CODESRIA

Dissertation By

TAMBE, Roseline Eneke

Departement of : Agricultural Economies, University of Nigeria,Nsukka

The economics of cocoyam production by small-holder farmers in Manyu division, southwest province of Cameroon

DECEMBER, 1994

UNIVERSITY OF NIGERIA, NSUKKA
DEPARTMENT OF AGRICULTURAL ECONOMICS

THE ECONOMICS OF COCOYAM PRODUCTION BY SMALL-HOLDER FARMERS IN MANYU DIVISION, SOUTHWEST PROVINCE OF CAMEROON

BY

TAMBE, R. E.
PG/MSC/91/12790

SUPERVISOR: DR. E. C. OKORJI

DECEMBER, 1994

TITLE PAGE

THE ECONOMICS OF COCOYAM PRODUCTION BY SMALL-HOLDER FARMERS IN MANYU DIVISION SOUTHWEST PROVINCE OF CAMEROON

CERTIFICATION

Miss Roseline Eneke Tambe, a Postgraduate student of the Department of Agricultural Economics and with Reg. No. PG/MSC/91/12790, has satisfactorily completed the requirements for course and research work for the degree of Master of Science (M.Sc) in Agricultural Economics. The work embodied in this prodect report is original and has not been submitted in part or full for any other Diploma or Degree of this or any other university.

Sign: ______________________ ______________________

Dr. E.C. Okorji, B.Sc (Nig), MSC (Nig), PH.D (Nig) Supervisor

External Examiner

Date: 11/9/95

Sign: ______________________

Dr. E.C. Okorji
B.SC (Nig), MSC (Nig), PH.D (Nig)
Head of Department.

Date: 11/9/95

DEDICATION

Cultivators of the earth are the most valuable citizens. They are the most vigorous, the most independent, the most virtuous .....

Thomas Jefferson.

This work is dedicated to my late father Mr. Thomas Tambe Ashu who couldn't wait long enough to see the fruit of his labour.

To my mother, Mrs. Tambe Helen Ake, who sees education, as a definite path to progress, and therefore, worthy to make sacrifices for.

Roseline Eneke Tambe

ACKNOWLEDGEMENT

My profound gratitude goes to my supervisor Dr. E.C. Okorji, whose friendly commitment and accessibility made the seemingly very difficult topic easy to work on.

He assisted me and made most valuable suggestions. and contributions towards the successful completion of this work.

The financial assistance provided by the Council for Development of Social Science Research in Africa (CODESRIA) for the execution of this research work is greatly appreciated.

My thanks also goes to Prof. E.O. Arua for his fatherly understanding and kindness. May I also use this opportunity to express my sincere and profound gratitude to Dr. S.A.N.D. Chidebelu and all others who contributed immensely either in one way or the other towards the take-off and successful completion of this project.

Furthermore, my love and appreciation goes to my mother Mrs. Helen Ako Tambe, Tambe Thomas of blessed and evergreen memory, who nutured, moulded and made me what I am today.

Finally, my thanks goes to all persons associated with, "Tambe" to whom I am ever indebted.

I must express my thanks and appreciation to my mother for her moral and financial support throughout my programme.

ABSTRACT

An attempt has been made to examine the economics of cocoyam production by smallholder farmers in Manyu Division, Southwest Province of Cameroon. The continuous decrease in cocoyam production in the area has necessitated this investigation into the profitability or otherwise of the enterprise.

A multi-stage sampling technique was used to select twenty villages from the Manyu Division for study. A random sample of six farmers was made from each of the selected villages to provide the 120 respondents interviewed. Questionnaires were administered to these farmers and information obtained on the socio-economic characteristics of the farmers, production systems, types, sources and costs of imputs used, output and value of product, as well as on processing, storage and utilization of cocoyam. Descriptive statistics such as means, percentages, and frequency distribution were used in data analysis. Multiple regression analysis was also used to determine the effects of certain socio-economic variables on the output of cocoyam.

The results of the study show that although majority of the survey farmers are fairly literate and experienced in farming, traditional production inputs and techniques are dominant. This was largely attributed to the non-availability of modern inputs and lack of extension services. Cocoyam ranked first in importance as a food security crop and third as a revenue generator relative to other arable crops in the study area. Gross margin per hectare of cocoyam enterprise was ₦5613.65 (36,937.82 francs) while the benefit-cost ratio was 1.44:1. Net revenue per hectare was ₦5546.67 (36,497 francs). These figures indicate that cocoyam enterprise production is profitable. An examination of the effects of socio-economic variables on the output of cocoyam shows that the effects of farming experience, farm size and income were significant at 5% probability, While age of the farmer, his level of formal education, family size, extension contact and technology were not. The major problems encountered by cocoyam farmers include non-availability of modern inputs, poor transportation network, lack of credit facilities and logistic support as well as high incidence of diseases and pests of the cocoyam crop.

The study recommended that modern inputs (seedlings, fertilizer, pesticides, insecticides, etc) and extension services be adequately provided to the farmers as and when due, as well as the introduction of agricultural credit scheme. Provision of feeder roads and rural electrification are highly recommended to enhance input distribution and

evacuation of farm produce; rural electrification would encourage the establishment of cottage industries for the processing of cocoyam. The rising demand for cocoyam in the study area for home consumption as well as raw materials in the industrial sector indicate bright prospects for the cocoyam crop.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER ONE

INTRODUCTION

1.1 Background Information

Agriculture is the main occupation of more than 60% of Cameroon's population (Rassas *et al*, 1991). Like any other African country, Cameroonian economy depends to a large extent on the agricultural sector. Up to 1981, this sector provided 70% of the country's foreign exchange (Ministry of Economic Affairs and Planning, 1981).

In Cameroon, the smallholder farmers produce 90% of the total agricultural output and 80% of the marketed output. However, the 1984 general agricultural survey revealed that the traditional sector still covers 90% of the cultivable land area and is extensive in nature but low in productivity (Ministry of Economic Affairs and Planning, 1987). Food production in the South-west province is largely carried out by smallholder farmers. These are farmers with very limited farm holdings usually less than two hectares (Besong *et al*, 1992). They grow basically for subsistence and in mixed cultures, employing usually low levels of production technology. This practice which is common in the tropics has been identified as the crop production system that appeals most to the small scale farmers with limited resources (Arze *et al*, 1990). Besong *et al* (1992), reported that the farms are sometimes parcelized and scattered while land, hoe/cutlass (Capital

Technology) and human labour are always employed by farmers in the province. They further indicate that, of these three basic inputs, human labour appears most crucial and limiting.

After Cameroon's independence in 1960, she attached more importance to cash crop production; especially cocoa and coffee which in 1980 accounted for 41% of total exports. The other cash crops are cotton, tea, rubber, banana, tobacco, oil palm, rice and sugar-cane. These cash crops constitute the major source of foreign exchange in the country (Arrah, 1992).

Despite the increasing importance of oil and consequent decline of agriculture, food crop production has not been neglected. Programmes as "Grow more Food" and "Back to the Soil" were aimed at increasing food crop production. The "Green Revolution" launched 17 years ago promoted the use of improved seed materials, fertilizers, phytosanitary products, etc. As confirmed in the development plan, through the above modernisation measures, the country could boast of food self-sufficiency when enough varied and nutritive food crops (Yams, cassava, cocoyams, plantain, potatoes, rice, beans, vegetables, etc) were locally produced (Arrah, 1992). In terms of sales, cassava which is also the main supplier of energy ranks second to plantain and the former is also cultivated in all the provinces of the country (Besong, 1989).

Root crops in Cameroon have share values of 17% of total agricultural output and constitute 3.5% Gross National Product (GNP) (Rassas et al, 1991). Lyonga (1980) reported that root and tuber crops are major components of the food of Cameroonians, especially the communities in the central and Southern parts of the country. In these areas cocoyams (Xanthosoma sagittifolium macabo) and Colocasia esculenta (faro) and cassava form the major staples.

Agriculture constitutes more than 20% of the Gross National Product (GNP) and employs more than 60% of the population (Rassas et al, 1991). According to the authors, 54% share within agriculture is accounted for by food crops. They further estimated that cassava and cocoyam (X. sagittifolium and C. esculenta), being very important staple foods in Cameroon, are grown by over 50% of the farmers. Lyonga (1979) and Rassas et al (1991) further reported that, among the root and tuber crops, cocoyam is the second most important after cassava in both production level and area planted.

Cocoyam is an edible aroid of the family Araceae, usually grown for its edible cormel and at times the corms and leaves. The edible aroids belong to five genera: Alocasia, Amorphophallus, Colocasia, Cyrtosperma and Xanthosoma. Only Colocasia and Xanthosoma, are considered of major economic importance (Warid, 1970; Doku, 1981; Plucknett, 1983). Colocasia originated in South-east Asia while Xanthosoma originated from tropical America (Doku, 1981). According to Doku, 1981; IITA, 1982 and Agueguia et al, 1984; cocoyam was probably introduced into Cameroon around the 1840s.

Cocoyams (Colocasia spp. and Xanthosoma, spp.) are produced and consumed as a staple food by about 200 million people (Lyonga and Nzietchueng, 1987). The total world cocoyam production was estimated at 5 x 10^6t in 1983, with more than half of that production (3.4 x 10^6t) from Africa. Nigeria is the world's largest producer of cocoyams, 2.0 x 10^6t, followed by Ghana, 1.4 x 10^6t (Horton et al, 1984). The cocoyam output in Cameroon was 1.8 x 10^6t in 1976/77 and 0.8 x 10^6t in 1980/81 (Cameroon Ministry of Agriculture, 1981).

In Cameroon, cocoyam is cultivated in the Southern part of the country in a region which is bounded on the North by the Adamawa mountains. Specifically, it has been grown very extensively in three ecological zones namely; South-west, North-west, West and to a much lesser extent, in South, Litoral and Central provinces (Wutoh et al, 1989; Acquah et al, 1991). The crop therefore has a preference for deep, well-drained soil in regions where rainfall exceeds 1000mm per annum. The cropping practices involved in cocoyam production are inter-related with those of other crops with which cocoyam are usually intercropped as influenced by the ecological conditions and the eating pattern of producers (Lyonga, 1979). The 1984 agricultural census result showed that, South-west province ranked first and second compared to other nine provinces in the total production and sales of cocoyam (Macabo and taro) respectively.

Cocoyams are of high nutritional value. Many varieties of Colocasia and Xanthosoma are valuable because most parts of the plant may be used for food. The tubers provide easily digested starch and because of this; they are acclaimed to be good carbohydrate sources for diabetics. Also, the leaves are consumed as green vegetables. Cocoyam leaves have a high thiamine content (Morton, 1972), which is an advantage in modern diets where a lot of refined carbohydrate is consumed (as in Burkina Faso). Colocasia leaves are an excellent source of Folic acid, riboflavin, Vitamins A and C, Calcium and Phosphorus which are particularly valuable to anemics. The food - energy yield of cocoyams per unit land area is high (Parkinson, 1984). The protein in Colocasia is richer in total amino acids and sulphur - bearing amino acids than that of other root crops (Splittstoesser et al, 1973, Parkinson, 1984).

According to the 1986-1988 farming systems survey of ninety-five households in nineteen villages within Manyu Division, approximately 12,400 tons of cocoyams (macabo) were harvested in the 1987 crop year, equivalent to 770 million francs at local prices or 16.5 million kilocalories of food energy. Also, approximately 9,600 tons of taro were harvested in the same year, equivalent to 490 million francs at local prices or 10.8 million kilocalories of food energy. This puts cocoyam second after plantain in economic importance (Almy et al, 1988). For instance in 1990 the price of plantain per kilogram in Manyu ranged between 86 francs to 80 francs compared to that of cocoyam per kilogram which ranged from 75 francs to 30 francs for macabo and from 60 francs to 33 francs for taro. However, cocoyam comes third after cassava and maize in terms of local preference in Manyu Division (Almy et al, 1988; 1990b). In addition, cocoyam is more nutritious than cassava in terms of protein content (Bender, 1975; Arene, 1987).

1.2 Problem Statement

One of the major objectives in the economic development of a nation is self-sufficiency in food crop production. In spite of the various food crop production programmes embarked upon by the Cameroon government, there is a growing concern about the capability of Cameroon agriculture to satisfy the food requirements of a fast growing population and to provides enough raw materials for the agro-based industries.

Cameroon, like other tropical African countries, experiences a situation in which the increase in food production has not kept pace with rapid population growth. While its population increased by 3% annually, food production increased by only 1.5% annually. The growth of the agricultural sector was projected to 5% annually; but this had not been achieved because the growing importance of oil in the country's economy has led to a decline in the relative importance of agriculture (MINPAT, 1986; Anon, 1983).

The food deficit situation is exacerbated by declining farm productivity. Evidence of the latter abound in various official and research reports (Wells, 1974; Almy et al, 1987;

1988; 1990). For root and tuber crops, a supply deficit of 64.5% (340,000T) was registered in 1984/85 for cocoyam (taro and macabo), while 1990/91 forecast depicted a deficit of 55.9% (301,000T) (MINPAT, 1986). Furthermore, the situation of cocoyam production in Cameroon reveals a decreasing trend. The combined production of macabo and taro declined from 1,087,733T in 1985 to 833,974T in 1989 with a corresponding decrease in hectarage planted from 112,164ha to 93,703ha (MINAGRI, 1989). This decrease in production as well as the deficit in aggregate supply call for concern with respect to the production and distribution of these crops.

Cocoyam is further plagued by disease incidence which tend to decrease production. Almy et al (1990) indicated that the root rot disease was cutting deeply into *Xanthosoma* production, and that the social as well as economic value of this crop is also declining. Wutoh et al (1989), also noted that, associated with the root rot disease was a decline in production.

Studies in addition, have shown that low yield of cocoyam and other food crops is caused by inefficient production techniques, inadequate input supply, decline in soil productivity, poor extension services and inefficient traditional management practices. The consequence of this has been rapid increases in domestic food prices as well as increased importation of food until the worsening balance of payments position in recent years could no longer sustain the food importation (Almy et al, 1988;

TLU/TRA-Ekona, 1989; Besong, 1989).

The Cameroon Fertilizer Sector Study Report (1986) showed that between 1961 and 1985, Cameroon's annual growth of per capitalfood production dropped tremendously from +2% in 1961 to less than -2% in the 1980s, while food import increased from about -3% to about 0.1% of per capita growth in food production. An indepth analysis of the country's food situation by Cameroon Ministry of Economic Affairs and Planning (1981) showed that for all foods, Cameroon will move from a position of self-sufficiency or slight excess demand to a position of serious shortages by the end of the century, if the situation revealed above in food production and consumption continues. Thus Cameroon risks becoming a net food importer by the end of this decade (Besong, 1989).

In Cameroon, cocoyam occupies fourth position in production after cassava, maize, sorghum/millet, among other food crops. Nevertheless, it falls short of expectation in sales because it occupies eleventh position (Agricultural Census, 1984). The explanation could perhaps be due to its low commercial value, high consumption, lack of storage and processing facilities, transportation and marketing constraints plaguing cocoyam.

The situation of cocoyam production and sales in the South-west province has been examined by MINAGRI (1987). While Fako Division is outstanding in the province, considering the ratio of sales to production, Manyu Division has relatively low quantity of cocoyam harvested and also the lowest both in quantity of cocoyams (metric tons) sold and ratio of sales to production. Manyu is greatly endowed with favourable factors for cocoyam production. In spite of that, cocoyam production is low in Manyu when compared to other divisions of South-west province. This study therefore is necessary as it will investigate these problems.

Although the effects of socio-economic constraints on cocoyam production are numerous, these are not known with precision. Efforts to improve production are therefore not well organised. To improve the productivity of the farmers, it is important to understand their technology, their problems and therefore better appreciate how to assist them. Hence, there is urgent need to identify and propose solutions to prevailing impediments seriously affecting cocoyam production and food security in Manyu Division. The fulfilment of the above, will help solve the problem of rural-urban migration which seems to be one of the major causes of the declining trend in the level of food production in Cameroon.

1.3 Objectives

The broad objective of the study is to examine the economics of cocoyam (*Xanthosoma sagittifolium* and *Colocasia esculenta*) production by small holder farmers in Manyu Division, South-west province of Cameroon.

The specific objectives are to:

1) describe the cocoyam production systems predominant in the study area;
2) determine the relative importance and contribution of cocoyam in the life of the people;
3) determine the effects of socio-economic and other factors on the output of cocoyam in the study area;
4) determine the profitability of cocoyam production under the existing farming systems among the smallholder farmers;
5) identify the problems and prospects of cocoyam production in Manyu Division; and
6) make policy recommendations based on the findings.

1.4 Hypotheses

Based on the specific objectives the following null hypotheses will be tested:

1) H_0: Cocoyam is not profitable under the existing farming systems in Manyu Division.
2) H_0: Socio-economic factors do not affect cocoyam output in the study area.

1.5 Justification for the Study

Cocoyam - *Xanthosoma sagittifolium*, *Colocasia esculenta*, *Colocasia antiquorum* are grown in Cameroon like in other tropical and subtropical regions of the world for food. They are grown mainly for local consumption and constitute one of the major subsistence crops in these regions. The corms supply easily digestible starch and are known to contain substantial amounts of protein, vitamin C, thiamine, riboflavin, and niacin (Cobley and Steele, 1976).

Effective agricultural development planning is hampered by scarcity of information on all aspects of agricultural production. A study of this nature would contribute to the pool of knowledge available on food production in Manyu Division and Cameroon as a whole.

Of the root crops cultivated in Africa, cocoyam has received the least research attention. Research on cocoyam, which started as far back as the early 1930s has not been sustained; more attention has been given to yams, cassava (Doku, 1981). This study is expected to open up areas for further research in the areas of cocoyam production where available information does not, at present appear adequate. Furthermore, some other authors are of the same opinion with Doku that cocoyam research and development has been meagre compared with other tropical root crops (Coursey, 1984; Wang and Higa, 1984).

The need for this research also arises from the fact that researchers who are developing improved cocoyam varieties and improved production practices need basic information about the present cocoyam cultivation methods in the study area. Research work on cocoyam (Xanthosoma spp.) focused mainly on control methods aimed at minimizing Pythium myriotylum root rot (Agueguia et al, 1985) and the physiological determinants of yield (Enyi, 1968, 1977; Ezumah and Plucknett, 1977; Sivan, 1980). Not much work has been done on the economics of cocoyam production. Hence, a study of this nature which looks at the costs and returns involved in cocoyam production so as to assess the profitability of the enterprise is justified.

It is believed that increase in cocoyam production will offer a solution to the low carbohydrate intake in the division and in consequence meet up in the nearest future with the carbohydrate demand estimated by FAO (1971) at 2,300 calories per person per day by the year 2,000.

Manyu division, the focus of this study, has the lowest quantity produced and total sales of cocoyam compared to the other divisions of South-west province. Hence, there is need to investigate the levels of resource utilization and the constraints responsible for low levels of cocoyam production in the area.

Information from this study would also be useful to the following:

a) Agricultural Policy Makers, Students, farmers, traders and consumers as a reference material.

b) The Tropical Root and Tuber Research Project (ROTREP) which aims at contributing to the improvement of Cameroon farmers' socio-economic welfare through increased productivity of root and tuber crops.

c) Institute of Agronomic Research (IRA) especially to the Cameroon Root Crop Improvement Program (CNRCIP) and Testing and Liason Unit (TLU) in relating their research packages to the needs and potentials of food crop farmers and consumers in general.

d) The African Institute of Social and Economic Development (INADES) to better understand the plight of the rural masses.

e) Ministry of Agriculture (MINAGRI) in formulating of policy on cocoyam production that enhances producer incentives through increasing their share of the consumer prices.

1.6 Limitations of the Study

In the process of collecting data and writing the report, the researcher was constrained by a number of factors. Among these factors were those relating to finance, transportation, communication and the unwillingness of some of the respondents to provide the necessary information required of them.

Most of the farmers have no formal education. As a result, the questionnaire had to be read and interpreted to them, Some of them were reluctant to supply certain information. They grew suspicious as to the use to which the answers will be put by the researcher. Most of them only felt relieved when they had their educated children around.

Another limitation is the sampling error which is likely to exist since only twenty respondents were drawn from each village to make up the hundred and twenty farmers. Such errors could have been minimized had the size of samples been larger. Time and cost however could not warrant larger sample size. However, this limitation is not significant enough as to render the informati obtained less effective.

A study of this nature is never without its own problems. The major constraint were time and this made it almost impossible for a more detailed work.

Precisely, limited time was allocated for carrying out the research and writing up of the project report since this was done alongside with lectures.

Some other limitation include the following:

1) The inability of the farmers to keep records on output, prices, income per annum and loans. However, questions had to be asked in different ways to get data that are as reliable as possible.

2) Despite these limitations, the findings are a fair representation of the situation that existed as at the time of the study.

1.7 Plan of the Report

The report of this study is presented in five chapters. Chapter one, which is the introduction, gives the background information, problem statement, objectives of the study, hypotheses, justification and limitations of the study. Chapter two deals with a review of related literature while chapter three presents the methodology. The results and discussions are presented in chapter four while chapter five gives the summary, conclusions, recommendations and suggestions for further research.

CHAPTER TWO

LITERATURE REVIEW

2.1 Origin, Species and Varieties of Cocoyam

The cocoyam - *Colocasia* and *Xanthosoma* - are the two most important genera of the family Araceae. The other three genera *Alocasia*, *Amorphophallus* and *Cyrtosperma* are important as food plants only in the pacific basin (Doku, 1981).

Originating in Southeast Asia, probably in India or Malaysia, where wild forms are still found, *Colocasia* spread throughout India and the Pacific basin (including New Zealand and Hawaii) in prehistoric times (Burkhill, 1938; Porteres, 1960). It reached Egypt through the Middle East in 100AD and later spread westward along the Mediterranean and across Africa to the Guinea Coast (West Africa). By 1500 it was already in cultivation in Gambia and Sao Thome. Madagascar, which is culturally linked with Indonesia, is believed to be another route by which the cultivation of *Colocasia* diffused through Africa. From West Africa, it reached tropical America in the early 1500s, and by 1800 it had spread from the Caribbean to Brazil and, recently, to the South Coast of the United States of America. The cultivation of *Colocasia* is therefore world-wide throughout the tropics to the borders of the temperate regions (Doku, 1981).

Xanthosoma originated in tropical America and was in cultivation in Pre-Colombian times (Thompson and de Wet, 1983).

It occurs from Mexico to Brazil, but its cultivation is concentrated in the Caribbean. It was introduced in the 1840s or probably earlier by West Indian missionaries into West Africa (Wright, 1930, Coursey, 1968, Plucknett, 1970; Karikari, 1971; Purseglove, 1972; Doku, 1981; Nzientchueng, 1985). From there it spread to other parts of Africa. It is also cultivated in Oceania and Southeast Asia.

Colocasia (q.v) and Xanthosoma (q.v) are widely cultivated throughout the tropics. The taxonomy of Colocasia cultivars with edible tubers is confused (Purseglove, 1972). Some authorities, recognise two species namely; C. esculenta, in which the sterile appendage of the spadix is much shorter than the male portion and is exserted, and C. antiquorium schott, in which the sterile appendage is longer than the male portion and is retained within the Spathe (Barrau, 1957). Others consider that there is only one species; C. esculenta, but many recognise two botanical varieties, variety esculenta (Syn.var. typica A.F. Hill) and variety antiquorum (schott) Hubbard and Rahder, Haudricourt (1941) retains the name C. antiquorum for the species and makes a number of botanical varieties based on vegetative characteristics.

The common names add further to the confusion. The taro, eddoe, dasheen curcas or "old" cocoyam are all forms of a plant referred to as Colocasia esculenta or Colocasia antiquorum (Cobley, 1957; Doku, 1981). All types are known as taro in the Pacific. The name cocoyam in West Africa is used for <u>Colocasia</u> and <u>Xanthosoma</u>. West Indian dasheen cultivars have a large central corm, which is the main edible portion, and a few side tubers or cormels. West Indian eddoe cultivars have a relatively small main corm and many side tubers, which constitute the main edible portion (Purseglove, 1972). The dasheen of the Southern United States, described by Hodge (1954), is the eddoe of Trinidad.

The edible clones of <u>Colocasia</u> are propagated vegetatively. They exhibit considerable variation. Hill (1939) recognized only one polymorphic species, namely; <u>C. esculenta</u>. Dasheen and eddoe appear to be distinct agronomically, and also in the form of their corms and, in those cultivars which flower, in the length of the sterile appendage of the spadix. It seems reasonable that they may be differentiated as two botanical varieties - Var. <u>esculenta</u> and variety <u>antiquorum</u>, a procedure which is shared by several workers. Much confusion could be prevented if the common name dasheen was confined to var. esculenta and eddoe to var. antiquorum (Purseglove, 1972).

However, there are hundreds of cultivars of <u>C. esculenta</u> differing in corm size, shape, texture, colour, starch, properties, acidity, storage characteristics, number of secondary corms, and uses. Cultivars, also differ in fertilizer and irrigation requirements, pest and disease resistance (Doku, 1981).

The genus Xanthosoma consist of about 40 species which are easily distinguished from Colocasia by their sagittate or hastate leaves. Some species are grown for their edible tubers or leaves; others are sometimes grown for their ornamental foliage, which may be variegated (Purseglove, 1972).

Like Colocasia, the taxonomy of the edible tuber bearing species is very confused and variability within Xanthosoma is fairly large. The genus Xanthosoma includes crops popularly known as Yautia, Tannia, Macabo, Mafaffa, or new cocoyam. Agriculturists usually refer to the edible corm-producing representatives of Xanthosoma simply as X. sagittifolium (Doku, 1981). Haudricourt's classification in 1941, which was based on Engler's work of 1919, listed eight cultivated species, including X. sagittifolium, the species grown in West Africa (Onwueme, 1978). These species include X. sagittifolium; X. jacquini, X Caracu (White Flesh); X. mafaffa (three cultivars), X. beloplylum (four cultivars); X. brasiliense; X. violaceum (Pinkish flesh) Barrau, 1957; Coursey, 1968; Doku, 1981).

Xanthosoma production has relied mostly on local cultivars. Gooding and Campbell (1961) have identified several cultivars in the West Indies, among which are 22/57, Molkon, 11/56, and Nut eddoes, but even there, the prefered cultivar still differs from one locality to another.

Xanthosoma sagittifolium is the species common in Cameroon. This specie has three local macabo (common name) varieties which are white, red and yellow fleshed. The white is susceptible to root rot; the red, slightly tolerant; the yellow resistant. The red and white are commonly grown for tuber production (Agueguia et al, 1985). The white variety is mostly preferred, despite its greater susceptibility to root rot. The yellow variety is slow-growing, very tasty, and resistant, but has seldom been found to bear cormels outside the South-west province (Almy *et al*, 1990).

Varietal improvement is being carried out by the Cameroon National Root Crops Improvement Program (CNRCIP) which aims to increase yields of cocoyams (*X. sagittifolium*) in production systems suitable for low-resource farmers in Cameroon. The job involves identifying and incorporating disease and insect resistance into cocoyam. (X. sagittifolium) that are high-yielding, have high nutritive quality that consumers accept, and that are adapted to the ecology.. Improved varieties are obtained by crossing the Central American Variety and yellow local variety with the cultivated varieties (IITA, 1985).

Taro is apparently one of the oldest staple tuber in Cameroon, and comes in many varieties, most of which, the traditional ones' which are late-maturing (8-10 months) and prefer shade. These are classed together as "country Coco".

"Ibo Coco" (which does not come from the Ibo (Almy et al, 1990) is a recent arrival, possibly from an area near litoral, or possibly from Hausa areas, which matures in 5-7 months and does well in full sun. Its spread has been remarkable in the last few years (Almy et al, 1990).

2.2 Environment for Cocoyams

In less-developed tropical agricultures with poor resources, the environment more often influences crop productivity than in more developed temperate agricultures (Lyonga and Nzietchueng, 1987).

Dasheen types of taro grow best where the soil is heavy and has a high moisture holding capacity. Eddoe types of taro prefer well-drained loamy soils that have a high water table. For either type of taro, flooding and water-logging of the soil are well tolerated, and are indeed preferred by certain cultivars. Apparently, taro plants growing under flooded or reducing soil conditions are able to transport oxygen from the aerial parts of the plant to the roots; this enables the roots to respire and grow normally (Onwueme, 1978). Unlike taro, tannia cannot tolerate waterlogging; it therefore grows best on deep, well-drained soils (Agueguia et al, 1984; Onwueme, 1978). In Nigeria, Knipscheer and Wilson (1980) reported that cocoyam is best grown in welldrained, fertile upland soils. For all cocoyam, a soil pH of 5.5 - 6.5 is prefered. Cocoyam can tolerate saline soils better than many other crops (Onwueme, 1978).

Root and tuber crops now receive research attention because some can tolerate marginal farm conditions. Colocasia can be grown in hydromorphic soils or under flooded conditions (Plucknett and de la Pena, 1971). Xanthosoma thrives on hydromorphic soils and tolerates upland conditions with an annual rainfall as low as 1000mm and a wide range of soils, from those with a high aluminum content to those composed mostly of coral rock (Horton et al, 1984).

Plant growth environments are mainly determined by the amount and distribution of rainfall and incident-solar radiation, which, in turn, determines temperature (Lyonga and Nzietchueng, 1987). An important characteristic of cocoyams is their high requirement for moisture. Both taro and tannia require rainfall above 2000mm per annum for the best yields to be obtained. When rainfall is low, corm growth is reduced. Among the taros, the eddoe types can tolerate drier conditions than the dasheen types. Indeed most of the dasheen taros do best under flooded conditions (Onwueme, 1978).

Cocoyams are essentially low land crops. Although they have been grown at altitudes as high as 2000m, the yields at such high altitudes tend to be very poor. The relatively cool temperatures encountered at high altitudes probably contribute to keep the yields low (Onwueme, 1978).

However, in Cameroon and Manyu Division in particular, the natural environment is quite favourable for cocoyam production. A rainfall of above 2500mm per annum, mean temperature of 23°c, mean annual relative humidity ranges between 76% and 89% coupled with soil type which have been tentatively identified as granitic, sandy sedimentary; older and recent volcanic are conditions favourable for cocoyam growth.

2.3 Production Systems and Modern Technological Innovations in Cocoyam Production

For flooded culture of taro, land preparation involves essentially clearing, ploughing, disking and harrowing, and puddling (Onwueme, 1978). In Hawaii, where land preparation for taro culture has attained a high degree of mechanization, ploughing and disking are done with rubber-tyred farm tractors equipped with special track devices (Plucknett *et al*, 1970). Puddling is then done with a disk or spike-tooth harrow. Puddling does not necessarily result in higher yields (Ezumah, 1973), and may be conveniently omitted. In most of the fields, land preparation is done while the field is wet; studies are being conducted into the advisability of preparing the soil and planting the crop while the soil is dry (Plucknett *et al*, 1973). In other localities, other kinds of equipment or even hand tools are employed in land preparation for flooded taro culture.

For upland culture of taro or tannia, land preparation also involves clearing, ploughing, and harrowing. There is no necessity to build dikes around the field since no standing water will be needed (Onwueme, 1978).

In traditional, less mechanized, cocoyam production, planting is done on low mounds or in holes dug in unploughed land. In many parts of West Africa, for example, cocoyams are commonly grown on low mounds which are identical to the mounds prepared for production of yam or cassava (Onwueme, 1978).

However, land preparation in the study area for cocoyam production by smallholder farmers involves cutting trees, saplings and grass (including shrubs) as well as raking, burning, tilling and making mounds or beds on which the setts are planted.

According to a farming systems survey by Almy et al (1990a) in the South West Province of Cameroon, farmers were found to plant up to eight crops (maize, groundnuts, egusi, Ibo coco, country coco, yams, macabo and cassava) on the same piece of land in the first season. The most frequent crop associations in Manfe zone were maize, egusi, Ibo coco, macabo, yam and cassava. Macabo (Xanthosoma) and Ibo coco (Colocasia) were intercropped 61.5% and 56.5% of the time respectively in the entire province. The same study reported that farmers intercrop because total productivity per unit of land and total income are higher under intercrops or mixed cropping than monoculture. Also intercropping reduces the risk of losing the farmer's base crop. Almy and Besong (1987) in their farming systems survey of Fako Division revealed that 87 out of 111 fields had cocoyam as a major crop. The authors also pointed out that, of the 87 major fields, only 6 were grown sole stand, while the crops usually intercropped with cocoyam were plantains, cassava, taro, maize and tree crops (the most common system was found to be cocoyam-plantain). Considering the field size of cocoyam farmers, Nyientewang (1989) revealed that the average farm size per cocoyam farmer in Fontem Sub-Division was 0.5ha. Almy and Besong (1987) however converted the field sizes to cocoyam monocrop equivalent and found in their Fako Survey that 15% of the farms were small (one week to clear). 54% medium (one month to clear) and 31% large. Since cocoyam are usually intercropped; therefore, cropping practices are dependent upon those of the other crops. The cropping practices of these crops, in turn, are influenced by the agroecology and consumer habits (Coursey, 1968; Knipacheer and Wilson, 1980 Onwueme, 1984; Igbokwe et al, 1984; Karikari, 1984). In Nigeria, Onwueme (1978) noted that intercropping with maize, yam, okra, cassava, pepper and plantain crops is most common in Imo and Anambra State. In Egypt, cocoyam is often intercropped with vegetable such as radish, tarnips or cucumber (Warid, 1976).

The commercial planting material used for cocoyam production may be; (a) small corms or setts cut from larger corms; (b) cormels or setts cut from large cormels; or (c) stem cuttings consisting of the apical portion of the corm and the lower 15-25cm of the petioles - this type of stem cutting is referred to as 'hull' in taro culture in Hawaii. Setts from corms normally give a higher yield than those from cormels.

while the stem cuttings give a higher yield than even setts from corms (Onwueme, 1978). The high yield of cocoyam from the stem cuttings may be due to the fact that they produce a greater number of roots and a greater total leaf weight than the other two kinds of planting material (Moursi, 1954). The optimal size of sett used for cocoyam planting is about 150g (Onwueme, 1978).

Planting is most commonly done on the flat, although planting on ridges or on beds may sometimes be practiced (Enyi, 1967; Almy et al, 1983). Planting on ridges does not necessarily give higher yields than on low mounds and in holes in unploughed land although it may be of some advantages if mechanized harvesting is to be done (Enyi, 1967). For Upland cultivation of taro or tannia, the setts are planted 5-7cm deep in the soil. Where stem cuttings are used, the top of the corm - portion of the cutting should lie 5-7cm beneath the soil. It is important that the sett-piece or the stem-cutting should not be planted too shallow (Onwueme, 1978). Planting dates varied from March/April to April/May and seemed to depend on the planting and harvesting dates for yam. As such, the cocoyam farming system is a component of a larger yam-based farming system (IITA, 1981)

The general relationship between field spacing and cocoyam performance is as follows: Close spacing increases the corm yield per hectare and the shoot yield per hectare but it decreas the corm yield per plant, the contribution of sucker corms to yield, and the leaf area per plant. This has been found true from trials in Brazil (Silva et al, 1971), in India (Purewal and Dargan, 1957), and in Hawaii (Ezumah, 1973, Ezumah and Plucknett, 1973). High yields per hectare continue to be realized even if spacing is decreased to 30cm x 30cm; but at such high planting densities (109000 plants hectare^{-1}), the amount of planting material is enormous, and the net return per unit of planting material is low. As a compromise a spacing of 60cm x 60cm is recommended. This is the spacing recommended for Fiji (Svan, 1973) where the wide spacing of 90cm x 90cm now used by the farmers results in low yields. Phillips (1976) recommended (0.81 - 1.8m^2) spacing for cocoyam. In farming survey of Manyu Division (Cameroon) by Almy et al, 1988; it was reported that the planting distance of cocoyam varied from 15cm to 140cm, with a median of 60cm and a mean of 59cm. The densities varied around a mean of 28,600 pph.

Mulching increases the yield of cocoyam significantly irrespective of the type of mulch, the heavier the mulch the higher the yield (Chinaka and Arene, 1987).

Enyi (1967) maintained that mulching increases corm yields. Arene and Okpala (1981) noted that mulching soon after planting with slowly decomposing materials that increases the carbon: Nitrogen ratio in the soil, reduce C. rolfsii build up by increasing population of other better competitors for the limited nitrogen available. Weeding and hilling reduce population of nematodes (Okpala; Arene, 1980).

In traditional cocoyam cultivation in Africa and parts of the pacific Islands, little or no fertilizers are used. This is particularly true when cocoyams are grown on land that has just been cleared from bush-fallow. On land that has been cropped for long periods, farmyard manure is sometimes placed in the planting holes (Onwueme, 1978). Reports from various regions indicate that taro responds well to fertilizer applications. In general, the plant has a high requirement for potassium and calcium (Onwueme, 1978). Nitrogen fertilizer results in an increased protein content of the corm, while potassium enhances efficient water use by the plant (Cable, 1975).

With respect to modern technological innovations, recent research in Nigeria (Arene and Okpala, 1981) has revealed that it is possible to control cocoyam disease (Corticium rolfsii) through improved cultural techniques (e.g; hilling, and deep planting). In Cameroon, Nzietchueng (1983) reported that the root rot disease of Xanthosoma (Pythuim myriotylum) can be controlled with a fungicide (metalaxyl); still, selection for root rot resistance in Cameroon is ongoing. In fact, techniques for floral induction with gibberellic acid (IITA, 1978; 1979, 1980; Agueguia and Nzietchueng, 1984) now enable hybridizational breeding in

Xanthosoma and Colocasia (CNRCIP 1980; 1981, 1982; Wilson, 1984). Herbicide use is effective for controlling weeds in *Xanthosoma* and *Colocasia* (CNRCIP, 1980; 1981; 1982; 1983; Wilson, 1984). Herbicide use is effective for controlling weeds in *Xanthosoma* cultivation in Nigeria (Abasi and Onwueme, 1984). Biological control for taro leafhopper has been achieved by using the philoppine egg-sucking bug (*Cyrtorhinus*). Dusting with 1% EHC at 7-8kg hectare^{-1} is also effective. Tannia beefle (*Ligyrus*) is controlled by spraying with malathion or DDT (Onwueme, 1978).

2.4 Harvesting, Yield, Processing and Productivity Studies of Relevance

Cocoyams are ready for harvesting when most of the leaves begin to turn yellow. Apparently, there are not morphological changes indicating maturity, but physiological maturity corresponds to the time when sugars in the corm are at a minimum (Hashad *et al*, 1956). The time of planting to harvesting varies with cultivar as well as the method of cultivation. In Hawaii, it is about 12 months for upland taro and 15 months for flooded taro. Reported durations of taro in the field are 7-9 months in India, 7-11 months in the Philippines, 10-12 months in Fiji, and 6-8 months in Nigeria. In Trinidad, the dasheen types of taro require 8-10 months, while the eddoe types mature earlier, in 5-6 months (Onwueme, 1978). Tannia is mature for harvesting in 9-12 months after planting. For both taro and tannia, no serious deteriotation occurs if the crop is left in the ground for a few weeks after maturity. To some extent therefore, harvesting may be done at the convenience of the farmer (Onwueme, 1978).

Most of the cocoyams grown in the world are harvested by hand or by use of hand tools. In upland culture, pulling of the withered aerial portions of the plant is enough to lift the corms and cormels. The hand labour required for cocoyam harvesting contributes to the high cost of the crop. It is hoped that, in future, some of the machinery now used to harvest other root crops, such as sweet potatoes and sugar beets, could be modified to harvest cocoyams (Onwueme, 1978).

Eluagu, and Unamma (1987) maintained that planting period is between March and June while harvesting lasts from November to February. Knipscheer and Wilson (1980) are of the opinion that harvesting is done from November until March to April. Harvesting could be done in bits or at once.

Yields of cocoyam vary greatly from place to place, depending on the conditions under which they were produced, and the methods used for production. For taro, average yield on a world basis is about 5.5 tonnes hectare^{-1} (Onwueme, 1978). However, the average yield for some regions have been estimated. In Hawaii, with heavy fertilization Colocasia yields up to 50t/ha (de la Pena and Plucknett, 1967). Under tropical peasant farming, Colocasia yields are very low (Campbell and Gooding, 1962). In Nigeria, cocoyam yields are estimated at 6t/ha (Phillips, 1976); in Cameroon 1.4t/ha (Cameroon Ministry of Agriculture, 1981). For tannia, average yields are about 12-20 tonnes $hectare^{-1}$ (5-8 tons $acre^{-1}$). In puerto Rico, yields of 25-37 tonnes $hectare^{-1}$ (10-15 tons $acre^{-1}$) have been reported (Onwueme, 1978).

However, with respect to yields and returns in Cameroon; Nyientewang's (1989) study revealed that cocoyam yields varied from 13.62 tons/ha (deforested zones) to 31.57 tons/ha (forest zones). The author however, also indicated that, despite the high yields, the farmers do not enjoy commensurate income as the marketing middlemen capture the bulk of the marketing (profit) margin: 37.35 francs/kilogram (retailers), 32.92 francs/kilogram (wholesalers) while the farmers had 10.74 francs/kilogram and 18.92 francs/kilogram for annual and perennial farms respectively, when the opportunity cost of labour is considered.

There has been a declining trend in production as well as shortage of supply of cocoyams in some domestic markets. This is attributed to its declining yields, low storability and bulkiness (Coursey, 1984; Ezeh and Arene, 1987). Therefore, the need to process cocoyam into storable, transportable and easily marketable forms becomes glaringly obvious.

Presently in Cameroon, like Nigeria, cocoyam is mainly, traditionally processed and utilized in boiled, cooked, chipped, fried and fufu forms. It is found that this state of processing, and utilization is inadequate to carry consumption over time and space, given the high degree of storage loss (Chandra, 1979); Nweke, 1981; Plucknett, 1979; Taleafoa, 1975 and Ezeh, 1983). If large output of the crop is envisaged, then there is need to process it into storable and easily distributable products.

Processing is a useful means of preserving perishable agricultural produce, such as cocoyam, and thus obtaining a wider market for commodities which may also be available for a certain season of the year and which may have limited storage properties (Nwana and Onochie, 1979; King, 1980; Coursey, 1984).

Productivity studies of relevance include those by Torrence (1982); Moock (1983); Nganje (1990) and Arrah (1992); In all the studies, labour was found to significantly influence output. Moock's regression analysis on maize revealed that labour hours per acre was significant at the 0.05 level. Education was found to have a greater impact on agricultural productivity for women than for men. Nganje (1990) and Arrah (1992) employed the Cobb-Douglas functional form for regression analysis and Torrence found that the productivity of female was more than that of male farmers in the production of yams and vegetables when farming years and years of education were considered. Torrence also showed that female labour inputs (mandays) was utilized more than any other labour type for various activities. Nganje and Arrah had positive regression coefficients for labour, land and planting materials which significantly influenced the output of yam (*Discorea rotunda*) and cassava respectively.

2.5 Storage, Transportation and Marketing

When produced under conditions of subsistence agriculture, at least in Africa, cocoyams are not normally stored for any substantial period but are harvested as and when required (Leakey and Wills, 1977). This provides field storage for the crop, and partly compensates for the poor ability of most types of cocoyam to store well for long periods (Onwueme, 1978). However, it appears that cocoyams can best be stored in cool, dry, well-ventilaged surroundings. The best temperature for prolonged storage is about 7°C; at this temperature, tannia in Trinidad (Kay, 1973), and taro in Egypt (Hashad *et al*, 1956) did not deteriorate in storage for over 3-5 months. Storage at higher temperature (eg. 15-23°C) is not satisfactory for long periods; while storage at lower, non-freezing temperatures (eg. 2°C) results in death of the buds and decay of the corms within two months. A relative humidity of 85% has been recommended for cocoyam storage (Onwueme, 1978). Some authors maintained that, cocoyams are stored in heaps covered with leaves in a shady place. Sometimes barns are constructed. Also storage in the house (in basket or on the floor with wood ash to deter rot is common (Knipscheer and Wilson, 1980 ; Almy et al (1980). The storage of cocoyam in underground pits is common practice for taro in Egypt and Samoa, and for tannia in Cameroon. In other areas, cocoyams may be stored on open platforms in well-aerated surroundings. Apart from storage as the fresh corms or cormels, cocoyams can be stored in dry processed or semi-processed forms.

Under the more highly sophisticated conditions in Hawaii, they are normally processed into 'Poi' (a fermented food) shortly after harvest. There seems to be a considerable degree of confusion as to the suitability of cocoyams for storage (Leakey and Wills, 1977). Recent work conducted in Malanesia (Gollifer and Booth, 1973) suggests, however, that storage life is limited to a few weeks by the development of a complex of post-harvest rots.

In Nigeria, the marketing and transportation of agricultural products are far from being efficient due to the unpredictable fluctuations in prices of produce, lack of access roads, and high transportation costs. The situation is such that the consumers of agricultural products pay exhorbitant prices while the producers receive relatively low prices; a situation attributed to the role of middlemen involved in the distribution and sale of agricultural products including yams

(Eluagu, et al, 1987).

A similar situation operates in Cameroon. Nyientewang's (1989) study on cocoyams revealed that the farmers do not enjoy commensurate income as the marketing middlemen capture the bulk of the marketing (profit) margin, Almy et al, (1988) also indicated that there is a lack of transport in many parts of Manyu Division; where the fields are widely scattered and that the present profusion of small traders very adequately serve the need of the farmers and urban population, while creating employment, in the accesible areas of the division. They further indicated that most of the division is connected by roads which become impassable in rainy season. This affects transportation and marketing of agricultural products. The marketing channel is made up of itinerant wholesalers, urban and rural market wholesalers and retailers. Retailers are of two types — major and minor retailers.

However, Okereke and Umearokwu (1983) observed that the type and means of transportation available to farmers affected the quantity of goods that flow within the marketing system. According to them, if large quantities of goods can be moved cheaply and quickly to markets and if buyers have access to such markets, their absorptive capacity will be strengthened. Furthermore, in most rural communities, farmers convey their farm products to the homes and markets with porters, bicycles, wheel barrows, etc and this is a constraint to the distribution of farmers produce.

The importance of cocoyam in marketing and export trade is constrained by their utilization which is associated with low income people in low income countries. As their utilization is of limited importance in high income countries they have limited export market. On the other hand, low income people constitute low effective market demand and therefore cocoyams which are utilized mainly by them do not have large domestic markets in the low income countries. Marketing and export trade is also constrained by their low value per unit weight and high perishability. These cause marketing costs to be high.

2.6 Labour Utilization in Cocoyam Production

Cocoyam required less labour than cassava for land preparation, weeding and harvesting. Only for planting was it more labour-intensive than cassava (Wilson, 1980). Knipscheer and Wilson (1980) reported that cocoyam is mostly grown by women and further indicated that the crop is less labour intensive than cassava - labour utilization was estimated to be about 142 man-days per ha. The authors proposed that further attention be given to cocoyam breeding because of its economic value and potential. In the same vein, the IITA economists of the farming systems in a 1980 survey, estimated labour utilization for cocoyam to be 148 man-days per hectare. They further estimated the mandays for each cocoyam farming activity (Land preparation 36 mandays/ha; planting 14 mandays/ha;

weeding (twice) 38 mandays/ha; harvesting 60 mandays/hectare) (IITA, 1981). Labour requirement for food preparation of cocoyam is less than for cassava (Knipscheer, 1980).

Most literature on food crop production indicate that women are the major actors in this enterprise. Nyientewang (1989) indicated that cocoyam farmers in Pontem Sub-division are exclusively women. Rassas et al (1991) stressed that root and tuber crops in Cameroon, are produced and marketed by women. This same view was also echoed by Okorji (1983) who noted that, yam is stereotyped men's crop, while cassava, cocoyam, maize, legumes and vegetables are stereotyped women's crop in Nigeria. Endeley (1987) in his study notes that, women farmers are the principal producers of food crop in Meme Division.

Family labour is commonly used for cocoyam production while hired labour is used in addition to family labour in growing yam (Onwueme, 1978). Chi (1989) indicated that family labour was predominantly used and women supplied most of the labour force followed by children (7-15 years), in weeding.

Besong et al, (1992) in their study noted that there is no distinct gender specific activity, but the extent of labour input on each land preparation activity varies with gender. Men cut and prune most trees. Women prepare almost all the mounds and beds. They also dominate in cutting of grass, raking, burning and tilling.

2.7 Prospects of Cocoyam Production

The National Academy of Sciences (1975) report points out that, the potentials of cocoyam are not being realised while their use is declining. While proposing that agronomists should select high yield, good quality cultivars and develop a technology for their intensive cultivation, the report further stressed the need for reducing production costs (possibly by Mechanizing some of the cultural practices). Plucknett (1970) also stresses that the market for the product of edible aroids would probably improve if production costs were reduced and goes ahead to propose mechanization as a major requirement for modernization.

Knipscheer and Wilson (1980) in their paper on cocoyam farming systems in Nigeria, revealed that a large number of households (40% of farmers surveyed) grow cocoyam as a cash crop, selling at least half of the yearly production. In a 1980 survey, IITA economists of the farming systems program found that farmers in Western and Eastern Nigeria are increasing their cocoyam production and that the crop may have a more promising future. It is the second most important root crop in Cameroon, Ghana and Gabon (IITA, 1981).

The promising value of cocoyam can be seen in its role towards alleviating the African Food Crisis. Tropical root crops were essentially products of subsistence agriculture until 20-30 years ago; changes are now evident. Over the last 15 years, with the exception of the Near East, root crops production has expanded (Horton et al, 1984; Plucknett, 1984). Root crops are now being considered as a source of energy. There is interest in cassava as a source of alcohol and colocasia has received similar attention (Wang et al, 1984). Mazumdar's estimates of the need for supplementary food of some African countries berween 1972 and 1985 show that, except for Burkina Faso and Kenya, their food needs are higher for roots and tubers than for cereals.

Cocoyams are a staple in certain regions of some Affican countries (Lyonga, 1979; Karikari, 1984; Nzietchueng, 1985). Corms and cormels may be eaten boiled, mashed, pounded, alone or mixed with other starchy staples (eg. plantain), or grated and incorporated into soups and stews. The youngest leaves of several cultivars are consumed as constituents of either soups or salads. In the caribbean Islands, one species, Xanthosoma brasiliense, is grown essentially for its leaves which are used in salads (Morton, 1972).

Colocasia is grown as a staple food crop in South pacific areas, but is a commercial crop in Fiji, Hawaii, the Philippines, Samoa, and Tonga (Plucknett et al, 1970; Watso, 1979; de la Pena and Melchor, 1984).

2.8 Constraints to Cocoyam Production

Labour has been cited by many authors as a major constraint in cocoyam production and food crop production in general. Upton and Anthonio (1975), found out that labour supply was a major constraint during work peak, which are busy periods of the year corresponding with land preparation, planting and harvesting. Both rapid appraisal (1989) and farming systems (Almy et al, 1990a) surveys in the South-west province of Cameroon, indicated labour costs especially during land preparation were very heavy thus restricting average farm holdings to 2.6 ha of which 1.5 ha is in trees and 1.1 ha in seasonal crops.

Farmers were spending an average of 75,000 FCFA per year in paying labour, mostly for land preparation. Williams (1978), in a study, found out that with the exception of the use of spraying equipment, agriculture depended entirely on human power and this lack of mechanical equipment contributed towards limiting the size of farms cultivated. Nyientewang's (1989) study showed that labour especially transportation labour accounted for about 85% of the total cocoyam production cost. Atayi and Knipscheer (1980) surveying food crop farming systems in "ZAPI"-EST", found that labour was the most limiting factor to production and recommended that research be focused on technologies that will reduce the labour requirements of operations such as land clearing and weeding. Rogers (1980) stressed particularly that, women's labour input is increasingly becoming a constraint on the production of subsistence crops and adds that weeding is very often the crucial bottleneck.

From studies by some researchers, it was found out that, the cropping system in the villages studies depended on traditional hand tools for various farm operations. The consequence of this low level of capital equipment on the farms is low labour productivity (Nweke and Winch, 1980; Okorji, 1983). Other authors like Ongla and Davis (1979), Endeley (1987) and Teh (1989) are of the same opinion that increased food production is constrained by the use of rudimentary farm implements, inadequate access to production inputs (fertilizers and pesticides) as well as ineffective methods of cultivation.

Johnson (1982), identified communal land tenure system which predominates in subsistence farming as one of the factors leading to low agricultural productivity. This system he said, leads to fragmentation of farm land, little incentives in improvement and no security of tenure. Upton and Anthonio (1975), stated that as farms become smaller through fragmentation, land becomes a serious limitation to farming and the result is that farmers tend to reduce the length of the bush fallow which eventually leads to low soil productivity. Furthermore, Strohl (1981), identifies capital and land to be generally scarce resources on small farms and they therefore serve as constraints to increased yields.

In addition to the lack of improved setts and cultural practices, recent studies (Arene and Okpala, 1981; Okeke, 1980;

Nzientchueng, 1983a, 1985) show that field and storage rots are the major constraints to cocoyam production in Africa. Other constraints include weeds (Abasi and Onwueme, 1984) and relate to the long maturation of cocoyam. Because of tuber irritancy, some cultivars of cocoyam are not safely eaten until thoroughly cooked (Coursey, 1984).

Low cocoyam yields in Africa are mainly attributable to disease (Arene and Okpala, 1981; Nzientchueng, 1985). The major diseases are cocoyam disease (Corticium rolfsii) in Nigeria and root rot disease of Xanthosoma (Phythium myriotylum) in Cameroon; both reduce yield by up to 90%. Cocoyams are also liable to weed infestation (Abasi and Onwueme, 1984). The taro leafhopper (Tarophagua proserpina) is the most serious insect pest of taro. It has caused severe losses in Polynesia, Hawaii, the Caroline Islands, and Samoa. Other insect pests of taro are the sweet potato hawk-moth, whose larvae defoliate the plant and the taro beetle, which feeds on the roots and corms of taro. The tannia beetle (Ligyrus) is a serious insect pest of tannia in Trinidad, Venezuela and Guyana (Onwueme, 1978).

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Study Area

The Republic of Cameroon lies to the Northeast of the Gulf of Guinea, between longitudes 8° and 16° east of Greenwich and Latitudes 2° and 13° north of the equator. It has frontiers with Nigeria to the West. Chad and the Central African Empire to the east and the Congo Republic (Brazzaville). Gabon and Equatorial Guinea to the South. Its coastline stretches from Rio-del-Ray near Calabar in Nigeria, down to Equatoria Guinea. Cameroon has a total land area of 474,926 square kilometres (Ngwa, 1978). At present, the population stands at 11.9 million inhabitants due to an increase in annual growth rate of population from 2.2% to 3%.

Manyu Division, the focus of this study is by far the largest division in Southwest province of Cameroon (figure 3.1) with an area of 10,180 square kilometres, It has a population of 153,000 people (1976 Census) which makes it the third most populous (Almy et al, (1988). It has a rural density of 16 persons per square kilometer (Almy et al, 1990). The division comprises four sub-divisions, namely: Mamfe Central, Akwaya, Upper Bayang and Eyumojock. It also has five agro-ecological zones which include: Mamfe forest, Mamfe West, Eyumojock, Akwaya and the Highlands.

Manyu Division is located in the humid forest agro-ecological zone of Cameroon. The evergreen vegetation is dense and luxuriant with tall trees. The annual rainfall is unimodal and ranges from 2500mm to 3,290mm (Dravi, 1985; NMS, 1983). Two seasons prevail. The rainy season has a duration of 7-8 months from March to October while the dry season ~~last~~ lasts for 3-4 months from November to February. The mean temperature is about 23^{0}C and mean annual relative humidity ranges between 76% and 89% (Arze *et al*, 1990). The pattern of rainfall dictates the farming season.

Farming is the predominant occupation in the area. The inhabitants are mostly subsistence farmers. The soil type ranges from granitic, sandy to clayey and rich volcanic loam at highest altitudes (Almy *et al*, 1990). The granitic soils vary from extremely porous sediments to very heavy clay, and are low in PH and essential nutrients, although they can often be corrected by using beds or mounds as planting surfaces (Almy *et al*, 1990). The cash crops produced include cocoa, coffee (Robusta and Arabica types) and oil palm, while the food crops include plantain, banana, yams, cassava, cocoyams, potatoes, maize, groundnuts, melon, vegetables, fruits etc. (Tambe, 1991). Sheep, goats and poultry constitute the important livestock enterprise. Shifting cultivation is still the rule throughout Manyu, and the need to leave land in fallow and to escape damage from goats causes most fields to be distant from home.

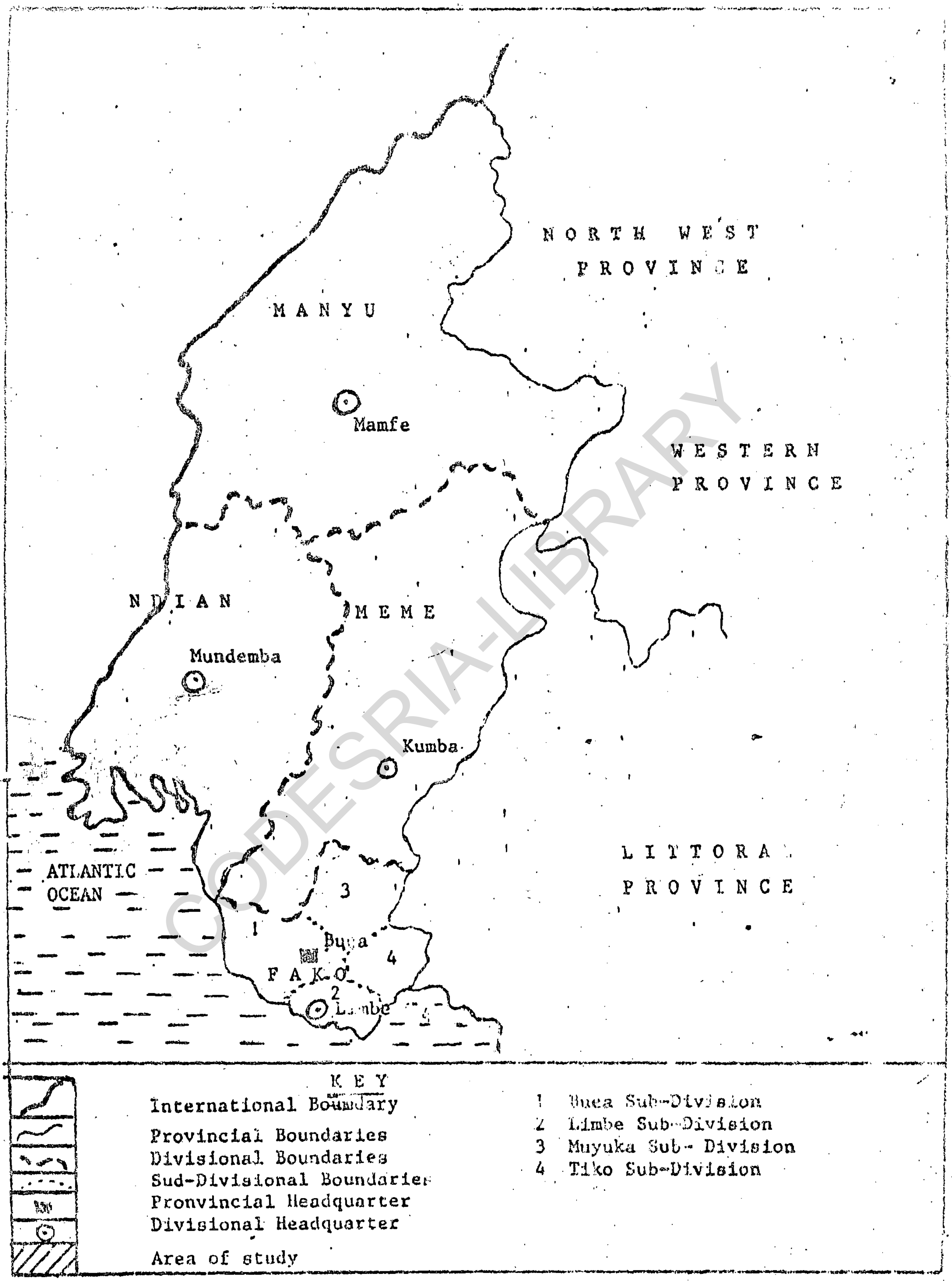


Figure 1: Map of the South West Province locating study area (Not to scale)

SOURCE: Adapted from TLU/IRA Ekona

3.2 Sampling Procedure

Multi-stage random sampling was used for this study. This was adopted in the following ways:

Stage One: Selection of subdivisions: There was a random selection of two cocoyam producing subdivisions out of a total of four subdivisions in Manyu Division.

Stage Two: Selection of villages: Three villages were selected by random sampling from each of the two subdivisions initially selected. This brought the study areas to six villages.

Stage Three: Selection of farmers: From the list of cocoyam farmers collected from each of the six villages under study, twenty farmers were randomly selected from each village. This gave a total sample size of one hundred and twenty respondents/ farmers for the study.

3.3 Data Collection

Data for the study were obtained from both primary and secondary sources.

The The primary data were collected using a set of structured questionnaire which was administered to the farmers. Direct observations during the visits also provided part of the required data. The questionnaire provided information on personal and socio-economic characteristics of the farmers, prices, types and sources of inputs, method of production, processing, storage and utilization of cocoyam, etc.

The researcher was assisted in the administration of the questionnaire by some extension and agricultural officers based in the villages.

Similarly, secondary data relevant to the study including recommended cocoyam practices, varieties of cocoyam and average yield per hectare for a local farmer were collected from annual reports from Ministry of Agriculture, Divisional and Subdivisional departments of Agri culture, research reports from Institute of Agronomic Research. Additional information were obtained from relevant publications, published and unpublished works, text books, journals, periodicals, conference proceedings, seminar papers etc.

3.4 Data Analysis

Descriptive statistics such as means, percentages, frequency distribution were used to analyse objectives 1, 2 and 5.

Objective 3 was analysed using Gross Margin analysis. The Gross revenue of the output/hectare of cocoyam was calculated. Production cost is the aggregation of the product of the price and quantities of the various factors of production used. Both variable and fixed costs were involved. The variable cost of production include cocoyam seeds, cost of land clearing, mounding/ ridging, planting and mulching, weeding cost, fertilizer application costs, cost of mulching materials, fertilizer cost,

cost of harvesting (Eze, 1991). Fixed costs were determined by depreciation of fixed assets using the straight-line method. The salvage value was assumed to be zero. The difference between gross income earned and the variable costs incured gives the gross margin (Abbott and Makeham, 1980). The difference between the gross margin and the fixed cost gives the net income. The hypothesis 1 was tested using profitability function by looking at the net returns.

Objective 4 was analysed using multiple regression. This shows the impact of socio-economic factors and other variables on output of cocoyam. Hypothesis 2 was tested using coefficient of determination (R^2) and appropriateness of signs of socio-economic variables.

<u>Model Specification</u>

The multiple regression analysis model used in analysing objective 4 is implicitly expressed as follows:

$$Y = F(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, U)$$

where,

Y = Output of cocoyam (Francs).

X_1 = Age of cocoyam farmer (years).

X_2 = Level of formal education of cocoyam farmer (year).

X_3 = Family size of farmer (number of persons).

X_4 = Farming experience (years).

X_5 = Farm size (ha).

X_6 = Contact with extension agents (number of visits last farming season).

X_7 = Income.

X_8 = Technology (1 if traditional, and 0, if modern technology).

U = Random term.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Socio-Economic Characteristics Of the Cocoyam Farmers

Socio-economic variables have been shown to influence farmers' production decisions with regards to adoption of technologies, enterprise combinations, cropping systems and farm practices adopted, among others. In this study, such socio-economic variables as age, family size, educational attainment, sex and marital status, occupation, and extension contact are considered.

4.1.1 Age Distribution:

Table 4.1 shows the frequency distribution of respondents according to age. The table shows that about 89 percent of the farmers are between 21 and 50 years old. This shows that cocoyam production is dominated by people who are in their prime of life or productive stage.

Table 4.1: Frequency Distribution of Respondents According to Age.

Age Range (Years)	Frequency	Percentage
20	1	1
21 - 30	32	28
31 - 40	42	36
41 - 50	29	25
51 - 60	8	3
Above 60	3	3
Total	115	100

Source: Field Data 1993/94.

Greater involvement of relatively young than old people in cocoyam production in the study area has implications for increased production of the crop. For instance, younger people are known to adopt innovations more readily than older ones, and this has bright prospects for cocoyam production in the study area.

4.1.2 Family Size:

Table 4.2 shows the distribution of respondents according to family size. About 48 percent of the respondents had family sizes of over 10 persons.

Table 4.2: Frequency Distribution of Respondents According to Family Size.

Range (Persons)	Frequency	Percentage
1 - 3	6	5
4 - 6	18	16
7 - 9	36	31
10 - 12	27	24
Above 12	28	24
Total	115	100

Source: Field Data 1993/94.

Family size ranged from one to 24 persons, with an average of nine persons per family. The relatively large family size among farmers in the area is largely due to the predominance of traditional farming system in the area. Family labour supply is the major source of farm labour in the area; consequently this has encouraged large family sizes. Not only is hired labour costly to employ, its availability is not always guaranteed as labour is required for arable cropping at about the same time by all the farmers. Hence family members have always been engaged in the farms to meet the timeliness required in farm production (Okorji and Obiechina, 1985; Onwuchekwa, 1988). Family members include the man, his wife or wives, children and other dependents. The numbers of children per family varied from one to nineteen, while that for other dependents varied from one to nine. The extended family system prevalent in the study area has helped the farmers to cope with labour demand in their farms.

4.1.3 Educational Attainment:

The number of years of formal education attained by the family head was investigated. Among other reasons, it was expected to affect decision making especially as regards adoption of modern innovations and farm practices. Table 4.3 shows the frequency distribution of respondents according to educational attainment.

Table 4.3: Frequency Distribution of Respondents According to Educational Attainment.

Level of Education (Years)	Frequency	Percentage
Zero	37	32
1 - 6	14	12
7 - 12	58	51
13 - 16	5	4
Above 16	1	1
Total	115	100

Source: Field Data 1993/94.

About 32 percent of the farmers interviewed had no formal education, while 12 percent spent between one and six years in formal school. However, about 56 percent spent more than six years in formal school and these can be considered as fairly literate. The relatively high percent of literate farmers in the study area is probably due to the dominance of school leavers (youths) and middle aged people in the farming business. These had better educational opportunities than the older generation of farmers. Educational attainment is likely to have a positive correlation with lavel of awareness and ability to adopt innovations in farming.

4.1.4 Sex and Marital Status

Sex-stereotyping of crops and farm roles is common in many countries. These are based mainly on the socio-cultural significance traditionally ascribed to certain crops relative to others (Okorji and Obiechina, 1985). In the study area cocoyam is considered a woman's crop, hence its production is dominated by the women folk (table 4.4).

Table 4.4: Frequency Distribution of Respondents According to Sex.

Sex	Frequency	Percentage
Male	12	10
Female	103	90
Total	115	100

Source: Field Data 1993/94.

Table 4.4 shows that 90 percent of the cocoyam farmers were females while only ten percent were males. In Nigeria, however, it has been shown that cassava, for instance, which was considered a woman's crop is increasingly being produced by the men mainly due to relatively high returns from the enterprise compared to other arable crops (Okorji and Obiechina, 1989). A similar trend may be expected in Cameroon for cocoyam if the modern technological packages and processing facilities for diversified products and increased storability are made available to the farmers.

The frequency distribution of the respondents according to marital status shows that about 71 percent of this respondents are married, 15% are single, five percent are widowed while nine percent are divorced. Marital status is important in traditional farming of the study area largely due to the system of land ownership and control of family farm resources. Men own the land and control household farm resources. This explains why mostly married women are involved in cocoyam production; they obtain farm land from their husbands. Farmers who are single were mostly men, who have a share of their family land. Widowed farmers had claim to family land, while divorced farmers, most of whom were females, had land allocated to them by their paternal families for sustenance.

4.1.5 Occupational Distribution:

About 94% of the farmers were full-time farmers while six percent engaged in farming on part time basis. Sixty percent of the farmers produced only crops, none produced only livestock, while 31 percent produced both crop and livestock enterprises. In the study area, greater emphasis was placed on crop production not only because of its profitability relative to livestock enterprise but also because of greater incidence of livestock pest and disease attack. Verterinary services in this study area are grossly inadequate and most farmers are reluctant to undertake risk involved in livestock production under the prevailing pest and disease infestations. In addition to farming, the farmers engaged in such other activities as trading (27%), masonry (3%), civil service (2%), craftmanship (4%) and hunting (18%) as secondary occupations.

4.1.6 Farm Size:

Table 4.5 shows the frequency distribution of respondents according to their farm size. Farm size per family ranged from less than one hectare to about four hectares (ha).

Table 4.5: Frequency Distribution of Respondents According to Farm Size.

Farm Size (ha)	Frequency	Percentage
Less than 1	26	23
1 - 2	81	70
21 - 3	6	5
31 - 4	2	2
Total	115	100

Source: Field Data 1993/94.

About 93 percent of the cocoyam farmers cultivated less than two hectares of land, while only seven percent cultivated between two and four hectares. Not only are the farms small in size, they are scattered, making it relatively difficult for farmers to effectively cultivate using such modern equipment as tractors. Also effective extension supervision is hampered by the scattered nature of the farms especially where accessibility is also a problem.

4.1.7 Farming Experience

The frequency distribution of respondents according to farming experience is shown in table 4.6. Majority (96%) have spent between one and thirty years in farming, while only four percent spent above thirty years. The latter group included those who had worked with their parents in their farms, while the former group included mostly new entrants into the profession.

Table 4.6: Frequency Distribution of Respondents According to Farming Experience.

Farming Experience (Years)	Frequency	Percentage
1 - 10	45	39
11 - 20	38	33
21 - 30	38	24
31 - 40	2	2
41 - 50	1	1
51 - 60	1	1
Total	115	100

Source: Field Data 1993/94.

Farming experience enhances adoption of innovations in agricultural enterprises. However, only six percent of the respondents have had one farm of agricultural training or the other, while the rest (94%) have never been involved in any agricultural training. Experience and training in farming increase farmers' skills and ability to adopt innovations. This should be encouraged among smallholder farmers to achieve increased food production and improved welfare.

4.1.8: Extension Contact:

The effectiveness of extension services in the study area was measured in this study by the number of visits made by extension agent to a farmer in a year. Extension contact increases awareness by the farmers about innovations, enables the farmers to learn modern techniques as well as assists the farmers on procurement of improved inputs, among other benefits. Table 4.7 shows the frequency distribution of respondents according to extension visit in a year.

Table 4.7: Frequency Distribution of Respondents According to Extension Visits in a Year.

Extension Visit	Frequency	Percentage
No visit	98	85
1 - 3 times	8	7
4 - 7 times	8	7
7 times	1	1
Total	115	100

Source: Field Data 1993/94.

From the table, 85 percent of the respondents indicated that they were never visited by any extension agent. Only one (1%) farmer was visited by an extension agent for more than seven times, while seven percent each were visited between one to three times and four to seven times respectively in a year. The fact remains that most farmers have no access to technological innovation in the area due to the absence of extension agents. Miller (1972) remarked that peasant farmers are ignorant of existing innovations to adopt due to lack of adequate extension service. Absence of extension services could therefore be a serious constraint to increased cocoyam production in the study area.

4.2 Factors of Production

The factors of production considered for cocoyam enterprise production include land, labour and capital.

4.2.1 Land

Land is one of the factors of production and a major constraint to increased agricultural production in many areas. In the study area, the traditional system of land tenure is by both individual and communal. For instance, a child inherits a piece of land and could put it to any use of his choice without first having to obtain approval from any person. In the case of communal ownership, the decision to use land is made by the leaders of the community. Land for family can be rented, purchased or received as a gift. Table 4.8 shows the frequency distribution of farmers according to the major source of farm land.

Table 4.8: Frequency Distribution of Farmers According to the Major Source of Farm Land for Cocoyam Production.

Source	Frequency	Percentage
Communical land	16	14
Family land (inherited)	89	77
Purchased	2	2
Rented	2	2
Gift	6	5
Pledge	0	0
Total	115	100

Source: Field Data 1993/94

Family land is the main source of land for cocoyam production for majority of the farmers. About 77 percent of the farmers depended mainly on family land which they inherited for cocoyam production, while about 14 percent used mostly communal land which is normally allocated to farmers at the beginning of each farming season for cultivation. Such communal land reverts back to the community at the end of the farming season. Only two percent of the farmers used mostly purchased and rented land respectively for cultivation, while about five percent depended mostly on land received as gifts from friends and relatives for cultivation. No farmer indicated use of pledged land for cocoyam cultivation in the survey year.

About 89 percent of the farmers indicated that they have enough land for cocoyam production while 11 percent indicated otherwise. This is attributed to the predominantly small-scale nature of the cocoyam enterprise in the study area. Majority (61%) of the farmers grew cocoyam in distant farms, while 39% grew cocoyam in the compound or neighbour hood farms. This is mainly dependent on the availability of land for cultivation. Table 4.9 shows the frequency distribution of respondents according to reasons for using particular farm land for cocoyam production.

Table 4.9: Frequency Distribution of Respondents According to Reasons For Using Particular Farm Land for Cocoyam Production.

Reasons	Frequency	Percentage
Land is more suitable and fertile	102	34
Reduced cost of transportation	45	15
Have easy access to the crops as need arises	49	17
For effective and efficient supervision.	39	13
To avoid destruction by livestock	61	21
Total	296*	100

Note * - multiple responses were recorded.

Source: Field Data, 1993/94.

About 34 percent of the respondents based their choice of farm land for cocoyam on the perceived fertility of the land; distant farm land tends to be preferred because of fallow practice adopted. However, 21 percent of the farmers would prefer distant to compound/neighbourhood farm in order to avoid destruction of the crops by livestock which they usually keep at home. About 15 percent of the farmers based their choice of farm land for cocoyam on transportation cost, 17% considered the easy access to the crops as the need arises while 13% considered effective and efficient supervision of the cocoyam enterprise. These latter groups of farmers have more cocoyam farms in their compound than in the distant farm land.

There were an average of four cocoyam farms per farmer in the survey year. Table 4.10 shows the frequency distribution of respondents according to the number of cocoyam farms cultivated in the survey year.

Table 4.10: Frequency Distribution of Respondents According to the Number of Cocoyam Farms Cultivated in the Survey Year.

Number of Farms	Frequency	Percentage
1	9	8
2	9	8
3	34	30
4	50	43
5	13	11
Total	115	100

Source: Field Data 1993/94.

Forty six percent of the farmers had between one and three cocoyam farms, 43 percent had four farms while 11 percent had five cocoyam farms. None of the survey farmers cultivated more than five cocoyam farms in the survey year.

The cocoyam farms were located at average distances of between 0.5km and 6.0km from the homestead. The average sizes of the cocoyam farms ranged from 0.3ha to 1.5ha. It was observed that farmers considered some factors in deciding on the size of their cocoyam farms. Table 4.11 shows the frequency distribution of respondents according to what determines the size of their cocoyam farms.

Table 4.11: Frequency Distribution of Respondents According to What Determines the Size of Their Cocoyam Farms.

Factors	Frequency	Percentage
Farming experience	28	8
Food requirement	126	30
Cash requirement	88	25
Availability of land	59	17
Availability of Planting materials	34	10
Market price of cocoyam	36	10
Total	351*	100

Note *:- Multiple responses were recorded.

Source: Field Data 1993/94.

The major factors considered by the farmers in deciding on the size or land area to be allocated to cocoyam enterprise include food requirement (30%), cash requirement (25%) and availability of land (17%). Availability of planting materials and market price of cocoyam were equally considered though they were of relatively low significance. Availability of planting materials is not a serious problem in the study area since cocoyam is easily propagated by cutting the corms. Experience was the least factor considered probably because the production systems including farming practices adopted for cocoyam enterprise have not witnessed significant changes over the years. All would adopt similar production techniques irrespective of farming experience.

4.2.2 Labour:

Survey farmers obtained labour for cocoyam production from four main sources namely family, hired, exchange and cooperatives (Table 4.12).

Table 4.12: Frequency Distribution of Respondents According to Type of Labour Used in Cocoyam Production.

Type/Source of Labour	Frequency	Percentage
Family	115	50
Hired	76	33
Exchange	28	12
Cooperatives	11	5
Total	230*	100

Note *:- Multiple responses were recorded.

Source: Field Data, 1993/94.

Farmers sourced their farm labour from more than one source. All the farmers used family labour for cocoyam production. On aggregate basis, family labour accounted for

50 percent of the labour used, hired labour accounted for 33 percent, exchange twelve percent, while cooperative labour accounted for only five percent. Labour input per day was estimated at about eight hours. Hired labour was engaged mostly on daily basis, although in a few cases they were employed on hourly basis or the farm operation(s) to be performed contracted out. The average daily wage rates were ₦50.00 for males and ₦40.00 for females. Children were paid about ₦15.00 per day on the average. Mode of payment for hired labour actually involved payment in both cash and kind in most cases. Sixty percent of the farmers paid their labourers in both cash and kind, 32 percent paid only in cash while only two percent of the farmers paid only in kind. Payment in kind includes use of farm produce, and meals, which are given to the labourers for the services rendered.

Exchange labour involves peers who usually come together to form workgangs of two to five persons. Their mode of operation is to work on their individual farms in rotation. Since each member benefits from the arrangement, no cash payment is made. However, meals and drinks are provided to members during the work period. This arrangement has brought relief to many farmers as it helps to alleviate the problem of labour bottlenecks arising from scarcity of labour and high wage rates charged by available ones.

Cooperative labour is similar to exchange labour except that in addition to working on their cooperative farms, their labour is also available for sale to non-members. Due to their relatively few membership and the bureaucracy involved in securing their services, not many farmers employ such labour type.

Men, women and children provided their labour for the performance of different operations on cocoyam farms (Table 4.13).

Table 4.13: Labour Allocation (Mandays) per Hectare For Different Farm Operations in a Cocoyam Based Crop Mixture Enterprise.

Operation	Males (MD)	Females (MD)	Children (MD)	Total (MD)	%
Land clearing	10.46	4.33	0.00	14.79	7.35
Mounding/ridging	29.85	2.41	0.00	32.26	16.02
Planting	0.44	20.00	2.50	22.94	11.40
Weeding	0.00	84.00	10.00	94.00	46.72
Fertilizer Application	0.44	4.44	0.00	4.88	2.42
Harvesting	1.70	26.30	4.33	32.33	16.07
Total	42.89	141.51	16.33	201.23	100.00
%	21.32	70.32	8.36		100.00

Source: Field Data, 1993/94.

Although all labour types are engaged in cocoyam production there is sex-stereotyping of farm operations.

For instance, while land preparation (clearing, ridging and mounding) is predominantly a male activity, planting, weeding and harvesting are dominated by females in the study area. Female labour accounted for about 70 percent of total labour used per hectare of cocoyam enterprise, while male labour accounted for 21 percent and child labour 8 percent. A 1:1 ratio was adopted for male and female labour because it has been shown that in traditional arable crop farming there is no significant difference in input and work efficiency by sex for their particular operations (Okorji and Obiechina, 1985). Each labour type specialises in the performance of its traditionally ascribed farm roles.

Weeding was the most important farm operation in cocoyam production in terms of labour requirement. This was followed by ridging/mounding (16%) and harvesting (16%). There is yet no modern technology for weed control in cocoyam based farms in the study area, hence the operation is entirely mannually performed.

4.2.3 Capital

Capital as considered in this study includes cash, farm implements and tools. Such physical structures as buildings in which farmers kept their farm tools and other items were ignored because they were primarily for residence;

Farm structures were absent in the study areas.

Due to the relatively poor financial status of the farmers they obtained financial assistance from other sources to augment their personal savings. These sources include friends/relatives, Njangi and cooperative society (Table 4.14).

Table 4.14: Frequency Distribution of Farmers According to Sources of Fund Used For Cocoyam Production.

Sources of Fund	Frequency	Percentage
Friends/relatives	9	7
Njangi (Village Association)	22	17
Cooperative Society	7	5
Personal savings	94	71
Total	132*	100

Note *: Multiple responses were recorded

Source: Field Data, 1993/94.

The survey farmers obtained financial assistance from more than one source in the survey year. However, personal savings was the most important source of fund used by the farmers. Njangi, which is a form of village Isusu, was helpful to the farmers as a source of fund for cocoyam production. It was observed that no farmer received any form of assistance from Agricultural banks, commercial banks, government agency (extension) or money lenders. The main reasons advanced by the farmers were that they could not provide the required collateral securities for such bank loans and the processes were cumbersome and time consuming. The farmers could not obtain fund from money lenders either mainly becuause of their exhorbitant interest and other difficult conditions usually attached to such loans.

The implements used by the farmers include hoe, matchet, sharpened knife, digger and baskets. None of the farmers employed tractor services for any of the farm operations. Apart from the fact that their farms are small and scattered thereby creating some difficulties for mechanisation of such operations as land clearing and ridging, tractor-hire services were not available in the study area. Table 4.15 shows farm implements used by the farmers and their depreciated values.

Table 4.15: Farm Implements Used and Their Depreciated Values.

Farm Implement	No Used Per Farmer	Unit Cost (₦)	Total Value (₦)	Life Span (yrs)	Depreciated Value (₦)
Hoe	3	13.50	40.50	3	13.50
Matchet	4	29.50	118.00	3	39.33
Sharpened Knife	2	8.50	17.00	4	4.25
Digger	1	12.00	12.00	5	2.40
Basket	5	3.00	15.00	2	7.50
Total	-	-	-	-	66.98

Note: (N1.00 = 6.58 francs in 1993/94 season).

Source: Field Data 1993/94.

Using the straight line method of depreciation, the depriciated value of all the farm implements used per farmer amounted to ₦66.98. This buttresses not only the dominance of traditional technology in cocoyam production but also the low scale of operation and poor financial status of the farmers in the study area.

4.3 Cocoyam Production in Manyu Division

4.3.1 Relative Importance of Cocoyam:

Farmers in the study area grow such crops as yam, cocoyam, cassava, sweet potato, banana, maize, plantain, beans, pepper, okro, and melon. The survey farmers were asked to provide reasons why they grow cocoyams. A summary of their responses indicated that they grow cocoyam mainly for consumption (95%) and for revenue generation (75%). Farmers were asked to rank the major arable crops they produce in terms of consumption needs and revenue generation. The responses were analysed using weighted indices and the results are presented in table 4.16.

Table 4.16: Ranking of the Major Arable Crops in Order of Importance in Terms of Consumption and Revenue Potentials.

Crop	Consumption		Revenue	
	Weighted Index Score	Rank	Weighted Index Score	Rank
Yam	5.9	5th	8.4	4th
Cocoyam	10.6	1st	9.1	3rd
Cassava	7.4	3rd	10.3	1st
Sweet potato	4.7	6th	4.4	6th
Banana	4.1	7th	4.3	7th
Maize	6.8	4th	6.2	5th
Plantain	9.2	2nd	9.7	2nd
Beans	1.8	10th	1.5	11th
Pepper	0.7	11th	3.8	8th
Okro	2.3	9th	3.4	9th
Melon (Egusi)	3.8	8th	2.8	10th

Source: Field Data 1993/94.

Table 4.16 indicates that cocoyam is a very important crop in the study area both as a reliable source of household food and cash needs. Based on the weighted indices scores, cocoyam ranks first in terms of consumption needs and third in economic importance when compared to the other arable crops grown in the study area. Plantain closely follows cocoyam in consumption needs but ranks higher than cocoyam in economic importance or revenue generation. Cassava is the most important crop in terms of revenue generation in the study area.

Earlier studies reported that cocoyam occupied the third and second positions in terms of consumption and revenue generation respectively (Almy and Besong, 1988). Tiapo (1993) in his study reported that cocoyam ranks first in revenue generation in the Fako Division. The present study has shown that the relative importance of cocoyam as a food security crop has been on the increase. The recent introduction and mass adoption of improved high-yielding cassava varieties coupled with processing facilities and increased market for the cassava products has given the crop an edge over cocoyam in terms of revenue generation in the Manyu Division.

4.3.2 Cocoyam Varieties Grown in the Study Area

Two species of cocoyam namely *Xanthosoma* (macabo) and *Colocasia* (Ibo coco, country coco) are grown in the study area. Ninety four percent of the survey farmers grow both species, while six percent grow only Colocasia and three percent grow only Xanthosoma on their farms. The choice of the specie grown depends on the intended use to be made of the cocoyam by the farmer. For instance, Xanthosoma is preferred for preparing cocoyam porridge, foofoo, cocoyam biscuits and roasted cocoyam. This is because Xanthosoma is bulkier and less irritant than Colocasia. On the other hand, Colocasia is preferred for soup thickening.

Different varieties of these cocoyam species are grown by the farmers (Table 4.17).

Table 4.17: Frequency Distribution of Respondents According to Varieties of Cocoyam grown.

Variety		Frequency	Percentage
Xanthosoma:	White	61	53.0
	Red	6	5.0
	Yellow	0	0
	White & Red	50	43.0
	White & Yellow	2	2.0
	Red & Yellow	1	1.0
Colocasia:	Ibo coco	15	13.0
	Country coco	9	8.0
	Ibo & Country coco	99	86.0
Total		243*	-

Note: Multiple responses were recorded.

Source: Field Data 1993/94.

The white variety of Xanthosoma is the commonest variety of cocoyam grown by the farmers. This is mainly because of its colour (white) which makes the product relatively more attractive. Many farmers (53%) also grow both the white and red varieties of Xanthosoma on their farms. No farmer grew the yellow variety alone although one farmer grew it in combination with the red variety. Both varieties of Colocasia are grown by majority of the farmers, although the Ibo coco variety is preferred. As mentioned earlier, the farmers grow both cocoyam species mainly for consumption and revenue generation. However, the white of the Xanthosoma is preferred mainly because of the various forms into which products can be prepared for consumption. The colocasia is consumed mainly as a soup thickner; few farmers consume it as foofoo.

4.3.3 Cropping Systems and Calender of Farm Operations on Cocoyam Based Enterprise

Mixed cropping is the commonest cropping system adopted by farmers in the study area. Various crop combinations refered to as crop-based mixtures are grown, the most important being yam-based, cassava-based, cocoyam-based crop mixtures. For instance, yam-based crop mixture enterprise may include such other crops as cassava, cocoyam, maize, melon, banana, etc but with yam as the main crop in the mixture. The commonest form of cocoyam-based crop mixture enterprise include cocoyam, maize, beans, cassava, and melon. In such farms there may be some stands of plantain, banana, and even yams, but cocoyam is regarded as the main crop. Farmers in general adopt mixed cropping as an insurance against the failure of particular crop. Land scarcity has also been noted as one of the reasons why farmers practice mixed cropping system. Some farmers also adopt mixed cropping as a measure of controlling weeds, pests and disease attacks through the provision of shades which helps to smother weeds as well as reduce the population of nematodes and other soil pathogens.

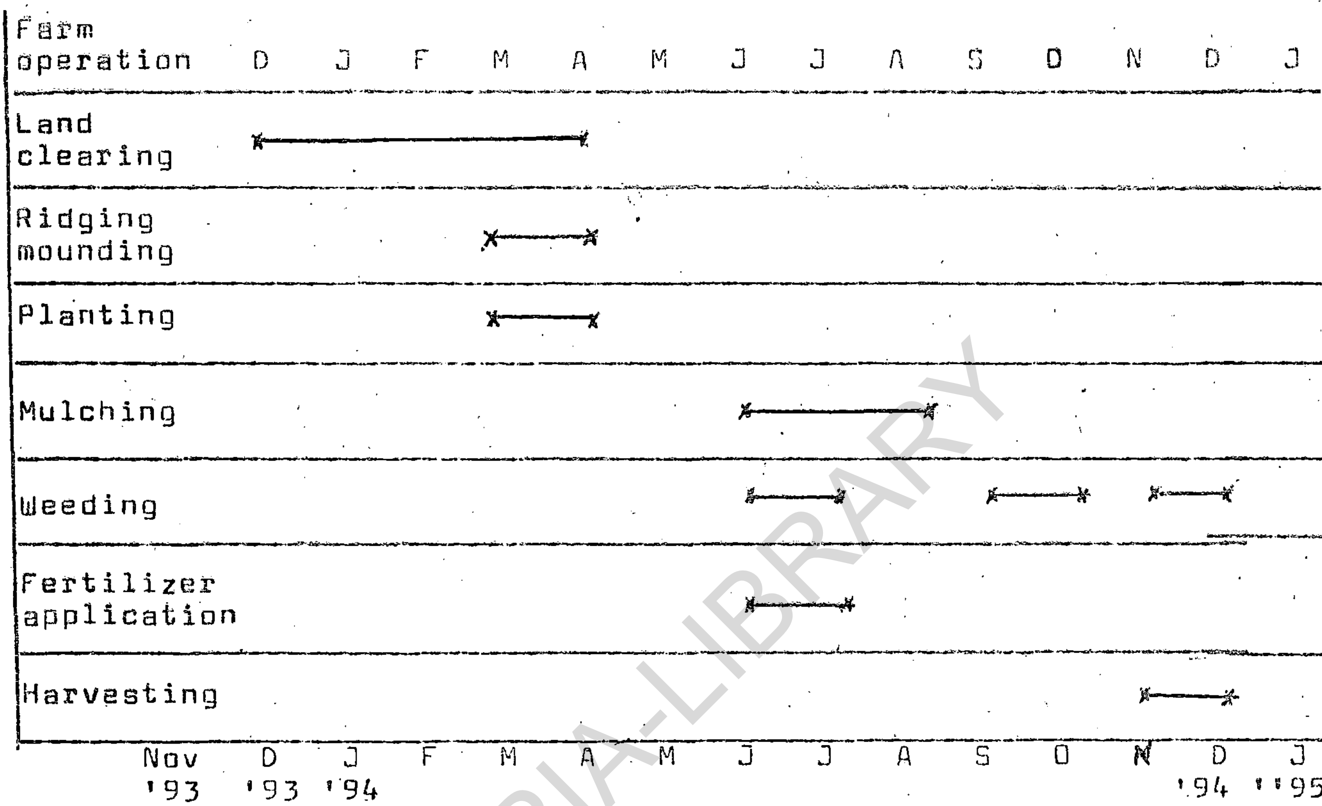
The farm operations performed in cocoyam-based crop mixtures include land clearing, mounding/ridging, planting, mulching, weeding, fertilizer application and harvesting. Land clearing for cocoyam production commences in the month of November and lasts till about the month of April of the followin year. The method of land clearing used include slashing with matchet (92%) and bush burning (63%). Many farmers adopt both methods depending mainly on the vegetation of the farm to be cultivated for the season.

Mounding/ridging operations commence in March and lasts till April (Figure 4.1). Cocoyams are usually planted on small mounds, big mounds, ridges, beds, minimum tillage or no tillage (flat land) depending on the soil structure and texture as well as toposequence. About 57 percent of the farmers planted their cocoyam on small mounds, 66 percent on big mounds, four percent on ridges, four percent on beds, three percent in small holes made in unploughed land (minimum tillage), while only one percent planted on flat land (no tillage).

Planting of cocoyams is also done between the months of March and April. During this period the rains have set in. Ninety percent of the farmers planted the cormels, 77 percent planted the corms, 12 percent planted the head sett while only two percent planted the stem cuttings. The part of cocoyam planted by a farmer often depends on availability of the cocoyam. Three main methods of planting are used namely cut surface placed facing upward and covered with soil, cut surface placed facing downwards, and sideway planting. Majority of the farmers (81%) plant with cut surface facing upwards, 31 percent plant with cut surface facing downwards, while 10 percent plant with cut surface facing sideways. The method adopted seems to be based on choice as there is so far no scientific data on effect of planting method on yield of the cocoyam.

About 94 percent of the farmers sourced their planting materials from personal reserve from previous harvest, while 70 percent purchased cocoyam from the local market. None of the survey farmers obtained cocoyam for planting from the agro-service centres. The major problems encountered by farmers in getting the cocoyam planting materials include inadequacy of quantity preserved from previous harvest (71%), lack of improved cocoyam varieties (58%), high cost of the improved varieties when available (16%). This explains why many farmers had to buy cocoyam planting materials from the local market to supplement the quantity got from the inventory of previous harvest.

Mulching is usually done between June and August. However, none of the survey farmers mulched his cocoyam farm in the survey year. Weeding operations commence in June and lasts till July for the first weeding commences in September and lasts till October, while third weeding is done between November and December (Figure 4.1). Atleast two weedings are performed on the cocoyam farms. Many cocoyam farms are weeded thrice depending on labour availability and vegetation of the farm or ecology. Weeding operation was done by all (100%) of the farmers manually using hoes. One of the survey farmers, however applied herbicide in his cocoyam farm for weed control in addition to the manual weeding.



Key

Period during which operation is performed.

Figure 4.1: Calendar of farm operations on cocoyam-based crop mixture enterprises.

Source: Field Data, 1993/94.

Fertilizer application is done between June and July, usually after the first weeding. However, only one of the survey farmers applied fertilizer on his cocoyam farm in the survey year. While some farmers reported that fertilizer was not available for use, many indicated their preference for organic manure. According to the latter group fertilizer is injurious to human beings who consume the farm produce.

Harvesting of cocoyam is done between the months of November and February. The respondents indicated that cocoyam (Xanthosoma spp) stayed in the soil for an average period of ten months, while Colocasia stayed for an average of eight months before harvest. Only 15 percent of the respondents harvested all their cocoyam at once, while majority (85%) harvested in bits, mainly as need arises. Delayed harvesting of cocoyam was however, observed to result to high rate of post harvest losses.

4.4: Cost and Returns in Cocoyam Enterprise.

The cost items considered include cocoyam seeds, labour input for the different farm operations, depreciated values for farm implements and tools and cost of fertilizer. Since other agro-chemicals were not used by the survey farmers, no costs were inputed for them. Table 4.18 shows the gross margin analysis for cocoyam production in the survey year.

Table 4.18: Gross Margin Analysis for Cocoyam Enterprise in the Survey Year.

Item	Unit	Quantity	Unit price (₦)	Amount (₦)
Gross returns	t/ha	7.43	2450.00	18,203.50
Total revenue				18,203.50
Variable costs:				
Cocoyam seeds	t/ha	1.86	2450.00	4,532.50
Land clearing	mandays/hr	14.79	Male ₦50/day Female ₦40/day	696.20*
Mounding/ Ridging	manday/hr	32.26	Children ₦15/day	1,590.10*
Planting	"	22.94	*	859.50*
Weeding	"	94.00	*	3,510.00*
Fertilizer application	"	4.88	*	199.60*
Harvesting	"	32.33	*	1,201.95*
Total variables cost (TVC)				12,589.85

Gross margin:= TR - TVC.

= ₦18203.50 - ₦12,589.85

= ₦5613.65 (36,937.82 francs)

(₦1.00 = 6.58 francs).

Note: Wage rates varied by labour type for same operation. The value of labour input by labour type and by farm operation is shown in appendix 1. A gross margin of the ₦5613.65 indicates total cocoyam production is profitable.

Net revenue per hectare is computed by deducting the depreciated values of farm implements used in production (Table 4.15) and it amounts to ₦5546.67 (₦5613.65 - ₦66.98). Benefit-cost ratio for the cocoyam enterprise gives a value of 1.44:1. This shows that one naira invested in cocoyam production yields about 44 kobo. When this is compared with the prevailing interest rate of between 9 to 15 percent confirms the profitability of the cocoyam enterprise. Introduction of improved cocoyam varieties and other modern inputs in cocoyam production will increase output remarkably and hence the net revenue realisable by the farmers.

4.5 Socio-economic Variables and Output of Cocoyam

The effect of certain socio-economic variables on the output of cocoyam was investigated using a multiple regression model. The regression model is implicitly expressed as:

$$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, U)$$

where

Y = output of cocoyam (monetary terms).

X_1 = Age of the farmer.

X_2 = Level of formal education attained by the farmer.

X_3 = Family size.

X_4 = Farming experience.

X_5 = Farm size.

X_6 = Extension contact.

X_7 = Income.

X_8 = Technology.

U = Error term.

Of the three functional forms tried, the double-log gave the best fit in terms of R^2 value and conformity with a priori expectations with respect to the signs of the b coefficients, and hence was chosen. The regression results are presented as follows:

$$\log Y = \log 8.51 + \underset{(0.109)}{0.11} \log X_1 + \underset{(0.007)}{0.01} \log X_2 + \underset{(0.037)}{0.04} \log X_3 +$$

$$\underset{(0.033)}{0.07} \log X_4^{*} + \underset{(0.053)}{0.48} \log X_5^{*} + \underset{(0.012)}{0.01} \log X_6 +$$

$$\underset{(0.018)}{0.04} \log X_7^{*} + \underset{(0.048)}{0.06} \log X_8; \quad R^2 = 0.69; \; F - \text{ratio} = 30.14.$$

Note: the values in parentheses represent standard errors.

* means significant at 5%

All the independent variables have a positive comelation with the output of cocoyam (Appendix 2). However, the effects of farm size, farming experience and income were significant while those of age of farmer, his level of formal education, family size, modern technology adopted and extension contact were not significant. Age was not a significant determinant of output of cocoyam probably because its distribution showed that many respondents fell within the same age cohort and hence there was low variability. Similar reasoning can be adduced for level of formal education attained. Moreover, the lack of extension contact with the farmers more or less did not allow most of the fairly literate farmers to exhibit their learning potentials. Although a sizeable proportion of total labour input was sourced from the family, size of family was not a significant determinant of output of cocoyam in the study area. This suggests that the proportion of family members who actually work on the farms may be relatively low, especially given the increasing rate of school enrollment in the study area.

The effect of farming experience was significant and this could be related to the acquisition of farming skills and managerial expertise over the years. Farm size also had a significant effect on output. This is probably due to better management, crop combinations and greater efficiency in the use of productive resources in large than small farms. Income had a significant effect on output and this may be related to ability to employ adequate resource inputs. Level of technology had a significant effect on cocoyam output. Such modern technologies as mechanisation, use of improved cocoyam varieties and application of herbicides, pesticides etc were not done. This probably explains why level of technology did not have a significant effect on cocoyam output. It has been shown by Eze (1991) that there are high potentials and bright prospects for increased output of cocoyam if adequate modern technological package is made available to the farmers.

4.6 Utilisation of Cocoyam in the Study Area

4.6.1 Cocoyam Consumption and Martketing Pattern:

Harvested cocoyams were put into different uses by the farmers. On the average about 38 percent of the harvested cocoyams was consumed in the household, 47 percent was sold for revenue, 13 percent was preserved for use as planting materials while two percent was put to other uses including given away to friends and relatives as gifts.

Cocoyam is consumed in different forms in the study area.

Table 4.19: shows the frequency distribution of respondents according to the farms in which cocoyam was consumed in the household.

Table 4.19: Frequency Distribution of Respondents According to the Forms in Which Cocoyam was Consumed in the Household.

Form of Consumption	Frequency	Percentage
Fufu (pounded)	97	83.0
Boiled	101	88.0
Soup thickner	14	12.0
Cocoyam porridge	94	82.0
Roasted	67	58.0
Fried	3	3.0
Pudding	66	57.0
Total	442*	-

Note: * Multiple responses were recorded.

Source: Field Data 1993/94.

Cocoyam is most commonly eaten in the boiled form, followed by consumption in pounded and porridge forms. Fifty eight percent of the farmers consumed cocoyam in roasted forms while 57 percent consumed it as a pudding. Fried cocoyam is the least form in which cocoyam is consumed in the study area. It was observed that both the white Xanthosoma and the Ibo coco (Colocasia) varieties are consumed by all the survey farmers, 25 percent consumed country coco (Colocasia), while 17 percent consumed the red Xanthosoma variety. None of the survey farmers consumed the Xanthosoma yellow variety in the survey year.

The survey farmers sold their cocoyams at various places. Eighty percent sold mostly at the local market, 31 percent sold mostly at the home while 10 percent sold mostly at the farm gate. Survey farmers did not sell their cocoyams at cooperative shops. The sales arrangement made by the farmers for the sale of their cocoyams include sale to wholesalers which was done by only seven percent of the farmers, sale to retailers (33%), sale to the consumers (66%) and contact sale which was done by only one percent of the farmers. Thus most farmers prefer to sell their cocoyams direct to the consumers.

About 55 percent of the survey farmers indicated that they grade their cocoyams before taking to the market while the rest do not. Seventy percent of those who graded their cocoyams did so on the basis of size, while 30 percent mainly graded according to colour. Different modes of transportation were used by the respondents in conveying their cocoyam to the markets. All the respondents carried some quantity to the market by means of head porterage; in addition, 25 percent used bicycles/wheel barrow, seven percent used motor vehicle while three percent used motor-cycle. Ninety four percent of the respondents indicated that they have transportation problems, the most important of which include bad roads (poor accessibility) (55%), high transportation cost (30%) and lack of means of transportation (37%). Most of the roads and footpaths in the study area are in deplorable conditions. This impedes the movement of farm inputs and evacuation of farm output.

4.6.2 Processing and Storage of Cocoyam:

The major form in which cocoyam was processed was into flour which entailed slicing the corms, drying and pounding or grinding. Absence of grinding machines in the rural areas makes this activity tedious, hence only few farmers engaged in the processing of cocoyam into cocoyam flour.

Survey farmers stored their harvested cocoyams for various reasons. About 90 percent stored mainly for future consumption, 76 percent stored mainly for use as planting materials, while about 70% stored to sell in the future when prices are more favourable. Most of the respondents (71 percent) stored their cocoyam in heaps under tree shade, 32 percent stored in rafts above the ground, 21 percent stored in well ventillated barns, 12 percent stored in dug pits while about four percent of the respondents stored at home on the floor of a cool room. Sprout inhibitors and refrigerators were not used by any respondent in cocoyam storage.

Ninety six percent of the cocoyam farmers indicated that they suffered losses of the stored cocoyams. The losses recorded ranged from between fourteen and thirty-two percent of the stored cocoyams. The identified causes of the losses of stored cocoyams include decay (97%) diseases (43%), pests (34%) and drying up (18%). It was observed that the post harvest loss of cocoyam seriously reduces the farmers revenue. Even though some farmers dry their cocoyams as chips mostly the proportion meant for household consumption is dried. Some farmers also dry for sale but the problems of diseases and pests often come into play especially when the sliced cocoyams chips are not dried adequately.

4.7 Problems and Prospects of Cocoyam Production in the Study Area.

Cocoyam farmers in the study area face a lot of problems in cocoyam production. These problems could be grouped into non-availability of modern inputs, poor infrastructures, diseases and pest attack and inadequate logistic support.

Cocoyam production as in the case of other arable crop enterprises in the study area is still dependent on use of such simple farm implements and tools as matchets, hoes, diggers and cutlasses. There is no mechanization of such farm operations as land clearing and ridging/mounding. Improved cocoyam varieties are grossly inadequate. fertilizers and other agro-chemicals are scarcely used by the farmers. The prevailing ineffective extension services have worsened the situation. Most of the farmers are not aware of the existence of modern inputs and the few that are aware of such inputs have no access to them. There is lack of agricultural training for the farmers to up-date their knowledge and skills. Farm input distribution system in the study area has not been effective either.

Transportation facilities in the study area are poor. The roads are poorly maintained and in many cases the food producing areas are not accessible. These create problems for movement of inputs to the farms as well as evacuation of farm produce. Processing and storage facilities in the area are inadequate. In many cases this results from absence of rural electrification projects.

Diseases and pests which are prevalent in the study area have had adverse effects on cocoyam production. Absence of such agro-chemicals as pesticides, fugicides etc has made it difficult to control or minimise the effects of diseases and pests. Farmers often resort to the traditional control systems which include physical destruction of pests and use of wood ash to control diseases and pests.

Lack of credit facilities to the farmers has made the farmers incapable of increasing production. Credit facilities if provided would enable the farmers tackle some of the above problems on their own. The government has also not been able to introduce programmes that will boost cocoyam production in the area as is the case in many of the neighbouring countries. In Nigeria, for instance, there are Agricultural banks which cater for the credit needs of the farmers; there are also programmes for the women folk under the auspices of which women farmers are provided with farm inputs, processing and storage facilities for their farm produce. These logistic support programmes are yet to be operationalized in Cameroon.

These problems notwithstanding, cocoyam enterprise production in Cameroon has bright prospects. Cocoyam production presently is dominated by school leavers and middle aged men most of whom have basic education to enable them effectively adopt modern production techniques.

There is also increasing demand for cocoyam not only for consumption but more importantly for use as raw materials in the industrial sector. Pharmaceutical industries, confectionary and beverage industries even outside Cameroon have need for the cocoyams produced in Cameroon. What is needed is to effectively explore these market opportunities for increased production and improved welfare of the cocoyam farmers.

CHAPTER FIVE

SUMMARY, RECOMMENDATION AND CONCLUSION

5.1 Summary

This study examined the economics of cocoyam production by small holder farmers in Manyu Division, Southwest Province of Cameroon. Multistage sampling technique was adopted in the selection of the twenty villages, while a random sampling technique was used to select six farmers from each of the twenty villages selected for study. The results of this study are, however, based on the information provided by the 115 farmers who completed the study.

The results of the study showed that the cocoyam farmers are relatively young and fairly literate. Cocoyam enterprise is grown in both compound and distant farms, although majority of the farmers prefer distant farm lands which they perceive to be relatively fertile for their cocoyam enterprise. There were four cocoyam farms per farmer with sizes ranging between 0.3ha to 1.5ha per farm in the survey year. All the survey farmers used family labour in cocoyam enterprise production. In addition to family labour, 33 percent of the farmers used hired labour, 12 percent used exchange labour while five percent used cooperative labour. The operations involved in cocoyam production included land clearing, mounding/ridging, planting, weeding, fertilizer application and harvesting. Men, women and children were involved in the performance of these operations though to varying degrees. Wage rates were differentiated for same operations. For instace, adult males receiced ₦50.00 per day, adult female ₦40.00, while children received ₦15.00. Labour input per hectare of cocoyam enterprise was estimated at about 201 mandays.

Hoes, matchets, cutlasses and diggers were the major implements used by the cocoyam farmers. There was no mechanisation of any of the farm operations. Farmers obtained the largest proportion of the cash used in production from their personal savings (71%), followed by village association (17%), friends/relatives (7%) and cooperative society (5%).

Cocoyam ranked first in importance as a food security crop, and third as a revenue or cash crop relative to other arable crops. Two main species of cocoyam namely the Xanthosoma and the Colocasia were grown. The most important varieties grown include the white Xanthosoma, and the Ibo coco of the Colocasia specie. The red and yellow varieties of the Xanthosoma, and the country coco of the Colocasia were equally grown though on relatively few farms. Cocoyam was grown in combination with such other crops as cassava, maize, melon and beans. These formed the cocoyam-based crop mixture enterprises where cocoyam was considered the main crop in the mixture. Planting of cocoyam depends to a large extent on the arrival of the rains which occurs between March and April. Most of the farmers sourced their planting materials from their inventory of previous harvest. Many also purchased some quantity of cocoyam from the market to supplement the quantity they preserved for planting.

Cost and return analysis for the cocoyam enterprise showed that cocoyam enterprise yielded a gross margin of ₦5613.55 (36,937 francs) per hectare. Gross return per hectare was ₦18,703.50 (123,069 francs) while total variable cost amounted to ₦12,589.85 (82,841 francs). Benefit-cost ratio for the cocoyam enterprise was 1.44:1. These indicate that cocoyam enterprise production is a profitable venture or investment, given the prevailing interest rate of between nine to fifteen percent in the country.

The effect of socio-economic variables on output of cocoyam was also investigated using a multiple regression model. The results of the regression analysis showed that farming experience, farm size and income had significant effect on output of cocoyam, while age of the farmer, level of education, family size, extension contact and technology did not. Cocoyam production in the area is predominantly traditional and this partly explains the significance of farming experience as a determinant of output of cocoyam. On the other hand, the non-significance of level of technology buttresses the absence of modern production inputs and practices in cocoyam production in the area. This is also supported by the inadequate extension services observed in the study areas. The positive correlation between output of cocoyam and the independent variables suggests that improved extension services, provision of modern production imputs, for instance, would increase output of cocoyam.

Cocoyam is utilized in various forms in the study area. Absence of processing and storage facilities has posed some constraints to exploring the consumption and raw material potentials of the crop. This is worsened by the dearth of infrastructural facilities especially good road net work for the movement of imputs and evacuation of cocoyams to consuming centres. Incidence of disease

The effect of socio-economic variables on output of cocoyam was also investigated using a multiple regression model. The results of the regression analysis showed that farming experience, farm size and income had significant effect on output of cocoyam, while age of the farmer, level of education, family size, extension contact and technology did not. Cocoyam production in the area is predominantly traditional and this partly explains the significance of farming experience as a determinant of output of cocoyam. On the other hand, the non-significance of level of technology buttresses the absence of modern production inputs and practices in cocoyam production in the area. This is also supported by the inadequate extension services observed in the study areas. The positive correlation between output of cocoyam and the independent variables suggests that improved extension services, provision of modern production imputs, for instance, would increase output of cocoyam.

Cocoyam is utilized in various forms in the study area. Absence of processing and storage facilities has posed some constraints to exploring the consumption and raw material potentials of the crop. This is worsened by the dearth of infrastructural facilities especially good road net work for the movement of inputs and evacuation of cocoyams to consuming centres. Incidence of disease and pest attacks on the cocoyam crop has been reported to decrease output of cocoyam in the study area. Agro-chemicals for the prevention and control of the diseases and pests of cocoyam were not available to the farmers. These problems notwithstanding, cocoyam enterprise has signs of bright prospects especially as its demands for both consumption and industrial uses seem to be on the increase.

5.2 Recommendations:

Based on the findings of this study the following recommendations are made to improve on cocoyam production in the study areas.

(i) Agricultural extension service in the study area should be made more functional. This is in terms of not only creating awareness among farmers about the existence and use of modern innovations but also in terms of making these innovations (improved seeds, agrochemicals etc) adequately available to the farmers as and when due. This will ofcourse, entail providing adequate funds and mobility to the extension agents, among other logistic support.

(ii) Provision of such basic infrastructures as good feeder roads and rural electrification will boost food production in general, and cocoyam production in the study area. These will not only enhance distribution of farm inputs and timely evaluation of farm produce, but will also encourage the establishment of cottage industries that would undertake the processing of cocoyam and other farm produce.

(iii) Introduction of credit schemes for the farmers will also help in alleviating their financial problems. This will enable the farmers to purchase adequate farm inputs for increased production.

(iv) Farmers should be encouraged to form cooperatives. This will enable them benefit from the economies of scale in production, better organise their purchases and marketing activities as well as improve on their credit worthiness, among others.

5.3 Conclusion

Majority of farmers in Manyu Division grow cocoyam primarily for cash and food security. Cocoyam production in the study area is profitable given the relatively high gross margin/ha and the benefit-cost ratio of the cocoyam enterprise. Higher returns are expected from the enterprise if the present constraints to increased production of the crop are removed by making modern farm inputs available to the farmers, intensifying the extension services, providing good roads, controlling diseases and pests of the cocoyam crop as well as providing processing and storage facilities in the area. These will act as incentive to the farmers to achieve the goal of increased production thereby meeting the increasing demand for cocoyam for home consumption and raw material for the agro-based industries.

REFERENCES

Abasi, L. and I.C. Onwueme (1984). "Herbicidal weed Control in Tannia (Xanthosoma sagittifolium). In: Proceedings of the 6th Symposium of the International Society of Tropical Root Crops (I.S.T.R.C.) Lima, Peru, 21-26 February 1983. International Potato Centre, Lima, Peru, pp. 91-95.

Abbott, J.C. and J.P. Makeham (1980). Agricultural Economics and Marketing in the Tropics. Longman Group Ltd., Ibadan, p. 83.

Acquah, E.T; A. Nnoung and J.C. Mboua (1991). Macabo Root Rot Disease: Knowledge, Occurence and Incidence. A Case Study of Fako Division in Cameroon. ROTREP/IRA-EKONA, Cameroon, p. 25.

Agueguia, A. and S. Nzietchueng (1984). "Production of Hybrid Xanthosoma sagittifolium and Test for Resistance to Pythium Myriotylum". In: Terry, E.R; E.V. Doku; O.B. Arene and N.M. Mahungu (eds). Tropical Root Crops Production and Uses in Africa: Proceedings of the second Triennial Symposium of the International Society for Tropical Root Crops - Africa Branch, held in Douala, Cameroon, 14-19 August 1983. Ottawa, Ont., IDRC, pp. 169-171,

Agueguia, A; S. Lyonga and J.A. Whyte (1985). "Root Crops Research in Cameroon - CNRCIP 1984". In: International Institute of Tropical Agriculture, 1985, Annual Report for 1984. IITA, Ibadan, Nigeria, pp. 148-152.

Almy, S.W., and M.T. Besong (1987). Farming Systems Survey of Fako Division, South West Province of Cameroon. TLU/IRA-EKONA, Cameroon p. 37.

__________ (1988). Farming Systems Survey of Manyu Division, Southwest Province of Cameroon. Fiche Technique TLU-IRA EKONA, Cameroon.

Almy, S.W; M.T. Beson and B. Bakia (1990a). The Farming Systems Survey of South-West Province of Cameroon. Fiche Technique TLU-IRA EKONA, Cameroon.

_______________ (1990b). Food Crop Prices in South-West Province of Cameroon. A study of Food Crops in Twelve Markets: Two - Year Report (1988-1990). Fiche Technique TLU-IRA EKONA, Cameroon.

Anon (1983). USAID/CAMEROON Agricultural Sector Briefing Paper, Cameroon.

Arene, O.B. (1987). "Cocoyam, A Staple for the Future in Nigeria". In Cocoyam in Nigeria Production, Storage, Processing and Utilisation. Proceedings of the First National Workshop on Cocoyam N.R.C.R.I. Umudike, pp. 12-13.

Arene, O.B. and E.U. Okpala (1981). "A Disease of Cocoyam in Nigeria Caused by Corticium rolfsii" In Terry, E.R., K.A. Oduro and F. Caveness (eds), Tropical Root Crops: Research Strategies for the 1980s. Proceedings of the 1st Biriennial root crops symposium of the International Society for Tropical Root Crops - African Branch, 8-12 September, 1980, Ibadan, Nigeria, IDRC 163e, Ottawa, Ont., Canada. pp. 236-246.

Arrah, E.E. (1992). "A Comparative Analysis of Women Group and Individual Farms in Manyu Division, Cameroon", Project Report for M.Sc. Degree, Dept, of Agricultural Economics, University of Nigeria, Nsukka, p. 115.

Arze, J.: C. den Briggelar; W. Brinkman; E. Frimpong; J. Kimemia; E. Lazaro and M. Timmermans (1990). Agricultural Research and Extension. A Contribution to Understanding of the Linkages with Small Scale Farmers: A Case Study in Kumba-Corridor Agro-Ecological Zone, SWP, Cameroon. ICRA Team, Cameroon.

Atayi, E.A. and H.C. Knipscheer (1980). Survey of Food Crop Farming Systems in the ZAPI-EST East Cameroon. IITA/ONAREST. Cameroon.

Azikiwe, G.U.D. (1988). "Cocoyam in the Farming System of Nsukka Local Government Area of Anambra State", B. Agric. Project Report Submitted to Agricultural Economics Department, University of Nigeria, Nsukka.

Barrau, J. (1957). Les aracees a tubercules altmentaires des iles du pacifique Sud. J. Agric. trop. Bot. apol. 3, 385-401.

Bender, A.E. (1975). Dictionary of Nutrition and Food Technology. Butterworth and Co. (Publishers) Ltd., London, pp. 48, 217-218.

Besong, M.T. (1989). "Economics of Cassava Production in Fako Division, Cameroon. A Comparative Analysis of Local and Improved Cassava", Unpublished Phd Thesis, Department of Agric. Econs., University of Nigeria, Nsukka. p. 4.

Besong, M.T., S.W. Almy and B. Bakia (1992). "Labour Management in Land Preparation by Food Crop Farmers in South West Province of Cameroon", Journal of West African Farming Systems Research Network, Vol. 2, No. 2.

Burkhill, I.H. (1938). "The Contact of the Portuguese with African Food Plants, which gave words such as "Yam" to European Languages", Proc. Linn. Soc. Lond. 150, 84-95.

Cable, W.J. (1975). "Potassium Requirement of Taro Colocasia esculenta (L.) Schott in Solution Culture". Trop. Root and Tuber Crops Newsletter, 8. 39-40.

Cameroon Ministry of Agriculture (1981). Annuaire de Statistiques Agricoles 1980/81. In Direction des etudes et projets. Ministry of Agriculture, Yaounde, Cameroon. 77p.

CAMFSS (1986). "Cameroon Fertilizer Sector Study, IFDC. Muscle Shoals, Alabama, Cited in Manfred, T.B. (1989), Economics of Cassava Production in Fako Division, Cameroon. A Comparative Analysis of Local and Improved Cassava", Unpublished PhD Thesis, Department of Agricultural Economics, U.N.N. p. 4.

Campbell, J.S. and H.J. Gooding (1962). "Recent Development in the Production of Food Crops in Trinidad", Tropical Agriculture (Trinidad). 39(4), 261-270.

Chandra, S. (1979). "Root Crops in Fiji-Part I:: Production, Marketing and Consumption Patterns", Fiji Agric. J. 42. pp. 73-85.

Chi, S. (1989). Labour Costs Involved in Weeding Food Crop Fields and the Effect of Status of Workers in Neme and Fako Divisions of South West Province. Field Work Report. Dschang University Centre, Cameroon.

Chinaka, C.C. and O.B. Arene (1987). "Effects of Mulch Type and Quantity on Yield of Cocoyam", Paper Delivered at the First National Workshop on Cocoyam held at NRCRI, Umudike, August 16-21.

CNRCIP (Cameroon National Root Crops Improvement Programme) (1980). Annual Technical Report. Institut de la recherche agronomique, Yaounde, Cameroon.

__________ (1981). Annual Technical Report Institut de la recherche agronomique, Yaounde, Cameroon.

__________ (1982). Annual Technical Report Institut de la recherche agronomique, Yaounde, Cameroon.

__________ (1983). Annual Technical Report, Institut de la recherche agronomique, Yaounde, Cameroon.

Cobley, L.S. (1957). An Introduction to the Botany of Tropical Crops. Longmans, Green and Co. London.

Cobley, L.S. and W.M. Steele (1976). An Introduction to Botancy of Tropical Crops. 2 edition. London, England, English Language Book Society and Longman, pp. 123-128.

Coursey, D.G. (1968). The Edible Aroids. World Crops 20, Longmans Co. Ltd., London, pp. 25-30.

Coursey, D.G. (1984). "Potential Utilization of Major Root Crops with Special Emphasis on Human, Animal and Industrial Uses", In: Terry, E. R.; E.V. Doku; O.B. Arene; N.M. Mahungu (eds). Tropical Root Crops, Production and Uses in Africa Proceedings of the Second Triennial Sympossium of the International Society for Tropical Root Crops - Africa Branch Held in Douala, Cameroon, 14-19 August 1983. International Development Research Centre, Ottawa, Ont., Canada. IDRC - 221e, pp. 25-35.

Doku, E.V. (1981). "Strategies for Progress in Cocoyam Research", In: Terry, E.R; K.A. Oduro and F. Caveness (eds). Tropical Root Crops, Research Strategies for the 1980s. Proceedings of the First Triennial Symposium of the I.S.T.R.C. - African Branch, 8-12 September, 1980, IITA Ibadan, Nigeria, Ottawa, Ont., IDRC, pp. 227-230.

Dravi, M.M. (1985). "The Alleviation of Rural Poverty in Cameroon", Rome, Food and Agriculture Organisation, Italy.

De la Pena, R.S. and D.L. Plucknett (1967). "Response of taro to N.P. and K. Fertilization under Upland and Lowland Conditions in Hawaii", In: Proceedings of the 1st Symposium of the International Society of Tropical Root Crops Held at St. Augustine, Trinidad and Tobago, 2-8 April, 1967. University of the West Indies, St. Augustine, Trinidad and Tobago.

De la Pena, R.S. and F.M. Melchor (1984). "Water Use and Efficiency in Lowland taro Production", In: Proceedings of the 6th Symposium of the International Society of Tropical Root Crops, Lima, Peru 21-26 February, 1983. International Potato Centre, Lima, Peru. pp. 97-101.

Eluagu, L.S; M.N. Unamma; F.O. Anaebunwa; S.I. Iloka and T. Enyinnaya (1987). "Economics Importance of Cocoyams in the Farming Systems of Southern Nigeria: A Case Study of Imo", In: Cocoyams In Nigeria; Production, Storage, Processing and Utilization. First National Workshop on Cocoyams N.R.C.R.I. Umudike, pp. 145-150.

Endeley, J.B.M. (1987). Women Farmers' Perception of the Economics Problems Influencing their Productivity in Agricultural Systems. Meme Division of S.W. Province, Cameroon, Ph.D Thesis, OHIO State University.

Enyi, B.A.C. (1967). Tropical Agriculture, University of Ibadan.

__________ (1968). "Growth of Cocoyams (Xanthosoma sagittifolium)", Indian Journal of Agricultural Science. 38, pp. 627-633.

__________ (1977). "Growth Development and Yield of Some Tropical Root Crops", In: Proceedings of the Third Symposium of the International Society for Tropical - Roots Crops held at Ibadan, Nigeria, 2-9 December, 1977. International Institute of Tropical Agriculture, Ibadan, Nigeria.

Eze, C.C. (1991). "Economics of Cocoyams Production by Small Holder Farmers in Ihitte/Uboma Local Government Area of Imo State, Nigeria", Unpublished M.Sc. Thesis, Department of Agricultural Economics, University of Nigeria, Nsukka.

Ezeh, N.O.A. (1983). "The Development of Food Processing Industry in Nigeria", Unpublished M.A. Degree Thesis, Department of Economics, University of Cincinnati, Cincinnati, Ohio, U.S.A., 5-13.

Ezeh, N.O.A. and O.B. Arene (1987). "Economic Analysis of Technological Change in Six Nigerian Root and Tuber Crops Industries", Paper Presented at the 28th Annual Conference of the Science Association of Nigeria held at the Federal University of Technology, Owerri.

Ezumah, H.C. (1973). "The Growth and Development of Taro, Colocasia esculenta (L.) Schott in Relation to Selected Cultural Management Practices", Diss. Abstracts International. B. 34, 24.

Ezumah, H.C. and D.D. Plucknett (1973). "Response of Taro, Colocasia esculenta (L.) Schott, to Water Management, Plot Preparation and Population", 3rd Int. Symposium Tropical Root Crops. Ibadan, Nigeria.

__________ (1977). "Response of Taro Colocasia esculenta Under dry Land Conditions in Fiji", International Foundation for Science, Stockholm, Sweden, Provisional Report, pp. 167-182.

FAO (Food and Agriculture Organisation) (1971). Production Year Book. FAO, Rome, Italy.

Gollifer, D.E. and R.H. Booth (1973). Storage Losses of Taro Corms in the British Solomon Islands Protectorate. Ann. appl. Biol. 73,

Gooding, H.J. and Campbell, J.S. (1961). Preliminary Trails of West Indian Xanthosoma Cultivars, Trop. Agric. 38. pp. 145-152.

Hashad, M.N.R. Stinoard and S.I. Elhinnawy (1956). Transformation of Carbohydrate in Taro Corms during Storage. Ann. Agri. Sc. Fac. Agr. Aninshams University, Cairo, I. pp. 269-276.

Haudricourt, A. (1941). Les Colocasiees alimentaires (taros et Yautias) Rev. Bot. Appl. Agric. Trop. 21 (233-234), pp. 40-65.

Hill, A.F. (1939). The Nomenclature of the Taro and Its Varieties. Bot. Mus. Leaflet Harv. Univ., 7, pp. 133-118.

Hodge, W.H. (1954). The Dasheen: A Tropical Root Crop for the South. U.S.D.A. Circ., 950.

Horton, D; J. Lynam; H. Knipscheer (1984). "Root crops and Developing Countries: An Economic Appraisal", In: Proceedings of the 6th Symposium of the International Society for Tropical Root Crops. Lima, Peru, 21-26 February, 1983. International Potato Centre, Lima, Peru, pp. 4-39.

Igbokwe, M.C; O.B. Arene; T.C. Ndubuizu; E.E. Umana (1984). "Intercropping Cocoyams with Plantain: Effects on the Yield and Disease of Cocoyams", In: Terry, E.R; E.V. Doku; O.B. Arene; N.M. Mahungu (eds). Tropical Root Crops: Production and Uses in Africa: Proceedings of the Second Triennial Symposium of the I.S.T.R.C -ZAfrica Branch Held in Douala, Cameroon, 14-19 August, 1983. International Development Research Centre, Ottawa, Ont. Canada. IDRC - 221e, 182-184.

IITA (International Institute of Tropical Agriculture) (1978). Annual Technical Report. IITA, Ibadan, Nigeria.

__________ (1979). Annual Technical Report. IITA, Ibadan, Nigeria.

__________ (1980). Annual Technical Report, IITA, Ibadan, Nigeria.

__________ (1981). Research Highlights for 1980. Ibadan, Nigeria.

__________ (1982). Annual Report and Research Highlights. IITA, Ibadan, Nigeria.

__________ (1985). Root and Tuber Improvement Program Research Highlights 1981-1984) IITA, Ibadan, Nigeria.

Johnson, D.T. (1985). The Business of Farming: A Guide to Farm Business Management in the Tropics. ELBS/ Macmillian, London. pp. 14-15, 17.

Karikari, S.K. (1971). Cocoyam Cultivation in Ghana. World Crops 23(3). May-June, pp. 118-122.

Karikari, S.K. (1981). "Intercropping of Plantains, Cocoyams, and Cassava", In: Terry, E.R; K.A. Oduro and F. Caveness (eds). Tropical Root Crops: Research Strategies for the 1980s. Proceedings of the First Triennial Root Crops Symposium of the I.S.T.R.C. - African Branch, 8-12 Sept., 1980, Ibadan, Nigeria. Ottawa, CANADA, IDRC - 163e, pp. 120-123.

Kay, D.E. (1973). Crop and Product Digest 2: Root Crops. Tropical Product Institute, London, U.K. p. 245.

King, P. (1980). A Guide to the Economics of Dehydration of Vegetables in Developing Countries. Tropical Products Institute, p. 27.

Knipscheer, H.C. (1980). "Labour Utilization data for Selected Tropical Food Crops", Agricultural Economics Information Bulletin 6, IITA, Ibadan, Nigeria.

Knipscheer, H.C. and J.E. Wilson (1980). "Cocoyam Farming Systems in Nigeria". In: Terry, E.R; K.A. Oduro and F. Caveness (eds). Tropical Root Crops Research Strategies for the 1980s. Proceedings of the First Triennial Root Crops Symposium Africa Branch 8-12th September, 1980, Ibadan - Nigeria, pp. 247-254, 279.

Leakey, G.L.A. and J.B. Wills (1977). Food Crops of the Lowland Tropics. Oxford University Press, Oxford, Great Britain.

Lyonga, S.N. (1979). "Cocoyam Production in Cameroon", Paper Presented at the Cocoyam Seminar, Baybay, Leyte, Philippines, 24-25 September, 1979. International Foundation for Science, Stockholm, Sweden; Provinsional Report No. 5, pp. 24-26.

Lyonga, S.N. (1980). Cassava (Manihot esculenta crantz) Production. Centres des Cultures Vivrieres et Fruitieres DGRST/IRA, p. 18.

Lyonga, S.N. and Nzietchueng (1987). "Cocoyam and the African Food Crisis", Proceedings of the Third Triennial Symposium of the International Society for Tropical Root Crops - Africa Branch Held in Owerri, 17-23 August. 1986. Nigeria, pp. 84-87.

Mazumdar, S. (1980). "Realistic Food Goals for Africa", Ceres, 1980 (July-August), pp. 36-40.

MINAGRI (1987). Agricultural Census 1984 Ministry of Agriculture: The National Printing Press, Yaounde, Cameroon.

________ (1989). Agricultural Census and Survey 1984-1989. Ministry of Agriculture: The National Printing Press, Yaounde, Cameroon.

Ministry of Economic Affairs and Planning (1981). Annual Report, Yaounde, Cameroon.

________ (1987). Annual Report. Yaounde, Cameroon.

MINPAT (1986). Sixth Five Year Economic, Social and Cultural Development Plan, 1986-1991. Ministry of Planning and Territorial Administration. The National Printing Press Yaounde, Cameroon.

Moock, R. (1983). A Study on Maize in Kenya. Cited in World Bank (1989). Sub-Saharan Africa: From Crisis to Sustainable Growth. The World Bank, Washington, D.C. p. 12.

Morton, J.F. (1972). Cocoyam (Xanthosoma caracu, X. atrovirens and X. nigrum), ancient root and lead Vegetables Gaining in Economic Importance. Proceedings of the Florida State Horticulture Society, pp. 85-94.

Moursi, M.A. (1954). "A Comparative Physiological Study of Dasheen (Colocasia antiquorum) (Schott)", Indian J. Hort. Sci., II, p. 74.

National Meterorological Service (NMS) (1983). Annual Report - Monthly Rainfall Variation in Mamfe, Cameroon.

Nganje, W.E. (1990). "Productivity Analysis of Small-Holder Yam Production in Fako Division, Cameroon", Unpublished Agricultural Engineering Thesis, University Centre Dschang, Cameroon.

Ngwa, J.A. (1978). A New Geography of Cameroon. Longman Group Limited, London, p. 1.

Nwana, I.E. and B.E. Orochie (1979). "The Technical and Social Problems of Tare Processing and Storage in Nigeria", In Pluckhett, D.L. (ed). Small-scale Processing and Storage of Tropical Root Crops. Westvie Press, Boulder, Colorado, U.S.A., pp. 100-109.

Nweke, F.I. (1981). "Consumption Patterns and their Implications for Research and Production in Tropical Africa", Proc. First Triennial Symp. International Society for Tropical Root Crops - AB, IDRC, Ottawa, Canada, pp. 88-94.

Nweke, F.I. and F.E. Winch (1980). "Bases for Farm Resource Allocation in the Small Holder Cropping System of Southeastern Nigeria: A Case Study of Awka and Abakaliki Villages", Discussion Paper No. 4/80 International Institute of Tropical Agriculture, Ibadan.

Nyientewang, P. (1989). A Survey of the Technical and Economic Performance of Cocoyam Production and Marketing in Fontem-South West Province. Unpublished end of Course Memoir- ENSA/Dschang.

Nzietchueng, S. (1983a). Etudes surla Pourriture racinaire du macabo (Xanthosoma sagittofolium) an Cameroon: I-Symptomatologie et etiologie de la maladie. Agronomie Tropicale 38(4), pp. 321-325.

Nzietchueng, S. (1983b). Etudes sur la pPourriture racinaire du macabo (Xanthosoma sagittifolium) au Cameroon: II - Quelques aspects de L'epidemiologie et Moyens de Lutte. Agronomique Tropicals, (38(4). 326-330.

Nzietchueng, S. (1984). "Root Rot of Xanthosoma sagittifolium caused by Pythium myriotylium in Cameroon", In: Terry, E.R; E.V. Doku; O.B. Arene and N.M. Mahungu (eds). Tropical Root Crops: Production and Uses in Africa. Proceedings of the Second Triennial Symposium of the International Society for Tropical Root Crops - Africa Branch held in Douala, Cameroon, 14-19 August, 1983, Ottawa, Ont., IDRC, p. 231.

Nzietchueng, S. (1985). "Genre Xanthosoma (macabo) et Constraintes de Production: Cas Particulier de la Pourriture racinaire Causee Par Pythium mynotylium au Cameroon", Universite de Yaounde, Yaounde, Cameroon. These doctorat d'etat et Science naturelles. p. 253.

Okeke, G.C. (1980). "Root and Storage Rot Disease of Cocoyam in Nigeria", In: Terry, E.R; K.A. Oduro; F. Cavenness (ed). Tropical Root Crops: Research Strategies for the 1980s: Proceedings of the First Triennial Root Crops Symposium of the International Society for Tropical Root Crops - Africa Branch, 8-12 September, 1980, Ibadan, Nigeria. International Development Research Centre, Ottawa, Ont., Canada. IDRC - 163e, pp. 231-234.

Okereke, O. and B.N. Umearokwu (1983). "Marketing Constraints to New Production Technologies. The Case of Kano State Farmers", in the Nigerian Journal of Development Studies, Vol. 3, Nos. 21 and 2, April/October, pp. 1-9.

Okorji, E.C. (1983). "Consequences on Agricultural Productivity of Crop Stereotyping along sex lines: A Case Study of Four Villages in Abakaliki Area of Anambra State", Unpublished M.Sc. Thesis, Department of Agricultural Economics, University of Nigeria, Nsukka.

Okorji, E.C. and C.O.B. Obiechina (1985). "Based for Farm Resource Allocation in the Traditional Farming System: A Comparative Study of Productivity of Farm Resources in the Abakaliki Area of Anambra State, Nigeria", Agricultural Systems, 17, pp. 197-210.

Okorji, E.C. and O. Okereke, (1988). "Trends in Cassava Production in Abakaliki Area of Anambra State and Implications for Farmers' Welfare," Cassava-Based Cropping System Research, No. 1, IITA Ibadan pp. 195-200.

Ongla, J. and C.G. Davis (1979). Economics of Food Crop Marketing in Central Cameroon. CTA Report I Gainsville Florida.

Onwueme, I.C. (1978). The Tropical Tuber Crops: Yam, Cassava, Sweet Potato and Cocoyam. John Wiley and Sons Inc. New York, U.S.A. pp. 199-225.

Onwueme, I.C. (1984). "The Place of Edible aroids in Tropical Farming Systems", In: Chandra, S. ed. Edible aroids. Clarendon Press, Oxford, U.K. pp. 136-139.

Parkinson, S. (1984). "The Contribution of aroids in the Nutrition of People in the South Pacific", In: Chandra, S. (ed). Edible aroids, Clarendon Press, Oxford, U.K. pp. 215-224.

Phillips, T.A. (1976). An Agricultural Notebook. Longman Group Ltd., London, U.K.

Plucknett, D.L. (1970). Status and Future of the Major Edible Aroids, Colocasia, Xanthosoma, Alocasia, Cyrtosperma and Amorphophallus", In: Plucknett, D.L. (ed). Tropical Root and Tuber Crops Tomorrow. Volume 1, Proceedings of the Second International Symposium on Tropical Root and Tuber Crops. August 23-30, 1970, HONOLULU, Hawaii/College of Technical Agriculture (CTA), University of Hawaii, p. 171.

Plucknett, D.L. (1979). Small-Scale Processing and Storage of Tropical Root Crops, Westview Press, Boulder, Colorado. Inc. p. 483.

Plucknett, D.L. (1983). "Taxonomy of the Genus Colocasia", esculenta and its Potentials. University of Hawaii Press, Honolulu. p. 399.

Plucknett, D.L. (1984). Tropical Root Crops in the Eighties. In Proceedings of the 6th Symposium of the International Society for Tropical Root Crops. Lima, Peru, 21-26 February, 1983. International Potato Centre, Lima Peru. pp. 3-8.

Plucknett, D.L; R.S. de la Pena and F. Obrero (1970. Taro (Colocasia esculenta). Field Crop Abstract, 23, pp. 413-426.

Plucknett, D.L. and R.S. du la Pena (1971). "Taro Production in Hawaii", World Crops 23, pp. 244-249.

Plucknett, D.L; H.C. Ezuma and R.S. de la Pena (1973). "Taro (Colocasia esculenta) Mechanization Experiments in Hawaii", 3rd Int. Symp. Trop. Root Crops, Ibadan, Nigeria.

Porteres, R. (1960). La Sombre aroides Cultivee: Colocasia antiquorum Schott ou taro de Polynesie. Essai d' etymologie Semantique. J. Agric. Trop. Bot. Appl., 7, pp. 169-192.

Purewal, S.S. and K.S. Dargan (1957). "Effects of Spacing on Development and Yield of Arum (Colocasia esculenta)", Indian J. Agric. Sci. 27, pp. 151-162.

Purseglove, J. W. (1972). Tropical Monocotyledons: I and II. Longman Group Ltd., London U.K.

Rassas, B; R. Carroll; A. Johnson and J. Ngalani (1991). The Marketing System and Demand for Root and Tuber Crops in Cameroon. Draft Report ROTREP/USAID, Project No. 031-0058. Cameroon, J. 8p.

Rogers, D.J. (1980). "Cassava Leaf Protein", Eco. Bot. 13, pp. 261-263.

Sivan, P. (1980). "Growth and Development of Taro (Colocasia esculenta) Under Dry land Conditions in Fiji", International Foundation for Science, Stockholm, Sweden. Provisional Report, pp. 167-182.

Sivan, J.F; F.A.A. Da, Couto and E. Tigchelaar (1971). Effects of Spacing, Fertilizer Application and Size of Setts on the Yield of Cocoyam, Colocasia esculenta Schott. Experiential, 12, pp. 135-154.

Splittstoesser, W.E; P.W. Martin and A.M. Rhodes (1973). "The Nutritional Value of Some Tropical Root Crops", Proceedings of the Tropical Region of the American Society for Horticultural Science, 17, pp. 290-294.

Strohl, R.J. (1981). "Technology on the Small Farms", World Agricultural Economics and Rural Sociology Abstracts.

Taleafoa, F. (1975). "Marketing of Root Crops: Taro", South Pacific Commission Technical Paper 1974.

Tambe, R.E. (1991). "Contributions of Cooperatives in Agricultural Development: A Case Study of Manyu Division, South West Province of Cameroon", Unpublished B. Agric. Thesis, Department of Agricultural Economics, University of Nigeria, Nsukka, p. 15.

The National Academy of Science (1975). "Under Exploited Tropical Plants with Promising Economic Values", Washington, D.C., U.S.A.

Teh, Teresa (1989). "Policy, Programs and Strategies in Favour of Women in Agricultural Sector in Cameroon", (72-86) In: Cluadia Von Braun Mohl, (ed.): Women in the Development Process. Reports and Papers of the International Conference, of 8-16 July, 1989, in Berlin, (West). German Foundation of International Development.

TLU/IRA-Ekona (1989). "Land Preparation and Weeding Assessment Surveys", In Rapid Appraisal Surveys, IRA Ekona, South West Province, Cameroon.

Terrence, E.R. (1982). "The Impact of Women's Contribution in Farm-Firm Household Production in Ghana. A Case Study of the Atebudu District", An Unpublished Master Thesis, The Virginia State University.

Upton, M. and Q.B.O. Anthonio (1975). Farming as a Business. University Press, Oxford, p. 20.

Wang, J.K. and S. Higa (1983). "Taro: A Review of Colocasia esculenta, and its Potentials", University of Hawaii Press, Honolulu, HI, U.S.A. p. 394.

Wang, J.K; J.R. Carpenter: R.S. de la Pena (1984). The Potential of Taro in Some South Pacific Islands. In: Proceedings of the 6th Symposium of the Internantional Society for Tropical Root Crops, Lima, Peru, 21-26 February, 1983. International Potato Centre, Lima, Peru. pp. 109-114.

Warid, A.W. (1970). "Production and Improvement of Edible Aroids in Africa", In: Plucknett, D.L. (ed). Tropical Root and Tuber Crops Tomorrow, Volume II. Proceedings of the Second International Symposium on Tropical Root and Tuber Crops. August 23-30, 1970. Honolulu/Hawaii, College of Technical Agriculture (CTA), University of Hawaii, p. 104.

Warid, A.W. (1976). "Trends in the Production of Taro in Egypt", In: Tropical Root and Tuber Crops Tomorrow Vol. 1, pp. 141-142.

Watson, J. (1979). Importing Root Crops from the South Pacific Islands for New Zealand Markets. In: Plucknett, D.L. (ed), Small-scale Processing and Storage of Tropical Root Crops. Westview Press, Boulder, Co. USA.

Wells, J.C. (1974). Agricultural Policy and Economic Growth in Nigeria, 1962-68. Nigerian Institute of Social and Economic Resdarch, Ibadan.

Williams, A.R.T. (1978). Rural Development in Nigeria. University of Ife Press, Ile-Ife, p. 40.

Wilson, J.E. (1980). "Promotion of Flowering and Production of Seed in Cocoyams (Xanthosoma and Colocasia)", Paper Prepared for the Fifth Symposium of the International Society for Tropical Root Crops, Manila, Philippines, 17-21 September.

Wilson, J.E. (1984). Taro and Cocoyam: What is the Ideal Plant Type? In: Chandra, S. (ed). Edible Aroids. Clarendon Press, Oxford, U.K. pp. 151-159.

Wright, J. (1930). "Cocoyam Varieties in the Gold Coast, Accra, Ghana", Accra, Ghana, Gold Coast Dept. of Agriculture, Bulletin, 23, pp. 198-207.

Wutoh, J.C; O.U. Onokpise; X. Ndzana and A. Sama (1989). Symposis of Cameroon (Xanthosoma sagittafolium and L: Macabo) Root Rot Disease: Situation in Cameroon. Report Submitted to ROTREP/USAID, Project No. 631-0058, Cameroon.

Appendix 1: Value (₦) of Labour Input Per hectare by type and farm operation.

Operation	Males	Females	Children	Total
Land clearing	523.00	173.20	0.00	696.20
Mounding/ridging	1492.50	97.60	0.00	1590.10
Planting	22.00	800.00	37.50	859.50
Weeding	0.00	3360.00	150.00	3510.00
Fertilizer application	22.00	177.60	0.00	199.60
Harvesting	85.00	5660.40	64.95	1201.95
Total	2144.50	5660.40	252.45	8057.35

Appendix 2: Correlation coefficient of socio-economic variables (Xis) with output of cocoyam (Y).

I	Y
Y	1.000
X_1	0.393
X_2	0.042
X_3	0.113
X_4	0.564
X_5	0.742
X_6	0.103
X_7	0.554
X_8	0.706