International Journal of Research Studies in Agricultural Sciences (IJRSAS)
Volume 5, Issue 8, 2019, PP 15-25
ISSN No. (Online) 2454–6224
DOI: http://dx.doi.org/10.20431/2454-6224.0508003
www.arcjournals.org

Challenges and Opportunities of Vegetable Quality Seed Production and Seed System in Ethiopia

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Abstract: *Seed is among the most key input for improving crop production and productivity. This review paper was aimed to recognize opportunities, constraints and potentials in Ethiopia for production of vegetable seed production. Major opportunities and potentials existing in the country for production of vegetable seeds were reviewed and described. Ethiopia has a comparative advantage in production of horticultural commodities on account it's favorable climate, proximity to European and Middle Eastern markets and cheap labor, low cost, disciplined and trainable Labor force and the size of its domestic market and the numerous river basins affording great potential for irrigation. 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, ensuring food security and improving livelihoods. The Ethiopia seed system has undergone a tremendous change during the past three decades. 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 highly centralized seed distribution system and virtual absence of seed marketing conducted by the seed producing enterprises and companies. Currently, government and private seed enterprises are involving and combining their efforts to produce and supply seed to the growers. Beside these, the sector suffers from weak linkage and integration among the stakeholders; there is a substantial gap exists between the production and availability of commercial seed and farmers' demand. It describes the stakeholders and structure of the seed system and examines its performance in contributing to seed availability and access. It also briefly indicates the major constraints and opportunities in the sector regarding with the production and dissemination of improved seed and suggests the possible solution to tackle these constraints.*

Keywords: *Production, Seed Yield, Seed System, vegetable*

1. INTRODUCTION

Vegetable production is an important economic activity in Ethiopia. The production system ranges from home gardening, smallholder farming to commercial farms owned both by public parastatal and private enterprises (Aklilu, 2000). In the context of this paper, vegetables are defined in culinary terms to include vegetables "proper", that have fruit and leafy herbaceous parts eaten raw or cooked (i.e., lettuce, head cabbage, Ethiopian cabbage/kale, tomatoes, green and red peppers, Swiss chard, celery, green beans, etc.), root and tubers which include beetroot, carrot, potatoes, sweet potatoes, taro/*godere* and bulb crops (onion, garlic, shallot). Indeed, Ethiopia is endowed with diverse agro-ecologies suitable for the production of different categories of vegetables. Tropical, sub-tropical and temperate vegetables are produced in the lowlands (<1500 meters above sea level), midlands (1500-2200 masl), and highlands (>2200 masl), respectively (EHDA, 2012).

The vegetable crops are very important source of nutrition to a country like Ethiopia where the population experiences malnutrition due to heavy dependency on cereal crops. Its primary contribution is solving the heath problem through providing vitamins, minerals and protein also important for food security in times of drought, famine and food shortage. Vegetables serve as suitable crops for farming systems diversification and land intensification, particularly with recent increases in the establishment of small and medium scale irrigation schemes in the country .The country has favourable climatic conditions for seed production of various crops ranging from temperate to tropical vegetables. The successful seed production of these crops depends on the supply of good quality seed. Cultivation practices for vegetable seed production require more attention and special skills compared to field crops (Shimeles, 2000).

Seed is among the most key input for improving crop production and productivity. 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, ensuring food security and improving livelihoods. The Ethiopian seed system has undergone a tremendous change during the past three decades. 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 highly centralized seed distribution system and virtual absence of seed marketing conducted by the seed producing enterprises and companies.

Although the seed production and quality are very low due to main reason is restricted use of inputs, lack of improved seeds and fertilizers. The use of poor genetic potential is one of the contributing factors for low productivity. Over 95% of seed sources come from farm saved seed of non-improved land races different vegetable seeds are imported. There is a danger in relying on imported seed. Imported supplies may be disrupted by political changes; outbreaks of insects and diseases abroad may force the importation of seeds to be banned. Complete reliance on imported seeds may also lead to a dependence on foreign technology. It also may be low quality both genetically and physically (Lemma, 1998).

In general; Major seed system constraints in Ethiopia are inadequate seed marketing information and infrastructure, diseases and pests introduction due quarantine problem, lack of a clear seed strategy, inefficient extension services, limited collaboration within the seed sector, private companies tend to concentrate on profitable crops, lack of awareness and knowledge gap about seed production, inadequate basic seed supply, budget limitation for field inspection, lack of effective large scale seed enterprise and industry.

Sustainable availability of good quality seed and well-functioning seed system is vital development issue, without it which attaining the required agricultural production and productivity is impossible. Therefore, it is highly important to assess or review challenges and opportunities of seed system in Ethiopia that entirely influence quality seed production and subsequent crop production.

2. REQUIREMENTS FOR VEGETABLE QUALITY SEED PRODUCTION

2.1. Climate Factors and Physiographic Factors

The yield potential of vegetables seed revolves around photosynthesis and respiration, directly or indirectly, climatic factors that affect the efficiency of these processes must be at optimum level. Each crop has certain climatic requirements. To attain the highest potential yield per unit of land, a crop must be grown in an environment which meets these requirements. A crop that is well matched to a particular climate can be grown with minimal adjustments (AVRDC, 1990). The major environmental factors influencing vegetable seed production are: Photoperiod Temperature, Rainfall, Wind, Altitude, Topography and Steepness of Slope

Light: Light for the plant is not only used as an informational medium, but also for producing food through the process of photosynthesis. Light Quality is often referred to as white light and is composed of all colors of light. The amount of sunlight also varies with the season of the year, elevation and time of day. The plants have varying preferences for light intensity. The light saturation point is the point above which an increase in light intensity does not result in an increase in photosynthetic rate. The crops such as corn, cucurbits, legumes, potato, and sweet potato require a relatively high level of light for proper plant growth, while onions, asparagus, carrot, celery, lettuce and spinach can grow satisfactorily with lower light intensity (Dennis, 1998).

Light duration is the length of the light period (also called photoperiod or day length) varies according to the season of the year and latitude. One important plant response to day length in some plants is flowering. Short day plants flower rapidly when the days get shorter, for amaranths, soybean and long-day plants flower fast when days get longer, for spinach, radish, cabbage, cauliflower, broccoli, turnip. The plants that are not affected by day length are called day-neutral plants. These plants can flower under any light period for, tomato, brinjal, lettuce, cucurbits, carrot (Xiaoyu *et al.*, 2012).

Temperature*:* The seed production potential studies of cool season vegetables have been under taken in the highland of Ethiopia that correspond to temperate climatic conditions at 2000-3000 m.a.s.l. at Bokoji (Arsi highland), Ankober (Northern Shoa) and Lai Giant, (Southern Gonder) in 12 months planting dates. In these area crops require cooler climate for vernalizing the dormant bud and develop flower stalk and then warmer conditions for seed development.

Temperature significantly influences the transition from the vegetative to the reproductive phase of the crop species having specific critical temperature requirements for flowering. Not only has the flowering, the prevailing temperature during growth and developmental phases of plant determined the final seed yield. The seeds of carrot, beet root and cabbage were well adapted for seed in specific growing seasons in this area. The seed yield and quality depend on the growing seasons and specific location (Semahagne *et al*. 2006). The overall onion seed germination percent varies between 90-95% with 1000 seed weigh of about 3.5-4.0 g (Yemane, 2016).

The high temperature has direct dramatic effects on plant growth and development, organic matter decay, seed germination, root development, and water and nutrient absorption by roots. The size, quality, and shape of storage organs are greatly affected by soil temperature. The most crops are injured at temperatures at or slightly below freezing. Tropical or subtropical plants may be killed or damaged at temperatures above freezing but below 50ºF (10ºC) (Xiaoyu *et al*., 2012**).**

Rainfall: an appropriate balance between sufficient rainfall for crop growth and establishment and sufficiently dry conditions for satisfactory pollination and seed ripening is the most important factor in the vegetable seed production. The sufficient soil moisture must be ensured during flowering stage when the crop is moisture sensitive, owing the reduced root growth. The seed viability can be seriously affected by high rainfall during the seed ripening period (Rashid and Singh, 2000).

Wind: The excessive wind increases water loss from the crop, soil and prevent maximum activity of pollinating insects, carry wind-borne pollen over long distances and increases loss of seed by enhancing shattering during seed ripening. The strong winds during the reproductive phase can cause severe crop losses through lodging, shattering and shedding of seed. On the other hand gentle wind facilitates increased pollination in cross-pollinated crops (George, 1980).

2.2. Soil Factors

The soil holds up the plant and acts as reservoir for water. The soils may be neutral, acidic or alkaline depending upon their content of basic salts and acidic components. Neutral soils are the best for growth of most crops. It is also the main source of plant nutrient elements. Its physical and chemical characteristics greatly influence the nature and rate of plant growth. The mineral particles tend to group together, so that there are spaces.

The most suitable soils for vegetable seed production are usually defined as deep, fertile, well drained, light to medium learns. Well drained organic soils are also suitable, although in practice most vegetable crops can be grown on a much wider range of soil type's- Brussels sprouts, for example, root crops thrive well in light soils, provided it is rich enough for them. In selecting a soil for vegetable growing, good texture and structure are of great importance. In silt loam soils are one of the best soils for growing most of the vegetable crops especially when heavy yields are desired production (Has, 1997).

2.3. Agronomic Factors

2.3.1. Site Selection

The three major points should be considered in selecting a field for growing vegetables such as site topography, soil type, and water availability (quantity and quality).Topography refers to the physical layout or characteristic of the field area. Elevation, contour, soil depth, water and air drainage patterns as well as the presence or proximity of rock out cropping and trees can significantly influence production. The selections of suitable areas for seed production are based on climatic factors which ensure a relatively satisfactory environment for vegetable quality seed production (Joseph *et al*., 2009).

2.3.2. Land Preparation

The optimum land preparations for seed beds has mellow soils comprised of fine sized particles, free of clods, weeds and previous crop residue. The appropriate soil preparation for the various vegetables, the yield is found to be better. The plants can be grown on raised or flat surfaces. The seed beds must be uniform as the vegetable seeds require precision planting for best performance and uniform development (Joseph *et al*., 2009).

2.3.3. Method of Seed Production

Vegetable seeds are propagated through direct drilling or transplantation methods. Planting at the right time is essential for these crops. They are various methods of planting such as "seed-to-seed"

method is one which involves planting of the biennial seed and harvesting of the seed crop the next season. Carrots and onions are typically grown similarly. The other method is the "root-to-seed" method which involves the planting of the biennial seed and transplanting of the seed crop in the next season. Row spacing for the vegetable seed production differ from the fresh market production. The factors taken into consideration for growing the plants include provision of sufficient space for flower development, air movement, machinery cultivation and harvest operations (Peter, 2001).

The use of an appropriate seed class and an approved source is necessary for raising the seed crop. They are four classes of seeds, namely, breeders, foundation, registered and certified. Isolation is one of most important during seed production to ensure that the possibility of cross-pollination between different cross-compatible plots or fields is minimized. The adequate isolation also assists in avoiding admixture during harvesting and the transmission of pests and pathogens from alternative host crops. The vegetable seed crops can be isolated by time and by distance, for highly cross-pollinated (by insects) vegetable crops like onion, radish, cabbage, cauliflower and cucurbits require isolation distance of 800-1000m, while wind pollinated vegetables like spinach, beet require isolation distance of about 2000m (Rashid and Singh, 2000).

2.3.4. Fertilizer Management

The best management practices are reducing the load of specific fertilizer compounds entering ground and surface water, while maintaining or increasing economical yields. The nutrient integrated management are intended to be economically sound, environmentally effective, and based on crops requirement. They should be viewed as a means to balance economical vegetable production with environmental responsibility. At the field level, adequate fertilizer rates should be used together with proper irrigation scheduling techniques and crop nutritional status monitoring (Guodong *et al.*, 2016).

2.3.5. Water Management

Proper water management planning must consider all uses of water from the source of irrigation water to plant water use. It is very important to differentiate between crop water requirements and irrigation or production system water requirements. Irrigation water is also required for field preparation, crop establishment, crop growth and development, within-season system maintenance, delivery of chemicals, frost protection, and other uses such as dust control (Lincoln *et al.*, 2016).

2.3.6. Disease and Pest Management

The health of vegetable seed production is best maintained through management practices that integrate different techniques. It is important to consider the economics of the crop, cost of the management practice, history of the production area, weather and climatic conditions, and potential risk for disease, insects to develop. Integrated management strategies are more likely to successfully control diseases, insect than non-integrated. Ultimately, integrated management strategies provide a means for producers to reduce the risks of economic losses (Colquhoun et *al.*, 2015).

2.3.7. Harvesting, Processing, Extraction and Drying Of Seeds

The harvesting stage usually determines seed quality. Thus it is generally accepted that the seeds should be allowed to develop fully in the fruit or seed moisture content reach below 25% before extraction. Early harvesting can avoid adverse conditions such as bad weather, molds insects, birds and rodents. The precautions are taken to prevent damage to the seed and mechanical mixture with seed of other varieties. After harvesting, all the process operations such as winnowing, cleaning, separation, drying and packaging are performed in carefully and time manner (Kuo *et al*., 2006).

It is of great importance to harvest the seed crop at the time that will allow both the maximum yield and the best quality seeds. The seeds are harvested when their moisture content is about 15-20%. Cole crops are harvested when siliqua becomes yellow; the pods of legume vegetables are harvested when they are dry enough. In vegetables like tomato, brinjal, chilies and cucurbits well ripen fruits are collected. They are cut or smashed under pressure to extract seeds. In brinjal and tomato, crushed fruits are allowed to ferment for one or two days for quick and easy extraction of seeds. In order to preserve seed viability and vigor it is necessary to dry seeds to safe moisture content level. The drying of seeds may be done by sunlight, chemical desiccants and by mechanical driers. The air temperature of the drier should not exceed 38°C in order to maintain good vigor and viability of the seeds.

Sensitive seeds like onion, carrot, and leek are requiring dry temperature below 27°C. For short period storage clean and dried seeds should be filled in neat and clean sacks or bags and stored in a clean, cool go down (Rashid and Singh, 2000).

2.3.8. Storage Period of Vegetables Seed

After seed extraction and drying have been completed, it is necessary to keep the seed under the best possible conditions to ensure that the maximum seed quality factors are maintained. Stored seeds are the primary input the country's Vegetable production program. In practice it is the combined effect of temperature and RH which reduce potential viability or longevity of seeds throughout its storage life. There reduction of the seed viability is usually slow at low RH and temperature. The control of RH and its subsequent effect on seed moisture content is more critical than storage temperature in achieving optimum storage condition (McDonald, 2001).

Onion seed is the most sensitive to storage conditions, and tomato seed the least sensitive. In storage experiments at 50°F (10°C) and 50% RH, seeds of bean, cucumber, pea, sweet corn, tomato, and watermelon did not decrease significantly in germination over a 9-year period. Under similar conditions, seed stocks of cabbage, carrot, celery, lettuce, okra, onion, pepper, spinach, and turnip did not decrease significantly in germination during 36 weeks. The viability of seeds of most vegetable species will be maintained at a satisfactory level for 10-12 months when stored under conditions where the sum of the percent RH and the temperature (F) does not exceed 100 (Loren and Elhadi,2008).

2.4. Biological Factors

The biotic factors include beneficial and harmful insects and microorganisms and higher plants and animals. The disease and insect control is very important in raising healthy seed crops. The pest infestation not only reduces the seed yield, but also damages the quality. The same control methods are used in seed production as for the production of market vegetables. The range of available pesticides differs from one country to another, but only approved and proven products should be used in seed production, as possible adverse effects of pesticides include in advertent killing of pollinating insects, modification of the seed's potential germination and a reduction in quality (Rashid and Singh, 2000).

2.5. Socio Economic Factors

The man or women produce changes in plant environment and responsible for specific crop and soil management, breeding of varieties for increased yield and introduction of exotic plants. Factors affecting the crop production are economic condition of the farmers greatly decides the input, the educational status and technical known-how of the farmers, the resource allocation, ability, and social value of the farmers, government, prices, policy, marketing and storage facilities (Chandrasekaran *et al.*, 2010).

3. VEGETABLE SEED SYSTEMS IN ETHIOPIA

3.1. Status of the Ethiopian Seed Industry

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. 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 (Atilaw, 2010). Legal issues, such as variety release procedures, intellectual property rights, seed certification programs, seed standard authorization and contract laws enforcement are also important components of seed systems determining the quality and costs of seeds passing through the seed systems in the country (Abebe and Lijalem , 2011).

Seed systems in Ethiopia can be divided into three components: the formal system, the informal system (sometimes called local or farmers' seed system) and alternative or integrated seed system (Getachew, 2010; Adane, *et.al*. 2010 and Gebremedhin, 2014). Both informal and formal seed systems are operating simultaneously in the country and difficult to demarcate between the two. The formal seed supply is not well developed in many developing countries, including Ethiopia. In Ethiopia, as in many other countries in sub-Saharan Africa, the informal seed marketing is still the dominant system for seed supply. The proportion of seed supplied by the formal seed system is estimated to be around 10-20% in Ethiopia (Kiros *et al*., 2009 and Getachew, 2010).

In Ethiopia informal, alternative and formal seed systems co-exist. The informal system with low quality seed is dominant (Adane *et al*., 2010). As listed in the table below, from the total of 12 thousands hectare of land covered by seed in the year 2005 to 2010, the formal seed in Ethiopia is only contributed less than 4%. Hence; the formal system is too small to contribute significantly to improve the situation. The informal seed system should prioritize improving seed quality by increasing awareness and skills of farmers, improving seed quality of early generations and market access. The alternative and formal seed systems should prioritize improving the production capacity of quality seed by availing new varieties, designing quality control methods and improving farmer's awareness.

Table1. *Comparison of area coverage (ha) by the informal and formal seed system during 2005/06 to 2009/10*

Total	2005/06	2006/07	2007/08	2008/09	2009/10
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: *Abebe and Lijalem, 2011*

3.2. Seed System Structure

The seed industry in Ethiopia involves range of both public and private sector. The national research system-headed by the Ethiopian institute of agriculture research (EIAR) and comprised of a range of federal research centers, regional research centers, and agricultural universities and faculties is charged with developing improved varieties and materials needed to produce and multiply certified seed for onward sale to farmers. Regulatory function, such as, varietal release reviews and seed certification are performed by various department of the MoARD (Spielman *et al*., 2009). Improved seed production and multiplication is carried out by the Ethiopian Seed Enterprise (ESE), which relies on its own farm and to a limited extent, private sub-contractor, state farms and cooperatives- to bulk up seed that is supplied to the regional extension and input supply system, more recently, state owned regional seed enterprise have also emerged in Oromiya, South and Amhara.

4. MAJOR CHALLENGES OF VEGETABLE SEED SYSTEM IN ETHIOPIA

4.1. Inadequate Seed Marketing Information and Infrastructure

Remote area farmers or furthest from cities are faced by in accessibility of seed market information and infrastructure. The fact we know that seed must reach the farmer at the right time, place, in the right amount with appropriate price and of the highest economic quality. Since seed Marketing is sensitive to so many factors, it has been considered as a high risk for seed distribution.

In our country Ethiopia seed marketing remains one of the weakest links in the seed supply chain, thus limiting farmer access to good quality seed. It is also a big constraint for African countries in general. The marketing system is poor, access to market information is limited and so far market linkage is weak or non-existent (Bezabih *et al*, 2014). Therefore, to minimize the high risk-business nature of the seed sector, it is very crucial to implement and follow all the marketing functions and marketing principles. For this reason it is very important to understand what are the challenges of seed marketing? Why only few farmers are participating in the seed marketing, etc.? Although so many measures has been taken to improve the service efficiency of the seed sector (public institution) for the last five decades, farmers' access to seed was hindered by technical problems, poorly developed seed sector and rural marketing infrastructures. The formal seed sector, despite all the efforts made to improve the sector for the last five decades, it was able to supply only 10-20% of the potential demand of the country. In this respect development and promotion of different seed system at both community and private levels near by the farmers' area are a potential solution to this problem (Getachew, 2010).

4.2. Diseases and Pests Introduction Due to Quarantine Problem

The imported seeds are distributed by local traders, farmers' cooperative/union, bureaus of agriculture, and NGOS. Such seeds are rarely checked for quarantine and quality by the seed regulatory department of the Ministry of Agriculture and the regional bureaus of agriculture. Access to quality seed sources is limited incase farmers use any available seeds they access that increase seed borne diseases and subsequent seed damaging.

4.3. Lack of a Clear Seed Strategy

The informal seed system has gone largely unrecognized, unappreciated and undocumented while the formal seed sector has been unsuccessful in meeting farmers' needs. Various factors may hinder the efficiency of seed system in Ethiopia. These factors were not studied in-depth; as a result no appropriate strategy is designed to promote the local seed marketing development in a commercial way, which in turn suppresses the Economy in general. For this reason it has been remained to be difficult to utilize local seed resources (Getachew, 2010).

According to Bezabih *et al*., (2014) the vegetable seed system in the country is at infant stage, primarily depending on the informal, community-based seed production and on unregulated seed import. Therefore; clear seed strategy is prerequisite in order to plan programs and projects in the seed sector.

4.4. Inefficient Extension Services

Most farmers and even some extension agents do not know the types of imported varieties used by the farmers. The varietal replacement period is very long as older varieties are still in production due to the weak variety development program and slow promotion of newly released varieties by the extension system. Whenever; there is chance varieties are chosen or replaced for their yielding potential, taste, color, long shelf life, market demand and largely availability of seed (Bezabih *et al*., 2014). So as to lack of adequate extension information is one of the main reasons for the low adoption rates of improved varieties.

4.5. Private Companies Tend to Concentrate on Profitable Crops

Offers only seed of a limited range of varieties especially those in which particularly developing hybrids and seeds for specialized cash crops have got attention.The seed production of low-value, self-pollinating cereals, most horticultural crops and legumes do not generally attract private investment and are either ignored or left in the hands of government agencies.

Small farmers rely heavily on the cultivation of these low margin crops, but production is often constrained by a combination of factors including low purchasing power, lack of appropriate new varieties, inadequate extension and awareness, and poor infrastructure. The limited success of public enterprises in distributing seed to small farmers explains why many developing countries now seek alternative seed supply systems as part of their civilization (Getachew, 2010).

4.6. Lack of Awareness and Knowledge Gap About Seed Production

In developing countries farmers still do seed selections save before harvesting based on their experience and save their own seed for a long time which not genetically pure and low in yield and relates specially for easily out crossing crops. Some old cultivars commonly used by farmers within the presence of elite newly released varieties for such crops which due to lack of awareness and updating knowledge. Seed companies do not generally have a commercial interest in many of the crops grown by small farmers because they earn relatively small profit margins. There is therefore still a challenge within rural communities to identify cost-effective mechanisms to update their knowledge and deliver seeds to small farmers (ISSD, 2013).

4.7. Inadequate Basic Seed Supply

The seed enterprise through research recommends the variety and the class of seed to be multiplied. Seed must be obtained from an authentic source (FAO, 2012).However; most of the contractual farmers are insisting to give back what has been produced and the seed is sold as grain instead of seed in any local markets. The government also understood that a single enterprise couldn.t meet the huge demand of seeds in the whole country (Abebe and Lijalem, 2011). Limited number of private investors in the Rift Valley also produces seeds and sells to farmers, or NGOs which purchase seed and distribute to farmers through development programs (Bezabih *et al*, 2014).

4.8. Lack of Postharvest Handling Experiences

Proper and suitable post-harvest handling system is very crucial conditions to avoid seed deterioration. Especially at peak harvest, storage and handling of the seed (Gebremedhin, 2014).

4.9. Budget Limitation for Field Inspection

Some established seed enterprises, NGOs and public services trying to supply certified seed for rural populations. However, most of them face various structural, technical and financial problems (ISSD, 2013).

4.10. Lack of Effective Large Scale Seed Enterprise and Industry

The seed industry in Ethiopia is still in the infantile stage. Lack of seed production technology is one of the major reasons for the proper development of seed industry the reverse also true. Quality seed multiplication and distribution is difficult by public universities and research institutes alone. Especially the private sectors have the chance of being strengthened and develop seed industry. Currently; Ethiopian Seed Enterprise is still expected to play a greater role in alleviating the problem of seed shortage in the medium term if not in the short run.

5. Opportunities to Develop Vegetable Seed Production in Ethiopia

5.1. Presence of High Seed Demands with a Limited Seed Supply

The demand for improved seed is still increasing rapidly from time to time over the last seven years (Abebe *et.al*, 2017).This is true for cereal crops such as wheat, Teff, etc, and vegetables seed such as potato, onion, and pulses. The existing private and public companies in Ethiopia produce limited amount of seed that do not cope with the growing demand in the country due to both technical and organizational low capacity. Over 95% of seed sources come from farm-saved seed of non-improved land races (Getachew, 2010).

5.2. Governments and Assisting Agencies are Currently Reassessing their Strategies

Now a days the government paying greater attention to the potential contributions of private firms, cooperatives and other nongovernmental organizations (NGOs) which are currently reassessing their strategies.

5.3. Government Investments in Rural Infrastructure and General Agricultural Policies

There are normally determined independently of the needs of the seed sector, can indirectly exercise a profound influence on the growth and structure of the seed supply sector. Investments in rural roads, markets and storage facilities can substantially reduce the cost of improved seed by decreasing transport, processing and distribution costs.

5.4. Availability of Human Resource with Trained Person

Now a days, from different colleges graduated professionals and technicians in the field of agriculture and others exist in good number throughout the country. This thus, unemployment also increase day after days this asset is lacking in many developed countries. This is a very important factor, which if the seed system becoming strengthen and properly managed, can facilitate the transition with them.

5.5. Presences of Strong National and Regional Initiatives in Seed Production

One of the major constraints for small farmers face is the limited availability of credit from formal sources (such as commercial banks and the government) to finance farming operations. Micro finance and development banks of Ethiopia give priority for agriculture based despite seed programs working with small farmers often provide a credit package which covers the cost of inputs such as foundation seed, fertilizer, and mechanical cultivation, to be repaid using revenue earned from the seed they produce at harvest time Willingness among stakeholders and their commitment towards promoting seed suppliers despite improve seed production system.

5.6. Presence of Development Agents and Different Cooperatives

Currently, more graduated youths are cooperated in different ways that given priority in the government of Ethiopia especially by micro and small enterprise development agency.

5.6.1. Research System

Bezabih *et al*, (2014) stated that Ethiopia has strong agricultural research programme, operating at federal as well as regional states. 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 and seed producer cooperative/unions are producing certified seed.

5.7. Non-Governmental Organizations (NGOs)

Private seed growers and other farmer institutions such as Unions and cooperatives are also playing key roles in multiplication and distribution of different classes of seeds (Maredia *et al*., 1999). In Ethiopia some Non-government organizations like Vita, World Vision Ethiopia, SOS-Sahel, Sasakawa Global Africa, International Development Enterprise (IDE), Food for the Hunger Ethiopia

(FHE) and many others are supporting farmers in the area of inputs supply small irrigation scheme and IDE, capacity building, and knowledge management such as experience sharing visits and sharing market information (Bezabih *et.al*, 2014).

5.8. Climate

Ethiopia's agro-Climatic conditions make it suitable for the production of a broad range of fruits, vegetables as well as other horticultural crops.

5.9. Water Supply

Ethiopia has huge run-off and ground water potential. However, it utilizes a small portion of these resources. Ethiopia is endowed with abundant water resources.

5.10. Transport

Road plays a vital role in transporting people and goods in Ethiopia. The Government has identified the road sector as top priority for public investment and remarkable progress has been made in the expansion of the road network in the country Road transport is by far the most dominant means of transport in Ethiopia providing for over 90% passenger and freight carriage. Both asphalt and gravel roads radiate from Addis Ababa to main cities, towns and centers of commercial, industrial and agricultural activities. International highways also link Addis Ababa to neighboring countries like Djibouti, Kenya and the Sudan (Nimona, 2017). Air transport is an important part of Ethiopia's transport network. Ethiopian Airline, Africa's World Class Airline, which has gained a very good reputation internationally in its 68 years of active services, provides both domestic and international air transport services. Domestic flight services are provided through 17 destinations across the country. Ethiopian links the country with over 63 destinations worldwide

6. Summary and Conclusion

Vegetable seed production is an important economic activity in Ethiopia. The production system ranges from home gardening, smallholder farming to commercial farms owned both by public parastatal and private enterprises. Ethiopia is endowed with diverse agro-ecologies suitable for the production of different categories of vegetables. Tropical, sub-tropical and temperate vegetables are produced in the lowlands (<1500 meters above sea level), midlands (1500-2200 masl), and highlands (>2200 masl), respectively.

Generally, the seed system of Ethiopia needs further investigation specially to run the three seed system with full collaboration and dedicated responsibilities and beside the following points should be given attention: effective seed demand assessment mechanisms, involvement of end users farmers during seed system planning, every seed producer must be channeled into the seed system, seed system strategy should prepared attractive seed chain with respect to quality, time and place of supply and fair pricing; more times seed production per year is needed to fill the huge gap between seed demand and supply establish clear and simple institutional and functional linkages between research and seed producing institutions formulation and implementation of clear seed strategy in the country is highly crucial.

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Citation: *Fasikaw Belay Mihretu, "Challenges and Opportunities of Vegetable Quality Seed Production and Seed System in Ethiopia" International Journal of Research Studies in Agricultural Sciences (IJRSAS), 2019; 5(8), pp. 15-25, http://dx.doi.org/10.20431/2454-6224.0508003*