ECONOMIC STUDY OF THE USE OF ORGANIC MANURE IN YELLOW PEPPER (*Capsicum annuum L.*) PRODUCTION IN NSUKKA LOCAL GOVERNMENT AREA OF ENUGU STATE

BY

UGWOKE, FRANCISCA NKECHINYERE
PG/M.Sc/ 06/41428

DEPARTMENT OF AGRICULTURAL ECONOMICS
UNIVERSITY OF NIGERIA, NSUKKA

FEBRUARY, 2010

TITLE PAGE

ECONOMIC STUDY OF THE USE OF ORGANIC MANURE IN YELLOW PEPPER (*Capsicum annuum L.*) PRODUCTION IN NSUKKA LOCAL GOVERNMENT AREA OF ENUGU STATE

BY

UGWOKE, FRANCISCA NKECHINYERE
B. AGRIC (AGRIC. ECONOMICS) NIGERIA
PG/M.Sc/ 06/41428

**A DISSERTATION
SUBMITTED TO THE DEPARTMENT OF AGRICULTURAL ECONOMICS, UNIVERSITY OF NIGERIA, NSUKKA IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF SCIENCE (M.Sc) DEGREE IN AGRICULTURAL ECONOMICS OF THE UNIVERSITY OF NIGERIA NSUKKA.**

FEBRUARY, 2010

CERTIFICATION

Francisca Nkechinyere Ugwoke, a postgraduate student in the Department of Agricultural Economics, PG/M.Sc/06/41428 has satisfactorily completed the requirements for the degree of Master of Science in Agricultural Economics. The work embodied in this dissertation is original and has not been submitted in part or full for any other diploma or degree of this or any other University.

______________________________	______________________________
DR. (MRS.) A.I. ACHIKE	**PROF. N.J NWEZE**
SUPERVISOR	**HEAD OF DEPARTMENT**
______________________________	______________________________
DATE	**DATE**

DEDICATION

This piece of work is dedicated to Almighty God who made my educational journey feasible. TO HIM BE ALL THE GLORY.

ACKNOWLEDGEMENTS

I wish to express my profound gratitude to all who in one way or the other made useful contribution towards the successful completion of this research. I am sincerely indebted to my supervisor Dr. (Mrs.) A.I. Achike in whose model I work with perseverance. Her constant constructive criticisms and suggestion were undoubtedly instrumental to the success of this work.

Next in the list is my HOD, Prof. E.C. Nwagbo whose classroom teachings made me to develop interest in resource and Environmental Economics. My sincere appreciation goes to Dr. A.A. Enete who never failed to accord me full attention whenever I approached him for clarifications. I will ever remain grateful to Dr. B.C. Okpukpara, Dr. N. Chukwuone and Mr. A.N. Onyekuru for their untiring efforts during the data analysis. My immense greeting goes to Dr. F.U. Agbo for his fatherly guidance and words of encouragement throughout the research period. The non-academic staff of this Department: Sis Onyishi Blessing, Mrs Romaine, Mr T.A Ogbu and others are remembered in a special way for their prayers and words of encouragement.

I wish to extend my profound gratitude to Mr W.C Otti a staff of ADP Nsukka zone for his cheerful disposition during the fieldwork. My respondents are however, not left out in this special appreciation .

Finally, it gladdens my heart to extend an unquantifiable appreciation to my loving husband Dr. C.E.C. Ugwoke and the entire Ugwoke family of Edem-home and abroad.

Ugwoke, F.N.
Dept. of Agric Economics
University of Nigeria, Nsukka.

TABLE OF CONTENTS

CHAPTER FOUR: RESULTS AND DISCUSSION

CHAPTER FIVE: SUMMARY, RECOMMENDATION AND CONCLUSION

ABSTRACT

Economic study of the use of organic manure in yellow pepper production in Nsukka Local Government Area of Enugu State was carried out. The study was aimed at; describing the socio economic characteristics of yellow pepper farmers, identifying factors that motivate the use of organic manure by yellow pepper farmers, determining the yellow pepper farmers' willingness to pay for processed biodegradable waste, determining and comparing the costs and returns from organic manure use only and users of both organic manure and mineral fertilizer. Nsukka Local Government was purposively selected for the study because of their high level of involvement in the production of the crop from nursery to maturity. A multi stage random sampling technique was used in the selection of the town communities. Primary data were generated through the use of structured questionnaire. Descriptive statistics, probit model Gross margin analysis and student t-test were employed in data analysis. The study showed that all yellow pepper farmers studied maintained their soil either by the use of organic manure only or use of organic manure supplemented with inorganic manure. 79% of the farmers maintained their soil through the use of organic manure sourced from poultry droppings. It was also observed that income, age and educational level of farmers were very important determinants of willingness to use and willingness to pay for organic manure. These parameters were consistent in sign in both 'willingness to use' and 'willingness to pay' models. A significant difference (-0.374 at 1%) between the net profits made by the two groups of farmers under study revealed the need to diversify organic manure source through waste recycling for prompt supply of organic manure at affordable price.

LIST OF TABLES

LIST OF FIGURES

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Despite her plentiful resources and oil wealth, poverty is widespread in Nigeria. The situation has worsened since the late 1990s, to the extent that the country is now considered the 20^{th} poorest country in the world (IFAD, 2000). Feeding the rapidly growing population of Africa and Nigeria in particular has become a major development concern (FAO, 1990). Over 70% of Nigeria population is classified as poor, with 35% living in absolute poverty (IFAD, 2000). Poverty is especially severe in rural areas where social services and infrastructure are limited, with unstable income being a primary factor militating against their welfare (Enete and Achike, 2008). The great majority of those who live in rural areas are poor and depend on agriculture for food and income.

To meet the food and raw material demand of the growing population, agriculture must be approached on a sustainable basis (FAO, 2003). Sustainable development according to the Bruntland Commission is development that meets the needs of the present generation without compromising the ability of the future generation to meet their own needs (WCED, 1987). The struggle for food supply to catch up with massive population growth which is in a geometric pattern requires a consistently adequate level of soil fertility achieved in a sustainable way (Heckman, 2005).

Soil fertility, an element of natural capital, is key to the livelihood of the majority of the rural population of sub Saharan Africa who depend on agriculture as a central element in their livelihood strategy (Mangala, 2005). As agricultural production is the main source of economic activity in Nigeria, declining soil productivity means not only less food crops is grown but also that production of cash crops and income are endangered (FAO, 2001). The rural poor are often trapped in vicious cycle of poverty between land degradation fuelled by the lack of relevant knowledge of appropriate technology to generate adequate income and opportunities to overcome land degradation (FAO, 2000; Ojameruage, 2004).

Low organic matter coupled with low native nutrient status in most arable soil of Africa is responsible for low productivity and unsustainable production base (Fakoye, 2007). One of the most well known practices to recover and maintain the soil productivity is to add organic amendments (Westerman and Bicudo, 2003). Organic manure plays an invaluable role in rectifying land degradation and enhancing productivity thus achieving farm household food security, income and agricultural development (IFDC, 2007; Alimi, 2002).

As the population increases and puts pressure on diminishing resource, escalating environmental problems further threatens food production (IFAD, 2000). Increasing population pressure on the country has contributed to land degradation constraint leading to reduced size of land holding and consequently to reduced or zero fallow periods (Corsini, 1991). This has led to concerns over the long-term sustainability of agriculture. The reduced ability to use traditional soil fertility management practices such as fallow and crop rotation to restore soil fertility limit farmers' productivity (Lal and Stewart, 1990; Dewitt, 2002). Organic manure remains the major natural and sustainable means of rectifying soil fertility.

Biodegradable waste if well managed could be of immense help in ameliorating soil nutrient problem.

The extent to which agriculture can absorb municipal solid waste and contribute to poverty reduction, increased food security is still lacking among policy makers (Mkwabisi, 2005). The implication is that the financial costs associated with waste management are ' directly linked to food insecurity and soil fertility problems (Cave, 2001). Adeniyi (2008), attributed this to poor waste management, as plants nutrients that can be used for crop production, forestry programmes, landscaping, land restoration, soil improvement or animal feed are delivered to dumping sites.

One important consideration in dealing with wastes is to treat it as an important resource (Mercado, 2006). With the unlimited and available sources of biodegradable waste from metropolitan cities coupled with the unstoppable rise in prices of fossil-based fertilizers, organic manure production from municipal solid waste becomes a promising enterprise (Aganon, Roxas, and Dacumos, 1999) in (Mercado, 2006). By converting biodegradable waste to organic manure for crop production, a lot would have been saved to our foreign reserves due to reduction in fertilizer importation (Aganon *et el.,* 1999) in Mercado 2006.

Dumping sites and landfills as methods of waste disposal occupy the limited scarce agricultural land, which would have been put into crop production. This thus, creates further problem on the scarce factor of production. The disposal of this form is unsustainable and a route to land degradation.

According to Senjobi *et al.,* (2000), the disposal of organic wastes represent the loss of large amount of valuable resources, in particular nitrogen which is a limiting factor in most crop production. Despite the fact that a small portion of urban farms close to the dumping sites have benefited from the waste delivered by using them for crop production, Mkwabisi, (2005), affirms that the current trend in waste management has increased loss of soil organic matter which is important for nutrient storage, helps to maintain soil structure and interacts with trace metals to reduce their toxicity to plants. Meanwhile, all thisj opportunity cost is happening when the lives of many people are in danger with hunger, malnutrition and major diseases with agriculture facing a grim future due to high level of soil infertility (Alimi *et al.,* 2006; Kim, 1998).

Since agriculture is very crucial to the social and economic development of the nation, a sustainable approach should be embraced. All over the world, the concept of evolving strategies for ensuring food security under a sustainable environmental management has gained prominence (NEEDS, 2004). Agricultural production should focus not only on yield but conservation mechanism. Conservation is described as option used to maintain the essential features of the natural habitat (Young, 1998; Mulongoy, 1986). It is also defined as a process by which the life of resources is prolonged either by preserving, re-using or by re-cycling it (FAO, 2000). The production of agricultural crops which give high returns per unit of input used is a major challenge in an effort to achieve food security, economic growth and sustainable development while maintaining the integrity of the environment (WCED, 1987).

Organic manure use has been classified as sustainable conservation technique. Its use in crop production especially in the tropics holds a lot of potentials (Westerman AND Bicudo 2003). This research work therefore, takes an insight into unfolding the potentials of organic manure use in ameliorating the problems of nutrient status of the soil, reduction in cost and unavailability of artificial fertilizer and most importantly is restoring environmental quality.

The interest in organic manure in African agriculture is not necessarily the same in the developed countries, where the overwhelming issue is on environmental and health consciousness (Nwajiuba and Akinsanmi, 2002). In Africa it is the damage to the soil and scarcity of inorganic fertilizer provision as and when due that gives prominence to the use of organic manure. Africa has the lowest mineral fertilizer consumption, about 10 kg nutrient (N, P_2O_5, K_2O)

per hectare per year compared to the world average of 90 Kg or 60 kg in the near East and 130 kg per year in Asia (FAO, 2001).

The low inorganic fertilizer utilization in African, Nigeria inclusive has prompted researches into indigenous soil conservation mechanism. Indigenous soil conservation can be referred to as the local means of combining crop production and soil management practices that are likely to protect the soil against physical loss or chemical deterioration by either natural or man-made factors (Scoones and Toulmin, 1996). Using indigenous soil conservation have been found to reduce the negative impact agriculture would have on the environment (Ayinde 2004). Also farmers will be able to maximize total gross margin by using fewer external inputs.

In recent years, organic matter is increasingly being ploughed back as soil amendments. The incorporation of organic manure into soil prolongs productive life of the soil and influences other properties such as soil structure, water holding capacity and water movement (Nwajiuba & Akinsanmi, 2002). Organic matter tremendously improved soil physical properties and ameliorated the effect of acidifying inorganic fertilizer under continuous cultivation (Lal, 1989; Greg, 1996).

The economics of organic manure use in crop production becomes a challenge because of the high nutrient demand. Organic manure used in crop production not only maintains the soil but enhances yield with minimum cost of procurement depending on sources (USDA, 2002). Verdoft and Kamon (1982), showed that tomatoes grown in soils amended with 10% farm yard manure (FYM) had a better yield of 112.5 tons/ha compared with 92 tons/ha grown without farm yard manure.

Healthy soil is the key to sustainable agricultural production (Kuepper and Gegner, 2004). The benefits of organic manure are relevant to developing countries like Nigeria in areas of sustainable resource use, increased crop yield without over reliance on costly external inputs and restoring environmental protection (Knowler, 2004).

1.2 Problem Statement

In the past when land was more abundant, traditional bush fallow had many merits in preserving land productivity and maintaining agro-ecological environment (Eboh, 1990). Today scarcity of land has led to intensified use of land leading to nutrient depletion.

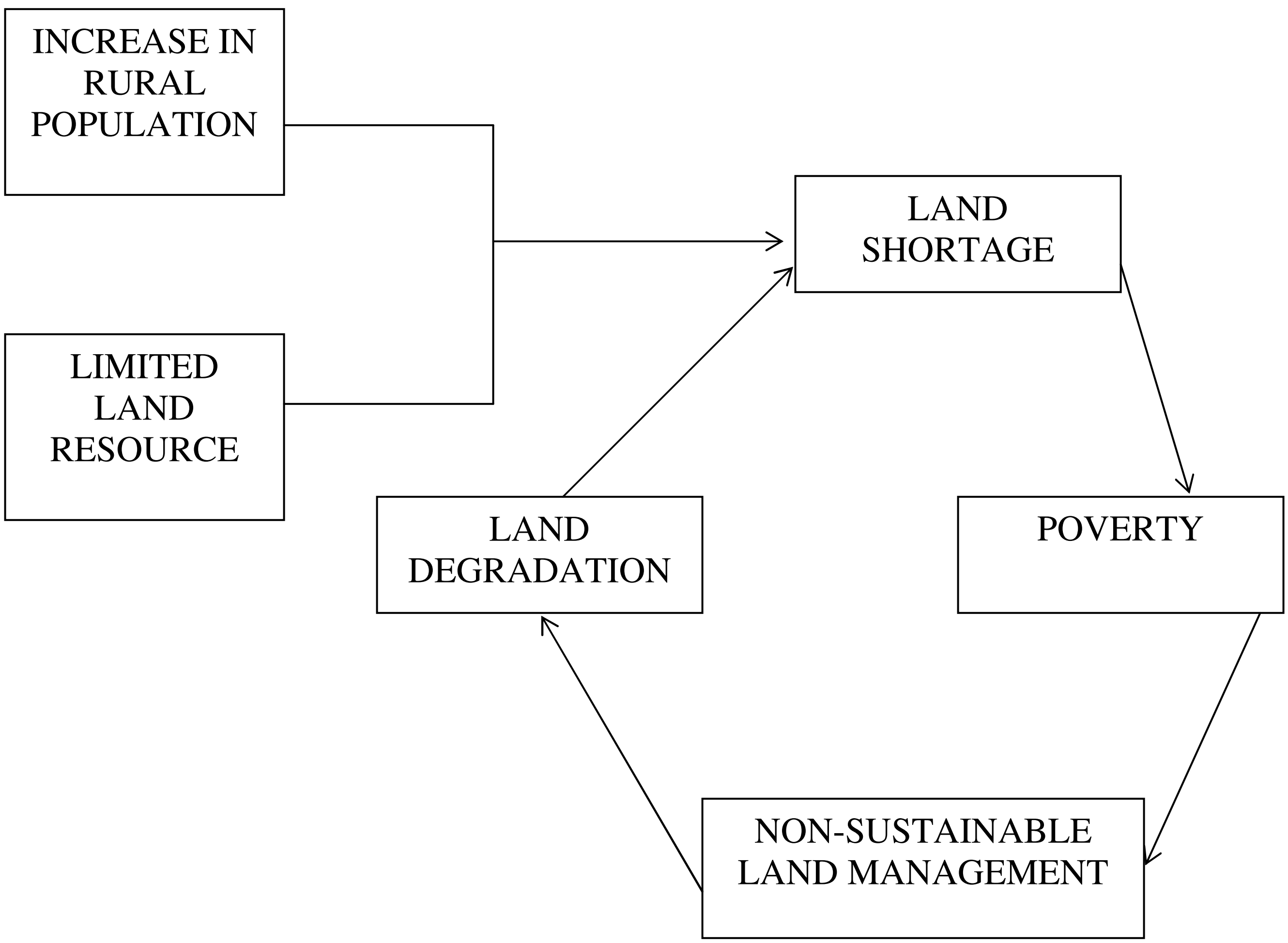

Fig 1: Causal nexus among land resource, population, poverty and land degradation

Source: FAO of the United Nations 2001.

The fragility and high susceptibility of the soils in Nigeria to degradation and loss of nutrients make augmentation through the use of fertilizers necessary to obtain reasonable yield (Alimi, Ajewole Awosola and Idowu, 2006). Although, various soil conservation practices under different categories of farming systems have evolved over time (such as crop rotation, alley farming, composting, agro forestry etc); it is essential for countries to promote policy measures that will enable farmers to make use of their natural advantages (DFID, 2002).

The damage to the soil, high cost and scarcity of industrial fertilizer have necessitated the use of alternative soil fertility regeneration strategies. The traditional soil fertility management practices are also no longer affordable due to plot size shrinkage emanating from high population density. This has an impact on resource productivity and poverty, thus farmers seek solution in organic based soil fertility amendment. Also farmers have the perception that inorganic fertilizer leads to the disappearance of the quality aroma of some crops like yellow pepper, which is of economic interest. It is very important to note that the utilization of public organic waste in crop production will minimize environmental hazards posed by the careless disposal of the wastes in every nook and cranny of the city. The incorporation of organic manure use into soil management may not only maximize output but may also reduce cost of soil maintenance and could be environmentally friendlier (DFID, 2002). The excessive use of inorganic fertilizer where available is a threat to environmental quality (Olayide, Oguntowora, Essang & Idachaba, 1981).

Several studies including the work by Ohaeri (2000) dwelt on the economics of soil fertility management in general and did not zero in on soil fertility management in relation to crop production. That by Nwajiuba and Akinsanmi (2002) dwelt on comparative analysis of inorganic and organic manure use, while Alimi *et al.,* dealt on economics of commercial organic fertilizer use. Thus, there is dearth of empirical information on the economics of organic use. This work, therefore seeks to analyse the social and economic rational of incorporating organic manure use in crop production (yellow pepper production) in the study area as a means of supporting rural livelihood and maintaining soil fertility for environmental quality recovery.

1.3 Objective of the Study

The broad objective of the study is to analyze the effect of organic manure use in yellow pepper production.

Specifically, the study will;

(i) describe the socio economic characteristics of yellow pepper farmers in the study area

(ii) identify factors that motivate the use of organic manure by yellow pepper farmers

(iii) determine the yellow pepper farmers' willingness to pay for bagged public organic waste

(iv) compare costs and returns from organic manure use only and use of both organic and inorganic manure

(v) make appropriate recommendations based on findings

1.4 Hypotheses of the Study

The following null hypotheses were tested:

(i) Socio economic characteristics of the farmers have no significant influence on their willingness to pay for organic manure.

(ii) there is no significant difference between the net profits of the two groups of farmers under study.

1.5 Justification of the study.

Organic manure use has the advantage of being relatively cheaper to the resource poor farmers. It is readily available and accessible to the farmers without formal protocols. Hence farmers can plan ahead of season to procure the resource input and timeliness of operation ensured. Socially, it has the potential of maintaining or increasing land quality in the long run, especially as the soil in the study area is acidic one (Mkwabisi 2005)

The call for organically produced foods by the National Organic Standard Board (NOSB) of the United States (Kuepper and Gegner 2004), proves a research into organic manure use in vegetable crop production a way forward

Yellow pepper is the major cash crop in the study area, therefore any research geared towards improving yield and income is highly justifiable.

The recent waste-clearing programme by the Enugu State Government has introduced an envisaged environmental problem in the area. The dumping site will likely occupy lands that would have been used for agricultural production. Furthermore, the decomposition of these wastes will eventually lead to carbon (iv) oxide emission contributing to global warming. Finding farmers' willingness to pay for these wastes to be used is a sustainable long run programme that justifies this study a timely contribution to wise policy decision.

CHAPTER TWO

LITERATURE REVIEW

Literature is reviewed under the following headings:

- Concept of sustainability in crop production
- Sustainability measurement
- Soil degradation
- Soil quality and soil fertility
- Soil fertility maintenance
- Methods of soil fertility maintenance
- Concept of organic and inorganic fertilizer
- Concept of waste
- Waste and environment
- Waste and agriculture
- Policy position in waste management in Nigeria from independence era till date
- Environmental issues in fertilizer use
- Pepper
- Nsukka yellow pepper
- Theoretical frame work
- Analytical framework.

2.1 Concept of Sustainability in Crop Production

In recent times sustainability development has become the catchword in both national and international discussions (NEEDS, 2004). According to WCED (1987), sustainable development as defined by the Brandt land commission is a development that meets the needs of the present generation without compromising the ability of the future generation to meet their own needs. Sustainability in crop production is defined as that which ensures the successful management of resources in agriculture to satisfy the changing human needs while maintaining or enhancing the quality of the environment and conserving natural resources (CGIAR, 1988). According to World Bank (1992), an agricultural system is sustainable when it is ecologically sound, economically viable, socially just and culturally appropriate. Sustainability as simply put by Young (1998), is production plus Conservation. Alimi, *et al* (2006) emphasized that organic manure incorporation in crop production is a strategy for sustainable resource management to complement improved soil fertility and productivity.

Kuepper and Gegner (2004), viewed sustainable management of agricultural land as that which should simultaneously; enhance production and services, reduce the level of production risk, protect the potentials of the natural resources, prevent degradation of soil and water quality, be economically viable and finally be socially acceptable. One of the perspectives of the Agro-ecosystem: to obtain the desired qualities of a productive and sustainable agricultural system that minimizes impact on the environment; we must understand the functioning of the whole ecosystem, with its inherent interactions and feedback (Agboola and Adeoyo, 1990). It implies understanding how deriving variables affect properties through process (Obatolu, 1990). Agro-ecosystems are intentionally disturbed ecosystems that are being forced through human modification of deriving variables or components into state which differ from the natural system from which they are derived (Olutawosin and Olaniyan, 2001). A sustainable agro ecosystem is one which is managed for long- term profitable production of food or fibre while utilizing the full potentials of biological, chemical and physical processes to conserve natural resources and minimize environmental damage (Kim 1998; Mclellan, 2006). FAO (2005) affirms that to be sustainable, an agro ecosystem must have profitable output either in the production of food for direct consumption or in market value.

For sustainability to hold, there must be a trade- off between optimizing crop production and minimizing environmental damage (Lal, 1989), this balance will however, depend upon resource use management (FA O, 2003).

According to Lynam and Herdt (1989), a system is sustainable if it has a "non negative trend in measured output and contribute to sustainability if it "increases the scope of the trend line". Ehui and Spenser (1990) opined that this measurement be based on inter temporal Total Factor productivity (TFP), which is defined as the rate of change of an index of outputs divided by an index of inputs (both convectional inputs and natural stock and flows). They related this approach in terms of the productive capacity of a system over time arguing that this is an appropriate measure of sustainability as it addresses the question of change in the productivity of a system between two phases.

A system is, therefore, sustainable over time if after fully accounting for differences in factor inputs and natural stock and flows produces at least the same amount of output as previously (Ehui and Spencer, 1990). The yellow pepper production in the study area should be considered sustainable if the dividend is capable of providing an adequate balance diet for the family throughout the year. It should also produce a monetary surplus to allow the household to acquire goods not produced in the farm with minimum environmental damage (Manyong and Degand, 1995) in Adejobi *et al* (2003).

2.2 Soil Degradation

Agriculture is the most important user of environmental services such as water, forests, pastures and soil nutrient (Alimi *et al.,* 2006). The author further stressed that intensive land use without appropriate soil management practices leads to environmental degradation. DFID (2002) states that environmental degradation can aggravate the current agricultural productivity, undermine future production and perpetrate poverty. Inappropriate land management, particularly in areas with high population densities and fragile ecosystem, further increases loss of productivity of resources poor farmers (Lorry, Massey and Brad, 2006). Soils in most African countries have inherent low fertility and do not receive adequate nutrient replenishment. Soil fertility decline (also described as soil productivity decline) is a deterioration of chemical, physical and biological soil properties (FAO, 2000). The main contributing processes are:

- decline in organic matter and biological activity
- degradation of soil structure and loss of other soil physical quantities.
- Reduction in availability of major nutrient (NPK)
- Increase in toxicity due to acidification or pollution.

Nwagbo (2000), Opines that Nigeria lacks an aggressive land management practices unless if packaged as recommended technology. Studies by Corsini (1991) showed that even when farmers are aware of the monetary benefits of soil conservation technologies such as increase in yield, they still ignore the downstream benefits (reduced environmental damage) that accrue to the society. In many developing countries, hunger is forcing poor people to cultivate degraded soils that are not suitable for agricultural use and which only with major and costly soil maintenance effort can be sustainably converted to agricultural land (Fredrick, 2001). As soil degenerates, yield and income losses build up (Benin, 2005). At any stage of soil depletion the net returns without conservation exceeds the net return with conservation. Over time as the soil degenerates further, the gap declines until eventually net returns with conservation become higher than those without (Senjobi, Odumanya, Sosaya, 2000). In spite of the decline, however, adoption of soil fertility maintenance is unlikely to occur before this point of net return decline (Sevier and Lee 2003). It is therefore important to give attention to the condition of the soil in terms of quality, soil degradation by erosion, salinization, acidification and compaction. In lieu of this situation, it is economically justifiable to offer farmers incentives to induce timely adoption of soil maintenance (Tiffin and Mortimore, 1992).

2.3 Soil Quality and Soil Fertility

Soil quality is often used to describe soil attributes (Knowler, 2004). However, soil quality should be regarded as a concept and not just a denominator for specific soil attributes. Soil quality as defined by Knowler (2004), is simply how well soil does what we want it to do. 'How well' related to grading soils while "what we want" relates to priority of soil function. Societies with shortage of food supply focus on soil productivity, while societies with abundant supply of affordable food switch their focus from mere productivity to the overall sustainability of the food production system (Lory *et al.,* 2006). The concept of soil quality is deeply noted in considerations on sustainable production. Nevertheless, the term soil quality' should not be confused with the term soil fertility. Soil fertility primarily relates to the soil productivity

(Andrews, Karlen and Mitchell, 2002). In contrast, soil quality is a more basic term including the soil's ability to fulfill all potential uses and functions of the soil. However, sustainable farming also has to consider impacts on the environment and other concerns (Andrews *et al.,* 2002).

2.4 Soil Fertility Maintenance

Soils are the primary resource for agricultural production and their protection and improvement are essential for agriculture in the nation (USDA, 2005). Soil fertility maintenance is an important component of sustainable land management of soil and plant nutrients (World Bank, 2006). Soil fertility can be improved by managing nutrients stocks and flows. Plant nutrients are usually removed from the soil and forest systems via harvesting of grains, tubers, fruits and woods as well as by surface erosion and subsurface leaching (Benin, 2005). In ecologically less favoured areas farmers use a variety of risk minimization strategies for soil fertility improvement and high crop yield (Cave, 2001). Although soil fertility management technologies abound; adoption of these technologies by farmers has been disappointing (Alimi *et al*., 2006).

Soil fertility can be viewed in an economic framework, in the context of derived demand emanating from farmers objectives for utility through product sales and consumption (McClellan, 2006; Knowler, 2004). The demand for the services that farm land or farm soil offers is thus largely derived from the need that land is an input to the farm production, whether of crops directly or indirectly of livestock through pasture, planted forage or crop residues (Douglas, 1993)

Soil fertility management practices can be seen as management of soil services to increase the quality and durability of those services (FAO, 2001 and Douglas, 1993). Increased demand for soil services is likely to lead to increased use of sustainable soil fertility management practices and environmentally friendly measures (Greg, 1996; Mkwambisi, 2005 and Dyson, 1996).

2.5 Methods of Soil Fertility Maintenance

2.5.1 Shifting Cultivation

Shifting cultivation is an agricultural system in which plots of land are cultivated temporarily and then abandoned (VASATWiki, 2007). It is a type of farming in which the land under cultivation is periodically shifted so that, fields which were previously cropped are left fallow and subject to the encroaching forest (VASATWiki, 2007). It is the oldest method of making use of land (Christanty, 1986). Shifting cultivation in its ancient meaning implies shifting cultivation and the settlement (VASATWiki, 2007). The land is cropped for several years and then left forest fallow cultivation. The regeneration period maintains the fertility of the soil (Christanty, 1986).

More recently, however, the population increase in many regions has made it necessary to clear land more and more frequently and cut down on the time of fallow thus endangering the fertility of the soil (Akobundu, *et al.*, 1993; IITA, 1992).

2.5.2 Alley Farming

Research in various parts of the humid tropics during the past few decades clearly indicates the important role that soil organic matter and other biotic factors play in maintaining the productivity of fragile uplands dominated by low activity clay soils, which cover large areas of the humid and sub-humid zones of Sub-Saharan Africa (Bamire and Manyong, 2003) . To deal with the unique management problems of these soils, scientists at the International Institute of

Tropical Agriculture (IITA) in the 1970s incorporated woody species in crop production systems. This ultimately led to the development of the alley cropping system (IITA, 1992). In alley cropping, food crops and woody species are intercropped, food crops are grown in the alleys formed by hedgerows of planted trees and shrubs, preferably legumes.

The hedgerows are cut back at planting and periodically pruned during cropping to prevent shading and to reduce competition

with the food crops. The prunings are used as green manure or mulch. The hedgerows are allowed to grow freely to cover the land when there are no crops. Alley cropping retains the basic features of the traditional fallow system, and can thus be considered as an improved bush fallow system.

One major advantage of alley cropping is that the cropping and

fallow phases take place concurrently on the same land, thus allowing the farmer to crop the land for an extended period without a break. Though alley farming was originally designed for use by small farmers, it is believed that it is sufficiently flexible to be adapted for mechanized farming using appropriate machinery

However, alley cropping as such is not the solution to all soil fertility problems. Like other technologies, it works only under certain climatic and economic conditions (Mulongoy, 1986; FAO, 1997). In lieu of this, the Nsukka yellow pepper cannot thrive well under this system as output is maximized under zero shading.

2.5.3 Composting

Composting is a process of breaking down the organic materials to make the nutrients in the biomass accessible to plants (kim 1998). One of the best means of handling manure is composting (USDA, 2002). Composting stabilizes the nutrients in manure and builds population of beneficial organisms (Kim,1998), Torbert, Roger and Way (2005). Throughout the 20th century chemical fertilisers have been used to increase and maintain production, however they cannot replace the loss of organic carbon in the soil, they are increasingly expensive and, ultimately, deplete soil nutrient levels (Greenland and Nabban, 2001). Compost provides both the nutrients and organic carbon necessary to rehabilitate degraded soils and to support production in intensive farming systems. Application of compost can reduce the need for irrigation water and increase production, particularly where soils are already degraded by many years of farming (Bamire and Manyong, 2003).

Greg (1996), and Alimi (2002), acknowledged the achievement of composting in combating waste to manure thereby achieving environmental improvement. According to Kim (1998), composting played significant role in providing residents of Nairobi with some of the income needed for improving other aspects of their life.

Composting is usually produced from a mixture of all kinds of organic wastes including crop residues and household wastes. The technology is very ancient and there are many ways to compost organic matter. The most popular method uses a moist heap with enough nitrogen for the breakdown of the organic materials. According to Pam (2008), the most effective decomposing bacteria grow at moderate temperature of 70-100^{0}F while most pathogenic organisms and weed seeds are killed at high temperature above 140^{0}F.Composting is the long term workable solution to the waste dilemma, it converts waste to resource (Pam, 2008)

2.5.4 Livestock and Poultry manure

Historically, manure generated from animal production facilities has been returned to the land to increase soil organic matter and replace nutrients removed during crop production (ILCA, 1998), under ideal circumstances, livestock enterprises are integrated into the whole farm operation and manure becomes part of the closed system of nutrient recycling. Integration of livestock and crop allow nutrients to be recycled more effectively on the farm (FAO, 1999; ILCA ,1998). FAO (1999) also details that manure of this nature contains 8kg N, 4kg P and 16kg k per ton. Also important to note is the growth of Nigeria's poultry industry that has opened more potentials in terms of steady provision of essential raw materials for alternative soil fertility and land quality maintenance (Bamire and Amujoyegbe, 2003). The authors assure that poultry manure results in higher yield level per unit of land and is more profitable than non use. A field experiment carried out by Asawalam, Emeasor and Okezie (2007) on soil amendment in pepper production showed that inorganic manure had the highest growth in height with a yield of 1819.8 g/ha while organic manure (Poultry manure) yielded 2020.3 g/ha.

2.6 Concept of Organic and Inorganic fertilizers

Fertilizers are in general any material added to the soil to enhance its productivity. Any substance that contains one or more essential plant nutrient element has the potential to be used as a fertilizer (Kim, 1998). Fertilizers are broadly classified either as organic or inorganic. According to (USDA, 2002), a natural occurring organic fertilizer has to be derived from either plant or animal materials containing one or more elements (other than carbon. hydrogen and oxygen) that are essential for plant growth. Inorganic fertilizers on the other hand are chemically industrial synthesized fertilizers.

Organic fertilizers are more complex chemical substances that take time to be broken down into forms usable by plants (Schuiz, Tian, Oyewole and Baka, 2003). They are slow release type fertilizers compared to quick release characteristics of most inorganic fertilizers. Organic fertilizers have a low salt index; hence so large amount can be applied at once without causing injury to plant roots (Nill and Nill, 1993). Organic fertilizers come mainly from household wastes. Household waste consists of decomposed wastes of a variety of origins (Peet, 1996).

According to Frederic (2001), these wastes play no part in fertility management where land is in abundant. Susan and Peters (1991) maintained that farmers are prepared to work hard to maintain nutrient on their soil using these wastes under crop intensification emanating from land scarcity.

Inorganic fertilizer can help to maintain nutrient supplies on short-term basis but without returns of organic matter to the soil, yield are not maintained (FAO, 2001). The use of inorganic fertilizer in sub-Saharan Africa has been slow despite the large yield increases demonstrated in field experiments (research stations and farmers' fields) (Dyson, 1996). The main reason being the high cost of fertilizers relative to the price of food crops. A research by Nwajiuba and Akinsami (2002) showed that output from organic manure farm was slightly less than that from inorganic farm only by 5% but the inorganic farm added about 20% cost to the cost of production.

Where inorganic fertilizers have been subsidized their use has usually increased rapidly, but when subsidy is withdrawn, there is a substantial decrease in use (Young, 1998; Cave, 2001). Unless a sustainable alternative measure is focused upon, there will be continuing food shortage and decreasing contributions from agriculture to national income (FAO, 1997; DFID, 2002; Benin, 2005).

2.7 Concept of Waste

Waste refers to unwanted by-products of industrial, commercial and domestic activities or anything otherwise discarded (Bankole, 2004). It is regarded as any substance which constitute a scrap material or an effluent or other unwanted surplus substances arising from the application of any process; and substance or article which requires to be disposed off as being broken, worn-out, contaminated or otherwise spoiled, but does not include explosives (Mkwambisi, 2008). Waste can be gaseous, liquid or solid. This work however, concentrates on municipal solid waste. Priority is now being given to the reduction of waste at source, re-use, its recovery by recycling and to the use of waste as source of organic manure to croplands as well as source of energy (Gail, 1997).

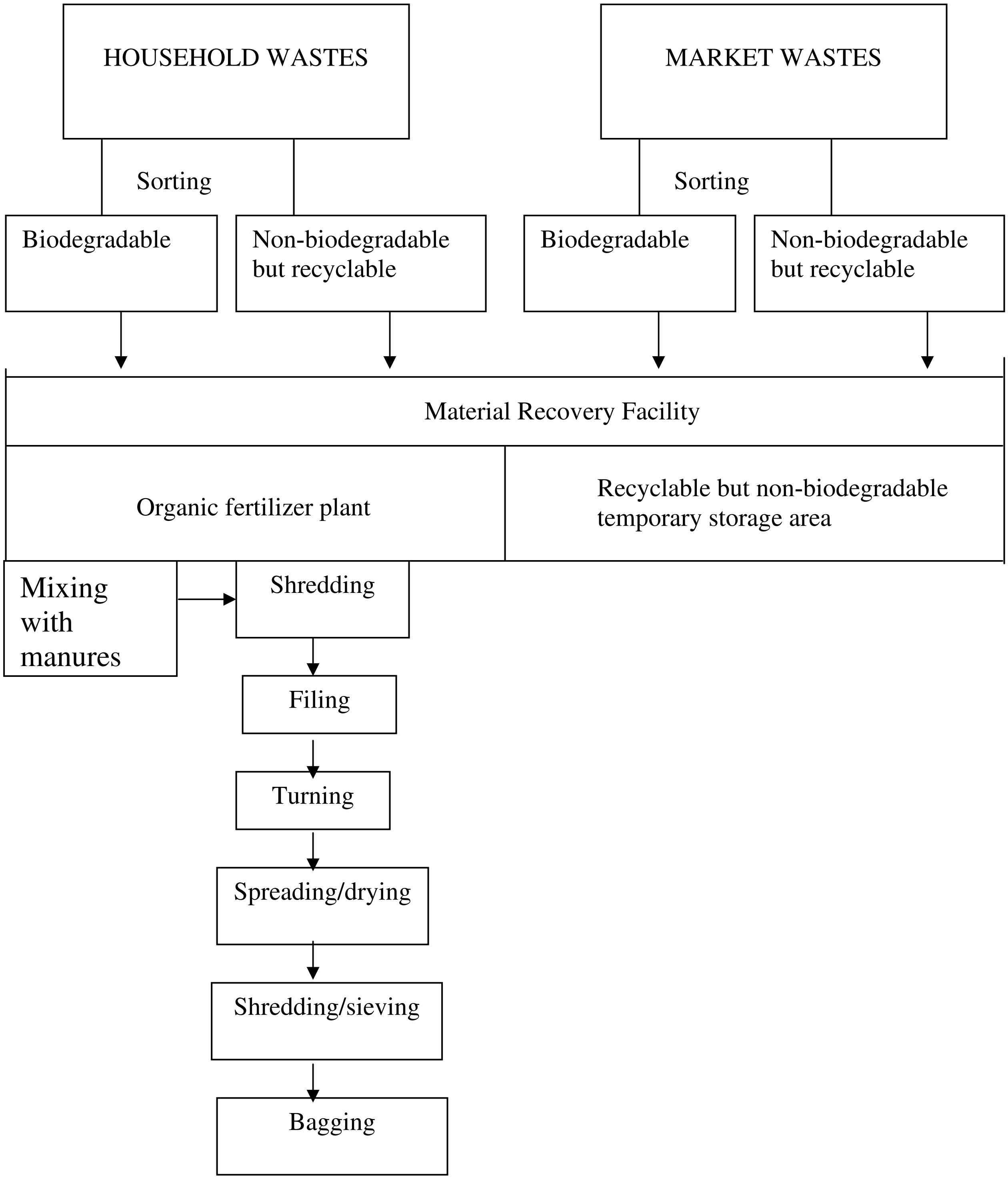

Fig 2: Flow Chart for Organic Manure Production from Household Waste and Market Waste

Source: Adapted from Mercado, R.A. (2006). Solid waste management cum organic fertilizer production. Central Luzon state university

2.8 Waste and Environment

How we choose to manage our waste as a society will ultimately impact the quality of our environment and our lives (Torbert *et al.,* 2005). The waste management system employed by any society is the result of a balance between competing interests (Kim, 1998). Mkwambisi (2005), and DFID (2002) are of the opinion that environmental sustainability, economic viability and social acceptance must all be considered when determining appropriate waste management strategies for communities, industries and agricultural operations.

Disposing wastes to either landfill or dumping sites like all methods of waste disposal have both serious environmental implications (Mkwambisi, 2005). The most alarming being its contribution to global warming and serious economic implications of the cost of its disposal annually. (Watson et *al.,* 1998, Mkwambisi, 2005). Dumping sites have the potential risk of leaking chemicals, heavy metals and bacteria into the soil and water table. Wastes can cause problems by degrading to form leachate, a highly polluting liquid (Mkwambisi, 2005). Waste dumping sites are potential breeding grounds for diseases and are associated with unpleasant odour of the degrading materials. Wastes entering dumping sites have also the potential, acting as a large source of food attracting vermin and scavengers and the associated problems of spreading diseases (WHO 1998).

Study by Busby, Gebhart and Torbert (2006), proved that disposing of other wastes such as plastics, glass, paper, cardboard, metals and textiles to dumping sites is exacerbating the ever increasing demand for raw materials and depleting the world's non -renewable natural resources. All wastes have the potential to adversely affect the environment, either by contaminating the air, soil or water (Frankenberger, 2006). Though, there are uncertainties about the type and magnitude of health effects which derive from waste disposal in the environment, some adverse impacts are probable (Cave, 2001). Due to this growing environmental concern regarding organic waste disposal, field research is necessary to develop improved methods to utilize waste products for soil and crop benefits while minimizing environmental degradation (Torbert *et al.,* 2005).

2.9 Policy Position in Waste Management in Nigeria from Independence Era till Date

Since independence from Great Britain in 1960, Nigerian government has not given attention to environmental issues (Walling, Walston, Warren Washay and Wilhelm, 2004).Over decades , the military leaders of Nigeria grossly ignored the development of environmental and waste management infrastructures (Walling *et al.,* 2004).The federal government has little control over environmental regulations as a whole. The Federal Environmental Protection Agency (FEPA) was established in 1988 to control the growing problems of waste management and pollution in Nigeria. Vision 2010 was FEPA's attempt to address environmental problems in the country. The vision is aimed to achieve not less than 80% effective management of the volume of municipal waste generated at all levels to ensure environmentally sound management (Vision 2010 committee, 2003). However, the reality of poverty and government corruption has prevented the implementation of the plan (Walling *et al,* 2004).

In contrast, however, it is worthy to note that since the return of democratic governance in 1999, the 36 state governments of Nigeria have employed staff, imported environmental machinery and managed municipal solid waste with inherent government bureaucratic bottleneck and negligence. The current escalation of waste arising from population growth has motivated the state governments to seek the assistance of foreign environmental companies to partner with their government in Public-Private Partnership (PPP) model or contract basis (Walling *et al.,* 2004)

Agunwamba (1998) estimates that efficient recycling and composting programs could save 18.6% in waste management cost and 57.7% in landfill avoidance costs. The essence being to create markets and market incentives to encourage scavenging, recycling and composting. These environmental challenges have opened opportunities for foreign companies with environmental technologies and infrastructural solutions in such area as;

(i) Supply of compactor trucks, tipper and pay loaders
(ii) Supply of monitoring equipment and other ancillary tools
(iii) Provision and rehabilitation of sewage/drainage infrastructure
(iv) Procurement of requisite equipment for collection and disposal of wastes
(v) Construction of high temperature incinerator
(vi) Construction of plastics, bottles and paper recycling plants
(vii) Conversion of animal and food wastes to organic fertilizer for agriculture
(viii) Technical support to establish a framework, implementation and training among others.

2.10 Environmental Issues on the use of Chemical Inputs

Once in a while it makes sense to think about the serious impact of synthetic fertilizer use on the environment. Some claims of dire consequences have been leveled against inorganic fertilizer use. However, these claims become valid when the quantities of fertilizer application exceed those reasonably required for the crop (Olembo, 1991)

Excessive use of inorganic fertilizer has deleterious effects on crop growth (Olembo, 1991). The author outlined some of the effects as: nutritional disorders involving such trace elements as Zinc incurred by excessive phosphate fertilizers and lime, damaging salt effects on seed germination, a seedling injury from too much soluble fertilizer salt, acidifying action of excessive nitrogen fertilizer on soil, induced by aluminum and manganese toxicities when compensating lime is not applied.

On the macro and micro organisms, intensive use of synthetic fertilizer has been establish to cause a plasmolytic effect on soil fauna especially earthworm thus reducing their population and their aeration activity, indirectly contributing to poor soil fertility. Also heavy use of chemical fertilizer, nitrogen in particular inhibits soils capacity to nitrify from the native organic matter source.

Another major problem created by excessive use of chemical fertilizers are the contributions of phosphate and nitrogen concentrations to eutrophication of surface waters and excessive concentration of nitrogen compounds in water and atmosphere. The high nitrate levels (over 40mg/litre) in wells in the mosel valley in the Federal Republic of Germany have been attributed mainly to the application of nitrogenous fertilizers in vineyard (Olembo, 1991).

On the part of climate, it has been estimated that nitrous oxide fluxes from soils contribute to the greenhouse warming by 4% and that estimated global emission of nitrous oxides totals 30 million tons annually (Olembo, 1991; FAO, 2003). The issue of the greenhouse gases and global warning is currently one of the hottest global environmental topics.

Finally, the undesirable effects of a high nitrate intake on human health are based on the conversion of nitrate to nitrite which is highly toxic to the body when absorbed into the blood stream (Greg, 1996). In children, it combines with blood haemoglobin to give methaemoglobin, which reduces the transport of oxygen in the blood. In adults, the nitrate is converted to nitrosamine that causes some health hazards (FAO, 1997). It has been estimated that the utilization of pesticides by crop farms is only 30%, the remaining 70% is retained in the soil crop and river water which later gets into the human body to cause health problems (United Nation Environmental Protection, 2002) in Ayinde (2004).

2.11 Benefits of Organic manure use

Organic wastes and many other materials used as organic fertilizers add considerable quantities of organic matter to the soil (Bamire and Amujoyegbe, 2003). Adeniyi (2008), urged farmers in the country to embrace the use of organic fertilizers more than inorganic for better crop production and good profit. The author emphasized that compost manure contains both micro and macro nutrients than inorganic fertilizer. He added that up till date many farmers cannot still afford to buy inorganic fertilizers due to middlemen activities. This waste-to wealth technology is not only targeting private profit but also environmental benefit (Idowu, 2008).

Organic manure can increase soil drainage, soil aeration, water holding capacity and the ability of the soil to hold nutrients. The beneficial effects of organic matter on soil structure can have a greater effect on plant growth than the fertilizer value of some of the organic materials (FAO, 2000). Adding organic manure to the soil not only fertilizes the soil but improves soil structure and retention capacity (ILCA, 1998). In more developing countries (European countries), there is a growing demand for organic foods driven primarily by consumer's perceptions of the quality and safety of such foods and to the position of environmental impact of organic agriculture practices (Mangala, 2005). It was also reported from the same source that organically produced foods have lower levels of pesticides, hormonal residues and better storage quality than the conventional produce. Idowu (2008), assures of the benefit of organic fertilizer all over the world today and opines that Nigeria must not lack behind if they must overcome the problems of food insufficiency and food insecurity.

2.12 Pepper (*Capsicum annuum L.*)

(i) Pepper belongs to the group of crops commonly referred to as perishables (Onwubuya, Okorie and Nenna,2009). In the native habitats, peppers are grown as tender perennials. In many part of the world however they are grown as annuals. In their fresh form under hot tropical conditions, they suffer extensive deterioration within a short time after harvest. Thus, a great % is lost through spoilage (Onwubuya *et al.,* 2009).

(ii) **Origin:** Capsicum species is popularly known as pepper and belong to the family solanaceae (Bosland, 1994). It is the world's second most important vegetable after tomatoes (Yoon. Green, Tshanz, Tsou, Chenge, 1989). According to Adamu, Ado-Eruofor and Olawrewaju (1994), the primary centre of origin was Mexico though Nigeria happens to be the largest producer of pepper in Africa covering about 50% of total African production. Nsukka yellow pepper belongs to the species *Capsicum annum* which is the most widely spread and most important (Adamu et al 1994). Nsukka yellow pepper owes its name to its characteristics yellow colour and the area it is popularly grown.

(iii) **Botany:** The plant is a herbaceous annual usually growing from 45cm - 65cm high. Nsukka yellow pepper is characterized by yellow colour at fruit ripening and a unique aroma. It is made up 1-3 fruits in the axile of one leaf (Adamu *et al,* 1994). Pepper morphology is similar to that of tomatoes and they are members of the same family. Pepper roots are fibrous and top growth of shiny, glabrous; simple leaves, generally more compact and more erect than tomatoes.

(iv) **Consumption:** Consumption of pepper accounts for about 20% of the average vegetable consumption per person per day in Nigeria (Alegbejo and Orakwe, 2001). It is used extensively in food flavoring, either in soup or as condiments for colouring of meats, fish and other food materials (Adetula and Olakojo, 2006) In their fresh form under hot tropical conditions, they suffer extensive deterioration within a short time after harvest. Thus, a great % is lost through spoilage.

(v) Agronomy: Pepper grows best at 70 – 800F (21 – 260C). Temperature below 60^0F will reduce capsaicin content (Peet, 1996). Peppers have greater drought tolerance in terms of plants survival, with adequate rainfall of 625-1250mg. Pepper need a deep well drained medium textured sandy loam or loam soil that holds moisture and has enough organic matter.

(vi) **Nutritional/Medicinal value:** Pepper is a recognized source of vitamin C as other vegetables and vitamin E in addition with high antioxidant property. Echezona (2006) reported that pepper has an excellent preservative property and is used in the preservation of most grains and legumes, cowpea in particular.

The capsaicin extract from chili pepper is used in pharmaceuticals as counter irritant balm (Purseglove, 1997). In Germany it is approved as a topical ointment for relief of painful spasm. It is also used in the treatment of diabetic neuropathy, as well as in the management of surgical neuropathic pains in cancer patients (Messiaen, 1992). Currently about ten research papers a month are published on the medicinal use of pepper which is presently the most recommended topical medication for arthritis (Bosland, 1997). Hence there is a need for policy decision that promotes pepper production in Nigeria.

2.12.1 *Nsukka Yellow Pepper (Capsicum annuum L.)*

Nsukka yellow pepper is an indigenous pepper whose production is basically peculiar to Nsukka agro-ecological zone of Enugu state (Ajayi and Eneje, 1998). It is among the principal vegetable crops grown in the zone partly due to its popularity, nutritional value, adaptability to the existing cropping system and its potential to increase farmers' income (Ajayi and Eneje, 1998). Over the yeas, the cultivation of the Nsukka yellow pepper in Nsukka has been restricted to Nsukka Agricultural zone owing to the general belief that the pepper looses its characteristic aroma when gown outside the zone. This has kept the supply consistently below the demand and consequently made the pepper a high premium crop (Uguru, 1999). One important constraint to effective production of the pepper is the scarcity and high cost of chemical fertilizers (Utomakili and Edekie, 1998). It is therefore important to research for alternative means of enhancing production to meet the demand.

2.13 Theoretical Framework

Agricultural intensification which is the production of more food per unit area of land emanated as a result of population growth on a fixed mass of land. Agricultural intensification is usually portrayed either as an opportunity or as a threat to the environment (Alimi *et al.,* 2005). For food production to meet the needs of the growing population, appropriate and cheap technological approach to soil management that makes the environment better off must be employed (Swarup, 1987).

The decision of soil fertility maintenance should not be left in the hands of the smallholder farmers alone but should involve public intervention. This leads us to the theory of production economics and resource allocation.

The theory of production economics is concerned with the optimization of the farmers' objectives or goals and optimization implies efficiency (Adejobi, Kormawa, Manyong and Olayemi, 2003). On the other hand, the theory of resource allocation according to Heady (1969) in Adejobi *et al.,* (2003) refers to the technical concept of efficiency which brings about great product to the society from given resource combination.

The soil fertility input is one of the major resource constraints facing the Nsukka Yellow Pepper farmers. This is as a result of continuous cropping activities on the scarce land resources. There is a need to create a balance among the available soil maintenance alternatives (such as mineral fertilizer, composting, poultry manure, organic waste etc) to enable them choose the most appropriate combination with least cost. Efficient allocation of resources through an optimal input combination by these smallholder farmers (Yellow Pepper Farmers) among their usual multiple goals of providing food for the family and accumulating income to offset poverty should be vital focus point in decision making.

The Nsukka yellow pepper production is such a lucrative enterprise that needs a research effort for improvement in order to create a balance between private and social cost.

2.14 Analytical Framework

The framework of analysis of this work is reviewed under the following tools of analysis:

2.15.1 Contingency Valuation Method (CVM)

This is an invaluable analytical tool in environmental economics as it provides information on non-marketable natural resources goods. Udziella and Gennet (1996), opined that CVM can be an effective method of obtaining price estimates for non-market values that would be excluded from consideration in traditional economic decision making as they have no associated price. Hence, this type of valuation has a crucial role to play in preserving and restoring priceless environmental resources (Field, 1997). This method uses a survey to find from people, their willingness to pay for a particular environmental good or their willingness to accept compensation for a loss of a particular environmental or public good (Chukwuone, 2008). It provides a direct method of measuring natural resources without resorting to the market valuation method (Garrod and Wills, 1994). CVM puts direct questions to individuals to determine how much they might be willing to pay for a proposed change in their environment (Mitchell and Carson, 1989).

The goal of contingency valuation method is to measure the compensating or equivalent variation for the good in question, compensating variation is appropriates measure when the person must purchase the good, such as, an improvement in environmental quality while equivalent variation is appropriate if the person faces a potential loss of the good (FAO, 2000). Both compensating variation and equivalent variation can be elicited by asking a person to report a willingness to pay amount either to obtain a good or to avoid a loss.

Willingness to pay elicitation formats include; open ended questions, bidding game, payment card approach, and single- bounded dichotomous choice. In this study the single-bounded dichotomous choice method will be employed. Willingness to pay takes the form of binary as some responses will yield yes and be assigned one (1) while others will yield no and be assigned zero (o). The probit model will therefore be a best fit to calculate their WTP in order to estimate their bid function.

In this research, CVM will be adopted to ascertain the yellow pepper farmers' willingness to pay for bagged waste which will reduce their cost on other commercial organic fertilizers (e.g. poultry) and at the same time help to ameliorate environmental degradation (environmental quality loss) imposed by these wastes.

CVM which is based on the willingness to pay of respondents can be given in the form: $U(Y\text{-}WTP,P,Q_1;Z) = (Y,P,Q_0;Z)$

Where

U = indirect utility function

Y = income

WTP = willingness to pay

P = vector of prices faced by the individuals

q_o and q_1 = alternative levels of the good or quality indexes. If $q_1 > q_0$, it indicates that q_1 refers to improved environmental quality (FAO, 2000).

2.15.2 Probit Model

Linear regression model assumes that the dependent variable being tested is both continuous and measured for all the observations within a sample. However, probit model plays important role in a situation of discontinuous and dichotomous binary variables (Sevier and Lee, 2004)

It is an alternative means of running a regression analysis as it can appropriately handle binary data. This model is useful in ascertaining the level of adoption of new technology. In this research the model will be used to capture the factors influencing the willingness of farmers to pay for bagged organic wastes

2.15.3 Costs and Returns

Cost is a sacrifice that must be made for the purpose of doing or acquiring something (Nweze, 2002). Return on the other hand is the amount of money produced as a profit or loss (Upton, 1996). Cost of materials and related services make up a major component of variable costs involved in the farming operation (McClellan, 2006). Crop production cost include expenses for materials used in production such as fertilizers, chemicals, seeds, irrigation, cost of land, labour, machinery, management and marketing costs. Increasing crop production in sustainable ways such as introducing soil fertility control measures or improving long-term productivity of land involves direct costs such as compositing, liming, transportation or indirect costs such as that of family labour (Nweze, 2002; Mclellan, 2006). In this study the benefit of organic manure use in yellow pepper production will be assessed using net income analysis to verity if the effort put in campaign for organic manure use is justified. Net income gives the profit of the business and its analysis sheds light on the efficiency and performance of the business. It is obtained by adjusting net cash income for depreciation, net inventory charges and value of product consumed by family members and gifts to friends. It represents the return to the producer for personal and family labour, management and equity capital used in the production activities. Revenue generation will be estimated from produce sales and value of consumed and gift produce while cost flows will come from inputs used in production, depreciation packaging and transportation.

Net income analysis is however obtained from Gross margin analysis

Gross Margin (GM) = Total Revenue (TR) – Total variable cost (TVC)

NIA = GM – Total Fixed Cost (TFC)

CHAPTER THREE
METHODOLOGY

3.1 The Study Area

The study was carried out in Nsukka local government area due to the prominence of yellow pepper production in the area. Nsukka Local Government Area lies within longitudes 7^0 $15^'$ to 7^0 $34^'$. E and latitudes 6^0 $44^'$ to 7^0 N. It has an area of 463 square kilometers (Nsukka Local Government information unit, 2000). Nsukka Local Government has a total population of 39, 633 (NPC, 2006).

Nsukka local government area is bound to the north by Igbo-Eze South, to the east, by Isiuzo, to the south by Igbo-Etiti, to the west by Kogi state and to the south west by Uzo-Uwani Local Government Area. It is located on the Nsukka Plateau, which lies generally over 356 m above sea level with isolated peaks reading over 545 m above sea level (Nsukka Local Government information unit, 2000). This elevated nature of Nsukka makes its weather cooler than the surrounding areas. The local government area is covered with acidic soil type, which has proved the excessive use of inorganic fertilizer a threat to the environment (Nsukka Local Government information unit, 2000).

The farming activities in the study area are influenced by two seasons – the rainy season and the dry season. The northeast trade wind sets in tough harmattan weather in Nsukka, which is perceived by the people to be responsible for high yield of crops and successful fruiting. The Nsukka people are traditionally farmers; such crops as cassava, cocoyam, maize, and yam are the staple food crops grown in the area. Yellow pepper, fruits and leafy vegetable are their major cash crops. They also rear pigs, goats, other small ruminants and non-ruminants including poultry on medium scale production.

3.2 Sampling Procedure

Purposive and random sampling techniques were employed in the selection of respondents for the study. First, from the ADP list of yellow pepper producing town communities, eight (8) town communities were purposively selected based on their prominence in yellow pepper production. In addition to the ADP list, the researcher embarked on reconnaissance survey to argument and makes the ADP list more authentic.

In the random sampling, two (2) villages were randomly selected from each of the already selected eight (8) town communities giving a total of sixteen (16) villages. Finally, eight (8) yellow pepper farmers were purposively selected from each of the village (four farmers from users of organic manure only and four farmers from users of organic manure supplemented with inorganic fertilizer) to give a total of 128 respondents for the analysis.

3.3 Data Collection

Data for this study were generated from primary source. Primary data were sourced using a set of structured questionnaire as well as informal oral interview method. The copies of the questionnaires were administered to selected yellow pepper farmers soliciting information on their socio-economic characteristics, their method of soil fertility maintenance, reasons for the use of organic manure, sources of organic manure to their farms, costs and returns in the enterprise and finally information on their willingness to use and willingness to pay for commercially bagged organic manure to enrich their farm lands.

3.4 Method of Data Analysis

In order to achieve the specific objective of the study, relevant analytical tools were employed. Objective (i) was realized using descriptive statistics such as mean, frequency distribution, and percentages. Objectives (ii) and (iii) were realized through probit model while objective (iv) was achieved using gross margin analysis and confirmed with student t-test.

3.5 Model Specification

3.5.2 Contingent Valuation Method (CVM)

The willingness to use (WTuse) and willingness to pay (WTP) take the binary form, thus the dichotomous choice elicitation method using probit model was considered appropriate in estimating the yellow pepper farmers' bid function. This was specified thus;

Willingness to Use (WTuse):

$Pr(y = 1|x) = b_o + b_1x_1Inc + b_2x_2Ldu + b_3x_3Fxp + b_4x_4Ald + b_5x_5Hhz + b_6x_6Occ + b_7x_7Sex + b_8x_8Ava + b_9x_9Yld + b_{10}x_{10}Sdg + b_{11}x_{11} + e$

Willingness to Pay (WTP):

$Pr(y = 1|x) = b_o + b_1x_1Inc + b_2x_2Age + b_3x_3Sex + b_4x_4Hhz + b_5x_5Occ + b_6x_6Ald + b_7x_7Occ + b_8x_8Fxp + b_9x_9Ldu + e$

In WTuse: y = willingness to use (dummy; y = 1 if farmers are willing to use, otherwise y = 0

Where y = willingness to pay (dummy; y= I if farmers are willing to pay, y = o if farmers are not willing to pay.

$b_{o} =$ intercept

b_1- b_{11} = regression coefficients that explain the probability of WTP and WTuse of the farmers

x_1-x_{11} = the independent variables

Inc = income (~~N~~)

Ava	=	Availability (dummy; readly available=1,0 = otherwise
Yld	=	Yield (Kg)
Sx	=	Sex (dummy: female 1, male= 0)
Age	=	age (yrs)
Ldu	=	level of education
Fxp	=	Farming experience (yrs)
Ald	=	Size of land (Ha)
Hhz	=	Household size
Occ	=	Occupation (fulltime = 1, parttime = 0)
Sdg	=	Soil degradation
e	=	stochastic error term.

3.5.3 Net Income Analysis

Net income analysis was used to determine the profitability of yellow pepper production. This was derived from Gross margin analysis and is specified thus:

$$GM = TR - TVC$$

$$NIA = GM - TFC$$

Where	GM	=	Gross margin
	TR	=	Total Revenue
	TVC	=	Total variable cost
	TFC	=	Total fixed c ost
	NI	=	Net income

3.6 Hypothesis testing

From the probit model, 1Ho: Socio economic characteristics of the yellow pepper farmers have no significance influence on their willingness to pay for bagged organic manure was concluded.

Ho_2: There is no significant difference between the net returns of the two groups of farmers under study was concluded from gross margin analysis using student t-test.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Socio-Economic Characteristics of the farmers

From the field survey, it was observed that various socio-economic characteristics of the respondents affect organic manure use by yellow pepper farmers at varying degrees. Such socio-economic characteristics considered were age, household size, income, level of education, sex, awareness, area of land used by the farmers for yellow pepper production and sources of organic manure to the farm.

4.1.1 Age Distribution of the Respondents

Age plays important role in agricultural production. The farming activities from pre-planting operation through planting to post- planting operations require a lot of labour. Rural-urban migration had indeed obstructed active participation of youths in agriculture (FAO, 1993) Although yellow pepper has become a major cash crop in the study area involving both old and young farmers in the production, there was a popular age bracket (31-50) that trailed the occupation. The frequency distribution of the respondents according to age was presented in Table 4.1.

Table 4.1: Frequency Distribution of Respondents by Age

Age Range (Years)	Frequency	Percentage (%)
20 – 30	17	14.1
31 – 40	64	53.3
41 – 50	35	29.2
> 50	4	3.3
Total	120	100

Source: Field Survey, 2008

The table showed that majority (53%) of the yellow pepper farmers that used organic manure fall within the age bracket of 31-40, followed by a close age range of 41-50 (29%). This indicated that yellow pepper farming as an occupation provided job opportunity to people within the age bracket of 31-50, implying that middle aged farmers had greater strength to tackle labour intensive farm works like yellow pepper production. This explained why older farmers (>50 years or 3.8%) were not major producers. Also, young school leavers of the age range 20-30 years (14.1%) engaged in the production as a means of earning their livelihood when the white collar job is not forthcoming.

4.1.2 Distribution of Respondents by Sex

Some occupations are gender specific (FAO, 2003). In agriculture, vegetable production is majorly carried out by women. This was clearly presented in Table 4.2

Table 4.2: Sex Distribution of Respondents

Sex	Frequency	Percentage (%)
Male	45	37
Female	75	63
Total	120	100

Source*:* Field Survey, 2008

The table indicated that majority of the yellow pepper farmers (63%) were females. This was so because yellow pepper, like other vegetables is mostly produced by women. This is supported by FAO (2003), which noted that, in the rural areas where most of the world's hungry people live, women produce most of the food (especially vegetables) consumed locally. The research also showed that male yellow pepper farmers (37%) were mostly part-time farmers and retired civil servants who used the income from the production to supplement their living.

4.1.3 Distribution of Respondents by Household Size

In traditional African agricultural setting, large sized families had advantage over small sized families (Tumer et al, 1993). Families with good number of productive adults will spend little on hired labour. On the other hand, large sized families have negative impact on resource allocation as income might be diverted to consumption needs (Arene and Mbata, 2008). Frequency distribution of respondents according to household size is presented in Table 4.3

Table 4.3: Distribution of Respondents by Household Size

Household Size	Frequency	Percentage (%)
1 – 3	6	5
4 – 6	45	38
7 – 9	66	55
> 10	3	2
Total	120	100

Source*:* Field Survey, 2008

The table indicated that 55% of the sampled respondents had family size of 7-9 persons; this was followed by those with 4-6(38%). This showed that these farmers can partly satisfy their labour needs and depend less on hired labourers. Families whose numbers exceeded ten (>10) were very few (2%), showing that people were very much conscious of the interplay between population growth and scarce resources. On the other hand, some families with

1-3 persons (5%) were also involved in yellow pepper production but they spent more on hired labourers.

4.1.4 Frequency Distribution of Respondents by Marital Status

In the study area, production of yellow pepper was undertaken by all categories of people in the society – married, single, widows and widowers. Details of this distribution are presented in Table 4.4.

Table 4.4: Frequency Distribution of Respondents by Marital Status

Marital Status	Frequency	Percentage (%)
Single	14	12
Married	98	82
Widow/Widower	8	6
Total	120	100

Source*:* Field Survey, 2008

The table showed that majority (82%) of the respondents were married. This is in line with apriori expectation that familied people engage in enterprises that have quick returns for the upkeep of their families. Focus group discussion revealed that many families were able to send their children to higher institutions by depending on proceeds from outputs. Bachelors and spinsters were few (12%) in the field as majority of them were in the urban areas searching for white collar jobs. The least position was occupied by widows/widowers (6%) for obvious reason that, as single parents they hardly afford the resources (financial and labour) required for production.

4.1.5 Distribution of Respondents by Primary Occupation

Yellow pepper production can either be taken up as a full-time activity or part-time to supplement off-farm income. The distribution of respondents according to their primary occupation is presented in Table 4.5

Table 4.5: Distribution of Respondents by Primary Occupation

Primary Occupation	Frequency	Percentage (%)
Full-time farming	76	63
Part-time farming	44	37
Total	120	100

Source*:* Field Survey, 2008

This table indicated that 63 percent of the respondents had taken up yellow pepper production as their primary occupation. This implied that any aid coming from the government to this group will be appropriately directed and utilized. Although the remaining percentage (37%) engage in other off-farm activities (trading, civil service, handcraft), they have not abandoned yellow pepper production – their traditional occupation (Nsukka local government information unit, 2000). They produced it as part-time venture to augment their income.

4.1.6 Distribution of Respondents by Farming Experience

Experience, they say, is the best teacher. A greater number of years of interaction in a given occupation is expected to make one more competent / used to the condition, ready to adapt to changes and to accept innovations. The frequency distribution of respondents according to number of years of experience in yellow pepper production is presented in the Table 4.6

Table 4.6: Frequency Distribution of Respondents by Farming Experience

Farming Experience (Years)	**Frequency**	**Percentage (%)**
1 – 5	7	6
6 – 10	47	39
11 – 15	52	43
16 – 20	14	12
Total	120	100

Source*:* Field Survey, 2008

The table indicated that farming experience of 11-15 years (43%) and 6-10 years (39%) ranked highest in the distribution. Few farmers were just in their first 5 years (6%) in the production. These were probably young school leavers that joined the enterprise recently. However, the field data showed that few farmers remained in the business for 16-20 years (12%). This could have a relationship with the farmers' age, because at older age, their strength fail them and they discontinue since most of the cultural practices were not mechanized. It could also mean that, within the first 6-15 years, a productive farmer must have accumulated enough wealth that had helped him establish other business enterprises, withdrawing from primary production.

4.1.7 Distribution of Respondents by Duration of Formal Education

Education is a vital tool to the farmers as it helps them to react sharply and constructively to changes in their environment (Sevier and Lee,2003). Education enhances/promotes rate of adoption of innovation by the farmers. The frequency distribution of respondents according to number of years spent in formal education is presented in Table 4.7

Table 4.7: Distribution of Respondents by Duration of Formal Education

Duration of Formal Education	Frequency	Percentage (%)
Zero	3	3
1 – 6	41	34
7 – 12	55	46
≥13	21	18
Total	120	100

Source: Field Survey, 2008

Table 4.7 showed that these farmers were literate as majority of them (34% and 46%) fall within the range of primary and secondary school levels. They were most likely to react positively to innovations to enhance their production. With 18 percent of the respondents having gone above secondary schools and through social interactions, rate of diffusion of innovation will be higher. Only a very infinitesimal percentage (3%) of the farmers could not get the Western education.

4.1.8 Distribution of Respondents by Area of Land Devoted to Yellow Pepper production

Land is known to be one of the limiting inputs in agriculture due to population growth (Greenland & Nabban, 2001). The frequency distribution of respondents according to area of land devoted to yellow pepper production is presented in Table 4.8.

Table 4.8: Distribution of Respondents by Area of Land Devoted to Yellow Pepper Production

Area of Land (Ha)	Frequency	Percentage (%)
< 1	1	1
1 – 1.5	4	3
1.6 – 2	9	8
2.1 – 2.5	43	36
2.6 – 3	62	52
> 3	1	1
Total	120	100

Source*:* Field Survey, 2008

The table showed that land as an input is fairly available in the study area as majority of the farmers (36% and 52%) devoted between 2.1-2.5 and 2.6-3 hectares to yellow pepper cultivation alone. This showed their interest in yellow pepper production and its level of returns to the farmers. Out of average area of 4 hectares, they are devoting 2-3 hectares to yellow pepper, leaving about 1 hectare to other arable crops (Field Survey, 2008). This simply indicated that yellow pepper was their major cash crop, as such; they will be ready to welcome innovations that will enhance productivity – such as soil maintenance techniques.

4.2 Soil Fertility Maintenance Practices

The result from the field survey showed that all the respondents interviewed maintained their soil but the methods of soil maintenance varied among them. The frequency distribution of respondents according to soil maintenance method adopted is presented below:

Table 4.9: Distribution of Respondents by Soil Maintenance Practices

Soil Maintenance Method	Frequency	Percentage (%)
Use of organic manure only	95	79
Organic manure plus artificial fertilizer	25	21
Total	120	100

Source*:* Field Survey, 2008

This table actually showed that almost all the farmers (79%) used organic manure in maintaining their soil, while the remaining few farmers (21%) combined organic manure and inorganic fertilizer. This corroborates the literature by Westerman & Bicudo (2003), that organic manure is one of the most well-known practices to recover and maintain soil productivity. Alimi (2002), IFDC (2007), noted that organic manure was an invaluable component in rectifying soil degradation and enhancing productivity. In recent years, organic manure is increasingly being ploughed back as soil amendment practice (Nwajiuba & Akinsami, 2002).

4.2.2 Distribution of Respondents by Source of Organic Manure Used in their Farms

This section x-rayed the different ways through which the farmers sourced their organic manure. Organic manure can be sourced from composting, livestock bedding, household waste, ash, alley farming, poultry droppings and from public refuse dumps. The distribution of respondents according to their sources of organic manure is presented in Table 4.2.2:

Table 4.10: Distribution of Respondents by their Sources of Organic Manure

Source of Organic Manure	Frequency	Percentage (%)
Poultry droppings	112	93
Livestock beddings	3	2.5
Household waste	5	4.2
Total	120	100

Source*:* Field Survey, 2008

Table 4.10 showed that almost all the farmers (93%) sourced the organic manure they used in their farm from poultry droppings. Only 4 percent made use of their household wastes to enrich their farm, while livestock beddings had the least respondents' indications (3%). This has shown the necessity of this research. If other sources are not explored, the poultry industry will monopolize the supply and take advantage of high profit as the farmers become the price takers. Use of organic waste as source of organic manure to the farm will help to diversify its source, reduce monopoly and cost of poultry manure as well as reduction in fertilizer importation (Aganon, et al, 1999 in Mercado, 2006).

4.3 Factors that Determine the Use of Organic Manure by the Yellow Pepper Farmers

The probit regression model was used to elicit those factors that motivated the farmers to use organic manure in their farms. The variables that were significant at 5% level of probability adversely affected organic manure use. The probit regression table is presented below:

Table 4.11: Regression Result Table for Willingness to Use (WT Use)

WT Use	Coef.	Std. Err.	Z	P> / Z /
Income	2.12e - 06	2.12e – 06	0.96	0.338
Education	.0350425	.0315672	1.11	0.267
Farming experience	-.0996807	.0476991	2.09	0.370
Area of land	-.2770605	.1665069	-1.66	0.096
Household size	-.1666807	.0937951	-1.78	0.076
Occupation	.8978597	.3581304	2.51	0.012
Sex	.2772457	.2952629	0.94	0.348
Availability	.3628625	.3584735	1.01	0.311
Yield	-.7847357	.2980829	2.63	0.008
Soil degradation	-.6062148	.3723844	-1.63	0.104
Age	.0709074	.0244563	2.90	0.004
Cons	.8313616	.9899017	0.84	0.401

Number of observations = 120

LR X^2 (11) = 30.83

Prob > X^2 = 0.0012

Pseudo R^2 = 0.5971

Use is a dichotomous variable hence willingness to use was assigned value one (1), while not willing to use was assigned value zero (0). The explanatory variables were; Income (X_1), Education (X_2), Farming Experience (X_3), Area of land (X_4), Household size (X_5), Occupation (X_6), Sex (X_7), Availability (X_8), Yield (X_9), Soil degradation (X_{10}), Age (X_{11}).

The coefficient of multiple determination (Pseudo $R^2 = 0.5971 \underline{\otimes} 0.60$) value showed a statistically significant model. This implied that the explanatory variables were adequate in predicting 60% of the dependent variables while the stochastic term took care of the remaining 40%.

Income (X_1) had positive correlation with use. It implied that like other commodities, use of organic manure was dependent on the farmers' disposable income. This is in line with apriori expectation as demand is only effective when it is backed up with the ability to pay (Lipsey and Chrystal, 1999).

Educational (X_2) level of the farmers had positive coefficient. Education is always a vital tool in imparting knowledge, creating enlightenment and widening research scope of the farmers. Educated farmers are very flexible in adopting innovations, hence willingness to use organic manure from organic waste technology will be easily adopted by the target farmers. From the frequency distribution table (Table 4.7), it was observed that majority (80%) of the farmers was between primary and secondary school level, while 17 percent attended tertiary institutions. Their levels of education will positively influence them in making wise decision on appropriate technologies such as the use of organic manure generated from biodegradable waste.

Farming experience (X_3) had inverse relationship with willingness to use organic manure. This implied that organic manure use was independent on years spent in farming as every farmer was aware of the detrimental effect of soil deterioration hence production and soil maintenance (organic manure use) moved simultaneously

Area of land (X_4) also showed inverse relationship with willingness to use. Although land was not a major input constraint, willingness to use organic manure was independent of quantity of land available for cultivation but quality of land. Kuepper & Gegner, 2004;Mkwabisi,2004; opined that in area of abundant land, farmers do not make use of these organic wastes for manure, rather they resort to other traditional soil fertility measures like crop rotation. However, in the study area, these farmers saw organic manure quite indispensable to their production.

Household size (X_5) inversely related to willingness to use of organic manure. This is probably because organic manure enhances weed infestation and increases farm labour. The research survey showed that productive youth labourers were scarcely available for farm works as majority of them were in pursuit of higher education, a privilege arising from the siting of a university in the study area.

Occupation of the respondents was a very important determinant of use as it was significant at 5 percent level of probability and showed positive relationship with use. It implied that farmers who engaged in yellow pepper production as their primary and major occupation adopted innovations and readily accepted changes (like organic manure use) for improvement.

Sex of the farmer (X_7) had positive relationship with willingness to use. This, all thins being equal, use of organic manure will increase as the number of female farmers increased. From the descriptive statistics (table 4.2), it was recorded that majority (63%) of the yellow pepper farmers were females. This implied that the poverty level of women had predisposed them to resorting to their indigenous least cost input (FAO 2003).

Availability of organic manure (X_8) positively related to use. This implied that farmers were willing to use organic manure for obvious reason that it is ever readily available for timeliness operation. Chemical fertilizers, even when available, delay farm activities due to the bureaucratic bottlenecks associated with its distribution (Olufunke & Bradford, 2001).

Yield (X_9) and soil degradation (X_{10}), both had negative coefficients. They were inversely related to willingness to use. The effect of soil degradation was manifested on the low yield of crops. Farmers reluctantly address the issue of soil fertility problem until further deterioration manifested in reduced crop yield. This implied that if soil status and crop yield were adequate, farmers would not have put in extra effort to maintain their soil (FAO 2001, Frankenberger 2006)

The apriori expectation is that in area of high soil degradation and low yield, the use of organic manure will increase tremendously but these yellow pepper farmers had inculcated the habit of maintaining their soils with organic manure. However the issue was diversifying source of organic manure to enhance supply. Finally, age of the farmer was positive and significant at 5 percent level of probability. This showed that age was a very important determinant of use. The field survey showed that majority (83%) of the farmers were in the productive age bracket (31-50) required for active farm work especially that involving the use of organic manure. It also revealed that older farmers were more knowledgeable about traditional practices (such as organic manure) in agriculture. Mkwabisi (2005) affirms that older farmers adhere to natural and traditional soil fertility maintenance than younger farmers who make use of mostly synthetic soil nutrients.

4.4 Willingness to Pay (WTP) for Organic Manure by the Yellow Pepper Farmers

The socio-economic variables that adversely affected farmers' willingness to pay for organic manure were captured using probit regression model. The variables that were significant at 5 percent level of probability seriously influenced farmers' willingness to pay to for organic manure. The probit regression table is presented below:

Table 4.12: Regression Result Table for WTP

WTP	Coef.	Std. Err.	Z	P> / Z /
Income	3.92e – 06	1.91e – 06	2.05	0.040
Age	0.53086	.221174	2.40	0.017
Gender	-.1053784	.278813	-0.38	0.705
Household size	-.0683075	.080895	-0.84	0.398
Occupation	-.6770799	.3241634	-1.98	0.048
Land area	-.1864685	.1529042	-1.22	0.223
Farming experience	.0537848	1.0423729	1.27	0.204
Education	.0114034	.0302972	0.38	0.707
Cons	.177445	.8030531	0.22	0.825

Number of observations = 120

LR X^2 (11) = 15.80

Prob > X^2 = 0.0453

Pseudo R^2 = 0.6961

Willingness to pay (WTP) is a dichotomous variable. Some farmers may be willing to pay and others may not, taking the values of one (1) and zero (0) respectively. Willingness to pay (WTP) was the dependent variable while the independent variables included: Income (X_1), Age (X_2), Sex (X_3), Household size (X_4), Occupation (X_5), Land area (X_6), Farming experience (X_7), and Education (X_8). The coefficient of multiple determination (Pseudo $R^2 = 0.6961$ $\underline{\otimes}$ 0.701) value showed that the model was statistically significant and was able to predict 70% of the dependent variables while the stochastic term accounted for the remaining 30%. With this high pseudo R^2(70%) , it implied that the socio-economic variables of the farmers significantly influenced their willingness to pay for organic manure, therefore, the first null hypothesis-1HO was rejected and the alternative accepted.

Income (X_1) and age (X_2) were positive and significant at 5 percent level of probability. It indicated that farmer's age was a very important determinant of willingness to pay for organic manure. It implied that, as the farmer got older, he explored other avenues of enhancing his off-farm income. With more income at his disposal, he will be most willing to welcome improved technology like that of organic manure.

In the willingness to use model, sex (X_3) had positive coefficient signifying that majority of yellow pepper farmers who were females were willing to use organic manure. However, in the willingness to pay model, this same variable showed inverse relationship thus indicating that the vulnerability of women to poverty had deprived them the opportunity of welcoming improved technology. It implied that the probability to pay for organic manure produced from biodegradable waste decreased as the number of women in the production increased undoubtedly as a result of low income. Though women produce most of the vegetables consumed locally, their contribution was hindered by unequal access to essential resources like credit (FAO 2003; Adeniyi, 2008).

Household size (X_4) showed inverse relationship with willingness to pay. This indicated that the size of a family determined to a large extent the effectiveness of their demand for improved innovation. It implied that as the family size increased, their willingness to pay for such innovations decreased because their income was directed towards other developmental ventures like paying school fees and housing. In a similar study by Arene & Mbata (2008), household size was also found to be inversely related to willingness to pay for organic waste use in urban agriculture. The authors attributed this result to diversion of family disposable income to consumption needs thereby leaving little or no disposable income for other expenses.

Primary occupation (X_5) was significant at 5 percent level of probability but inversely related to willingness to pay. This indicated that the amount of time put into production influenced farmers' willingness to pay for the resources they use. This result showed that the probability of the farmers being willing to pay for organic manure reduced as they put more time into production (full-time). This was so because, as they put more time in their farm, they had little or no time for other off-farm activities that could yield them income; low income implied low willingness to pay.

Land area (X_6) was found to be inversely related to willingness to pay. This implied that willingness to pay was independent of land area put into use by the farmers as these farmers were ready to pay for the resource (organic manure) that enhanced the quality of their lands for appreciable yield (Senjobi et al,2000;Mkwabisi,2005.).

Farming experience (X_7) and educational level (X_8) both had positive coefficients. It followed that those who had stayed long in the field of production coupled with some years of educational qualification should have a wider scope of information and more opportuned to adopt innovations hence they responded willingly to pay for organic manure. This is in line with apriori expectation that education enhances adoption and that experience, is the best teacher. From the bid function presented to the yellow pepper farmers, an average willingness to pay amount was ₦800.00 per 100Kg bag of organic manure generated from organic waste.

4.5 Gross Margin Analysis

4.5.1 Costs and Returns from Yellow pepper Farmers Using Organic Manure

Table 4.13: Returns and Costs from Users of Organic Manure only.

Returns:

Item	Unit	Qtty.	Price/ Unit (₦)	Amount (₦)
Ugi (Pumpkin leaf)	Bundle (320g)	3392	50	550350.00
Green (Spinach)	Bundle (400g)	2141	30	166470.00
Melon	Bucket (2kg)	118	300	84193.55
Maize	Basket(50cubs)	3478	1,200	446709.68
Seedling sales	Nursery basket(25stands/basket)	1715	150	314322.58
Nursery bed sales	Bed(1.3 x 6m)	165	1,500	339677.42
Ugi head (Pumpkin fruit)	Kg	19712	25	492800.00
Yellow Pepper	Kg	9578	700	6704600
Total Revenue (TR)		=		9099123.23

Table 4.14 Variable Costs

Item	Unit	Qtty.	Price/ Unit (₦)	Amount (₦)
Seed	Kg	10	1750	17500
Seedling	Nursery basket(25stands/basket)	48	150	60000
Tillage	Ha	130	1500	195000
Water	Litre	70755	2.80	198114
Weeding	Ha	130	5000	720000
Nursery bed making	Bed(1.3 x 6)	5086	30	152580
Mound making	Ha	130	4000	520000
Chemical spray	Ha	80	600	48000
Organic manure	Kg	46228	15	693425
Transport	-	-	-	76420
Harvesting	50 kg	10714	30	321420
Total Variable Cost (TVC)		=		3032459

Table 4.15 Fixed Cost on Equipment

Item	Quantity	Unit Cost (₦)	Amount (₦)
Hoe	118	150	177,00
Cutlass	30	350	10,500
Watering can	109	150	16,350
Water pump	3	6,000	18,000
Wheelbarrow	15	1,800	27,000
Total Fixed Cost (TFC) =			89,550

Value (₦) after depreciation by straight line depreciation method = ₦83,685.

GM = TR – TVC

= 9099123.23 – 3032456

GM = ₦6066667.23

Net Return (NR) = GM – TFC

= 6066667.23 – 83,685

= ₦5977117.23

Gain per ₦1 investment:

$$= \frac{NR}{TC}$$

$$TC = TVC + TFC$$

$$= \frac{5977117.23}{3082254} = ₦1.94$$

Costs and Returns from Farmers Using Organic Manure and Inorganic Manure

Table 4.16: Returns and Costs from Users of Organic Manure and inorganic

Returns

Item	**Unit**	**Qtty.**	**Price/ Unit (₦)**	**Amount (₦)**
Ugi (Pumpkin leaf)	Bundle(320g)	11007	50	169600.00
Green (Spinach)	Bundle (400g)	5549	30	64221.00
Melon	Bucket(2kg)	281	300	35500.00
Maize	Basket(50 cubs)	372	1,200	417500.00
Seedling sales	Nursery basket(25 stands/basket)	2096	150	257200.00
Nursery bed sales	Bed(1.3 x 6m)	227	1,500	246700.00
Ugi head (Pumpkin fruit)	Kg	19712	25	251500.00
Yellow Pepper	Kg	8509	700	5956300.00
Total Revenue (TR)		=		7398521

Table 4.17 Variable Costs

Item	Unit	Qtty.	Price/ Unit (₦)	Amount (₦)
Seed	Kg	10	350	17500
Seedling	Nursery baske	48	150	60000
Tillage	Ha	130	1,500	195000
Nursery bed making	Bed (1.3x6m)	5086	30	152580
Mound making	Ha	130	4,000	520000
Water	Litre	70755	2.8	198,114
Fertilizer	Kg	8662	110	952820
Weeding	Ha	130	2500 x 2	650000
Organic manure	Kg	32475	15	487125
Chemical spray	Ha	80	600	48000
Harvesting	50 kg	6440	30	193200
Transport	-	-	-	65000
Total Variable Cost (TVC)		=		3539339

Table 4.18 Fixed Cost on Equipment

Item	Quantity	Unit Cost (₦)	Amount (₦)
Hoe	118	150	17700
Cutlass	30	350	10500
Watering can	109	150	16350
Water pump	3	6000	18000
Wheelbarrow	15	1,800	27000
Total Fixed Cost (TFC)	=		89550

Value (₦) after depreciation by straight line depreciation method = ₦ 83,685

GM = TR – TC

7398521 – 3539339

GM = ₦3628889

Net Return (NR) = GM – TFC

3628889 – 83685

NR = ₦3769632

Gain per ₦1 investment:

$\frac{NR}{TC}$, TC = TVC + TFC

$= \frac{3769632}{3628889} =$ ₦1.04

Tables 4.15 and 4.18 above x-rayed the costs from the two yellow pepper farms to the target respondents. From the tables, it was observed that inorganic fertilizer had the highest cost in the group using both organic manure and inorganic manure as it was very costly when available (Adeniyi, 2008; Alimi et al, 2006). The other group of farmers – users of organic manure only incurred their highest cost on weeding. This is in line with apriori expectation as organic manure supported the rapid growth of weeds (Alimi *et al.,* 2006,Kupper,2003). Also, same apriori expectation was held on labour cost for harvesting as organic manure led to increased yield through extended harvest period (Olufunke & Bradford, 2001).

In general, the field survey result showed that cost items in both groups of farmers were almost the same as they produced under the same condition and environment. Sources of returns were the same for both groups although there were differences in quantities of output from the same area of land under the same production condition. The group using both organic manure and inorganic fertilizer had a shorter harvest period with a yield reduction in some minor crops which were affected by excessive nitrogen in the soil (e.g. melon). In the other group using organic manure only, growth and maturity were relatively slower, more flowering, fruiting continuous, steady and prolonged harvest ensured steady inflow of income even towards the off-season. Inorganically fertilized soils produced crops with rapid growth but reduced fruiting (Asawalam *et al.,* 2007). The returns from the minor crops in both farms aided a long way in offsetting the production cost. Some of them also acted as cover crops, controlling weed and supplying nutrient to the farm (e.g. melon).

However, the wide difference in the net returns and return per Naira investment of N5977117.23 and ₦1.94 respectively for users of organic manure only and ₦3769632 and ₦1.04 respectively for users of both organic and inorganic manures enlightened research interest on exploring some avenues for organic manure production for farmers' use.

Table 4.19: Student T-test

Variable	N	Mean (₦)		Std. (₦)	T	2-tailed
Both organic and inorganic	60	42788.60	±	42154.11		
					-5.844	0.000
Organic only	60	75336.32	±	9167.41		

The t-test table above showed that the result was significant at less than 1% (0.000) level of probability. This is a confirmatory test that there was significant difference between the net return made by the two groups of farmers under study. This difference may have occurred due to the extra cost imposed on the second group of farmers from inorganic fertilizer purchase as well as reduced revenue due to short harvest period characterized by inorganically managed farms. With this result the second hypothesis-2HO was rejected and the alternative accepted since there is a significant difference between the net returns of the two groups of farmers.

CHAPTER FIVE

SUMMARY, RECOMMENDATIONS AND CONCLUSION

5.1 Summary

This study was designed to bridge the empirical gap between organic manure use and organic waste re-use in yellow pepper production. This is with a view to making use of a relatively least cost resource in crop (yellow pepper) production and restoration of environmental quality. The research was also underpinned by the consistent price increase in external input use in crop production. Furthermore, the high cost and scarcity of chemical fertilizer in particular exerted pressure on the price of poultry manure as the major alternative source of soil nutrient (organic manure) to crops in the study area. Thus the quest for farmers' willingness to pay for organic manure processed from organic waste was geared towards ensuring steady supply of organic manure at lower cost as well as ensuring ecological sustainability. Organic manure use had the advantage of being relatively cheaper, readily available and accessible to the resource poor farmers. Socially it had the potential of increasing land quality on the longrun. Converting organic waste to organic manure will release such lands formally used as refuse dumping grounds for agricultural production.

Yellow pepper farmers in Nsukka Local Government Area were the target respondents for the research. Purposive and random sampling techniques were employed in the selection of the respondents. Primary and secondary data were used in providing the needed information. Data collected were analysed with descriptive statistics, contingent valuation method (CVM), partial budget analysis and student t-test.

It was found that similar to other vegetables, yellow pepper production was practiced predominantly by women (63%). Seventy nine (79%) percent of the yellow pepper farmers maintained their soil using organic manure, while 93 percent of this organic manure was sourced from poultry manure. The literacy level of the respondents was high enough (80%) that they could react positively and constructively to innovations. Majority of the yellow pepper farmers (82%) were within the productive age of 31-50 years. The two probit models- willingness to use and willingness to pay under the contigent valuation method were all statistically significant at 5 percent level of probability. An average willingness to pay amount of ₦800 per 100kg bag of organic manure generated from biodegradable organic waste was elicited from the respondents. This would, however, be relatively cheaper compared to a price range of between ₦1500 and ₦1800 per 100kg bag of poultry manure and ₦5500 per100kg bag of chemical fertilizer.

The student t-test showed that there was a significant difference between the net returns of the two groups of the farmers. Based on analytical findings, the two null hypotheses were rejected and the alternatives accepted.

5.2 Recommendation

Based on the findings of this research study, the following recommendations are made:

- Yield was a major factor that motivated these farmers to adhere to the use of organic manure, therefore, there is need to ensure its availability as and when due by diversifying the source of organic manure. This could be achieved through the conversion of biodegradable waste to manure.
- Investment in the production of organic manure from waste should involve both government and individual participation in order to supply input to farmers at a lower cost. This will also help to reduce level of monopoly by

the poultry industry which is the major supplier of organic manure in the study area.

- Use of organic manure may perhaps be as profitable in other food crops as it is in vegetable production, it is therefore, recommended for use in the production of other food crops.
- It is necessary to empower women to be able to explore and avail themselves the golden opportunity of utilizing improved technologies. This is very important because women's vulnerability to poverty manifested in the research result as they were willing to use (+ve coefficient in the willingness to use model), but not willing to pay (-ve coefficient in the WTP model) for organic manure.

Finally, policy makers should gear policy direction towards utilizing our indigenous resources which have least cost advantage in crop production so that there will be a trade-off between economic and social benefits in terms of environmental degradation.

5.3 Conclusion

This study showed that every yellow pepper farmer in the study area was aware of the detrimental effects of soil nutrient depletion, hence soil maintenance was carried out simultaneously with crop production.The use of organic manure as the major soil amendment was perceived very important by the respondent farmers. However, it was found that weed re-growth had been the major disadvantage in the use of organic manure for crop production. Yellow pepper farmers fall into two categories: those using organic manure only and those using organic manure supplemented with chemical fertilizer. The use of organic manure only yielded a greater return of ₦ 1.94K per ₦ investment as against ₦ 1.04K return per ₦ investment from using both organic and chemical fertilize.

REFERENCES

Adamu, S.U., S.G. Ado, P.G. Eruofor and J.D. Olawrewaju (1994). Variations in the fruit of Pepper. *Nigerian Journal of Horticultural Sciences Vol* 2: 10-14.

Adeniyi, S. (2008). Farmers can gain more from using organic fertilizer. http://www.tribune.com.ng/16012008/agric.htm(13/7/08)

Adetula, and S.A. Olakojo (2006). Genetic Characterization and Evaluation of some Pepper Accessions Capsicum Frutescent (L): The Nigerian 'Shombo' collection: American-Eurasian. *Journal of Agriculture and Environmental Science.* **1**(3): 273-281. IDOSI Publications.

Agboola, A.A. and G. Adeoye (1990). Strategies for increased reliance on bio fertilization in crop production in Nigeria. *Paper presented at National workshop on soil management,* Ibadan Nigeria Dec. 1990.

Agunwamba, J.C. (1998). "Solid Waste Management in Nigeria; Problems and issues" Journal of Environmental Management Vol 22 No 6: 849-853. www.springerlink.com/index/IRUS8FVQ965RDW4.pdf.(11/09/08)

Ajayi, A.R. and C. N. Eneje (1998), The production pattern of Nsukka Yellow Pepper Amongst Rural Farmers in Enugu State Nigeria. *Nigerian Journal of Horticultural Science (NJHS).*Vol. 3 pp33-43

Akobundu, I. O., A. O. Isichie, A.O. Meregini, F. Ekelem, C. W. Agyak(wa, E.S. Tucker and K. Mulongoy (1993), An analysis of vegetation as a resource in southeastern Nigeria. mulongoy K. and R. Merckx (ed.) A Wiley-Sayce Co-Publication.

Alegbejo, M. D. and F. C. Orakwe (2001), Characteristics of some pepper cultivar commonly grown in Nigeria. Apsjournals.apsnet.org/doi/pdf/10.1094/PHYTO-95-0227.(20/08/08)

Alimi, T. (2002). Economic rationale of integration in poultry production system. *Lesotho Social Science Review*. Vol 7 No2.

Alimi, T., O.C. Ajewole, O.O., Olubode-Awosola and E.O. Idowu (2006). Economic rationale of Commercial Organic fertilizer technology in vegetable production in Osun State of Nigeria http://www.horticultureworld.net/Economic. (7/07/08)

Andrews, S.S., D. L., Karlen and J.P. Mitchell (2002), A comparison of soil quality indexing methods for vegetation production system in Northern California. Agriculture, Ecosystem and Environment.

Arene C.J. and G.I.O. Mbata (2008). Determinants of p rofitability and Willingness to Pay for Metropolitan Waste –Use in Urban Agriculture of the Federal Capital Territory, Abuja, Nigeria. *Journal of Tropical Agriculture, Food, Environment and Extension. Vol No 1 pp 41-46*

Asawalam, E. F., K.C. Emeasor and J.C. Okezie (2007). Control of Pests of some capsicum species (Pepper) cultivars using soil amendments in Umudike-Nigeria. *Electronic Journal of Environmental, Agricultural and Food Chemistry (EJEAFChe)*

Bamire, A.S. and V.M Manyong (2003).Balanced Nutrient Management for Cropping System in the Tropics:From concept to practice. http://www.sciencedirect.com/science? (20/05/08)

Bamire, A.S. and B. J. Amujoyegbe (2003), Economics of Poultry manure utilization in land quality improvement among Integrated Poultry-Maize farmers in Southeastern Nigeria http//www.haworthpress.com(20/05/08)

Bankole, P.O. (2004). "Nigeria Environmental Profile: Natural Environmental outlook". United Nations Environmental Program. hhp://www.unep.net/profile/index.cfm?tab=1000&countrycode=Ng. (20/05/08)

Benin, S. (2005), Policies and Programs Affecting Land Management Practices, input use and productivity in the Highlands of Ambava Region Ethiopia. Washington D.C. International Food Policy Research Institute.

Bosland, P.W. and E.J. Votava (1999), Peppers: Vegetable and spice Capsicums CABI Publishing.

Busby, R.R., L. Gebhart and H.A. Torbert (2006), Effects of an uncomposted municipal waste processing by-product on prarie grass establishment *Agronomy Journal* Vol 98: 1073-1080. Agron.scijournals.org/cgi/content/full/98/4/1073 (13/05/08)

Cave, B. (2001). Municipal waste Management Strategy: The health of our children HMSO, London. www.wastekeysheets.net (20/05/08)

CGIAR (1988). (Consultative Group on International Agricultural Research), Sustainable Agricultural production: Implication for International Agricultural Research. Washington D.C. USA.

Christanty, L. (1986), Shifting Cultivation and Tropical Soils. Pattern, Problems and Possible improvement in Traditional Agriculture in South east Asia. A human Ecology perspective, Colo: Westview.

Chukwuone, N.A. and Okorji, C.E. (2008). Willingness to Pay for Systematic Management of Community Forests for Conservation of non-Timber forest products in Nigeria's Rainforest Region in Economics of Poverty, Environment and Natural Resources Use. Springer Science + Business Media, 117-137. www.sprngerlink.com/index/j7641527q0304884.pdf. (15/01/2010).

Corsini, P.C. (1991), Impact of Soil degradation on crop production in Brazil. Soil Tillage Research. linkinghub.elsevier.com/retrieve/pii/0167198793900231.(13/08/08)

Dewitt, J. (2002). Understanding the potential benefits of a crop rotation system; Lowa state University US Environmental Protection Agency. http://www.extension.iastate.edu/publications/NMEP5/Pdf.(06/04/07)

DFID (Department for International Development (2002), Better Livelihood for poor people: The role of agriculture. Issues. Fuller-Davis Ltd., London, U.K.

Douglas, (1993). Sustainable use of agricultural soil: Issues and options. Centre for Environment and Development, Berne.

Dyson, T. (1996). Population and Food: Global trends and future prospect, London Routledge. Earthscan Publications, London.

Eboh, E.C (1990).Agricultural Intensification and factor productivity in Anambra state of Nigeria: A case study .A Ph .D thesis submitted to the Department of Agricultural Economics Faculty of Agriculture, UNN.

Echezona , B. C. (2006). Selection of Pepper Cultivars (*Capsicum* spp.) for the Control of *bruchids calloSbruchus maculates* (F). on stored Cowpea *Vigna unguiculata* (L.) walp) Seeds. African *Journal of Biotechnology* Vol. 5, No. 8 April, 2006.

Ehui, S. K. and D.S.C. Spencer. (1990). Indices for measuring the sustainability and economic viability of farming systems, IITA Ibadan Nigeria.

Enete, A. A. and A. I. Achike (2008). cash income diversification in rural smallholder cassava producing households of Nigeria. *Tropicultura*,2008,vol. 26 No 3 pp159-163.

Fakoya, E. O. (2007). Utilization of Crop-Livestock Production system for sustainable Agriculture in Oyo State Nigeria www.Krepublishers. Com.

Fakoya, E.O. (2002). "Assessment of Livestock Production system based on crop residues and legumes in humid zones of Nigeria". *proceedings of the Nigeria society for Annual Production.* 27th Annual NASP Conference Akure Pp. 375-376.

FAO (1997), "Food and Agricultural Organisation integrating Crops and Livestock in West Africa" Animal Production Health Paper No 43 Rome, Italy.

FAO (1999), World Production of Animal Protein and need for new Approach FAO Rome. www. Naweb.iaea.org/nafa/aph/stories/stop-stories.html

FAO (2000), Soil Conservation and Management for small farm-Experiences. FAO Rome.http://www.organic-world.net/statistics-fao.html (10/12/07)

FAO (2001).Soil Fertility Management in Support of Food Security in Sub-Saharan Africa. Food and Agricultural Organisation of the United Nations. Rome.

FAO (2003), Women, Land tenure and food security http://www.fao.org/DOCREP/x0171e/x017107.htm. (15/08/07)

Field, B.C. (1997), Environmental Economics, An introduction. McGraw-Hill.

Frankenberger, J.R. (2006), Best Environmental Management Practices: Land Application of manure and Environmentally Sensitive Field Characteristics. A discussion paper 2005.Michigan State University

Frederic, F.(2001).Organic farming in Canada: an overview. http://attra.ncat.org/attra-pub/organiccrop.html(15/07/07)

Gail, F. (1997). UC Sustainable Agriculture Research and Education Programme www.sarep.ucdavis.edu/concept/htm. (13/08/08)

Garrod, G.D. and K.G. Wills (1994). "Valuing biodiversity and nature conservation at a local level". www.fao.org/docrep/v5890e 10.html(20/05/08).

Gati, F. (1982). Use of organic materials as soil amendment. In: Organic materials and soil Productivity in the Near East. *FAO Soil Bulletin* No **45**(89): Rome.

Greg, E. (1996). Effects of organic and chemical inputs in soil quality. *Crop and Environmental News.* Mimeo.

Greenland, H. Nabban, (2001). Soil fertility management in support of food security in sub-Saharan Africa. In: Food and Agricultural Organisation (FAO) 2001.

Heckman, J. (2005).History of Organic Farming www.westonaprice.org/farming/history-organicfarming.htm.(15/07/07)

Idowu, A. (2008). Nigerian Tribune-Agric. http://www.tribune.com.ng/16012008/asgric.htm.(13/08/08)

IFDC (2007). International Centre for Soil Fertility. www.ifdc.org/new-layout/programs/Research-market-Development/index.html(15/05/08)

IFAD (2000). International Fund for Agricultural Development: Enabling the rural poor to overcome poverty in Nigeria. www.ifad.org(15/05/08)

IITA (1992), "Alley farming Research Turns to the farmers". *Annual Report IITA,* Ibadan, Nigeria.

ILCA 91998), Annual Report of International Livestock centre for Africa 1998 Pp.95-97.

Kim, P. (1998). Community based waste Management for Environmental Management and Income Generation in low Income Areas: A case study of Nairobi Kenya www.cityfarmer.org/Nirobicompost.html.(20/05/08)

Knowler, D.J. (2004). Land Degradation and Development: The economics of soil Productivity, Local national and global perspectives. John Wiley & sons Ltd.

Kuepper G. and L. Gegner (2004), Fundamentals of Sustainable Agriculture, an organic crop production overview. ATTRA Publications #1P170 http://attra.ncat.org/attra-pub/organicrop.html (20/05/08)

Lal, R. (1987). Managing soils of Sub-Saharan Africa Science Vol 236: 1069-1071.
www.unu.edu/unupressbooks/uu 27seOg.html.(20/05/08)

Lal, R. and B. A. Stewart (1990), Soil degradation: A global threat. Advanced soil science Vol. 11. Spinger-verlag, New York.

Lal, R. (1989), Effects of Long term fertilization, manuring and liming of an alfisol in maize; wheat and soil properties. *Journal of Indian Society Soil Science* Vol. **37**: 717-224.

Lipsey, R. G. and K.A. Chrystal (1999). Principles of Economics in Oji K.O. (2002). Basic Principles of Economics for Agricultural projects and Policy Analysis. Price Publishers, Nsukka, Nigeria

Lipsey, R. G. and K.A. Chrystal (1999), Principles of Economics 9th Ed. Oxford University Press New York.

Lynam, J.K. & Herdt, R.W. (1989). Is agricultural sustainability a useful concept? Earthscan Publications. *linkinghub.elsevier.com/retrieve/pii/0308521X9500011S.* (20/05/08).

Lory, J.A., R. Massey and J. Brad (2006), using Manure as a fertilizer www.epa.gov/msbasin/taskfroce/2006symposia/8manurelory.Pdf.(20/05/08)

Mangala R. (2005).Organic Farming:Potentials and Strategies.http://www.icar.org.in/dgspmr/03062005.htm(20/05/08)

Mclellan, B. (2006). Enhancing Crop Production and Soil Resources http://www.cooknjaes.rutgers.edu/contact/webmaster.asp.(20/05/08)

Mercado, R. A. (2006). Solid waste management cum organic fertilizer production central Luzon State University www.neda.gov.ph/…/byRegionlist.asp?...%20Central%20Luzon

Messiaen, C.M. (1992). The tropical vegetable Garden. Macmillan (London). www.cababstractsplus..org/abstrcts/Abstrac.aspx?Ac No 19750331636=

Mitchel, C. and R.T. Carson (1989). Using surveys to value Public Goods: The contingent valuation method. Washington D.C. Resources for the future. www.questia.com/pmm.qst?a = 0&d=59144224(07/06/08)

Mkwambisi, D. (2005). Urban Agriculture and waste Management in Developing Countries. www.david-mkwambisi.com/Home/public-forum/urban_agriculture_and_wastemanagement.aspx(15/07/07)

Mkwambisi, D. (2008). Policy implication of urban Agriculture in Malawi www.nyasatimes.com/columns/756.htm. (15/07/07)

Mulonogy, K. (1986). "Alley Farming: A promising Management of Nitrogen-fixing trees for sustained food production in Tropical Africa" Paper presented at IDRO-NFTA Workshop on Nitrogen Trees, Dakar, Senega.

NEEDS (2004). National Economic Empowerment and Development Strategies: The Development Challenges Facing Nigeria. national Planning Commission, Abuja Nigeria.

Nill, D. and E. Nill (1993). Soil organic matter Dynamics and sustainability of Tropical Agriculture. A Wiley-Sayce Co-Publication.

Nwagbo E.C. (2000), Agricultural Policy in Nigeria: Challenges of the 21st Century. *Journal of Tropical Agriculture food, Environment and Extension.* Vol. 1, No. 1.

Nwajiuba and Akinsanmi (2002). Organic manure use Among small holders in Rainforest of Southeast Nigeria. www.tropentag.de/2002/asbtracts/datashows/267.pdf.(13/08/08)

Nweze, N. J. (2002). Agricultural Production Economics. An Introduction Text. Ap Express Publishers Limited 3 Obollo Road, Nsukka. Nigeria.

Obatolu, C.R. (1990). An evaluation of five different sources of organic materials for their manurial l properties. Paper presented at 18th Annual Conference of the Soil Science Society of Nigeria, Maiduguri, Nigeria. November 1990.

Ohaeri,A.A (2000). The Economics of Soil Fertility Management Practices Among Small-Scale Farmers in Orumba South L.G.A OF Anambra State.An unpublished M. Sc Thesis Presented to the Department of Agricultural Economics, University of Nigeria Nsukka.

Ojameruaye, E. (2004). The Essentials of sustainable Development of Urobo land in Nigeria: A paper presented at the 11th Annual Convection of UNANA, Newark International Airport Marriot Hotel, New Jersey Sept. 4th 2004.

Olayide, S.O., O, Ogunfowora, S. M., Essang and F.S. Idachaba (1981). Elements of Rural Economics University Press Publishing House UI, Nigeria.

Olembo, R.J. (1991). Fertilization: An Overview in: Intensification of Agriculture and the Environment in Tropical Area. Dellere R and Symoens J.J. (ed.) www.fao.org/wairdocs/lead/x6123e/e/x6123e.08.htm. (13/06/07).

Olutawosin, G. A. and G.O. Olaniyan. (2001). Planning sustainable land management system for continuous cropping production in Nigeria: An Ecosystem approach. *Paper presented at Eco-farming Workshop* NECOFA-Nigeria, Dec. 10-21.

Onwubuya E. A., E. O. Okporie and M. G. Nenna (2009). Nsukka yellow pepper processing and preservation techniques among women farmers in Enugu State. *African Journal of Agricultural Research*.Vol 4 No 9 pp859-863.September 2009. http://www.academicjournals.org/AJAR (13/05/10)

Pam, P. (2008).Waste to Resource. Waste management Association of Australia, Centre for organic and Resource Enterprises. http://www.bfa.com.au/index.asp?(18/007/08)

Peet, M. (1996). Sustainable Practices for Vegetable Production in the South America. attar.ncat.org>master Publication list.

Purseglove, J.W. (1981), Pepper Morphology and Uses: *In Encyclopaedia of food science, food technology and induction*. Academy Press Pp. 456.

Purseglove, J.W. (1997). Tropical crop dicotyledons. Longman Greens & Co., London). www.tnau.ac.in/Pg/syll/PhdSST.html.

Ragan, G.(2004).Agriculture and Rural Development:New Composting Option the Horizon. http://www.agric.gov.ab.ca/app21/rtw/search.jsp(05/07/07)

Schulz, S. G., Tian, B. Oyewole and S. Baka (2003). Rice Mill Waste. http://www.sciencedirect.com. (13/05/08)

Scoones, I.R., R.C. Toulmin (1996). Sustaining the soil: Indigenous soil and water conservation in Africa. Earthsan, London 260pp. linkinghub.elsevier.com/retrieve/pii/S0143622897872268. (20/05/08)

Senjobi, B. A., O. Odumaiya, and D. Sosanya. (2000), Combating the land degradation hazard. A key to sustainable farming*: Paper presented to Eco-farming workshop,* NECOFA-NIGERIA Dec. 20-21.

Sevier, B. J. and W.S. Lee. (2003), Adoption Trends and Attitudes towards Precision Agriculture in Florida Citrus: Preliminary Results from a Citrus Producer Survey. American Society of Agricultural engineers.

Srivastrava, O.P. (1989). Role of Organic Matter in Soil fertility. *Indian Journal of Agricultural Chemistry (260).*

Sussan, O. and I. Peter (1991), Environmental Resources and Conservation. Cambridge University Press.

Swarup, A. (1987), Effects of pre-submergence and green maturing sebstania aculeate on nutrition and yield of wetland rice on an acidic soil. *Journal of Biology and Fertility of Soil Vol* **5**: pp203-205.

Tiffen, M.M.and M.F. Gichuki (1994), More People less erosion: Environmental recovery in Kenya. Chichester John Willey and Sons.

Torbert, H.A. H. Rogers and T.T. Way (2005), Soil Application of Agricultural Waste to Improve Crop production and environmental Quality. USDA Agric Research Service ;Project Annual Report 2005 http://ww.appropedia.org/integrated. (13/07/08)

Udziela, M.K. and Bennett, L.L. (1996). Contingent Valuation of Urban Salt Marsh restoration. *A research paper presented at the Yale school of forestry and Environmental studies.* http://environment.yale.edu/documents/downloads/09/100udzielabennett.pdf.(15/07/08).

Uguru, M. I. (1999). Location effects on the growth yield and flavour expression of Nsuka Yellor Pepper. *Journal of Applied Chemistry and Agricultural Research* Vol. 6: 84-87.

USDA (2002), Organic Crop Production Overview http:ww/attar.ncat.org/attar-pub/organicrop. htm. www.ers.usda.gov/Data/Organic (13/08/08).

USDA (2005), Soil Application of Agricultural Waste to Improve Crop Production system and environmental Quality. www.ars.usda.gov/research/projects/projects.htm?accn_no (13/07/07).

Utomakili, J.B. and G.O.I. Edekie (1998). Constraint to Tomato production in Edo State-Implication for food sufficiency. www.bib.fsagx.ac.be/tropicultura/text/v22nsp.pdf . (12/09/08).

Vanlauwa, B., J. Diels and N. Sanginga (2002). Integrated Plant nutrient Management in Sub-Saharan Africa. www.tropentag.de/2002/abstracts/datashows/267.Pdf.(12/09/08)

VASATWiki (2007).Shifting Cultivation
http://en.wikipedia.org/wiki/shifting_cultivation
http://vasatwiki.icrisat.org/index.(12/09/08)

Verdoft and Kamon (1982).Economics of Tomato Production. www.hightunnels.org/.../TomatoProduction/versus.htm.(06/09/07)

Vision 2010 Committee.(2003). "Ecology and the Environment: Protect our environment for our unborn children." Vision 2010 Report. http://www.vision2010.org/vision- 2010/ecology.htm(12/09/08)

Walling, E. A. Walston, E.Warren, B. Washay and E. Wilhelm (2004). Municipal solid waste management in Developing countries: Nigeria a case study.

WCED(1987).World Commission on Environment and Development Our Common Future. Oxford University press U .K

Westerman, P.W. & Bicudo, J.R. (2003). Long-term effects of Organic amendments on soil fertility. www.agronomyjournal.org/10.1051/agro/2009040. (13/05/08).

World Bank (1992). Development and the Environment. World Development Report 1992. World bank, Washington D.C.

World Bank. (2002). Nigeria Women in Agriculture http://www.worldbank.org/wbi/sourcebook/sb0212.htm (15/07/07)

Worldbank, (2006). Sustainable Land Management: Challenges, Opportunities and Trade-offs. The Worldbank Washington D.C.

Yoon, J.Y., S.K. Green, A.J. Tshanz, S.C.S. Tsou and L.C. Chenge (1989). Pepper Improvement for the tropics, problems and approach. In: Tomato and Pepper Production in the tropics Asian Vegetable research and development centre. AVRDC Shantine Taiwan.

Young, A.M. (1998). Land resources: Now and future, Cambridge, U.K. Cambridge University Press.

APPENDIX

UNIVERSITY OF NIGERIA, NSUKKA
DEPARTMENT OF AGRICULTURAL ECONOMICS
FACULTY OF AGRICULTURE

Research Questionnaire on Economics of Organic Manure use in Yellow Pepper Production in Nsukka Local Government Area

Please tick (√) or fill in where appropriate

(A) Data on socio-economic characteristics of the farmers

1. Name of your village …………………………………………………
2. Sex: Male ☐ Female ☐
3. Age of a farmer (yrs): (a) 20-30 (b) 31 – 40 (c) 41-50 (d) 51 and above
4. Marital status; (a) Married (b) Single (c) Divorced (d) Widow/Widower
5. Household size: (a) 1-3 (b) 4-6(c)7-9 (d) 10 and above
6. No of Children …………………………………………………
7. No of dependents ……………………………………………

8. Age distribution of children and dependents

Age	**Children**	**Dependents**
0 – 10		
11 – 18		
19 – 26		
Above 26		

9. Duration of formal education (yrs): (a) Zero (b)1-6 (c)7-12 (d) 13-17What is your primary occupation? (a) Full-time farming (b) part-time farming

10. What is your off –farm income in a period of one year-----------------------------

12. What is the major cash crop produced in your village? (a) Cassava (b)Yam (c)Maize (d) Yellow pepper (e) Others specify

13. If you are a yellow pepper farmer, for how long have you been producing the crop? (a) 1-5 (b) 6-10 (c) 11-15 (d)16-20

14. What is the average land ownership in your village? (a) 1ha (b) 2ha (c) 3ha (d) 4ha

15. What area of your land do you put into yellow pepper production? (a) Less than 1ha (b) 1-1.5ha (c) 1.6 – 2ha (d) 2.1 – 2.5ha (e) 2.6 – 3.0ha (f) above 3ha

(B)$_1$ SOIL MAINTENANCE AWARENESS

Do you maintain your soil at all? (a) Yes [ ] (b) [ ]

2. If yes, what are the methods you adopt in maintaining your soil.
   (a) Use of artificial fertilizer (b) Use of organic manure
   (c) Other methods
   i) ---
   ii) --
   iii) --

3. If organic manure, what are the sources of organic manure to your farm? (a)Compositing (b) Poultry manure (c) Livestock bedding (d) household waste generated in the family (e) Public organic waste from refuse dumps

4. Are you aware that organic manure is generated from the organic wastes at the refuse dumps? (a) Yes [ ] (b) No [ ]

5. If yes, have you been using it in your farm (a) Yes [ ] (b) No [ ]

(B)$_2$ FACTORS THAT MOTIVATE THE USE OF ORGANIC MANURE

What are your reasons for resorting to organic manure instead of commercial inorganic fertilizers?

		Remarks	
	Reasons	**Yes**	**No**
1	Income of the farmer		
2	Improves yield of crop		
3	Readily available		
4	Area of land under cultivation		
5	Farming experience		
6	Occupation of the respondent		
7	Inorganic fertilizer degrades the soil		
8	Sex of the farmer		
9	Age of the farmer		
	Others specify: (i) ------------------------------------ (ii) ------------------------------------		

(C) WILLINGNESS TO PAY FOR PROCESSED ORGANIC WASTE

Market Scenario

Bearing in mind the scarcity and high cost of inorganic manure, rise in the price of poultry manure and the importance of these manure in your farm, would you like to make alternative arrangement to ensure steady supply of organic manure to your farm?

(a) Yes [ ] (b) No [ ]

Assuming an industry is set up in your village to process and convert the organic wastes being dumped by ESWAMA to useful resources (your organic manure)

1. Will you be willing to use them (a) Yes [ ] (b) No [ ]

As inorganic manure costs #5500 per 50kg, poultry manure #1,500 per 100kg, now if yes from 1(a) above,

2. Will you be willing to pay; #600 /#800/#1000 for 100kg of this bagged organic manure.

(E) COSTS AND RETURNS TO ORGANIC FARMS AND CONVECTIONAL FARMS

Tools	**Quantity**	**Unit price(₦)**	**Total price (₦)**
Hoe			
Cutlass			
Watering can			
Water pump			
Wheelbarrow			

Sources of Variable Costs	**Amount (₦)**	**Organic Manure**	**Organic +Inorganic Manure**

Sources of Returns	Amount (₦)	Organic Manure	Organic+ Inorganic Manure