

JIMMA UNIVERSITY, COLLEGE OF NATURAL SCIENCES, DEPARTMENT OF  
BIOLOGY

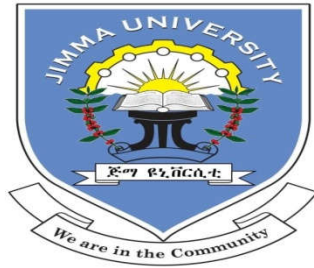
URBAN HORTICULTURE DIVERSITY AND ITS BENEFIT IN FOOD SECURITY,  
CHALLENGES AND OPPORTUNITIES IN JIMMA TOWN

*BY*

BIZUNESH LAKEW

*A THESIS SUBMITTED TO DEPARTMENT OF BIOLOGY, COLLEGE OF NATURAL  
SCIENCES JIMMA UNIVERSITY IN PARTIAL FULFILLMENT OF THE REQUIREMENTS  
FOR THE MASTER'S DEGREE IN BOTANICAL SCIENCE*

March, 2022  
Jimma, Ethiopia



JIMMA UNIVERSITY, COLLEGE OF NATURAL SCIENCES, DEPARTMENT OF  
BIOLOGY, BOTANICAL SCIENCE STREAM

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March, 2022  
Jimma, Ethiopia

## Declaration

I the under signed declare that this MSc. thesis work in titled “Urban Horticulture Diversity and its Benefits in Food security; Challenges and Opportunities in Jimma City.” is my original work, which has not been presented for a degree in any other university, and all sources of information taken from another study are well acknowledged.

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## **List of Abbreviations**

CBD.....	Convention on Biological Diversity
EHDA.....	Ethiopian Horticulture Development Agency
ESIAS.....	Environmental and Social Impact Assessment Study
FAO.....	Food and Agriculture Organization
UN.....	United Nation
UNDP.....	United Nation Development Program
WHO.....	World Health Organization
WFS.....	World Food Summit



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## **Abstract**

*Urban horticulture is the practice of food production within the town boundary or on the immediate periphery which includes the growing of food crops, fruits, trees, herbs, flowers, and firewood. However, its benefit is not well known and the challenges are not well investigated and identified in the Jimma City. The present study investigated the diversity, benefits to food security, challenges, and opportunities of urban horticulture in Jimma City. The study was conducted in four small administrative units, with 303 households by using purposive and stratified random sampling methods. To achieve the desired objectives field observation, surveying and household interview were used as a tool for data collection. The result revealed that urban horticulture has different benefits, such as improves food security, increases alternative income, serve as a recreational place. The study identified various challenges and opportunities to promote urban horticulture. In addition, the challenges identified were; lack of awareness and shortage of training, flooding, and lack of government support, lack of improved seed, chemical fertilizer, and pesticides. However, the town has great opportunities to improve urban horticulture due to; the suitability of the weather condition and soil, availability of water, organic fertilizer, and labor force. To improve the urban horticulture practice in Jimma City, all stakeholders should engage and give attention to fill the available gaps.*

**Key words:**, Challenges, diversity, food security, opportunities, urban horticulture

# 1. INTRODUCTION

## 1.1 Background of the study

Urban horticulture is the practice of food production within the town boundary or on the immediate periphery which includes the growing of food crops, fruits, trees, herbs, flowers and firewood. It is intensive cultivation requiring only small area around small residential areas such as vacant plots, outdoors, gardens, parks, balconies, containers, road strips and even on the roofs or upper covering of buildings (Edmondson *et al.*, 2020).

Biodiversity is the variability among living organisms from all sources. Agro-biodiversity in urban food systems plays a critical role in the fight against hunger and diet-related health problems and is keys in developing resilient food systems (SCBD, 2012). Preserving urban biodiversity is recognized for its important role playing in intrinsic value, natural and cultural heritage, sense of place, climate amelioration, noise amelioration, pollution filtration, water-sensitive urban design and human health and wellbeing (McDonnell and Hahs, 2012). Consequently, enhancement of biodiversity in urban home gardens is very crucial which its composition and configuration exerts a strong influence on the pools of species that temporarily use, colonize, or persist in urban areas (Smith *et al.*, 2006).

Food security is ensuring that all people at all times have both physical and economic access to the basic food that they need. Ethiopia is one of the most food insecure and food aid dependent countries in the world (Mulugeta, 2010). To meet part of the food needs of urban dwellers, urban horticulture both in intra-urban and peri-urban areas, is becoming a familiar and almost permanent feature in the developing world. In this regard, different researchers agree that the causes of the existing food insecurity problems in Ethiopia are numerous and interrelated. These include rainfall variability, soil degradation, in appropriate storage facility, pre- and post-harvest crop loss, the inability of the households to purchase adequate food, less and fragmented farmland size, lack of off-farm income opportunity, inadequate credit and extension services, and tenure insecurity. At this juncture, one can forward the question addressing what urban horticulture is as well as benefits in food security attainment. Urban horticulture is a dynamic

concept that comprises systems ranging from subsistence cultivate at household level to a fully commercialized horticulture (Mulugeta, 2010).

Urban horticulture cultivation challenges as Smit *et al.* (2001) classifies in to five categories such as: Socio-cultural biases and institutional challenges; Challenges to access resources, inputs, and services; Risks associated to town farming; Post-production challenges in processing and marketing; and Organizational constraints. However, urban horticulture has many opportunities according to Tuji, 2015 identified that availability of better public open spaces, better market and labor availability, good motivation and organization of district farmers as strong points. On the other hand, poverty reduction and food security initiatives, youth initiatives, HIV/AIDS and employment reduction initiatives, population increment, availability of more solid waste, adoption of intensive horticulture production system, and increasing demand for vegetable and fruits products provided opportunity.

Irrespective of the work of urban agricultural management agency in Ethiopia, urban agriculture is still in a traditional practice and mostly under taking informally. However, it has been the most important part of income for urban farmers in Addis Ababa contributing more than 60% of their total household income (Tewodros, 2007). In the study area there are observable urban farming practices.

## **1.2 Statement of the problem**

In developing country, rate of urbanization is higher and competing its agricultural land in the nearby rural areas (UN, 2006). As being one among the developing countries the situation in Ethiopia is not dissimilar to this general feature. The horizontal expansions of urban centers in general and Jimma town in particular increasingly consume away the rural arable lands. Urban horticulture appeared as the prior solution related to land scarcity for the situation. Producing food in urban areas will support the rural production of food which is increasingly depleting. Rural migrants are out numbering the urban poor. Farming in urban area can be the coping strategy for such migrants and the urban poor. Properly handled and managed urban horticulture could support the urban community beyond the consumption of producers. Even though, urban horticulture is an important source of vegetables, fruits, root and tuber and other cereal crops in

most towns of developed and developing nations. In Jimma City vegetables, fruits and other cereal crops used by the town population are not enough and mostly supplied from rural and distance places. This is because of low productivity of urban horticulture in the area although the area has high potential of production in different kinds of urban farming practices. Virtually all urban centers of Ethiopia at large and Jimma City in particular, joblessness is the challenging problem. However, the effort by the municipality or other concerned officials to make stronger cultivating in the town is limited. The reason behind limited cultivation of urban horticulture in the town maybe attributed to various challenges. However, there is limited information and no research has done in the area. Due to these gaps, the current study work initiated the following objectives and achieved these objectives yet.

### **1.3. Research questions**

1. What is the diversity of Jimma City fruit, vegetable, root and tuber crops?
2. . What are the benefits of urban horticulture in food security in Jimma City?
3. What are the challenges of urban horticulture in Jimma City?
4. What are the opportunities of urban horticulture in Jimma City?

### **1.4. Objective of the study**

- The general objective of the study was to examine the diversity, benefits in food security, challenges and opportunities of urban horticulture in Jimma City.
- The specific objectives of the research were:
  1. To assess diversity of fruit and vegetable crops in Jimma City.
  2. Identify the benefits of urban horticulture in food security.
  3. To assess the challenges of urban horticulture in Jimma City.
  4. Investigate the opportunities of urban horticulture in Jimma City.

## **1.5 Significance of the study**

The significance of this study is to provide a different insight into managing urban horticulture by using urban land use planning which is easy to implement and helpful for alleviating the problem sustainably. The research works also have been helpful for urban farmers, consumers as well as the government for the smooth functioning of the sector. Planners and municipal policy makers will get important inputs in supporting and planning the urban horticulture. The finding will also believe to be critical to planners to re-assess their planning and zonation of areas for urban horticulture in the town and for the municipality to give more emphasis to urban cultivation. Therefore, decision makers, especially Jimma City agriculture office department of horticulture, Jimma University College of Agriculture and Veterinary Medicine and other researchers can use the research outcome as a possible solution for the issue under study and use as a mechanism board of future research undertaking.

## **1.6 Scope of the study**

The study was only delimited to urban horticulture taking place in urban areas or urban *kebeles* of Jimma City. Issues that were assessed include; the diversity, benefits for food security, challenges and opportunities of urban horticulture from its advancement, the type of cultivation practice in the town and the major significances of urban cultivation were the major issues assessed in this study.

## 2. REVIEW OF RELATED LITERATURE

### 2.1 Concepts and Definitions of Urban Agriculture

Horticulture is sub division of agriculture which deals with gardening (cultivation) of plants. Urban horticulture is not a recent phenomenon. Archaeological findings are unraveling horticulture practices of urban settlements achieved by ancient civilizations for the production of food, feed and fodder, firewood, building materials, windbreak and medical plants (Hynes and Howe, 2002; Teferee, 2003; Brock and Foeken, 2006; Edmondson *et al.*, 2020; Khan *et al.*, 2020).

Since the 1970s, urban horticulture has been growing in the developing world as a result of rapid urbanization, crippled domestic food distribution systems, wage cuts, soaring inflation, rising unemployment, declining purchasing power, limited urban land use regulations, civil strife and natural disasters in urban areas. There happens to be no general consensus about the exact definition of urban horticulture among scholars and as a result it has been defined in different ways (Arku *et al.*, 2012). But all revolve around some central concepts which could be summed as location, nature of the activity, and the reason behind the practice.

Mireri *et al.* (2006) considers any kind of crop production and agro forestry or fuel wood production to constitute the practice of urban horticulture. These authors also believe that the choice of what is to be produced is determined by different factors like culture, tradition, markets, water and rainfall supply, the climate of the area, the soil condition, and the level of exposure to the sun. Game and Primus (2015) explain the nature of urban horticulture as an activity which is concerned with food and other products that are obtained usually through plant cultivation; while Arku *et al.* (2012) refers to any agricultural enterprise.

Concerning the third concept, the reason behind the engagement in the activities of urban horticulture, Arku *et al.* (2012), states that it might range from home consumption to being sold at urban markets and export markets for pure profit generation purpose. In some practices the objective may range from supporting the household nutritional needs to income generation, and even to being a leisure activity .Therefore, urban horticulture is the practice of horticulture in urban areas. Also urban horticulture can be defined as the growing of plants for food and other uses within and around cities and towns, and related activities such as the production and delivery of inputs, and the processing and marketing of products (Veenhuizen, 2010).Veenhuizen



definition is more focused on the major activities of urban horticulture, however, Mougeot,(2000) define urban horticulture more broadly i.e. ‘urban horticulture is located within (intra-urban) or on the fringe (peri-urban) of a town, a city or a metropolis, and grows or raises, processes and distributes a diversity of food and non-food products, (re-uses) largely human and material resources, products and services found in and around that of urban area, and in turn supplies human and material resources, products and services largely to that of urban area.

It is defined in different ways by different scholars (Hynes and Howe, 2002; Teferee, 2003; Brock and Foeken, 2006; Edmondson *et al.*, 2020; Khan *et al.*, 2020).However, the definition by Edmondson *et al.* (2020) will most appropriate for this research. Edmondson *et al.*, 2020 defines urban horticulture as the practice of food production within the town boundary or on the immediate periphery which includes the growing of food crops, fruits, trees, herbs, flowers and firewood. It is a labor intensive cultivation requiring only small area around small residential areas.

### **2.1.1 Urban horticulture diversity**

A concern for environmental protection has been in diverse forms in different countries throughout world. A consequence of industrial revolution in late 18<sup>th</sup> century has resulted in environmental movements in Europe. The Post-Green revolution has resulted in adverse environmental effects which have raised widespread environmental concern. Subsequently, we have witnesses massive concern expressed at International forum for protection of environment.

There is a widely held belief that increasing trend of urbanization accelerates biodiversity loss and that disturbed or man-made landscapes generally harbor less species than natural ecosystems (Husen, 2012).

### **2.1.2 Definition of Agro-biodiversity**

The term agro-biodiversity specifies the variety and variability of plants, animals and microorganisms that are crucial for sustaining key functions of the agro ecosystem, comprising of its structure and processes for, and in support of food production and security (FAO, 2004)

Biological diversity or biodiversity can have many interpretations. There exists a bone of contention between its biological roots and as a political issue with as many meanings as it has advocates (Redford & Sanderson, 1992). Biological diversity has been defined by the “Convention on Biological Diversity“ (CBD) as “the variability among living organisms from all sources, i.e. terrestrial, marine and other aquatic ecosystems, and the ecological complexes of which they are part. According to World Resources Institute, World Conservation Union, and United Nations Environment Programmed, "Global Biodiversity Strategy (1992), biodiversity is the totality of genes, species, and ecosystems in a region. It encompasses diversity within species, between species, and of ecosystem. In most common sense biodiversity is about gene, species and ecosystem (Husen, 2012).

### **2.1.3 Home Garden plant diversity in Ethiopia**

Traditional home gardens of Ethiopia demonstrate a sustainable agricultural practice that is environmentally, friendly and allows the harvesting of diverse products in response to the needs of farming families and urban dwellers .Hailu and Asfaw (2011) studied that in parts of Ethiopia, home gardens and other traditional agro forestry systems are found in a complex state like in the enset based home garden in southern and southwestern.

Home gardens have been described as ‘living gene banks’ in which a variety of germ plasma, in the form of indigenous varieties, landraces and rare species thrive side by side and has been preserved through generations (Haile *et al.*, 2009). Seta *et al.*, (2013) described home garden as multi-storied and multi-purpose. This heterogeneous environment of home gardens provides favorable growing conditions for wide varieties of useful plants.

Ethiopia has different plant diversity within different climatic condition throughout the country. Out of these plant species, most of them are found in different home garden of Ethiopia. According to Ageze (2013) two hundred fourteen plant species were recorded in the home garden of the Loma and Gena district of Dawaro Zone and these are distributed in 174 genera

and 63 families. Fabaceae stood first containing 21(12.07 %) genera and 24 (11.21 %) species, Asteraceae came in the second place with 18 (10.34 %) genera and 29 (13.55 %) species, and Poaceae in the third with 17 (9.77 %) genera and 17 (7.94 %) species. The families Fabaceae, Asteraceae and Poaceae were among the plants that are frequently used by the Dawro people.

Ageze *et al.*, (2012) reported that, Dawaro people have a tradition of diversifying their home gardens at least with enset, coffee, spices, vegetables, medicinal plants and fruits with other multipurpose plants. They knew that diversified home gardens provide balanced diet, medicine and income; the owner could not be affected by starvation, disease and poverty. Mokkonin *et al.* (2013) studied that there were 112 plant species identified and documented from Holeta town. These plant species were classified into 93 genera and 43 families. From 112 plants species identified, 6.25% were indigenous plants such as *Enset ventricosum*, *Juniperus procera* and 35 species were wild plants, and 70 species were cultivated crops. The growth form of the species were 49 (43%) herb species, 32 (29%) tree species, 28 (25%) shrub species, and 3% were climber plants.

#### **2.1.4 Food Plant Diversity**

Food plant includes those plants consumed by humans as major constituents. Plant products that are used as food can come from any part of the plant such as Seeds, fruits, leaves, stem, root and flowers. Such plant foods are largely obtained from the conventional crops that are purposely grown in the home garden. Asfaw (1997) reported that there are more than 130 species of cultivated food plants distributed in about 35 angiosperm families in the whole of Ethiopia. According to Zerihun *et al.* (2011) the most cultivated crops in the home garden of Jimma Zone were enset, avocado, cabbage, maize. These crops were cultivated in the home garden for consumption and sale. However, the purpose of cultivating specific crop was quite different among house hold

#### **2.1.5 Importance of urban horticulture diversity**

Around 15 % of varieties of the world's food are now grown in urban areas (Food, 2015). In Russia, urban land produces 30 % of the total food grown in the country and 80 % of the vegetables. One-half of the vegetables consumed in Havana, Cuba are grown in the town's farms

and gardens. In Singapore from 10,000 urban horticulture 25% of the vegetables consumed (Husen, 2012).

Moreover, preserving urban biodiversity is recognized for its important role playing in intrinsic value, natural and cultural heritage, sense of place, climate amelioration, noise amelioration, pollution filtration, water-sensitive urban design and human health and wellbeing (Husen, 2012). Consequently, enhancement of biodiversity in urban home gardens is very crucial which its composition and configuration exerts a strong influence on the pools of species that temporarily use, colonize, or persist in urban areas (Smith *et al.*, 2006). The farm types identified include a wide diversity of the urban horticulture activities, since they are based on multiple variables. Dossa *et al.* (2011) also reported that typology classification based on multiple variables performs better than classification based on a single criterion. Hence, this study suggested that urban horticulture in Jimma town will be rather quite rich in fruit and vegetable

## **2.2 Urban horticulture benefit for food security**

Food security is a broad and flexible concept encompassing issues related to the nature, quality, access causes and coping strategies of food shortfalls (Tarasuk 2001; Clay 2002). Food security as a concept originated only in the mid-1970s in the discussions of international food problems at a time of global food crises. Since then, there was a substantive change in definition and concept of food security. The initial focus of attention was primarily on food supply problems that is assuring the availability and price stability of basic food stuffs at international and national levels.

Food security was first defined in the Proceedings of the 1974 World Food Summit as: ‘availability at all times of adequate world food supplies of basic food stuffs to sustain a steady expansion of food consumption and to offset fluctuations in production and prices (UN 1975). In (Mulugeta, 2010) expanded its concept to include a third point: ‘Ensuring that all people at all times have both physical and economic access to the basic food that they need’. In the World Bank’s (1986) report of Poverty and Hunger, this concept of food security has been further elaborated in terms of: ‘access of all people at all times to enough food for an active, healthy life.’ The 1996 World Food Summit in its Plan of Action adopted a still more complex definition: ‘Food security at the individual, household, national, regional and global levels is

achieved when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life (FAO, 1996; Khan *et al.*, 2020).

The continuing evolution of food security as an operational concept in public policy has reflected the wider recognition of the complexities of the technical and policy issues involved. The most recent and careful redefinition of food security is that negotiated in the process of international consultation leading to the World Food Summit (WFS) in November 1996. A comparison of these definitions highlights the considerable reconstruction of official thinking on food security that has occurred over 33 years. These statements also provide signposts to researches and policy analyses, which have re-shaped our understanding of food security as a problem of international and national responsibility (Hynes and Howe, 2002; Teferee, 2003; Brock and Foeken, 2006; Edmondson *et al.*, 2020; Khan *et al.*, 2020).

### **2.2.1 Food security in Ethiopia**

Depending on its level of influence and the duration of occurrence, researchers have identified at least two types of food insecurity in the Ethiopian context: chronic and transitory food insecurity (Degefa, 2002). Chronic food insecurity is a continuous inadequate food intake while transitory food insecurity implies a temporary decline in the required quantity and quality of food. Ethiopia is found to be one of the most food insecure and food aid dependent countries in the world. A great majority of people, both in urban and rural areas, have been suffering from chronic and transitory food shortfalls particularly over the past recent decades. The number of food insecure households has been increasing, whilst per capita food availability has been decreasing (Mulugeta, 2010).

For instance, as Woldeamlak (2009) noted, the average per capita food availability was 128.08kg for the period 1961-1974, and it declined to 119.99kg in 1975-1991. Though the average per capita food availability was 125.41kg during 1992-2001, still it remained far below the recommended average per capita daily requirement. This suggests that the per capita food supply simply stagnated far below the minimum required level for over four decades. The large gap between food demand and food supply was filled by food imports and food aid, the later contributing the largest share.

In this regard, different researchers agree that the causes of the existing food insecurity problems in Ethiopia are numerous and interrelated. These include rainfall variability, soil degradation, inappropriate storage facility, pre- and post-harvest crop loss, inability of the households to purchase adequate food, less and fragmented farmland size, lack of off-farm income opportunity, inadequate credit and extension services, and tenure insecurity (Edmondson *et al.*, 2020; Mesay, 2001; Degefa, 2002; Dessalegn, 2009; Woldeamlak, 2009). At this juncture, one can forward the question addressing what urban horticulture is as well as the benefit of urban horticulture in food security attainment. Urban horticulture is a dynamic concept that comprises systems ranging from subsistence cultivate at household level to a fully commercialized horticulture.

To meet part of the food needs of urban dwellers, urban cultivation both in intra-urban and peri-urban areas, is becoming a familiar and almost permanent feature in the developing world. Spatially juxtaposed with other urban activities and resources, urban cultivation makes a vital contribution to the household economy of the urban residents (Hynes and Howe, 2002; Teferee, 2003; Brock and Foeken, 2006; Edmondson *et al.*, 2020; Khan *et al.*, 2020). It is supplying food to around 800 million urban dwellers worldwide. It is the source of food for 40 percent of African and 50 percent of Latin American urban dwellers (UNDP, 1996; Zezzav and Tasciotti, 2008). Based on the concepts and discussions, here in before, it is now possible to visually frame the benefit of urban horticulture in food security attainment in the Ethiopian context as depicted below. Source of food items, urban house hold food security, informal employment, formal employment, investment, saving capital, food purchase insecurity, loan, aid and remittance, and other expenditure such as clothes, school fees, transportation, utensils and healthcare.

### **2.2.2 Benefit of Fruits and Vegetables in Food utilization**

The nutritional and health value of Fruits and vegetables play a number of important roles in human health. They provide antioxidants such as vitamin A, C and E that are important in neutralizing free radicals (oxidants) known to cause cancer, cataracts, heart disease, hypertension, stroke and diabetes (Wargovich, 2000). It is widely accepted that fruit and vegetables are important component of a healthy diet and that the consumption can help prevent a wide range of diseases. The world health organization (WHO) or food and agriculture organization (FAO) recommends a minimum of 400g of fruit and vegetables per day (excluding potatoes and other starchy tubers) for the prevention of chronic diseases such as heart disease,

cancer, diabetes and obesity, as well as for the prevention and alleviation of several micronutrient deficiencies, especially in less developed countries. Despite the growth recorded in the global Fruits and vegetables production and trade, the food consumption per capita in Africa is still well below the recommended 400 gram of fruits and vegetables per day (= 146 kg per person per year). Combined the annual fruit and vegetable consumption in Africa is less than 100 kg per person, which equals around 250 gram per capita per day (FAO, 2013). However in general, girls and women consume larger amounts of fruit and vegetables than do boys and men (Rasmussen *et al.*, 2006). The substantial shortages in utilization are confirmed by the levels of fruits and vegetable consumption in Sub-Saharan African countries. Detail research by (Ruelet *et al.*, 2005) in 10 different countries including Ethiopia, Kenya, Ghana, Rwanda and Uganda show that consumption ranges from 27 to 114 kg per person per year, which is far below the recommended amount. Except for Kenya, the majority of the households consume less than the minimum amount of fruits and vegetables recommended by the WHO and FAO.

## **2.3 Urban horticulture challenges and opportunities**

### **2.3.1 Challenges to urban horticulture**

Until two decades ago practicing any form of cultivation activity within the boundaries of urban centers states was made illegal in most of the African as a result of laws which date back to colonial times (Foeken *et al.*, 2004). He further stated that urban farmers face challenges like uncertainty regarding land tenure, stealing of crops, lack of capital and inputs, threats of eviction and the possible destruction of crops. Smith *et al.* (2001) gives a better explanation to the challenges and classifies the challenges in to five categories: Socio-cultural biases and institutional challenges; Challenges to access resources, inputs, and services; Risks associated to town farming; Post-production challenges in processing and marketing; and Organizational constraints

The socio cultural biases and institutional constraints usually emanate from misconceptions about aesthetics, efficiency, hygiene, and modernity in general. Policies, laws and regulations tend to institutionalize these biases (Smith *et al.* 2001) the challenges associated to access to resources, inputs and services include the problems associated with water sources for irrigation in towns. The lack of access to farming inputs like seeds, fertilizer, pesticides and equipment and

the like are the other constraints hampering the practice of urban horticulture in the second category. The challenge associated with accessing services for getting products to market on time, getting different technologies that promote the field also makes up this second category of challenge. The lack of trainings and formal education in the field accompanied by lack to credit access further complement the challenges. In post-production challenges, Smitet *al.* (2001) identifies the following as urban horticulture challenges: inadequate processing, storage, packing, distribution, and marketing facilities. The organizational constraints amount to the lack of organization among the urban agriculturists themselves; especially in the case of low-income practitioners.

Lack of policy measures, poor land use and fertility management situation, poor extension and input provisioning services were identified as weakest points. On the other hand, planners knowledge and awareness level, bad attitude in some sectors of the society, lack of sustainable input provisioning system, temporary land tenure system, as well as fast growth in industry and the service sector were identified as threat for sustainable urban and per urban horticulture practices (Assefa, 2015).

According to Veenhuizen and Danso (2007), the main health risks associated with urban horticulture can be grouped into the following categories: Contamination of crops with pathogenic organisms as a result of irrigation with water from polluted streams and insufficiently treated wastewater or the unhygienic handling of the products during transport, processing and marketing of fresh products; Spread of certain human diseases by mosquitoes and scavenging animals attracted by agricultural activities; Contamination of crops due to prolonged intensive use of agrochemicals; Contamination of crops by uptake of heavy metals from contaminated soils, air and water.

### **2.3.2 Opportunities of urban horticulture**

Evidently, Ethiopia has favorable climate and edaphic conditions for the production of tropical, sub-tropical and temperate vegetables in the lowlands, midlands, and highlands, respectively (EHDA, 2011). The warm season vegetables such as tomato, onion, capsicum and snap beans are produced in hot semi-arid areas both under rain fed and irrigation (particularly in the Rift Valley), while the highland offers favorable growing conditions for the production of cool season vegetables like kale, cabbage, garlic, shallot, carrot, beetroot (Hussen and Muluneh, 2013).



Vegetable production is practiced both under rain fed and irrigation systems. The irrigated vegetable production system is increasing because of increasing commercial farms and development of small scale irrigation schemes (Baredo, 2012). From the (Tuji, 2015) identified that availability of better public open spaces, better market and labor availability, good motivation and organization of district farmers as strong points. On the other hand, poverty reduction and food security initiatives, youth initiatives, HIV/AIDS and employment reduction initiatives, population increment, availability of more solid waste, adoption of intensive horticulture production system, and increasing demand for vegetable and fruits products provided opportunity

### **2.3.2.1 Urban horticulture Opportunities in urban economy**

Today, even in and around large urban areas like Beijing, urban farming not only provides residents with safer and healthier food, it also keeps farmers in business. Urban horticulture has also been practiced in the towns of developed countries. For example, in Vancouver, Canada, 44 percent of the people grow vegetables, fruit berries, nuts or herbs in their yards, on their balconies or in community gardens. In general, now a day, towns worldwide produce about one-third of food consumed by their residents on average. Hence, urban cultivation is neither a new nor a declining activity in towns and it remains the cornerstone of many urban economies (Tacio 2007).

The situation of the urban poor is precarious in the present context of volatile food prices and the financial, fuel and economic crises. Urban consumers are almost exclusively dependent on food purchases and the urban poor are the most affected the first to lose their jobs; 60-80% of their household expenditure is on food, hence these households are highly affected by decreasing purchasing power and rising food prices (De Zeeuw and Dubbeling, 2009).

Redwood (2004) also describes the socio-economic role of. Urban horticulture as it is a pragmatic and useful activity. The growing population in urban areas creates a huge demand for horticultural produce. Instead of importing food in from rural hinterlands, urban horticulture is close to urban markets and thus transportation costs are lower. In addition, Urban horticulture improves household nutrition through food self-reliance, reduces the amount of money spent on food while also providing extra income if it is sold in the market. Vegetable and fruit production

are an important economic activity in Ethiopia, ranging from gardening smallholder farming to commercial state and private farms (Zelleke and Gebremariam, 1991). According to (CSA, 2012), about 2,710 million tons of vegetables and root and tubers were produced on 541 thousand ha, creating means of livelihood for more than one million households in 2010/11. Commercial production of horticultural crops, including vegetables and fruit, have also been increasing in recent years because of expansion of state farms (e.g. Ethiopian Horticulture Development Corporation) and increasing private investment in the sector by national and international entrepreneurs (EHDA, 2012).

The commercial production is concentrated in the Rift Valley areas of Ethiopia, due to availability of irrigation facility, accessibility and closeness to agro-processing industries. The Ethiopian Horticulture Development Corporation has been carrying out production and marketing activities of horticultural crops since its establishment in 1980 (Yohannes, 1992). The Ethiopian Fruit and Vegetables Marketing Enterprise is a parasol trading organization established in April, 1980 under the Horticulture Development Corporation to deal with domestic and export trade of fresh fruits, vegetables, flowers, and processed horticultural products. 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 (Ethiopian Investment Agency, 2012). Recently crops like green peas, okra, celery and eggplant are also becoming important for private companies for the export market. Vegetable production and consumption is increasing in Ethiopia because of increasing export to Djibouti, Somalia, South Sudan, the Sudan, the Middle East and European markets and urbanization (Tabor and Yesuf, 2012). In these countries there is a sustained demand for products such as chillies, onions, and cabbages, resulting in export increase from 25,300 tons in 2002/03 to 63,140 tons in 2009/10 (EHDA, 2011).

Vegetables and fruits constitute also source of cash income for the households and an opportunity to increase small holder farmers' participation in the market (Alemayehu *et al.*, 2010). Vegetables and fruits are also used as source of raw material for local processing industry. Products like tomato paste, tomato juice, and oleoresin and ground spice of Capsicum are

produced for exports making a significant contribution to the national economy (Baredo, 2013). The increasing development of the horticulture industry and the intensive production practices of horticultural crops are creating employment opportunity, especially for women and youth (Ethiopian Investment Agency, 2012). It constitute source of cash income for the households and an opportunity to increase smallholder farmers' participation in the market (Alemayehuet *al.*, 2010). Fruits and vegetables for both fresh and processed have a huge domestic market in Ethiopia which is by far significant than that of the export volume (Yeabsira, 2014).

### **2.3.2.2 Urban horticulture Opportunities for employment**

Globally, about 800 million people are engaged in urban and pre-urban horticulture/ agriculture; of these, 200 million are market producers, employing 150 million people full time (Smit *et al.*, 1996). Urban and pre-urban cultivation has been well recognized in the developed world for decades, and is getting new momentum in developing countries. In Africa, it supports the livelihood of many urban and pre-urban low income families. (Mireri *et al.*, 2006) Ethiopia is an agrarian country. More than 75% of the country's total labor force is employed in agriculture including horticulture (Yalew, 2020). In Ethiopia, (Worku, 2002) the urban population in 1984 was 4.3 million forming 11% of the total population. In 1994, it was 7.4 million, which was 72% increment from that of 1984. Currently the growth rate of urban population is about 5.4% per year. Such rapid growth rate has major implications on a country's ability to provide public services and employment.

The Urban Employment and Unemployment Surveys also show an increasing trend of urban employment. For instance, it increased from 2,858,018 in 2003 to 7,518,855 in 2018. In the same period, although its share has declined from 9% to 7%, employment in urban horticulture has increased from 253,793 to 542,151 persons. The differences in absolute and relative urban horticulture employment figures in the national labor force surveys and urban employment and unemployment surveys maybe due to differences in the sample sizes covered and methods used. On the other hand, Micro Small Enterprises in horticulture created jobs to 172,682 persons (11% of the total in 2013/14) and 852,612 persons (31% of the total in 2014/15) while GMEs in horticulture created jobs to 3,214 persons (3% of the total in 2015/16 (Yalew, 202).

### 3. MATERIALS AND METHODS

#### 3.1 Description of the study area

The study was conducted in Jimma City, Jimma zone, and south west Oromia region in Ethiopia (Figure 1). The town of Jimma is 346 km away from Addis Ababa, capital of the country. The major part of Jimma City, including the central, southern and western parts, is characterized by flat to gently sloping/undulating topography, while the northern and eastern parts of the town and its peripheries are characterized by hilly/ sloping landscape. It is located  $7.639^{\circ}$  N latitude and  $36.8358^{\circ}$  E longitude. The elevation within the City boundary and its peripheries ranges from around 1700 to 2000m.a.s.l. The mean annual rainfall in the area is around 1500 mm and annual potential evaporation is about 1465mm (ESIA, 2011). The rainfall pattern shows major seasonal variation ranging from mean monthly rainfall of about 38mm in January to 229mm in August (ESIA, 2011). The main rainy season extends from April to September. The mean temperature is between  $13^{\circ}\text{C}$  and  $29^{\circ}\text{C}$  with the mean daily temperature of  $19.5^{\circ}\text{C}$ . Two major (reddish and alluvial soils of brownish gray and grayish) soil types are observed. As described in the Jimma town Profile of 2008/2009(ESIA, 2011).

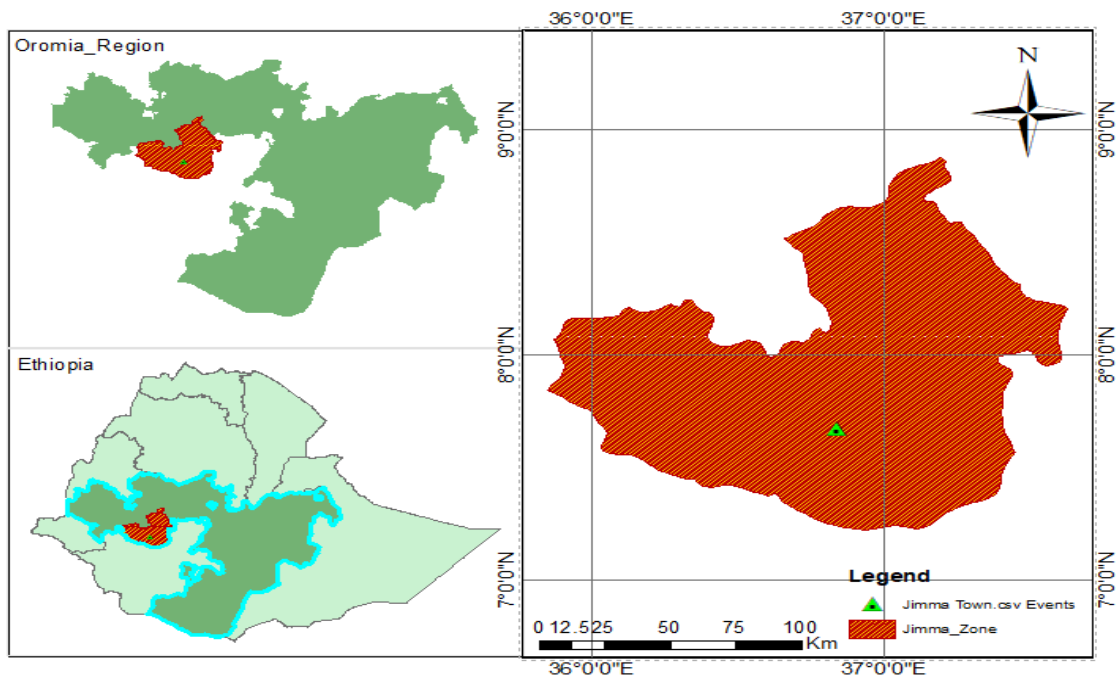


Figure 1. Map of the study area

### **3.2. Population**

The 2018 Population and Housing Census of Ethiopia identified a total of 167,359 people living in Jimma City out of which account 50.24% and 49.76% males and females respectively. Jimma City consists of heterogeneous population in terms of ethnic composition. In view of this, Oromo, Amara, Dawro, Gurage and Kafficho are the five major ethnic groups living in Jimma City.

The main economic activities of population in the town are commerce and small-scale manufacturing enterprises. The local urban–rural exchange in the area has contributed significant business activities in Jimma City. The industries in the town are small scale and cottage industries like grain mill, wood and metal workshops, coffee hullers, hollow block manufacturing, bakeries and pastries. The dominant manufacturing activities that account 70% of the total number of manufacturing enterprises in the town are grain mill and wood works.

### **3.3 Vegetation**

The original vegetation of these sites has been totally modified by human activities and currently they are covered by some scattered trees, bushes and shrubs, most of which are secondary vegetation. The Gilgel Gibe river banks including the intake site is covered by very narrow strip of bushy and shrubby vegetation, dominantly *Salix subserrata*, which is small tree, and others include *Senna*, *Sesbania* and *Solanum* species. At most places these plant overhang or half-submerge inshore zone of the river. Whereas the corridor of the main rivers are covered by some remnant Acacia trees (*Acacia abyssinica* and *A. polystachya*) and other plant. The dominant species in the wetland area are *Typhalatifolia*, *Cyperuslatifolius* and *Cyperusrotundus*.

According to Zerihunet *al.* (2011) the most cultivated crops in the home garden of Jimma town were *Enset ventricosum*, *Persea americana* and *Brassica oleracea*. These crops were cultivated in the home garden for consumption and sale. However, the purpose of cultivating specific crop was quite different among house hold.

### **3.4 Research design**

The research applied field observation, surveying, FGD and household interview. To achieve the research objectives both qualitative and quantitative data were collected. Qualitative data was collected based on the household interviews and focus group discussions on the status of urban

horticulture in Jimma City, constraints and the available opportunities to adopt the practices. Quantitative data was obtained from the horticultural plants to investigate its diversity

### 3.5 Sample size and sampling techniques

In this study, two types of sampling techniques were employed. These are purposive and stratified random sampling methods. The *kebeles* from where sampling is done was purposely selected based on horticultural practices. Again from section of the society, farmers who practice urban horticulture have been purposefully selected given the fact that including all society as study population is difficult. Hence, sampling is done from the smallest administrative unit purposively based on their experiences and adoption to urban horticulture.

The sample sizes for survey study from seventeen smallest administrative units four smallest administrative units (Ifabula, Boree, Horra Gibe and Jirren) were taken based on Cochran (1977) and Kothari (2004) as:

$$n = \frac{Z^2 N p q}{e^2 (N-1) + Z^2 p q} \dots\dots\dots (1)$$

Where;  $n = 303$ (is the desired sample size).

$N = 2430$ (is the total target population),

$Z = 1.96$ (is the standardized normal deviation set at 95% confidence level).

$p = 0.5$ (is the estimated proportion of an attribute that is present in the population),

$q = 1 - p$ , and

$e = 0.05$ (is degree of accuracy required normally set at alpha level).

Accordingly, the total farmers from four smallest administrative unit were 2, 430 the investigator selected 303 farmers for the study. The samples were selected from each stratum by the given formula and by applying the principle of proportional sample selection method. The sample size in each stratum was proportional to the size of stratum.

Sample of informants of one smallest administrative unit was selected from four smallest administrative units by using proportion to population size as shown below in (Table 1). This

means number of sample divided by total population of the farmers in four smallest administrative units multiplied by total farmers in individual smallest administrative unit.

$(N/T \times p_i)$  Where N=number of sample, T=total number of farmers in four smallest administrative unit  $p_i$ =number of farmers in one smallest administrative unit (Bare, 2015).

For example: in case of Ifa Bula 76 respondents were identified =  $(303/2430) \times 607$

Table 1. Stratum of Sample

Name of smallest administrative unit	Total No. of farmers	Sample size
IfaBula	607	76
Borre	616	77
HorraGibbe	610	76
Jiren	597	74
total	2430	303

### 3.5.1. Demographic characteristics of the respondents in the study area

The demographic characteristics of the respondents are presented in Table.1. Out of the total household heads 303 household heads (HHs) who responded to the questionnaires, 90.1% were male and 9.9% were female. Regarding marital status, 81.2% of the total household's heads were married, 10.9% were single, 2.6% were divorced and the remaining 5.3% were widowed, 40.7% households have a family size of 1-4 individuals and the remaining 59.3% have 5 and above members. The result also shows that the largest proportion of the households have 5 and above members that are responsible to take care of their families, this group of farmers mainly undertakes urban horticulture to generate income.

Regarding educational status, 42.6% completed elementary education, 25.4% was illiterate, 19.1% completed secondary education, and 9.9% can read and write only, while 3% had college and university education. In age category, out of the total 303 household head who responded to the questionnaires, 14.2% were between 20–30 years, 39.9% were in the age group 31–41 years, 29.0% were 42–52 years old and the remaining 16.8% were 53 and above years of age.

Job category of the households which adopted urban horticulture were, 65% farming, 13.2% government employee, 12.9% merchant, 7.6% daily labor, while 1.3% retired. Larger number of

respondent's (65%) was practicing urban farming; this implies that the farmers have been practicing indigenous horticulture. In addition, they have shown an interest to adopt the practice.

Table 2. Demographic characteristics of the respondents

<b>Demographic characteristics</b>	<b>Frequency</b>	<b>Percentage (%)</b>
<b><i>Sex</i></b>		
Male	273	90.1
Female	30	9.9
<b><i>Marital status</i></b>		
Married	246	81.2
Single	33	10.9
Divorced	8	2.6
Widowed	16	5.3
<b><i>Family size</i></b>		
1-4	93	40.7
5 and above	210	69.3
<b><i>Educational status</i></b>		
Illiterate	77	25.4
Read and write	30	9.9
1 <sup>st</sup> and 2 <sup>nd</sup> cycle(1-8)	129	42.6
High school	58	19.1
College/University	9	3
<b><i>Age categories</i></b>		
20-30	43	14.2
31-41	121	39.9
42-52	88	29.0
53 and above	51	16.8
<b><i>Income sources</i></b>		
Farming only	197	65.0
Government employee	40	13.2
Merchant	39	12.9
Daily labor	23	7.6
Retired	4	1.3
Total	303	100



### **3.6 Materials**

Different materials were used for data collection in the study area. For example, plant press, scissor or knife, newspaper, cola, alcohol, bloater, flash disk, pen, pencil and note book for plant preservation and specimens collection; digital camera and tape recorder for collecting photographing and to record the audio information given by the informants respectively.

### **3.7 Data collection Method**

Primary data were collected through questionnaire, interviews; focus group discussion (FGD) and field observation. Questionnaire for farmers, structured interviews questions, for Development Agents (DA) and FGD for Agriculture officers of Jimma City were done to assess urban horticulture and its benefits for food security, challenges and opportunities.

Check-list was used and photographs were taken during field observation to assess diversity of fruit, vegetable, root and tuber crops. Sample crop plant specimens were collected and taken to Jimma University Herbarium for identification. The identification was made using Ethiopian and Eritrean Flora (Volume I-VIII) in Jimma University Herbarium. All the vegetable, fruits, trees, shrub and herbs, root and tubers and their parts were collected and identified from the sampled horticulture using different materials and made ready for taxonomic identification. Identification was done using taxonomic literatures and volumes of the flora of Ethiopia and deposited in the herbarium of Jimma University.

### **3.8 Method of data analysis**

The collected data were organized, processed, summarized and interpreted using appropriate data analysis techniques to make them meaningful and to draw sound conclusion based on the research findings. Some data collected by questionnaires were quantitatively tabulated, interpreted and presented by using descriptive statistical methods such as frequency distribution, tables and bar graph, percentages and pie chart. The analyses were made by using Ms excel. Also qualitative data collected through interview, personal observations and focus group discussion were analyzed and interpreted.

## 4. Result and discussion

### 4.1. Results

#### 4.1.1. Diversity of fruit and vegetable crops in the study area

Twenty-eight species of fruit and vegetable were identified as urban horticulture species, distributed among 22 families (Appendix 5 and 6). Of the 28 species encountered, 10 have both food and medicinal value. In terms of habit of horticultural plants, ten are trees; six shrubs, five climber and seven herbs. However, the purpose of cultivating specific crop was quite different among house hold



Figure 2. Some fruit crop in the study area

A. *Mangifera indica* C, *Persea americana* B, *Punica granatum* D, *Carica papaya*

According to information obtained from sample respondents mixed farming practice is usual with the majority of urban farms. Some of the fruit and vegetable species in the town are (Figure.3).

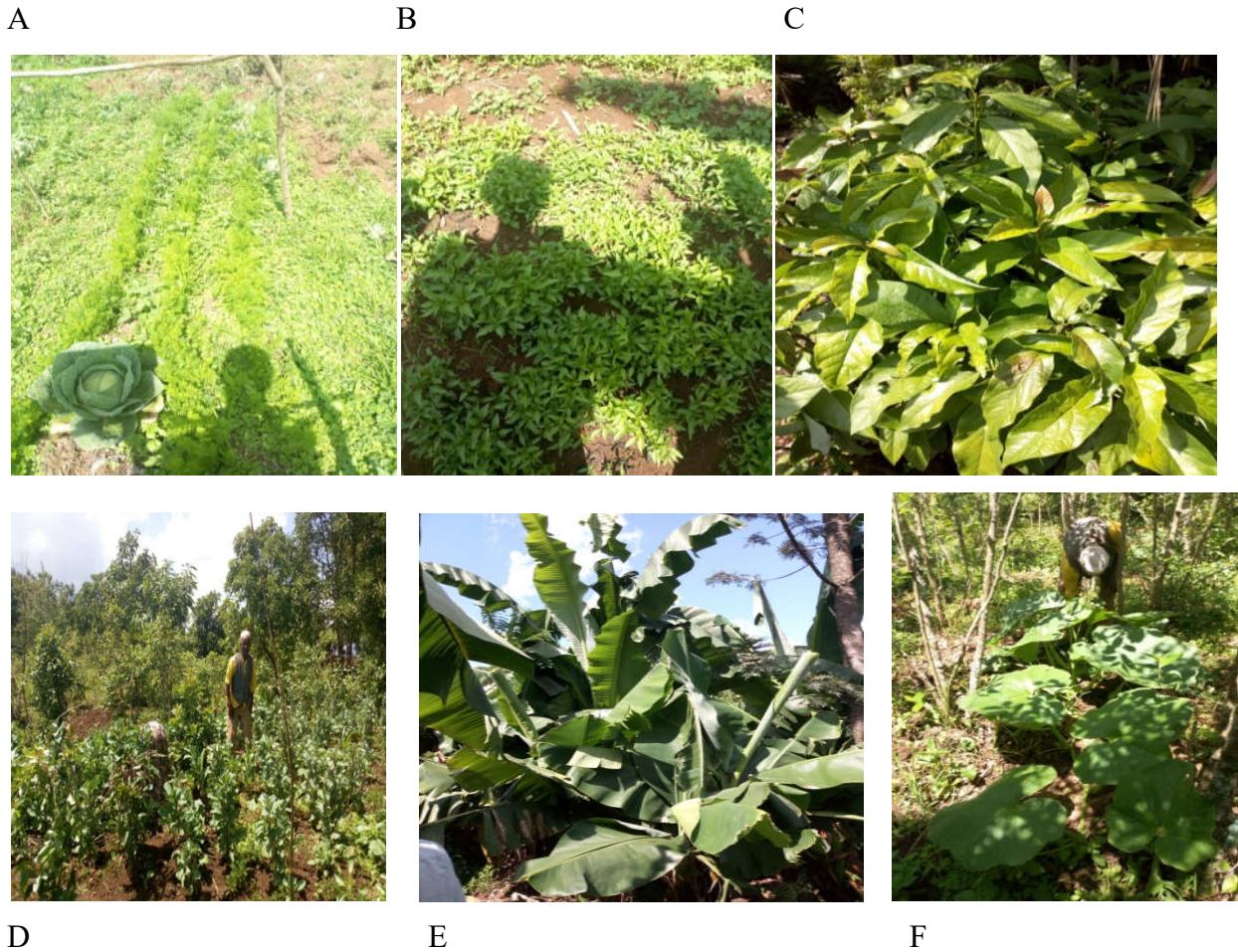


Figure 3. Same vegetable and fruit crops in the study area

A. *Daucus carota* subsp. *Sativus* B. *Capsicum annum* C. *Mangifera indica*  
D. *Brassica oleracea* var. *viridis* E. *Musa paradisiacal* F. *Cucurbita pepe*



#### 4.1.1.1. Fruit Species

According to field survey and information obtained from informants there were 13 species with 12 families' fruits in the study area. Those were; *Persea americana* (Lauraceae), *Mangifera indica* (Anacardiaceae), *Carica papaya* (Caricaceae), *Annona chrysophylla* (Annonaceae), *Anana scomosus* (Bromeliaceae), *Musa paradisiacal* (Musaceae), *Citrus sinensis* (Rutaceae), *Citrus limon* (Rutaceae), *Malus domestica* (Rosaceae), *Punica granatum* (Punicaceae), *Morinda citrifolia* (Rubiaceae), *Artoca rpusheterophyllus* (Moraceae) and *Psidiu mguajava*(Myrtaceae). From those the 3 were the most common (*Persea americana*, *Mangifera indica* and *Carica papaya*), cultivate by all sample respondents (Appendix, 5). The habits of 11 fruit plants are trees and the rest 2 are shrub (Apple and Ananias). According to respondents 8 species of fruit plants were used for both food and medicine the rest5 fruit plants were used only for foods.

#### 4.1.1.2. Vegetable Species

In the study area based on information obtained from field survey and sample respondents 15 species with 10 families were vegetable. Those were; *Colocasia esculenta* (Araceae), *Manihote sculenta* (Euphorbiaceae), *Ipomoea batatas* (Solanaceae), *Solanum tuberosum* (Solanaceae), *Beta vulgaris, subsp, vulgaris Conditiva* (Amaranthaceae), *Daucu scarota subsp. Sativus* (Apiaceae), *Allium sativum* (Amaryllidaceae), *Allium cepare* (Amaryllidaceae), *Protea goguedi* (Proteaceae), *Phaseolus vulgaris* (Fabaceae), *Capsicum annum*(Solanaceae), *Brassica oleraceavar. Viridis* (Brassicaceae), *Solanu mlycopersicum* (Solanaceae), *Lactuca sativa* (Asteraceae) and *Spinacia oleracea* (Amaranthaceae). Those vegetable classify by part that consume (leave, tuber, fruit and root).The most common vegetable were 4, which have *Colocasia esculenta*, *Daucu scarota subsp. Sativus* *Capsicum annum* and *Brassica oleracea var. viridis* (Appendix, 6) cultivate by most (86%) farmers. The habit of those vegetable are 6 herbs, 5climbers and 4 shrubs. From those 2 (*Capsicum annum* and *Allium sativum*) used for both food and medicine the rest 13 were used only for food.

#### 4.1.1.3 Percentage of fruits and edible parts of vegetables

The study revealed that about 28 species of fruit and vegetables were identified as horticultural crops in the study area. From 28 species the highest proportion was vegetables about 54% specifically grouped as parts used such as; leafy vegetables 10.7%, tuber vegetables 21.4%, fruit vegetable 14.3% and root vegetables 7.1% and the second category were fruit about 46%.

Table 3. Species diversity of fruit and edible part of vegetable

No	Species category	Parts used	Frequency	% of species
1	Fruit	Fruits	13	46.43
2	Vegetable		15	53.37
		Leave	3	10.7
		Tuber	6	21.4
		Root	2	7.1
		Fruit	4	14.3

#### 4.1.2. Farm size, times of growing per year and experience of household heads

About 82% of the farmers have a plot size between 0.25 ha to 1.0 ha and about 18.5% of them have a land size between 1.1 ha to 2.5 ha (Table 4). Most of the informants (44.6%) produce twice in a year, 32.7% of the informants produce once per year, while the remaining 22.7% produce three times per year. This is attributed with the suitability of the soil and weather conditions to produce crops. In this finding, the investigator observed the informants who could grow crops three times per year and this could contribute positively to food security in the study area. In Table 8 the farmers replied that the weather condition of the area could give them an opportunity to adopt urban horticulture. Their conventional cultivating experience is very important to adopt and promote the urban horticulture, since they have enough human power to engage in farming activity whole the year.

Table 4. Farm size and times of growing per year

Variables	Frequency	Percentage
<b><i>Farm size (hectare)</i></b>		
0.25-1.0	247	81.5
1.1-2.5	56	18.5
<b><i>Times of growing per year</i></b>		
Once	99	32.7
Twice	135	44.6
3 times	69	22.7

The experience of the respondent's with horticultural crops ranges from a minimum of one year to a maximum of 40 years. Classifying the experience range in to four (Figure. 4), the majority of the respondents fall within 1-10 year experience which is about 46% and the last category respondent's 2.6% which is 31-40 years.

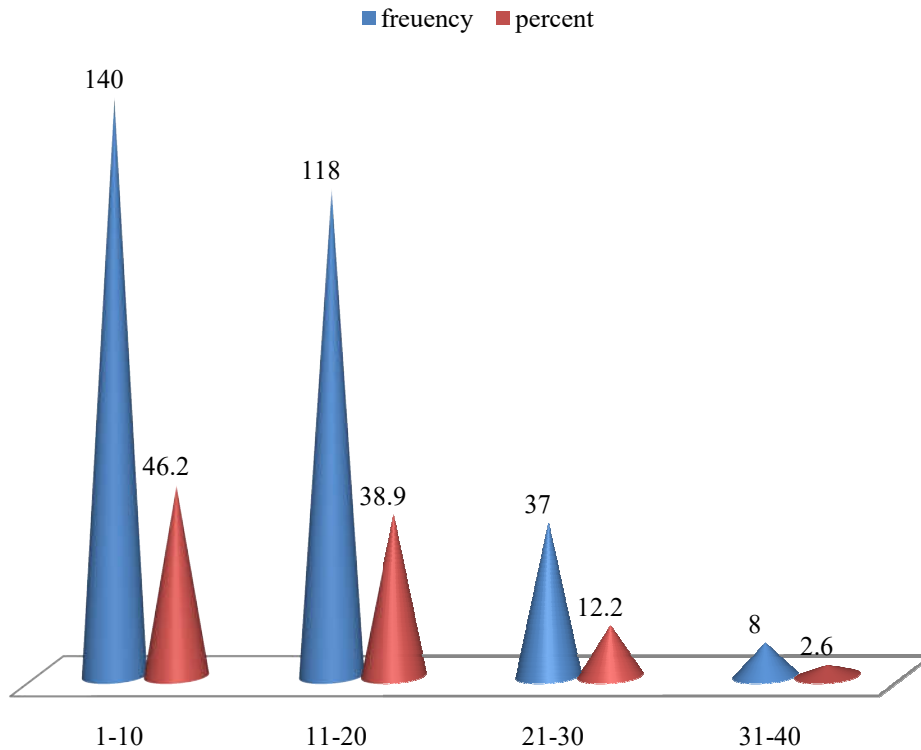


Figure.4. Shows experience of Household heads in urban farming in the study site

### 4.1.3 The benefits of urban horticulture for food security in Jimma town

#### 4.1.3.1. The farmers get enough money from sale in the market

As demonstrated in figure 5, the largest proportion of urban cultivator about 53% gets enough money from sale sometimes, 35% of farmers get enough money from sale and about 12% of farmers said that they do not get enough money from sale in the market. The result shows that almost 88 % (farmers that responded yes and sometimes) farmers get more or less enough money from production, while the rest (12.2%) not get enough money.

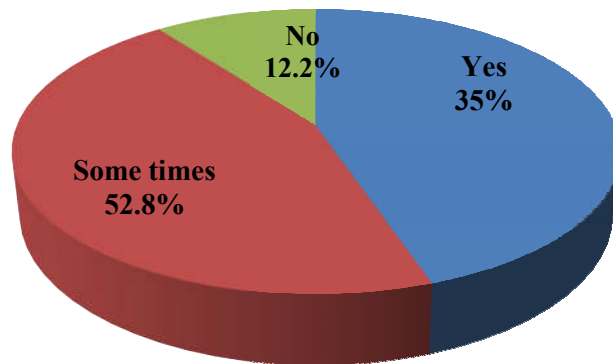


Figure 5. Shows money earned from vegetables and fruits sale in percentage

#### 4.1.3.2. Sources of income for the community

Urban farmers involved in fruit and vegetable cultivation activities secure income sources. Income from fruit and vegetables in the study area were shown in Figure 6. According to respondents growing fruits, about 58% earn less than 10,000 birr (the basic unit of money in Ethiopia) annually. The rest 38.9%, 2.3%, and 0.3% earn 10-30,000 birr, 30-50,000 birr, 50-70,000 birr respectively. From vegetable selling less than 10,000, 10-30,000, 30-50, 000, 50-70,000 and more than 70,000 birr is obtained by 48.4%, 39.3%, 10.6%, 0.7% and 0.7% respondents respectively. The result also shows that the largest proportion of income were more than 70,001 Birr which derived from vegetable and 50,001 Birr to 70,000 Birr from fruit production was the second largest income.

Farmers practicing urban horticulture came from various groups of urban society. They can be the poor or the rich, women or men, natives or migrants, and so on. The most important benefit of urban agriculture in the study area is additional income generation; because as shown in Table 5 all households were responded urban horticulture generate income. Regarding the proportionalities of income and cost to buy fruits and vegetables, all household heads were answered not proportional with other income.



Income is one of the basic assets that directly impact the livelihood of households. More income means more dispensable income, which in turn means more food security, more saving, more investments (investments on health, education, and employment condition of household members). Therefore, this directly implies that the vulnerability context of the households is somehow reduced and that the well-being of households is improved.

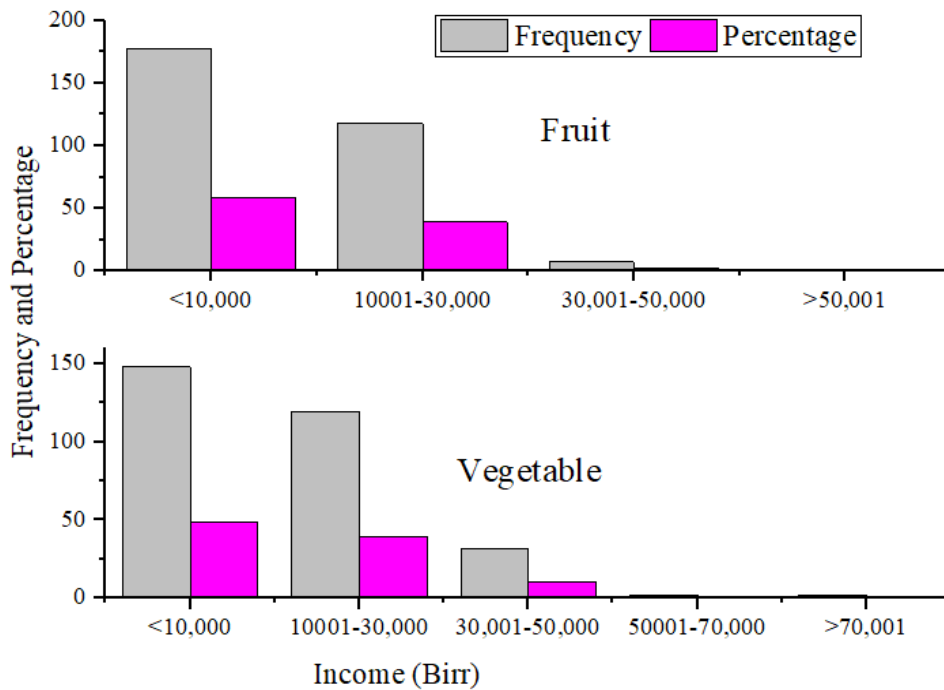


Figure 6. Indicates amounts of income earned by selling fruits and vegetables annually

#### 4.1.4. Multi-purpose role of urban horticulture

The study shows that there are various role of urban horticulture in the study area. Among these, it plays a crucial role in generating household income; serve as employment opportunities, contribution to food supply, economic use of land and environmental enhancement. The alternative of what to produce and how, is determined by a variety of social, economic and physical determinants.

#### **4.1.4.1. Urban horticulture for local consumption**

The contribution of urban horticulture to food security and healthy nutrition is probably its most important asset. Food production in the town is in many cases a response of the urban poor to inadequate, unreliable and irregular access to food, and the lack of purchasing power. Urban horticulture plays an important role in enhancing urban food security since the costs of supplying and distributing food to urban areas based on rural production and imports continue to increase, and do not satisfy the demand, especially of the poorer sectors of the population.

Concerning urban horticulture contribution to household's food security and improvement in the overall livelihood condition all of the respondents in study area were responded their perception. All responded that primarily urban horticulture is used for local consumption. Urban households are generally more food secure and benefited from a more diverse diet provided through urban horticulture.

#### **4.1.4.2. Urban horticulture for Recreation**

Urban horticulture is more capital and labor intensive, more market oriented, more dangerous for health if not carefully managed, and more advantageous for environmental greening, recreational service provision and micro-climate improvement. This is because urban agriculture takes place in an area of restricted population, severe land scarcity, harsh environmental pollution, and intense and enthusiastic recreational requirements. As a result, the importance of urban farming in combating urban environmental pollution and recreational development for the urbanites is really huge, according to this finding 70% of respondent agreed that urban horticulture is for recreation in addition of other roles.

#### **4.1.4.3 .Urban horticulture for medicine**

A total of 28 fruit and vegetable plant species were identified in study area. Of these, 10 species were used both for food and medicine (Appendix 5 and 6). Those are; *Persea americana*, *Mangifer aindica*, *Carica papaya*, *Anana scomosus*, *Citrus sinensis*, *Citrus × limon*, *Psidium guajava*, *Allium sativum* *Musapara disiaca* and *Capsicum annum*. From 303 households about 52% households used fruit and vegetables as food and medicine (Table 5).

#### 4.1.4.4 Urban horticulture for employment

The other form of benefit supporting the livelihood of the practitioners identified by this study is employment creation. Accordingly, about 84.2% of the respondents benefited from this opportunity (Table 5). Employment creation is a major benefit contributing to the livelihood improvement of households. As a conclusion to this part, with additional income generation, contributing to the food needs of the household, and by creating medicine and employment opportunity, urban horticulture is reducing the vulnerability and improving the well-being of the poor households under the study.

Table 5. Shows multipurpose roles of urban horticulture

<i>Variables</i>	<i>Frequency</i>	<i>Percent</i>
Consumption	303	100
Income	303	100
Recreation	212	70
Medicine	156	51.5
Employment	225	84.2

#### 4.1.5. Urban horticulture in improving Food Security

The respondents practice urban horticulture to overcome food security of their family in the town because the majority of households cultivate varieties of fruit and vegetable by growing in different season of the year for consumption (Table 6).Based on the surveyed data 66.7% of households growing vegetables all the season, 33.3% of households do not grow all the season. In addition, about 52% of households use irrigation and 47.9% do not using irrigation because of landscape not suitable for irrigation or the plots are far from river but grow using rain water one season per year. This result shows that majority of households cultivate all the seasons (two or three times per year) using irrigation. This implies that to adopt urban horticulture in Jimma town, the availability of water for irrigation could provide opportunities to improve food security.

Table 6. Indicate improving food security

<i>Variables</i>	<i>Frequency</i>	<i>Percent</i>
<b><i>Growing all the season</i></b>		
Yes	202	66.7
No	101	33.3
<b><i>Using irrigation</i></b>		
Yes	158	52.1
No	145	47.9

#### **4.1.6. Inputs and equipment's used by the respondents**

In this section, horticulture inputs and equipment employed by urban farmers in study area are presented. Urban horticulture basically requires land, labor, inputs equipment and capital as inputs to carry out their farming activities. In this section, horticulture inputs and equipment employed by urban farmers in study area are presented. Generally, urban farming activities in study area are not different from the rural Ethiopia in terms of technology uses. It was observed in all the cases that the farmers employ traditional tools such as hand tools and extensive labor to cultivate their farms. Increase in productivity requires intensive utilization of agricultural inputs such as natural and artificial fertilizers, selected seeds, herbicide and pesticides. According to table 6, 0.7% of respondents used pesticide, 1.7% of respondents used mineral fertilizer, 5.9% of respondents used organic fertilizer and 91.7% of respondents used all together (organic and mineral fertilizers, selected seeds, herbicide and pesticides). According to the information collected from farmers in the study area horticulture inputs used to increase urban horticulture productivity.

Uses of irrigation were common activity across all the study area for crop production. About 32% of farmers use small pond and different hand tools, 32.4% of cultivators use water pumping machine and different hand tools to irrigate their plots during the production period (Table 6). About 33% respondents use rain and different hand tools. The result shows that all farmers use hand tools to dug and related activities with axes, shovel and similar equipment. However, in all the cases, furrow irrigation are the most common activity, which is labor demanding and has risk of flooding during heavy rains. The farmers reported that building dam is a prerequisite for cultivating crops every year. It is because the dams are washed away by heavy rains during rainy season and sometimes in dry seasons when there are sudden heavy rains.

Table 7. Inputs and equipment used by the respondents

<b>Variables</b>	<b>Frequency</b>	<b>Percentage</b>
<b><i>Inputs</i></b>		
Mineral fertilizer	5	1.7
Organic fertilizer	18	5.9
Used altogether	278	91.7
Pesticide	2	0.7
<b>Agricultural equipment used</b>		
Different hand tool	199	65.6
Water pumping machine & different hand tool	104	34.4

#### **4.1.7. The challenges to adopt urban horticulture in Jimma City**

About 50% of respondents were challenged due to natural disasters, such as flooding and 49.8% of respondents were not (Figure 7). Though, 50.2% respondents indicate that flooding is the natural threat to their horticulture activities; as a result farmers during summer season become jobless and waiting to end summer rain when the rain water is above normal because the land is saturated by water.

Technical, financial and in-kind supports of urban horticulture improve the overall performance of cultivation practices. In the study area vegetable and fruit producers have no significant support from government organizations and NGOs operating in the town. About 99% of respondents do not have horticultural awareness and training but cultivate by using indigenous knowledge. About 92% of respondents also said horticulture inputs (pesticide, selected seeds and mineral fertilizer) are not available from the government but bought from merchant. Moreover, of the total respondents, 99% have confirmed that there is no support from NGO in the production vegetables and fruits.

Results of the study indicate that challenges on the urban horticulture in the study area were various. According to respondents from Jiren area, the challenge include; access to input, lack of training, lack of awareness, flooding and the topography of land is not suitable for irrigation. Similarly in Horra gibe, Borre and Ifa bulal have lack of access to input, lack of training, lack of awareness, insects and flooding during summer season by over flow of Gibe river.

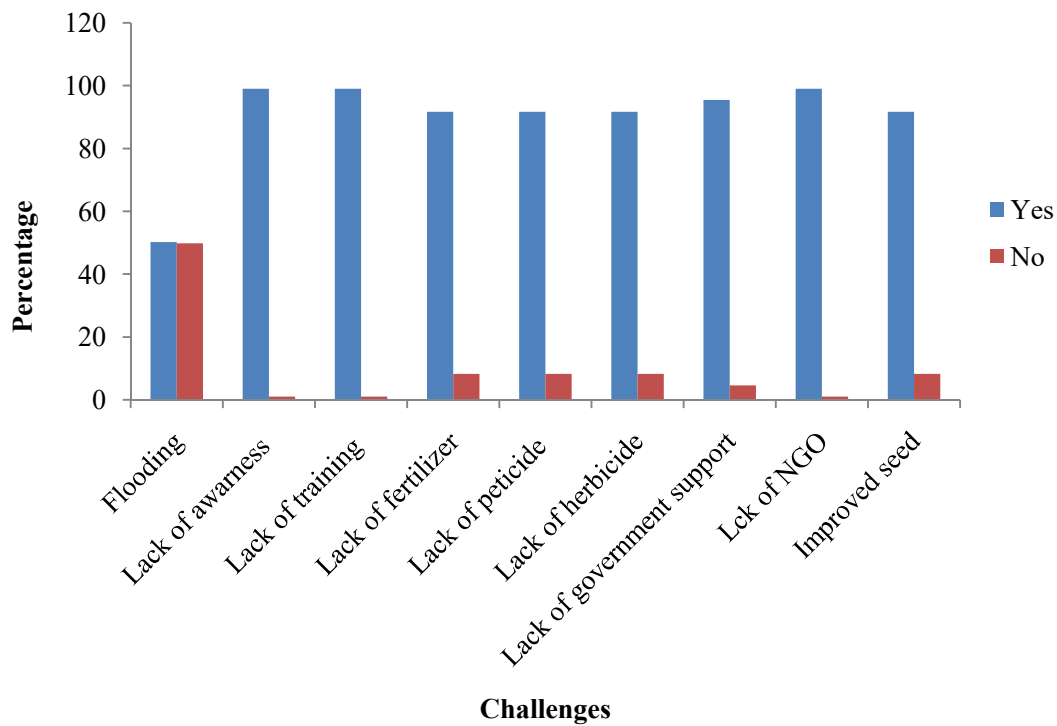


Figure 7. Challenges to adopt urban horticulture in Jimma town

#### 4.1.8. The opportunities to promote the urban horticulture in Jimma City

In this finding the opportunity to encourage cultivation of urban horticulture in Jimma City were revealed. Accordingly, the identified opportunities of urban horticulture in Jimma City are availability of enough water, farmland, labor forces, organic fertilizer, suitable weather conditions and fertility status of the soil conditions. These factors could be considered as opportunities to promote urban horticulture in the town.

Table 8. The opportunities to promote the urban horticulture in Jimma City

<i>Variables</i>	<i>Frequency</i>	<i>Percentage</i>
<i>Enough water</i>		
Yes	206	68
No	97	32
<i>Enough farmland</i>		
Yes	210	69.3
No	93	31.7
<i>Good weather</i>		
Yes	210	69.3
No	93	31.7
<i>Enough labor force</i>		
Yes	210	69.3
No	93	31.7
<i>Availability of organic fertilizer</i>		
Yes	298	98.3
No	5	1.7
<i>Good soil condition</i>		
Yes	199	65.7
No	104	34.3

#### **4.1.8.1 Enough water**

Jimma City is situated within the Gibe river catchment. Gibe River originates from highland areas in the west of Jimma and generally drains eastwards. Locally, the Jimma City is drained by two perennial rivers, namely Aweytu and Kitto, which join and pass through the Boye Swamp before they join the Gilgel Giberiver and different small river in all (Borre, Horra gibe, Ifabula and Jiren) study area used by cultivator. According to key informants, in most part of Jimma City the access for the ground water is easy to irrigate their crop. Regarding to this result about 68% is in agreement that there is enough water and about 32% households said that there is not enough water. These result shows that there are sufficient water sources for cultivation of urban horticulture in Jimma City. The photograph taken during data collection could be an evidence for the availability of enough water in the town (Figure 8).





Figure 8. Water resources in the area (Gibe)

#### **4.1.8.2 Enough farmland**

In the study area of four small administrative units there are enough farm land for urban horticulture as seen in table 2, here also according table 7, about 68% households were responded that there is enough farmland and about 32% households said there are not enough land in the area. This result shows that there is enough farm land because large proportion of households 68% agreed on it. Cultivating vegetables vertically has a variety of advantages for households without enough land. However, the issue is not understood well by households but during survey some were started the practice by using different materials.

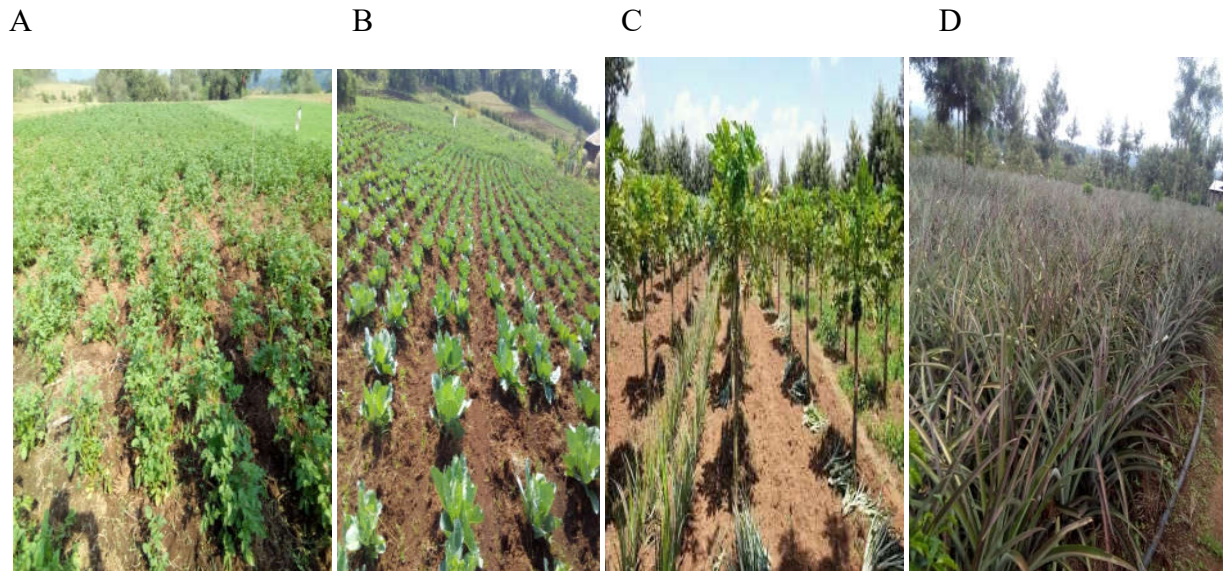


Figure 9. Cultivating vegetables in a vertical way

A. *Solanu mycopersicum*

C. *Carica papaya*

B. *Brassica oleracea var. viridis*

D. *Anana scomosus*

#### 4.1.8.3 Good weather condition

As described in Jimma City profile of 2008/2009, the study area is characterized by temperate humid climate that has high precipitation, warm temperature and long wet period. In this finding from 303 households about 69.3% were interviewed by structured questioners responded that good weather conditions are available and about 31.7% of them responded that no good weather conditions are available for cultivating fruits and vegetables. From this result we can say that the study area has good weather condition, because majority of households 69.3% agreed that there is suitable weather for urban horticulture.

#### 4.1.8.4 Enough labor force

Labor is an important issue in horticulture production. Smallholder farmers rely on family labor for land preparation, planting, cultivation, weeding, irrigation, fertilizer and pesticides application, harvesting and transporting of the product. About 69% of the respondents rely on labor, while 32.7% not expend money on labor force, but work in group and association and at the end everybody gets its share. This system is useful to accomplish a given farm activity in a limited timeframe to ensure uniform planting, plant growth and maturity. The different vegetables produced require different amount of labor inputs. As indicated in Figure 10, most farmers were fully engaged in farming activities.





Figure 10. The labor forces

#### **4.1.8.5 Availability of organic fertilizer**

Farmers apply organic fertilizers in addition of mineral fertilizers to improve soil fertility and increase production. The use of manure is common in the study area while the use of composite is not. Animal manure is transported from homestead to the field mostly during the dry season and spread in the field. From the sample producers interviewed, 98.3% used manure to fertilize land used for different cultivation of fruit and vegetable. To some extent, households also not used fertilizers which are about 1.7%.

#### **4.1.8.6 Good soil condition**

As described in area description, two major soil types are observed in Jimma area. These are reddish brown residual soils and alluvial soils of brownish gray and grayish white clay soils. The reddish brown soils are well-drained soils which are found in the hilly and rolling/sloping areas. Whereas the alluvial soils are found in the low-lying flatter or gently sloping plains and these soils are poorly drained. In this study about 66% households were responded the presence of good soil condition in the plot of horticulture and about 34% households were responded that there is not good soil condition in their plot, so from this result good soil condition is available in the study area.

## 4.2 Discussion

In the study area, urban horticultural practice is dominated by male than female. This shows that the male group dominated by taking the larger proportion that is 90.1% of the total farmers engaged in urban horticulture activities. More over information obtained from FGD and interviewer indicates women were spending more time on maternity and small trade activity. The result for this research is in opposite with the previous finding by Asadu *et al.*(2013), who reported greater number of household heads who participated in urban horticulture were women than men (Brock and Foeken, 2006; Khan *et al.*, 2020). As a result increasing the female involvement in the area is very crucial, because women are more sensitive and concerned to family food security.

Regarding the marital status, based on the results most (81%) of the respondents were married and responsible to take care of their families. Also the family size of most respondents about 59.3% were 5 and above 5. This implies that there will be an increasing number of populations in the future and to feed these ever-increasing people the community should adopt urban horticulture. Since urban horticulture has a great influence on food security because farmers can cultivate these crops throughout the year and it could improve food security. This finding is in line with the findings of Edmondson *et al.*(2020).

Most of the respondents in the study area are literate (74.6%). They can therefore adopt innovations meant to improve urban agriculture, since education has a positive relationship with adoption. This finding is supported by the finding of Asadu *et al.*(2013), who reported the value of education to adopt urban horticulture. As mentioned in table2, some of the respondents were illiterate; this may impact the adoption status of the community for the urban horticulture. So governments change the educational status of the illiterate.

Some of the respondents in the study area said that they have additional work in different private sectors and governmental organizations. These farmers cannot obtain enough benefit from urban horticulture, because they have no enough time to invest on their farm activities. When they compare their incomes with full time farmers, they have low income. During the FGD they

raised the issues and shared some important experience from the model farmers with half time farmers. They agreed that in applying urban horticulture they improved their incomes. This study is in agreement with the previous research report by Hungwe (2007) in Zimbabwe, urban farmers who obtain incomes from non-farm based activities do not take farming as seriously as those farmers and they have get low income compared with full time farmers.

In this study also all the respondents agreed that urban horticulture creates both full time employment for the household head and their spouse and part time employment for the children and other household members. It also reduces unemployment within the family and improves the overall level of family income. This study agreed with other scholars (Edmondson *et al.*, 2020; Khan *et al.*, 2020), who stated urban horticulture is used as a means of employment for two categories of people: members of the farming households and hired laborers. Also with regard to the type of involvement in farming, for some of the people, farming are a full time occupation, for others it is a part time job, and for few it is a leisure time activity. This finding agrees with the finding of (Forkenet *et al.*, 2004).

There are wide varieties of horticultural crops growing in study site which is carried out to feed the farmers family and for market purpose. As information obtained from the key informants and sample respondents, mostly they practiced these farming activities both by forming association and also by individuals who lonely practice the farming in view of increasing their income and for family consumption. During the survey it was observed that farmers of the area practice crop farming by inter-cropping with other vegetable crops.

The study indicates that about 54% were vegetables while 46.43 % were fruits are produced for their edible leaves, roots, tubers and fruit as an integral part of farming system of the study site. For instance, vegetables are dominant in farmer gardens of study area. Vegetables and fruit provide important minerals and vitamins in human nutrition and add variety as well as interest to our meals. Most cultivated crops in the study area were *Persea americana*, *Mangifera indica* and *Carica papaya* from fruit and *Coloca siaesculenta*, *Daucuscarota subsp. Sativus*, *Capsicum annum* and *Brassica oleracea var. viridis* from vegetable. However, the purpose of cultivating specific crop was quite different among households (for consumption, income and medicine). This study is in agreement with the report of Zerihunet *al.* (2011) in Jimma Zone the most

cultivated home garden crops were enset, avocado, cabbage, maize, mango, banana which are use for food and other purposes.

In study area the investigator identified the availability of farm plots, all the respondents have farm plot for cultivation and the farm size are also enough about 81.5% have 0.125-1.0 ha and 18. 5% have 1.1-2.5 ha. The size of farm land has positive impact on the adoption of new technology. For instance, lack of sufficient land to use as an alternative, rather than formal agriculture hinders the farmers to adopt a new technology. Also the landscape is suitable for irrigation except Jiren, the soil is fertile, and the weather condition is good and an adequate amount of water for irrigation. However there is Poor land use that means all farm plots are not covered by crops some are left uncultivated and forage for livestock and fertility management situation especially farmers who have plot size between 1.1ha-2.5 ha, poorly managed and input provisioning services were identified as weak. This study is contrary to those scholars (Bryld, 2003; Deelstra and Girard *et.al.*, 1999) in most cases; urban horticulture is practiced in marginal spaces in town and outskirts where lands are not suitable for other use. It, therefore, creates beautiful situations and landscapes, and improved microclimate, and nutrient recycling

Production efficiency is measured by computing the gross margins and profits earned from production and marketing of urban horticultural products. Cost information is used to compute the desired efficiency indicators. Alternative markets for selling the products were assumed. That is the producers can choose between selling the product to a merchant at market. Based on the information collected from individual farmers in the study area about 67% are growing all the season and 52.1% are using irrigation especially for vegetable. The net income earned from vegetable is higher due to three times cultivation per year and highly consumed in community. Vegetable are more cultivated in area due to long rainy season and land allocated to vegetable production is relatively better access to irrigation during the dry season using Gibe river bank that crosses three small administrative unit namely Horragibe, Borre and Ifabula and there are number of different rivers used for irrigation in all study area including Jiren. The land topography is more or less flat and suitable for irrigation except Jiren which is hilly not suitable for irrigation. Vegetable derived more income than fruit (Fig, 6), due to the remarkable increase in the market. Other findings from (Zemedede, 2006) also confirmed the opinion; increasing

growth of production is a mechanism for overcoming the impacts of land shortage and the farmers use this strategy to increase income.

According to information gathered from FGD and farmers urban horticulture contributes to food security and poverty alleviation of cultivators. And also urban horticulture provides the low and middle income urban dwellers with low-price food items, horticulture jobs and cash income. Most of urban cultivation is practiced with poor farmers who consume most of the production and supply the surplus to market. The major expense for most of the urban poor is purchasing of food; thus, they will be left with nothing for health, education and other necessities. They also hardly consume varieties of food. Thus, it is not surprising that urban cultivation contributes to improving livelihoods for the urban poor. It improves not only quantity of food intake but also the nutritional value if the poor self-grow vegetables and fruits. This finding is in line with the finding of (Bryld, 2003; Mireri *et al*, 2006).

Urban horticulture also contributes for traditional medicines. About 51.5% respondents said, they are highly depended on traditional medicine than modern medicine, due to its easy to obtain and use. The wide spread use of traditional medicine among both urban and rural population in Ethiopia could be attributed to cultural acceptability, efficacy against certain types of diseases, physical acceptability and economic affordability as compared to modern medicine. This study is confirmed the opinion by those researchers (Abebe, 2001), (Bekele, 2007), the use of medicinal plants is common phenomenon in Ethiopia, nearly 70% of humans and 90% of livestock population in the country use plant based traditional medicines as their major health care system.

Respondents in study area urban horticulture are used in addition to consumption, income, medicine and employment use as a recreation. Because the crop growing is green, different varieties, different in habit and consist different leave size that collection takes beatification for environment. This investigation is in line with Veenhuizen (2010) which says urban horticulture can also have a positive impact upon the greening of the town, the improvement of the urban micro-climate, the maintenance of biodiversity as well as the reduction of the ecological foot print of the town by producing fresh foods to the consumers

Urban horticulture activities in study area challenged by a variety of factors, mainly about 99% of the respondents have lack of awareness and training. The respondents said that cultivation using indigenous knowledge and scale up experience from model farmers. Challenge emphasized by respondents in four small administrative units were; insignificant supports from government organizations and NGOs, lack of accessibility of input (mineral fertilizers, selected seeds, herbicide and pesticides) and natural disaster such as flooding are challenges to adopt urban horticulture. These are lack of expert and negative attitudes not considering of the potential to enhance food security at household level. This study also agrees with by some researchers in other countries who wrote, if these challenges can be removed and attitudes changed, urban horticulture will become more competitive and efficient in providing food for millions of urban people (Smith *et al.*, 1999; Edmondson *et al.*, 2020; Khan *et al.*, 2020).

The other critical challenges mentioned by respondent were from input about 91.7% lack of availability of pesticide. Pesticide that bought from merchants is mostly outdated, but weeds removed by labor-intensive and replaced mineral fertilizer by organic fertilizer. This study agrees with the findings of (Drescheret *et al.*, 1999; Khan *et al.*, 2020), who face urban horticulture in most developing countries include: lack of access to land, recognition and horticulture inputs (such as improved seeds, fertilizers, pesticide and equipment and hand tools)

Access to farmland, good soil condition, enough water, good weather condition and availability of organic fertilizer are opportunity to adopt horticulture in study area. According to respondents in study site they identified stable factor in the development and sustainability of urban horticulture. However, relatively in Jimma City the scarcity is less than other towns in Ethiopia. The finding is also supported by Negash *et al.*, (2020), who observed the positive willingness to adopt urban agriculture for the farmers who have large farm size.



## 5. Conclusion and Recommendation

### 5.1. Conclusions

Urban horticulture is the promising sector to increase food security in Jimma City. To increase food security for the increasing population adoption of urban horticulture is a viable option. Horticultural crops (fruit and vegetable) are the major source of local consumption and the only practical and sustainable way to ensure their supply. In study areas, the farmers' conducts different types of horticultural practices in view of feeding their family and increasing their income through different ways. The study identifies diverse grope of fruit and vegetables. There are 15 vegetables and 13 identified fruits species. There are four most common vegetable crops namely *Brassica oleracea*, *Daucu scarota subsp. sativus*, *Capsicum annuum* and *Colocasi aesculenta* and for fruit known as *Persea americana*, *Mangifera indica* and *Carica papaya*. Among these, food security attainment is crucial role, generating household income, serve as employment opportunities, urban greening and medicine are the major roles of urban horticulture in the area. However, its adoption status is low due to different challenges; some of the challenges were confirmed as a hinder to promote urban horticulture in study area. The study also confirmed the following challenges, which hinders the adoption such as lack of awareness and shortage of training, lack of government support, lack of NGOs, lack of chemical fertilizer and pesticides The study also identified that the town has a great opportunity to adopt urban horticulture. Some of the investigated and identified opportunities were; the suitability of the weather condition, fertile soil, availability of organic fertilizer, availability of water and enough daily labor.

## 5.2 Recommendations

Based on the finding of the study, the following recommendations were forwarded to improve the existing challenges created by urban horticulture activities as well as obstacles that hinder the practice of urban horticulture in the city in general and in the study area in particular.

- ❖ Awareness creation for the urban communities and other concerned bodies is found to be very important to encourage such farming practices in the area
- ❖ Improve the existing production system. This can be done by introducing fruit and vegetable varieties that best fit into the crop calendar pattern, the rotation and enable efficient utilization of the crop production cycle used by the cultivator.
- ❖ Concentrated efforts should be needed by research institution and other government and non-government organization by providing the urban cultivator to support how urban horticulture is important for food security in town.
- ❖ Promoting the establishment of urban farmer training center at sub-smallest administrative level and sufficient professional experts, to ensure the expectant of awareness and training for cultivator on urban horticulture.
- ❖ Technical and training gap can be managed through strengthening the capacity and mandates of Jimma City Urban Agriculture Extension
- ❖ Urban cultivation should be encouraged in addition to food security for fruit and vegetable but also in biodiversity conservation and management.
- ❖ Improve the input supply system so that farmers use the right type of production inputs, the quantity needed at the right time. Improving the system will protect farmers from buying contaminated and fraudulent products.
- ❖ Giving more emphasis for collaborations and cooperation with all stakeholders such as, farmers, town administrative, small administrative units, development agents, and researchers to identify the best practice and provide updated information.
- ❖ To overcome the challenges and to increase the adoption of urban horticulture, different stakeholders should involve actively.
- ❖ Development agents in the small administrative units, the administrative of district, researchers, and the local community should enhance awareness about role of urban horticulture.

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## Appendix

### Appendix 1. Questionnaire to be answered by Urban Farmers in the urban horticulture activities

This questionnaire is designed to collect information on urban horticulture diversity and its benefit in food security, challenges and opportunities in Jimma City. Therefore, your genuine cooperation in answering the questions listed below will be of a great importance to the study.

Thank You!

Answer the following questions in the box provided on each options by putting “X” sign in Your choice,

1. Sex of household heads

Male       Female

2. Marital status

Married    Single    Divorced    Widowed

3. Family size

One    Two    Three    Four    Five    More than five

4. Educational level

Illiterate    Only read and write    Elementary  
 High school completed    College or university graduate

5. Do you have any other job other than farming activity in the city?

Yes       No

5.1. If your answer is yes what is your occupation?

Public employed    Self-employed    Private formal employment  
 Unemployed    Retired

6. Do you have plot of land for cultivation?       Yes       No

6.1 What is its size in hectare? \_\_\_\_\_

6.2 What type of crop plants you grow? Would you list them? \_\_\_\_\_

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7. How many times you grow within a year?

7.1 Vegetables  One  Two  Three  Four

7.2 Fruits  One  Two

8. How much money do you earn during one farming season?

8.1 From vegetable \_\_\_\_\_

8.2 From fruits \_\_\_\_\_

9. Did you get enough money from the sale in the market?  Yes  Sometimes there are marketing problem  No

10. Is horticulture benefit in food security in your family?  No  yes

11. How many years of practice do you have on horticultural crop production? \_\_\_\_\_

12. If you purchase, what is the proportion of your income used for purchase of horticulture product? \_\_\_\_\_

13. What are the benefits of horticulture products? (You can choice more than one)

For consumption  For recreation  Employment

For income  For medicine

14. What agricultural equipment you use during irrigating activities? (You can Select more than one choice)

Water pumping machine

Different hand tools

Other Please specify \_\_\_\_\_

15. Are you growing all seasons of the year?  Yes  No

15.1 Are you using irrigation?  Yes  No

15.2 What type of irrigation? (You can choice more than one)

Surface irrigation  By using can  Water pumping machine

16. Have you ever encounter flooding on your vegetable Cultivation?

Yes  No

16.1 Is there any challenge you come across during horticultural crop plants production?

Yes  No

16.2 If yes what are these?  Natural disaster such as flooding due to excess rain  
 Lack of chemical /natural fertilizers

Other, Please specify

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17. What additional input used to grow horticultural crop? (You can choice more than one)

Pesticide  Natural fertilizer  Artificial fertilizer  Herbicide

Other, Please specify

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18. Have you ever got government support for your growing activity?

Yes  No

19. Did NGOs give you support for your activities?  Yes  No

21. Which challenges of the following is mainly affect your horticulture activity? (You can

choice more than one)  Water/ Lack of rainfall  socio-economic status

Pesticide  Herbicide  Natural fertilizer  artificial fertilizer lack of awareness  Lack of enough land  lack of training  Farm machine

22. Do you think there are opportunities with cultivation of horticulture within area?

Yes  No

23.1. If yes, which opportunities of the following are mainly found in your horticulture activity area? (You can choice more than one)

Enough water sources  enough farm land  Good climate  Training

Worker  Natural fertilizer  Good soil character

Other, Please specify

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## Appendix 2. Interview Questions to Development Agents working at district level

1. What is the background of the horticulture in Jimma City?
2. What are the main challenges frequently happen in the urban horticulture in relation to cultivation activities? What measure you took to overcome such challenges?
3. What are input (water, improved seed, fertilizer, herbicide, pesticide, etc...) and the marketing access and other related situation of your cultivator products?
4. Which vegetable and fruit are most common that have been cultivated in the district? Why?
5. What technical support the office provided to the cultivator so as to determine what vegetable type and fruit they should produce for improve food security and to alleviate market related and other challenges?
6. What are the opportunities of urban horticulture in your district?

### Appendix 3. Focus group discussion Questions to Agriculture officers of Jimma City

1. What is the background of the urban horticulture activity in Jimma City?
2. How many urban horticulture cultivators are available in the City?
  - 2.1. From these how many of them are organized by your office?
  - 2.2. From these how many of them are growing both vegetable and fruit in cultivation?
  - 2.3. Do you have know model urban farmers operated in Jiren, Ifa bulla, Borre and Horragibe?
3. What are the benefits of urban horticulture in food security and other sector in Jimma town?
4. What are the opportunities of urban horticulture in Jimma City?
5. Are your office collaborating with other respective institutions which directly or indirectly increase benefit of urban horticulture for food security for urban dweller and cultivators?
6. Are you provided training on improving farming practice as well as financial management?  
How?
7. What are the challenges of urban horticulture in Jimma City?

## Appendix 4. Format for collecting data check list of semi: structured Questionnaires

### I General Information of the respondents

Name \_\_\_\_\_ age \_\_\_\_\_ sex \_\_\_\_\_ date \_\_\_\_\_

Serial number \_\_\_\_\_

Religion: Orthodox \_\_\_\_\_ Protestant \_\_\_\_\_ Muslim \_\_\_\_\_ others \_\_\_\_\_ ethnicity \_\_\_\_\_

Education status: education (grade level) \_\_\_\_\_

Non educated \_\_\_\_\_

Occupation \_\_\_\_\_ locality \_\_\_\_\_ kebele \_\_\_\_\_

Marital status: single \_\_\_\_\_ married \_\_\_\_\_ Divorced \_\_\_\_\_

For how long you have lived in the area \_\_\_\_\_

### List of fruits and vegetables species cultivated by farmer in urban horticulture in Jimma town.

<b>NO</b>	<b>Plant name(local)</b>	<b>Parts used</b>	<b>Purpose of use</b>	<b>Human/animal feeding</b>	<b>Habit</b>

### Appendix 5. The diversity of Jimma town fruit crops

Local name	Scientific name	Family name	parts used	Used for	Habit	Freq uenc y	Percentag e
Avocado	<i>Persea americana</i>	<i>Lauraceae</i>	fruit	Food & medicine	Tree	303	100
Mango	<i>Mangifera indica</i>	<i>Anacardiaceae</i>	fruit	Food & medicine	Tree	303	100
Papaya	<i>Carica papaya</i>	<i>Caricaceae</i>	fruit	Food & medicine	Tree	303	100
Gishta	<i>Annona chrysophylla</i>	<i>Annonaceae</i>	fruit	Food	Tree	129	42.6
Ananas	<i>Anana scomosus</i>	<i>Bromeliaceae</i>	fruit	Food & medicine	Shrub	93	31
Muzz	<i>Musa paradisiaca</i>	<i>Musaceae</i>	fruit	Food & medicine	Herb	262	86.5
Birtikuan	<i>Citrus sinensis</i>	<i>Rutaceae</i>	fruit	Food & medicine	Tree	85	28.1
Lomi	<i>Citrus × limon</i>	<i>Rutaceae</i>	fruit	Food & medicine	Tree	63	20.8
Apple	<i>Malus domestica</i>	<i>Rosaceae</i>	fruit	Food	Shrub	62	20.5
Romman	<i>Punica granatum</i>	<i>Punicaceae</i>	fruit	Food	Tree	26	8.6
Abukeerii	<i>Morinda citrifolia</i>	<i>Rubiaceae</i>	fruit	Food	Tree	18	5.9
Jackfruit	<i>Artocarpus heterophyllus</i>	<i>Moraceae</i>	fruit	Food	Tree	20	6.6
Zeytunna	<i>Psidium guajava</i>	<i>Myrtaceae</i>	fruit	Food & medicine	Tree	217	71.6

## Appendix 6. The diversity of Jimma town vegetable (leave, root and tuber) crops

Local name	Scientific name	Family name	parts used	Used for	Habit	Frequency	Percentage
Goddere	<i>Colocasiae sculenta</i>	<i>Araceae</i>	tuber	Food	Herb	262	86.5
Huchino	<i>Manihotea sculenta</i>	<i>Euphorbiaceae</i>	tuber	Food	Herb	127	41.9
Sikuadincha	<i>Ipomoea batatas</i>	<i>Solanaceae</i>	root	Food	Climber	216	71.3
Dinch	<i>Solanumtu berosum</i>	<i>Solanaceace</i>	tuber	Food	Climber	216	71.3
Hundedima	<i>Beta vulgaris</i>	<i>Amaranthaceae</i>	tuber	Food	Herb	176	58.1
Karot	<i>Daucu scarota subsp. sativus</i>	<i>Apiaceae</i>	root	Food	Herb	262	86.5
Qulubi	<i>Cucurbita pepo</i>	<i>Cucurbitaceae</i>	tuber	Food & medicine	Shrub	164	54.1
Shinkurta	<i>Allium cepa</i>	<i>Amaryllidaceae</i>	tuber	Food	Shrub	111	36.6
Buqqe	<i>Protea goguedi</i>	<i>Proteaceae</i>	firut	Food	Climber	154	50.8
Fosolia	<i>Phaseolus vulgaris</i>	<i>Fabaceae.</i>	firut	Food	Climber	72	23.7
Barbare	<i>Capsicum annum</i>	<i>Solanaceae</i>	firut	Food & medicine	Shrub	262	86.5
Ebrango	<i>Brassica oleracea var. viridis</i>	<i>Brassicaceae</i>	leave	Food	Shrub	262	86.5
Timatim	<i>Solanum lycopersicum</i>	<i>Solanaceae</i>	firut	Food	Climber	185	61.1
Salata	<i>Lactuca sativa</i>	<i>Asteraceae</i>	leave	Food	Herb	112	36.9
Qosta	<i>Spinaci aoleracea</i>	<i>Amaranthaceae</i>	leave	Food	Herb	112	36.9



**Appendix 7. Pictures during focus group discussions**

