieties are disseminated through intermediate systems through which varieties are demonstrated, multiplied and distributed by groups of farmers or motivated private farmers. The national research system is playing significant role in variety development, variety promotion and seed supply for such vegetable crop. However, cool season vegetable crops such cabbage, carrot, beet root, carrot , lettuce and Swiss Chard are not given due attention largely due to limited access to germplasm as well as low technical capacity and capability to work on these vegetables. As a result the bulk of seed for these vegetables is imported by parastatal enterprises and private companies.
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INTRODUCTION

Vegetable production plays crucial role in the Ethiopia economy. It also has got due policy attention from the government. As a result there is steady increase in vegetable production over the last years. Much of the increased production comes as a result of area expansion and increase in small scale irrigation, enabling two or more production/year.. The production system ranges from home gardening, smallholder farming to commercial farms owned both by public parastatal and private enterprises. Vegetable crops of economic importance that are largely produced in Ethiopia include pepper, kale (Ethiopian cabbage), onion, tomato, pepper, chilies, carrot, garlic and cabbages. Green beans and peas, okra, asparagus, cauliflower, broccoli, celery, eggplant, paprika and cucumbers have recently emerged as important export vegetables, (Lemma D. et al., 1994;.

Currently , Ethiopia has shows a great demand for improved seeds of different vegetables crop to meet the high demand of private investors, small farmers and different producers for local and export markets. Most of the vegetables produced in the country are grown from imported seeds of different sources and are distributed through local traders, local stores and NGOs, which in most cases are low in quality,(Lemma D., et al., 2010).

There are numerous problems associated with the improved seed production in the country which include, absences of agencies involved in vegetable seeds, poor seed promotion and extension activities, serious disease and insect pests, lack of organized markets for small farmers and poor marketing system. Through many years of research improved varieties that have demonstrated good potential in the country have been released. Research centers also supply breeder seed and limited quantity of pre-basics seed of the major vegetable crops like tomato, onion, shallot and capsicum. Significant impact in the life of farmers have been made especially in the Rift Valley Belt where model informal vegetable seed production have been demonstrated and scaled up to different vegetables production belts in the country, (Lemma D., et al., 2002)

Therefore, the objective of this paper is to review the current status, achievement, challenges and regulatory experiences in the vegetable seed system.

LITERATURE REVIEW

Vegetable Production

In Ethiopia, there are ranges of vegetables produced in the country for local use and export markets. These are produced by smallholder farmers and farmers' organizations, private commercial growers and urban and pre-urban gardeners in which crops like tomato, hot pepper, chili, onion, cabbages, carrot, beet root, Swiss chard, lettuce snap beans, cucumber, squash, garlic and melons are the dominant ones. Recently crops like green peas, okra, asparagus, broccoli, celery, eggplant are also becoming important for private companies for the export market. The production, export and utilization of the crops have improved over the last few years MoA ,(2013).

According to CSA in the last five years (CSA, 2010) the production area of the crops under rain fed conditions increased by 25%, that is to 353,000 ha, however there was no much increase in volume of production and productivity. The highest share in area and production in small farmers sector are cabbage, hot pepper and

onion. Besides local used different vegetables like tomato, onion, garlic, shallot, cabbage, eggplant, cauliflower, green beans, carrot, turnips, lettuce, beet root, okra, Swiss chard, cucumber, sweet and hot pepper, leek, asparagus, water melon, zucchini and broccoli are being exported to different destination. Recently crops like green peas, okra, asparagus, broccoli, celery, eggplant are also becoming important for private companies mainly for export market.

The production in the public state horticultural enterprises and especially in private sector has been increased for local and export markets. The total export value of fruits and vegetables has increased to USD 30 million, which was not more than 1% of the national export. According to the five years agricultural transformation strategy plan of the country, the export of vegetable crops is expected to increase to USD 427 million in 2015, in which the development of the seed sector is critical one. It has been noted that availability of the required volume of quality seed is one of the most important bottlenecks for development in the sector in the country MoA ,(2013).

Unlike cereals, production practices of vegetable crops are diverse in which some are vegetative and others are true seed propagated types. The true seed propagated ones could be annuals of 3-5 months or biennial (10-13 months) and require different climatic conditions favorable for vegetative, reproductive and ripening processes, especially temperature that many biological processes, like floral development, pollination, and seed set and ripening. The central and Upper Rift Valley belts is demonstrated for high yield and quality produces are promising locations for various types of tropical vegetables seeds such as melon, tomatoes, capsicum, Alliums, beans. The region has dry and warm climate of 21-27 °C day and 11-16 °C night temperatures favorable for high quality seed production. The highlands of Ethiopia above 2,000 m with day and night temperatures of 15-25 °C and 5-10 °C and even cooler are favorable for flower stalk development and seed set of biennial vegetables like carrot, beets, head cabbage and Swiss chards,(Lemma ,D. et al., 2012).

The research and production experiences indicated the potential of edible and seed production of diverse vegetable crops ranging from temperate to tropical types. So, one can locally produce most vegetable crop cultivars that have good acceptability in the market. Since the sector is a newly emerged one and the commonly produced crops are exotic ones, various problems have been observed. This include availability of good quality seed to farmers and commercial growers like low quality seed, sale of some fake seed in the market which are either mixed with other crop seeds or poor in germination and product quality (like onion), old varieties susceptible to diseases, and deteriorated in the quality of fresh product (like hot pepper), field contamination and lack of qualified distributors and retailers, poor linkage of breeders and vegetable seed producers and retailers, Damte, T. (2012).

Progress of the Vegetable Seed Sector

The vegetable seed has become an important sector with the rapidly expanding vegetable development in the country. Currently there are formal (private seed companies, seed importers, research) and informal (individual farmers-based/community-based), intermediate (unions, FRGs) seed supply systems in different vegetable crops; however, the bulk of the vegetable seed is available through seed import of foreign companies and the rest through local production. The cultivars are expected to fulfill quarantine regulation, be registered, and fulfill the national seed quality standards of the country for bulk importation and distribution of the seed in the production belts in the country. The public sector, i.e. research, extension, and regulatory services, and Ethiopian Seed Enterprise (ESE) have limited involvement in availing the required volume of seed to growers. Even if it is difficult to get data of the overall seed collected and distributed in the country, the volume of supply is far below the demand of the sector ,Lemma D. and Chemdo A.,(2006). .

Recently, between the formal and informal seed system there are intermediate actors like unions, cooperatives, and FRGs with the technical support of research centers are also producing quality seed. This is a positive direction for the development of possible vegetable seed producing enterprises. In the overall informal vegetable seed system, farmers and producers get seed from research centers; private producers, farmers, and farmers organizations and individuals who produced seed and save for further uses. The small farmers receive seed through exchange with neighbors and relatives, direct purchase from local stores, donated in a form of technical support from NGOs or received from research centers as part of technology promotion programs. They also purchase from local agents of foreign seed companies, agro-dealers like Et-fruit and Agriculture Input Service of the Ministry of Agriculture, local shops and merchants. Since the sector is emerging, there is no organized seed supply system developed yet, Lemma D. and Chemdo A.,(2006.

Generally vegetable seeds of exotic types are widely imported except onion which is widely produced from locally developed technologies. The rest of the vegetables like hot pepper, shallot, leafy cabbage which are widely produced and consumed in the country are recycled in the communities either in a form of gift, sale or exchange with other seeds or seedlings of homestead horticultural crops. The main achievement will be summarized in the subsequent subsections, Lemma D. and Chemdo A.,(2006).

Seed Improvement

Research has been under taken by the public sector over the last three decades on development of technologies for edible and seed production of different vegetables. It includes varietal development, seed maintenance and initial seed multiplication. The output has been demonstrated and popularized to farmers and private companies involved in the vegetables seed especially in the Rift Valley belt.In the previous years, the vegetable technology development efforts was focused on small farmers, but recently it has been redirected to support the commercial sector in the supply of improved package technologies that help cope up with the growing demand of improved vegetable crop varieties and high quality seed for export oriented development direction of the country, Lemma D. and Shimales A., (2003).

Table 1: shows summary of released vegetable crops up to 2012 by category of releasing institutes, i.e. federal research centers, regional research centers, universities and private seed companies/agents. Although the involvement of the private sector in registering commercial varieties in Ethiopia is a very recent phenomenon, its contribution is high for vegetable crops like cabbage, onion, carrot, tomato and pepper. Regional research institutes/centers and Haramaya university have played a major role in releasing sweet potato and Irish-potato varieties. Overall, the regional research centers released about 36.4% of all vegetable varieties followed by the Federal research centers (29.8%) and private companies (26.4%). Haramaya University contributed 7.4% of the vegetable varieties released. The private sector is doing well in introducing, testing and register mainly varieties of tomato, onion, cabbage and pepper in that order MoA ,(2012).

Table 1: Summary of released vegetable crops in Ethiopia

	Federal research centre	Regional research center	Universities	Private company	Total
Tomato	10	4	0	9	23
Pepper	7	2	0	5	14
Onion	4	0	0	8	12
Shallot	4	0	0	0	4
Garlic	3	1	0	0	4
Lettuce	0	1	0	0	1
Cabbage	0	0	0	6	6
Ethiopian mustard	1	0	0		1
Carrot		0	0	1	1
Snap beans	1	0	0	0	1
Total	30	8	0	29	67

Source: Adapted from MoA (2011)

Seed Importation

In Ethiopia, to a large extent, vegetable seed demand is met through imported commercial seeds, which is imported mainly by private seed importers and parastatal enterprises such as Et-fruit and AISCO. In 2012 alone, a total of 127.8 ton of different vegetable seeds was imported (Table 2), which is more than 50% increase compared to the 2010 import (84 ton) and 276% increase relative to 2004 import, Bezabih,E., et. al,(2014).

The increase in import of vegetable seed is attributed to expansion of irrigated vegetable production both for local consumption and export. This implies that there is substantial demand for vegetable seed and consequently increase of vegetable production in Ethiopia. The bulk of the imported seed is from the Netherlands (more than 80% of the quantity and 64% of the value), followed by Italy, Germany and France in terms of share of quantity. Import of vegetable seeds from Israel accounts for 20% of the value (Table 2), Bezabih,E., et. al,(2014).

This is the main sources of seed supply for vegetable production sector in the country. Seeds of open-pollinated cultivars of the commonly produced vegetables that are registered and/or long time known to be well adapted in the country are legally regularly imported by the private and public agro-dealers like Et-fruit and Agricultural Input Service of MoA. The seed reach farmers and growers through direct sale to farmers, retailer's local shop and through informal exchange between farmers, Moa, (2011)The highest percentage (79%) imported seed in early year (2001) was highland vegetables that include cabbage, carrot, beet root and the rest were lowland vegetables like tomatoes, and onion. However, in the later year, the volume of import for lowland vegetables like tomatoes and onions increased over years due to the expansion of irrigated vegetables production in the different national regional states of the country. In 2010, the same types of vegetable seed were imported but onion took most of the share (59%) due to the fast growing irrigation development projects in the country and the diverse economic benefit of the crop mainly as major sources of income for small farmers. Since seeds of the most economically important vegetable varieties released in the national system could easily be produced, the country could save 1.3 million Euros annually from import substitution only if it is domestically produced,

Bezabih,E., et. al,(2014).

Table 2: Amount and value of vegetable seed imported from country of consignment in 2012

Country (Consignment)	Quantity (Ton)	CIF Value ('000 USD)	% of quantity	% of value
Belgium	0.08	70.75	0.06	2.1
France	3.6	64.68	2.81	1.9
Germany	3.84	74.03	3.00	2.2
India	2.58	24.24	2.02	0.7
Israel	1.16	690.87	0.91	20.5
Italy	11.94	216.31	9.34	6.4
Kenya	0.01	14.44	0.01	0.4
Netherlands	103.6 4	2,169.9	81.01	64.4
Niger	0.07	13.52	0.05	0.4
Spain	1.02	29.45	0.80	0.9
Total	127.8	3,368.24	100.00	100.0

Source: Bezabih,E., et. al,(2014).

Local Seed Production

In addition to importation, private local investors, individual farmers, and cooperative unions also produce open-pollinated vegetables seed with the technical support of the research centre like in onion, hot pepper, and limited amount in tomatoes. ESE has limited activities on vegetables. Small farmers produce vegetable seeds and planting materials for onion, tomatoes, capsicum, leaf cabbage, shallot, and garlic for their own use and for exchange and sale. Crop like onion is widely produced and farmers attained 1.5-2.0 tone of onion seed per hectare, Bezabih,E., et. al,(2014)

Depending on harvesting and cleaning operations, the germination percentage of seed, especially of onion, ranged between 60 and 98%. In tomatoes, there have been complete losses in many of farmer's fields due to exchange and sale of seed extracted from fruits rejected due diseased and poor quality. There is wide use of genetically deteriorated and contaminated hot pepper seed by farmers that seriously affected the yield and quality of the crop in the main production belts of the country. This was due to the traditional extracting practices and use of seed from farms where cultivars have been genetically contaminated and affected by complex diseases problems. The local seed production of onion is very much progressing and encouraging in the Rift Valley that improved the supply in the last few years. It is estimated that 20 tone of onion seed is produced annually in last five years which was apparently unknown in the Ethiopian agriculture system some 20 years back, (Lemma,D. et al., 2012).

The seeds produced are not certified and is properly packed and labeled to protect farmers from purchasing either fake or poor quality seed. Such producers can be supported to pack to encourage the local seed production effort that has high potential to substitute the high volume of seed imported to the country. Besides farmers and private companies, cultivars multiplied and released by research centers have been widely demonstrated and seeds have been distributed to different sectors. The promotion has helped reduce the amount of seed imported and it has been the main sources to cover the domestic seed demand of annually cultivated areas of 193,657 ha under vegetables (CSA, 2010).

Licensed Organizations in Vegetable Seed Business

Unlike in many eastern and southern Africa countries, there are few companies registered and licensed for seed production, import, and retail in vegetable seed. The companies are mainly involved in the importation and distribution (Table 3). They do not undertake research nor do they have adequate production and processing facilities and or vegetable seed production experiences developed yet. In 2010, three companies including EAR (34%), Markos (29%) and Harvest General Trading (12%) imported 75% of the total vegetable seed import and the majority of the seed is channeled to the retailers in the major horticultural crop producing areas. Very limited amount particularly from Agricultural Input Supply Enterprise goes through cooperatives/unions, MoA, (2011).

In countries like Kenya, India and Asia, where vegetables are the most important export commodities, the bulk of the seed sector is managed by foreign private companies. For example Kenya has 42 registered companies (locally owned and subsidiaries of international companies), of which 26 are licensed to sell horticultural seed. There is also limited involvement of the public sector in multiplying seeds of commonly produced vegetables. Many international private companies operate in Kenya depends strongly on the technical support and facilities of mother companies to carry out the operation, like SEMINIS seed which is also taking steps in Ethiopia. In contrast local seed production is expanding in Tanzania with the support of the research instructions and NGOs (Lenne et al., 2005. It is important to develop the sector through building awareness in

the production of quality seed and regulatory procedures, providing technical support, link different actors, control illegal importation of poor quality with the critical focus in building the capacity of the private sector and emerging seed producing and improving the production and marketing chain of fresh produces. It is also important to organize local seed producers and invite foreign companies for a joint seed business, Bezabih,E., et. al,(2014).

Table 3: Organizations licensed for vegetable seed business in Ethiopia up to 2010

Organizations	Seed Production	Seed Processing	Seed importer	Seed Retail
Teppo agric and trading PLC	x		x	x
Hawassa Greenwood	x		x	x
Ethioflora	x			
Ethiopian Seed Enterprise (ESE)	x	x	x	x
Markos PLC			x	x
Axum Green Line			x	x
Sol -Agrow PLC	x		x	x
Elfora PLC	x			
EAR Private limited Company			x	
Chemtex PLC			x	x
Ethio -Veg Fru	x			
ETFRUIT			x	x
Ajmu Import and Export Trading Enterprise			x	x
Kaleab Farm Development	x			x
General Chemical and Trading PLC			x	x
Segel General Trading PLC			x	x
Upper Awash Agro -industry	x			x

Source: Adapted from MoA (2011).

Institutions supporting vegetable seeds supply system

A successful vegetable seed system is supported by research for germplasm and variety development, seed multiplication, processing, marketing and distribution, supported by a functional seed quality control and regulatory framework.

Research system

Ethiopia has strong agricultural research program, operating at federal as well as regional states. Although horticulture (including vegetables, fruits and root and tuber crops) is one of the research program, the resources (budget and research staff) allocated to these horticultural crops are not adequate and often less than the resource allocated to grain crops. Potato, tomato, pepper, onion, and sweet potato, in that order, are among the crops for which major emphasis is given. Although seeds onion and tomato are also imported. Shallot, garlic, and paprika are considered to a limited extent. For other vegetables such as head cabbage, carrot, onion, beet root, lettuce, cauliflower, spinach, and Swiss chard, packed seeds are imported by agricultural product importers largely from European countries such as Denmark and the Netherlands. The identity (hybrid or open-pollinated) of such seeds is seldom known, Bezabih,E., et. al,(2014)

In Ethiopia, Melkasa Agricultural Research Center, which is located 117 km southeast Addis Ababa in the Rift Valley, is the main vegetable (tomato, pepper, onion, shallot, snap bean) research center. Debre Zeit Agricultural Research Center is working on garlic and shallot. The other research centers (Holeta, Bako, Adet, Areka, Sinana, and Hawassa) and Haramaya University are more focusing on root and tuber crops such potato, sweet potato, enset , taro, yam, and cassava, Bezabih,E., et. al,(2014).

Ethiopia follows the OECD seed generation (breeder seed, pre-basic, basic and certified seed) system of seed production. Research Centers are largely responsible for the first three generations, while the public seed enterprises, private (often small to medium), and seed producer cooperative/unions are producing certified seed. A number of NGOs and seed program are also involved in community based seed production. But all are largely involved in grain crops, cereals, pulses and oilseeds seed production. Virtually no public seed enterprise is involved in vegetable seed production. Research centers are contributing to seed production of tomato, pepper and onion as well as seed potato. Seed program, FAO, NGOs and community-based seed production consider seed potato production as well as distribution of seed, including vegetable seed, Bezabih,E., et. al,(2014).

Locally produced vegetable seeds like onion are sold mainly by the producers to the farmers directly as they are in the same area and the remaining part is sold through stockiest in major vegetable production areas.

Dominant vegetable seeds/varieties known to farmers are Bombey Red for onion, Bezabih,E., et. al,(2014).

Public extensions services

The regional bureaus of agriculture (having structure down up to village level) supports vegetables seed production and marketing in terms of facilitating input supply (seeds, fertilizers and pesticides), technical support in use of improved production practices and small and medium scale irrigation scheme development. Regions employ experts along thematic areas such as vegetable experts. As the structure goes down, the extension personnel become general agriculturalist like crop or livestock or natural resources. This mainstreaming emanates from the curricula of the Agricultural Technical, Vocational and Education Training Colleges (ATVET) from where the DAs graduate. The extension system provides technical backstopping to smallholder farmers and cooperatives to increase production and productivity through the use of improved varieties and yield increasing inputs such as fertilizer and compost. Vegetables are a component of the list of mandate crops considered in the extension system,(MOA, 2012).

Ethiopian Horticulture Producer-Exporters Association

The Ethiopian Horticultural Producers and Exporters Association (EHPEA) was established in 2002 as a non-profit, Non- government organization to facilitate and support development of horticulture (i.e. vegetables, fruits and flowers) sector in Ethiopia. Having more than 90 members and affiliated to the Ministry of Trade and Industry, EHPE has established network with the Department Fund for International Development (DFID), CBI in Netherlands and the French Development Cooperation. In Addition it has developed linkages with the different government organizations, Ethiopian Airlines and local banks. It has also explored linkages with business enterprises in Africa, Middle East, Europe and the USA in order to enhance development of horticulture industry in Ethiopia for export market, Bezabih,E., et. al,(2014).

Private sector

The scoping study reveals that vegetable seeds are largely supplied by government parastatal companies such as the Ethiopian Fruit and Vegetable Marketing Enterprise (Etfruit) and Agricultural Inputs Supply Corporation (AISCO). Important private sectors involved in vegetable seeds import and seed supply are Markos PLC, General Chemicals and Trading PLC, Era Agrilink PLC, and Harvest General Trading. The majority of the seed is channeled to the retailers and cooperatives/unions in the major horticultural crop producing areas. For instance, Etfruit supplies the Nantes variety of carrot from Dutch companies and distributes from its store in Addis Ababa to its branches in regional towns, seed retailers and farmers in different parts of the country (Tabor and Yesuf, 2012).

The seed quality from such government sources is reported to be of high germination and true-to-type. Private companies dealing with agricultural input supply and licensed traders also import packed vegetable seeds from Dutch companies such as Proseed, Backer Brathors and Top Harvest (Tabor and Yesuf, 2012).

Cooperatives and Cooperative Unions

In Ethiopia, cooperatives and cooperative unions considered as a means to increasing the bargaining power of smallholder farmers to increase their share in agricultural inputs marketing. Cooperatives and unions provide alternative marketing channel to smallholder farmers to market their products and stabilize market price. Cooperatives and unions also provide vegetable inputs such as seed, fertilizers, pesticides and farm tools to producers. In effect cooperatives started to play crucial role in vegetable seeds marketing, MOA, 2012).

Non-Governmental Organizations (NGOs)

In Ethiopia some Non-government organizations like Kale-Hiwot, Vita, World Vision Ethiopia, SOS-Sahel, Sasakawa Global Africa, FAO International Development Enterprise (IDE), Food for the Hunger Ethiopia (FHE) and many others are supporting vegetable producing farmers in the area of inputs supply (seeds and fertilizers), small irrigation scheme (IDE), capacity building, and knowledge management such as experience sharing visits and sharing market information.

NGOs also attempt to create market linkage for vegetables producers, although the problem of vegetable marketing is still a challenge ,Bezabih,E., et. al,(2014).

Commercial farms

Private commercial and parstatal farms in Ethiopia involved in vegetable seed importation, vegetable production, processing and export both as fresh and processed products. The major private farms include Ethio-Flora PLC, Ethio veg fru, and Jittu Horticulture, while the parstatal farms include ETFUIT, Horticulture Development Corporation and Upper Awash Agro- industries. Both groups of farms are located in the Rift Valley. Major vegetables produced for export include green peas, baby corn, okra, fine and bobby beans, asparagus,

cucumber, tomatoes, egg plant, German and Chinese cabbages, paprika, radish, carrot, cauliflower, broccoli, cabbage, and kohlrabi, Bezabih,E., et. al,(2014).

Local seed enterprises

There are four public (parastatal) seed enterprises, namely Ethiopian Seed Enterprise (ESE), Oromia Seed Enterprise (OSE), Amhara Seed Enterprise (ASE), and South Seed Enterprise (SSE). None of these enterprises is producing or importing vegetable seed, although vegetable seeds production and importation is within their mandates and establishment objectives. There are about 30-40 small to medium private seed companies/individual producers, largely producing hybrid maize seed, and a few of such small and medium seed producers are engaged in onion seed and seed potato production. Certain groups of farmers are organized into seed producer cooperatives produce seed for local level supply. Some of these seed producer cooperatives are also producing seed potato and onion, which are not certified as such (Table 5). Such cooperatives and individuals are linked with a nearby agricultural research center or university, which gives them technical backstopping in onion seed and seed potato production,(Bezabih, E., 2014).

Table 4: Seed producer cooperatives involved in seed potato and onion production

Name Cooperative	Wereda/District	Zone	Region	Crop
Aradom	Kobo	North Wol	Amhara	Onion
Meki Batu Union	Duda	East Shewa	Oromia	Onion
Burka Gudina	Tullo	West Harerg	Oromia	Potato, Onion

Source: Bezabih,E., et. al,(2014).

Seed Distribution

Today, the overall seed production and supply is a mix of both the formal and the informal sector. Seeds are marketed through agents of foreign companies, some cooperative unions, local shops, merchants, NGOs, and through other distribution agents. Since there are a number of stockiest in different part of the country, the seed is distributed in the major vegetable producing belts because of high market force mainly through local shops and exchange between farmers. Except those seed packed in cans or directly obtained from the companies, the seeds that are locally produced are not either bagged or labeled they are distributed in cloth bags or paper bags that are not standard ones. Studies have indicated that seed in farmer shop of most crops are very low, 40-60%, in germination. Considering neighboring countries like Kenya, Tanzania and Uganda, many companies are involved in vegetable seed business of seed production, packing, distribution in the domestic and export markets. However, the assessment in Ethiopia indicated that the seed supply is very limited and the distribution is not organized to satisfy the bulk of vegetable growers and those involved in the development chain , (MOA, 2012).

Vegetable Seed Regulation

Seed regulation is important to ensure the release and availability of good quality cultivars and facilitates seed import and export, and support the involvement of different actors. Similar to cereal, there are regulatory supports like variety release, registration, and already developed seed standards for different vegetable crops. However, seed quality control and certification is not implemented yet for locally produced seed. Commercial cultivars imported by different seed companies and Agro-dealers are checked for their quality performances and being free from diseases, however this is not effectively implemented due to resources limitation. Minimum laboratory and field quality standards have been developed for 20 vegetables that provide the necessary quality assurance for producers. It included field standards (isolation distances, rotation and pests levels) and laboratory standards (germination, purity, moisture content (for the different classes of seeds that includes breeder/pre-basic, basic and certified (1-4 levels) (QSAE, 1997). On the other hand, a Plant Breeders Right (Proclamation, No.481/2006) that protects and rewards breeders and encourages private companies in the seed business has been established. As in many countries, such legal protection encourages the involvement of foreign companies in vegetable seed business. Since it is an emerging industry; it may not be encouraging to regulate all aspects of the seed industry in the early stage of development that may discourage involvement of local and foreign companies in seed business, (MOA, 2012).

Enterprises in the vegetable business

The Ethiopian Industrial Development Strategy also encourages agriculture-led, export-oriented and labor-intensive industries, including agro-processing vegetables and fruits (Ethiopian Investment Agency, 2012).The Ethiopian investment policy encourages private sector involvement in production, processing, marketing and distribution as well as export of horticultural crops, including fresh vegetables (Ethiopian Investment Agency, 2012). Incentives include amongst others duty free importation of production equipment and an income tax holiday. Access to land is facilitated through EHDA and the regional authorities. At Federal level the Government policies and plans include strategies for the more efficient use of irrigation facilities and the

development of new irrigation schemes. However, there are few agencies engaged in vegetable processing. Table 4 presents some agro-processing industries involved in vegetable processing and cottage level processing of vegetables such as hot pepper, which is common in major cities in Ethiopia,(MOA, 2012).

Table 4: Vegetable processing factories in Ethiopia

Name	Ownership	Major Products
Melege Wendo Food Processing Factory	Private	Tomato paste
Gondar Food Processing Factory	Private	Tomato paste
Merti Processing Factory	Public	Tomato paste
ECOPIA	NGO	Processing and canning of hot pepper

Source: Ethiopian Investment Agency (2008).

Success in Onion Crop Development

As part of the research system, Melkassa Research Center (MRC) is the pioneer for the introduction and promotion of onion crop with the release of Adama Red cultivar. It is rapidly becoming popular crop for its diverse economic benefit to small farmers and its substantial contribution to the economy of the country as an export commodity in different forms, i.e. dry bulb, seed and cut flower, overcoming the local demand, Lemma and Chemdo (2006).

The research center organized a linkage forum with the concerned bodies and farmer of five potential onions producing weredas in East Shewa Zone of Rift Valley Belt. The research assisted farmers in supplying breeder seed, in marketing, organizing field days and training and regularly inspection of the seed plots where as the rest actors were also given the responsibility to support the production and marketing as noted in detail in Lemma and Chemdo (2006). The farmers produced 4-30 q of onion seed depending on the size of plot. The seed price has been increasing from 100-200 Birr kg-1 of the previous years to 400-500 Birr kg-1 in 2010. It is estimated that 200 q of onion seed was produced annually in the last five years. Significant improvements in the living standard of onion dry bulb and seed growers and a rapid shift of small farmers to commercial producers took place, Lemma and Chemdo (2006).

This situation create opportunity for growers to expand onion production as the locally produced onion seed is available everywhere for sale, as a result growers in the region grow only locally produced seed, and most farmers in the Rift valley region became self sufficient in onion seed. As a result of this effort the crop is currently produced in different regions of the country where it was not known before like West and East Hararghe, Gonder, Tigray, QSAE SNNPR. This has contributed to the growing seed demand from different development regions of the country like, Amhara, SNNP, Somalia and Afar Regional States, (MOA, 2012).

Small farmers became self-sufficient in seed and the number of private investors and small farmers' seed involved in vegetable seed production increased over the last five year. Seed availability in private seed shops,Local communities in the Rift Valley and the request for improved vegetables seeds have been beyond the capacity of the research centers. The experiences of Rift Valley have been largely publicized which enable many farmers to realize the advantage of producing onion seed in large scale. The knowledge and skill gained in onion seed production techniques by farmers, development agents and other partners improved availability of onion seed in the local market and promote the onion industry in the country.

Challenges in the Vegetable Seed Sector

There is limited awareness on the importance of vegetable seed sector and in technical knowhow on the production, processing, and distribution. The seed program has not been given due attention as an important sector for the development of the industry.

There is a lack of linkage between the government-breeding program and the private seed sector, and lack of public and private sector partnership in the sector created gaps in availing improved seed production technologies and technical support for emerging actors in the sector.

There is no strong seed technology and variety development program on hybrids and even on open-pollinated cultivars released from the research system are not widely multiplied and have not reached vegetable producers.

In many countries, the vegetable seed sector is well handled by the private sector, but in Ethiopia, there are no strong private local and foreign companies involved which is important for such types of high value crops development.

Conclusion

Vegetable production plays crucial role in the Ethiopia economy. It also has got due policy attention from the government. As a result there is steady increase in vegetable production over the last years. Much of the increased production comes as a result of area expansion and increase in small scale irrigation, enabling two or more production/year. But the implementation of the policy on seed system development, variety development,

seed multiplication and distribution and quality control is weak or lacking. The vegetable seed system is mainly based on informal system where farmer saved seeds are used for own production for some of the vegetables for which improved varieties are not available. Research released varieties are disseminated through intermediate systems through which varieties are demonstrated, multiplied and distributed by groups of farmers or motivated private farmers. This community-based seed system is not subject to proper quality regulation.

Progress in production, marketing and utilization of fresh produces is important for sustainable development of the vegetable seed sector. This could be achieved with well organized and integrated production plan program of concerned actors. In the overall assessment, improved vegetable technologies have shown the potential of producing good quality vegetables in different ago climatic regions of the country. The production, local consumption and export have also been increasing over the years. It is important that the production and supply of good quality seed for small farmers should be promoted with technical guidance and financial support considering, that there are many open-pollinated cultivars that are not multiplied and reached farmers; it is important to promote the onion seed multiplication scheme/model experiences with strong collaboration of research, farmers/growers, seed distributors, vegetable producers and the extension sector. Improving the linkage between the formal and informal practices that help build capacities and experiences for further promotion of the vegetable seed sector. Consultation forum could be important to discuss and promote the availability of the required volume of quality vegetable seed for small farmers.

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