

Contributions of Urban Mixed-Cropping to Household Food Security in Nigeria and Around the Globe

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Abstract— *Rapid rate of urbanization as a result of provision of improved infrastructural facilities in the cities has resulted in massive rural-urban migration of young people to cities in Nigeria and in other parts of the World. This has led to over-population and food insecurity among the urban people. Feeding over-populated towns has been a considerable challenge to governments of Africa, Caribbean and Pacific (ACP) countries. Several strategies had been employed by the past Nigerian governments. The practice of urban mixed-cropping, whereby the urbanites grow two or more crops simultaneously in small plots or using available materials like worn-out tyres, plastic pots, sacks and wheelbarrow among other things, has helped to improve urban household food security, enhance household income and provide job opportunities, among others. Urban mixed-crop farmers are facing many constraints like agricultural land scarcity, conversion of agricultural land to non-agricultural uses and difficulty in acquisition of micro-credit from banks which hinder their effectiveness. It was recommended that land reforms by governments should put into effect increased access by landless urban mixed-crop farmers to available unused government land to cultivate. Also, banks and extension agencies should extend micro-credit and extension services to urban mixed-crop farmers in Nigeria and in other countries in the world.*

Keywords— *Urban, Urbanization, Mixed-cropping, Household, Food security.*

I. INTRODUCTION

Agriculture is the most important sector of the Nigerian economy from the standpoint of rural employment, sufficiency in food, fiber and export earnings prior to the discovery of crude oil. About 2.5 billion men and women, forming almost 40 percent of the world population, depend on agriculture for their livelihood in order to feed themselves and earn a living (Mohammed, Achem, Abdulquadri and Age, 2009; Spore, 2007). National Bureau of Statistics (2007) states that agriculture provides

direct employment to about 75 percent of the country's population and Central Bank of Nigeria (2006) asserted that it contributes about 37.2 percent to the Gross Domestic Product. According to Amalu (1998), before the advent of the oil boom era, agriculture used to be the mainstay of the Nigerian economy. It accounted for over 35 percent of the Gross Domestic Product (GDP), provided employment for more than 67 percent of the nation's labour force and, most importantly contributed about 10% of total export trade. However, from the late 1970s and especially in the early 1980s, Nigeria witnessed an unprecedented stagnation in its agricultural economy and a downward trend in the general performance of the entire economy.

Given the agrarian nature of the Nigerian economy, the fundamental condition for overall social and economic growth of the country is a dynamic agricultural sector brought about by a steady increase in agricultural productivity, which is a product of technological change. Reports on agricultural production and food security showed that food production has to increase substantially in order to meet the food demand of a growing population (Wikipedia, 2006; Amalu, 1998). According to World Review (2001), agricultural production in developing countries increased only by 2.8 percent, which was the same rate as in 1998, but lower than 3.2 percent in 1977 and well below the high rates of between 4 percent and 5 percent recorded in 1993-1996. Moreover, FAO (1996) estimates showed that aggregate food production in sub-Saharan Africa for 1995 fell short of the 1994 levels by as much as 9.5 million tones. More recently, FAO reported that overall production fell by 0.3 percent in 2000, after an increase of about 1.9 percent in 1999 (FAO, 2002).

In, Nigeria, agricultural output is not increasing at the same rate with population growth rate. According to Mohammed et al. (2009), agricultural output increases at 2.0 percent while population growth rate is estimated at 2.8 percent. This is due to the fact that agricultural sector is characterized by preponderance of smallholder farmers and their families, who produce about 90 percent of the

staple food requirements of the ever –increasing population. They play a key role in economic growth and development (Olayemi, 1980; Olatunbode, 1990; Ijere, 1986; Ihimodu, 1986; FOS, 1987).

One particular concern relating to population growth that is beyond dispute is the very rapid rate of urbanization with an urban growth rate of over 5 percent per annum between 1975 and 1995. More young people are moving to towns than to rural areas. In Africa, 35 percent of the continent's population of 749 million in 1998 is urban. It is growing at a rapid rate of 8 percent each year. In Africa, it will rise from 38 percent to 55 percent (Spore, 2005).

Feeding towns which have more than a million inhabitants is a considerable challenge for the governments of Africa, Caribbean and Pacific (ACP) countries. For a long time now, their main concern has been how to supply sufficient quantities of food for their people. In many countries, local farmers have dramatically stepped up production in order to supply the urban demand. Agriculture has also developed in and around the major cities which contributes to the supply of fresh vegetables, eggs and poultry among other products for people living there (World Bank, 2005; Spore, 2005). The United States National Research Council estimates that by 2030 more people will be living in urban areas (4.1 billion) than in rural areas (3.1 billion) in middle and low income countries. Between now and then, nearly all population growth will be in the cities of developing countries, where some cities are growing two or three times faster than the country's overall population. This trend is equivalent to adding a city of one million residents every week (UN- HABITAT, 2004).

On a global scale, the population of towns outstripped the countryside in 2008 (Friedberg, 1996; Spore, 2009). The rural exodus continues unabated with the flow mainly directed towards the capital cities. In Nigeria, there is heavy migration of rural dwellers to big cities like Lagos, Ibadan, Enugu, Abuja, Zaria, Port Harcourt and Calabar to mention but a few. Those moving away from the rural areas to the cities are mostly young people aged between 15 and 45 years, the most productive members of the society. They set off to the towns with the hope of finding suitable jobs so as to earn a decent living and have access to services like pipe-borne water, regular electricity supply, good health, education and communication which are lacking in the rural areas. Government and international communities have long given priority to towns in terms of provision of these essential services at the detriment of the rural areas thereby, prompting the rural dwellers to leave their homes for the cities.

The rapid urbanization of the developing world and associated changes in lifestyles will have profound effects

on food preferences and hence on food demand (IFPRI, 2000). According to Wilson (2001), one way to help ward off hunger among low-income households of the future may be through urban agriculture – the farming of small plots of land available in urban environments or on the perimeter of the city. Urban agriculture might be able to supplement family diets. It can have a beneficial impact on food security for low-income residents. FAO (2001) noted that the finding of the national census on household survey and research project suggested that up to two – third of urban and semi-urban households in developing countries are involved in agriculture.

Garrett (2001) attested to this fact when he asserts that urban food security has a direct link with agriculture. The urban poor may have a home garden or raise small animals as part of a coping strategy. Urban production, often done by women, can compliment household incomes and improve the quality of urban diets. Also, majority of the urban dwellers depend indirectly on agriculture for their livelihood through employment in food transport, retailing and processing.

Household food security is the ability of the household to secure enough food to ensure adequate dietary intake of all its members (IFPRI, 2002, Pinstrup –Andersen and Pandya- Lorch , 2001; FAO, 1996, IFAD, 2007, Madeley, 2002).

A newspaper report had recognized the potential of urban and peri-urban agriculture noting that urban farming is lifting hundreds of millions of people out of extreme poverty and improving nutrition and health standard around the world (The Observer, 26 May 1996 cited in Binns and Feraday, 1996). It also remarked that an estimated 800 million people (just under a third of the world's city dwellers) grow food or keep livestock in cities for consumption or as a source of income. an estimated 800 million people (just under a third of the world's city dwellers) grow food or keep livestock in cities for consumption or as a source of income.. The crops are planted as mixed crops or inter-crops. Urban mixed- cropping is the growing of two or more crops simultaneously without distinct row arrangement in small plots of land available in urban environment or on the perimeter of the city (Wilson, 2001; Wikipedia, 2006). Whatever is the scale and the mixture or combination of crops grown by the urban farmers, urban mixed-cropping makes an important contribution to urban livelihood and food security, as well as ensuring a more balanced diet for city dwellers.

This paper discussed the contributions of urban mixed-cropping to household food security in Nigeria and around the world. The paper has seven parts. The first part is the introduction while the second part discussed the meaning of urban mixed-cropping and its characteristics.

The third part dealt on urban mixed-cropping and its dimensions in Nigeria and in other parts of the World. The fourth part showed the overview of food security in Nigeria, indicators for measuring food security and food security strategies in Nigeria. The fifth part outlined the contributions of urban mixed cropping in enhancing household food security in Nigeria and the sixth part highlighted the constraints and solutions to effective urban mixed-cropping in Nigeria. Conclusion and recommendations were made in the seventh part.

II. URBAN MIXED-CROPPING: MEANING AND CHARACTERISTICS

According to Cheema, Dhaliwal and Sahota (2006); Andrew and Kassam (1976) and Kantor (1999) intercropping is the cultivation of two or more crops simultaneously on the same field, with or without a row arrangement (row intercropping or mixed intercropping). In other words, mixed intercropping, also referred to as mixed-cropping, is the growing of two or more crops simultaneously without distinct row arrangement. Mixed-cropping or row cropping are forms of intercropping since the two involve cultivating two or more crops simultaneously on the same plot. Other forms of intercropping are patch cropping (where the component crops are planted in patches on the same plot), strip intercropping (growing of more crops simultaneously in strips wide enough to permit independent cultivation but narrow enough for the crops to interact agronomic ally), and relay intercropping or relay cropping (growing of two or more crops simultaneously during the part of the life cycle of each. A second crop is planted after the first crop has reached its reproductive stage of growth but before it is ready for harvest) (Cheema *et al.*, 2006; Spore, 2009; Kantor, 1999; Andrew and Kassam, 1976).

Urban mixed-cropping is less expensive. The plot area required is on the average small as any available space in the yard can be used. Worn-out tyres, plastic drink bottles and earthen pots can be used for urban mixed-cropping. In tyre garden, diversity of plants can be grown with less space requirement. Plastic bottle gardens are suitable for even smaller plot areas (Spore, 2005). According to Spore (2012), some of the techniques being used by a new generation of urban farmers, who are developing inventive ways to make the most of limited space to produce food include using worn-out tyres, old plastic pots, and sacks rigged up to make vertical gardens. For instance, a woman who lives on the outskirts of the densely populated town of Mandeville in Jamaica with no access to agricultural land used wheelbarrows and anything that can contain soil to grow her crops. Another woman in a suburban area of the parish of St Michael, in what is becoming the newest urban center in Barbados,

used a drip irrigation system to grow guava, lemon, pomegranate, ‘‘ackee’’, sugar apple, mango and banana as well as a variety of vegetables that she sells at a stall in the local market (Spore, 2012).

In Kenya, the French NGO Solidarities introduced the ‘‘sack garden project’’ where families were shown how to plant vegetables in jute sacks planted on rooftops or doorsteps called veranda vegetables. More so, in Senegal, an NGO named Centre de Development Horticole (CDU) in Camberene near Darkar launched the ‘‘micro-garden project’’ designed to help reduce the malnutrition that affect many of the poorest families who cannot afford fresh vegetables in the Senegalese capital. The scheme also helps the gardeners to earn extra income. The vegetables are grown in wooden tubs or polystyrene boxes. Instead of using earth, the substratum used is made up of peanut shell, rice husk, clay pellet watered with a solution containing micro-nutrients. Tomato, salad leaves, cucumber and other leaf vegetables are grown in profusion in all the Senegalese towns. They are planted in hydroponics micro-gardens set up in courtyards or on balconies (Spore, 2009; Cheema, *et al.* 2006; Andrew and Kassam, 1976).

In Enugu State, Nigeria, majority of the urban farmers (95 percent) practiced mixed-cropping. This is because the plot areas are small and the farmers want to make maximum use of the available space. Crops commonly grown by urban farmers were fluted pumpkin (ugu) (100 percent), maize (95 percent), okra (83 percent), green (71.67 percent), cassava (70 percent), pepper (61.67 percent) and spices (45 percent) (Chah, 2007; Spore, 2005; Spore, 2008). In other towns like Ugep, Calabar, Uyo, Port Harcourt, Ojo, Alapere, Nyanyan and Ketu in Nigeria, tomato, watermelon, waterleaf, cabbage, carrot, onion, garlic and ginger are also grown as mixed crops. Songhai Farms Resort in Porto-Novo, Republic of Benin adopted methods such as intercropping, mixed cropping and planting with *Moringa citifolia* leaves in order to increase production and ensure sustainable agriculture (Kuye, 2010),

FAO (2005) reported that urban mixed-cropping is practiced on small to medium size areas within the city for growing annual food and tree crops for home consumption or for sale. Urban mixed-cropping involves using vacant plots and garden. It can take many forms, from small / micro-garden to large operations. Skinner (1981) reported that in six Chinese villages visited, well over 85% of the vegetable production has evolved as part of the traditional ecological complex tied to pig breeding and recycling of night- soil and rubbish produced by urban population for application to vegetable farms.

In Guangzhon, China up to nine crops a year may be grown sequentially on a single field (FAO, 2005).

Similarly, in Karachi, where rain is not always heavy but fluctuates widely from year to year, urban farmers take advantage of the dry river flood plains to produce half of the city's fresh vegetables (Smith, 1996). The high productivity of small and marginal spaces in urban mixed-cropping has been so well demonstrated. Ganapathy (1983) reported that an area of six square meter can produce the vegetable needs of a family of four in a year. In Indonesia, urban farmers have also adopted the micro-horticulture approach as a long term solution in the fight against the widely prevalent vitamin A deficiency.

In whatever form urban mixed-cropping is practiced in the cities, it should be noted that it is one of the survival strategies employed by city dwellers to supplement family diets and earn extra income. It also serves as a source of employment for the multitude of unemployed migrants when it is practiced on unused government lands, roadsides or private residential lands or sites. Thus, urban mixed-cropping can improve family food security and reduces poverty alleviation through extra income earning.

III. URBAN MIXED-CROPPING AND ITS DIMENSIONS IN NIGERIA AND AROUND THE GLOBE

Wilson (2001) asserted that the global population is half rural and half urban, but the world's cities are swelling. By 2025, two-thirds of the world's people will live in urban areas, and 80 percent of these urban residents will live in developing countries. As urbanization increases, policy makers in developing countries will be challenged to design ways to feed their cities ideally by relying mostly on their countries agriculture sectors. They must work hard to prevent under-nutrition, cope with changing diets among residents, and seek to quell the trend towards obesity. Consequently, urban mixed-cropping has won the attention of agriculturists and policy makers.

They describe how rich and poor urban dwellers practice farming system based on growing the mixture of vegetables and staple crops together on small plots in the environment, their backyards, and government allotted areas (Wilson, 2001; Spore, 1999; Garrett, 2001).

All over the world, especially in sub-Saharan Africa, case studies abound. For instance, In Harare, Zimbabwe, some former civil servants were driven to farm on illegal urban plot in order to supplement their household diets and income. When they found that they could earn 10 times their salary, they took up street farming full-time (Spore, 1999). More so, in Dar es Salaam, Tanzania, more than two-thirds of all families were engaged in some forms of town farming in the early 1990's, compared with only one-fifth in the late 1960s (Smith, 1996).

Most urban agriculture is small-scaled. In many countries, it is dominated by women, the major exception is in

Brazil, China and Senegal where men dominated. Women accounted for 70-80 percent of household food production in sub-Saharan Africa, 65 percent in Asia, and 45 percent in Latin America and the Caribbean. They achieve this despite unequal access to land, inputs such as improved seeds and fertilizer, and to information (Spore, 1999; Brown, Felstein, Haddad, Pena and Quisumbing, 2001). City farming has a long tradition in both Asia and Europe. In the past, it was practiced mainly because it brought the product close to the consumers at a time when transport was slow and communication was poor. For many of today's poor urban dwellers, it is a route to survival, but in addition, it also provides freshness, diet variety and aesthetic enjoyment. As the world cities grow, the roles of urban farmers become increasingly important. The percentage of urban families that engaged in agriculture varies from 10 percent in large cities in North America to as much as 80 percent in some Siberian and Asian countries (World Food Summit, 1996).

Urban mixed-cropping plays an important role in many developing countries especially in sub-Saharan Africa where it plays a dual role of supplementing families' diet and securing their income according to Maxell (adopted in Wilson, 2001).

Garrett (2001) logically stated that income security is crucial to food security for urban dwellers. This is because urban dwellers buy most of their food. Urban food security depends mostly on whether the household can afford to buy food, at given prices and incomes. The extent of urban mixed-cropping varies according to time and place. In Libreville, Gabon in 1957, 80 percent of the women were reported to cultivate a field (Newland, 1980).

In 1962, a survey conducted in Ouagadougou, Upper Volta, showed that 36.4 percent of those questioned called themselves cultivators (Pernia, 1983). A similar percentage was found towards the end of the 1970s in Yaounde, Cameroon (Jackson, 1979). In 1967, in Dar es Salaam, Tanzania 18.6 percent of the households were engaged in agriculture (Ganapathy, 1983). The percentage grew from 20 percent to more than 65 percent in 1999 (Addison, 2000). During the last years of General Bokassa's regime in Bangui, Central Africa Republic, many of the prisoners and residents of Ngaragba survived only because of the gardening efforts of local women (Wade, 1984). The area devoted to urban mixed-cropping in Harare, Zimbabwe doubled between 1990 and 1994 (Addison, 2000). In Bangkok, China, 60 percent of the land is under cultivation. Seventy-two percent of all urban families are engaged in growing food crops, mostly on part-time basis. In Moscow, families growing food crops tripled between 1972 and 1992 from 20 percent to 50 percent (Addison, 2000).

In Zaria, Nigeria, 66.2 percent of the urban areas were cultivated (Song and Lee, 1984). In Enugu, Nigeria, Chah (2007) reported that about 38 percent of the respondents carried out their urban mixed-cropping on government - owned land. About 28% percent used private unused sites while others used acquired plots from relatives (38 %), friends (20%), neighbours (5%), leased (1.67%) and 15 % on own plots in their compounds. The report further indicated that half (50%) of the urban farmers have been in urban farming from 6-10 years in one location followed by about 27 percent for 1-5 years, about 17 % for 11-15 years and only 6 percent for 16-20 years. Also, majority of the urban farmers (80 percent) were females and married (Chah, 2007).

In Yaounde, Cameroon, the IITA team conducted a survey of urban households and discovered that traditional leafy vegetables are essential for both nutrition and economic livelihood. Traditional vegetables emerge as the most commonly found greens grown in the home

gardens of the poor farmers. The report concluded that leafy green vegetables are part of the diets of many households across Africa. They are used primarily to accompany starchy staples like rice, "fufu" pounded yam and "garri". Rapid urbanization in recent years has led to traditional leafy vegetables being replaced by species of Brassica including cabbage, kale and mustard (Spore, 2004; FAO, 2001). The Food and Agriculture Organization is promoting integrated production of vegetables among households in flood-hit areas of northern Uganda. Women are learning how to grow Brassica and solanacea vegetables in sacks packed with stones, fertilizer and earth. They lift the jute sacks onto stones to allow aeration and proper drainage. Vegetables grown in this way can easily be moved to protected areas away from floods and plant diseases. According to the report, the sack vegetables are proving popular in cities like Arapai, Asuret, Kadungulu, Pingire and Tubu in northern Uganda (FAO, 2001; Spore, 2005).



Plate 1: A woman cultivating backyard farm to improve household food security in Kigali, Rwanda Source: CTA/SPORE (2005)



*Plate 2: A micro-garden in Haiti
Source: CTA/SPORE (2012)*



Plate 3: Sack gardening in a Kenyan suburb. Source: Spore (2012)

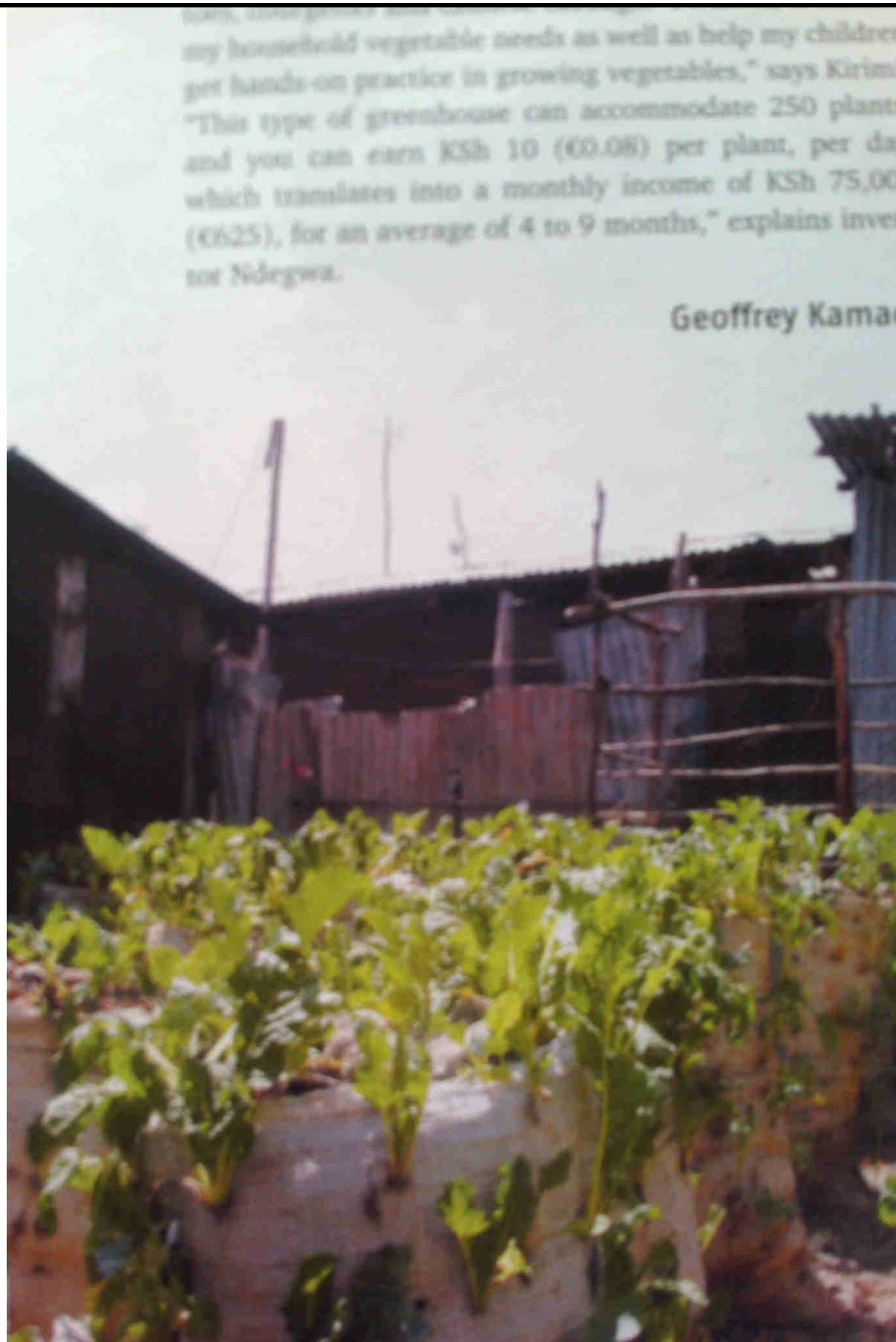


Plate 4: Sack gardening in a Kenyan suburb. Source: Spore (2012)



Plate 5: Urban Agriculture in Mali. Source: Spore (2012)

IV. OVERVIEW OF FOOD SECURITY IN NIGERIA

World Bank (2001) defined food security as access by all people at all times to enough food for an active healthy life. According to IFAD (2007), household food security is the ability of the household to ensure adequate dietary intake for its entire members. Availability and accessibility to food are two essential determinants of food security. The first does not ensure the second. For instance, food may be available but a household, for various reasons, may not have access to the food. The report concludes that it may be as a result of poverty, unsustainable farm practices or powerlessness. In line with IFAD (2007) assertion, the World Bank (2001) identified three pillars underpinning food security. They are food availability, food accessibility and food utilization.

According to Obamiro, Doppler and Komawa (2003) and Clover (2003), food availability for the farm household translates to sufficient food available for them through own production. Clover (2003) described food accessibility as reducing poverty. Making food available is not enough, but one must be able to purchase it- especially by the low-income households. Food utilization means ensuring a good nutritional outcome which is nutrition security. According to Doppler (2002), having sufficient food will not ensure a good nutritional outcome if poor health results in frequent sickness.

Food security problems among individuals and households are linked not only to food production but also to general, economic and social development. Food security, which is synonymous to high food consumption, exists when and where the population is sure of constant access to safe and nutritious food. At the national level, it means a country must have a stable supply of food that is available to all households and individuals. At the aggregate household level, food security is the processes representing inter and intra household, distribution of income and the level and structure of aggregate income (Doppler, 2002).

4.1 Indicators for Measuring Food Security.

According to AVISO (1999), accurate and timely measures of food insecurity are difficult to obtain. Malnutrition and hunger are often employed as surrogate measures, but actually represent the most advanced and chronic forms of food insecurity. Food insecurity occurs long before malnutrition and hunger set in. Hulse (1995) asserted that malnutrition describes a significant insufficiency or imbalance in essential nutrient intake, which may be due to consumption of too little or too much of one or more of food nutrients. Hunger and famine are two concepts, which can be accommodated

within the meanings of conventional nutritional inadequacy. Hunger describes distressing discomfort caused by want of food. It is a temporal desire for food while famine is the extreme form of hunger. Famine is a situation of inadequate food supply, which may be caused by crop failure, disasters, natural or man-made, or loss of purchasing power. Hunger can be either transitory or chronic. Transitory hunger is experienced from time to time by active persons who enjoy healthy appetites while chronic hunger describes a painful and debilitating condition caused by long deprivation of food sufficient to sustain healthy growth and activity.

AVISO (1999) concluded that using these indicators; malnutrition, hunger and famine greatly underestimate the number of individuals suffering from food insecurity. Food security indicators are summary measures of one or more of the dimensions of food security used to demonstrate change or the result of a programme activity for a target population. Indicator construction begins with a set of observations or measurements of food security related conditions at the level of individual, the household, the community, the market or the region. Once the basic measurements have taken place, indicators are constructed by classifying individual observations according to a set of criteria such as food secured/food insecure, malnourished/well-nourished, aggregating the individual observations to the level of programme coverage and placing those observations in some programme - relevant perspective (AED, FANTA, USAID, 1999).

One indicator regularly used to establish a standard or threshold for separating under-nourished persons from others is minimum value of Recommended Daily Allowance (RDA) or Recommended Daily Nutrient Intake (RDI) (IFPRI, 2002). The complex relationship between diet and human development is represented adequately by a single indicator such as calorie intake. Methods for estimating RDAs as well as designation of minimum thresholds vary amongst agencies and countries and sometimes result in diverging estimates of food insecurity (AVISO, 1999).

4.2 Food Security Strategies in Nigeria.

Food security means ensuring that all people at all times have access to the food they need for a healthy active life. It arises from stable food supplies that are both physically and economically accessible to all. Food security strategies or measures are those strategies aimed at achieving and sustain-ably maintaining comprehensive food security at different levels – regional, national and household (Achike and Urama, 1999).

In desperate attempts to solve the country's food and nutrition problems, various food policies, programmes

and projects were put in place. Some of the projects introduced since the country's independence are; the Farm Settlement Scheme (1960s), National Accelerated Food Production Programme (1972), Operation Feed the Nation (1976), Green Revolution (1980) and Agricultural Development Projects (1975). To facilitate the above projects various national programmes were set up. They include the Nigeria Agricultural and Cooperative Bank (1973) (now Bank of Agriculture), Rural Banking Scheme (1980), Agricultural Credit Guarantee Scheme of the Central Bank of Nigeria (1973), Community Banking (1990), People's Bank of Nigeria (1989), River Basin Development Authorities (1976), Directorate of Food, Roads and Rural Infrastructure (1987), National Directorate of Employment (1987), Directorate of Mass Mobilization and Social Infrastructure (1987), National Agriculture Land Development Authority (1991), Better Life for Rural Women (1986), Family Economic Advancement Programme (1997), Poverty Alleviation Programme (1999), National Fadama Development Project Phases 1&11 (1999- 2003), Phase 111 (2004- 2009), Cassava Initiative Programme (2007), Rice Initiative Programme (2007) and National Special Programme for Food Security (2002).

These programmes were aimed at achieving sustaining food security, employment generation and eradication of rural poverty. In Cross River State, the present state government introduced the Partnership Opportunities for Women Empowerment Realization (POWER) in November 2007. This is in line with the Global Millennium Development Goals (MGD) committed to ensure sustainable gender empowerment, food security, poverty alleviation and uplifting the socio-economic life of the people of Cross River State

On the 29th May, 2004 the former President of Nigeria, President Olusegun Obasanjo launched the National Economic Empowerment and Development Strategy (NEEDS) as one of its economic reform strategies. He mandated states and local governments to design and implement State Economic Empowerment and Development Strategy (SEEDS) and Local Economic Empowerment and Development Strategy (LEEDS). These programmes were anchored on wealth creation, elimination of malnutrition and achieving food security.

Another strategy for food security in Nigeria launched in 1999 is the Three – tier Storage Programme to stem post-harvest losses and make food available at all times and at affordable prices. According to Abu *et al.* (1999), the programme involves;

i. on-farm adaptive storage, operated by the local governments to minimize post- harvest losses at the farm level. At this level, 85% of the total production is stored

by the peasant farmers and it is available for normal trade during the off-season.

ii. Buffer-stock storage operated by the state governments to guarantee price stabilization. Ten percent of the national grain production is stored at this level.

iii. Strategic grain reserve operated by the federal government to store 5% of total grain produced in the country for release in time of distress like war, religion, political upheavals and others.

Apart from the above strategies, food security has also been ensured through indigenous knowledge practiced by farmers. In various communities in Nigeria, indigenous knowledge is an indispensable ingredient in the assurance of food security. The concept of indigenous knowledge (IK) which Haverkort *et al.* (2003) described as knowledge generated, used and developed in a certain area has proved to ameliorate the problem of food insecurity. Some of the indigenous (traditional) knowledge employed as strategies include mixed-cropping in multiple farms, planting crops that mature at different times, use of proven local varieties, processing staple food crops to dried forms, diversification of livestock management using leasing techniques and the use of bio- fertilizers (for example, moringa (*Moringa citifolia*)) and bio- insecticides (for example, neem, (*Azadiracta indica*) (Kuye, 1998).

V. CONTRIBUTIONS OF URBAN MIXED-CROPPING TO ENHANCING FOOD SECURITY

Indispensability of urban mixed-cropping to many urban dwellers in Africa and the world over cannot be over-estimated. Its potentiality to improve the socio-economic situation of the poor urbanites is a major advantage of urban mixed-cropping. Large numbers of rural dwellers who migrate to cities have hope of finding a more promising future. Many of them are illiterates. They rely on family members and other contacts for their support and often settle in shanty towns or city slums. The opportunity to grow their own food using abandoned or unused government sites, roadsides or undeveloped swampy areas can be a strong stimulus to stabilize their residence as well as to improve their nutritional standard. The self esteem that such persons lack can be reinforced when they realize that it is possible to improve their situation through urban mixed-cropping. According to Deelstra (1987), a feeling of having a base upon which to work gives them increased security and enable them to integrate more fully with city life.

2. Urban mixed-cropping also contributes to one's social contact, a pre-requisite for success in the town. Streiffler (1987) observed this in Zaire where men adapted too

quickly to ways of life in the town. When it became clear that urban mixed-cropping could be used for intensive lucrative production of vegetables as cash crops, their attitudinal barriers vanished and men displaced women.

3. Urban mixed-cropping improves the lives of the urbanites not only economically through income generation and substitution of purchases but also nutritionally through availability of greater variety and freshness of food. A healthy and nutritionally well-fed population is indispensable for economic growth and development. Health and nutritional status affect the capacity to learn, which in turn determines productivity and economic growth. Evidence from developing countries shows that adult productivity depends on a considerable extent on the contribution health and nutrition during early childhood make to educational attainment. Studies also show that a healthy adult with a nutritionally adequate diet has a higher level of economic productivity in both own-farm production and the labour market than one who eats and keeps less (Flores, 2001; Spore, 1999).

4. Urban mixed-cropping increases food supply because of higher yields of herbs and vegetable on composted areas and hydroponics crops. It is a means of improving food security and earning extra income which is particularly attractive to women. It allows them to work close to their homes and to provide extra food to improve the nutritional status of their children. Any surplus may be sold and the income used to improve their living conditions or even to invest in more profitable small enterprises, processing and marketing city-grown products (Mougeot, 2006; Engle, 2001; Brown, *et al.*, 2001; Spore, 1999).

5. According to FAO (2001) women that engage in urban mixed-cropping activities close to their homes are able to organize their time better and combine production with domestic activities in a more satisfactory way than women that work far from their homes. They will save time on transport, have more time with their children and also be able to carry out series of tasks which are essential to good health and nutrition. Furthermore, women who combine food production process with children and other household responsibilities are often involved in urban mixed-cropping on part-time basis. In addition to direct employment, there are opportunities for induced jobs in relation to equipment and inputs supply including liquid fertilizer, compost making and platelets, technical service and marketing (FAO, 2001; Engle, 2001).

6. Urban mixed-cropping improves air quality by acting as a sink for gas emissions. The resulting beneficial interactions of the mixture of crops can lower the need for external inputs to improve soil fertility. It can increase

biodiversity, stability and financial diversification in the farm (Spore, 1999; Kantor, 1976).

7. According to Soemarwoto (1981) urban mixed-cropping can provide some residents with up to 40 percent of their recommended daily allowance of calories and 30 percent of their protein needs, including most of the vitamins and minerals needed the body. Indonesia and many other Asian countries are practicing urban mixed-cropping system to improve vitamin A levels in their diets (Yeung, 1987). In Pacific-Island, a number of studies have shown that urban dwellers with home gardens are better nourished than those without, while in Honiara (Solomon Island) people without home gardens were found to have a lower intake of iron and vitamins A and C derived from traditional foods and the edible leaves of local trees such as

Moringa citifolia, *Pisonia grandis* and *Plyscias* spp. (Thaman, 1987 cited in Cater, 1994).

8. Urban mixed-cropping improves the socio-economic standards of farmers in terms of vegetable and ornamental plants production. These have generally proven to be rewarding as it fetches high prices, not only in the local markets, but also from export (FAO, 2001).

In New Delhi, poor people gain income from harvesting and sale of a number of products from trees growing on land owned by the Municipal Corporation (FAO, 2001).

9. Another significant contribution of urban mixed-cropping is that during the off- season, between major harvest, as the stock of stored food ran out and before new crops mature, the small output of permanent garden can play a major role for the limited time period. Such produce may not be among the most preferred, but there is always something to eat (Sachs and Silk, 1990). It therefore, contributes to the stability of urban food supply. The production of more food in the urban areas also reduces the need for economically expensive transportation of perishable produce as well as eliminating often wasteful processing, packaging and storage requirements of commercial foodstuff.

10. The problem of considerable losses due to spoilage and pests as a result of transshipment and transportation of food products such as cereals and vegetables can be reduced by more decentralized food production (Sachs and Silk, 1990).

11. Urban mixed-cropping contributes to poverty alleviation by generating income for urban marketers and distributors of these food items, thereby, allowing them to buy food and settle other expenses. In general, the urban poor spends 60-80 % of their income on food.

The income they earn is usually spent on non-food items (for example, transport, housing, children school fees,

health cost and so on) and to a less extent, especially by female producers, on other food items (FAO, 2001).

12. Urban mixed-cropping makes an immense contribution to environmental health. Every year, 5.2 million people, including 4 million children, mostly in cities, die from diseases caused by unhygienic sewage and waste disposal. Urban waste production is growing faster than urban population; by the year 2025, urban waste production will have quadrupled. City farmers play a major role in waste recycling, creating a closed system in which organic waste from food manufacturing and sewage are re-used instead of fostering in dumps and polluting waterways. Human waste is turned into composts; domestic waste water safely irrigates many crops (Pernia, 1983). In Calcutta and Uganda, garbage gardens thrive on cities degradable waste which is painstakingly sorted by thousands of garbage pickers (Furedy and Ghosh, 1984 5b).

13. According to Wade (1987), by organizing the recycling of organic waste one also facilitates the recycling of other materials, which not only reduces pollution but generates employment and conserves energy. This has already been partly achieved in Lae Papua, New Guinea, where a gardening programme led to a surplus that is sold to commercial farmers. This has resulted in a 10 % reduction in solid waste disposal.

14. Apart from its contribution to community development and crime reduction programme, urban mixed-cropping has many other indirect benefits. The conversion of vacant plots into production green space can help to moderate the micro-climate by reducing noise and dust levels in addition to improving oxygen production through photosynthesis, thereby, refreshing the atmosphere.

15. Lastly, increased vegetation cover protects soil and reduces erosion (Sachs and Silk, 1990).

VI. CONSTRAINTS AND SOLUTIONS TO EFFECTIVE URBAN MIXED-CROPPING PRACTICED IN NIGERIA AND AROUND THE GLOBE

Urban mixed-cropping faces numerous constraints despite its growing contributions to urban food security in Nigeria and around the globe. The major constraints include scarcity of arable land, weakness of women's right to land, difficulty of urban mixed crop farmers gaining access to credit facility, inadequate technical know-how and marginalization of women in agricultural extension services.

6.1 Constraints to Effective Urban Mixed-cropping in Nigeria and around the globe

1. A major challenge to the viability of urban mixed-cropping is scarcity of arable land resources (Amalu,1998; Drescher <http://www.actahort.org/books/643-29.htm>).

According to Amalu (1998) population experts say that as many as three billion people will face hunger, starvation and severe malnutrition early in the next century because arable land for food production is declining fast. In 1990, an estimated 1.4 billion hectares of land were under cultivation worldwide, but the rate of expansion, currently less than 0.2 percent per annum, does not march the world's population which is growing eight times faster than the cultivated land area.

According to the Population Action International (PAI) report (cited in Amalu, 1998), it is estimated that by the year AD 2025, only 14 years away now, the available arable land will not produce food to feed the United Nation's projected world population of between 7.6 and 9.0 billion people. To determine a country with the problem of land scarcity, PAI (1990), examined the per capita availability of arable land in 125 countries worldwide. Nigeria, with a land area of 356,670 km² was ranked 61 in 1990, with a bench mark average of 0.34 hectares of arable land. The report however, indicated the danger that the arable land would deplete to 0.14 hectares per inhabitant by 2025. 2. Another constraint to urban mixed-cropping is the conversion of arable land to non-agricultural uses in most cities around the world (Song and Lee, 1984; Wade, 1984; Amalu, 1998). Song and Lee (1984) pointed out that in South Korea, a total of 1,016 km² of agricultural land has been converted to non-agricultural uses during the past 10 years, and that a similar amount will be lost due to urban expansion according to the predictions of the country's Second National Comprehensive Development Plan. In a similar vein, Wade (1984) indicated that because of urban growth and expansion urban farmland has been disappearing fast in Taipei. He concluded that such farmland once provided 70 percent of vegetables consumed by the city's population. Urban mixed-crop farmers in big cities like Lagos, Port Harcourt, Abuja and Calabar in Nigeria are not excluded from this problem. These cities have lost their agricultural land to property developers and financial institutions locating their offices in city's high brow areas. 2. Closely related to the problem of land unavailability is the weakness of women's right to land which results in their inability to use land as collateral to obtain access to agricultural credit (Amalu,1998; Brown, et al.,2001). Laws governing women's right to land vary widely from place to place. Some communities and religions' laws forbid female landownership. Even when civil law gives women the right to inherit land, local custom may rule

otherwise. According to Brown et al. (2001) in sub-Saharan Africa, where women have prime responsibility for food production, they are generally limited to user rights to land, and then only with the consent of a male relative. Women tend to be allocated poorer land, whose quality deteriorates even further as it is intensively cultivated (Omeregbe, 1995). Some resettlement and irrigation projects have actually eroded women's rights to land providing formal titles only to men. The insecurity of land reduces the likelihood that women will invest much time and many resources in land with user's right or adopt environmentally sustainable farming practices.

3. Another constraint to urban mixed-cropping is difficulty in gaining access to micro-credit by the farmers. According to FAO (2001) low income households with urban agricultural activities often have difficult access to credit facility. This is because micro-finance institutions typically provide small loans to fast income-generating and less risky activities such as petty trading and services. Brown et al. (2001) indicated that access to micro-credit is crucial to timely purchase of productivity-enhancing inputs such as improved seed varieties and agro-chemicals. The absence of credit limits urban mixed-crop farmers' ability to adopt new technology, to hire labour when it is needed, to grow crops that require large outlays of cash up front and purchase land or other capital goods.

4. Inadequate practical technical know-how is another constraint confronting urban mixed-crop farmers. According to Amalu (1998) the practical problems include lack of appropriate agricultural know-how technology. Despite volumes of research results and spectacular breakthrough in seed hybridization and recently, animal vaccine technologies, much hard work is ahead for developing high-yielding input packages appropriate for these farmers. There is an almost general inadequacy of useful social and economic information on specific agricultural environment. Erosion prone sites; saline, acid, sulfurous or calcareous soils, disease endemic areas, prevalent pests and so on, and changes likely to take place there as a result of human activities are little known by the urban mixed-crop farmers.

5. Agricultural extension is an important source of information to farmers generally. Lele (1975) reported that women had unfortunately being marginalized in the dissemination of agricultural information which is an essential ingredient for rural transformation. This has been worsened by the bias in the recruitment of extension staff in favour of men.

According to Ochai and Obinne (1991) and Omeregbe (1995) some societies forbid the interaction of female farmers with male extension workers. Despite the long tradition of female farming, male farmers have far greater

contact with extension services than female farmers due to the problem of insufficient female extension workers.

6.2 Solutions to Effective Urban Mixed-Cropping in Nigeria

In order to solve the afore-mentioned constraints, the productive potentials of the urban mixed-crop farmers must be enhanced through the following:

(i) adequate availability of land to urban mixed-crop farmers. Government should introduce favourable policy on agricultural land acquisition and utilization in urban areas. The policy should be able to discourage estate developers and financial institutions from enticing the farmers with large money in order to acquire their farmlands.

(ii) In order to improve the practical know-how of the farmers, there should be availability of adequate useful social and economic information on specific agricultural environment such as soil erosion sites, areas of prevalent diseases and pests and so on.

(iii) More female agricultural extension workers should be employed by the government to cater for the extension of agricultural information to female farmers in places where their religion forbids the interaction between male extension workers and female farmers.

(iv) Financial institutions should make it easier for urban mixed-crop farmers to have access to obtain micro-credit. This will enable them to purchase productivity-enhancing inputs on time. Easy accessibility to credit will also enable farmers to adopt new technology when needed.

(v) Government should create agricultural service providers that will enable urban mixed-crop farmers to have access, on collective basis, to specific equipment that they cannot afford individually at relatively cheap prices. Examples of such services include hiring of tractor and other farm implements.

(vi) Lastly, government should subsidize farm inputs prices for urban mixed-crop farmers.

VII. CONCLUSION AND POLICY RECOMMENDATIONS

7.1 Conclusion.

Due to rapid urbanization, urban population growth rate has increased tremendously over the years in most cities in Nigeria and in other parts of the World. Growth rate in urban population has outstripped that of rural areas. The rapid population growth in Nigerian cities has contributed greatly to food insecurity and increased poverty among urban households.

In order to combat these challenges, successive governments had designed various agricultural programmes such as Operation Feed the Nation, Green Revolution and National Special Programme for Food Security, among others. These programmes were meant to ensure food security and reduce poverty, but have always failed. This paper has shown that one way to ensure food security and reduce poverty among the urban dwellers is through the practice of urban mixed-cropping. This is because, it has been discovered that urban mixed-cropping can play a tripartite role of ensuring food, job and income security for those who are practicing it. Evidences in most cities like Calabar, Port Harcourt, Uyo, Enugu, and Nsukka among others, have shown that urban mixed-cropping is thriving and sustaining a large population of urban families. Thus, there is no gainsaying of the fact that urban mixed-cropping is a key to urban food security in Nigeria.

7.2. Policy Recommendations

The following policy recommendations are made in order to reduce the constraints faced by urban mixed-crop farmers in Nigeria:

1. Any programme that is to enhance food security should require a land reform measure to effect increased access by the landless urban mixed-crop farmers to available agricultural land. To do this, government should ensure that men and women urban mixed-crop farmers have equitable access to land.
2. The financial institutions regulatory body, the Central Bank of Nigeria, should formulate deliberate financial policy that will ensure that both the commercial and agricultural banks extend a certain percentage of their loans to urban mixed croppers.
3. Technological institutions and foundries should fabricate simple machines and equipment that are appropriate and have gender relevance to urban mixed-crop men and women farmers. A technology is gender-relevant if it is gender-specific, and appropriate, if it is affordable and usable by the intended beneficiaries.
4. Extension education is an important service to farmers. Therefore, an effective extension services must be put in place with planned programme of learning activities specifically designed for urban mixed-croppers.
5. There is a need for the employment and training of more female extension workers. They will be better placed to assist women urban mixed-crop farmers in areas where there is problem of men

extension workers having direct contact with women farmers.

6. Urban mixed-cropping must be managed carefully by the farmers in order to address important safety and environment concerns. They must not irrigate edible crops with raw sewage or farm intensively with fertilizers and pesticides in highly populated area.
7. For the sake of millions of hungry and undernourished people living in Nigerian cities today, as well as for the sake of those millions who may be forced to live there tomorrow, governments, development agencies and communities must act now. They must work forcefully, confidentially and seasonably to promote policies, including those that promote rural development. This will help to combat the rising scepter of urban poverty, hunger and malnutrition and to achieve the Vision 2020 of sustainable food and nutrition security for all Nigerians.

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