

Review Article

Vegetables Production and Management Practices, Challenges, and Opportunities by Smallholder Farmers in Ethiopia

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Abstract: The production of vegetables is very important to Ethiopia's economy and various types of vegetables can grow in Ethiopia. However, despite the existing potentials, smallholder vegetable farms are based on low input–low output production system in the country. The production is run by smallholder farmers and is located on a relatively small part of land. In the same way, there is inadequate knowledge on improved vegetables production practices, challenges and opportunities by smallholder farmers in the country and public research on vegetable crops was negligible. To this end, this review was aimed to assess practices of vegetable production and management, challenges of vegetable production and management and opportunity of vegetable production by small holder farming household. The review found that, vegetable production practices and management are not the primary activity for the majority of smallholder farming households in the country; rather, they are seen as a supplement to the production of major crops. It was mainly based on traditional farming system. Further the review found out that, lack of access to credit, limited supply of improved seed, marketing and market information, appropriate management techniques, appropriate disease and insect pest control measures, outbreak of new disease and pest are among the main challenges of vegetable production in the country. This is mainly because of the limited resource allocation to research and development including the extension services. Finally, the review recommends that, in promoting vegetable producer households, diversified and intensified agricultural farming, and problems related to extension service and research, credit service, disease and pest control, market and marketing information, and provision of modern agricultural inputs should be addressed by concerned bodies.

Keywords: Improved seed, Limited supply, Challenges and Opportunities, inadequate knowledge.

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1. INTRODUCTION

1.1 Background of Review

The production of vegetables is very important to Ethiopia's economy. Both commercial and small-scale farmers in Ethiopia cultivate a wide variety of vegetable crops, which are produced in different agro-ecological zones and used it as food and a source of income (Serbessa *et al.*, 2023; Tabor *et al.*, 2016). However, compared to the potential yield produced at research centers and in farmers' field technology verification studies, the country's vegetable output is incredibly poor. For example, compared to the projected production of 400 and 350 quintal per hectare in research centers, the productivity of onions and tomatoes was roughly 90 and 70 quintals per hectare, respectively (Amare, 2019). The

lack of technological advancements in research and production, including traditional methods of production, the absence of high yielding germplasms, pest infestations, poor agronomic practices, a lack of trained labour, and a lack of advanced facilities for variety development and propagation, among other factors, are the main causes of the productivity gap (Tabor *et al.*, 2016).

Vegetable production in Ethiopia can range from small-scale production for domestic markets to large-scale production for personal consumption (Kumilachew *et al.*, 2014; Hailu, 2016; Hunde, 2017). Depending on land availability and crop compatibility for intercropping, some vegetables are produced as

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solitary crops or intercropped with other vegetables or cereals (Shimeles, 2000; Erana and Zelalem, 2020). While small-scale production is concentrated in Harerghe (the eastern high land areas) and the central high lands, commercial vegetable crop production practices and management are mostly carried out in the central rift valley, low land zones, and eastern half of the country (Hunde, 2017).

There are both positive and negative driving forces at work in the system of vegetable production. The key driving forces in this sector are the availability of labour, a climate that is conducive, farmers' motivation, and government initiatives (Serbessa *et al.*, 2023). Vegetable cultivation practices and management, however, are not the primary activity for the majority of smallholder farming households in the country; rather, they are seen as a supplement to the production of major crops. The production is run by a family and is located on a relatively small part of land. The traditional food consumption practices that priorities grain crops and livestock goods in the majority of the country's regions contributed to the low priority given to the growth of vegetable crops, which resulted in weak domestic market demand for vegetables products (Hailu, 2016).

Recently, vegetable production is becoming an increasingly important activity in the agricultural sector of Ethiopia following the development of irrigation and increased emphases given by the government policy with respect to commercialization of agriculture focuses on those commodities that have export potential and high growth impact (Asfaw, 2021). Despite the increasing importance of vegetables in Ethiopia, there is inadequate knowledge on improved production practices, challenges and opportunities by smallholder farmers in the country. In the same way public research on vegetable crops was negligible and attention of extension agents were mainly focused on staple crop production so far in the country (MoFED, 2010). As a result, there was a need to provide more insights on the practices, challenges, and opportunities of vegetables production and management by smallholder farming households in the country.

Some authors (Adugna, 2009; Meron, 2015; Kumilachew *et al.*, 2014; Hunde, 2017; Wondim, 2021; Serbessa *et al.*, 2023) have conducted studies addressing the difficulties, effectiveness, and chain of the vegetable market in Ethiopia so far. However, the majority of earlier researches have mainly concentrated on the market chain, agro-industry, and market performances of vegetables, ignoring the practices of vegetable production and management by smallholder farming households as well as the possibilities for the future. Therefore, this review was conducted to fill previous gaps by reviewing and summarizing the practices, challenges, and opportunities of vegetables production and management by smallholder farming households in Ethiopia.

2. OBJECTIVES OF THE REVIEW

2.1 General Objective

The general objective of this article was to review the vegetables production and management practices, challenges, and opportunities by smallholder farming households in Ethiopia

2.2 Specific Objectives

- ☞ To review the practices of vegetable production and management by smallholder farmers in the country,
- ☞ To review and document challenges and opportunities of vegetable production and management by smallholders in the country,

3. REVIEW OF LITERATURE

3.1 Vegetable Production and Management among Smallholder Farmers in Ethiopia

In Ethiopia, growing and managing vegetables is a significant economic activity. It is a practical means of addressing poverty reduction, caring for the health and wellbeing of customers, and providing new market opportunities for farmers, consumers, and the agro-industry. Furthermore, vegetable production being integrated into farming systems has greatly improved food and nutrition security because the plants' ability to supplement stable meals for a balanced diet with vitamins and minerals (Dassa *et al.*, 2019).

Ethiopia has a wide range of climatic conditions and soil types, making it possible to grow a wide variety of vegetable crops for both domestic and international markets. For a country like Ethiopia, where the population suffers from malnutrition as a result of a significant reliance on cereal crops, the vegetable crops are an essential source of nutrition. Its main contribution is to improve health by supplying vitamins, minerals, and protein that are necessary for food security during times of famine, famine, and drought. Given the recent expansions in the country's small- and medium-scale irrigation scheme establishment, vegetables are excellent crops for agricultural system diversification and land intensification. The country's climate is ideally suited for the development of seeds for a variety of crops, ranging from temperate to tropical vegetables (Emana *et al.*, 2015; Shimeles, 2000).

However, the productivity of vegetable is very low compared to the potential yield obtained in the research centers and on farmers' field technology verification studies. For instance, the productivity of onion and tomatoes was about 90 and 70 quintals per hectare compared to the potential yield of 400 and 350 quintal per hectare in research centers (Amare, 2019).

Vegetable production in Ethiopia can range from small-scale production for domestic markets to large-scale production for personal consumption (Kumilachew *et al.*, 2014; Haile, 2014; Hunde, 2017). In Ethiopia, a variety of vegetable crops are grown using

irrigation and/or rain-fed systems (Alemayehu *et al.*, 2010). Depending on land availability and crop compatibility for intercropping, some vegetables are produced as solitary crops or intercropped with other vegetables or cereals (Shimeles, 2000 1990; Erana and Zelalem, 2020). While small-scale production is centered in Harerghe (the eastern high land areas) and the central high lands, commercial vegetable crop production practices and management are mostly carried out in the central rift valley, low land zones, and eastern half of the country (Hunde, 2017).

Vegetable production is becoming an increasingly important activity in the agricultural sector of Ethiopia following the development of irrigation and increased emphases given by the government to small scale commercial farmers. A report indicated that the major share of an estimated 1.4 million tons of vegetable and fruits is consumed locally and only 4.5% of the total is exported. Ethiopian vegetable and fruits are mainly destined to the regional markets especially neighboring countries like Djibouti and Somalia. About 90% of Ethiopian vegetable and fruit is exported to Djibouti and Somalia even though the value generated from this is too small. Vegetables are also used as a source of raw material for the local processing industry (Wondim, 2021).

Despite the existing potentials, smallholder vegetable farms are based on low input low output production system in the country. The production is run by smallholder farmers and is located on a relatively small part of land (Hailu, 2016). Production is constrained by diverse abiotic and biotic factors. Lack or limited access to improved seeds, diseases and insect pests, high postharvest losses and poor marketing system are the major challenges of the sub-sector with tomato suffering the most from these challenges. Vegetable marketing is also constrained by lack of market information systems, poor market linkages, low institutional support, lack of value chain development to ensure participation and benefit to the smallholders. This necessitates looking into the whole vegetable system development via a value chain upgrading/development approach (Wondim, 2021).

3.2 Practices of Vegetable Production and Management

The production of vegetables is very important to Ethiopia's economy and various types of vegetables can grow in Ethiopia. However, despite the existing potentials, smallholder vegetable farms are based on low input-low output production system in the country. The production is run by smallholder farmers and is located on a relatively small part of land. However, vegetable cultivation practices and management are not the primary activity for the majority of smallholder farming households in the country; rather, they are seen as a supplement to the production of major crops. The production is run by a family and is located on a

relatively small part of land. The traditional food consumption practices that prioritize grain crops and livestock goods in the majority of the country's regions contributed to the low priority given to the growth of vegetable crops, which resulted in weak domestic market demand for vegetable products (A. Hailu, 2016).

Recently, vegetable production is rising in the country as a result of greater area allocation, increased yield per unit area, and increased production area. Increased small-scale irrigation activities and area growth are major contributors to the increase in production, which allows for two or more production cycles year (Awulachew, S. B., 2019). The area used to grow vegetable crops is adaptable and flexible, and only skilled farmers are able to maintain their vegetable production and management. Vegetable crop producers find it far simpler to switch up their production from one crop to another than fruit crop producers do. Cooperative efforts and organizations with vegetable crop producers can be a little more challenging. Farmers that raise vegetables do not have a long planning horizon. Vegetable cultivation benefits urban growers and the urban economy more as a result of these advantages (Wondim, D., 2021).

In the country, vegetable production is integrated into mixed farming system where different types of crops are produced on the same plot of land or in sequence with other crops in rotation. Depending on availability of land and crop suitability for intercropping, some vegetables are grown either as sole or intercropped with other vegetables or cereals. Vegetables such as tomato, beetroot, Swiss-chard, lettuce, carrot, cabbage, onion, garlic, kale, sweet potato and hot pepper are dominantly grown as sole crop whereas Ethiopian mustard and pumpkin are dominantly intercropped with maize and other annual or perennial crops, and with Irish potato especially in homesteads (Emana, 2015).

Vegetable growers are required to list the varieties of vegetables that come from their farms, identify any potential serious risks, and set up and maintain suitable safeguards throughout all stages of farm production. Improved agricultural technology and effective soil management, along with adaptability, increase the potential for vegetable output. Farmyard manure, crop rotation, fallowing, the use of composite and intercropping systems, and weed and disease management methods were some of the practices used by smallholder farmers in the (Dassa *et al.*, 2019).

Undoubtedly one of the contributing elements to the current low average yield is the poor agronomic practices used by Ethiopian growers of vegetables. Several agronomic practices and packages have been suggested in recent years to enhance the performance of released varieties (Endale and Kassa, 2008; Edossa *et al.*, 2008). In addition, agronomic studies have been conducted by various research centers to develop a

package of ideal management practices, along with improved varieties, for things like planting time, seed tuber size, population density, fertilizer rate, intercropping, harvesting time, etc. (Abebe *et al.*, 2008; Gebremedhin and Taye, 2013; Tesfaye *et al.*, 2013).

Because many vegetable crops have short growing seasons and are typically poor weed competitors, they are typically more susceptible to weed invasion than cereal crops. Vegetable crops' common weeds were recognized and noted. The Rift Valley's tomato fields have been found to benefit from parasitic weed (*Orobanch* spp) management techniques like soil solarization, trap crops like beans and maize, flooding to suffocate *Orobanch* seeds, maintaining the crop's nutrient requirements, and removing the parasite before setting seeds. Thus, smallholder farmers in the nation developed and applied host plant resistance, botanical and trap cropping controls for *Orobanch* on tomato, as well as chemical weed controls on onion, tomato, and hot pepper (Etagegnehu *et al.*, 2009; Ferdu *et al.*, 2009b; Gashawbeza *et al.*, 2009; Mesfin *et al.*, 2009; Mohammed *et al.*, 2009).

Crop management experiments for vegetable and fruit crops were carried out to develop the best nursery and field management techniques, to identify the appropriate mulch type, mulching percentages and sucker management in pineapple, as well as the nutrient requirements (Daneil and Gobeze, 2012; Wondifraw *et al.*, 2008). Grape agronomy studies such as pruning and training, as well as physiological studies such as dormancy and bud break were carried out (Tessema *et al.*, 1994). The spacing, sowing date, rate of fertilizer (NP) application, irrigation frequency, planting method, transplanting and harvesting stages spacing for pepper have all been examined and recommended (Getachew *et al.*, 2010; Lemma *et al.*, 1994b, 1994a; Lemma, 2002; Lemma and Shimels, 2003; Selamawit, 2013). The planting date for the seed production of cool-season vegetables was also investigated (Semagn and Fentahun, 2012). The outcomes of these studies are applied to the nation's systems for growing fruits and vegetables.

4. Challenges of Vegetable Production and Management by Smallholder Farming Household in Ethiopia

Vegetable production management is a risky investment activity since vegetables are perishable and produced using biological principles. In this setting, farmers' decisions on production and investment behavior in the production of vegetables are significantly influenced by their perceptions of risk. Vegetables are extremely perishable; they begin to lose their quality as soon as they are harvested and continue to do so until they are consumed. It is challenging for smallholder farmers to compete in the management and product. The review summarizes result and discussion of different studies done so far on the common vegetable production

constraints challenges facing smallholder farmers, as revealed through international experience here below.

Ethiopia's smallholder vegetable production and management system is founded on tradition, which is not well-supported by scientific advice. It is evident that the supply of vegetables produced is impacted by insufficient farmer skills, production expertise, product management, efforts to select varieties, usage of fertilizers, and conventional crop management techniques. (Hunde, 2019). The traditional food consumption practices that priorities grain crops and livestock goods in the majority of the country's regions contributed to the low priority given to the growth of vegetable crops, which resulted in weak domestic market demand for vegetables products (Bezabih and Hadera, 2007; Hailu, 2016).

One of the main causes of Ethiopia's current poor average yield is probably the poor agronomic practices used by producers of roots and tubers there. One significant agronomic component that may have an impact on Ethiopia's vegetable production and productivity is the plant population density (Yemane, 2013). According to Etana *et al.*, (2019), a plant that has been grown too closely together is competing for sunlight, essential nutrients, water, and air, which results in the production of small bulbs with poor quality, whereas a plant that has been grown too far apart produces vigour individual plants but low yield in the given areas. Because of this, different onion cultivars have reacted differently to varying plant spacing's.

According to Tabor *et al.*, (2016), the knowledge and skill gap, the lack of improved varieties and germplasm, and other factors limit Ethiopia's ability to produce vegetables. lack of healthy and high-quality seed and planting supplies, maladies, pest insects, limited agro-processing sector and variety for processing, postharvest, processing, utilization, handling and management (packaging, storage, processing, techniques, value addition), ineffective irrigation, spacing, fertility, pruning, and training techniques, inadequate marketing and transportation, limited resources (human capital, infrastructure, and facilities), little financial backing, and absence of a regional seed infrastructure.

The lack of high yielding and high-quality cultivars for the domestic and export markets, as well as the lack of appropriate management practices, disease and insect pest control measures, quality seed supply, input availability, proper post-harvest technology, trained manpower, and research facilities. Other limitations include the lack of marketing and production infrastructure as well as the lack of a seed production and distribution plan. Despite the potentials already present, the industry did not contribute as much as it could have. This mostly results from the allocation of limited

resources to research and development, especially the extension services (Selamawit and Tesfaye, 2019).

Kumlachew *et al.*, (2014) investigated the main risk factors that farmers in Kombolcha Woreda, Ethiopian must deal with when growing vegetables. The findings imply that price and production risks were usually seen as the most significant sources of risk. Output price volatility, drought, pest/disease, termite/insect attack, high input costs, flood/heavy rainfall, illness/injury/death of operator/member, changes in family relationships, theft, conflict and violence, changes in policy and rules, and high cost of credit were among the risk sources that needed to be taken seriously.

Constraints like limited access to pest and disease control, water shortages, limited farm credit, fear of eviction, seed shortages, unregulated movement of livestock in the city, a lack of fertilizer, theft, and limited extension services must be overcome in order to maximize output and ensure desired outcomes (Habtamu *et al.*, 2023).

Vegetable production is limited by a lack of high-quality seed and market knowledge, although having the potential to increase farmers' livelihoods (Eshetu *et al.*, 2008). Vegetable production is impacted by a lack of resources, including irrigation water, high-quality seed, as well as adverse weather conditions like drought and frost. Additionally, a number of significant weeds, insect pests, and diseases, such as late blight and Fusarium wilt, reduced the production (Gemechis *et al.*, 2012).

Due to limitations in the use of improved seeds and planting materials of high yielding varieties, as well as other inputs like fertilizer and plant protection materials in the smallholder sector, smallholder vegetable farms are based on low input-low output production systems. Production and productivity are also found to be limited by a lack of money, marketing and production skills, and adulteration (bad seed quality) (Wondim, 2021).

Bezabih and Hadera (2007) identified additional factors that affect horticulture productivity in Eastern Ethiopia, including pests, drought, a lack of fertilizers, and the cost of fuel for water pumping. Poor skill in product sorting, grading, packing, and conventional transporting, which affects the product's quality, is another issue they mentioned.

According to Regasa and Firafis (2022, unpublished), some of the biggest obstacles are poor extension support services, restricted land holdings, a lack of credit, a limited supply of better seed, poor marketing and market knowledge, and pest and disease outbreaks.

Aliyi *et al.*, (2021) reported that, shortage of inputs, pests and diseases, lack of improved storage, post-harvest loss, brokers' interventions, low price of the product, poor transportation facility and information flow were the major constraints.

The lack of consumer awareness, the economic motivations of the local consumers, the absence of nutrition intervention programmes using vegetables and their processed products, certain environmental restrictions, significant losses primarily attributable to price fluctuations, the absence of guaranteed prices, and other factors are all drawbacks to the sector. Heavy post-harvest losses result from this. The majority of veggies are sold untreated; Lack of storage facilities, inadequate traditional storage methods that are vulnerable to pests and illnesses, a lack of on-farm storage methods, and a lack of cold storage facilities are some of the major obstacles facing the nation's vegetable production industry (Hunde, 2017)

5. Opportunities of Vegetable Production and Management by Smallholder Farming House Hold in Ethiopia

The system of vegetable production is being driven by both positive and negative factors. Ethiopia has a comparative advantage in a number of vegetable commodities. Ethiopia has a comparative advantage in a number of vegetable commodities. Different studies done so far summarized and discussed the favorable factors that contribute to vegetable in the country as below.

Due to its favorable environment, accessibility to markets in Europe and the Middle East, and affordable labour, Ethiopia, according to EHDA (2012), has a comparative advantage in a variety of vegetable commodities. According to the findings of Serbessa *et al.*, (2023), the availability of workers, a favorable climate, farmers' motivation, and government initiatives are the main driving forces in the country.

Ethiopia has an immense potential to develop intensive vegetables farming on small scale as well as on commercial scale. Some of the favorable factors that contribute to an overall investment are proximity to lucrative markets, agro-climatic suitability, abundant labor, land and water resources, growth/rise of demand for horticultural crops, particularly in urban areas, export possibilities of these crops are very encouraging, favorable policy support by the government, and frequent effort of research centers (Selamawit and Tesfaye, 2019).

Moreover, Tabor *et al.*, (2016) shows that, due to conducive policy framework, irrigation potential, market proximity and niche, high labor force, agro-ecology and diversity of horticultural crops (temperate to tropics), high yield per unit area as compared to other crops, suitable agro-processing (fresh, semi-processed,

etc.), high demand of vegetables in local and export markets, and availability of improved varieties and technologies.

6. CONCLUSION AND RECOMMENDATION

6.1 CONCLUSION

The production of vegetables is very important to Ethiopia's economy. Despite the fact that, various types of vegetables can grow in Ethiopia smallholder vegetable farms are based on low input–low output production systems in the country. Therefore, this review was conducted to review and summarizing the practices, challenges, and opportunities of vegetables production and management by smallholder farming households in Ethiopia.

The review has found out that vegetable production practices have a significant contribution to household income generation and change their living standard. However, vegetable cultivation practices and management are not the primary activity for the majority of smallholder farming households in the country; rather, they are seen as a supplement to the production of major crops. The production is mainly integrated into mixed farming system, run by a family and is located on a relatively small part of land. In the recent year, in order to improve the performance vegetable production, various agronomic practices and packages have been recommended and practiced by smallholder farmers in the country.

However, vegetable production is not without challenges, the different study result revealed that weak research and extension support service, lack of access to credit, limited supply of improved seed, marketing and market information, appropriate management techniques, appropriate disease and insect pest control measures, outbreak of new disease and pest are some of the most important challenges. This is mainly because of the limited resource allocation to research and development including the extension services.

The review also shows that, Ethiopia has a comparative advantage in a number of vegetable productions due to its favorable climate, abundant labor, land and water resources, growth/rise of demand for vegetable crops, particularly in urban areas, export possibilities of these crops are very encouraging, and favorable policy support by the government.

6.2 RECOMMENDATIONS

Based on the finding the following core recommendations are forwarded to improve vegetable production.

- The government with other concerned development organization should give due attention to improve smallholder farmers vegetable production practices and management by encouraging smallholder farmers to participate in the sector and

providing them with support and training in suggested agronomic practices.

- Enhancing the generation and transfer of accepted technologies. Therefore, research institutions and universities should play a critical role in the release of high yielding and disease resistant varieties.
- Build and strengthen production technology and irrigation infrastructure to support modern irrigation.
- Enhance the farmers' input delivery system and deliver the appropriate inputs to them promptly and in adequate quantities.
- Develop and strengthen the ability of main stakeholders in vegetable production to improve production and productivity.
- Through the use of digital information distribution and the training of extension agents, government and non-governmental organizations should develop the necessary skills in vegetable production management practices and extension services.

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