# ECONOMIC EVALUATION OF THE IMPACT OF GOMBE AGRICULTURAL DEVELOPMENT PROJECT ON RESOURCE USE AND PRODUCTIVITY OF FARMERS IN BAUCHI STATE

**BY**

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A Thesis submitted to the postgraduate School, Ahmadu BeIlo University, in partial fulfillment of the requirements for the Degree of Master of Science in Agricultural Economics.

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## D E C L A R A T I O N

The author hereby declares that the whole of the work now submitted for the Master of Science degree (Agricultural Economics) of Ahmadu Bello University is the result of his research, except where reference is made to published literature and duely acknowle ge has not been part of any presentation for any other qualification.

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# C E R T I F I C A T I O N

This Thesis entitled ECONOMIC EVALUATION OF THE IMPACT OF GOMBE AGRICULTURAL DEVELOPMENT PROJECT ON RESOURCE USE AND PRODUCTIVITY OF FARMERS IN DAUCHI STATE by Jesse Elma Yaro meets the regulations governing the degree of Master of Science of Ahmadu Bello University, Zaria, and is approved for its contribution to scientific knowledge of literary presentation.

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# DEDICATION

This piece of work is dedicated:

To my wife, Mrs. Benedicta Yaro

To the family of Elma Tolba

To late Salihu I. Musa.

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# ABSTRACT

Increased agricultural productivity is one of the prerequisites of economic progress, especially in the developing countries where a large proportion of the population depends largely on primary production. One of the ways for increasing agricultural productivity is to increase the level of farm resources and to make efficient use of the resources committed to the farm sector. This has resulted in the establishment of the various agricultural development projects in Nigeria. This study was, therefore, designed to evaluate the impact of the Gombe Agricultural Development Project on resource use and productivity of farmers. The objectives of this study were to describe and compare the structure and organisation of farms in the two areas, to compare the extent of labour employment and productivity in the two areas and to estimate and compare returns to scale between the two areas.

The analytical tool used in the study were the farm budget and production function models. The data necessary for the analysis were obtained through a survey of 70 farmers comprising 35 in the project and 35 outside the project area. Secondary data were obtained from

the farm management survey (agronomic) data of the Evaluation Unit of the project.

The results of the study indicated that more family labour input was utilized in the non-project area than in the project area, while more hired labour was utilized in the project are. More quantities of fertilizer, improved seeds and bullock labour were utilized in the project area than in the non-project area. The results of the study also indicated higher gross returns, net returns and labour productivity in the project area than in the non-project area. The suits of the production function analysis indicated that the independent variables, namely farm size, family sbour, hired labour and non-durable capital reasonably explain the variability in the total value of output earned frc farms. Land and family labour have the highest elasticities in the project and non-project areas respectively. Land also has the highest marginal value of product (MVP) in the project area. In ie non-project area family labour and non-durable capital have the highest MVP. The results of the production function analysis in the project and non-project areas indicated decreasing and constant returns to scale respectively.

The results of the study have indicated some increases in resource use end productivity through the piementation of the project. Therefore such programmes should be planned and implemented to enhance agricultural production. One of the implications of the study is the need to educate the farmers on the type, quantity and time of fertilizer application. Since fertilizer contributes greatly to raising production, its supply should be made available to the farmers at the right time. Other improved inputs such as seed dressing chemicals, varieties of seeds, pesticides etc. should be made available to farmers.

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# CHAPTER I

# INTRODUCTION

## 1.1 General Problems Situation in Agriculture

Agriculture is still the mainstay of the Nigerian economy. The sector is expected to provide food to the rapidly growing and expanding labour force. Besides, agriculture is expected to meet requirement for local industries and for exports which will continue to be an important earner of foreign exchange needed for general economic development. Agriculture also provides a market for the product of industrial section, (Essang, 1977).

In spite of the high potential for increasing agricultural production in the country, both by expanding the area under cultivation and by improving yields from existing area, the country has failed to produce enough food for meeting her needs. The supply of agricultural products for domestic industries and for exports has been declining steadily with consequent adverse effects on the country's foreign exchange earnings. The country has to resort to massive food importation in recent years as a short term solution to the food problem.

The Nigerian policy makers appreciate the need to devise a set of policy measures which can attain

productivity objectives. Since 1970, attention has been focussed on productivity increasing measures to combat a threatened food shortage arising from a variety of factors such as stagnation productivity in the food sub-sector, rapid population growth, increased urbanisation, rapid growth of incomes and a high income elasticity of demand for food.

The Federal Government emphasis on productivity increases also reflects the need to expand Nigeria's traditional exports such as cotton, groundnuts, cocoa and palm kernel, which until recently, were the source of foreign exchange earnings, government revenues, capital for economic development, incomes and employment for the vast majority of farmers in the country. It is reasoned that productivity increases are needed to reduce unit cost and also to increase the country's competitive strength in the world market. Another consideration is the importance of domestically produced raw materials in the drive towards import substitution. The rapid growth of agro-allied industries underlines the need for policy makers to undertake measures aimed at making raw materials readily available to the domestic agro-allied industries at reasonable prices. At present, the shortage of raw materials has several adverse consequences.

It makes the purchase of domestically produced raw materials costly, a circumstance which accounts for high production cost and high prices of agro-industrial products. Moreover, the problem of inadequate raw materials makes the importation of raw materials a must and this involves the expenditure of foreign exchange and it also weakens the linkage between agro-allied industrialization and agricultural production in the country. These considerations make policy makers attach great importance to the increase in raw materials output by stepping up agricultural productivity increases.

Productivity increase is regarded as the most dependable approach to raising rural incomes, employment, purchasing power and the capacity to finance and maintain infrastructural facilities in the context of integrated rural development. It is believed that increased rural incomes, consequent to rising productivity of agriculture, will lay a foundation for rural industrialization. Planners and policy makers believe that lagging agricultural productivity exerts a dampening effect on the growth of the Nigerian economy. For example, according to the 1975-80 plan, there was a decline in the growth rate of the Gross Domestic Products, mainly, due to a 7% fall in

agricultural output which was in turn the result of lagging productivity. This implies that policy measures which raise the productivity of the agricultural sector will also raise the growth rate of the economy. The inability of the agricultural sector to meet the increasing food demand and raw material need of the nation was attributed to such factors as decreasing soil fertility, limited use of fertilizer, use of traditional crop varieties, lack of credit facilities, inadequate extension services and manually operated tools.

The performance of the agricultural sector in recent years clearly dictates the need for greater mobilisation of resources at all levels than has hitherto been done. This is of crucial importance since agriculture and its related activities will continue to be the mainstay of the Nigerian economy in the foreseable future.

## 1.2 Measures for Raising Agricultural Productivity

Increased agricultural productivity is one of the pre-requisites of economic progress. This is particularly true of developing countries where a large proportion of the population live in rural areas and depend largely on primary production. One

of the often suggested strategies for increasing agricultural productivity is a combination of measures designed to increase the level of farm resources as well as to make efficient use of the resources already committed to the farm sector (Heady, 1966).

The transformation of Nigerian agriculture from subsistence to a modern scientific system will no doubt increase agricultural productivity. This would involve the extensive use of improved inputs to increase the productivity of agriculture. The use of simple technologies in the form of improved seeds, seed dressing chemicals, fertilizer and improved cultural practices is one of the quickest ways of improving agricultural production and raising the productivity of resources on farms, (Etuk, 1982).

It is usually assumed by policy makers, planners etc. that the central bottleneck to productivity increase in Nigerian agriculture is the peasant farmer and his system of production. This assumption was based on a number of considerations. First, it is believed that the farmer is conservative and too risk conscious to embrace productivity increasing innovation. Second, that the resource base of the farmer is very slender, consisting of undersized fragmented holdings to which the farmer generally

holds no valid title deeds. Third, is the subsistence nature of agriculture with limited marketable surpluses and consequently inability to meet rising demand for food and raw materials (Idachaba, 1980).

Fully aware of the problems facing agriculture, the Government feels committed to "transform" Nigerian agriculture by introducing new agricultural organisations and institutions. The importance attached to the creation of large units of agricultural organisation under government control and direction is evident in the 1975-80, plan. In this 'Third National Plan', (1975) the Nigerian government established a number of production programmes aimed at raising agricultural productivity. These programmes include:

(i) The National Accelerated Food Production Programme (N.A.F.P.P)

(ii) The Operation Feed the Nation (Now Green Revolution).

(iii) The National Grain and Root Crop Production Company.

(iv) Various River Basin Development Authorities

(v) The Integrated Rural Development Programmes

The last programmes, the Integrated Rural Development Programmes, are a joint Federal and State Government projects with the World Bank financing the

foreign exchange component of the projects. Government interest in Integrated Rural Development schemes is not new in Nigeria. The then Western Nigerian Regional Government had issued a white paper on Integrated Rural Development (IRD) in Western Nigeria. This was followed by isolated efforts in specific rural development projects in other regions. Federal concern for Integrated Rural Development received its first articulate expression in the Guidelines to the Third National Plan. It was envisaged that rural development policy during the Third Plan would concentrate on:

- raising productivity in agriculture, the predominant occupation of the rural areas.
- providing basic social amenities such as water, medical services, schools and electricity.

Government programmes in the rural areas were to concentrate on raising farm output through intensive and extensive agriculture. The revised volume II contains project description of the first projects, that is, Gombe, Funtua, Lafia and Ayangba Agricultural Development Projects, where they envisaged to provide "a package of infrastructural improvements, agricultural

supporting services, farm inputs and credit". The plan document uses the terms: Agricultural Development Projects (A.D.Ps) and Integrated Rural Development Projects (IRDPs) interchangeably. Thus the agricultural development projects were designed to increase small holder incomes and production by providing basic infrastructure, support services (input distribution) and new technology (Idachaba, 1980). The projects were prepared in 1973/74, but due to political changes in the country their implementation was delayed until 1976.

The Gombe Agricultural Development Project (GADP), where the study was conducted, was implemented in November 1976. The project combines farm management, extension, marketing, agronomic, technical, engineering and evaluation functions. It aimed at not only raising the total production of the target farmers, but also the productivity of the small farmer. It is expected that this will raise the welfare and standard of living of the majority of the farmers in the project area. The project is within the programme framework outlined in Nigeria's "perspective plan for agricultural development to 1985". In particular, it follows Federal government's policy to increase production of both food and industrial crops to supply Nigeria's rapidly

increasing population and industries.

## 1.3 Problem and Justification of the Study

In Nigeria, like in many parts of the tropical world, the bulk of the food production is supplied by small farmers with limited capital resources. Due to increase urbanization and rapid population growth, the agricultural sector of the Nigerian economy has not been able to cope with the demands made on it. Food production has not responded adequately to increases in the demand for food. As a result, there has been sharp and frequent rise in food prices (Etuk, 1982). This situation has necessitated the diversion of scarce foreign exchange to the importation of basic staple foods, which had previously been produced locally and in sufficient quantity to satisfy domestic needs. It has been suggested that the primary cause of the unsatisfactory situation in the agricultural sector is the traditional system of agricultural production.

In an effort to boost agricultural production in Nigeria, the government established some agricultural development programmes in 1976. The main objective of the projects is to increase the small holder's income and production. Other objectives include the

provision of feeder roads, input distribution, extension and the improvement of life in the rural areas. This means that the small farmers were to be the target of increasing productivity. The Gombe Agricultural Development Project (GADP) is one of the first agricultural projects established in the northern states of Nigeria. Others include Funtua and Gusau.

Since the inception of the Gombe agricultural project, few attempts have been made to collect input-output data on the new technology. The result is that there is a dearth of basic input-output data on the use of modern inputs under farmers' condition. Farm management data in the project area is usually supplied by the Evaluation Unit of the project. The surveys were broad enough to provide consumption and production profiles. However, most of the data provided by the project are not adequate as to allow a detailed analysis of the productivity of resources at the farmers' level without supplementing the data.

The specific problem is therefore lack of adequate information on resource productivity at the farmers' level in the project area. This makes it difficult to evaluate the efficiency with which farmers use resources in crop production activities and hence the impact of the project on resource use and

productivity on farms. The above information would be obtained by comparing resource productivity of farmers in the project and non-project areas. This knowledge would be useful in indicating the possibilities of increasing agricultural production by indicating the direction in adjustment in resource use and allocation.

Another important aspect of the study is that it will enable the farmers to know whether they are efficiently using their resources or not. In other words, whether they are over or under using their resources. The study was also designed to find out if employment of resources, including those locally available have expanded under the impact of the project. Due to a number of operational constraints, including cost, time etc. The study was limited to only four villages, two chosen within one local government area in the non-project area and two chosen in the project area.

## 1.4 Objectives of the Study

The general objective of this study is to examine the impact of the Gombe Agricultural Development Project on resource use and productivity at the farmers' level.

Specifically the objectives of this study are:

(1) To describe and compare the structure

and organisation of farms in the project and non-project areas.

(2) To compare the extent of labour employment and productivity in the two areas.

(3) To estimate and compare returns to scale between the two areas.

(4) To suggest how the expansion of the project could contribute to improving the productivity on the farms.

## 1.5 Methodology

The data analysed in this paper were collected from four villages, two within one local government area in the project area while the other two villages were selected within one local government area outside the project area. The villages were selected from the list of villages compiled by the Evaluation unit of the project during their survey.

From the frame of farm families compiled by the project during their baseline survey for the selected villages, a random sample of farmers was selected for each area. A total of 35 samples were chosen for each area, making a total of 70 samples for the study.

The data was obtained by means of questionnaires

which were administered to the household heads. Secondary data was obtained from the farm management survey (agronomic) data of the project. Detailed information was collected on farm inputs (labour, land, seeds, fertilizer, tools and livestock); output and farm activities of family members. The bulk of the data for this study was obtained during the 1982 season.

In the analysis, two methodological approaches were selected on the basis of convenience and relevance to achieve the objectives stated above. They are the farm budget and the production function models. The farm budget model gives an estimate of costs and returns for a given production period. The production function used was the Cobb-Douglas or power function.

Detailed formulation of both methods are given in chapter 3.

## 1.6 Organisation of the Report

Following this introductory chapter which gives a brief description of the importance and problems of agriculture in Nigeria and ways of raising production, chapter two is devoted to the literature review.

Chapter three gives information on theoretical

models of productivity studies, such as linear programming, production function analysis and farm budget analysis. Problems of data collection are also discussed in this chapter. Chapter four gives information on the structure of sample farms. Chapter five is devoted to the results of the farm budget and production function analysis. Chapter six contains the summary, conclusions and areas for further study.

# CHAPTER II

## LITERATURE REVIEW

One of the major problems of growth in agriculture in Nigeria is how to increase output per unit of input. One way of approaching the problem of increasing production is to examine how farmers are using their resource. If resource is inefficiently used, production can be increased by making adjustments in the use of the factors of production in optimal direction. If it is efficiently utilized, the only way out for increasing production would be the adoption of modern inputs and technology. Singh et al (1973), stated that resource use efficiency of farmers has been judged on the basis that each factor of production is paid equal to its marginal productivity. A significance difference between the marginal value productivity and the market price of individual inputs would indicate that the farmers on the average are using their factors of production inefficiently.

The inefficiency in food producing areas of the under-developed world are due to many factors. Suhas (1975), stated two principal sources of inefficiency. One is the subsistence nature of agriculture which results in farmers adopting on diversified cropping

pattern.. This diversification may stem from (i) desire to minimise risk (ii) to produce certain minimum quantities of each food to meet family and livestock requirements. The second source of inefficiently lies in the selection of incorrect processes by the farmers such as inadequate ploughing, lack of crop protection, lack or insufficient application of fertilizers to produce various crops.

## 2.1 Resource Productivity Studies

Studies in resource productivity can be divided into two main categories. The first is micro-oriented, focussing attention on resource use efficiency in individual enterprises such as maize, cotton, poultry etc. produced on a sample of farms. The underlying assumptions of this category of studies is that the main objective of any producing unit is to coordinate and utilize resources or factors of production in such a way that altogether they yield the highest net returns (Saini, 1969). This is particularly true of agriculture in developed countries where profit maximization is the ultimate goal of farm business. The prices of products and the cost of inputs are used together with the estimated production functions, as indicators for determining the quantities of resources to use and the

scale at which production is to be carried out. This category of studies thus provides quantitative estimates which would be used as a basis for efficient allocation of resources at the farm level.

The second category of resource productivity studies involve the comparison of resource productivity between enterprises or food crops versus export crops. This category of studies provide quantitative estimates which could guide macro-level resource allocation decisions on these groups of enterprises. When conducted on a national basis the results could provide policy makers with relevant information on how to achieve an optimal allocation of the limited development resources among regions producing these groups of enterprises (Ogunfowora, 1975).

Scholars such as Norman et al (1979), and Ogunfowora et al (1975), have conducted studies on resource productivity. Norman conducted a study on the economics of small farm agriculture in Bauchi, Zaria and Sokoto areas. The study was designed to overcome the paucity of data on the economics of peasant farming practices, as well as to provide basic information for farm planners and agricultural policy planners. In the study, the Cobb-Douglas function was

used in the analysis of the input-output data from the sampled farms. The results of the production function estimation showed that farmers in general were allocating resources to crop production in a manner consistent with the goal of profit maximization. Also the results indicated a constant return to scale. Singh et al (1973) and Saini (1969), also conducted studies on resource productivities in India. They used the Cobb-Douglas function in the analysis of the input-output data from sampled farms. In all these studies, the dependent variable has been the value of output of crops or the total output in kilograms, while the independent variables have been land (in hectares); labour input (either man-hours or man-days); value of fertilizer, manure and capital.

The yardstick of resource productivity in all these studies was the marginal value productivity of resources which were calculated from production functions fitted to input-output data. The study conducted by Ogunfowora et al (1975), on "Resource productivity in traditional agriculture", reported that land plays a major role in explaining the variation in crop production in the study areas. All the marginal values product for labour were negative except in one town, revealing excessive use of labour on the cultivated land.

### 2.1.1 Measurement of Resource Productivity

The simplest method of measuring resource productivity is in terms of input-output ratios. For example labour productivity can be measured in terms of the ratio of the total output to the total inputs of labour. In terms of aggregate input-output framework resource productivity in crop production for example, can be measured as an index of total output of crops to the index of total inputs used in crop production (Olayide, 1972). These indices enable the farmer to determine whether to modify the intensity of resource use or whether his attention should be directed towards improving production efficiency of the existing enterprises so as to obtain higher yields. Resource productivity indices for the component farm enterprises could be calculated and used to obtain a pattern or direction of resource adjustment on the farm. However, these productivity measurements are crude estimates or indicators. They really do not tell us the contribution to the output of individual resources in a situation where more than one resource is involved in the production process. Two analytical tools commonly used for studying resource productivity are linear programming and the production function.

Production function describes the relationship

between the production of a given output and the factors affecting the production process. Various types of functions such as quadratic, linear, Cobb-Douglas/spillman and various others could be fitted to agricultural production data, each subject to its assumptions and limitations. However functions estimated from farm samples ordinarily have been of power type because of the smaller degrees of freedom involved in estimating the parameters (Head, 1964). From the estimated production function, measures of resource use efficiency can be derived by calculating the marginal productivities of any one of the resource or all of the resources taken together. Saini (1969), in his study of resource use efficiency of agriculture in India, fitted the Cobb-Douglas production function to a sample of farms in India. The study indicated that land and human labour were the important inputs to which output was very responsive in the area. The result also indicated constant returns to scale. Cohen (1981), specified a production function model to analyse resource availability and employment in the traditional cultivation systems of two villages in the Mopti region of Mali. Production function analysis was used to estimate the marginal returns to land and labour in cereals production as well as in specific

between the production of a given output and the factors affecting the production process. Various types of functions such as quadratic, linear, Cobb-Douglas spillman and various others could be fitted to agricultural production data, each subject to its assumptions and limitations. However functions estimated from farm samples ordinarily have been of power type because of the smaller degrees of freedom involved in estimating the parameters (Head, 1964). From the estimated production function, measures of resource use efficiency can be derived by calculating the marginal productivities of any one of the resource or all of the resources taken together. Saini (1969), in his study of resource use efficiency of agriculture in India, fitted the Cobb-Douglas production function to a sample of farms in India. The study indicated that land and human labour were the important inputs to which output was very responsive in the area. The result also indicated constant returns to scale. Cohen (1981), specified a production function model to analyse resource availability and employment in the traditional cultivation systems of two villages in the Mopti region of Mali. Production function analysis was used to estimate the marginal returns to land and labour in cereal production as well as in specific

mixed cropped enterprises. Based on Yotopoulous' (1967), three basic decision rules to choose among alternative functional forms, Cohen (1981) chose the Cobb-Douglas production function as the appropriate algebraic form to represent the production process. The three decision rules stated by Yotopoulous (1967), in choosing among the numerous alternative algebraic forms are: (1) the production function presupposes a production process with a specific 'logic'. The functional form chosen should be consistent with the 'true' relationship. Perhaps testing a functional algebraic form with various criteria of statistical adequancy may, nevertheless, be a satisfactory means to approximate the 'true' function. (2) given the body of established economic theory, the explicit relation chosen should offer possibilities of providing a unified explanation of a wide range of empirical phenomena, which would otherwise be given ad hoc interpretations and (3) it is desirable that the function displays computational feasibility.

Linear programming is another tool which is used in resource productivity studies. By conducting linear programming exercises for different farming systems or for the same farming system in different regions, the marginal value productivities of resources

can be compared and used as the basis for resource adjustment and pricing policies (Ogunfowora, 1975). Linear programming however has two major shortcomings: first, only resources which are exhausted in the production process have marginal value productivities in the final solution; resources which are in surplus supply have zero marginal value products. Secondly, the marginal value productivities of resources relate only to their use in the given enterprise system considered in the programming exercise and their marginal value productivities may differ significantly when used for the production of individual enterprises that comprise the system.

### 2.1.2 Problems of Resource Productivity Measurement

The problems of resource productivity measurement in traditional agriculture revolve around the quality of the data from which parameters of resource productivity are derived. The problems of data collection and some measures for improving their accuracy and reliability have been fully discussed by Spencer (1972), and Norman (1973). In most of the production analyses involving cross-sectional data, the measurement of the variables and the specification of the production function are important steps in the

estimation of resource productivity parameters (Ogunfowora, 1975). The first problem is the measurement of variables, since the farmers are predominantly illitrate and the units of measurement vary from farmer to farmer. Heady and Dillon (1964) recommended that the best approach was to gather observations in terms of physical quantities. However many of the inputs used in traditional agriculture are difficult to quantify in physical terms and the preponderance of multiple enterprise and crop mixtures complicates the procedure for determining input allocation to specific crops in the mixture. Operations like weeding, fertilizer application etc. affect all crops in the mixture, even though these operations may be carried out in respect of one or two of the crops in the mixture. These problems often necessitate the aggregation of yields or inputs, which are sometimes measured in different units regardless of the enterprise from which they are derived or to which they are applied. Another problem is measuring unlike things in terms of common physical units. This problem is often solved by measuring input and output in monetary terms. The net effect of these factors is a high degree of error in observation and measurement which gives rise to statistical problems such as multicollinearity, low

coefficient of multiple determination etc. (Ogunfowora, 1975). Saini (1969), reported that the use of production function on cross-sectional data may lead to high correlation between some of the explanatory variables which leads to multicollinearity. His study on resource-use efficiency in agriculture in India indicated a high correlation between land and human labour and between land and bullock labour. The second problem is the specification of production function which includes all the relevant explanatory variables. There are many unquantifiable variables such as management which affect the production process, but which are not usually accounted for. Yotopoulous (1967), stated that omission of management may lead to the overestimation of the coefficients of some of the included inputs and the underestimation of returns to scale. Heady (1954), stated that it is difficult for a single algebraic model to adequately describe the complex agricultural production with its ranges of competition between resources and products.

## 2.2 The Project Area

### 2.2.1 Background

The Gombe Agricultural Development Project (G.A.D.P) was situated in the south-eastern part of Bauchi state

(formerly part of North-Eastern State) in the Federation of Nigeria. Bordered by the Gongola river on its eastern side, and by the Kaltungo hills to the South, the project area lies between latitudes $9^{o}$ 45' and $10^{o}$ 30' north and longitudes $10^{o}$ 45' east. The project was intended to increase the production of food and fibre crops and to improve the living standard of rural dwellers in the area. It was financed by the Bauchi state government; the Federal government and the World Bank.

The project area consisted of Gombe local government area and parts of Akko and Tangale-Waja local government areas, with a combined area of 6,450 square kilometers or 8% of the state. Population was estimated to be 640,000 including Gombe town.

The projects' strategy for raising production was to attempt to raise the productivity of the small farmers who form the great majority of the population and control most of the land. This called for the strengthening of the extension service, supplies of farm inputs and building network of farm service centres. Rural roads were improved for transport of inputs and of produce and dams were built to improve water supplies.

## 2.2.2 The Formulation of the Project

The G.A.D.P was prepared by the World Bank Mission in early 1973. The basic objective is to increase agricultural production and thereby earnings of the rural community by developing infrastructure and farmer skills with modern technology. The objectives were in line with "Operation Feed the Nation" (now Green Revolution). Within the project area, during the 5 year programme (the project became operational in April, 1976 and completed on September 1980) it was estimated that about half the farming population in the area will improve their farming techniques; grain production would improve and production of other crops will have significantly increased. The objectives as specified in the appraisal report were as follows:

(a) construction of 1,000 km of low cost agricultural roads, 85 earth dams, 160 tapkis (ponds) and associated conservation works.

(b) constructing an administrative centre in Gombe, 5 development centres and 50 farm service centres.

(c) developing and equipping seed multiplication farms at Tumu.

(d) providing adequate farmer extension, credit and marketing services, including staff, vehicles and equipments.

(e) provision of seasonal and medium term loans to farmers for the purchase of crop inputs and farm equipment.

(f) establishing a project evaluation unit.

### 2.2.3 The Environmental Conditions

The major features of the project are important as these would have some influence in crop production in the area.

Climate: The project area has a relatively reliable rainfall of about 900 mm in about 150 days, sufficient for all crops normally grown in Northern states of Nigeria. Rainfall occurs between months of April to October, with most of the rains falling in July and August. Rainfall distribution is suited to a range of annual crops. However, due to limitations in timely land preparation and to a labour bottleneck at planting time, farmers can often not plant all their crops at the optimum time. Radiation is adequate throughout the year, rising to a maximum in November through February and falling to minimum in August.

Temperature rises to about 36.5°C in March/April. Minimum temperatures can drop to about 12°C in December and January. Between months of November and March there is virtually no rain; this long season is rendered harsh by hot dry north-easternly wind (known as harmattan) blowing from Sahara and carrying dust along.

Demographic Characteristics: The project area is predominantly occupied by people of the Hausa tribe, who are devout moslems. Literacy in English and Hausa is not high among adults in the rural areas but rising rapidly with the younger generation. Other tribes in the project area include: Bolawa, Tera, Fulani, Waja and Tangale. Islam is the dominant religion in the project area. Christianity is also an important religion in the area, especially the south-eastern part of the project area (around Tangale - Waja local government area).

Vegetation: The project area lies within the sub-sudan vegetation zone. Natural vegetation ranges from savanah woodland typified by Anogeissus and Combretum species on the sands and sandy loams to Acacia Seyal and A. Polycantha savana woodland on the heavier soils. Grassland associations are dominated by Pennisetum

pedicellatum and loudetia togoenis in the west and south, merging into Hyparrhenia soluta associations in the east. Farm trees, such as Adansonia digitata, Parkia clappertoniana, and Acacia albida on the lighter soils are replaced by occasional stands of Balanites aegyptiaca and Ziziphus mucronata on the cracking clays to the east of the area.

Land Form and Soils: The land form changes from rolling plateau in the west to undulating sandstones and clay plains in the east. Altitudes range from 450 m in the west and south to 150 m in the east. A number of small, ephemeral streams occur throughout the area.

The area is underlain largely by sandstones of the cretaceous period with some tertiary sandstones to the west. Soils vary widely from very deep red sandy loams in the west through sand to sandy loams to cracking clays derived from cretaceous shales in the east. The soils of the area are complex. The sandy soils have been classified generally as leached ferruginous tropical soils generally without iron concretions. The cracking clays are lithomorphic yertisols (known as 'black cotton soils). Drainage on these soils is moderate to poor and they require careful management to maximise their considerable crop

production potential. The black cotton soils are of high fertility but difficult to cultivate. The sandy soils are less difficult to cultivate with unsophisticated equipment and much of the area of these soils have been overcropped and is low in organic matters.

Water: There are few perennial streams in the area and groundwater supplies are limited. With increasing pressure on land, the flow period of streams has diminished markedly. Shallow wells commonly fail during the dry months, leading to prolonged water shortages which are becoming an increasingly critical issue for both human and livestock populations.

## 2.3 Agricultural Production in the Project Area

Agricultural production is in the hands of an estimated 60,000 farming families. Most of these farmers have less than 5 hectares. Farms are usually fragmented into small fields of average size. The average size of holdings was found to be 2.97 in 1978. These fields are rarely adjacent to each other and distance from the homestead may be several kilometres.

Farming Systems: Field operations are generally undertaken by men, but in some areas the entire family

labour force is mobilized in periods of peak labour demand. Most of the agricultural production comes from upland rainfed annual crops. Bush fallow rotations and dry season "kraaling" of nomadic stock to feed on crop residues are rapidly disappearing as a means of maintaining soil fertility and usually occurs in areas of poor soils and low population density. Cultivated areas are being increased by the use of ox-ploughs and artificial fertilizers. Few farmers own tractors.

Land Tenure: In the past land has generally been regarded as the property of the community and authority on land matters was usually vested in the village head. However, with the new land use decree promulgated by the Federal Military Government, land in rural areas come under the control of the local government, which set up a land allocation committee. In practice, local land matters are still dealt with by the traditional village, but larger allocations of land are decided by the local government. Once a farmer is allocated the land, he has the right of use and this he enjoys in perpetuity for as long as he decides to use the land. However as soon as he discontinues to do so, it reverts to the community. Under the Islamic law, the land is divided among the sons on

the death of the father which, if they farm it themselves, leads to greater fragmentation.

Farm Labour: Most of the farm labour is from the male adults. Females do not usually work in some areas, especially the moslems. The recently introduced universal primary education reduces available family labour. This indicates that many families may have to hire additional labour at the peak periods of weeding. Thus the major source of labour for agricultural production in traditional agriculture is from the family. Norman et al (1979), reported that 84 percent of the total labour input on the family farm originated from family sources. Etuk (1982), reported that 55 percent of the total labour input came from family sources. He also indicated that 90 percent of the total family labour input was male adult labour. He reported that 45 percent of the total labour input was hired. The hired labour was obtained under a variety of arrangements, including contract system as well as simply hiring on a daily or per hour basis.

Farm Size: The average size of holdings in traditional agriculture is generally small. In the project area, information on farm size is scant. However, the average

size of cultivated holding ie. excluding fallow, had been 4.0 hectares. Matlon (1979), reported average size of holding to be 2.5 hectares in Kano area. Norman et al (1979), in their study of Bauchi, Sokoto and Zaria, reported average size of holdings to be 3.9 hectares. A common characteristic of traditional agriculture is fragmentation of farms. The major disadvantage of fragmentation under traditional agriculture is that disapproportionate amount of time is spent by the farmer in walking between the residence and the various fields.

The Cropping System: The cropping system that have evolved by the Nigerian traditional farmers has come about through generations and is a reflection of adoption of his environment (Abalu and D'Silva, 1979). Crops are grown either in mixture or in sole stands. Traditional farmers however grow most of their crops in mixtures. Many reasons are often advanced for the continued existence of mixed cropping. Such reasons include effective utilization of environmental factors such as light, water and nutrients. Others are technical reasons such as the protection of soil against erosion and reducing incidence of insect and disease attack.

Cropping pattern in the project are dominated by sorghum and millet as food crops, and cotton and groundnuts as the major cash crops. The main annual crops are guinea corn, millet, cotton, groundnut and cowpea, which, considering both sole and mixed cropped areas, account for about 95% of the total planted area. Sorghum and millet typically occupy about 50% of the cultivated areas. Minor crops, usually grown include, maize, kenaf, cassava, okro and a range of vegetables. Vegetables are usually grown during the wet season and in the low land (fadama) during the dry season.

# CHAPTER III

## ANALYTICAL FRAMEWORK AND DATA REQUIREMENTS

### 3.1 Analytic Framework

Various techniques exist for productivity studies. Their application depends on the choice of the investigator who is normally constrained by the nature of the available data, resources and facilities available and the use to which the results are to be put. The most common approaches are as follows:

(1) Production function analysis

(2) Linear programming analysis

(3) Farm budgeting analysis.

#### 3.1.1 Production Function Approach

The production function is a mathematical way of describing the relationship between the production of a given output and the factors affecting the production process. The production function has been the traditional tool for analysing problems of resource productivity and returns to scale. It provides a direct measurement of the parameters of resource productivity.

Numerous algebraic equations can be used in

deriving productions. No single form can be used to characterise agricultural production under all environmental conditions. Heady and Dillon (1964), noted that the algebraic form of the function and the magnitudes of its coefficients will vary with soil, climate, type and variety of crop or livestock being used. Selection of any specific type of function to express production phenomena automatically imposes certain restraints or assumptions in respect to the relationships involved and the optimum resource quantities which will be specified. A number of functional forms, quadratic, spillman, square root, power and variants of these - are possible in production function studies, but functions estimated from farm samples ordinarily have been power or linear forms because of the relative ease of computation and the smaller degrees of freedom involved in estimating the parameters.

The linear production function is usually given in the following form:

$$Y = a_o + b_1 X_1 + b_2 X_2 \ldots\ldots b_n X_n + u \quad (1)$$

where: Y = the dependent variable (output)

$X_1$ $X_2$ ... $X_n$ = the explanatory (independent) variable (input factors).

$b_1$ $b_2$ .... bn = the regression coefficients

u = error term.

$a_o$ = constant.

The Cobb-Douglas (power function) takes the following form:

$$Y = b_o X_1^{b_1} X_2^{b_2} \ldots\ldots X_n^{b_n} + u \quad (2)$$

Y = dependent variable (output)

$b_o$ = constant

$X_1$, $X_2$ ..... $X_n$ = explanatory variables (inputs)

$b_1$, $b_2$ ..... $b_n$ = the powers (exponents) of the explanatory variables (inputs)

u = a proportional error term due to the exclusion of some unknown but relevant explanatory variables from the specifications.

In the Cobb-Douglas production function, the relationship is non-linear; however, it can be transformed into a linear form. One of the most extensively used transformations in empirical work for the power functions is the logarithmic transformation. The above Cobb-Douglas function can be transformed into logarithmic form as follows:

$$\log Y = \log b_o + b_1 \log X_1 + b_2 \log X_2 \ldots\ldots b_n \log X_n \quad (3)$$

This is similar to equation (2) and therefore ordinary least squares multiple regression can be used on it.

The use of the production functions such as the equations of the types (1) and (3) is to determine certain characteristics such as total product; average product, marginal product, scale effects and elasticity of output to various factors. A few of those such as marginal productivities, scale effect are briefly described below:

(a) Marginal Productivities: From estimated production function, measures of resource use efficiency can be derived by calculating marginal productivities of any one resource or of all the resources taken together. In equation (2) above, the marginal productivity of an input, say $X_1$, is the first partial derivative of output with respect to $X_1$. The marginal value of product for $X_1$, is given by the equation:

$$\frac{dy}{dx_1} = MPP_X \, P_y \quad \ldots\ldots \quad (4)$$

where Py is the price per unit of output, Y. The most reliable and perhaps the most useful estimate of marginal productivity is obtained

by taking $X_1$ at its geometric mean i.e. at the value where log $X_1$ assumes its logarithmetic mean. Also Y should be the estimated level of output when each input is level at its geometric means.

(b) Returns to Scale: In the Cobb-Douglas function, the sum of the estimated input coefficients has been taken as an indication of the returns to scale. Also in fitting a Cobb-Douglas function, the coefficients equal the elasticities of the respective inputs. The elasticities indicate the percentage increase in the output that would be forth-coming within a one percent increase in the individual resource. If the sum of the elasticities equal one, a given percentage increase in all the inputs will result in an equal percentage increase in output. A sum greater or less than one, output will increase by a greater or smaller percentage respectively than inputs indicating increasing and decreasing returns to scale respectively.

## Production Functions in Agriculture

Many functions have been used in productivity

studies, they have different characteristics which determine the type of studies where each is appropriate. Some of these are discussed below:

(i) Cobb-Douglas (Power) Function

This function is essentially the one shown in equation (2) above and the characteristics described are largely those peculiar to it.

This function allows either constant, increasing or decreasing marginal productivity. It does not allow an input-output embracing all the three. With all other inputs held in a fixed magnitude, the marginal product is expected to decline. Given the mathematical properties of the equation, this function cannot be used satisfactorily for data where there are ranges of both increasing and decreasing marginal productivity. Neither can the function be used satisfactorily for data which might have both positive and negative marginal products. Here the power function provides a curve that "flattens out" as input increases and a maximum product is not defined. Unless an economic optimum is defined for small magnitudes of input, the power function may overestimate the input in attaining economic optimum.

The isoquants of this production function are asymptotic to the input axes. Because of the properties of the Cobb-Douglas function, no output is forthcoming if the inputs are at zero level.

Advantages of the Cobb-Douglas Function

The Cobb-Douglas functions have been the most popular in farm analyses. The function has the following advantages:

(i) adequate fit of the data

(ii) computational feasibility and

(iii) sufficient degree of freedom unused to allow for statistical testing. In other words, the Cobb-Douglas function is a relatively "efficient user" of degree of freedom (Heady and Dillon, 1964). Such efficiency is important where research resources are limited and the collection of farm data expensive.

One of the major disadvantages of this function is that the sum of squares are minimised in logarithmic rather than in their natural form. Hence the residual sums of squares are not minimised in terms of the natural data. Thus the least squares logarithmic

parameters are biased estimators of the natural parameters. The function is usually used where interest resolves only around knowledge of resource productivities at the mean of inputs and where a small number of degrees of freedom is involved.

(ii) Quadratic Functions

This function has the characteristics described in the power function. For two resource inputs a quadratic function is normally designed as in equation (5) below:

$$Y = a + b_1 X_1 + b_2 X_2 - b_3 X_1^2 - b_4 X_2^2 + b_5 X_1 X_2 + u \quad \ldots\ldots \quad (5)$$

Where: a = output obtained when $X_1$ and $X_2$ are both zero, it represents output from the mix of fixed resources and may sometimes be zero.

Y = output got from the inputs

$X_1 X_2$ = inputs

$b_1 b_2$ = measure of the direct effect of levels of input on output, normally showing a positive production respose to increasing inputs of the variable factors from

zero upwards.

$b_3b_4$ = measures rate of change in the slope of the response curve. The negative signs before $b_3$ and $b_4$ denote diminishing marginal returns.

$b_5$ = shows that the two inputs are more productive when used in combination.

$u$ = error term.

Dininishing marginal returns exist for either factor above but there is positive interaction between the two factors. The isoquants are not asymptotic to the input axes, as in the Cobb-Douglas function. Certain output levels can be attained from input of $X_1$ alone, with $X_2$ at zero depending on the magnitudes of a, $b_1$ and $b_3$. Similarly, certain levels of output can be attained with zero input of $X_1$ and isoquants are allowed to intersect the input axes of a contour map of the surface. In contrast to the surface formed by the Gobb-Douglas, the surface formed by the quadratic equation can have a distinct peak, denoting a maximum output for a single limitational combinations of the factors.

The possible disadvantages of this function are that it cannot show both increasing and

diminishing marginal returns in a single response curve. It may give negative total products for very high or very low levels of output. Mostly, the large number of b values or regression coefficient, which must be estimated for a given number of variable inputs is inconvenient. For a quadratic function, each variable input involves two regression coefficients, one for the X term and the other for the $X^2$ term; further, the number of coefficient increases more rapidly than the number of variable inputs hence, if many inputs are allowed to vary in the production function, the quadratic function may become very large and cumbersome and may require a very large number of observations for reliable estimation.

(iii) Square - Root Function

A square root function is normally given by the following equation:

$$Y = a - b_1X_1 - b_2X_2 + b_3X_1^{.5} + b_4X_2^{.5} + b_5X_1^{.5}X_2^{.5} + u \ldots\ldots (6)$$

where; Y = output

$b_i$ = regression coefficient

$X_i$ = are the variable inputs.

u = error term.

This type of function has the following characteristics:

(a) It allows isoclines which are curved and pass through the origin - a compromise between the power and the quadratic functions.

(b) It does not specify a fixed mix of resources for attaining different output levels as in power functions or impose linear isoclines as quadratic forms.

(c) It allows product contours nearest the origin in the input plane to intersect the factor axes.

The isoclines coverge at an input combination corresponding to the maximum output, the peak of the production surface. Thus the least - cot path to higher outputs denotes a changing mix or ratios of inputs. The input mix should change as product price increases or decreases and output level increases or decreases accordingly.

(iv) Spillman Function

This function is normally formulated as follows:

$$Y = A\ (1-R_x^x)\ (1-R_z^z) \quad \ldots\ldots\ (7)$$

Y = the value of production resulting from the resources being varied.

X = is the quantity of one factor and

Z = is the quantity of another factor.

$R_X$ = the ratio by which marginal products of X decline while $R_Z$ has the same meaning for Z.

A = the maximum response from increasing both factors.

The height of the surface is asymptotic at level A and extends to a long broad "ridge" over the input plane. By the nature of formulation (6) above, if input of either or both factors is zero, output is also zero.

## Problems of Applying Production Functions

Applying production function to farm samples have some problems:

(1) The choice of the function and of the variable inputs to include involve some arbitrary and subjective judgement.

(2) The application of production function depends on the way in which the input and output factors are defined and measured. If a high degree of aggregation is inevitable,

say if the input class is heterogenous, the implications of the resultant function may be of little relevance in decision making.

(3) Multicollinearity - This is a situation where some or all of the explanatory (independent) variables are highly collinear such that they move in the same direction. This problem is usually related to the problem of errors of observation in the independent variables. The existence of such problems leads to a high standard error and make coefficient indeterminate. However, it is not a serious problems if the multiple coefficient, $R^2$ is higher than the value r, the correlation coefficient between the independent variables (Norman, 1972).

(4) The specification of the production function which includes all the relevant explanatory variables is extremely difficult, if not impossible. There are many unquantifiable variables affecting production process in agriculture. Managerial ability and other socio-economic factors affect the production function, but are not usually accounted for. One cannot but agree with Heady that it is difficult for a single algebraic model to adequately describe the complex agricultural

production with its wide range of complementarity and competition between resources and products (Heady and Dillon, 1964).

## Choice of Production Function for the Study

In choosing an algebraic form of the function to be estimated, the researcher must attempt to account for whatever is known of the production process. Also the selected function must be computationally manageable for estimation and testing. Functions estimated from farm samples ordinarily have been power or linear forms because of the relative ease of computation and the smaller degrees of freedom involved in estimating the parameters. Quadratic and other functional forms fitted to farm samples generally lead to a loss of many degrees of freedom and often results in too many regression coefficients which are not often significant in a probability sense.

Of the different functions discussed above, the Cobb-Douglas function has been chosen for this study. It was chosen despite the peculiar problems for reasons of convenience and because of it's general acceptance for agricultural data. The function was also chosen because it is economical in its use of degrees of freedom, in calculating parameter estimates, its

convenience in interpreting elasticities of production, and the computation is relatively easy (Heady and Dillon, 1964).

The major limitation in the use of the Cobb-Douglas function is that it cannot be used for data where there are ranges of both increasing and decreasing marginal productivity.

## Variables and Reasons for Selection

In fitting the Cobb-Douglas production function, the variables used are as follows:

(1) Farm size ($X_1$): This was included in the model as a result of the much discussed inverse relationship between farm size and productivity in farm management studies (Saini, 1969). The inclusion was therefore to enable us know the influence of farm sizes on the production of crops in the two areas. The inclusion of land would therefore help in determining the extent to which it explains the variability in the value of the output.

(2) Labour input ($X_2$, $X_3$): The labour inputs was measured in man-hours for both family labour ($X_2$) and non-family labour ($X_3$). The

inclusion of the labour input in the model was to see if labour was over-used on the farms. This is important in the light of the common assumption in economic literature that labour in less developed agriculture has a low (or near zero) marginal product.

(3) Fertilizer quantity ($X_4$): The inclusion of fertilizer in the model was a result of the observed variations in the quantities of fertilizers used in the study. While some had little or no fertilizer to apply on their farms, others had applied more than the recommended levels per hectare. It is therefore included in order to know the extent to which the variations affect the total output from farms.

(4) The inclusion of the error term in the model is due to the fact that the four quantifiable variables (independent) stated above may not completely explain the variation observed in the values of the output. Some other unquantifiable factor such as managerial ability other socio-economic factors affect production, but are not accounted for. The inclusion of the disturbance term was therefore to represent these unquantifiable factors in the production of crops.

### 3.1.2 Linear Programming Approach

Linear programming deals with the planning of economic activities in such a way that some optimal result is obtained for a given set of conditions, as well as the mathematical techniques for solving problems.

To apply this technique four main assumptions must be valid. These are:

(i) Linearity: This assumption ensures that the relationship between output and input is not quadratic, exponential i.e., it conforms with the specification of a linear production function.

(ii) The Activities: There must be a limit to the number of alternative enterprises and resources which need to be considered. This assumption of finiteness is a practical one. If there exists an unlimited number of alternatives it would be impossible to programme because neither the description of the additional enterprises nor the computational task of obtaining the optimal programmes could ever be finished (Olayide and Oluwode, 1972). In agriculture these

activities could be early maize, late cotton or irrigated cotton etc.

(iii) The fixed constraints: These are rigid conditions which restrict the combination of activities which are feasible. The constraints in agriculture usually include land, total labour and capital. These resource inputs and the commodities produced from them can be obtained in fractional units. That is, inputs and outputs are infinitely divisible.

(iv) Lastly, it is usually assumed that resource supplies, input-output coefficients and prices are known with certainty.

In a typical linear programming analysis, the magnitudes of the marginal value productivities of fixed resources are obtained as by-products of the convectional linear programming solution. By conducting linear programming exercises for different farming systems, or for the same farming system in different regions, the MVPs of resources can be compared and used as the basis for resource adjustment and pricing policy (Ogunfowora et al, 1975).

The linear programming has some shortcomings: (1) only resources which are exhausted in the production process have marginal value productivities in the final

solution; resources which are in surplus supply have zero marginal value products. (2) The marginal value productivities of resources relate to only to their use in given enterprise system considered in the programming exercise, their marginal value productivities may differ significantly when used for the production of the individual enterprises that comprise the system. (3) The assumption of fixed level of resources (constraints) is a little unrealistic in many cases. In practice, if say, June labour becomes limiting, the farmer will tend to find some means of increasing the labour supply in that month either by putting in more hours of work or by hiring non-family labour.

### 3.1.3 The Farm Budget

The farm budget model is one of the oldest tools of analysis used in farm management and production studies. A number of people such as Orewa (1978); Ofojekwu (1982), have used it for analysing the profitability of farm production practices.

The farm budget analysis leads to estimate of total cost and total revenue for the same production period (Olayemi and Oni, 1971). The difference between the two parameters is a measure of the net-farm income. The purpose of the model is therefore to identify the

costs, returns, profitability or loss (per hectare) of crop production within and outside the project. The measures of efficiency therefore considered include (a) the returns to management and land from a hectare of land (i.e. net farm income) and the gross value of output per unit of land and labour (i.e. the average productivity coefficients).

Net Farm Income: The general equation for obtaining the "net farm income" developed is as follows:

$$NFI = TR - VC - FC$$

where

NFI = Net farm income in naira

TR = Total revenue or gross returns in naira

VC = Total variable costs

FC = Total fixed costs.

This model shows that for a given level of overhead costs an increase in the net farm income is possible either by an increase in total revenue or a decrease in the level of variable costs. Total revenue is a function of physical output and unit output price and the variable costs depend on the physical quantities of inputs used as well as their respective unit prices.

Cost Analysis: The costs analysed in the study were made up of the following:

(i) Variable costs: The variable (or direct, real, avoidable) costs, represent that part of the total costs which is related to any output. It included costs of inputs such as fertilizers, seed and labour. The hired labour costs are those incurred for hired labour used in the production. The wages paid to a labourer working on the farm were the prevailing wage rates in the area during the period of study. During the study period the average wage rate was put at ₦2.50 per day.

Family labour input evaluation was based on the economic opportunity cost principle. It was assumed that the cost of family labour was equal to the average wage rate paid to a labourer working in the farm. The non-durable costs analysed were those of seeds and fertilizer. At times imputed cost were used where farmers used local seeds or input from their stock.

(ii) Fixed costs: These are part of total costs

which would be incurred even if no output were produced. In the study the fixed costs included mainly depreciation on the use implements such as hoes, cutlasses, ox-plough etc. as none of the sampled farmers had a tractor.

Limitations of the Model: One of the limitations of the farm budget is its inability to define how optimum returns can be attained from limited resources. It only shows the technical output possible as well as the monetary costs and returns from a production process. Another limitation is that it ceases to be a useful tool of analysis if a considerable number of the production inputs or output cannot be valued in monetary terms.

## 3.2 Data Collection Procedure

Since there was no resource productivity study of this nature in the project area, it was not possible to draw benchmark data from an earlier period. Information was obtained from primary data and supplemented, where necessary, with secondary sources. Because production of crops involve a large amount of labour input over a long production season, considerable effort was made to make sure that the farmers recall specific labour use and expenditure. The cost-route[1] survey is the

1. For a discussion of several methods of farm management data collection under African conditions, see Spencer (1972).

most appropriate framework for the collection of field data. This method involves continuous interviews from the sample of farmers. However, because of time factor and financial constraints, single interviews were conducted for this study.

### 3.2.1 Sampling Procedure and Sample Size

The Evaluation Unit of the Gombe Agricultural Development (GADP), had conducted an enumeration of all the villages and farming families in the project. The project covered some parts of Tangale-Waja, Akko and Gombe Local Government Areas.

From these local governments, Tangale-Waja was selected for the study. From the list of villages compiled by the project during the survey, two were selected for the study. A random sample of thirty five farmers were selected from the frame of farming families in the two villages (Dasa and Kamo). The 35 farmers selected for the study were among those compiled by the Evaluation Unit of the project for their farm management survey (agronomic survey). In the non-project area, one local government area, (Alkaleri) that is more or less similar to the one chosen in the project area was selected. Within

this local government area two villages were selected for the study (Gwaram and Alkaleri). From the list of farming families compiled by the project (Evaluation Unit) during the baseline survey for the proposed Bauchi State Agricultural Development Programme (BSADP) in the two villages, 35 farmers were randomly selected for the study. This gives a total of 70 farmers, 35 within the project area and 35 in the non-project area. This number was selected in consideration of the costs and supervision constraints. In the study, household heads were sampled because they are the main decision makers. The total number of farming families and the percentage included in the samples in the survey villages is depicted in Table 3.1.

Table 3.1 Total Number of Farming Families and the Percentage Included in the Sample in the Study Areas.

| Area | Village | No. of Farmers | Sampling Percentage |
|---|---|---|---|
| Project | Dasa | 208 | 11.0 |
| | Kamo | 95 | 12.6 |
| Non-Project | Alkaleri | 185 | 9.7 |
| | Gwaram | 150 | 11.3 |

### 3.2.2 Data Collection

The collection of the field data was done by 2 trained enumerators from the Evaluation Unit of the project. A designed questionnaire was used for interviewing the farmers. (Appendix A)

During the interviewing procedure, detailed information was collected on family composition; inputs; farm inventory; output, marketing etc.

The data employed in the farm budget analysis consisted of physical and monetary values of gross farm output, quantities of the various farm inputs, and their respective costs; labour (hired and family) input in man-hours and wages, depreciation of tools and equipment etc.

Similarly for the production function analysis, cross-sectional data were collected on gross farm output (in naira value); farm size, fertilizer and manure and seeds (in naira value), family labour input (man-hours) and hired labour input (in man-hours).

Secondary sources of data were obtained from the farm management survey (agronomic data) of the Evaluation Unit of the project. The average market prices prevailing at the time of the survey for the

various crops were used for the study (Appendix B).

### 3.2.3 Nature and Measurement of Input-Output Data

This section gives a brief description of the techniques used in the measurement of the factors of production used and of the output of the various crops.

To measure labour utilization, data was collected for family and non-family labour and were recorded on the basis of man-hours. The non-family labour consisted of communal and hired categories. Within each category the labour input was sub-divided into: male adult; female adult; large child and small child. Since work rates may be affected by age, sex of the worker as well as the task being performed (Spencer, 1972), a problem arises in deciding the weights to be used in aggregating the various categories of labour input in hours. In this study, female adult, large child and small child hours were converted to man-hours equivalent (before totalling) by using Norman's (1967) weighting formula[1] i.e. 0.75, 0.50 and 0.00 respectively. For hired labour, information on wage rates (naira per day), unit length of ridge per naira or kobo, total expenditures were made.

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1. This formula was used extensively by Norman D.W. (formerly of the Department of Agric. Economics, IAR/ABU Zaria) in all his village studies in the Northern parts of Nigeria.

Land was measured in hectares., Since traditional farmers had little or no knowledge of the size of the land in hectares, the area of land was measured by the Evaluation Unit during their farm management ronomic) survey using compasses, range poles and suring tapes.

Non-durable capital such as fertilizer, seeds and manure were costed using purchase or imputed prices$_0$ I 3 prices had to be used for local is and manure since most farmers used local seeds from their stock and manure is usually obtained from their livestock or given free of charge by friends of neighbours. In deciding what price to use in valuing local 3 the farmer was asked to state the price per unit (usually mudu) of the seed used on his farm at the time he used it. For manure, the farmer was asked :imate the worth of the manure (bag) he n his farm if he was to buy the same quantify from the market. Thus the average price per bag (&1.0) of manure was reasonably estimated and that was taken or assum the market price*

Total production or output in this study was obtained by asking the farmers the quantity of produce harvested on their farms. Since traditional farmers

have no scales for measuring their output, various units were employed, such as bag, bundle and mudu. Estimates were made on the number of bundles or mudus per bag. On the average 15 bundles of sorghum or millet was equivalent to one bag. Total production in this study includes quantity of produce consumed; sold and given free as a gift.

### 3.3 Data Limitations

The data collected for this study have a number of limitations. Some of them are briefly discussed below:

First, the data pertain to a single production year which may be a typical or atypical. There is also the fact that the output varies from year to year due in part, to the vagaries of nature, and the changing price structure.

Secondly, the nature of the survey used i.e. cross-sectional, in collecting input-output data is another limitation. Most of the farmers are illiterates and this contributes to the lapse in memory in regards to details about resource utilization, operations etc. More important, labour input, recorded in hours, took no account of the quality or quantity of work done by different labourers or labour within the same category

(e.g. male adult). Also between categories, the quality and quantity of work differs (e.g. between communal and contract). This problem is further complicated when labour is used for simultaneous operations. For example, weeding a field and at the same time planting.

The third limitation is that of the use of imputed costs concept. The problem arises in deciding what rates to use. Also the purchase price of certain inputs such as fertilizer is highly subsidized. Thus caution is to be exercised in interpreting some of the results obtained from the application of the models described.

# CHAPTER IV

## STRUCTURE OF SAMPLED FARMS

This chapter discusse the structure of the sampled farms in the project and non project areas. This takes into account the characteristics of the sampled farms such as farm size, land tenure, investment on farms and other details. All the respondents are family heads (pot-head). Norman (1973), defined a family as those people eating from one pot. Spencer (1972), uses a similar definition - those people eating together. The definitions imply that the consumption unit is also the production unit (Tollens, 1975).

### 4.1 Size of Farm

The size of the farm cultivated is a function of population pressure, size of the family labour available etc. Table 4.1 shows the basic information on the average size of land cultivated per household. It indicates that the average size of cultivated land of the households in the project and non-project areas amcunted to 2.95 and 2.05 hectares respectively. These figures differ from the average of 4.0 hectares obtained during the Appraisal of Gombe project. The decrease in the average size of cultivated land could be attributed to the increase in population pressure and the fact that more people took to farming. There is a tendency for a larger farm

Table 4.1 Average Size of Cultivated Farms Among the Respondents

| Size Category | GADP | | | NON-GADP | | |
|---|---|---|---|---|---|---|
| | No | % | Average Size | No | % | Average Size |
| 0.0 - 1.0 | 2 | 5.7 | 0.85 | 9 | 25.70 | 0.84 |
| 1.1 - 2.0 | 11 | 31.4 | 1.75 | 12 | 34.30 | 1.52 |
| 2.1 - 3.0 | 10 | 28.6 | 2.58 | 10 | 28.60 | 2.69 |
| 3.1 - 4.0 | 5 | 14.3 | 3.46 | 2 | 5.70 | 3.20 |
| 4.1 - 5.0 | 3 | 8.5 | 4.53 | 1 | 2.90 | 4.50 |
| 5.1 - 6.0 | 1 | 2.9 | 5.50 | 0 | - | - |
| 6.1 - 7.0 | 2 | 5.7 | 6.40 | 0 | - | - |
| Over 7.1 | 1 | 2.9 | 7.00 | 1 | 2.90 | 8.10 |

sizes in the project area as compared to the non-project area. In the areas, the total area of land left fallow was found to be 31.33 hectares in the project area and 40.96 in the non-project area. This gives a total of 134.33 hectares of family farm in the project area and 112.66 hectares in the non-project area. When fallow and cultivated land is taken together, the average family farm in the project and non-project area were found to be 3.8 and 3.2 hectares respectively. A farm here is defined as the sum of fallow and cultivated land; while a field is defined as a unitary piece of land farmed by one family unit. When expressed in percentage, this gives 23.3 and 36.3 percent of the total farm area left fallow in the project and non-project areas respectively. Table 4.1 indicates that the most common size cultivated land was between 1.1 - 2.0 hectare category in both areas, while only about 3 percent of the cultivated land were above 7 hectares. There are variations in size of individual farms and between the two area. There are many socio-cultural and economic factors which influence the sizes of individual farms.

## 4.2 Land Tenure

In the past, land ownership was largely vested

in the community and authority on land matters was usually vested on the village head. The individual residing in the community has no right to alienate the land he holds. However, with the new land use Decree promulgated by the Federal Military Government, land in rural areas come under the control of the local government, which set-up a land allocation committee. In practice, local land matters are still dealt with by the traditional village head, but larger allocations of land are decided by the local government. Once a farmer is allocated the land, he has the right of use and this he enjoys in perpetuity for as long as he decides to use the land. However, as soon as he discontinues to do so, it reverts to the community. Under Islamic law, the land is divided among the sons on the death of the father, which if they farm, leads to greater fragmentation, (International Bank for Reconstruction and Development, 1974).

Farm land in the two areas is partitioned mainly on inheritance. Table 4.2 indicates that 68.5 percent of the farmers held land by inheritance in the project area and 82.8 percent in the non-project area. Lease and purchased land accounted for a small percentage in both areas. In the project area, 25.7 percent of

the farmers cultivated leased land while only 2.8 percent of the farmers in the non-project area cultivated leased land. None of the respondents in the non-project area purchased land for farming while only 2.8 percent of the farmers in the project area purchased land for farming activities. Norman et. al (1979), in their study of Bauchi, Sokoto and Zaria areas indicated that 76 percent of the land area is held by inheritance.

Table 4.2 Types of Agricultural Land and Characteristics of Land Tenure in the Study Areas.

| | GADP | NON-GADP |
|---|---|---|
| Field Type: | | |
| Upland (Gona) | 84.6 | 91.4 |
| Lowland (fadama) | 15.4 | 8.6 |
| Average No. of Fields | 3.0 | 2.7 |
| Land Tenure: | | |
| Land inherited (%) | 68.5 | 82.8 |
| Land leased (%) | 25.5 | 2.8 |
| Land purchased (%) | 2.8 | - |

Many of the farms in the two areas were fragmented. This is as a result of hereditary nature of land acquisition. The average number of fields in the project and non-project areas are 3.0 and 2.7 respectively. Fragmentation of land has some disadvantages. One of the major disadvantages of fragmentation is that a lot of time is spent by farmers walking from their residence to the various farms.

Gill et. al (1966), in their study of socio-economic survey of peasant agriculture in Northern Nigeria classify land according to two criteria. One is the distance from the farm to the home i.e. farms near the home and farms away from home. The second criterion is based on topography: uplands and lowlands. Lowlands or fadama lands are again divided into two classes according to their drainage: (a) ordinary and (b) poorly drained fadama land. In the study areas two types of land are differentiated. The first is gona or rainfed upland, which supports crops such as millet, groundnuts, cowpea and cotton and secondly, fadama or lowland, which supports crops such as rice. However in the study areas, the fadama land supports crops such as maize, rice and sometimes cotton.

Gona (upland) land is the most dominant in the two areas. A total of 87.2 hectares of upland was cultivated in the project area. This represents 84.6 percent of the total cultivated land area. The cultivated fadama (lowland) land amounted to 15.8 hectares or 15.4 percent of the cultivated land area. In the non-project area, a total of 65.5 hectares of land was cultivated as gona (upland). This represents 91.4 percent of the total cultivated land area. The remaining 6.1 hectares or 8.6 percent of the total cultivated land area was fadama (lowland). A comparison between the two areas indicates that more fadama (lowland) was cultivated during the survey period in the project area than in the non-project area.

## 4.3 Cropping Pattern

The major crops grown in the two areas are maize, cotton, groundnut, millet, sorghum and cowpea. Table 4.3 indicates the percent of farmers who grew food and cash crops. In the non-project area, 88.5 percent of the farmers grew food crops only, while 68.5 percent of the farmers grew food crops only on the project area. In the project and non-project areas 31.5 and 11.5 percent of the farmers grew food and cash crops respectively. The Table indicates that the non-project

area which grew a higher percentage of food crops have smaller average size of farms. The project area with larger average farm size could spare some land for raising cash crops after meeting some of their subsistence needs. Among the cash crops grown on the fields in the areas included cotton and groundnut.

Table 4.3 Crop Pattern on Sample Farms

| Variable Specification | GADP | NON-GADP |
|---|---|---|
| Food crops only (%) | 68.5 | 88.5 |
| Food and cash crops (%) | 31.5 | 11.5 |

## 4.4 Mixed Cropping

Approximately 26.9 and 13.9 percent of the cultivated land area in the project and non-project areas was sole cropped respectively. The remaining land, amounting to 73.1 and 86.1 percent in the project and non-project areas respectively was primarily devoted to crop mixtures i.e. two or more crops grown on a given piece of land at the same time. A comparison between the two areas indicates that more land was devoted to sole cropping in the project area than in

the non-oroject area. Norman et. al (1979), in their study of Bauchi, Sokoto and Zaria areas reported that 26.0 percent of the cultivated land area was sole cropped.

A total of 75 crop mixtures was identified in the project area while 78 was identified in the non-project area. However, 68.2 percent of the total cultivated land was accounted for by six crop enterprises in the project area, while 62.9 percent was accounted for by five major crop enterprises in the non-project area (Table 4.4). The most dominant crop mixtures in the two areas are millet/sorghum in the non-project area and sorghum/cowpea in the project area, accounting for 30.5 and 18.3 percent respectively.

The frequency of sole and mixed cropping for the project and non-project areas is depicted in Table 4.5. The Table shows that 29.2 and 17.0 percent of the cultivated fields were sown to sole crops in the project and non-project areas respectively. This indicates that more fields were devoted to sole crops in the project area as compared to the non-project area. This is expected since the project encouraged farmers to grow sole crops.

Approximately the same percent (45.3 in the

Table 4.4 Percentage of Cultivated Land Devoted to Sole and Mixed Crops in the Areas

| Percent of Cultivated ha. | GADP | NON-GADP |
|---|---|---|
| Sole cropped | 26.9 | 13.9 |
| Mixed cropped | 73.1 | 86.1 |
| Major Crop Enterprises: | | |
| Sorghum | 16.9 | 4.2 |
| Cotton | 6.0 | 4.3 |
| Millet/sorghum | 8.7 | 30.5 |
| Sorghum/Cowpea | 18.3 | 6.5 |
| Maize/Cotton | 4.4 | - |
| Millet/sorghum/cowpea | 13.9 | 17.4 |

Table 4.5 Frequency of Sole and Mixed Crops: Percent of Crops in One, Two, Three and Four Mixtures.

| Crop Enterprise | GADP | | NON-GADP | |
|---|---|---|---|---|
| | No. | % | No. | % |
| Sole crops | 31 | 29.2 | 16 | 17.0 |
| Double Mixtures | 48 | 45.3 | 42 | 44.7 |
| Triple Mixtures | 23 | 21.7 | 31 | 32.7 |
| Quadruple Mixtures | 4 | 3.8 | 2 | 5.4 |

project and 44.7 in the non-project) of the total number of fields were devoted to double crop mixtures in the two areas. Quadruple crop mixtures accounted for 3.8 and 5.4 percent of the total number of fields in the project and non-project areas respectively.

Various reasons have been given for growing crops in mixtures by the farmers. In their study of peasant agriculture in Northern Nigeria, Gill et al (1966), stated some reasons given by farmers why they interplant. Some of their reasons were: to get as many food and cash crops as possible (to make more money); to avoid wastage of land; to get more crops and avoid wastage of land and to avoid failure of crops (to cover risk). Other reasons were centered on security, and the fact that it was traditional to grow crops in mixtures. However the major reason could be interpreted as the need to maximise the return from the most limiting factor.

## 4.5 Investment on Farms.

The amount of capital invested in traditional agriculture is generally low and is often composed of simple tools such as hoes, cutlasses, axes etc.

The shortage of capital available to farming family in developing countries is partly because the low

incomes derived from farming result in low capacity to save money for investment. In this study both durable and non-durable capital goods used in production was considered.

Tools and Equipment

The durable capital used in production in the two areas consist of tools and implements such as hoes, cutlasses and ox-ploughs. Tractor was not owned by any of the respondents in both areas. The consequence of low level of capital equipments on farms such as these mentioned is low labour productivity. Depreciation allowance of the durable capital was computed to provide flow services from the equipment. The straight line method was used to calculate the depreciation of the implements and equipment. In the study areas, 14 of the households had ox-ploughs in the project area while 6 of the households in the non-project area had ox-plough equipment (Table 4.6). This shows that more households used this equipment for farming in the project areas when compared to the non-project area. This also indicates some degree of modernization in farming in the project area. The hoe, sickle, basket, digger and cutlass are the tools used for farming in both areas.

Table 4.6 Average Number of Tools and Equipment Per Household in the Two Areas.

| Implement | GADP | | NON-GADP | |
|---|---|---|---|---|
| | No. | Average Number | No. | Average Number |
| Ox-Plough | 14 | 0.4 | 6 | 0.2 |
| Hoe | 274 | 7.8 | 219 | 6.3 |
| Cutlass | 50 | 1.4 | 42 | 1.2 |
| Sickle | 101 | 2.9 | 108 | 3.0 |
| Basket | 9 | 0.3 | 54 | 1.5 |
| Digger | 29 | 0.8 | 44 | 1.3 |

Table 4.6 indicates that the hoe and sickle are the most common tools used in the project and non-project areas. On the average, 7.8 and 6.3 hoes were owned per household in the project and non-project areas respectively. The average numbers of other implements such as basket, digger and cutlass owned per household are indicated in the Table. A comparison between the two areas indicates that basically the same types and numbers of implements are used for farming. Most of the farm operations such as weeding, harvesting etc. are done by the hoe. Other farm operations such as ridging, harvesting (separating heads of crops such as millet and sorghum), land

clearing etc. are done by tools such as ploughs, cutlass, and sickles. The use of these tools and equipments results in low efficiency, since most of these tools are crude and require a lot of human energy in using them (Gill et. al, 1966).

Livestock

Investment in livestock such as chicken, sheep and goats, horses and cattle is shown in Table 4.7. Livestock is a form of investment that can be easily translated into cash. Also the ownership of livestock, especially cattle, was an advantage in that they provide substantial amount of organic manure for field operations, and also supplement their income sources. The next most important durable asset to land in traditional farming is work-bull. Table 4.7 shows the number of draft cattle in each area and the percentage of the households owing them. The Table shows that 18 pairs of work-bulls (40% of households) were owned by respondents in the project area while 6 pairs (17% of households) were owned by the respondents in the non-project area. This gives an average of about 1.0 and 0.34 work-bulls per household in the project and non-project areas respectively. The lower percent of draft animals

Table 4.7 Number of Livestock and Percent of Holdings in the Areas

| Livestock | GADP | | | NON-GADP | | |
|---|---|---|---|---|---|---|
| | No. | Average per Holding | % | No. | Average Per Holding | % |
| Cattle | 19 | 0.5 | 17.1 | 77 | 2.2 | 31.4 |
| Other Livestock | | | | | | |
| Sheep | 53 | 1.5 | 37.1 | 138 | 3.9 | 60.0 |
| Goats | 244 | 6.9 | 68.5 | 225 | 6.4 | 77.1 |
| Donkey | 12 | 0.3 | 25.7 | 22 | 0.6 | 34.2 |
| Horse | - | - | - | - | - | - |
| Work-bulls | 36 | 1.0 | 40.0 | 12 | 0.2 | 17.1 |
| Poultry[1] | 733 | 21.0 | 91.4 | 553 | 15.8 | 85.7 |

1. Poultry here included duck, guinea fowl and chicken.

in the non-project area might contribute to the small size nature of the farms. Lack of means and other factors might explain the lower number of draft cattle. In the project area, the comparatively higher number of draft cattle could be attributed to the impact of the project, which encouraged and even made loans available to farmers for the purchase of bullocks. The Table also indicates that poultry, sheep and goats constitute the greatest area of investment by the respondents. In terms of percent, 91.4; 68.5 and 37.1 percent of the households in the project area owned poultry, goats and sheep respectively, while 85.7; 77.1 and 60.0 percent of the households owned poultry, goats and sheep in the non-project area respectively. A comparison between the two areas shows that investment in poultry, goats and sheep was high in both areas. However, investment in sheep and poultry was greater in the project area while investment in sheep was greater in the non-project area. Another important livestock is donkey. Most of the farmers in the sample used donkeys for transportation of produce to the markets or inputs to the farms. Farm yard manure is mostly conveyed to the farms by means of donkeys. In the study areas, 25% of the households owned donkeys in the project area while 34% owned them in the non-project area.

Table 4.7 indicates that a smaller percent of the respondents utilized donkeys in the project area. The probable explanation is that the project constructed access roads to villages for the evacuation of produce and also for the transportation of farm inputs. Therefore most of the farmers use the services of lorries or pick-ups for carrying farm inputs to their farms or farm produce to the markets. However, in the non-project area, due to inadequate access roads to the villages, most of the farmers use donkeys as their means of transport for their farm inputs. In the project area, 57.1% of the households (Table 4.8) indicated using lorries or pick-ups for transportation of inputs or farm produce to their houses or to the markets, while 32% of the households indicated using lorries or pick-ups for the same purpose in the non-project area.

The Table also shows that 18.5% of the households used donkey as a means of transporting either farm inputs or farm produce in the project area. In the non-project area 38% of the households utilized donkeys as a means of transporting their farm inputs or produce. Other means of transportation in the areas include bicycles and motorcycles. In the project area, 8.5% of the respondents utilized motorcycle

as a means of transport. Among the respondents in the non-project area, none used motorcycle for transporting farm inputs or produce.

Table 4.8 Various Types and Percent of Means of Transportation of Farm Produce and Inputs in the Areas.

| Means of Transport | GADP | NON-GADP |
|---|---|---|
| | Percent of Households | Percent of Households |
| Vehicle[1] | 57.1 | 32.0 |
| Motorcycle | 8.5 | - |
| Bicycle | 6.8 | 5.7 |
| Donkey | 18.5 | 38.0 |

1. Means of Transport by vehicle here includes lorries, pick-ups and tractor with trailers.

Apart from investment in mud grain stores (rumbu) and some huts for livestock, there is not much buildings connected with farming in the two areas. More than 90% of the respondents in both areas used mud grain stores (rumbu) for storage of farm produce such as millet, sorghum, cowpea etc.

Non-Durable Capital

Non-durable capital such as seeds, fertilizer,

insecticides were used by the respondents in both the areas. Table 4.9 shows the number and proportions of households who purchased farm inputs. About 62.8 percent of the households in the project area indicated use of fertilizer while 40.5 percent in the non-project area indicated use of the input. This shows that a higher percentage of the households in the project area used fertilizer for farming. This is expected since the project encourages farmers in the use of fertilizers and other farm inputs for farming. The two most commonly used fertilizers inputs in both areas are superphosphates and ammonium sulphate. These inputs were bought mostly in the farm service centres in the project area. Farmers in the non-project area purchased these inputs mostly from the ministry and sometimes from the market. When farmers were asked why they failed to use fertilizer, some of them indicated that they had no money to purchase them, others stated that the inputs were not available, while some indicated that they don't know how to use them.

The Table indicates that only one household or 2.0 percent used urea fertilizer in the project area while none used it in the non-project area. About 23 percent of the households used insecticides in

Table 4.9 Number and Proportions of Households who Purchased Inputs

| Input | GADP | | NON-GADP | |
|---|---|---|---|---|
| | No. | % | No. | % |
| Fertilizers | 23 | 64.8 | 14 | 40.0 |
| Insecticides | 8 | 22.9 | 4 | 11.4 |
| Improved Seeds | 2 | 5.7 | - | - |
| Manure | 5 | 14.3 | 11 | 31.4 |

the project area, while 11.4 percent used them in the non-project area. Much of the seed input used by the farmers in both the areas were stored from previous season's crops and explicitly it costs the households nothing. No improved seed input was used by the respondents in the non-project area, while only 5 percent of the farmers in the project area used improved seeds (mainly maize). More organic manure was used in the non-project area, accounting for 31.4 percent of the farmers. Only 5 of the respondents or 14.3% used this type of fertilizer on their farms in the project area. Generally, the Table indicates that more improved technology was utilized in the project area than in the non-project area.

The use of farm inputs especially fertilizer can be used as an indicator of "level of management and technology". As already shown, a higher percentage of this input was used in the project area.

## 4.6 Credit Situation on Farms

Credit is an important source of capital needed for farming. Credit is important in traditional farming since most of our small farmers have no money to purchase the various improved inputs necessary for farming. Improved inputs such as fertilizer, improved seeds, herbicides and pesticides are important in farming and their supplies depend on the availability of cash. In the two areas, credit supplied to the sampled farmers was meagre. Table 4.10 gives some information on households who use credit in the two areas.

A total of ₦2,160.00 was supplied to the respondents in the project area from various sources. This gives an average of ₦61.7 per household. In the non-project area, a loan of ₦1,888.00 was supplied to the respondents, giving an average of ₦53.9 per household. The credit was mostly supplied from cooperative societies, relatives, friends and money

Table 4.10 Statistics Concerning Credit in the Two Areas

| Variable Specification | GADP | | NON-GADP | |
|---|---|---|---|---|
| | Value (₦) | % | Value (₦) | % |
| Indebtedness of Farmers | | | | |
| Loan outstanding | nil | - | nil | - |
| Av. amount owed per farmer | 61.7 | 2.8 | 53.9 | 2.9 |
| Source of Credit | | | | |
| From cooperatives | 640.0 | 29.6 | 354.0 | 18.8 |
| From friends | 1,320.0 | 61.1 | 654.0 | 34.6 |
| From money lenders | - | - | 300.0 | 15.8 |
| From relatives | 200.0 | 9.3 | 580.0 | 30.7 |
| Rate of Interest | | | | |
| On cooperatives | - | 10.0 | - | 10.0 |
| On friends | - | 4.5 | - | - |
| On money lenders | - | - | | 15.8 |

lenders. The highest amount of loan was supplied by friends in the project and non-project areas. Other important sources of loans, as indicated in Table 4.10 are cooperatives and relatives. These two together account for 29.6 and 30.7 percent of the total amount of loan in the project and non-project areas respectively. Among the respondents who received loans, none had outstanding loan.

The rate of interest charged by the various sources of loans is indicated in Table 4.10. The Table shows that cooperative societies charged 10 percent as interest in both the project and non-project areas. Friends charged 4.5 percent as interest in the project area, while they charged nothing in the non-project area. A study undertaken by Vigo (1965), in four former provinces of the northern states indicated that the average farmer was deeply indebted to local traders (money lenders), who were found to charge high interest rate (49.0%) while only 2 percent was charged by the cooperatives. However in this study, the cooperatives charged up to 10 percent in both the areas, while money lenders charged 15.8 percent in the project area. Table 4.10 shows that the two main sources of credit in the project area are the cooperatives and friends. Together, they accounted for 90.7 percent of the total amount of loan received by the respondents. In the non-project

area, the two main sources of credit are from friends and relatives. These two sources of credit accounted for 65.3 percent of the total loan obtained by the respondents.

## 4.7 Size of Household and Organisation

Table 4.11 gives the size of family in the project and non-project areas. The average size of family in the project and non-project areas are 8.0 and 7.0 respectively. There is a tendency for family size to increase from the non-project area. When one considers the size of the family by class for the two areas, the average size of male adult and children are almost the same i.e. about 2.0 and 3.0 respectively.

The average size of about seven to eight individual in the project and non-project areas compares favourably well with Norman's (1979) study of Bauchi, Sokoto and Zaria areas, where he found an average family size of about seven individuals. In the study, he divided families into two types of units: a simple or iyali family unit, which consists of one married man with his wives and dependent children and a composite or gandu, which is composed of two or more male adults, usually married, together with their wives and children.

Table 4.11 Size of Household in the Two Areas

| Variable Specification by Class[1] | GADP | NON-GADP |
|---|---|---|
| Male adult | 2.05 | 2.00 |
| Female adult | 2.82 | 2.08 |
| Child | 3.14 | 3.17 |
| Total household average | 8.0 | 7.20 |

1. Male adult = 15 years or above
   Female adult = 15 years or above
   Child = 14 years or less

Generally, the simple family units were found to be more common than the composite families. In the two areas, about 28 and 42 percent of the farming families were organised under the gandu system in the project and non-project areas respectively. Norman's study of Bauchi, Sokoto and Zaria areas indicated that 38 percent of the families were organised under this system of family unit.

## 4.8 Labour Utilization

There is a wide variation in the relative importance of men, women and children in various activities in farming. The labour input in man-hours per cultivated hectare and their percentage contribution by class of

labour i.e by men, women, children, hired and communal in the two areas is shown in Table 4.12. Also, the percent of family and non-family labour input is depicted in the same Table.

The total family labour input in man-hours per hectare in the project and non-project areas was found to be 330.9 and 366.2 respectively. This took into account the time the farmers actually worked on their farms. That is, it did not take into account the time farmers took in travelling to and from their farms. This shows that 60.0 and 77.4 percent of the total labour input originated from family sources in the project and non-project areas respectively. There is a tendency for family labour input to increase from the project to the non-project area. In both areas, less than 3.0 percent of the total family labour input was contributed by women. Norman et al (1979), in their study, found that less than 2.0 percent of the total family labour input was contributed by women. The lack of participation by the women in the work force is due to the Moslem practice of secluding the women (Smith, 1955). Children contributed almost the same percent of the total family labour input on the family farm i.e 13.0 and 12.0 percent for the project and non-project areas respectively. The bulk of

Table 4.12 Labour Input (man-hours) Per Hectare and Percent Contribution by Different Labour Types

| Type and Class of Labour | GADP | | NON-GADP | |
|---|---|---|---|---|
| | Man-hours Per Hectare | % | Man-hours Per Hectare | % |
| Family | | | | |
| Male adult | 247.6 | 44.9 | 300.5 | 63.5 |
| Female adult | 11.6 | 2.1 | 8.9 | 1.9 |
| Child | 71.7 | 13.0 | 56.8 | 12.0 |
| Total family | 330.9 | 60.0 | 366.2 | 77.4 |
| Non-Family | | | | |
| Hired | 115.9 | 21.0 | 85.1 | 18.0 |
| Communal | 104.9 | 19.0 | 21.7 | 4.6 |
| Total non-family | 220.8 | 40.0 | 106.9 | 22.6 |
| Grand total | 551.8 | | 473.1 | |

the labour input from the family farm was contributed by the male adults in both areas, i.e 44.9 and 63.5 percent in the project and non-project areas respectively.

The total non-family labour input in the project and non-project areas was found to be 220.8 and 106.9 man-hours per hectare respectively. This accounted for 40.0 and 22.6 percent respectively (Table 4.12). This indicates that more non-family labour was utilized in the project area than in the non-project area.

In the study areas, three types of non-family labour was used. This consists of hired labour (kwadago, jinga and gayya). Kwadago is hired labour input by the hour and jinga which is hired labour paid by the job. Gayya is communal labour. Payment for these types of labour was either in cash or kind. Hired labour input contributed 21.0 percent in the project area and 18.0 percent in the non-project area. Norman et al (1979), in their study reported hired labour contributing 16.0 percent of the total labour input on the family farm.

In the study areas, all work was expressed in man-hours. The observed daily wage rate in the study areas ranges from ₦2.0 to ₦4.0, giving an average of ₦2.50 per day. An average of five hours work per day

was used in this study. This gives an average of 50k per hour.

## 4.9 Educational Level of Farmers

Education is an important factor in farming and it contributes significantly to managerial performance. Management here means the organisation and co-ordination of other factors of production such as land, labour and capital. Management in traditional agriculture is vested in the household heads. There has been little success by researchers in obtaining quantitative estimates of an input such as management which is essentially qualitative. As a result the investigator has to use his own subjective value judgement.

In this study, most of the respondents in both the areas had no formal education. Very few had koranic teaching. Only three out of the respondents in the project area had elementary school while none of the respondents in the non-project area had any elementary schooling.

## 4.10 Non-Farm Income

Farming is the main type of occupation in the two areas. Apart from farming, some of the respondents engaged in other non-farm activities such as trading,

building, craft, carpentry, tailoring, and other services. The total and percentage of non-farm income is shown in Table 4.13. These sources of income are important in that they supplement the incomes derived from farming. An average income of ₦243.6 was derived by all the respondents in the project area, as against an average income of ₦333.0 derived from the respondents in the non-project area.

Table 4.13 Percent of Non-Farm Income by Type of Occupation in the Study Area

| Occupation | GADP | | NON-GADP | |
|---|---|---|---|---|
| | Income(₦) | % | Income(₦) | % |
| Trading | 600.0 | 7.0 | 7460.0 | 64.0 |
| Building | 4002.0 | 46.9 | 820.0 | 7.0 |
| Craft | 280.0 | 3.4 | 510.0 | 4.4 |
| Carpentry | - | - | 1000.0 | 8.6 |
| Tailoring | - | - | 1500.0 | 12.6 |
| Others[1] | 3645.0 | 42.7 | 366.0 | 3.1 |

1. Others here include koranic teaching, government work and hunting.

These figures generally show that more respondents in the non-project area are engaged in non-farm occupations as compared to the respondents in the project area. In

the project area, building and services are the two major occupations apart from farming, accounting for over 89 percent of the total non-farm income. Trading and tailoring are the two main occupations in the non-project area, accounting for over 76 percent of the total non-farm income.

# CHAPTER V

# COST RETURN AND PRODUCTION FUNCTION ANALYSES

## 5.1 Cost-Return Analysis

The profitability of farm business can be deduced from the relationship between the costs incurred in running the farm and the returns accruing from it. If the returns are higher than the costs, there is a surplus that could be put to economic use. This section discusses the overall picture of cost-return relationship of the selected farm samples in the two study areas. This type of relationship helps in determining the profitability position of farm business organisation. Due to differences in average size of holdings between the project and non-project farms, perhaps a more meaningful analysis of costs and returns is to standardize resource use in terms of per unit of land area over which these resources are applied. First, the variable costs are considered since in the short-run, they are more sensitive to changes induced in agricultural practices.

### 5.1.1 Variable Costs

These are costs incurred during the production

period of the various crops. These included labour input costs; costs of fertilizer; seeds; tractor hire costs; bullock hire and its imputed costs. These various costs incurred in each of the study areas would be discussed one by one.

Labour (Input) Costs: This consisted of family and hired labour input in man-hours. The average wage rate was put at ₦0.5 per man-hour, which is equal to ₦2.50 per day. For the family labour input, the evaluation was carried out using the opportunity cost principle. It was assumed that the cost of family labour was equal to the average wage rate paid to the hired labourer working on the farm. Table 5.1 shows the average costs and returns of producing crops in the two study areas. The average cost of family labour input per hectare in the project area was found to be ₦165.4 while in the non-project area, it was found to be ₦181.1. When compared, the cost of family labour input per hectare in the non-project area exceeds that of the project area. This indicates that more family labour input was employed in the non-project area than in the project area. The average cost of hired labour input per hectare was found to be ₦52.1 and ₦11.3 for the project and non-project areas, respectively. This also implies that more hired labour

Table 5.1 Costs and Returns of Crops Per Hectare for the Study Areas

| Variable Specification | GADP | NON-GADP |
|---|---|---|
| INPUT | | |
| Variable Costs (₦) | | |
| Labour: | | |
| a) Family | 165.4 (65.2) | 183.1 (84.3) |
| b) Hired | 52.1 (20.6) | 11.3 ( 5.3) |
| Fertilizer | 4.5 ( 1.8) | 3.0 ( 1.3) |
| Seeds | 2.6 ( 1.0) | 3.5 ( 1.6) |
| Tractor Hire | 5.0 ( 2.0) | 3.0 ( 1.3) |
| Bullock | 10.5 ( 4.1) | 5.0 ( 2.3) |
| Sub-Total | 240.1 (94.9) | 208.9 (96.2) |
| Fixed Costs | | |
| Depreciation of equipments | 12.9 ( 5.1) | 8.2 ( 3.8) |
| Total Costs | 253.1 (100 ) | 217.1 (100 ) |
| OUTPUT | | |
| Average Yield (kg/hect.) | 904.0 | 723.0 |
| RETURNS (₦) | | |
| Gross returns per hec(₦) | 395.5 | 314.9 |
| Net returns/man-hour (₦) | 0.26 | 0.2 |
| Net returns (to land and management) | 142.4 | 97.9 |

Note: Figures in brackets denote percentage of total cost.

was utilized for crop production in the project area than in the non-project area.

Fertilizer Cost: Expenditure on fertilizer (organic and inorganic) is shown in Table 5.1. For organic fertilizer (manure) produced by livestock such as cattle, a value was placed, though in many cases it was given free of charge. An opportunity cost of ₦1.0 per bag of manure used on the farm was used. Table 5.1 indicates that the average cost of fertilizer per hectare accounted for ₦4.5 and ₦3.0 for the project and non-project areas respectively. It is expected that the average cost of fertilizer per hectare would be higher in the project area, considering the fact that more fertilizer input was used in the area. In the non-project area, less of fertilizer was used, probably because of its unavailability and the relatively higher price. In the project area, fertilizers such as superphosphates, ammonium sulphate are sold at the farm service centres which are found all over the project area.

Seed Cost: The cost of improved seeds especially maize, was computed using the prices given by the project. Much of the local seeds used in both areas was supplied

from the crop harvested by the household in the previous year. The local seeds were valued at the average market price prevailing for each type during the survey year. Imputed cost of cotton seed was not calculated during the analysis, since these are usually distributed free of charge to farmers. Table 5.1 indicates that the average cost of seeds per hectare was ₦2.6 and ₦3.5 in the project and non-project areas respectively. The results indicate that more seeds were used in the non-project area per hectare when compared to the project area. The higher amount of seeds used in the non-project could be attributed to two reasons. First, more local seeds were used in the non-project area and this resulted in low germination because the seeds were more prone to pest attack when planted and this necessitated replanting. Secondly, the poor quality of the local seeds and the method of planting also resulted in low germination percentage and therefore the need to replant.

Tractor Cost: The cost of hiring tractors for cultivation is depicted in Table 5.1. The Table shows that an average of ₦5.0 per hectare was used for cultivation of farms by tractor hire in the project area, while ₦3.0 per hectare was spent for cultivation in the non-project area. This indicates that more tractor services was

used in the project area than in the non-project area. This is expected because the project operates "Tractor Hire Service" to farmers at subsidized rates.

Bullock Cost: The cost of hiring work-bulls especially for ridging is shown in Table 5.1. Imputed cost was used for those farmers who own bullocks. The area cultivated was valued at the price prevailing during the survey year. The Table shows that an average of ₦10.5 and ₦5.0 per hectare was spent in the project and non-project area respectively for cultivation of farms. The results indicate that more bullock services was used in the project area than in the non-project area. This was due to the fact that more farmers own work-bulls in the project area and also the availability of work-bulls for hire, because the project gave out loans to farmers for the purchase of work-bulls and ox-drawn equipments.

### 5.1.2 Fixed Costs

Table 5.1 shows fixed cost per hectare on the sample farms. Depreciation of fixed assets such as hoes, cutlasses and ploughs have been examined. Land charges have not been taken into account. This is because out of the sample farmers, only one farmer

paid out about ₦20.0 for the use of a field for farming in the project area. Most of the farmers paid nothing for the use of their farms for farming. The Table also shows that the average cost of fixed capital in the project and non-project accounted for ₦12.9 and ₦8.2 respectively. The higher fixed cost incurred in the project area was attributed to larger investment in equipments such as ox-ploughs. In percentages, these represent 5.1 and 3.8 respectively. The total variable costs of production in the project and non-project areas amounted to ₦240.1 and ₦208.9 or 94.9 and 96.2 percent respectively. This implies that variable costs are significant in the production of crops in both the project and non-project areas. Hence any measure to reduce cost would be focussed on reducing the cost of the variable inputs especially labour. The low contribution of fixed cost especially in the non-project area is an indication of low investment in production in traditional agriculture. Norman et al (1979), in their study of Bauchi, Sokoto and Zaria areas reported that the average value of investment in hand tools and equipment was ₦8.29. This investment covered only the crop production component of the farming system i.e excluding livestock. The percentage contribution of labour, fertilizer and seeds to total production cost

accounted for 85.8; 1.8 and 1.0 respectively in the project area, while in the non-project area, they accounted for 89.6; 1.3 and 1.6 percent respectively.

### 5.1.3 Total Cost of Production

The total cost of production per hectare is estimated by adding total variable costs and total fixed cost. The variable costs consists of labour; cost of fertilizer, seeds; cost of tractor hire and bullock cost. The fixed costs consist of depreciation allowance of tools and equipments such as hoes, ox-ploughs, cutlasses etc. The total cost of production were found to be ₦253.1 and ₦217.1 in the project and non-project areas respectively. This indicates a higher cost of production in the project area than in the non-project area. The higher cost of production in the project area could be attributed to the adoption of the improved technology.

### 5.1.4 Farm Income

The level of farm income is a measure of the profitability of farm business and reflects the efficiency with which farm resources or services are utilized. Farm income can be measured as gross farm revenue, farm family income, returns to family labour and management,

and returns to family owned capital. Of these, the farm family income (Net farm income), which is return above paid-out costs and represents returns to owned land, family labour, management and capital, is perhaps the most widely used.

Gross Returns: The gross returns obtained by the sample farmers in this study were derived by multiplying the total quantity of produce harvested by the average market price prevailing at the period of the survey. The gross return per hectare in the study areas is shown in Table 5.1. The Table indicates that the gross returns in the project and non-project areas were ₦395.5 and ₦314.9 respectively. This shows about 25 percent increase in gross return per hectare in the project area. This could be attributed to the use of improved inputs for farming.

Net Returns: The net return per hectare represents the difference between the total value of all output per hectare (gross returns) and the total cost per hectare in crop production on the farms. This also represents the net farm income for crop production. Table 5.1 indicates a net return of ₦142.4 and ₦97.9 in the project and non-project areas respectively. The results indicate that the imputed cost of family

labour contributed substantially to the total cost of production in both the project and non-project areas, accounting for 65.2 and 84.3 percent respectively.

Labour Productivity: This gives an idea of productivity per unit of labour input in man-hours, including all types of labour i.e. family and hired labour. This has been calculated by dividing net income per hectare by the total labour input (man-hours) per hectare. Table 5.1 shows that the net return per man-hour in the project and non-project areas are 0.26 and 0.2 respectively. The results indicate a slightly higher labour productivity in the project area. Labour helps in the production process on land only in conjuction with other variable inputs.

### 5.1.5 Variation of Gross Revenue and Total Cost by Farm Size Category

Table 5.2 shows the gross revenue, costs and net return per hectare by farm size category in the study areas. In the project area there was a steady rise in the gross revenue per hectare as one moved from the smaller to the larger farm size category. Generally, cost per hectare in the project area has been found to decrease from the smaller farm size to the larger farm size category. The net return per hectare tends to rise steadily from the smaller to the larger farm size

category in the project area. In the project area, the highest gross returns per hectare occurred in the 5.1 - 6.0 farm size category, while the lowest occurred in the 0.0 - 1.0 farm size category. The lowest cost per hectare also occurred in the 5.1 - 6.0 farm size category, while the highest cost per hectare occurred in the 1.1 - 2.0 farm size category in the project area. The highest net return was recorded in the 5.1 - 6.0 farm size category, amounting to ₦251.8, while the lowest, amounting to ₦53.6, was recorded in the 0.0 - 1.0 farm size category. Generally the same trend was found to exist in the non-project area. Gross revenue and net revenue were found to rise steadily as one moved from the smaller farm size category to the larger category. However cost per hectare was found to decrease from the smaller to the larger farm size category. The highest gross revenue and net revenue were found to be ₦415.8 and ₦204.9 respectively in the non-project area. The overall output (gross revenue) - cost ratios for the project and the non-project areas are also shown in Table 5.2. The Table shows the ratios to be 1.6 and 1.4 for the project and non-project areas respectively.

## Factors Affecting Costs

This section examines the factors affecting costs of producing various crops within the project and

Table 5.2 Gross Revenue, Cost and Net Returns Per Hectare by Farm Size Category(₹)

| Size Group | GADP | | | NON-GADP | | |
|---|---|---|---|---|---|---|
| | GR | TC | NR | GR | TC | NR |
| 0.0 - 1.0 | 300.6 | 247.0 | 53.6 | 266.2 | 232.0 | 34.2 |
| 1.1 - 2.0 | 347.5 | 280.0 | 67.5 | 277.5 | 226.5 | 51.0 |
| 2.1 - 3.0 | 352.8 | 279.5 | 73.3 | 285.0 | 212.8 | 72.5 |
| 3.1 - 4.0 | 389.5 | 268.0 | 121.5 | 316.3 | 212.6 | 103.7 |
| 4.1 - 5.0 | 404.1 | 254.8 | 149.3 | 328.6 | 209.8 | 118.8 |
| 5.1 - 6.0 | 467.8 | 216.0 | 251.8 | - | - | - |
| 6.1 - 7.0 | 454.5 | 238.0 | 216.5 | - | - | - |
| 7.1 - over | 447.8 | 248.9 | 198.9 | 415.8 | 210.9 | 204.9 |
| output (GR)/ cost ratio | | 1.6 | | | 1.4 | |

Note: GR = Gross revenue TC = Total Cost

NR = Net revenue.

non-project areas with a view to suggest measures for reducing cost and thereby increase returns.

Looking at the profile of total cost of production per hectare (Table 5.1) for the various crops in the project and non-project areas, one sees that there are disparities in the costs of production between the two study areas. The average cost of production per hectare varies from ₦253.1 in the project to ₦217.1 in the non-project areas.

Table 5.2 shows the total cost of production per hectare for the different farm size categories for the two study areas. In the project area cost of production varies from ₦216.0 to ₦280.0. In the non-project area it varies from ₦209.8 to ₦232.0. These margin of differences in cost of production suggest that costs could be reduced. Table 5.1 gives the picture of the relative contribution of the various items of costs. In the project and non-project areas, the largest share of total cost was taken by labour, accounting for 85.8 and 89.6 percent of the total cost of production in the project and non-project areas respectively. These figures compare favourably well with Spencer's (1972), findings; that in traditional agriculture, labour is the most important input, usually accounting

for over 75 percent of the cost of production. Osifo (1976), made a similar observation in his study of the rice industry in the former western state of Nigeria. Since labour is the dominating cost item, some economy in its use will obviously reduce costs. Table 5.3 shows labour distribution by type of operation. The Table indicates that weeding accounts for the highest in terms of labour requirements.

Table 5.3 Labour Input in Man-Hours Per Hectare by Type of Operation

| Operation | GADP | | NON-GADP | |
|---|---|---|---|---|
| | Average Man-hour/ Hectare | % | Average Man-hour/ Hectare | % |
| Land preparation | 17.1 | 3.1 | 13.3 | 2.8 |
| Planting | 27.0 | 4.9 | 24.1 | 5.1 |
| Fertilizer application | 2.2 | 0.4 | 1.2 | 0.25 |
| Weeding | 333.9 | 60.5 | 302.2 | 63.8 |
| Harvesting | 171.6 | 31.1 | 132.5 | 28.0 |
| All operations | 551.8 | | 473.3 | |

An average of 333.9 and 302.2 man-hours per hectare was spent in weeding in the project and non-project areas respectively. The second highest in terms of

labour requirement, as shown in the Table, is harvesting, which accounted for 31.1 and 28.0 percent in the project and non-project areas respectively. Fertilizer application accounted for the least in terms of labour requirements. This was because less of this input was used in the two areas, especially in the non-project area. The Table shows that 0.4 and 0.25 percent of the total labour input in the project and non-project areas is used in fertilizer application. The percentage labour utilization on the other operations such as land preparation and planting are shown in the same Table (Table 5.3). The Table indicates that weeding and harvesting constitute the two main types of operations that require the highest proportion of labour. Over 91.0 percent of the total labour input in both the project and non-project areas was utilized on these two operations, the rest on the other types of operations.

The contribution of other inputs other than labour such as fertilizers, seeds etc. to the total production cost is, as expected, rather small. For fertilizer, the cost per hectare accounted for only ₦4.5 and ₦3.0 in the project and non-project areas respectively. Some caution has to be exercised in interpreting the cost figures. The cost figures are not always a good indication of the actual physical

amount of inputs applied to land or to the farm. Given the imperfections in the factor market, some farmers would pay more or less than others for the same physical amount of inputs. Secondly, there is the problem of imputing cost of family labour. Workers in the family usually do not work according to time schedule or job description and frequently combine their work with other non-farm activities. However in the study areas, as earlier explained, effort was made to determine work done by family labour in man-hours and the imputed or opportunity cost was calculated using the average wage rate of hired labour prevailing at the time of the survey.

## 5.2 Production Function Analaysis

The productivity of the individual factors of production presented in earlier chapters are crude estimates or indicators of agricultural productivity. They really do not tell us the contribution to the output of individual resources in a situation where more than one resource interact together. Marginal analysis based on production functions would be much better. The analysis of the production function is used to arrive at some judgement about the efficiency of the prevalent factors of production. An empirical

production function enables us to do so because the marginal product of each input estimated from the function can be compared with its acquisition price. Also the estimation of elasticity of production, returns to scale are also possible from production function analysis. All these give some basis for economic decision making.

The purpose of this section is therefore to determine the extent to which the important factors explain the variability of the output. The greater the extent to which these factors are able to explain the variability of the dependent variable, the larger the influence of the independent variables taken together, have on the dependent variable. If the marginal value of product is lower than its marginal cost, it is apparent that there is over-use of that input and its employment should be curtailed. On the other hand a higher marginal value of product than its marginal cost, means that its employment should be augmented in the production process.

### 5.2.1 Cobb-Douglas Production Function

In this study, the Cobb-Douglas function was used in the analysis. The function is specified as follows:

$$Y = b_o X_1^{b_1} X_2^{b_2} X_3^{b_3} X_4^{b_4} + u$$

The non-linear form can be transformed into linear form as follows:

$$\text{Log } Y = \log bo + b_1 \log X_1 + b_2 \log X_2 + b_3 \log X_3 + b_4 \log X_4 + \log u$$

Y = value of crop output in Naira

$X_1$ = area of cultivated land in hectares

$X_2$ = family labour in man-hours

$X_3$ = hired labour in man-hours

$X_4$ = non-durable capital (Naira)

u = error term.

The values of the constant $b_o$ and of the coefficients ($b_1$) in respect of the independent variables in the function have been estimated by using the least squares method. The regression statistics for the Cobb-Douglas is shown in Table 5.4.

The coefficient of multiple determination, $R^2$, indicates the percentage of the variation in the n observed Y values that is explained by the fitted regression equation. The values of $R^2$ are 0.92 and 0.91 in the project and non-project areas respectively. This implies that in the fitted equations, the independent

Table 5.4 Regression Statistics for Cobb-Douglas Function in the Study Areas

| Area | Constant | Regression Coefficients | | | | $R^2$ | F-values |
|---|---|---|---|---|---|---|---|
| | | $X_1$ | $X_2$ | $X_3$ | $X_4$ | | |
| Project | 2.26 | 0.81 (11.41)$^{xxx}$ | 0.03 (1.39) | 0.03 (0.98) | 0.11 (2.1)$^{xx}$ | 0.92 | 86.6 |
| Non-Project | 0.3 | 0.02 ( .21) | 0.54 (4.0)$^{xxx}$ | 0.21 (2.46)$^{xx}$ | 0.3 (5.1) | 0.91 | 84.4 |

Figures in parenthesis represent the t-values.

xxx - Significant at 1% level

xx - Significant at 5% level

variables explained, on the average, 92 and 91 percent of the variation in the output of the various crops in the project and non-project areas respectively. The unexplained part of variability in the output of crops is obviously due to other inputs which have not been specified in the model. One such input may be managerial which is unquantifiable. The F-values of 86.6 and 84.4 in the project and non-project areas respectively are significant at 1.0 percent, which indicates that the independent variables included in the model were important in explaining the variation in the dependent variable.

The regression coefficients or elasticities of production are shown in Table 5.4 for the individual inputs. The t-values have been derived and tested for significance. In the project area, the regression coefficients for land and non-durable capital are signifcant at 1 and 5% levels respectively, while family labour is not significant. Hired labour is also not significant at 5% level. In the non-project area family labour and hired labour are significant at 1% and 5% respectively. However, land is not significant.

The regression coefficients '$b_i$) measure the elasticity of production with respect to each individual variable input. The coefficients of all the inputs are positive (Table 5.4). This implies that a one percent change in any one of the input variable, while holding others constant, would result in a percentage change in the quantify of output equal to the coefficient of the variable in the same direction as the change of the input. The elasticity of production (regression coefficient) with respect to the various inputs indicates that land and fertilizer were the important inputs to which output was responsive in the project area. The elasticity of land input is 0.81, which means that 1 percent increase in this input results in 0.81 percent in gross agricultural output. The non-durable capital has elasticity of 0.11. In the non-project area, judging from the significance of the regression coefficients, all the inputs except land were important in explaining the variation in output. The elasticity of production with respect to family labour was found to be 0.54, which implies that a 1% increase in this input would result in a 0.54% increase in the output of crops in the area. Non-durable capital and hired labour have coefficients of 0.30 and 0.21 respectively. In the project area, the sum of elasticities

of individual factors is equal to 0.98, while in the non-project area, the sum of elasticities is equal to 1.0. The results therefore indicate constant return to scale.

5.2.2 Marginal Productivities

From the estimated elasticities of production, one can obtain a set of estimated marginal productivities. In Cobb-Douglas production function, the marginal productivity of a factor, $X_i$, in producing crops is given by the formula:

$$MVP = \frac{dY}{dX_i} = b_1 \frac{\bar{Y}}{\bar{X}_i}$$

where

MVP = marginal value of product

$b_i$ = the elasticity of the corresponding factor

$\bar{Y}$ = the value of log Y when it assumes its arithmetic means

$\bar{X}_i$ = the value of log $X_i$ when they assume their arithmetic means.

Heady et al (1964) has reported that the most reliable and perhaps the most useful estimate of marginal

productivity is obtained by taking $X_i$ at its geometric mean. Also Y should be the estimated level of output when each input is held at its geometric mean.

Table 5.5 shows the marginal value productivities estimate from the Cobb-Douglas production function.

Table 5.5 MVP of Land, Family Labour, Hired Labour and Non-Durable Capital for the Study Areas.

| Variable | GADP | NON-GADP |
|---|---|---|
| | MVP | MVP |
| $X_1$ | 5.63 | 0.25 |
| $X_2$ | 0.02 | 0.52 |
| $X_3$ | 0.04 | 0.25 |
| $X_4$ | 0.26 | 0.52 |

The marginal value productivity of resources differ greatly among the two areas. The differences in resource productivity between the two areas would be attributed to the inputs used; the value of crops and the soil types. With the inputs and output at their geometric means, the marginal value of product of land is the highest, amounting to 5.63 in the project area. In the non-project area, family labour and non-durable capital have the highest marginal value productivities, amounting to 0.52 for both factors.

### 5.2.3 Economics of Resource Allocation

The estimated production function underlying crop production enables us to evaluate the efficiency of the factors of production in agriculture. Masell et al (1970), in their study of "Economics of Small Holder Farming in Rhodesia" defined allocative efficiency as the efficiency with which inputs are combined or used. Given the prices of both inputs and output, the marginal value productivity is the yardstick for judging the efficiency of resource use. A given resource is optimally allocated if its marginal value product is just sufficient to offset its cost. Equality of MVP to factor cost is therefore, the basic condition that must be satisfied to obtain efficient use of resource.

The marginal value productivity of land cannot be compared with the acquisition value because the farmers did not buy land for farming in the study area. In fact only one farmer in the project area rented land for farming. Thus, the marginal value productivity of land is useful only to the extent that it provides an estimate of the potential rental values of land, Ogunfowora (1975). For example, if the marginal value productivity of land is higher than the

rental value, this means that more land should be brought under cultivation so as to add more to income.

The marginal value productivities of family labour are positive in the two areas indicating that output could be increased by using more of this resource. However, when the marginal value productivity (MVP) is compared with its acquisition cost, the result indicates that this input was over utilized in the project area, and therefore its employment should be curtailed. The result also tend to support the common assumption of low productivity of labour in traditional agriculture. The marginal productivity of family labour was 0.02 and the unit price was ₦0.50 per hour (Table 5.5). Ogunfowora et al (1975), in their study of resource productivity in traditional agriculture in Kwara State, found the MVPs of family labour to be negative in three villages, but positive only in one village. In all these villages, the MVPs of labour were found to be lower than their respective average acquisition prices, indicating low productivity of labour in traditional agriculture. In the non-project area, the marginal value of product of family labour was found to be 0.52. A comparison with its acquisition price indicates that it is almost the same as the unit price. The unit price or opportunity cost of family

labour was ₦0.50 per hour. The result indicates that in the non-project area, this resource was used efficiently in the production process. Table 5.6 shows the marginal values of product of inputs and their unit prices for the project and non-project areas.

Table 5.6 Estimated Marginal Value Productivities of Land, Family Labour, Hired Labour and Non-Durable Capital and their Unit Prices in the Project and Non-Project Areas.

| Variable | GADP | NON-GADP | UNIT PRICES |
|---|---|---|---|
| | MVP | MVP | ₦ |
| $X_1$ | 5.63 | 0.25 | n.a. |
| $X_2$ | 0.02 | 0.52 | 0.5 |
| $X_3$ | 0.04 | 0.25 | 0.5 |
| $X_4$ | 0.26 | 0.52 | 0.036 |

n.a = not available.

The marginal value of product for hired labour in the project area was found to be 0.02. When compared to the unit price of ₦0.5, it was found to be lower. This indicates excessive use of hired labour. Thus the use of this input should be curtailed. In the non-project area, the MVP of hired labour was found to be ₦0.25. When compared to the acquisition price, the result indicates excessive use of this input.

This also suggests that probably, the cost of hired labour tends to be high in the study areas.

The marginal value of product of non-durable capital in the project and non-project areas were found to be ₦0.26 and ₦0.52 respectively. When these MVPs are compared with the unit price of ₦0.036, the result shows that this input could be employed in the production process in both the project and non-project areas, since the MVPs are more than the unit price. This indicates that this input was underutilized, since more of it could be employed in the production process.

### 5.2.4 Returns to Scale

Ordinarily, in Cobb-Douglas production function, the regression coefficients equal the elasticities of production of the respective inputs and their sum indicates return to scale. In the function considered here, the regression coefficients for land, family labour, hired labour and non-durable capital are equal to the production elasticities with respect to these inputs. With decreasing, constant or increasing returns to scale, the sum of elasticities of production has to be less than, equal to or greater than unity respectively. Table 5.7 gives the sum of regression coefficient in the two study areas.

Table 5.7 Sum of Coefficients and Return to Scale

| Area | Sum of Regression Coefficients | Returns to Scale |
|---|---|---|
| GADP | 0.98 | Decreasing |
| NON-GADP | 1.0 | Constant |

The Table indicates that the project and non-project areas exhibit decreasing and constant returns to scale respectively. The economic implication of constant return to scale relationship is that if all the inputs included in the model were increased by one percent, then the output would increase by the same percentage.

# CHAPTER VI

## SUMMARY AND CONCLUSION

### 6.1 Summary

The present position of agricultural production and its performance in Nigeria cannot be said to be satisfactory. Agricultural output is inadequate and the producer incomes and resource productivities are relatively low. These problems seem to have handicapped the agricultural sector from contributing significantly to the general economic development.

The Federal and state governments of Nigeria have formulated development strategies designed to raise the productivity of resources already committed to farming. In order to improve the conditions in agricultural sector and enhance its capacity to perform the roles expected of it, the governments of Nigeria have embarked on a series of programmes in the 'Third National Development Plan', 1975-80, aimed at raising the level of agricultural production technology on the small farms. A major component of this technology improvement have been the introduction of modern inputs such as chemical fertilizer, improved seed varieties, pesticides and improved cultural practices.

The establishment of the Agricultural Development Projects (ADPs), was one of the major strategies which the government took to enhance agricultural production in the country. The Gombe Agricultural Development Project (GADP) was one of such projects.

The purpose of this study was to evaluate the impact of the Gombe Agricultural Development Project with regards to the resource use and productivity on farms at the farmers' level. For the purpose of the study, four villages were selected, two within the project area and two outside the project area. The data collected from a total of 70 farmers, 35 farmers within the project and 35 farmers outside the project, provided the base for the analysis carried out in the study.

Farm Structure

The land tenure in the two areas indicates a greater extent of inherited land in the non-project area as compared to the project area. In the project area only 2.8 percent of the farmers cultivated purchased land while none of the farmers in the non-project area bought land for farming. In the project and non-project areas, 25.5 and 2.8 percent of the

farmers cultivated lease land respectively. The overall average farm size in hectares in respect to the project and non-project areas was 3.8 and 3.2 respectively. Farms tend to be smaller in the non-project area as compared to the project area. The cropping pattern in the non-project area indicates that more food crops were grown as compared to the project areas. In the project area more cash crops were grown as compared to the non-project area. The probable reason could be that the project encouraged the cultivation of cash crops such as cotton more than food crop production.

The investment pattern took into account implements, draft cattle and other durable assets. The implements consist mostly hoes, cutlasses and ox-ploughs. Investment in ox-plough and work-bulls appears to be greater in the project area as compared to the non-project area. A total of thirty six draft cattle (work-bulls) were owned by farmers in the project area as compared to only twelve in the non-project area. There was not much investment in farm buildings apart from investment in mud grain stores. Investment in non-durable capital such as fertilizer, insecticides and improved seeds in the study areas indicates that more of these inputs were

used in the project area as compared to the non-project About 60 percent of the farmers used fertilizer for farming as compared to 40 percent in the non-project area. About 6 percent of the farmers used improved seeds in the project area while none of the farmers used them in the non-project areas.

The main source of credit in the project area was from friends and cooperatives. These two sources accounted for over 90 percent of the total amount of loan. In the non-project area, the main source of loan for farming was from friends and relatives. These two sources accounted for over 65 percent of the total amount of loan.

The average family size in the project area was found to be larger than in the non-project area. The overall average family size in the project and non-project area was found to be 8.0 and 7.0 respectively. The average family labour input in man-hours per hectare in the project and non-project areas was found to be 330.9 and 366.2 respectively. Much of the labour input originated from family sources in both the two areas. However more family labour input was utilized in the non-project area than in the project area. T

The total non-family labour per heactare

in the project and non-project areas was found to be 220.8 and 106.9 respectively. This indicates that more non-family labour input was utilized in the project area than in the non-project area.

Cost and Returns on Farms

The pattern of cost of production and returns in the project and non-project areas have been examined.

Labour cost consisted of both family and hired labour cost per hectare. The result indicated that more family labour input was utilized in the non-project area than in the project area. Hired labour cost was greater in the project area as compared to the non-project area. More quantities of fertilizer appear to be used in the project area than in the non-project area. The average cost of fertilizer per hectare incurred in the project and non-project areas were found to be ₦4.5 and ₦3.0 respectively. The total average cost of seeds tends to be greater in the non-project area than in the project area. However, the cost of improved seeds incurred in the project area is greater than in the non-project area. This could be attributed to the fact that the project distributed improved seeds such as maize, sorghum etc. to the farmers.

The overall picture regarding the use of bullock labour per hectare indicates that more bullock labour cost was incurred in the project area than in the non-project area. This was because the project gave out loans to farmers to purchase work-bulls and ox-plough equipment. The cost incurred in hiring tractor for cultivation in the project and non-project areas indicates that more tractor services was utilized in the project area. This is expected because the project was operating the "Tractor Hire Service" to farmers at subsidized cost.

The overall total average cost of production in the project area tends to be greater than in the non-project area. Average production costs in the project and non-project areas are ₦253.1 and ₦217.1 per hectare respectively. The adoption of improved technology such as fertilizer, improved seed, ox-plough equipment and bullock for farming contributed to the higher cost of production in the project area.

The gross return per hectare in the project area tends to be greater than in the non-project area. This may be attributed to the use of improved inputs in the project area as compared to the non-project area. The gross return per hectare in the project and non-project

area were found to be ₦395.5 and ₦314.9 respectively. This represents about 25 percent increase in gross returns per hectare in the project area. The net returns per hectare in the project area tends to be greater than in the non-project area. These two areas had net returns of ₦142.4 and ₦97.9 respectively. The higher net returns in the project area may be attributed to the use of improved inputs, cropping patterns and other features in farm organisation.

The average productivity of human labour per man-hour in the project area was slightly greater than in the non-project area. The results indicate an average of ₦0.3 and ₦0.2 per man-hour in the project and non-project areas respectively. The project has slightly contributed to a higher labour productivity.

Production Function Analysis

The Cobb-Douglas function was used in the analysis of the input-output data from the project and non-project areas. The results in both the project and non-project areas indicate that the independent variables selected, namely, farm size, family labour, hired labour and non-durable capital reasonably explain the variability in the total value of output earned from the farms.

Land turned out to be the factor with the highest elasticity (0.81) in the project area. In the non-project area, family labour has the highest elasticity of 0.54. In the project area family and hired labour have the lowest elasticities, while in the non-project area, land has the lowest elasticity.

The marginal value productivities of land, family labour, hired labour and non-durable capital were calculated for the project and non-project areas. The highest marginal value of productivity in the project area is land (5.63) and the least is family labour (0.02). In the non-project area, the highest marginal value of productivity is family labour and non-durable capital (0.52), while the least is land and hired labour (0.25).

The estimated marginal values of product in the study areas enable us to evaluate the efficiency with which inputs are used. A given resource is optimally allocated if its marginal value of product is just sufficient to offset its cost.

## 6.2 Conclusion

The study was designed to compare resource productivity on farms between the project and non-project

areas in Bauchi State. The emphasis was to determine the quantities of the production inputs used in crop production, as well as the costs and returns. With regards to the physical quantities and cost of inputs such as labour, fertilizer etc. by the sampled farmers, the following conclusions can be drawn from the study.

Fertilizer input is not being applied in adequate amounts in both areas, especially in the non-project area. This could be attributed to non-availability of fertilizer and the lack of money to purchase the input. Poor extension education on the type and quantities of fertilizer required especially in the non-project area might have contributed to lower productivity.

Labour input is the dominant element of crop production costs in both the project and non-project areas. The total labour cost accounted for over 85 and 89 percent of the total cost of production per hectare in the two areas respectively.

Weeding and harvesting are the two most labour consuming operations in crop production in the two areas. These two operations together accounted for over 90 percent of the total man-hours of labour required for crop production per hectare

## 6.3 Policy Implications

The results have indicated that some increases have been achieved in farm income, resource use and productivity through implementation of the project. Therefore, planning for agricultural development should continue to focus on the design and implementation of such programmes. Specifically, such programmes should aim at making farm inputs available at the right time.

One of the implication of the study is the need to educate the farmers on the type, quantity and time of fertilizer application. This will mean knowing the size of fields to be calculated and having specific fertilizer recommendation for each farm size and farm type (i.e upland and lowland). It is also important to look into ways of raising the level of fertilizer currently being used in the study areas, especially in the non-project area. Since fertilizer is the outstanding single contributor to raising production, its supply should be made available to the farmers at the right time. Improved inputs such as new varieties of seeds; seed dressing chemicals and pesticides should also be made available to the farmers. Ox-ploughs are important in the cultivation of crops.

These should therefore be made available to the farmers and at reasonable prices.

Because of the problem created by inadequate facilities to purchase inputs by individual farmers, the farmers could be encouraged to form cooperative societies, which will be responsible for input purchases. This may require an initial loan from the government or any financial agency.

## 6.4 Limitations of the Study

One important limitation of the study has been the reliance on one year's data. The variations in output, from year to year, particularly in agriculture, are very common. Apart from the vagaries of nature, the character of agriculture is determined by changing price structure which greatly influences production decisions on farms in the short-run. Thus the results of the study need to be complemented with the results in other areas and in different years in order to obtain a comprehensive picture that permits broad generalizations to be made concerning the impact of the project on farms at the farmers level.

Another limitation of the study had been lack of maintenance of records relating to input and output

by the farmers when the survey was carried out. Though every effort was made during the survey to get accurate information from the farmers, it should be remembered that there could be lapse of memory by the farmers in regard to details about operations and resource utilization.

The sample size (70) for the two areas was small due to inadequate funds, however such a sample allowed detailed interviews to the farmers.

Despite the limitations, the results of the study provide some useful insights into the impact of the project in the area.

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# APPENDIX A

## QUESTIONNAIRE ON ECONOMIC ANALYSIS OF RESOURCE USE AND PRODUCTIVITY ON FARMS IN BAUCHI STATE

A. DEMOGRAPHIC INFORMATION:

1. Name of farmer ----------
2. Age in years ----------
3. Local Government Area ----------
4. Village ----------
5. Literacy (Answer YES or NO):
   a) Read, write and speak in Hausa ---------
   b) Read, write and speak in English -------
   c) Read, write and speak in Fufulde -------
   d) Other (Specify) ----------
   e) Illiterate ----------
6. Schooling (Answer YES or NO):
   a) Primary ----------
   b) Post-Primary ----------
   c) Post-Secondary ----------
   d) No Primary at all----------
7. Religion (Answer YES or NO):
   a) Moslem ---------- b) Christian ------
   c) Other (Specify) ----------

8. Children in education:

| | No. | Male | Female |
|---|---|---|---|
| a) Primary | ---- | ------ | ------ |
| b) Post-Primary | ---- | ------ | ------ |
| c) Post-Secondary | ---- | ------ | ------- |
| d) University/Polytechnic | ---- | ------ | ------ |

9. Family Size:

a) Wives (No.) ----------

b) Male adults (over 15 years) (No.) -------

c) Female adults (Over 15 - years) (No.) ---

d) Children below (15 years) (No.) ---------

i) Males: ---------- ii) Females: -----

10. Non-Farm Occupation: What other activities do you engage yourself in the season? (make a tick)

a) Craftwork ☐

b) Trading ☐

c) Services ☐

d) Buildings (etc.) ☐

e) Government work ☐

f) Tailoring ☐

g) Commission Agents ☐

h) Other (Specify) ☐

B. LABOUR FORCE:

1. Household head working on the farm (YES or NO) ----

2. Household members working on the farm:

   a) Male adults over 15 years (No.) ---------

   b) Female adults over 15 years (No.) -------

   c) Large Child (7 - 15 years):

      1) Males ---------- ii) Females ------

3. Hired Labour:

   a) Male adult (No.) ----------

   b) Female adult (No.) ----------

   c) Large Child (7 - 15 years) No. ----------

   d) Cost of hired labour per:

      i) Day (₦) ----------

      ii) Ridge (₦) ----------

      iii) Length (₦) ----------

4. Non-Family Labour:

   a) Communal labour (Gayya) (YES or NO) -----

      i) Male adults --------

      ii) Female adults ------

      iii) Large Child --------

   b) Contract labour (Jinga) (YES or NO) ------

      i) Male adults --------

      ii) Female adults ------

      iii) Large Child --------

C. FARM INVENTORY:

1. Tools and Equipment:

| | Cost | Age | Salvage Value (₦) |
|---|---|---|---|
| a) Tractor YES/NO No-- | ---- | ---- | -------- |

WHAT ATTACHMENTS?

i) Disc Plough (No.) --- ---- ---- ----

ii) Harrow (No.) --- ---- ---- ----

iii) Ridger (No.) --- ---- ---- ----

iv) Other (Specify) (No.) --- ---- ---- ----

b) Traditional: (No.) --- ---- ---- ----

Hoe (No.) --- ---- ---- ----

Cutlass (No.) --- ---- ---- ----

Digger (No.) --- ---- ---- ----

Hand Plough (No.) ---- ---- ---- ----

Sickle (No.) --- ---- ---- ----

Basket (No.) --- ---- ---- ----

Other (No.) --- ---- ---- ----

c) Ox-drawn equipment: --- ---- ---- ----

d) Sprayers (No.) --- ---- ---- ----

e) Maize Sheller (No.) --- ---- ---- ----

OPERATION WITH EQUIPMENT/ANIMAL

i) Did you use animal for your farming activities? YES or NO:_____

ii) If YES, for what activities and with what equipment/animal?

iii) Activity ----------

Equipment/animal used ----------

Own or hired ----------

Area ----------

Cost of hire ----------

2. Livestock:

| Type | No. | Value | Type | No. | Value |
|---|---|---|---|---|---|
| Bulls | | | Donkey | | |
| Cows | | | Horse | | |
| Plough-Oxen | | | Chicken | | |
| Goats | | | Ducks | | |
| Sheep | | | Guinea-Fowl | | |

3. Buildings:

i) Do you have any building in your farm? (YES or NO)_____

ii) If YES, what type of building? (YES or NO)

a) Hut ------- No. ------- Cost (₦) -----

b) Rumbu ----- No. ------- Cost (₦) -----

c) Well ------ No. ------- Cost (₦) -----

d) Fencing ---------- Cost (₦) -----

D. LAND USE PATTERN AND TENURE:

1. Crops Grown: What crops did you grow in your field(s)?

| Field/No. | Hectarage | Sole Crops | Mixed Crops |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

2. Land Tenure:

| Field/No. | Type of Field | Type of Tenure | | Distance (km) | Acquisition of Field | | |
|---|---|---|---|---|---|---|---|
| | | Property | Rented | | Inherited | Lease | Purchase |
| 1 | | | | | | | |
| 2 | | | | | | | |
| 3 | | | | | | | |
| 4 | | | | | | | |

a) If purchased, how much at the time you bought it (₦) ----------

Year ----------

b) If hired or leased, how much per annum (₦) ----------

c) Total cropped area (acres) ----------

d) Fallow area (acres) ----------

E. INPUTS USED ON FARM:

| Type of Input | Source | Quantity Used | Cost (₦) |
|---|---|---|---|
| FERT | | | |
| Sulfa (CAN) | | | |
| Supa (SSP) | | | |
| Compound (NPK) | | | |
| Urea | | | |
| Manure | | | |
| PESTICIDE: | | | |
| Gammalin '20' | | | |
| D. D. T. | | | |
| Aldrin-Dust | | | |
| Ratak | | | |
| HERBICIDE: | | | |
| Primagram | | | |
| Other | | | |
| SEED: | | | |
| Improved | | | |
| LOCAL | | | |

i) Means of transporting input (fertilizer) to the farm(s) (Make a Tick)

a) Donkey ▱

b) Head ▱

c) Bicycle ▱

d) Motor-cycle ▱

e) Lorry or Pick-Up ▱

f) Other (Specify) ▱

ii) Cost of transportation (₦) ----------

F. LABOUR INPUT (MAN-HOURS): (See Table Overleaf)

G. FARMER USE OF CREDIT:

i) Did the farmer or any of his household members used loan for farm operation? YES or NO_____

ii) If YES, how much loan in each case?

a) CASH

1. (₦) ---------- (k) ----------

2. (₦) ---------- (k) ----------

3. (₦) ---------- (k) ----------

b) In kind: Type of inputs ----------

---

iii) Sources of the Loan: (Tick)

a) Project ▱

b) Relatives ▱

c) Friends ▱

d) Money lenders ▱

e) Cooperative Organisation ▱

f) Ministry ▱

g) Other (Specify) ▱

Labour Input (Man-Hours)

| Type of Worker | | Type of Operation | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Clearing | Planting | Fertilizer Application | Weeding Thinning | Spraying | Harvesting | Thrashing Grading | Total |
| Male Adults | No | | | | | | | | |
| | hrs | | | | | | | | |
| Female Adults | No | | | | | | | | |
| | hrs | | | | | | | | |
| Large Child | No | | | | | | | | |
| | hrs | | | | | | | | |
| Contract | No | | | | | | | | |
| | hrs | | | | | | | | |
| | W | | | | | | | | |
| Communal | No. | | | | | | | | |
| | hrs | | | | | | | | |
| | W | | | | | | | | |
| Male Labour | No | | | | | | | | |
| | hrs | | | | | | | | |
| | W | | | | | | | | |
| Female Labourer | No | | | | | | | | |
| | hrs | | | | | | | | |
| | W | | | | | | | | |
| Child Labourer | No | | | | | | | | |
| | hrs | | | | | | | | |
| | W | | | | | | | | |

iv) How much has been repaid (N) ----------

v) How much loan outstanding (N) ----------

vi) Was any interest charge on the loan?

Answer YES or NO: ----------

vii) If YES, how much interest (N) ----------

H. OUTPUT: Harvesting, sales and consumption:

i) What crops did you grow? (Make a tick)

a) Maize ☐

b) Sorghum ☐

c) Millet ☐

d) Groundnut ☐

e) Cotton ☐

f) Cowpea ☐

ii) What quantities of crop did you produce?

| Field No. | Crop Harvested | Total/ Output | Quantity Consumed | Qty. Sold | Gift Seed | Total Value |
|---|---|---|---|---|---|---|
| 1 | | | | | | |
| 2 | | | | | | |
| 3 | | | | | | |
| 4 | | | | | | |

iii) What do you estimate the total household income other than farming N----------

SOURCES:

1. ---------- (N) ----------

2. ---------- (N) ----------

3. ---------- (₦) ----------

4. ---------- (₦) ----------

iv) Means of transporting produce to house or market (Tick)

a) Donkey ▱

b) On the head ▱

c) Motor-cycle ▱

d) Bicycle ▱

e) Lorry or Pick-Up ▱

f) Other ▱

v) What was the total cost of transportation?

(₦) ----------

vi) What was the price of the produce at the time you sold it

| CROP | UNIT | PRICE PER UNIT |
|---|---|---|
| a) Maize | ---------- | ---------- |
| b) Sorghum | ---------- | ---------- |
| c) Cotton | ---------- | ---------- |
| d) Cowpea | ---------- | ---------- |
| e) Groundnut | ---------- | ---------- |
| f) Millet | ---------- | ---------- |

# APPENDIX B

The Average Market Prices of the Various Crops in the Study Areas at the Period of Survey.

| Crop | Price Per Bag (₦) |
|---|---|
| Maize | 22.5 |
| Sorghum | 24.0 |
| Millet | 24.0 |
| Groundnut | 40.0 |
| Cowpea | 56.0 |
| Cotton[1] | 560.0 per tonne |

Source: Field Survey Data, (1982/83).

1. Producer price for 1982/83 season by the Nigerian Cotton Board.