

**CONTRIBUTION OF HOMEGARDENS TO HOUSEHOLD FOOD SECURITY IN
MOROGORO MUNICIPALITY**

**FOR REFERENCE
ONLY**

**BY
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**A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE
REQUIREMENTS FOR THE DEGREE OF MASTER OF ARTS IN RURAL
DEVELOPMENT OF SOKOINE UNIVERSITY OF
AGRICULTURE. MOROGORO, TANZANIA.**



ABSTRACT

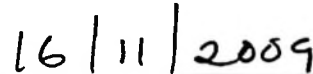
The present study was conducted in Morogoro Municipality; during December 2006 and April 2007. The main objective was to determine the contribution of homegardens to household food security in Morogoro Municipality. The study was carried out through reconnaissance survey of the selected wards; interview of the heads of households, ward leaders, extension and Municipal agricultural officers; and detailed technical field survey. Data collected included information on; the sources and quantities of food for the households; contribution of homegardens to household food security; factors affecting the level of contribution of homegardens to household food security and the measures required for improvement of homegardens contribution to household food security. The results obtained indicated that; the Morogoro Municipality's community depends on various sources of food for their households with employment being the major source of food followed by Homegardens: Employment contributes more to household food security 46% followed by homegardens 21%; Business 10%; Agriculture 10%; Livestock 8% and Forestry 5%. Constraints limiting homegardens contribution to household food security in Morogoro Municipality were identified to include shortage of irrigation water and unreliable rainfall, pests and diseases, Lack of extension services, shortage of land and poor soil fertility. Various measures required for improvement of homegardens contribution were also identified to include enhancing of rainwater harvesting, availability of extension services, use of organic fertilizers and provision of incentives. It is concluded that, among the various sources of food for the households in Morogoro Municipality, employment and homegardens are major sources of food that contribute more to household food security compared to other sources. Moreover, the contribution of homegardens can be promoted by using the identified corrective measures.

DECLARATION

I, AGNESS THEODORE MARIRO, do hereby declare to the Senate of Sokoine University of Agriculture that this dissertation is my own original work and it has neither been submitted nor concurrently being submitted for a higher degree award in any other university.



Agness Theodore Mariro
(MA Rural Development Candidate)

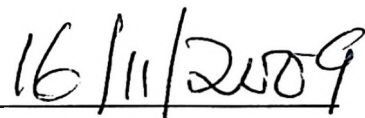


Date

The above declaration is confirmed



Prof. L.L.L. Lulandala
(Supervisor)



Date

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DEDICATION

I dedicate this work to my father Theodore Mariro, my late mother Clauder Mariro, my husband Abel Andrew Hango and to our two kids, Angel and Andrew.

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LIST OF ABBREVIATIONS

ANOVA	- Analysis of Variance
FAO	- Organization of the United Nations
ICRAF	- International Center For Research in Agroforestry
NGOs	- Non Governmental Organizations
RWH	- Rain Water Harvesting
SPSS	- Statistical Package for Social Service
TAZARA	- Tanzania and Zambia Railway Authority
TFNC	- Tanzania Food and Nutrition Center
UNDP	- United Nations Development Program
UNECA	- United Nations Economics Commission for Africa
URT	- United Republic of Tanzania
WHO	- World Health Organization

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background information

Homegardens technologies are used in Tanzania in order to meet needs of people in terms of food, fuel wood, fodder, medicines, soil fertility, shade and building materials, meanwhile alleviating the problem of environmental degradation. The sizes of homegardens are variable but usually composed of a large number of woody and herbaceous species, carefully structured to form several vertical canopy strata and each component has a specific place as well as function. The choice of species in the garden depends largely on environmental and socio-economic factors, dietary habits of people and market demands of the locality. The system enables a continuous production of different crops within limited areas (Karyomo, 1985).

Different forms of agriculture found in the tropics are a result of the variations in climate, soil, economics, social structures and history. Agro-ecology is the main determinant of the physical ability of crops to grow, livestock to survive and farming system to exist (Beets, 1989). In East Africa, especially Tanzania, the homegardens practices are not new. The practices have been successful over many decades in highlands where population densities are high. For example, the growing of coffee and banana mixed with fodder, shade, fuel wood, poles and timber trees practiced on slopes of Mount Kilimanjaro are an excellent example of homegardening practices (Fernandes *et al.*, 1984; Oktingati; 1985). Household gardens supply and supplement the subsistence requirements and generate secondary income. The technology specializes in subsistence production and thus plays an important role in the social life of the community. The mixture of several types of products, which are both subsistence and income generating help farmers to meet their basic needs and

minimizes the risks of the production system (ICRAF, 1996). It has been reported by Landaver and Brazil (1990) that large species diversity in homegarden providing for both subsistence and cash, often contributes to increased stability in food production. In many developing countries, Tanzania inclusive, the contribution of homegarden production both at the household and in the national economies is unknown. Homegarden components contribute significantly to the household income and food security (Karyomo, 1985). Today's increased focus on homegarden technologies is an example of efforts deployed in the search for a solution to the most pressing problems namely; rural food insecurity, environmental degradation, and loss of biodiversity. However, a full range of these potential benefits cannot be met by every agroforestry system. Thus, the challenge to the farmers is on the selection of suitable agroforestry practice and how to produce and supply economically sufficient quantities of agroforestry products in the world of steadily increasing population.

1.2 Problem statement

In many developing countries, Tanzania inclusive, the contribution of homegardens production both at the household and national economies is unknown. Homegardens are able to provide a wide range of traditional foods. They include edible leaves, nuts, fruits and vegetables, which are important in enhancing nutritional balance in daily needs. However in recent decades the technologies seems to collapse in some areas (O'king'ati, 1994). Recently there has been declining trends of food production from homegardens although agroforestry is considered to be a promising approach to alleviate the problem of environmental degradation and food insecurity. According to FAO (1994) the output of the subsistence gardening sector in developing countries is not expressed in quantitative monetary equivalent terms. Also the industry is not recognized as a significant contributor

to household economies as a result its potential value is often overlooked by resources management and development programmes.

1.3 Problem justification

According to Lorri (1998) people need to increase production per unit area while at the same time conserving the production potential of the land. Due to the limited external inputs availability and use by the traditional farmers, technologies like homegardens, which have low input and high generative production potential for food security deserve attention and promotion. Homegarden components contribute significantly to the household income and food security (Karyomo, 1985). In the study on gender and household food security situation in the Chagga home gardens by Edward (2003) in Rombo district, the results showed that homegardens contribute to household income and food security. It showed that homegarden crops contributed 67.7%, livestock 29.0% and homegarden trees 3.6%. However, information on the contribution of homegardens activities in the overall household food security in relation to other sources is widely lacking. It is the intension of the present study to fill up this gap.

1.4 Research objectives

1.4.1 Main objective

Determination of the contribution of homegardens to household food security in Morogoro Municipality, Tanzania.

1.4.2 Specific objectives

- i. To identify the sources and quantities of food for the households
- ii. To determine the contribution of homegardens to household food security.

- iii. To assess the factors affecting the level of contribution of homegardens to household food security
- iv. To determine the measures required in improving homegardens contribution to household food security.

1.4.3 Research questions

The study will be guided by the following questions:

- i. What are the main sources of food that sustain household in Morogoro Municipality?
- ii. What is the contribution of homegardens to household food security?
- iii. What are the factors affecting homegardens contributions to household food security?
- iv. What are the measures for improving homegardens in order to enhance their contribution to household food security?

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Overview

Most of the Sub-Saharan Africa countries experienced a steady decline in per capita food production (FAO/WHO, 1992). This is a result of several factors that caused a decline in agricultural production. Although, unfavorable farm policies e.g. pricing policies, inadequate extension and marketing services, may be described the reasons for low agricultural productivity, the capacity of the natural resources base to sustain current population has been questioned by FAO (FAO, 1990). Intensification of the existing agricultural land productivity through improved traditional agroforestry systems and practices, offer large potential for doubling or tripling crop yields through successive cropping seasons and subsequently contribute to reduced deforestation and increased income to farmers (Ingram, 1990). Agroforestry systems enable people to increase diversity and production from the same piece of land. In addition to food and wood products, homegardens have a wide and diverse potential to contribute to the preservation of the environment.

2.2 Sources of food security for the household

Various sources have been recognized, which contribute to the household food security. These include agroforestry, agriculture, forestry, livestock, business and employment.

2.2.1 Homegardens

A homegarden is a special type of agroforestry technologies because it consists of basic components of agroforestry systems namely; Multipurpose trees, agricultural crops, and livestock components within the same land management unit. In East Africa especially

Tanzania, the homegardens practices are not new. Household garden supply and supplement the subsistence requirements and generate secondary income. Production in homegardens is mainly of native subsistence (Rugalema *et al.* 1994), but studies of existing homegardens have shown that given appropriate infrastructure and incentives, a wide range of high value cash crops (coffee, vanilla, black paper and cardaman) are produced.

Several kinds of homegardens are known for stable yields, varied products, and continuous harvesting during a year (Soemarwoto, 1987). The productive role played by homegardens includes the production of food, fodder and fuel wood (Nair, 1992). iCRAF (1997) noted that agroforestry contributes to improved welfare of rural households by providing easy access to fuel wood, fodder, poles, timber and medicinal plants. Beets (1989), argued that, the high diversity of plant species in homegardens, with different flowering, fruiting and cropping seasons enable it to function as a living food store and potentially additional food sources. Homegardens also contribute to the dietary intake of the households through the garden products. In Indonesia for instance, the homegardens contribute about 10.8 percent of calories and 5.9 percent of protein in daily household intake (Christanty, 1985). Swaminathan (1987) found that consumption of 100g of *Persia americana*, *Manhot esculenta* and *Guilielma utilis* was equivalent to 10, 12, 150, 15.5, 3, 25, and 113 percent of the minimal daily requirement of protein, calcium, carotene, thiamin, riboflavin, niacin and ascorbic acid respectively. However in some countries, the yields are relatively medium although for most poor people they can significantly contribute to income and nutrients to poor diet, particularly during lean periods. For these reasons homegardens are being promoted in many countries like Peru, Ghana, Sri- Lanka and Indonesia (Wiersum, 1982).

2.2.2 Agriculture

The importance of small scale Urban Agriculture in Tanzania cannot be overemphasized (Mlozi, 2001). The majority of Tanzanians virtually depend on agriculture as their main occupation and source of livelihood. The economy of Tanzania largely depends on the agricultural sector, which employs more than 85 percent of the rural population (URT, 1990). The growing of crops in open and underdeveloped spaces within urban zones in Eastern and Southern African cities have become important sources of food security. Urban populations have expanded without corresponding increase in economic opportunities for employment. As a result of this vulnerable, households have resorted to urban agriculture to sustain their livelihoods (Mudimu, 1996). Although largely an informal economic activity, urban farming provides employment as well as an income for those involved. At the town or city level, urban farming contributes positively to the provision of affordable food for poorer urban dwellers (Mlozi *et al.*, 2004). However, because of its generally low productivity, the sector's potential in terms of food supply and employment is much higher than presently appreciated (Mlozi *at al.*, 2004). Although the mindsets of the majority of the urban households still linger with the notion of past trends that agriculture is a main means of sustaining livelihoods in urban areas (Mudimu 1996; Mlozi *et al.* 2004).

2.2.3 Forestry

Forestry and trees make a significant source of food security and household income. As pointed out by FAO (1996) they have a high potential of supplying food to millions of people if managed well. Forest foods are particularly important in predominantly subsistence economies in remote areas. There are vast numbers of foods gathered from forests; from caterpillars, larvae to nuts and honey (Falconer and Anolds, 1991). According to Tewari (1994) none timber forest products provide food security to a large low-income

population particularly during periods of drought and works as an insurance against famine and crop failure.

2.2.4 Livestock

Livestock keeping forms another important source for the household food security. Farmers keep a variety of domestic animals in their homegardens for several uses. For example, in Thailand animals are kept for food, rituals or religious sacrifices and prestige (Jensen, 1993). In Tanzania the Chaggas keep cattle for milk and pigs are kept for meat, sale and manure production (Fernandes et al, 1984). Cattle also recycle the biomass and provide nutrient inputs in the form of manure to improve soil fertility and help increase farm income and employment of farmers. According to Njuki (2001), the majority of farmers keep livestock for the purpose of obtaining milk and manure while others is for the purpose of obtaining manure only for the homegardens. According to Karyomo (1985) livestock is found to be the most income generating activity in Arumeru district, Arusha Region, Tanzania.

2.2.5 Business (off-farm income generating activities)

Off-farm income generating activities can be defined as those activities besides farming which people are engaged in to increase their income. They provide important secondary sources of earnings for smallholders and landless farmers (Oludimu, 1991). Some of off-farm activities include street food vending, owning and operating kiosks, which sell a variety of food and other items. Some have opened repair and maintenance service centers, furniture and other carpentry service enterprises, tailoring, hair curling and braiding salons. Others own hotels, shops, supermarkets, pharmacies, and many other businesses. Petty trade contributes to household income and used as coping strategy for food shortage (Mwagile, 2001). It has been noted that diversification of activities in terms of on- farm

and off- farm activities contribute to the improvement of household economy. Through diversification of the household activities, the risk of food insecurity is reduced (FAO, 1986; ICRAF, 1996) as failure in one activity can make up for another. The money earned from these activities could then be used to purchase farm inputs or food in times of deficits.

2.3 Homegardens and food security

Homegardens are perhaps the most intensive land use technologies providing all sorts of nutritional elements at low cost and in an ecologically friendly way. They conserve biological diversity especially of cultivated plants (FAO, 1996). This is especially relevant to areas of the tropics under pressure from increasing populations and indiscriminate deforestation (Fernandes and Nair, 1986). Beets (1989) argued that, the high diversity of plants species in homegardens, with different flowering, fruiting and cropping seasons enable it to function as a living food store and potentially additional food sources, Several kinds of homegardens are known for stable yields, varied products, continuous harvesting during a year (Soemarwoto, 1987). Homegardens also contribute to the dietary intake of the household through the garden products.

2.3.1 Household food security

At household level food security refers to the ability of the household to secure either from own production or through purchase, adequate food for dietary needs of its members. Ensuring food security is a necessary condition for improving the nutrition of each member in the household, though by itself is not sufficient because of other socio-cultural problems related to distribution of the food among the household members (Nyange, 2000). However, household food security issues differ in rural and urban settings. In urban areas, household food security depends primarily on the level of income, often in the form of

wages earned, prices of food and other consumer goods. While in the rural areas, household food security is often determined by farm food availability, prices of agricultural produces and income earned from both on farm and off- farm employment opportunities (Nyange, 2000).

2.3.2 Household food insecurity

Food insecurity exists when members of a household have inadequate diet for part or throughout the year or face the possibility of inadequate diet in the future. According to Nyange (2000) two types of insecurity are commonly distinguished, chronic and transitory. However, other studies identify emergency food insecurity as third category (Temu *at al.*, 1997).

Chronic food insecurity is a persistent lack of household's ability to buy or produce enough food. Chronic food insecurity can be attributed to persistent drought (Liwenga, 1995). It can be subdivided into either a lack of overall food quantity, normally measured in calories intake or insufficiencies at the level of particular nutrients. Transitory food insecurity refers to a temporary decline in household access to enough food resulting from instability in food production and prices or household income and health conditions (FAO/WHO, 1992). Mwangi (2001) showed that 72% of the households in Morogoro rural and Kilosa District produce food from their own farms but also supplemented the produce with purchased foods.

2.3.3 Causes of household food insecurity

Food consumption at the household level depends on amount of food produced and ability to purchase from the market or other sources. However, efforts to produce enough food are affected by various factors. Droughts, dependence on rainfall, poor storage, poor

agricultural knowledge and poor soil fertility have been identified as the main contributing factors to food insecurity in the country (Ringio, 1990).

It is estimated that 40% of Tanzanian population live in food deficit regions; that is the regions producing less food than they actually require feed their populations. While 20% just reach a tight balance leaving only 40% who could be described as self sufficient from own production (TFNC, 1992). TFNC (1992) has attempted to group the causes of food insecurity into five categories as follows:

- a) Inadequate food supply in rural households: Crop failures, storage and production deficiencies and excessive sale of food are some of the causes that may lead to inadequate food supply in rural households.
- b) Lack of purchasing power: Reports from the United Nations Economic Commission for Africa (UNECA) show that the widespread hunger prevailing in many nations is not due to non- availability of food in the market, but to inadequate purchasing power among the rural and urban poor.
- c) Inflation: Consumer purchasing power has been declining over the last years in most developing countries. The hardest hit are the urban low wage earners and the rural poor who are food deficit and do not have money to buy food.
- d) Inappropriate feeding practices: Inadequate feeding, especially for young children, or inadequate weaning foods, and low intake of animal protein by growing children are major direct causes. The origin of such behavior is sometimes deep rooted in the social cultural systems.

2.4 Factors affecting homegarden contribution to household food security

There are different factors affecting the contribution of homegardens to household food security. Some of the factors may include homegardens productivity, shortage of irrigation water, incidence of pests and diseases, and lack of extension services

2.4.1 Homegardens productivity

In viewing the homegardens productivity, it is essential to point out the general aspects of homegardens fertility. High fertility results into high crop production. The fertility of the homegardens which are usually more intensively cropped, is further enhanced by farmyard manure or pen manure, household refuse, kitchen wastes, compost, crop residues, litter fall, ant and termite nests (Fernandes et al., 1984; Okgbo, 1985). According to Crawley (2002) the productivity of the highlands is dwindling largely because of high and growing human populations. Soil fertility, crop yields, water supplies, forest cover and biodiversity are all decreasing while crop pests and diseases are on the rise. Productivity of homegardens is constrained by factors like drought and loss of fertility that are attributed to deforestation, which has led to serious erosion especially along riverbanks and steep slopes. Agroforestry, which involves deliberate integration of trees and shrubs under the same land use management unit with crops and livestock, offer a great opportunity to mitigate environmental degradation and deforestation (Mugah, 1996). Agroforestry as a composite system has the potential for increasing land use intensity while maintaining the productivity of the natural resources base. It enables the land to support much higher population densities than the traditional agriculture (Roling, 1995). Trees like *Leucaena* spp, *Calliandra* spp and *Sesbania* spp increase soil fertility through their nitrogen fixing characteristics and also provide fodder for farm animals, while *Grevillea robusta* acts as a good source of mulch, wood fuel and timber.

2.4.2 Shortage of irrigation water

Water is a basic natural resource required to sustain life and provide various social needs as well as for economic development (URT, 2002). Many parts of Tanzania face water stress situations. In Morogoro, the problem of unreliable rainfall relates to the quantity, distribution and reliability of rainfall. There is high fluctuation of monthly rainfall, with

high variations at the beginning and at the end of the seasons (Ngana; 1990; Rwehumbiza, 2000). Morogoro Municipality receives bimodal rainfall comprising the short rains “vuli” and long rains “masika”. The long rains last from mid February to mid May and short rains mid November to mid January (Rwehumbiza, 2000). Water is important for food production not only because of its direct effects on yields and cultivated area, but because reliable water supplies induce farmers to invest in other essential crop inputs, such as improved germplasm, fertilizers and capacity building for better resources management (Rosegrant et al. 1997). Water resources have a close relationship to food security. Mlozi *et al.* (2004) observed that irrigation is widespread, though the sources of water vary with the location of the plots. The large majority of homegardens in urban areas use tap water for irrigation but it is scarce in Tanzania during the dry season, the supply is unreliable, and water shortages or low pressure are common.

2.4.3 Incidence of pests and diseases

The impact of pests in some African countries has been estimated; on the average about 30% of the total subsistence production is lost annually (Makundi *et al.*, 2006). In Tanzania, a short fall in cereal production close to, or around this figure will threaten the food security of practically the entire nation and will necessitate food importation or food aid. The aim of Maize production is mainly to meet household consumption and cash needs. Country-wide, it is regarded as an important crop and ranks highest compared to other food crops at 67% of the total cereal crop production. The major cause of post-harvest losses during maize storage is infestation by insect pests. Estimates show that insects contribute about 30-40% to total post harvest losses (Makundi *et al.* 2006). Therefore applying measures to reduce crop damage and losses in the field and in storage will contribute to increased food security in Tanzania.

2.4.4 Lack of extension services

Since independence to mid-1980s the Government has been the major provider of extension services (MAC, 2000). In late 1980s to date, extension services are provided by the Ministries of Agriculture and food security, Water and Livestock Development and Regional Administration and Local Government, NGOs, Private Agri- business, Community based organizations and Religious organizations. Before decentralization, the extension system was judged by MAC (2000) to be ineffective. Some of its weaknesses included,

- Tendency to treat farmers as homogenous groups with the same characteristics
- Little attempt was made at helping farmers to solve their production and marketing constrains;
- Poor supervision of field staff
- National extension services are supply driven and could embody cost sharing, farmers capacity building and self-reliance. In such instances farmers do not own programs
- Resources were too thinly spread out mainly due to extension coverage; and
- The combining of crops and livestock disciplines under one umbrella was ineffective.

The other reasons were lack of linkage between research, extension and farmers. Although researchers have developed many technologies, only limited attempt has been made to popularize them to the users. Tesha, (1996) found that urban farmers did not get adequate extension advice and the extension agents were biased towards livestock keepers than crop

cultivators. Also urban extension agents were not sufficiently trained to serve urban farmers as they lacked the necessary skills to operate in complex urban environment.

2.5 Measures required for improvement of homegardens

There are several measures that can be used to enhance the productivity of homegardens, some of these include, use of organic fertilizers, adequacy of extension services, provision of incentives to farmers and use of rainwater harvesting techniques.

2.5.1 The Use of organic fertilizers.

Inadequate use of organic manure is caused by lack of close integration between the crops and livestock, and lack of appropriate transport facilities for farmyard manure and in some places unavailability of adequate amount of farmyard manure (Lema and Ahmed, 1996). Agroforestry, which involves deliberate integration of trees and shrubs under the same land use management unit with crops and livestock, offer a great opportunity to mitigate environmental degradation and deforestation (Mugah, 1996). Agroforestry as a composite system has the potential of increasing land use intensity while maintaining the productivity of the natural resources base. It enables the land to support much higher population density than traditional agriculture (Roling, 1995). Trees like *Leucaena* spp, *Calliandra* spp and *Sesbania* spp increase soil fertility through their nitrogen fixing characteristics and also provide fodder for farm animals, while *Grevillea robusta* acts as a good source of mulch, wood fuel and timber.

2.5.2 Adequacy of extension services

Since independence to mid-1980s the Government had been the major provider of extension services (MAC, 2000). In the late 1980s to date, extension services are provided by the Ministries of Agriculture and food security, Water and Livestock Development and

Regional Administration and Local Government, NGOs, Private Agribusiness, Community based organizations and Religious organizations. Due to this there is an urgent need for the government to allocate adequate resources and improve working environment for extension staffs. Extension agents should go for in service training to enable them to work efficiently in an urban environment and advice urban farmers to practice intensive crop cultivation in small plots to increase yields (Mlozi, 2001).

2.5.3 Provision of incentives

The provision of incentives to smallholder farmers by the government will ensure improvement in crop production since they can afford to buy all the inputs required.

The majority of farmers cannot afford the purchase of pesticides, insecticides and inorganic fertilizers due to removal of subsidy on agricultural inputs and lack of credit facilities and some times and in some places, poor fertilizer distribution is evident (Myaka *et al.* 2003).

2.5.4. The use of rainwater harvesting techniques

The intervention techniques of rainwater harvesting should in general, aim at maximizing soil water availability to crops from each rainfall event and optimizing crop yield per unit of this available soil water. The use of rainwater harvesting techniques for crop production has not, unfortunately, received much attention by the research and extension services (Gowing *et al.* 1999). The starting point of rainwater harvesting is to capture rainwater when it falls for the purpose of meeting the needs for irrigation activities.

CHAPTER THREE

3.0 METHODOLOGY

3.1 Materials

3.1.1 Study area

The Morogoro Municipality is located in the eastern zone of mainland Tanzania. It lies between 5° and 7° latitudes South of the equator and between 37° and 38° longitudes east of Greenwich. Morogoro town is the capital of Morogoro Region with a total land area of 260 km² (URT, 2002). It is located on the foot of the Uluguru Mountains whose peak is about 1600 feet above sea level. Major physical features include the famous Uluguru Mountains, which lie in the southern part and the Mindu and Ugala Hills, which lie in the Western part. There are four main rivers with several tributaries, which form a number of alluvial flood plains and source the Morogoro communities with water. These rivers are the Morogoro, Kilakala, Bigwa and Ngerengere. Other sources of water are the Mindu dam, which was built in the late 1980 to serve for the industrial activities as well as domestic purposes. The current population of the Municipality stands at 228 863 people according to the population Census of 2002 (URT, 2005). Morogoro town serves as a hub for two major roads from the Country hinterland (Southern highlands, Central and Western parts) to metro pole Dar es Salaam. The town is also served by Kigoma- Dar es Salaam railway and Tunduma- Dar es Salaam railway (TAZARA). Apart from the existence of a large number of mixed tribes, the dominant tribe is Luguru. Administratively the Morogoro municipality has only one division which is sub divided into nineteen wards namely, Mwembesongo, Mji Mpya, Kichangani, Kilakala, Boma, Mji Mkuu, Kingo, Mlimani, Sultani Area, Mafiga, Uwanja wa Taifa, Sabasaba, Kiwanja cha Ndege, Mazimbu, Mbuyuni, Mzinga, Bigwa, Kihonda and Kingorwila (URT, 2002).

3.1.2 Climate

The climate of the Morogoro Municipality is tropical savannah with mean annual rainfall varying between 800mm at the altitude of 400m above sea level to 2300mm at the altitude of 1500m above sea level. The rainfall distribution is bimodal with the short rain season from October to December and the long rain season from February to May. The mean annual temperatures range between 18° C on the mountains and 30° C in river valleys, but in most parts the average temperatures are almost uniform at 25° C (URT, 2002). The highest temperatures occur in November and December, during which the mean maximum temperature is 33°C. The minimum temperatures are in August and September when the temperatures go down to 16°C.

3.1.3 Socio-economic activities

The economic activities in Morogoro Municipality include industries of primary and secondary level, subsistence and commercial farming, small scale enterprises and commercial retail as well as wholesale. Apart from these economic activities people do some homegardening activities, agricultural crop production and selling of timber and non-timber forestry products (URT, 2002).

3.2 Sampling procedure

Simple random sampling technique was employed. Six out of 19 Wards of Morogoro Municipality were randomly selected. From each of the sample Wards, a representative sample of 20 households was also selected randomly thus making a total sample of 120 households.

3.3 Data collection

3.3.1 Reconnaissance survey

This involved personal visits and introduction to the Regional, Municipal, and Ward leaders, extension staff, NGOs dealing with environmental issues and other interest groups and obtain various background information from them, part of which helped in better planning of my study and part of it was real data. The various kinds of information obtained from the Regional and Municipal leaders and extension staff included the general profile of Morogoro municipality, total population, demographic structure, general economic activities, status of homegardens activities, number of livestock and livestock business in general. This information helped to plan the process of data collection. Other types of information like total Ward population, Ward area (kilometer or hectare), total household number in the Ward, food problems, market accessibility and homegarden development was also collected from the Ward leaders and Ward extension staff. Other information like role of homegardens in household food security, problems facing homegardens activities, and measures for improving homegardens activities were also collected from NGOs dealing with environmental issues and other interest groups.

3.3.2 Socio-economic survey

Both closed and open-ended questions were employed for interviewing heads of households and ward leaders in order to have various information in relation to the study. A checklist for key informants like Municipal leaders, extension staff, NGOs and other interest groups were also employed. The data collected include socio-economic data like occupation, education, and household sources and quantities of food security. Information like status of food shortage, households practicing homegardening, constraints in homegardens activities and the measures for improvement of homegardens were also collected. Questionnaires are in Appendix 1 and 2.

3.3.3 Data processing and analysis

Both qualitative and quantitative information collected were verified, summarized, edited, coded and entered into the computer spreadsheet. Statistical Package for Social Science (SPSS/PC) was used to determine descriptive statistical such as means, frequencies, percentages and coefficients of variability. Qualitative data was processed, categorized, summarized and presented in a tabular form. The statistical test ANOVA was also employed to demonstrate the differences between treatment means

CHAPTER FOUR

4.0 RESULTS

4.1 Sources and quantities of food supply for the households in Morogoro

Municipality

4.1.1 Sources and quantities of household food security in Morogoro Municipality

The results on the sources and quantities of annual households food security in Morogoro Municipality in maize equivalent are presented in Table 1. The detailed data and the associated statistical analysis procedures are presented in Appendices 3 and 4. It will be noted that the mean annual household food supply is 1754 Kilogram of maize equivalent with employment being significantly the most important source ($P < 0.05$) followed by homegardens. The majority of the population (78%) are catered for through a combination of own household production and purchases from the market and a very small minority (9%) entirely depend on the market for their livelihoods (Table 2).

4.1.2 Quantities of food supply for the households.

The results on the quantities of food supply for the households in Morogoro Municipality are presented in Table 3. The detailed data and the associated statistical analysis procedures are presented in Appendices 3 and 4. It will be noted that the mean annual quantities of food each household is assured to get, varies between wards with Mazimbu being the most richly supplied followed by Mwembe Songo Ward ($P < 0.05$) probably because they are larger available areas for homegardening.

**Table 1: Sources and quantities of household food security in Morogoro Municipality
(Kg of maize equivalent) during 2007**

Sources of household food	Quantities, Kg household ⁻¹
Employment	5110a
Homegarden	2184b
Business	1044c
Agriculture	1026c
Livestock	882c
Forest	277d
Total	10523
Mean	1754

Means with different superscripts differ significantly ($P < 0.05$)

Mean 1754 = Annual household food adequacy in Morogoro Municipality

**Table 2: Means of household food acquisition by the communities in Morogoro
Municipality in percentage**

Source of daily food	Percent
Own produce and purchase from the market	78a
Own produce	13b
Purchase from the market	9b

Means with different superscripts differ significantly ($P < 0.05$)

Table 3: The mean annual food supply (Kg of maize equivalent) in the various wards of Morogoro Municipality

Name of ward	Total household food ⁻¹
Mazimbu	28950687a
Mwembe Songo	8222752b
Uwanja wa Ndege	4856826b
Kilakala	4809468b
Mji Mpya	4469192b
Mbuyuni	4190880b
Mafiga	4109622b
Kichangani	4068887b
Kihonda	3620256b
Mlimani	3139970b
Uwanja wa Taifa	3113350b
Mji Mkuu	2701160b
Kingolwira	2669588b
Mzinga	2652048b
Bigwa	1715750b
Kingo	1482130b
Boma	1365910b
Sultani Area	1365910b
Sabasaba	1315500b
Total	88815350
Mean	4674492

The food supplies for all the wards in the Municipality have been projected from the sample mean and number of households per ward.

Note: 45 000 TSh is equivalent to 100 Kg of maize.

Means with different superscripts differ significantly ($P < 0.05$)

4.2 Contribution of homegardens to household food security in Morogoro

Municipality

4.2.1 Contribution of homegardens to household food security

Results on the contribution of homegardens to household food security in Morogoro Municipality are presented in Table 4. The detailed data and the associated statistical analysis results are presented in Appendices 7 and 8 respectively. It will be noted that the household food security in Morogoro urban is contributed by various sources with the employment being the most significant ($P < 0.05$). Homegardens come in as the second most important contributors to the Municipality's food security.

Table 4: Contribution of homegardens to household food security to the Morogoro

Municipality's community

Source of household food	Percent
Employment	46a
Homegarden	21b
Business	10c
Agriculture	10c
Livestock	8c
Forest	5c

Means with different superscripts differ significantly ($P < 0.05$)

4.2.2 Households practicing homegardening in Morogoro Municipality

The results on the proportion of households practicing homegardening are presented in Table 5. Results show that 84% of the households do practice homegardening and only the remaining 16% do not.

Table 5: Households practicing homegardening in Morogoro Municipality

Practicing homegardening	Percent
Practice homegarden	84
Do not practice homegarden	16

4.2.3 Status of food availability among the Morogoro Municipality's communities.

The results on the status of food security among the Morogoro Municipality community are presented in Table 6. It will be noted that 78% of the urban community are food secure and the remaining 22% experience food shortages.

Table 6: Status of food availability among the Morogoro Municipality community

Experience food shortage	Percent
Experience food shortage	22
Do not experience food shortage	78

4.3 Factors influencing the level of contribution of homegardens to household

food security in Morogoro Municipality

The results on the factors affecting the level of contribution of homegardens to household food security are presented in Table 7. The detailed data and the associated statistical analyses are presented in Appendices 9 and 10 respectively. It will be noted that the contribution of homegardens to food security in Morogoro Municipality is influenced by various factors with the shortage of irrigation water, being the most significant ($P < 0.05$) followed by pests and diseases.

Table 7: Factors influencing the level of contribution of homegardens to household food security in among the Morogoro Municipalities communities

Factors influencing contribution of Hg	Percent
Shortage of irrigation water	35a
Pests and diseases	20b
Lack of extension services	16b
Shortage of land	15b
Poor soil fertility	14b

Means with different superscripts differ significantly ($P < 0.05$)

4.4 Measures required in improving homegardens contribution to household food security in Morogoro Municipality

The results on the measures required to improve homegardens contribution to household food security are presented in Table 8. The detailed data and the associated statistical analysis results are presented in Appendices 11 and 12 respectively. Various measures have been noted to improve homegardens contribution to household food security with the enhancing rainwater harvesting being most significant ($P < 0.05$) closely followed by availability of extension services.

Table 8: Measures to improve homegardens contribution to household food security

Measures for improvement of homegardens contribution	Percent
Enhancing rain water harvesting	31a
Availability of extension services	30a
Use of organic fertilizers	22a
Provision of incentives	17ab

Means with different superscripts differ significantly ($P < 0.05$)

CHAPTER FIVE

5.0 DISCUSSION

This chapter discusses the results on the sources and quantities of food supply for the households in Morogoro Municipality (5.1), Contribution of homegardens to household food security (5.2), Factors influencing the level of contribution of homegardens to household food security (5.3), and the measures required in improving homegardens contribution to household food security (5.4).

5.1 Sources and quantities of food supply for the households in Morogoro

Municipality.

The results on the sources and quantities of annual food supply and mean of food acquisition for the households including mean food supply in the various wards of Morogoro Municipality are presented in Tables 1,2,and 3. The detailed data and the associated statistical analysis procedures are presented in appendices 3, 4, and 5, 6 respectively.

Various sources have been noted to contribute to annual household food supply in Morogoro Municipality with employment being the major source. The importance of employment as a major source of annual household food supply in Morogoro Municipality is expected due to the fact that a large percent (57%) of the households consist of part or all of the members that are employed and, therefore, income received from the salaries is used to purchase food for all the members of the households. These results are in parity with the results obtained by Mlozi *et al.* (2004) who found half of the households in Morogoro Municipality was depending on urban crop cultivation thus indicating to be a major source of food for the urban population. This shift from the dependence on crop

production to employment, probably reflects the escalating deterioration in the climatic conditions and shortage of irrigation water that disfavor crop production and increasing industrial and service activities that increasingly provide employment opportunity to the larger proportion of the urban community. This is consistent with the Morogoro Municipal Council Implementation report on economic activities, which explains the status of industries of primary and secondary level, subsistence and commercial farming, small scale enterprises and commercial retails as well as wholesales as the major economic activities which provide employment opportunities to the dwellers of Morogoro Municipality (URT, 2005).

The mean annual household food adequacy in the Municipality of 1754Kg maize equivalent is higher than the annual food adequacy averaged 120 Kg of carbohydrates per unit population of Morogoro Municipality with a household size of 4.2 (URT 2002). This indicates that the majority of communities in Morogoro Municipality are food secure. This higher food security level probably reflects the composite nature of the current figure of escalated maize prices to the current level of Tsh 45 000 per 100 Kg unit used in the present conversions compared to that of less than Tsh 10,000 per 100Kg unit that was prevailing at that time of the URT (2002) report and the higher employment levels and salary scales that are current prevailing in the Municipality (URT, 2005).

The majority of the Morogoro urban population (78%) depends on the combination of their own individual produce and purchases from the market as their own means of food acquisition. This shows that, most of the Morogoro communities are engaging in more than one activity, which enables them to procure their livelihoods. Thus the income acquired from employment and business help them to purchase food from the market. These results are consistent with the results obtained within Morogoro Municipality (Mlozi *et al.* 2004)

and elsewhere in the Region by mwagile (2001) that showed that 72% of the households in Morogoro rural and Kilosa District produce food from their own farms but also supplemented the produce with purchased foods.

The quantity of food supply for the Morogoro Municipality in maize equivalent is 88,815 tones. This is above the starch food requirement of the Morogoro Municipality, which is 25 735 tones (URT, 2002). This implies that the majority of the Morogoro Municipality communities in general are self sufficient in starch food but the food production trend showed a decrease in surplus between 1997/98 and 1999/2000 when the region experienced deficit for starch foods (URT, 2002). The growing of crops in open and underdeveloped spaces within urban zones that had previously been most important sources of food security, have currently declined and paved the way to the expansion in the economic opportunities for employment. Although the mindsets of the majority of the urban households still linger with the notion of past trends that agriculture is a main means of sustaining livelihoods in urban areas (Mudimu 1996; Mlozi *et al.*, 2004), from the current observations it is clear that its role in practice, is rapidly falling out. This trend of declining is likely to exccutate further as most open spaces are filling up by the intended structure and need for increased observance of urban hygiene requirements.

5.2 Contribution of homegardens to household food security in Morogoro

Municipality

The results on the contribution of homegardens to household food security in Morogoro Municipality are presented in Tables 4, 5, and 6. The detailed data and the associated statistical analysis results are presented in Appendices 7 and 8 respectively.

Household food security in Morogoro Municipality is contributed by various sources with employment being the most important contributor (i.e. 46%) but, however, closely followed by homegardens (i.e. 21 %). As discussed earlier a large part of the Morogoro Municipality households have members that are employed in the various paying activities and the income received from employment is used to purchase food for the households. This causes the employment to be the most contributor of household food security when compared with other sources. This status agrees well with Nyange's reported findings of 2000 which indicated household food security in the urban areas to depend primarily on the level of income, often in the form of wages earned, prices of food and other consumer goods. The majority of the urban communities in the Morogoro Municipality, on the other hands engage in homegardening activities, which conserve biological diversity especially of cultivated plants (FAO, 1996). This is especially relevant in areas of the tropics under pressure from increasing populations and indiscriminate deforestation (Fernandes and Nair, 1986). It seems, however, that crop production in urban areas is declining due to various constraints that include limited space, unreliable rainfall, shortage of irrigation water and increased opportunities for employment.

The majority of communities in Morogoro Municipality engage in homegardening activities that can ensure a constant food supply throughout the year. Besides the importance of homegardens in contributing to household food security, homegardens significantly enrich household environment. Beets (1989) argued that, the high diversity of plant species in homegardens, with different flowering, fruiting and cropping seasons and patterns enable it to function as a living food store and potentially additional food sources. Several kinds of homegardens are known for stable yield, varied products, and continuous harvesting during the year (Soemarwoto, 1987). The productive role played by homegardens includes the production of food, fodder and fuel wood (Nair, 1992). ICRAF

(1997) noted that agroforestry contributed to improved welfare of rural households by providing easy access to fuel wood, fodder, poles, timber and medicinal plants. Homegardens also contribute to the dietary intake and nutrition of the households through the diversification of the gardens products. .

In Indonesia for instance, the homegardens have shown to contribute up to 10.8 percent of the calories and 5.9 percent of protein in the daily household food intake (Christanty, 1985). Swaminathan (1987), on the other hand, found that consumption of 100g of *Persia americana*, *Manhot esculenta* and *Guuiielma utilis* was equivalent to 10, 12, 150, 15.5, 3, 25, and 113 percent of the minimal daily requirement of protein, calcium, carotene, thiamin, riboflavin, niacin and ascorbic acid respectively.

Overall the majority of Morogoro Municipality's communities are food secure. The availability of food to a large extent is enhanced by the dependence on own production especially through homegardening that contributes 21% of the Municipality's food security. It has been indicated that the community that practice both on-farm and of-farm activities were less affected by food shortages. This contribution in the mountain areas of Eastern Uluguru rises up to 72%. Also it has been noted that, off-farm activities provide important secondary sources of earnings for smallholders and landless farmers (Oludimu, 1991). Mwangile (2001) noted that, petty trade contributes to household income and is often used as a coping strategy for food shortage. However, diversification of activities in terms of on- farm and off- farm activities contributes to the improvement of household economy. Through diversification of the household activities, the risk of food insecurity is reduced (FAO, 1986; ICRAF, 1996) as failure in one activity can make up for another. It is estimated that 40% of Tanzanian population lives in food deficit regions; that is the regions producing less food than they actually require to feed their populations, while 20% just

reach a tight balance leaving only 40% who could be described as self sufficient from own production (Tanzania Food and Nutrition Center, 1992). According to (FAO, 1996), severe food insecurity that degenerates into famine has been on the decline. Today, unlike the late 1960's and early 1970s or even the 1980s, the symptoms of famine are evident only in several Africa countries such as Sudan, Ethiopia, and Mozambique and localized in war zones. The risk of famine continues to exist, however, due to political, economic, and environmental shocks and inadequate preparedness mainly at the national level.

5.3 Factors influencing the level of contribution of homegardens to household food security in Morogoro Municipality

The results on factors influencing the level of contribution of homegardens to household food security in Morogoro Municipality are presented in Table 7. The detailed data and the associated statistical analysis procedure are presented in Appendices 9 and 10 respectively.

Ringio (1990) reported that efforts to produce enough food are affected by various factors. Droughts, dependence on rainfall, poor storage, poor agricultural knowledge and poor soil fertility have been identified as the main contributing factors to food insecurity in the country. Shortage of irrigation water and unreliable rainfall has shown in the present study, to be the main factor (i.e.35%) constraining homegardening activities in Morogoro Municipality. The problem of unreliable rainfall relates to the quantity, distribution and reliability. High fluctuations of monthly rainfall, with high variations are often experienced at the beginning and at the end of the seasons (Ngana, 1990; Rwehumbiza, 2000). Although the total annual rainfalls may be high, they come within limited time periods and there are often overall moisture deficits to plants and hence poor crop yields which in turn lead to food shortage. Because of the general water shortage characterizing the Municipality, irrigation is virtually non-existent. That is why it accounts for a major

problem hindering homegarden contribution to household food security in Morogoro Municipality, as water is a basic natural resource required to sustain life and provide various social needs as well as for economic development (URT, 2002). Mlozi *et al.* (2004) observed that the shortage of irrigation was widespread, although the source of water varied with the location of the plots. The use of tap water for homegarden irrigation is increasingly becoming scarce in most households of the Morogoro Municipality and Tanzania in general, especially during the dry season. The importance of water for food production is not only because of its direct effects on yields and cultivated area, but because reliable water supplies induce farmers to invest in other essential crop inputs, such as improved germ plasma, fertilizers and capacity building for better resources management (Rosegrant *et al.* 1997).

Pests and diseases are the second most important factor that contributes enormously to reducing crop yields and post harvest crop losses, thus aggravating food shortages. In Tanzania estimates show that insects contribute about 30-40% to total post harvest losses (Makundi *et al.* 2006).

In addition individual farmers spend large sums of money to protect crops from damage by other pests such as stalk borers and storage pests. The extensive damage by pests and diseases to food crops implies that self-sufficiency in food production cannot be achieved solely by increasing production. In order for the potential yield to be achieved, prevention or reduction of crop damage and losses due to pests and diseases is mandatory. The impact of pests in some African countries account for about 30% of the total subsistence production cost annually (Makundi *et al.* 2006). In Tanzania, a short fall in cereal production close to, or around this figure will threaten the food security of practically the entire nation and will necessitate food importation or food aid. Therefore applying

measures to reduce crop damage and losses in the field and in storage will contribute to increased food security in Morogoro Municipality.

Lack of extension services was one of the factors indicated to be affecting the contribution of homegardens to household food security. As is the case in many parts of Tanzania, agricultural extension is not adequate in Morogoro Municipality. Most households claimed that extension workers were not frequently seen or visited them hence failed to get their advice immediately when needed. Thus farmers often rely on their own working experiences, which sometimes is an inappropriate solution. On the other hand extension workers complain that they are too few in number and most of them have no reliable transport means to facilitate their activities. The ultimate goal of extension workers is to have many contact farmers, but transport has been one of the major limitations (Chimsala, 1998).

MAC (2000) noted that there is lack of linkage between research, extension and farmers. Although researchers have developed many technologies, only limited attempt has been made to popularize them to the users. Tesha (1996) found that urban farmers did not get adequate extension advice and the extension agents were biased towards livestock keepers than crop cultivators. Also urban extension agents were not sufficiently trained to serve urban farmers as they lacked the necessary skills to operate in complex urban environment.

Poor soil fertility was also mentioned as one of the problems hindering homegardens productivity. The problem of poor soil fertility in the area could be attributed to lack of constant replenishment of plant nutrients through artificial fertilization, manuring and continued removal of nutrients from the soil through crops, weeds and trees. According to Scholes *et al.* (1994), permanent cropping results in the net removal of nutrients from the

site, that must be replenished to provide a lasting cropping base. Thus low nutrient replacements in the soil contribute to low yields per unit area. The fertility of the homegardens which are usually highly diversified and more intensively cropped, can efficiently and effectively be achieved through the intensification of the woody perennial and animal component that provide increased farmyard manure or pen manure, household refuse, kitchen wastes, compost, crop residues, litter fall, ant and termite nests (Fernandes *et al.* 1984; Okgbo, 1985).

5.4 Measures required for improvement of homegarden contribution to household food security

Results on the measures required for improvement of homegarden contribution to household food security are presented in Table 8. Detailed data and the associated statistical analysis procedure are presented in Appendices 11 and 12 respectively.

Enhancing Rain Water Harvesting is one of the measures suggested to be required in improving homegarden contribution to household food security. In order to stabilize crop production under the variable and unpredictable rainfall in Morogoro Municipality, appropriate technologies, water harvesting are urgently needed. The intervention techniques should, in general, aim at maximizing soil water availability to crops from each rainfall event and optimizing crop yield per unit of this available soil water. The use of rainwater harvesting techniques for crop production has not unfortunately, received much attention by the research and extension services (Gowing *et al.*, 1999). The starting point of rainwater harvesting is to capture rainwater when it falls for the purpose of meeting the needs for irrigation activities. .

Availability of extension services is one of the measures required for improvement of homegardens contribution to household food security. Since independence to mid-1980s the Government has been the major provider of extension services (MAC, 2000). In late 1980s to date, extension services are provided by the Ministries of Agriculture and food security, Water and Livestock Development and Regional Administration and Local Government, NGOs, Private Agri- business, Community based organizations and Religious organizations. Due to this all these sectors should make sure that extension services are well provided to the community so that they can make use of the knowledge required for improvement of production. Extension agents should go for in service training to enable them to work efficiently in an urban environment and advice urban farmers to practice intensive crop cultivation in small plots to increase yields (Mlozi, 2001). On the other hand farmers should create favorable environment and willingness to accept advices provided by extension agents on issues related to agro forestry and natural resources management.

Use of organic fertilizers is one of the measures required for improvement of homegardens contribution to household food security. Soil fertility depletion in smallholder farms is the fundamental biophysical cause of declining food production. Inadequate use of organic manure is caused by lack of close integration between crop and livestock, and lack of appropriate transport of farmyard manure and in some places unavailability of adequate amount of farmyard manure. Agroforestry, which involves deliberate integration of trees and shrubs under the same land use management with crops and livestock, offer a great opportunity to mitigate environmental degradation and deforestation (Mugah, 1996). Agroforestry as a composite system of various technologies has the potential for increasing land use intensity while maintaining the productivity of the natural resource base. It enables the land to support much higher population density than traditional agriculture

(Roling, 1995). Trees like *Leucaena* spp, *Calliandra* spp and *Sesbania* spp increase soil fertility through their nitrogen fixing characteristics and also provide fodder for farm animals, while *Grevillea robusta* acts as a good source of mulch, wood fuel and timber.

Provision of subsidy on agricultural inputs to farmers will likely enhance the contribution of homegardens to household food security. Similar findings were obtained by Myaka *et al.* (2003) who reported that, the majority of farmers cannot afford the purchase of pesticides, insecticides and inorganic fertilizers due to removal of subsidy on agricultural inputs and lack of credit facilities and some times and in some places, poor fertilizer distribution is evident.

CHAPTER SIX

6.0 CONCLUSION AND RECOMENDATIONS

This chapter presents the conclusions of the discussion on the contribution of homegardens to household food security in Morogoro Municipality (6.1) and recommendations for the measures to be taken for improvement (6.2).

6.1 Conclusions

Based on the results obtained and the preceding discussion, the following conclusions have been reached:

- With the mean annual food supply of 1754Kg maize equivalent most of the Morogoro Municipality communities are currently food secure with Mazimbu ward being the most endowed with food
- There are various sources of food security for the Morogoro Municipality community's households; these include employment, homegardens, business, agriculture, livestock and forestry with employment and homegardens being the major sources of food.
- From this study it can also be concluded that the problem of food shortage at household level in Morogoro Municipality is a result of many factors such as shortage of irrigation water and unreliable rainfall, pests and diseases, lack of extension services, poor soil fertility and shortages of land. Therefore to sustain the productivity of homegardens, prevailing constraints should be overcome by applying corrective measures such as enhancing rain water harvesting, provision of extension services, use of organic fertilizers and provision of incentives which can improve productivity and hence household food security

6.2 Recommendations

The following recommendations are made based on the findings of the study.

- The government and non-governmental organizations should increase employment opportunities to the dwellers of Morogoro Municipality who are not employed since it plays a major role in household food security.
- The current homegardens technologies in Morogoro Municipality play part in household food security, but the entire philosophy of homegardening is not well covered, therefore more research is needed concerning such particular field.
- The present system of extension services and technology transfer is inadequate; therefore government and non-governmental organizations should intervene to improve the current level of food production.
- More training of field officers in the municipality will ease the delivery of technical advice to the farmers. Formation of farmer groups to facilitate easiness of provision of agricultural extension services will be helpful

The development of technologies, which are responsible for sustainable production, and the use of appropriate transfer and adoption mechanisms are essential pre-requisites for increased farm productivity, and food supply stability at household level.

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APPENDICES

**Appendix 1: QUESTIONNAIRE FOR HOMEGARDENERS IN MOROGORO
MUNICIPALITY**

QUESTIONNAIRE FOR HEADS OF HOUSEHOLDS

Date of interview.....

Name of ward.....

Part 1: Background information

1. What is your name?

2. Sex.

1. Male

2. Female

3. Age (years)

1. Below 30 years

2. 31-45 years

3. 46-60 years

4. Above 60 years

4. Marital status

1. Single

2. Married

3. Divorced

4. Widowed

5. Separated

5. What is your highest level of education?

1. No formal education

2. Adult education

3. Primary education

4. Secondary education

5. Diploma colleges

6. University

6. What is your main occupation?

Small-scale farmer

Employee

Petty business

Others (specify)

7. Give the total number of your household members.....

9.1 children below (18 years)

9.2 adults (below 18 years)

Part 2: Sources of household food security

8. What are the sources of food that sustain your household?

1. Agroforestry 2. Agriculture 3. Forestry 4. Livestock 5. Employment

6. Business 7. Others (specify)

9. What is the main source of your daily food

1. Own produce

2. Purchased from the market

3. Own produce and purchased from the market

4. others (specify)

10. How much of each of the sources contribute to household food security since 2001 – 2006?

Table 2: Sources of food security and their contribution to household food security

Sources of food security	2001	2002	2003	2004	2005	2006
Agriculture						
Forestry						
Livestock						
Employment						
Business						
Homegarden						
Others (specify)						

11. Do you practice homegarden?

1. Yes 2. No

Part 3: Food security indicators

12. Have you ever-experienced food shortage in your household at least the two years?

1. Yes 2. No

13. If yes give reasons for that

1. Low production from the homegarden
2. Lack of enough land cultivation of food crops
3. Large number of dependants
4. Low income and purchasing power
5. Overselling of crops
6. Household gender division of labour
7. Cultural rituals and taboos

Part 4: Factors affecting contribution of homegarden to household food security and measures to improve their performance

14. What are the main constraints in homegarden activities?

.....
.....
.....
.....
.....

15. What measures do you think can be used to improve home gardening activities in Morogoro Municipality?

.....
.....
.....
.....

**Appendix 2: CHECKLIST FOR KEY INFORMANTS: MANICIPAL
LEADERS/WARD LEADERS / EXTENSION AGENTS/ NGOs AND INTEREST
GROUPS**

1. What is the total number of population?.....
2. What is the total number of households?.....
3. What is the total number of households with homegardens in Morogoro
Municipality?.....
4. What quantities of food crop are produced in Morogoro Municipality?
5. What are the main sources of food in Morogoro Municipality.....
6. What type of trees, crops and animals that are managed in
homegardens?.....
7. What quantity of food crops are produced in this ward?.....
8. What is the total number of livestock in this ward?.....
9. What about the laws/ legislations that govern the use of land in the
Municipality?.....
10. Do you think homegardens have a role in household food security?
11. What are the main problems facing the sustainability of homegarden?.....
12. What do you think should be done to improve homegardens for food
security?.....

THANK YOU VERY MUCH FOR YOUR GOOD COOPERATION

Appendix 3: Detailed data on the sources and quantities of food supply in the sample wards of Morogoro Municipality

	Bigwa	Boma	Kichangani	Mazimbu	Mbuyuni	Mlimani	Total
Agriculture	25129	6367	22622	20464	22853	22533	122968
Forestry	4820	4356	2018	1027	12156	8822	33199
Livestock	15550	23531	27899	22733	5651	10400	105764
Employment	35118	70933	95356	119444	148200	144156	613207
Business	12356	3400	4938	63289	14756	26733	125472
Homegarden	42305	68544	31346	62356	23533	34111	262195
Total	135278	180131	184179	289313	227149	246755	1262805

Source: Survey data 2007

Note: Figures in Kg maize equivalent

Appendix 4: Statistical analysis procedure of the data on sources and quantities of food supply in Morogoro Municipality.

Grand total =1262805; Correction factor=grand total²/N

CF=1262805²/36 = 4429656856

TSS= 3425801471 – 4429656856 = 2982835785

TrSS = 419175374/36 – 4429656856 = 7214103532

BISS = 2808559287/36 – 4429656856 = 3371896718

Residual error=TSS – TrSS – BISS = 2982835785-721410353 - 3371896718=

1924235760

ANOVA TABLE

Sv	df	SS	MS	F- value	Tabulated F-value
Treatment	5	7214103532	1442820706	18.7	2.60
Block	5	3371896718	674379343.6	8.76	2.60
Residual error	25	192423576	76969430.4		
Total	35	2982835785			

Since F-tabulated < F-calculated then there is significant difference between treatment and blocks.

Calculation of LSD;

$$\text{LSD} = (t_{\alpha=0.005}) S_d$$

$$S_d = \frac{\sqrt{2s^2/r}}{\sqrt{6}} = \frac{\sqrt{2 \times 76969430.4}}{\sqrt{6}} = \frac{2.0595 \times 5065.2}{\sqrt{6}} = \frac{10431.8/20}{\sqrt{6}} = 521.59$$

Treatment means in kg of maize

$$\text{Employment} = 102201^a \div 20 = 5110^a$$

$$\text{Homegarden} = 43699^b \div 20 = 2184^b$$

$$\text{Business} = 20912^c \div 20 = 1044^c$$

$$\text{Agriculture} = 20495^c \div 20 = 1026^c$$

$$\text{Livestock} = 17627^c \div 20 = 882^c$$

$$\text{Forest} = 5533^d \div 20 = 277^c$$

$$\text{LSD} = 10431.8 \times 1754 = 18297377.2$$

Block means in kg of maize

Mazimbu	48219 ^a
Mlimani	41126 ^a
Mbuyuni	37858 ^a
Kichangani	30697 ^{ab}
Boma	30022 ^{abc}
Bigwa	22546 ^{abcd}

**Appendix 5: The mean percentage data on the sources of daily food supply
in Morogoro Municipality**

	Bigwa	Boma	Kichangani	Mazimbu	Mbuyuni	Mlimani
Own produce	40	5	5	20	20	20
Purchase from the market	10	10	30	35	0	0
Own produce and purchase from the market	50	85	65	45	80	80

Source: Survey data 2007

**Appendix 6: Statistical analysis procedure on the sources of daily food supply
data in Morogoro Municipality.**

	Bigwa	Boma	Kichangani	Mazimbu	Mbuyuni	Mlimani	Total
Own production	18.44	12.92	12.92	26.56	26.56	26.56	123.96
Purchase from the market	18.44	18.44	33.21	36.27	0	0	106.36
Own production and purchase from the market	45	67.21	53.73	42.13	63.44	63.44	334.95
Total	81.88	98.57	99.86	104.96	90	90	565.27

Grand total = 565.27

Correction factor = $565.27 / 18 = 17751.68$

TSS = $25141.97 - 17751.68 = 7390.29$

TrSS = $138870 / 6 - 17751.68 = 5393.32$

BISS = $53609 / 3 - 17751.68 = 117.98$

Residual error = $7390.29 - 5393.32 - 117.98 = 1878.99$

ANOVA TABLE

Sv	df	SS	MS	F-value	F- tabulated
Treatment	2	5393.32	2696.66	14.35	4.10
Block	5	117.98	23.6	0.12	3.33
Residual error	10	1878.98	187.89		
Total	17	7390.29			

F-tabulated < F- calculated hence there is significant difference between treatment

Calculation of LSD

$$\text{LSD} = (t_{\alpha=0.05}) \times S_d$$

$$S_d = \sqrt{2s^2/r} = \sqrt{2 \times 187.89 / 6} = 7.9$$

$$\text{LSD} = 2.1009 \times 7.9 = 16.6$$

Treatment means

Own produce and purchase from the market 62.03^a

Own production 20.66^b

Purchase from the market 17.72^{ab}

**Appendix 7: The contribution of homegardens to household food security
in Morogoro Municipality**

	Bigwa	Boma	Kichangani	Mazimbu	Mbuyuni	Mlimani
Agriculture	19.3	4.4	12.4	7.1	10.1	9.1
Forest	14.5	2.1	6	3.1	5.4	3.6
Livestock	11.9	11.2	15.3	7.9	2.5	4.2
Employment	26.9	33.7	52.4	41.4	65.2	58.4
Business	9.5	16.1	2.7	21.9	6.5	10.8
Homegardens	32.4	32.5	17.2	21.6	10.4	13.8

Source: Survey data 2007

Note: Figures in Percentage

**Appendix 8: Statistical analysis procedure on the data for the contribution of
homegardens to household food security in Morogoro Municipality**

Table of arcsine angles

	Bigwa	Boma	Kichangani	Mazimbu	Mbuyuni	Mlimani	Total
Agriculture	26.06	12.11	20.62	15.45	18.53	17.56	110.33
Forest	22.38	8.33	14.18	10.14	13.44	10.94	79.83
Livestock	20.18	19.55	23.03	16.32	9.10	11.83	100.01
Employment	31.2	35.43	46.38	40.05	53.85	49.84	256.75
Business	17.95	22.66	9.46	27.90	14.77	19.19	111.93
Homegarden	35.30	34.76	24.5	27.69	18.81	21.81	162.87
Total	130.69	132.84	123.99	127.41	128.5	131.17	774.6

Source: Survey data 2007

Grand total = 774.6

Correction factor = $774.6^2/36 = 16666.8$

TSS = $22628.49 - 16666.81 = 5961.68$

TrSS = $128220.18/6 - 16666.18 = 4703.22$

BISS = $100050.99/6 - 16666.18 = 8.3548$

Residual error = $5961.68 - 4703.22 - 8.3548 = 1250.11$

ANOVA TABLE

Sv	df	SS	Ms	F value	F tabulated
Treatment	5	4703.22	940.64	18.8	2.60
Block	5	8.3548	1.67	0.003	2.60
Residual error	25	1250.11	50.0		
Total	35	5961.68			

Since $F_{\text{tabulated}} < F_{\text{calculated}}$ then there is significant difference between treatment

Calculation of LSD

$$\text{LSD} = (t_{\alpha=0.05}) \times S_d$$

$$S_d = \sqrt{2s^2/r} = \sqrt{2 \times 50/6} = 4.0$$

$$\text{LSD} = 2.0595 \times 4.08 = 8.4$$

Treatment means

Employment	42.79 ^a
Homegardens	27.15 ^b
Business	18.66 ^c
Agriculture	18.39 ^c
Livestock	16.67 ^c
Forest	13.31 ^c

Appendix 9: The constraints in home gardening activities in Morogoro Municipality

	Bigwa	Boma	Kichangani	Mazimbu	Mbuyuni	Mlimani
Shortage of water	75	100	65	95	80	20
Pests and diseases	85	65	65	50	60	60
Theft	20	55	50	65	50	40
Shortage of land	30	30	55	50	45	55
Lack of extension services	40	30	50	25	45	55

Source: Survey data 2007

Note: Figures in percentage

Appendix 10: Statistical analysis on the constraints in homegardening activities in Morogoro Municipality

	Bigwa	Boma	Kichangani	Mazimbu	Mbuyuni	Mlimani	Total
Shortage of water	60.00	90.00	53.73	77.08	63.44	90.00	434.25
Pests and diseases	67.21	53.73	53.73	45.00	50.77	50.77	321.21
Theft	26.56	47.87	45.00	53.73	45.0	39.23	257.39
Shortage of land	33.21	33.21	47.87	50.77	42.12	47.87	255.06
Lack of exte services	39.23	33.21	45.0	30.0	42.13	47.87	237.44
Total	226.21	258.02	245.33	256.58	243.47	275.74	1505.35

Grand total (G) = 1505.35

Correction factor = $G^2/N = \frac{1505.35^2}{6} = 75535.95$

TSS = 82371.73 - 75535.95 = 6835.78

TrSS = 499431.92/6 - 75535.95 = 4369.37

BISS = 379075.6/5 - 75535.95 = 279.17

Residual error = TSS - TrSS - BISS = 6835.78 - 4369.37 - 279.17 = 2187.2

ANOVA TABLE

Sv	df	SS	Ms	F- value	F- tabulated
Treatment	4	4369.37	1092.34	9.99	2.87
Blocks	5	279.17	55.83	0.51	2.71
Residual error	20	2187.24	109.36		
Total	29	6835.78			

Since F- tabulated < F-value then there is significant different between treatments

Calculation of LSD

$$\text{LSD} = (t_{\alpha=0.05}) \times \text{Sd}$$

$$\text{Sd} = \sqrt{2s^2/r} = \sqrt{2} \times 109.36 / 6 = 6.03$$

$$\text{LSD} = 6.03 \times 2.086 = 12.58$$

Treatment means

Shortage of water	72.38 ^a
Pests and diseases	53.54 ^b
Theft	42.89 ^b
Shortage of land	42.51 ^b
Lack of extension services	39.57 ^b

Appendix 11: The measures required to improve homegarden's contribution to household food security in Morogoro Municipality

	Bigwa	Boma	Kichangani	Mazimbu	Mbuyuni	Mlimani
Enhancing RWH	75	95	65	100	80	100
Provision of incentives	85	65	80	80	80	85
Availability of extension services	75	85	95	100	95	90
Use of organic fertilizers	50	85	60	75	70	70

Source: Survey data 2007

Note: Figures in percentage

Appendix 12: Statistical analysis of the data on the measures required to improve homegarden's contribution to household food security in Morogoro Municipality

Table of arcsine angles

	Bigwa	Boma	Kichangani	Mazimbu	Mbuyuni	Mlimani	Total
Enhancing RWH	60	77.08	53.73	90	63.44	90	434.25
Provision of incentives	67.21	53.73	63.44	63.44	63.44	67.21	378.47
Availability of exte services	60	67.21	77.08	90	77.08	71.56	442.93
Use of organic fertilizers	45	67.21	50.77	60	56.79	56.79	336.56
Total	232.21	265.23	245.02	303.44	260.75	285.56	1592.21

Grand total = 1592.21

Correction factor = $G^2/N = \frac{1592.21^2}{8} = 105630.5$

$$TSS = 109085.8 - 105630.5 = 3455.4$$

$$TrSS = \frac{3847633.2}{6} - 105630.5 = 1248.2$$

$$BISS = \frac{1703656.4}{4} - 105630.5 = 840.0$$

$$\begin{aligned} \text{Residual error} &= TSS - TrSS - BISS \\ &= 3455.4 - 1248.2 - 840 = 1367.2 \end{aligned}$$

ANOVA TABLE					
Sv	df	SS	Ms	F- value	F- tabulated
Treatment	3	1248.2	416	4.57	3.29
Block	5	840	168	1.84	2.90
Residual error	15	1367.2	91.1		
Total	23				

Since F- tabulated < F-calculated then there is significant different between treatments

Calculation of LSD

$$Sd = \sqrt{2s^2/r} = \sqrt{2 \times 91.1} = 5.5$$

$$LSD = (t_{\alpha=0.05}) \times Sd$$

$$2.1315 \times 5.5 = 11.7$$

Treatment means

Availability of extension services	73.8 ^a
Enhancing rain water harvesting	72.9 ^a
Provision of incentives	63.1 ^a
Use of organic fertilizers	61.1 ^{abc}



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