Dissertation

By

AZUBIKE, IKECHUKWU SAMUEL

Department of Sociology,
Faculty of the Social Sciences,
University of Ibadan,
Ibadan, Nigeria.

Rural Livelihoods in Zimbabwe: Impact of Remittances from South Africa

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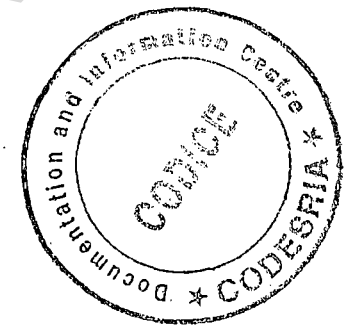
Année académique :

FEBRUARY, 2008

ECONOMIC ANALYSIS OF PRODUCTION AND UTILIZATION OF ORGANIC FERTILIZER: A CASE STUDY OF MARGARET ORGANIC FERTILIZER COMPANY, IMO STATE, NIGERIA.

THESIS SUBMITTED IN PARTIAL FUFILLMENT FOR THE AWARD OF MASTER OF SCIENCE DEGREE (M.Sc.) AGRICULTURAL ECONOMICS IN THE DEPARTMENT OF AGRICULTURAL ECONOMICS, EXTENSION AND RURAL DEVELOPMENT



BY

AZUBIKE, IKECHUKWU SAMUEL

03/M.Sc./0458

FEBRUARY, 2008

CERTIFICATION

Mr. Azubike Ikechukwu Samuel, a postgraduate student in the department of Agricultural Economics, Extension and Rural Development with registration number 03/M.Sc./0458 has satisfactorily completed the requirement for the degree of M.Sc. in Agricultural Economics. The work embodied in this Thesis is original and has not been submitted in part or in full for any other Diploma or Degree of this or any other university. It is hereby certified that this Thesis is acceptable in partial fulfillment for the award of a Master of Science degree of the Imo State University.

Professor C.U. Nwajuiba
Supervisor — Date 07/04/08

Mr. C.S. Nwosu.
Head of Department,
Department of Agricultural Economics, — Date 29/02/08

Professor F.N. Madubuike
Dean,
Faculty of Agriculture and Veterinary Medicine — Date

External Examiner — Date 07/04/08

DEDICATION

This work is dedicated to my beloved Parents; Mr. and Mrs. J.O. Azubike

ACKNOWLEDGEMENT

I wish to acknowledge the invaluable assistance and guidance of my Supervisor, Prof. C.U. Nwajiuba in making this work a reality. I am also grateful to the head of department of Agricultural Economics, Extension and Rural Development, Mr. C. S. Nwosu, for his contribution in the way of correction to this work.

My sincere gratitude goes to Mr. Nwankwo O.O., Mr. Onubogu G. and Mrs. Munonye Jane who helped by way of correction in making this work a reality. I also wish to thank Miss Rose Alozie who produced the typed scripts.

I also wish to acknowledge the financial support offered by the Council for the Development of Social Science Research (CODESRIA) to this work. This was made possible through their programme for Small Grants for Thesis Writing.

I also wish to thank my parents, Mr. and Mrs. J.O. Azubike, for their support and encouragement throughout the period of the study. My gratitude also goes to Miss Magdalene Chika for her support and encouragement.

Finally, I am most grateful and thankful to Almighty God for His mercies, blessings and protection throughout the period of the study.

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ABSTRACT

The study examined the economic analysis of the production and utilization of organic fertilizer in Imo State, Nigeria. The production aspect is a case study of Margaret Organic Fertilizer Company, Ahiara, in Ahiazu Mbaise local government araea of Imo State while the utilization aspect focused on farmers in Imo State. Specifically the study examined the following; costs and returns of production of organic fertilizer, costs and returns of utilization of organic fertilizer, factors that affect utilization of organic fertilizer and factors that affect output of farms. A list comprised 48 farmers who utilize organic fertilizer produced by Margaret Organic Fertilizer Company was obtained from the company and 32 farmers were identified based on the location of their farms from a survey of two randomly selected agricultural zones of Imo State. Primary data were collected with the assistance of the production manager of Margaret Organic fertilizer company, Ahiara while secondary data were collected from National Root Crops Research Institute, Umudike, Nigeria and other related Institutions. Descriptive statistics, cost return analysis and multiple regressions were used in data analysis. Findings showed a net return of ₦1,142,000.00 in the production of 240 tons of organic fertilizer in one year by Margaret Organic fertilizer Company. This showed that the production of Organic fertilizer is profitable. Results also showed a net return of ₦ 57,156.20 in the utilization of organic fertilizer by farmers in a cassava/yam crop based system in one year per hectare of farmland. This showed that the utilization of organic fertilizer is profitable. Farm income and area of farmland were found to be significant and had positive relationship with the utilization of organic fertilizer with an R^2 of 0.959. Area of farmland cropped, amount of credit available to farmers and quantity of organic fertilizer used showed a significant positive relationship with the output of farmers, and had an R^2 of 0.988. The study recommended the increased production of organic fertilizer and its adoption for use by farmers owing to its low cost and profitability of farms when organic fertilizer is utilized.

CHAPTER ONE
INTRODUCTION

1.1 Background Information

Organic fertilizers are composed mainly of wastes and residues of plant and animal sources. It is a source of nutrients for plants and the carbon-containing compounds are food for small animals and micro organisms (Cooke, 1972). Important sources include farmyard manure, rural and urban compost, green manure, fodder crops, mulch, night soil and urban sewage (Sobulo, 1988).

Organic fertilizers are known to supply nutrients to plants and also improve soil physical conditions for better growth (Marthan, 1978). Organic fertilizers often improve the structure of soils when the waste products of animals and micro-organisms cement soil particles together. These structural improvements increase the amount of water useful to crops that soil can hold. They also improve aeration and drainage and encourage good root growth by providing enough pores of the right sizes and preventing the soil from becoming too rigid when dry or completely waterlogged when wet (Cooke, 1972).

Organic fertilizers rot in the soil and thus give back to the soil; the minerals they contain. Plants growing on soils rich in organic manure resist diseases, pest attack and drought as they recover faster than plants growing on poor soils (Dupriez and De leener, 1988).

Generally, farmers will be prepared to adopt a practice including organic fertilizing practices, where the ratio of perceived costs to benefits is favourable. Duncan (1975) has suggested that in relatively unmodernised farming systems, there is scope for the use of organic fertilizer as a major source of crop nutrients in the following three situations;

i Where no alternative can provide basic necessities.

ii Where organic fertilizing will contribute to adequate and fairly secured returns from crops; and

iii Where the cost of organic fertilizing is exceptionally low.

Cash has a high value to farmers as the means to investment and consumer goods, and as a convenient method of saving. In most cases, the cost of organic fertilizer is low owing to specific local factors. Some settlements that lie on a major cattle route in Northern part of Nigeria have been able to support a high level of continuous cropping for a long time. Similarly, farms near urban areas may use low cost city wastes or organic by-products from a processing plant may be easily available (Fabiyi and Ogunfowora, 1994).

McConnel and Brue (1986) defined economic cost as the payment that must be made to secure and retain the needed amount of a resource. Economic costs can also be defined as the payments made to owners of the factors of production to supply the factors for a particular activity (Spencer, 1986). The development path followed by a society or country should make full use of its abundant resources,

those with low economic cost while economizing on those which are scarce. Less developed countries are characterized by rapid population growth and to varying degrees to limited cultivable land and foreign exchange reserves. Their aim should therefore be to employ techniques which raise the productivity of land using the energy of human beings and other domestically available resources rather than inputs, particularly capital and equipment that impose net demands on foreign exchange.

Under these circumstances, organic fertilizer has an important economic role. They raise returns to land by increasing yield, using labour and waste materials with a low economic cost, the foreign exchange requirement is insignificant and the investment need can often be provided simply by labour. The need for yield-increasing and labour using techniques under the deficit trading positions of most less developed countries ensures that a strong case can be made for the fuller use of organic materials in less developed countries. The adoption of organic fertilizer in soil fertility management by farmers in Imo State of Nigeria entails that complete information including the profitability of production and utilization of organic fertilizer and factors affecting the utilization of organic fertilizer should be provided.

1.2 Statement of Problem

The uses of organic waste for soil fertility management are well known to farmers. However in recent times, farmers have shown preference for inorganic

fertilizer. But the high cost, scarcity, unavailability of inorganic fertilizer and soil degradation resulting from inorganic fertilizer use pose a lot of problems to farmers (Fabiyi and Ogunfowora, 1994). Why farmers favour the use of inorganic fertilizer despite these problems is not clear. Because farmers are interested in the economics of their resource use, it could be that there are uncertified economic issues regarding the production and utilization of organic fertilizer. However, knowledge on these is not clear. Filing this gap in knowledge is the first challenge of this research.

Rural and urban waste management has been a serious problem in Nigeria. This has worsened due to rapid population growth, urbanization and industrialization. Wastes are still placed by the roadside in heaps or in depots made of mud blocks, cement blocks or steel tippers or other available equipment. The equipment used in the country for waste disposal varies from compaction trucks, prime movers for picking up large steel containers, skip containers and side loading tippers. The frequency is twice to once weekly. In reality, the common methods of final disposal are mass tripping and not in sanitary landfills or burning when dry (Sridhar, 1986). As a result, most of the disposal sites have become eyesores to the communities living nearby. They are known to emit smoke, breed flies, mosquitoes and rodents and are considered a source of health hazard (Omishakir and Sridhar, 1986). Some of these wastes can however be utilized as

fertilizer. Yet the extent of utilization is low. It is not known if this is related to the economies of the production and utilization of organic fertilizer.

Disposal of solid waste is a problem. The technology of land filling, which is currently being used in the country, remains at a primitive level and is most unsatisfactory. Even the choice of the land filling sites is not in most cases based on scientific assessment. The life span for sanitary land is usually between 10-15 years. From this point, though landfill technology seems cheap in terms of operating costs, could be expensive with regard to land, where the cost of land is at a premium. There is a need to look into alternate options to deal with the solid wastes, even though it may seem more expensive from operational point of view. One such option at the moment seems to be the organic recycling through compositing. This will fit in well with the government's objective of agricultural development to boost the economy and land use (Sridhar and Bammeke, 1986).

Although wastes can be a veritable source of organic fertilizer, which can be used in soil fertility management, the economics of their production and utilization are not well examined. All these problems justify intensive attention on the problem of producing and utilizing in a better way, rural and urban wastes to meet the fertilizer requirement of farmers in Imo state of Nigeria. A number of organic fertilizer production companies have been established in response to the market situation in Nigeria. One of these is the Margaret Organic Fertilizer Company. This company is located at Orie Ikpa, Ahiara in Ahiazu Mbaise local government area

of Imo state. These companies are in business for profit purposes. However evidences from literature search have not revealed studies on the economics of the production of organic fertilizer by these firms especially in Imo state. Related to this is that although there have been studies on organic fertilizer utilization by farmers (for instance, Munonye and Nwajiuba, 2006); the economics of utilization at farm level was not examined. Consequently, the following research questions share our appreciation of the research problems;

1. What are the costs and returns of production of organic fertilizer?
2. What are the costs and returns of utilization of organic fertilizers?
3. What are the factors that affect the utilization of organic fertilizer?
4. What are the factors that affect the output of farms?

1.3 Objectives of the Study

The broad objective of the study is to analyze the economics of production and utilization of organic fertilizer in Imo state. Specifically, the study will seek to:

1. Determine the costs and returns of production of organic fertilizer.
2. Determine the costs and returns of utilization of organic fertilizer.
3. Determine the factors that affect the utilization of organic fertilizer.
4. Determine the factors that affect output of farms.
5. Make recommendations on the strategies for promoting the production and utilization of organic fertilizer in Imo State of Nigeria.

1.4 Hypotheses of the Study

Hypothesis 1

Explicitly, the null hypothesis was stated as follows:

$\mathbf{H_0}$: $Y \neq f(X_1, X_2, X_3, X_4, X_5)$

And the alternative hypothesis was stated as follows:

$\mathbf{H_1}$: $Y = f(X_1, X_2, X_3, X_4, X_5)$

Hypothesis 2

Explicitly, the null hypothesis was stated as follows:

$\mathbf{H_0}$: $Z \neq f(X_1, X_2, X_3, X_4, X_5)$

And the alternative hypothesis was stated as follows:

$\mathbf{H_1}$: $Z = f(X_1, X_2, X_3, X_4, X_5)$

1.5 Justification of the Study

This study is a step towards proffering solutions to the problems associated with the use of inorganic fertilizer. This is because findings on the economic assessment of the production and utilization of organic fertilizers will boost the development of organic sources of fertilizers which have the potential of reducing dependence on chemical fertilizer?

The study will be useful to farmers and entrepreneurs, as it will provide information on the costs, benefits and other economic considerations for the production and utilization of organic fertilizer. The government will also use the results of this study to formulate some of the policies that would be geared towards reducing urban waste management crisis. This work will also be of immense benefit to individuals seeking materials for research work in related areas.

1.6 Limitations of the Study

The major limitation of this study was the inability of farmers to keep production records of their activities. Their great reliance on their memory impaired the accuracy of the information they provided before the extension agents came to my rescue. Farmers were initially reluctant to release information to the researcher. This reduced the pace of the research before the production manager of Margaret Organic Fertilizer Company came to my rescue as he was able to convince the farmers on the importance of the research.

CHAPTER TWO

LITERATURE REVIEW

2.1 Concept of Manure as an Organic Fertilizer

Manures are waste plant and animal products, which are recycled by returning them to the soil. This may occur in the excreta of grazing animals, but in the case of housed or confined animals, the excreta need to be processed or stored before they are spread on the soil. Manures have two main functions: to supply nutrients and to supply organic matter. Manures are by nature organic. Their organic matter is attacked and transformed by micro organisms when returned to the soil. Much of the carbon is converted to carbon dioxide and makes no long term contribution to the organic matter content of the soil. Other parts of the organic matter are converted to humus; a black or dark brown, colloidal, very complex organic material, which remains in the soil. Humus is a very valuable soil component, which increases the ability of the soil to hold water available to the plants, and through its cation exchange capacity, reduces the leaching of nutrients (Simpson, 1986).

2.2 Important Sources of Organic Fertilizer

The various important sources available in Nigeria for use may be classified as follows:

a. Farmyard Manure

This is the greatest organic source of plant nutrients available to less developed countries. The major organic sources include cows, bullocks and poultry droppings. The total contribution of organic wastes is put at 10 million tons. The cow and bullock are of major importance in Northern Nigeria during the 1920s to 1960s. In Southern Nigeria, poultry droppings are of economic importance because of poor performance of cattle. The drought of the 70s and between 1982 and 1984 made the production of animal dung of less importance and therefore scarce. The high cost of feed has led to the folding up of poultry industries thereby reducing the availability of poultry manure (Fabiyi and Ogunfowora, 1994). Also, transportation of this source of organic fertilizer due to its bulk makes it less feasible as sole source of fertilizing crop varieties in this country.

b. Rural and Urban Compost

This refers to deliberate decomposition of plant matter with or without some human or animal wastes. The extent of benefits to be derived from compost will depend largely on the method of preparation; of particular advantage is that, it requires neither cash input nor livestock except labour cost. The quality of compost depends on nitrogen content and carbon/nitrogen ratio. Animal manure is better than cereal straw because of lower carbon/nitrogen ratio in the former. This is why it is necessary to mix animal manure of higher nutrient quality with maize or rice straw of lower nutrient quality in composting (Sobulo, 1988).

c. Green Manure

These are green cover crops (usually legumes such as Centrosema, Stylosanthes, etc) generally planted to raise the organic matter content of the soil, hold plant nutrients and may fix atmospheric nitrogen. Its economic advantages over other methods of fertilization include small cash involvement, no transport cost and livestock husbandry is not involved. However, it has the disadvantage of high labour cost in growing these legumes without any cash return and a period of 4 to 5 months fallow before it could be used. These are the major constraints for this source of organic fertilizer (Sobulo, 1988).

d. Fodder Crops and Mulch

These are crop residues such as maize, sorghum and millet and the estimated quantities are put at 30 million tons (Fabiyi and Ogunfowora, 1994). In addition to supplying plant nutrients, mulch also help in moisture conservation, control of soil temperature and reduces weed growth. The rather limited use of mulch in Less Developed Countries (LDCs), except for yam production may be due to its opportunity cost of cutting and transporting the mulch material (Fabiyi and Ogunfowora, 1994).

e. Night Soil and Urban Sewage

There is technical economic scope for a better utilization of night soil and urban sewage as a source of crop nutrients. The extent of its potential use will be influenced by the farmers' costs, health risks and by culturally determined

attitudes. In case of urban wastes, using WHO estimates, the input will be about 20 million tons.

From above, it is estimate that available materials, as sources of organic wastes will be about 100 million tons. With increase in crop production programmes of this country, it is possible that this can rise to 200 million tons. However, the uses of these organic wastes are restricted to its source of production due to its high cost of transportation (Fabiyi and Ogunfowora, 1994).

2.3 Wastes Management As A Source of Organic Fertilizer

The major wastes are:

a. Liquid wastes originating from residential areas (sewage and sulage), storm drains and industries.

b. Solid wastes such as refuse and feaces, livestock wastes (poultry, piggery, dairy), farm wastes and industrial wastes.

The major concern however, is the increasing volume of refuse. Every state in the country has acknowledged that 65% to 75% of the refuse generated is organic in character and is highly compost able. The organic content also reaches up to 90% during maize harvesting. Traditionally, young children in the family are entrusted with the job of disposing the refuse out of the house. From any container such as basket, basin, nylon bag or empty carton, the refuse finally goes to depots located in various parts of the city, which will finally be collected by environmental protection agencies (Sridhar and Ojediran, 1983, Sridhar and

Bammeke, 1986). Recycling of organic wastes into compost has been an ancient practice. In many developing countries today, composting and compost are the most important process and product for agricultural fertilizers. It is still a preferred procedure for use by many gardeners in the USA and many European countries.

A survey conducted among 135 elders in Nigeria from predominantly agricultural areas in north, south and the east revealed that they are aware of the process being practiced in Nigeria traditionally but confessed that it is no longer practiced on a large scale (unpublished data from Sridhar). A fairly large composting plant was run during 1936 – 1942 in Kano, Nigeria under the guidance of Gilles (1946). In that study, night soil and domestic refuse were mixed thoroughly and loaded into 31 chambers specially constructed for the purpose, each one of them could take a day's collection. The mixtures were turned on three successive occasions and on the 31st day; the resulting product was dark, blackish brown resembling soil, inoffensive and did not attract flies. The novelty of this method is that no machinery was involved. The process only needed little supervision and farmers readily accepted the product. A total of 43,800 tons of 'black Gold' was produced in 5 years (Gilles, 1946).

A more systematic scientific study was carried out by Sridhar *et al.* (1985b) in which refuse from a trading community was mixed with the intestinal contents of cows from a slaughter house and compost was prepared. About 150kg of refuse and slaughterhouse wastes were processed and the produced compost was used for

growing vegetable plots. The chemical composition of the refuse and the compost are given in Table 2.1.

Table 2.1: The chemical composition of refuse and the compost made from it

Characteristics	Refuse	Compost
Moisture content, %	44.5	35.7
Dry weight, %	55.5	64.3
Volatile matter, %	61.0	24.8
Non volatile matter, %	39.0	75.2
Total Kjeldahl , %	1.35	1.70
Total P, %	0.80	0.5
Heavy metals, mg/kg om		
Cadmium	2.91	1.76
Copper	16.43	14.24
Mercury	0.97	14.50
Nickel	15.73	12.80
Lead	5.90	7.87
Zinc	165.79	45.82

Source: Sridhar and Bammeke (1986)

While refuse is in plentiful supply, the putrescible materials may be obtained from a variety of agro and other industrial sources.

Table 2.2: Chemical composition of various wastes materials.

Waste	Carbon	Nitrogen	C:N
Poultry droppings	27.9	1.96	14.30
Farmyard manure	33.9	1.54	22.01
Sewage sludge	46.2	2.60	17.76
Town refuse	40.6	1.40	29.00
Cocoa husk	33.1	0.91	36.37
Rice straw	41.7	0.53	75.67
Oil palm waste	34.8	0.11	22.70
Yam peeling	51.0	0.26	196.20
Sugar cane waste	38.0	0.11	31.0
Breweries spent grain	44.6	3.65	15.4
Saw dust	43.8	0.35	125.14

Source: Titiloye *et al.* (1985)

2.4 Nutrient Supplying Potentials Of Organic Fertilizers

Organic manure improves the soil productively in two ways viz:

a. Through the improvement of the physical conditions of the soil such as structure and tilt:

b. Through the nutrient it supplies and the way it supplies them, the nutrient supply is generally considered the more important at least in the short term (Cooke, 1972).

Although there's is considerable variation in the percentage nutrient composition of farm yard manure depending mainly upon the source, handling and management, the main nutrient supplied are nitrogen, phosphorus, potassium and a host of micro nutrients (Hemingway, 1961). The NPK composition of farmyard manure as reported in a number of francophone countries in West Africa (notably Senegal, Mali and Burkina Faso) have been summarized by Mokwunye (1980) giving wide variation. Similar average values have been given by Cooke, (1982). Investigations under continuous cropping in Ghana (Djokoto and Stephen, 1961) showed that 5 – 10t/ha of Kraal manure would supply about 25kg/ha each of NP_2O_5 and 35kg/ha of K_2O. Cooke (1982) estimated that an average dressing of 10t/ha FYM would supply about 50kg K_2O/ha. Yayock and Awoniyi, (1974) working in northern Nigeria gave a breakdown of the amounts of the various nutrients supplied from 1 ton/ha of the various forms of animal manure as given in table 2.3.

Table 2.3 Quantities of various plant nutrients (kg/ha) supplied to the soil from 1 ton/ha of various forms of animal manures.

Manure Sample	N	P	K	Ca	Mg
Poultry	21.80	11.20	6.0	6.20	2.40
Pig	19.0	8.40	15.51	5.20	5.20
Cattle	13.33	1.31	22.40	10.0	5.51
Horse	14.40	2.80	4.31	8.6	2.51

Source: Yayock and Awoniyi (1974)

2.5 Organic Manure and the Improvement of Soil Physical Properties.

Apart from this role as a store house for plant nutrients, it is a major contributor to the cation exchange capacity and as a buffering agent against understanding pH fluctuations (Kwakye, 1980). Soil organic matter and organic manure play a key role in sustaining the desirable soil physical condition for crop growth. Rapid deterioration of soil physical properties has been shown to accompany organic matter decline in Nigerian soils. Aina (1979) reported that as a result of diminished soil organic matter during a ten year continuous cultivation of a low soil in South West Nigeria, there was considerable reduction in soil aggregation, aggregate stability, porosity, hydraulic conductivity and increased bulk density. The ultimate consequence of this was declining soil fertility and reduced soil crust ration and crust strength. The beneficial effect of organic matter, dung or compost on the macro structure of the soil particularly soil compaction has also been discussed by Charreau, (1975) in Senegal. These various research findings demonstrate the important advantages that are derivable from the use of organic manure in building up the soil organic matter status.

2.6 Economic Analysis of Production and Utilization of Organic Fertilizer

As fertilizer cost increases, the economics of waste application to crop become more favorable. At this time, soil application is the most practical means of disposing of these wastes. The wastes must be applied on the basis of crop

nutrient requirements, avoiding over-application of toxic elements. When wastes are applied to the soil, subsequent management must confine the wastes to the application area. Most importantly, research has shown that wastes can supply plants, fertilizer (nutrient) needs. With proper application and management of wastes, excellent crop growth and yield can be achieved.

Large quantities of organic matter need to be supplied to soils in the tropics and sub-tropics in order to provide nutrients to plants, to help moisture retention and to keep the soil structure in good condition. Hence, it is most worthwhile to take care in saving organic waste so that it can be composted and recycled to help the soil in its task of good production. In the attempt to develop and operate waste management programmes in a responsive manner, decisions are to be made which are essentially determined by four basic categories of criteria: cost, environmental factors, resource conservation and institutional factors. Each category includes the following key points (Colonna and Mclaren, 1974).

Costs	Operating and Maintenance capital
Environmental factors	Water Pollution
	Air Pollution
	Other Health Factors
	Aesthetic Considerations

Resource Conservation:	Energy
	Materials
	Land
Institutional Factors	Political Stability
	Legislative Constraints
	Administrative Simplicity

Most farmers in the developed countries can purchase whatever quantity of inorganic fertilizer they need and because of the high cost of labour and degree of mechanization, they may not be able to handle large quantities of organic material. To this group of farmers, farm management has become an annual economic consideration controlled by production and price support systems. The economic system differs greatly in the developing world, a major portion of which falls in the tropical belt. In many years, the continuance of farming from year to year is dependent on soil conservation and the success of production in a season is dependent on soil moisture management. National food surpluses are an exception and for many farmers, production is directly linked to their food requirements for survival (Dalzell *et al.*, 1987).

Labour costs in less developed countries are much lower than in the developed ones. Labour is much more readily available and in the cases where composting would utilize family labour, no cash outlay will be required. Collecting, composting and spreading organic wastes would create work

opportunities for unemployed and underemployed labour; equally raw materials for composting are not usually subjected to artificial shortage due to local or international market fluctuations. Under these conditions, the decision on whether or not to adopt the use of organic manure in preference to inorganic fertilizer will depend on the availability of labour, organic raw materials and inorganic fertilizer in the farmers' locality. These factors can vary from year to year and so the relative cost of plant nutrients between organic and inorganic sources will also vary. It has been estimated that to prepare and spread one ton of compost will require between 2-3 mandays depending on the type of waste, the transporting distance and the composting process used.

Composting is suited to the Nigerian agriculture with the high level of rural unemployment and disguised unemployment. In addition much of the work involved in composting can be carried out by female labour. Compost can provide a cheap alternative source of nutrients to many of the single nutrient fertilizers. Considering the supply of the three (3) major nutrients; compost is able to compete economically on a nutrient basis with the more concentrated fertilizers.

Table 2.4: Comparison of compost and three different types of single nutrient fertilizers.

		Nutrient Supplied to Crop in Kg		
	Application	**Nitrogen**	**Phosphorus**	**Potassium**
1	Mineral Fertilizer			
	-Urea, 27.3kg	12.5	-	-
2	Single Super Phosphate 300kg	-	20.5	-
	-Muriate of Potash 45.9kg	-	-	23.6
	Total Fertilizer, 373.2kg	**12.5**	**20.0**	**24.0**

Sources:
1. Dalzell *et al.* 1987
2. Fabiyi and Idowu, 1989
3. Reports of PMAO consultants to FPDD, 1988

These calculations do not take into account of the beneficial effect of compost on trace elements supply, soil structure, improvement and water holding capacity. Another benefit of composting is that it reduces the volume and weight of wastes and thus eases transport problems if the composting site is as close as possible to the source of the main organic raw materials, in addition, there is a little sale value for most of the wastes used for composting. With regards to the use of green manures that can be ploughed directly to the soil, the only major cost item is the opportunity cost of the use of the land during the fallow period. In a study reported by Ofori (1980), it was found that incorporating the fallow crop into the

soil increased the yield of millet than if they were burned (Table 2.5). Better results were however obtained with additional application of NPK compound fertilizer.

Table 2.5: The effect of fallow incorporation on the yield of millet (kg/ha)

Fallow Treatment	No fertilizer	NPK applied
Burned	912	1565
Incorporated	1244	1809

Source: Ofori, 1980.

Organic fertilizer and agriculture are considered to be a natural fit. Increasing environmental constraints on the disposal of animal and city wastes and a growing understanding on the agronomic benefits of organic fertilizer is obvious win-win solution for farmers. Moreover, rising disposal costs improve the potential profitability of managing municipal wastes with composting and increase the potential for opportunities to compost organic waste in a farm setting (Stofella and Kahn, 2000).

Farmers should however consider the recycling of organic wastes from rural and urban centers into useful products such as organic fertilizer. With the growing need for agricultural improvement, production of organic fertilizer and supply to the farmers will be invaluable in the long run when the agricultural lands become fertile and productive.

2.7 The State of Knowledge

Previous studies on the economic analysis of the production and utilization of organic fertilizer have shown that composting is suited to the Nigerian agriculture with the high level of rural unemployment. This is because; much of the work involved in composting can be undertaken by labour. Organic fertilizer can provide a cheap alternative source of nutrients to inorganic fertilizers. It has also been established that the decision on whether or not to adopt the use of inorganic fertilizer will depend on the availability of labour, organic raw materials and inorganic fertilizer in the farmers' locality.

This level of research is inadequate to supply the systematic data required for a proper economic analysis of production and utilization of organic fertilizer in Imo State of Nigeria. There is urgent need for small farmers to raise food production in Imo State of Nigeria and this demands that the neglect for the production and utilization of organic fertilizer be put right and attention should be turned into two main directions. First, benefit-cost analysis should be carried out on technical feasible alternatives to determine which of the systems of collecting, processing, distributing and utilizing organic fertilizers make the best use of society's scarce resources. Secondly, at the farm level, attempts should be made to understand the economic and social pressures on decision makers, which lead to the evolution of particular production patterns. Much greater attention than hitherto should be directed to the costs to the farmer and his family of the different

fertilizing practices. The constraints on the utilization of organic fertilizers whether land, labour, markets or a combination of these should be identified and technical and economical must then be directed to their solution.

In order to obtain fruitful results for the extensive use of organic fertilizers, the following specific areas of research should be focused on:

1. Economics of the use of inorganic fertilizer in combination with various dosages of organic materials from rural and urban wastes, including studies leading to efficient methods for producing biogas as a by-product.
2. Management of harvest residues and green manures in relation to cropping patterns and systems.
3. The environmental implications resulting from the results of research.
4. The socio-economic implications involved in the use of organic materials as fertilizer.
5. The acceptability to farmers of different fertilizing practices in the light of the economic and social pressures bearing on their decisions.

In conclusion, the production and utilization of organic fertilizer by a greater number of farmers will provide a cheap alternative source of nutrients to inorganic fertilizers required for optimum crop yield. This will also reduce rural and urban waste management problems. Also farmers' problems associated with the use of inorganic fertilizers such as high cost, scarcity and unavailability of fertilizer and soil degradation will be greatly reduced.

CHAPTER THREE

METHODOLOGY

3.1 Study Area

Imo State is one of Nigeria's 36 states and is located in Southeast region. Southeast Nigeria stretches from the humid forest to the sub-humid guinea savannah ecological zones and lies between latitude $4^0\ 15^{11}$ and $7^0\ 0^{11}$ North of the equator and longitude $5^0\ 25^{11}$ and $8^0\ 51^{11}$ East of the meridian. Meteorological records at the National Roots Crops Research Institute, Umudike, show that Imo State of Nigeria is characterized by an average annual temperature of 28^0C, an average annual relative humidity of over 80% and an altitude of about 100m above sea level. Mean annual rainfall ranges from 1830-2200mm. Imo State is purposely selected because of its high population density and high dependence on fertilizer for soil fertility management.

3.2 Sampling Technique

The study involved two aspects. These are a case study of Margaret Organic Fertilizer Company, Ahiara in Ahiazu Mbaise local government area (L.G.A.) of Imo State, which was identified as a functional firm after a reconnaissance survey. The organic fertilizer company known as Margaret Organic Fertilizer Company started operations in 2003 and has a capacity utilization of 240 tons of organic fertilizer per annum. The second aspect is a cross sectional survey of farmers utilizing organic fertilizer. A list of farmers who utilize organic fertilizer produced

by Margaret Organic Fertilizer Company was obtained from the company. The list comprised 48 farmers. Farmers were then chosen based on the location of their farms in Imo State. Two agricultural zones in Imo State were chosen out of three. Sixteen farmers were then chosen from each agricultural zone. Two agricultural zones were purposely selected because the farm locations of the farmers are not widespread. A total of 32 farmers were used according to the sketch below;

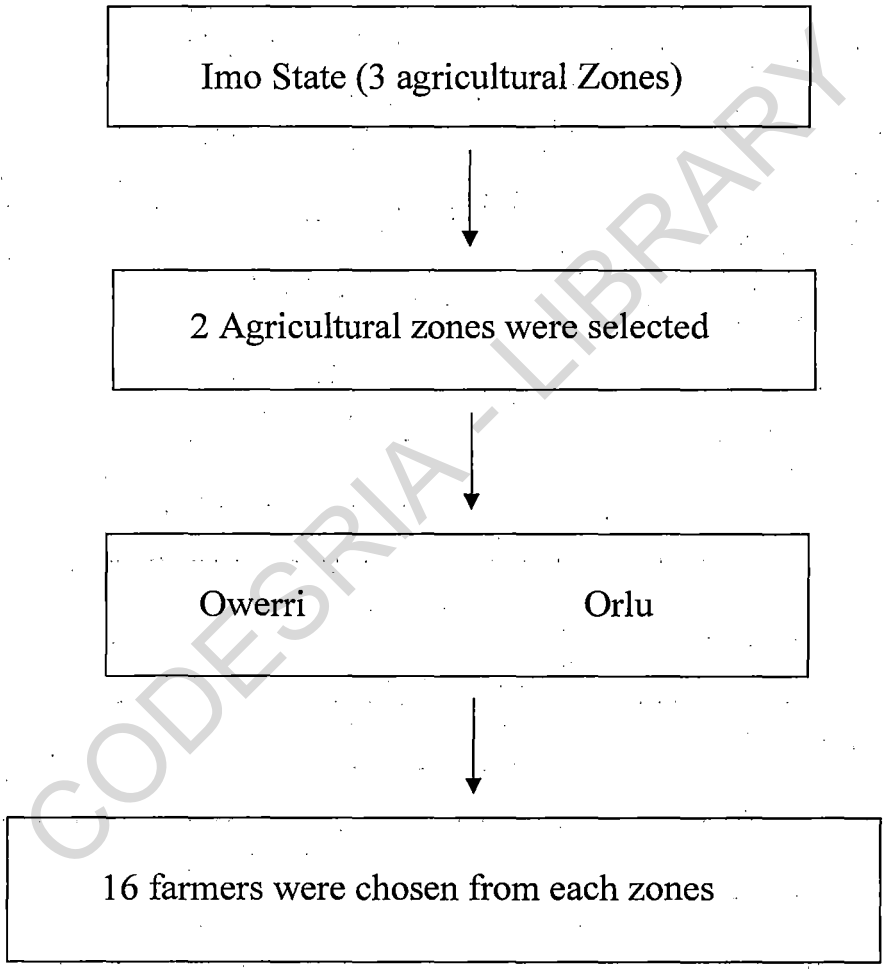

Fig. 1 Distribution of selection of farmers.

3.3 Method of Data Collection

Data for this study were obtained from primary and secondary sources. Primary data were obtained by using questionnaire and personal interview schedules. Types of primary data include those on quantity and quality of fertilizer which were obtained from Margaret Organic Fertilizer Company and those on farm income, average fallow years, area of land cropped in 2006, crop types and amount of credit used. Secondary data were however obtained from publications of the National Root Crops Research Institute, Umudike and other institutions. Examples of such publications include journals, bulletins and related texts.

3.3 Analytical Techniques

Objectives 1 and 2 were analyzed using the cost and return analysis

$$\prod = TR - TC$$

where $TC = FC + VC$

Key:

$\prod$ = Profit (₦)

TC = Total Cost (₦)

FC = Fixed Cost (₦)

TR = Total Revenue (₦)

VC = Variable Cost (₦)

Regression analyses of some factors that affect utilization of organic fertilizer were used to analyze objective 3.

Model 1: Determinants of utilization of organic fertilizer

1. $Y = f(X_1, X_2, X_3, X_4, X_5)$.....(1)

$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + e$.....(2)

Key:

Y = Quantity of organic fertilizer used per farmer (kg)

X_1 = Farm income (₦)

X_2 = Area of land cropped on 2006 per farmer (Hectares)

X_3 = Crop types (Cash crop/ Non cash crop)

X_4 = Amount of credit (₦)

X_5 = Average fallow years

b_0 = Intercept

e = error term

Model 2: Determinants of farm output

2. $Z = f(X_1, X_2, X_3, X_4, X_5)$.....(3)

$Z = a_0 + a_1X_1 + a_2X_2 + a_3X_3 + a_4X_4 + a_5X_5 + e$ .....(4)

Key:

Z = Farm output (kg)

X_1 = Farm income (₦)

X_2 = Area of land cropped in 2006 per farmer (Hectares)

X_3 = Amount of credit (₦)

X_4 = Average fallow years

X_5 = Quantity of organic fertilizer used per farmer (kg)

a_0 = Intercept

e = error term

Hypothesis 1: The first hypothesis was tested with students' "t" test.

Hypothesis 2: The second hypothesis was tested with students' "t" test.

The *a priori* expectation of model 1 is that farm income, average fallow years, area of land cropped; crop types and amount of credit used determine the utilization of organic fertilizer. It is expected that an increase in farm income, area of land cropped, production of cash crops and amount of credit available to farmers will increase the utilization of organic fertilizer and vice versa while an increase in average fallow years will decrease the utilization of organic fertilizer and vice versa.

The *a priori* expectation of model 2 is that an increase in quantity of organic fertilizer used, farm income, area of land cropped, average fallow years and amount of credit available to farmers will increase the output of farmers and vice versa.

Assumptions of Model 1

It was hypothesized that the use of organic fertilizer is a function of farm income, average fallow years, area of land cropped, crop types and amount of credit available to farmers. This hypothesis was also tested against empirical data using students' "t" test.

Assumptions of Model 2

It was hypothesized that farm output is a function of quantity of organic fertilizer used, farm income, average fallow years, area of land cropped and amount of credit available to farmers. This hypothesis was also tested against empirical data using students' "t" test.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1 Socio-Economic Characteristics of Farmers

4.1.1 Age of Farmers

The exodus of youths from the rural areas has resulted to reduction in available human force needed in agriculture (Nnadozie, 1993). The rural farm labour gap created by this out-migration is then left to be filled by men and women of middle ages most of the time. The percentage distribution of farmers according to age is shown in Table 4.1. The table shows that the majority of farmers are of middle ages (53.1%, 30-49 years). The table further shows that the mean age of farmers is 49 years. This shows that most of the farmers are of middle ages and need to improve their income and standard of living by engaging in the production and utilization of organic fertilization for increased output and profit.

Table 4.1 Mean and percentage distribution of farmers by age

Age Range (years)	Frequency (f)	Percentage (%)
30 – 39	6	18.75
40 – 49	11	34.38
50 – 59	9	28.12
60 – 69	6	18.75
Total	**$\sum f = 32$**	**100.00**

Source: Field Survey, 2007

4.1.2 Gender Distribution of Farmers

Women generally face more serious constraints than men regarding the establishment or expansion of their economic activities (Onweagba, 2000). The distribution of farmers according to gender shows that 90.6% are males and 9.4% are females. This is shown in Table 4.2

Table 4.2 Percentage distribution of farmers according to gender

Gender	Number	Percentage
Male	29	90.6
Female	3	9.4
Total	32	100.0

Source: Field Survey, 2007.

It can be deduced that the males in the study area embraced farming than their females counterparts. This could be due to the fact that a good number of females engage more in non farm work like petty trading than farming in the study area.

The table above however shows that majorities of the farmers are males and who can improve their income and standard of living by engaging in the production and utilization of organic fertilizer for increased output. This therefore highlights the importance of examining the economics of production and utilization of organic fertilizer at the farm level.

4.1.3 Educational Attainment

Education plays an important role in modeling the behaviour of people. Rate of innovation is enhanced by educational attainment (Alimba and Akubuilo, 2000). The percentage distribution of farmers according to education is shown in Table 4.3.

Table 4.3 Percentage distribution of farmers according to number of years spent in school.

Number of years spent in school	Number	Percentage (%)
Zero	4	12.5
1 – 6	19	59.4
7 – 12	6	18.7
13 and above	3	9.4
Total	32	100.0

Source: Field Survey, 2007.

Table 4.3 shows that majority of the farmers had a primary formal education (about 59.4%, 1 – 6 years). About 18.7% of the farmers had a secondary education. There is need for enhanced formal and informal education of the farmers as deficient education and information on the economics of production and utilization of organic fertilizer could hinder its adoption in soil fertility management by farmers.

4.1.3 Marital Status

The percentage distribution of farmers according to marital status shows that 96.9% are married while 3.1% widowed

Table 4.4 Percentage distribution of farmers according to marital status

Marital Status	Number	Percentage (%)
Married	31	96.9
Widowed	1	3.1
Total	32	100.0

Source: Field Survey, 2007.

Table 4.4 shows that majority of he farmers are married (96.9%). This shows that the farmers in the study area are usually married and therefore, own households. Members of these households usually assist the farmers in providing the labour requirements of his farm. Most of the farmers who are married also need to improve their income and standard of living of their households by adopting the use of organic fertilizer for increased production and profit. This also points out the need to examine the economics of the production and utilization of organic fertilizer. However, the only respondent who is widowed is a male farmer.

4.2 Cost and Returns of Production of Organic Fertilizer

A cost and return analysis of production of organic fertilizer in one year is presented in Table 4.5.

Heathcote (1970) identified the high cost of transportation of raw materials of organic fertilizer as a problem. The study identified piggery droppings and grasses as major raw materials for the production of organic fertilizer. A total variable cost (TFC) of ₦ 1,236,000 was incurred in one year. Furthermore, a total fixed cost (TFC) ₦ 22,000 was incurred. This gave a total cost of N 1,258,000. Relatively, total revenue (TR) of N 2,400,000 was obtained in the same year. Therefore the total revenue less the total cost gave a net return of N 1,142,000 which is considered profitable.

Table 4.5 Cost and return analysis of production of 240 tons of organic fertilizer in one year by Margaret Organic Fertilizer Company

S/No	Items	Unit	Quantity	Price/Unit (₦)	Total Value (₦)
1	**Revenue**				
a.	Organic fertilizer	Kg	240,000	10	2,400,000
	Total Revenue				**2,400,000**
2.	**Variable Costs**				
a.	Capital Inputs				
i.	Bags	Kg	4800	20	96,000
ii.	Maintenance of Vehicle/Machinery	Month	12	6,000	72,000
iii.	Staff Salaries	Month	12	20,000	240,000
iv.	Administrative Expenses	Month	12	5,000	60,000
v.	Miscellaneous	Month	12	4,000	48,000
b.	Labour Costs	Mnaday	240	500	120,000
i.	Loading of wastes and other raw materials	Manday	240	500	120,000
ii.	Transportation	Manday	240	500	120,000
iii.	Mixing	Manday	240	500	120,000
iv.	Bagging	Manday	240	500	120,000
v.	Loading of Bags	Manday	240	500	120,000
	Total Variable Costs				**1,236,000**
3.	**Fixed Costs**				
a.	Land charge	Hectare	0.04	25,000	10,000
b.	Annual depreciation of machinery at 10%				20,000
c.	Annual depreciation of implements at 10%				1,000
	Total Fixed Costs				**22,000**
	Total Cost				**1,258,000**
	Net Return				**1,142,000**

Source: Field survey, 2007.

These results show that the production of organic fertilizer is profitable.

4.3 Costs and Returns of Utilization of Organic Fertilizer

4.3.1 Types of cropping systems

About 97% of the farmers practice mixed cropping while about 3% of the farmers practice sole cropping. This shows that mixed cropping is widely practiced in the area, which implies that the farms are not mechanized. This is shown below in Table 4.6

Table 4.6: Distribution of respondents according to cropping systems

Cropping Systems	Number	Percentage (%)
Mixed	31	96.9
Sole	1	3.1
Total	32	100

Source: Field Survey, 2007.

4.3.2 Types of Crops

About 93.75% of the farmers planted their crops in the combination of yam/cassava while 6.25% of the farmers combined yam and maize. This implied that most of the farmers cultivated a combination of yam and cassava. This is shown in Table 4.7

Table 4.7: Distribution of respondents according to types of crops planted.

Type of Crop	Number	Percentage (%)
Yam/Cassava	29	93.55
Yam/Maize	2	6.45
Total	31	100.0

Source: Field Study, 2007.

A cost and return analysis of utilization of organic fertilizer in one year is presented in Table 4.8. An average total variable cost of ₦ 71,050 was incurred. Furthermore, an average total fixed cost of ₦ 14,625 was incurred. This gave a total cost of ₦ 85,675 while total revenue of ₦ 142,831.20 was obtained. Thus, the difference between the total revenue and the total cost gave a profit of ₦57, 156.20 which is considered profitable.

Table 4.8: Cost and return analysis of utilization of organic fertilizer per hectare of farm in one year by farmers in a cassava/yam based cropping

S/No	Items	Unit	Quantity	Price/Unit (₦)	Total Value (₦)
1	**Revenue**				
a.	Yam sales	Kg	3000	40	120,000
b.	Cassava sales	Kg	7610.4	3	22,831.20
	Total Revenue				**142,831.20**
2.	**Variable costs**				
a.	Capital input				
i.	Planting stock				
	-Yam tubers	Kg	350	30	10,500
	-Cassava stem	Kg	400	10	4,000
ii.	Organic fertilizer	Kg	1000	10	10,000
iii.	Staking material	Kg	80	10	800
b.	Labour costs				
i.	Land clearing	Manday	12.5	500	6250
ii.	Cultivation	Manday	12.5	500	6250
iii.	Planning	Manday	5.5	500	2750
iv.	Weeding	Manday	12.5	500	6250
v.	Fertilizer application	Manday	5.5	500	2750
vi.	Staking	Manday	5.5	500	2750
vii.	Harvesting	Manday	25	500	12500
viii.	Transportation	Manday	12.5	500	6250
	Total variable cost				**71,050**
3.	**Fixed cost**				
i.	Land charge	Hectare	0.525	25,000	13,125
ii.	Annual depreciation of implements at 20%				1500
	Total fixed cost				**14,625**
	Total cost				**85,675**
4.	**Net return**				**57,156.20**

Source: Field survey, 2007

4.4 Factors Affecting Utilization of Organic Fertilizer

Karikari and Yayock (1987) identified the technical problems in the use of organic materials for soil fertility management as high transportation cost for moving the bulk materials and health hazards posed by sewage. In order to establish if the utilization of organic fertilizer is affected by variation in some factors, a regression analysis was carried out. In carrying out the regression analysis, three functional forms namely: linear, semi-log and double log functional forms were used and the functional form which gave the best fit, was chosen for analysis (Table 4.9).

Table 4.9 Summary of the regression analysis to determine the factors that affect utilization of organic manure

Variables	Coefficient	Linear	Semi-log	Double log
	Constant	-158.51	2196.6	2.53***
		(187.34)	(1770.69)	(0.5)
Farm Income (₦)	b_1	-0.37	-0.234*	0.181*
		(0.001)	(290.9)	(0.082)
Area of land cropped (ha)	b_2	0.865***	1.09***	0.744***
		(366.14)	(520.48)	(0.147)
Crop types	b_3	0.62		
		(121.79)		
Amount of credit (₦)	b_4	0.0077	0.227**	0.011
		(3.22)	(258.58)	(0.073)
Average fallow years	b_5	-0.047	0.174**	-0.087
		(46.618)	(379.57)	(0.107)
	R^2	0.955	0.928	0.959
	Adjusted R^2	0.946	0.915	0.951
	f-ratio	110.335	68.064	122.807
	Significant f	0.001	0.001	0.001

Notes

*** means significant at 1%

** means significant at 5%

* means significant at 10%

Values in parenthesis are standard errors of the coefficients

Source: Regression Analysis

The double log functional form was found to give the best fit. According to Koutsoyiannis (1977), the higher the R^2, the greater the percentage of the variation of the dependent variable explained by the regression plane, that is, 'the better the goodness of fit' of the regression plane to the sample observations. The f-ratio was significant at 1% confidence level which suggests significant relationship between the utilization of organic fertilizer and farm income, area of land cropped, crop types, amount of credit available to farmers and average fallow years. Therefore the double log functional form was used for discussion.

The estimated regression equation from the double log function was found to be as follows:

$$\text{Log } Y = 2.53^{***} + \log 0.181X_1^{*} + \log 0.744X_2^{***} + \log 0.011X_4 - \log 0.087X_5 + e$$
$$\qquad\quad (0.05) \qquad (0.082) \qquad (0.017) \qquad (0.073) \qquad (0.107)$$

Note

*** means significant at 1%

* means significant at 10%

Hence, the area of land cropped was found to have significant effect on utilization of organic fertilizer at 1% confidence level while farm income was found to be significant at 10% level. With these results, it is clear that changes in area of land cropped and farm income have effects on the variations in the utilization of organic fertilizer. Therefore, the null hypothesis was rejected, while the alternative hypothesis, that there are factors that determine the utilization of organic fertilizer was accepted.

The variable X_1 which is farm income seem to relate with the utilization of organic fertilizer as it showed a significant and positive relationship with the utilization of organic fertilizer. According to Nwajiuba (2000), the basic agricultural problem remains poverty among peasant smallholders. This entraps them at a low equilibrium level with factors and inputs beyond their purchasing power, while they are compelled to sell in times of surplus but at low prices to meet urgent family needs or due to lack of storage, transport and processing facilities.

The variable X_2, which is the area of land cropped, showed a significant and positive relationship with the utilization of organic fertilizer. This tends to suggest that as area of farmland increases, the utilization of organic fertilizer also increases. The establishment of agro-allied industries will help to keep labour in the villages as well as encourage farm production on a commercial level since more land and other resources will be employed (Nnadozie and Ibe, 2000).

4.5 Factors Affecting Farm Output

A regression analysis was also carried out in order to establish if farm output is affected by variation in some factors. In carrying out the regression analysis, three functional forms namely; linear, semi-log and double log functional forms were used to find the form, which gives the best fit (Table 4.10)

Table 4.10 Summary of the regression analysis to determine the factors that affect farm output

Variables	Coefficient	Linear	Semi-log	Double log
	Constant	-3.52***	13.27	-0.348
		0.922)	(24.67)	(0.43)
Farm Income (₦)	a_1	0.110	-0.151	0.16**
		(0.00)	(2.97)	(0.051)
Area of land cropped (ha)	a_2	19.34***	1.054***	0.573***
		(3.195)	(8.77)	(0.153)
Amount of credit (₦)	a_3	0.099***	0.271**	0.095*
		(0.0001)	(2.418)	(0.042)
Average fallow years	a_4	0.045	0.184**	0.012
		(0.247)	(3.716)	(0.065)
Organic fertilizer	a_5	0.188***	-0.057	0.208
		(0.001)	(7.228)	(0.126)
	R^2	0.988	0.952	0.986
	Adjusted R^2	0.987	0.940	0.982
	f-ratio	461.405	79.602	275.067
	Significant f	0.001	0.001	0.001

Notes

*** means significant at 1%

** means significant at 5%

* means significant at 10%

Values in parenthesis are standard errors of the coefficients

Source: Regression Analysis

The linear functional form was found to give the best fit and the f-ratio was significant at 1% confidence level which suggests significant relationship between farm output and farm income, area of land cropped, amount of credit available to farmers and average fallow years. Therefore, the linear functional form was used for analysis and discussion.

The estimated regression equation from the linear function was found to be as follows:

$$Y = \underset{(0.922)}{-3.52^{**}} + \underset{(0.00)}{0.110X_1} + \underset{(3.195)}{19.34X_2^{***}} + \underset{(0.247)}{0.099X_3^{*}} + \underset{(0.247)}{0.045X_4^{*}} + \underset{(0.001)}{0.188X_5^{*}} + e$$

Hence, the area of land cropped was found to have significant effect on farm output at 1% confidence level while amount of credit and quantity of organic fertilizer used were also found to have significant effect on output at 10% confidence. With these results, it is clear that changes in area of land cropped, amount of credit available to farmers and quantity of organic fertilizer used have significant effects on the variation of farm output. Therefore, the null hypothesis was rejected while the alternative hypothesis, that, there are factors that determine output of farms was accepted.

The variable X_2, which is the area of land cropped, showed a significant and positive relationship with the output of farms. This tends to suggest that as the area of farmland increases, the output of farms also increases. This highlights the need for farmers to pull their land and other resources together by forming and joining co-operatives which will lead to the emergence of large sized plots and adequate finance.

The variable X_3, which is the amount of credit available to farmers, showed a significant and positive relationship with the output of farms. Mellor (1980) remarked that credit is a device for facilitating the temporary transfer of purchasing power from one individual or organization to another. He also stated that credit provides the basis for increased production efficiency through specialization of function. Adegeye and Dittoh (1985) also remarked that credit is vital for increased output and overall expansion of the farm enterprise. Ijere (1998) also located the centrality of credit in order to expand production and income. The policy implication is that farmers should as much as possible endeavour to embrace the use of agricultural credit for increased purchase of outputs and improved technological systems for consequent increase in production and farm output. The operators of various agricultural loan schemes should ensure that the loan is used for the purpose for which it was intended and that the loan is not diverted. The extension agents should also use instructions and relevant demonstrations to

convince the farmers. The farmers should also be encouraged to open up accounts with the micro-finance banks in order to obtain credit for agricultural production.

The variable X_5, which is the quantity of organic fertilizer used showed a positive and significant relationship with the output of farms. This suggests that as the quantity of organic fertilizer increases, the output of farms also increases. According to Marthan (1978), organic fertilizers are known to supply nutrients to plants and also improve soil physical conditions for better and output. This highlights the need for farmers to embrace the use of organic fertilizer. It also highlights the need for government and other organizations or entrepreneurs to expand the production of organic fertilizer. The extension agents should also use relevant demonstrations to convince the farmers to embrace the use of organic fertilizer.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary

The study examined the cost and returns of production of organic fertilizer as well as the cost and returns of utilization of organic fertilizer. The study also examined the factors that affect the utilization of organic fertilizer and the factors that affect the output of farms. This entailed a case study of Margaret Organic Fertilizer Company, Ahiara in Ahiazu Mbaise local government area of Imo State, Nigeria as well as 32 randomly selected farmers whose farms are located in two agricultural zones of Imo State.

The results of the study showed that the production of organic fertilizer is profitable. The utilization of organic fertilizer is also profitable. The areas of land and farm income have significant and positive effects on the utilization of organic fertilizer. The area of land cropped, amount of credit available to farmers and the quantity of organic fertilizer used have significant and positive effects on the output of farms.

5.2 Conclusion

According to Djokoto and Stephens (1961), the use of organic fertilizer in maintaining soil fertility and productivity is a known agricultural practice in Nigeria. Its wide scale use has however been hampered by two factors:

a. It is hardly ever available in sufficient quantities to meet the farmers' needs

b. Even if it were available in adequate amounts, the cost of transportation will be prohibitive.

They however suggested that where it is possible, chemical fertilizers should be supplemented with farmyard manure.

The production of organic fertilizer is justified because it is profitable and will help to alleviate the problems of unemployment. The utilization of organic fertilizer in soil fertility management by farmers is also justified as its use is profitable and will help to increase farm output, thereby boosting food production. The utilization of organic fertilizer will also help to alleviate farmers' problems associated with the use of inorganic fertilizer such as high cost, scarcity and soil degradation.

From the study, it can be said that government should embrace the production of organic fertilizer. Agribusiness entrepreneurs should also be involved. On the other hand, farmers should adopt the use of organic fertilizer in soil fertility management for increased food production.

5.3 Recommendations

Based on the findings of this study, the following recommendations are critical to agricultural policy makers if any hope for the production and utilization of organic fertilizer is to be achieved in Imo State of Nigeria.

1. All possible measures should be employed by the government to improve the level of education of the rural populace. This will further help to increase the level of awareness of organic fertilizer and will also sensitize the agribusiness entrepreneurs on the need to produce organic fertilizer on commercial basis. This can be achieved through free education schemes and agricultural extension services.
2. The government should vigorously pursue the production of organic fertilizer in order to meet the fertilizer needs of the farmers. This can be achieved through the establishment of agencies and plants that will solely be involved in the production of organic fertilizer and its distribution to farmers. These agencies and plants should employ the use of rural and urban wastes as a major raw material in the production of organic fertilizer. This will go a long way in alleviating the problem of rural and urban waste management.
3. Farmers should pool their resources together by forming and joining co-operatives which will tackle the problems of inadequate finance and small sized plots. This will improve production and will enhance the income of farmers. Enhancing the income of farmers implies greater economic access by farmers to organic fertilizer which will boost food production.
4. Agricultural research institutions should develop locally made plants and mills with high capacity utilization that can be used in the production of

organic fertilizer. This will save our hard earned foreign exchange resources that would have been wasted in the importation of such mills and mixers.

5. Provision of credit is justified for farmers and other agribusiness entrepreneurs because it helps to redistribute income towards the rural poor and hence reduces income inequality in the society by assisting in their capital formation and capacity to invest (Wells, 1974; Allens, 1987). With adequate capital obtained, agribusiness entrepreneurs and farmers will be willing to invest more in organic fertilizer, thus, increasing food production. Good storage, transport and processing facilities should be provided by the government in order to create time, place and form utilities of agricultural products. The economic value of output can be increased by providing them with time, place and form utilities (Mellor, 1980). This situation will however increase the purchasing power of farmers and will further grant them access to farm inputs such as organic fertilizer.

6. Owing to the peasant economic nature of the rural populace and the high unemployment rate, agribusiness entrepreneurs should as much as possible endeavour to embrace the production of organic fertilizer for consequent increase in income and decrease in the rate of unemployment. On the other hand, farmers should adopt the use of organic fertilizer owing to its low cost, profitability and the high cost and scarcity of inorganic fertilizer for consequent increase in food production.

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APPENDIX A

QUESTIONNAIRE

RESEARCH QUESTIONNAIRE FOR MARGARET ORGANIC FERTILIZER COMPANY, AHIARA, AHIAZU MBAISE LOCAL GOVERNMENT AREA, IMO STATE

Instruction: Fill in the blank spaces and tick (√) where appropriate.

Note: All information collected will be used for research purposes only.

SECTION A: General

1. What is/are your sources of organic fertilizer?

(a) Farmyard manure ( )

(b) Rural and urban compost ( )

(c) Green manure ( )

(d) Mulch ( )

(e) Fodder crops ( )

(f) Night soil and urban ( )

2. List all the types of organic fertilizer that are produced by your company

.....

.....

3. What technique(s) do you use in production?

(a) Labour using techniques ( )

(b) Mechanical techniques (Treatment plant) ( )

SECTION B: Cost and returns of production of organic fertilizer.

S/No	Items	Unit	Quantity	Price/Unit (₦)	Total Value (₦)
1.	**Revenue**				
a.	Organic fertilizer	Ton			
	Total Revenue				
2	**Variable Cost**				
a.	Capital inputs				
i.	Bags				
ii.	Maintenance of machinery				
iii.	Maintenance of equipment				
iv.	Vehicle maintenance including fueling				
v.	Staff salaries				
vi.	Administrative expenses				
vii.	Miscellaneous				
b.	Labour costs				
i.	Loading of wastes and other raw materials	Man day			
ii.	Off-loading of wastes and other raw materials	Man day			
iii.	Transportation	Man day			
iv.	Mixing	Man day			
v.	Bagging	Man day			
vi.	Loading of bags	Man day			
	Total Variable Costs				
3.	**Fixed Costs**				
a.	Land charge	Hectare			
b.	Annual depreciation of machinery at 10%				
c.	Annual depreciation of implements at 10%				
	Total fixed Cost				
	Total Cost				
	Net Return				

Annual depreciation of 10% implies that the implement or machinery has a useful life of 10 years with no scrap value.

Note: Total value of machinery = ₦ 200,000

Annual depreciation at 10% = $\frac{10}{100} \times 200{,}000$ = ₦ 20,000

Total value of implements = ₦ 10,000

Annual depreciation at 10% = $\frac{10}{100} \times 10{,}000$ = ₦ 1,000

APPENDIX B

QUESTIONNAIRE

RESEARCH QUESTIONNAIRE FOR FARMERS WHO UTILIZE ORGANIC FERTILIZER PRODUCED BY MARGARET ORGANIC FERTILIZER COMPANY, AHIARA, AHIAZU MBAISE LOCAL GOVERNMENT AREA, IMO STATE

Instruction: Fill in the blank spaces and tick (√) where appropriate.

Note: All information collected will be used for research purposes only.

SECTION A: General

1. Name: .....
2. Sex: Male ( ) Female ( )
3. Age: .....
4. Marital Status: .....
5. How long have you been in school? ..... (years)

SECTION B: Cost and returns of utilization of organic fertilizer. Fill in the table below

S/No	Items	Unit	Quantity	Price/Unit (₦)	Total Value (₦)
1.	**Revenue**				
a.	Sales of farm products (food/cash crops)	Ton			
i	Yam sales	Kg			
ii.	Cassava sales	Kg			
iii.					
iv.					
2.	**Total Revenue**				
a.	**Variable Cost**				
	Capital inputs				
i.	Planting stocks				
	1.	Kg			
	2.	Kg			
	3.	Kg			
	4.	Kg			
ii.	Organic fertilizer	Kg			
iii.	Agrochemical	Litres			
iv.	Staking materials	Kg			
b.	Labour costs				
i.	Land clearing	Man day			
ii.	Cultivation	Man day			
iii.	Planning	Man day			
iv.	Weeding	Man day			
v.	Fertilizer application	Man day			
vi.	Agrochemical application	Man day			
vii.	Staking	Man day			
viii.	Harvesting	Man day			
ix.	Transportation	Man day			
	Total Variable Costs				
3.	**Fixed Costs**				
i.	Land charge	Hectare			
ii.	Annual depreciation of implements at 10%				
	Total fixed Cost				
	Total Cost				
	Net Return				

Annual depreciation of 10% implies that the implement has a useful life of 5years with no scrap value. Note: Total value of implements = ₦ 7,500

Annual depreciation at 10% = $\frac{10}{100}$ X 7,500

= ₦ 1,500

SECTION C: Utilization of organic fertilizer and farm output

1. What was your farm output in 2006? ..... (kg/ha)
2. What was the area of farm cropped in 2006? ..... (Hectares)
3. What types of organic fertilizer do you use? .....
   .....
4. What quantity of organic fertilizer did you apply to your farm? ..... (kg)
5. What is the cost of a 50kg bag of such organic fertilizer? ..... (₦)
6. What is the cost of a 50kg bag of inorganic fertilizer? ..... (₦)
7. (a) What types of crops do you cultivate? ( ) Cash crops ( ) Food crops
   (b) If they are cash crops, please specify.....
   .....
8. (a) Do you lay farmland fallow? Yes ( ) No ( )
   (b) If yes, how long do you lay it fallow? ..... (years)
9. (a) Do you have access o loans/credit? Yes ( ) No ( )
   (b) What is the amount? ..... (₦)
10. What was your farm income in 2006? ..... (₦)

APPENDIX C

Hypothesis Testing

Hypothesis 1:

$\mathbf{H_0}$: $Y \neq f(X_1, X_2, X_3, X_4, X_5)$

$\mathbf{H_1}$: $Y = f(X_1, X_2, X_3, X_4, X_5)$

t_{cal} for b_1 = $\frac{0.181}{0.082}$ = 2.2073

t_{tab} 0.1, $(n - k + 1)df$ = 1.706 (two tail)

$t_{cal} > t_{tab}$: We reject H_0

t_{cal} for b_2 = $\frac{0.744}{0.147}$ = 5.0612

t_{tab} 0.01, $(n - k + 1)df$ = 2.779 (two tail)

$t_{cal} > t_{tab}$: We reject H_0

Hypothesis 2

$\mathbf{H_0}$: $Z \neq f(X_1, X_2, X_3, X_4, X_5)$

$\mathbf{H_1}$: $Z = f(X_1, X_2, X_3, X_4, X_5)$

t_{cal} for a_2 = $\frac{19.34}{3.195}$ = 6.053

t_{cal} for a_3 = $\frac{0.099}{0.0001}$ = 990

t_{cal} for a_5 = $\frac{0.188}{0.001}$ = 188

t_{tab} 0.01, $(n - k + 1)df$ = 2.779 (two tail)

$t_{cal} > t_{tab}$: We reject H_0.