ECONOMIC ANALYSIS OF DRY-SEASON IRRIGATED TOMATO PRODUCTION IN BOMO VILLAGE-ZARIA

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DECLARATION

It is hereby declared that the whole content of the work now submitted, for the M.Sc Agricultural Economics of Ahmadu Bello University, Zaria is the result of the author's research except where references are made to published literature, which are duly acknowledged. This work has not been part of any presentation for any other qualification.

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CERTIFICATION

This thesis entitled **"Economic Analysis of Dry Season Irrigated Tomato Production in Bomo Village-Zaria"** by Ali Abdulrahman meets the regulation governing the degree of Masters of Science (Agricultural Economics) of Ahmadu Bello University, Zaria and is approved for its contribution to scientific knowledge and literary presentation.

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DEDICATION

This thesis is dedicated to the memories of:-

My Father - Alhaji Ali

My Mother - Fatim

My Brother - Abdullahi

May God in his mercy reward them for all their support and may their souls rest in peace.

ABSTRACT

The importance of tomatoes in supplementing vitamins A and C deficiencies in most of the developing countries can not be over-emphasised. A crucial role it plays in the economies of most developing countries can be looked at in terms of rural employment, source of raw material for industries and source of food for the people. The specific problem is that of lack of information for economic evaluation of tomato production under the small scale irrigation in Bomo Village.

The thesis describes the small scale surface irrigation farming system in Bomo with respect to resource use, existing production method and output. It also determines the net farm incoeme from tomato production and it estimates the input-output relationship of tomato enterprise under the irrigation system. Thirty farmers were interviewed in the study area.

The farm budget model was used to determine the net farm income and the production function model was used in estimating the input-output relationship. The Results showed that inputs were relevant in explaining the variations in the output. The marginal value product of fertilizer and irrigation labour were higher than their marginal factor costs; while the marginal value product of family labour was less than its marginal factor cost.

This implies that less of irrigation labour and fertilizer were used than required at the optimum profit point. The increase in the use of irrigation labour input will therefore result in attainment of higher output in the study area. The farm budget

model shows that tomato growing in Bomo village is profitable.

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CHAPTER ONE

INTRODUCTION

1.1 Problem Setting

Tomatoes which are grown both in home gardens and commercially are one of the worlds most popular vegetables. They are good sources of vitamins A and C and can help in alleviating deficiencies of these vitamins in many developing countries. Tomatoes are attractive vegetable cash crop for small farmers (Villareal, 1980). In most developing countries however, cereals have received the highest research and production priorities. The relatively limited emphasis on other crops such as tomatoes is understandable since the first need of these countries is staple food to meet the demands created by rapidly increasing population. But as staPle food production accelerates many countries have found that tomato growing has distinct economic and nutritional advantages. This has promoted research attention by many scholars notably (Agbonifo, 1974, Orewa, 1978, Ofojekwu, 1982).

Potentials of tomato production include provision of rural employment; stimulation of urban employment and exports. It further improves nutrition of people and farmers' income.

1.2 Agriculture in Nigeria

Agriculture is a very important sector of the Nigerian economy. About 80 percent of the country's population live in the rural areas and most of these people are directly engaged in agricultural production.

A conspicuous aspect of the farming system is the dominance of small holders using simple technology such as hoes and cutlasses. The average farm family cultivates small parcels of land (about 2 hectares). There is a minimal use of capital and technology by the farmers and labour is a constraint in the context of existing technology. Also, shortage of capital is a major factor limiting the adoption of improved practices among the farmers. Farm income from sales of farm commodities is usually low and farmers can rarely afford to meet the annual farm expenditure required to improve their level of productivity. Only very few farmers have contact with extension agents on a regular basis.

It is noted that agricultural policies and strategies pursued by the government over the years have yet to succeed in promoting sustained growth and equity in agricultural production.

The concentrated projects and other programmes initiated by the government may have led to some increase in production but they often failed to meet growth targets as well as spread benefits commensurate with investment cost.

A survey of what people are eating in Nigeria will show that a substantial proportion of the population, especially rural people eat quantities of food that is much below the recommended average needs. This situation of hunger or undernourishment may be on seasonal or pre-harvest basis only for some people but for others it may be a year round

phenomenon.

Indeed, while most, if not all, caloric requirements will be met by most families during harvest there could be a significant drop of caloric intake for many during period of scarcity. Furthermore, such a survey will show that a large number of people are eating food that is deficient in important food nutrients, that is nutritionally poorly balanced diets showing inadequate quantity of specific nutrients necessary for good health e.g. animal and other protein requirements, fruits and vegetables.

Another issue is the inability of the agricultural sector to support the needs of the industrial sector in terms of raw materials requirements and market base as well as providing surplus for export to meet and expanded need for foreign exchange. It might be said that we are yet to increase in appreciable quantity the amount of food being produced in the country can be largely attributed to policy deficiencies and problems at the level of implementation. According to Tindall (1968), the greatest need in most developing countries appear to be as follows:

i) Assistance from government through provision of land, subsidies or loans for equipment, technical advice and training schemes;

ii) The use of high yielding and disease resistant varieties selected for suitability to local climatic condition and effective control of pest and disease by use of chemicals

linked with a high standard of management;

iii) Provision of a readily available supply of seed varieties adapted to the environment;

iv) An increase in the use of organic and chemical fertilizers;

v) The development of cooperative methods of production and marketing;

vi) The adoption of efficient soil conservation techniques. Mechanization of soil preparation cultivation and irrigation.

1.3 Tomato Growing in the Northern States

Tomato is a warm seasonal vegetable requiring three to four months of warm weather from time of raising the seedling to the first production of ripe fruits. It produces higher in a clear and rather dry weather under irrigation. It is mostly grown for canning both in the wet and dry season under irrigation. Tomato is one of the most popular salad vegetables made into soups, stews, ketchup, sauces and other product. Tomato by its succulent nature has high water requirements. Irrigation increases the average weight per fruit (Moore et al, 1958), irrigation also increase the percentage of flowers that set fruit (Vitton et al 1963). Although irrigation is essential, excessive amount of water can be deleterious and should be avoided. Excessive irrigation makes harvesting difficult because of the excessive

vine growth and reduces the soluble solid content of the fruit (Flocker and Lingle, 1961). Over irrigation results in rotting of early maturing fruit. Water deficit during main period of flowering days (40-70) may cause excessive shedding of young fruits. Optimum production appeared to be favoured by high level of soil moisture throughout the vegetative and early flowering periods followed by reduction during fruit development and lower level during ripening (Martin, 1966). The intervention of government in tomato production is mainly to use modern techniques in tomato production which will increase productivity which in turn results in higher standards of living for the farmer and increase GNP also to eliminate or reduce to the barest minimum the importation of tomato puree hence conserving foreign exchange. A considerable amount has been spent by the government on importation of tomato puree in 1964 to the tune of N1,200,000 when 5.400 metric tones was imported (Agbonifo, 1974). Consequently, the possibility of starting a tomato agro-industry began to receive serious consideration in both public and private circles.

The potentials of tomato growing with respect to tomato processing lead to the establishment of Cadbury Nigeria Limited who initially was importing tomapep (A mixture of concentrated tomato and hot pepper) but later with the increase in tariffs and importation established an extracting plant in Zaria. Similarly over the years many companies came

into being due to the potential of tomato growing in Kaduna State (Ikara tomatoes) and in Borno State (Vegru).

1.4 Irrigation Schemes

Efforts were made by government to identify potential tomato irrigation schemes. These include an area ranging from 20 hectares in Dutsinma to 7,000 hectares in Debiran (Kaduna and Katsina State (See Table 1.1). The schemes are governmental participation programmes where the irrigation land is acquired by paying compensation to owners of land. The irrigation schemes are usually ploughed and ridged during the dry season and allocated to volunteer farmers on payment of fees to irrigation division offices. The water supply is being controlled by the irrigation division of the ministry of agriculture. All these efforts are with the purpose of increasing the agricultural production to meet requirement of local industries and for export. Private irrigation schemes also exist. This includes the Cadbury system. The scheme supplies extension staff, credit to farmers and fix product price in consultation with ministry of agriculture. The ministry of agriculture supplies inputs (seeds, fertilizer and chemicals) at subsidized rates.

Table 1.1 Irrigation Schemes in Kaduna and Katsina State

Major Schemes	Estimated Area (ha) (1980)	Allocation for 1975 - 80) Plan (N000)
Debiran	7000	5.55
Ajira	200	0.70
Kafanchan	200	2.15
Galma	300	1.10
Kangiwi	400	0.55
Birnin Gwari	400	3.10
Minor Schemes		
Dutsinma	20	NA
Bakori	60	NA
Funtua	80	NA
Tabanni	20	NA
B/Gwari	20	NA
Hunkuyi	35	NA
Kaduna	75	NA
Kazuntu	NA	NA
Kagoro	40	NA

NA = Not available

Source:- Kaduna State Ministry of Agriculture; files of irrigation Division Zaria.

Within these various schemes, tomatoes are grown in

mixtures with other crops (Orewa 1978, Ofojekwu 1982). The crops includes pepper, Tomato, Sugarcane, Potatoes, Carrot, Green Pea, Wheat and so on. The crops are principally irrigated with pumps provided by the irrigation division of the ministry of agriculture. Usually a handful of farming population engaged in dry season tomato production due to constraint posed by irrigation water.

Capital investment is usually negligible. The capital goods which the farmers invest are hoes, (large and small) and cutlasses which are not purchased annually. Farmers are however aware of the profit yielding potential of such inputs as fertilizer, insecticides and irrigation pumps.

Family, communal and hired labour usually constitute the main source of labour for irrigated tomato production in the Northern States (Orewa, 1974). Water supply is usually controlled from dams under the ministry of agriculture or river valleys and lakes.

Field cultivated per farmer usually ranges from 0.13 - 0.17 hectare (Orewa, 1978) though this is a function of location, population pressure, size of family, farm labour available, off farm employment opportunities and availability of water.

1.5 Constraints facing irrigation schemes

These include lack of feasibility studies, defined statement on the relative participation of government and also lack of records on the agricultural activities which makes

appraisal difficult. Constraint results from inadequate time for planning of project and also resultant frequent changes in the organizational and administrative pattern (Orewa, 1978).

Constraints within the Cadbury system include the failure of farmers to deliver all their products to Cadbury. This is due to low price paid by Cadbury (Orewa, 1978; Agbonifo, 1974). Instead farmers directed their products to open markets where they obtained higher prices. Owing to meagre quantity of tomato supply to Cadbury, it became impossible for the factory to retrieve a substantial amount of its credit to farmers.

1.6 Problem Statement

The specific problem is that of lack of information for economic evaluation of tomato production under the small scale irrigation in Bomo Village. It is noted that dry season tomato irrigation farming has been going on in this area for a long time. Other studies conducted by Orewa, (1978) and Ofojekwu, (1982) do not provide information for economic assessment of tomato production under the system. For instance Orewa's study provided information under the pump and shaduf system under a different organizational set up (Cadbury) and ecological zone while that of Ofojekwu centers on an organizational set up (Galma) where government supply some inputs to farmers. It is noted that Orewa suggested that further studies be carried on different irrigation system

under different organization due to possible disparities which might exist in resource use for tomato production.

1.7 Objectives of the Study

i) To describe the small scale surface irrigation farming system in Bomo with respect to resource use, existing production method and output.

ii) To determine the net farm income from tomato production.

iii) To estimate the input-output relationship of tomato enterprise under the irrigation system.

1.8 Justification for Study

In view of bumper harvest recorded by peasant farmers from Bomo which was made possible by availability of water from lake nearby and the small population of the farmers, the need for economic analysis becomes significant to indicate the worthiness of their irrigation techniques also the choice between various types of irrigation, cropping pattern and optimum resource use must be based on economic evaluation if it is to be widely accepted. It is hope that information from this study will guide farmers in determining the most profitable production method in terms of optimum resource use etc.

Information from this study will also be helpful to the planners in the irrigation division of the ministry of agriculture.

1.9 Organization of Thesis

Chapter One gives a brief descriptio of the importance

and problems of agriculture in Nigeria, the various attempts being made by successive governments for developing agriculture, the irrigation schemes and their problems. The second chapter treats literature review while Chapter three gives information on methodology of the study. Chapter four is devoted to resource use among farmers and Chapters five and six contain the results of farm budget and production function analysis respectively. Chapter seven contains conclusion and policy implication of the study.

CHAPTER TWO

LITERATURE REVIEW

2.1 Measurement of Efficiency

Production efficiency measurement and analysis is complex even when viewed from the stand point of an individual farm. A lot of difficulties are encountered in making empirical estimates of the relevant physical cost and revenue relationship. There are also difficulties in delineating the relevant end to be maximized and the proper choice indicators to serve as a basis for resource administration by farmers.

There are also problems associated with the imperfect knowledge and uncertainty which both add to the complexity of the farmers decision making process and the process of empirical measurement.

These difficulties do not however cause farmers to cease production nor do they stop economists from making attempts to describe the productions process and the behaviour of producers or to make recommendations on resource use. When a farm is analyzed as a pure firm, profit maximization become the sole end of production organization and conceptually, the optimum use of resources is denoted by relating the choice indicator (price relationship) to the production possibilities of the farm. Choice indicators and choice making process is more complex when the farm family is considered the relevant economic unit. This is because value productivity of resources and net profit cannot be used as a gauge of whether

resources are used efficiently, the direct utility which farm persons derive from the resources must also be considered. The condition which define maximum economic efficiency is considered when resources are distributed between all the units in a manner such that their marginal productivity is equal in all cases whether or not the economic quantity to be maximized is profit. With resources given and limited, maximum efficiency is attained only as it becomes impossible to reshuffle resources without decreasing the total value of the product. If the marginal value of productivity of resources applied to one technical unit within the farm is greater than that for a second technical unit, an optimum pattern of resource allocation has not been attained (Heady, 1952). Other analytical techniques exist for estimating resource productivity and efficiency. One of such techniques consist of simply computing input-output ratios. For example, labour productivity can be measured in terms of ratio of total output to total input of labour. Indices of productivity can be constituted by multiplying the ratio by 100. In terms of aggregate output-input framework, resources productivity in crop production for example can be measured as an index of total output of crops to the quantity of inputs used in crop production (Olayide, 1972). The limitations of this techniques are however quite obvious. For example, it ignores the quantity of inputs used and also the results obtained are not amenable to a statistical test of reliability.

Microeconomic production function have usually been the tool for examining the problems of resource productivity and resource use efficiency at the farm enterprise level (Adesimi, 1982). In this regard attention is usually focused on the estimation of production function coefficients under the assumption that the production unit is mainly interested in maximizing profit (Adeniyi, 1988). From estimated production functions, measures of resource use efficiency can be derived by calculating the marginal productivities of any one resource or all the resources taken together. To have an indication of resource use efficiency the ratio of marginal value product (MVP) to the opportunity cost or acquisition cost of the resource is computed. One great advantage of the production function technique is that the estimated coefficients can be tested statistically for significances using the t - test. The marginal value productivities of individual resources provide a framework for policy decisions on resource adjustment i.e which input to increase or decrease to ensure efficiency. Positive MVP value implies that output can be raised by using more of a given resource. But the magnitude of the MVP must be compared with marginal factor cost or acquisition cost of the resource in order to determine the worthiness of increasing the level of resource use. The difference between the MVP and MFC indicates the scope of resource adjustment necessary to attain economic optimum (Ogunfowora et al, 1975).

2.2 Causes of Inefficiency in Agriculture

While production economists are not in full agreement as to the magnitude of inefficiency in Agriculture, they are in general agreement that inefficiency exists. Perhaps, more is known about the existence of inefficiency than about its exact causes. This is consequent upon the fact that the causes of inefficiency are found in an intertwined set of forces, each with varying but unspecified significance. The goals of this focus on inefficiency derives not only from the desire to increase the welfare of farm families, through the facilitation of greater returns from the resources which they administrate, but also in providing society in general with a greater economic product from the limited capital, land, labour and management resources at its command. The method of performance (productivity) valuation is of paramount importance in the discussion of ways to improve upon efficiency. So as to benefit both society and the individual firm. The efficiency parameters used here are physical productivity of factors (APP and MPP) and the value productivity of factors (AVP and MVP). Agricultural Economists are more concerned with the improvement of value productivity on farms, which is determined by the demand function of and supply function for agricultural products. The forces conditioning efficiency are both endogenous (lack of knowledge by farmers, farm birth rates, technical uncertainty etc) and exogenous (economic institutions, changes

in consumer demand etc) to the agricultural industry.

Inefficiency occurs:-

i) when the output on a farm is lower than the maximum attainable on the other farms.

ii) when a specific factor on a farm is lower than the maximum factor on another farm.

iii) when the ouput in a farming region or farm industry is lower than the maximum attainable in another farming industry or in agricultural production.

The reasons for the following will be examined:

i) Why the resource of individual farms are not organized to maximize the product.

ii) Why the return on resources differs between agricultural areas.

iii) Why the product for agricultural resource is :

- Low relative to that of certain other occupation
- Less than maximum for the resources employed in the industry. The examination of some of the reasons can be looked at in the light of the above guidelines.

2.3 The Causes of Inefficiency in Agriculture

2.3.1 The Conflict Between Cost and Return to the Farm and Society

An important extent of resource inefficiency exists in agriculture because of the gaps in costs and returns to the individual as compared to society. While a competitive

industry such as agriculture does provide an important setting wherein the use of resources to maximize the ends of the individual farmer also results in a maximum product to society, the statement cannot be applied to agriculture in its entirety. There are many areas of agricultural production where the costs and returns to the firms are not the same as for society. In cases where the returns to society are higher than the returns to the firm, there is a disincentive to invest on the part of the returns to the firm (e.g soil conservation and erosion schemes) whereas firms readily invest in farm enterprise whose cost are lower than that of society (e.g farming practices that result in soil erosion or pollution accompanied projects). Due to this gap resource allocation by farm firms does not result in a maximum output for society as whole.

2.3.2 Farmers Lack of Knowledge

Lack of knowledge of alternative technique and resource organization is also important in explaining why farmers individually do not maximize the value of products from given resources and why the mass physical production from given quantities of agricultural resources is not as great as it might be.

Lack of knowledge about such practices as in animal nutrition, cropping varieties, fertilizer application, labour use, irrigation etc, usually results in irrational resource and production organization. Part of this knowledge

deficiency stems from low income and the fact that farm operators concerned do not have the education to fully interpret research findings, or the funds to attend field days and educational demonstrations.

2.3.3 Uncertainty and Capital Limitation

Some great improvement in agricultural output could be attained either through the re-organization of capital between farms or by net addition of capital to the farms of individuals while the re-organization of existing capital labour and management between farms would without question increase the physical productivity of the industry, the value product would increase only where elasticity of demand is greater than one.

Uncertainty is important in explaining why so much labour is embodied in agricultural products. Many farmers stick to agriculture because they fear the possibility of industrial unemployment and equally because they fear the consequence of embracing an entirely different life, in off farm urban employments, about which their knowledge is so limited. This uncertainty attached to non-farm employment alternative results in immobilities which is a source of severe inefficiency because of the sticky nature of re-organizing farming units and families.

2.3.4 Net Labour Product in Relation to Capital

One of the major causes of low labour productivity resides with the capital/labour ratio. The rational here is

that poor capitalization of farm enterprises results in less than maximum output/worker. Labour productivity can be low or high depending on the quantity and form of capital employed per worker and the technique of production adopted. The problem is one of spreading labour between its farm and non-farm opportunities in a manner that equal marginal productivity is attached with proper recognition given to likes and values of people.

2.3.5 **Primary Production**

One of the explanations for low resource value returns in agriculture is associated to the general hypothesis that returns in extractive or primary industries continually press below those of secondary industries due to the fact that primary products are highly homogenous and do not lend themselves to product differentiation and monopoly profit, as in the case of manufactured products. Equally, consumer preferences are tilled more towards more complex variety forms of a given quantity of raw materials rather than more raw materials. For example consumers prefer more complex car designs than old designs with increased volume of steel. This primarily explains why the value productivity of agriculture is low relative to other industries.

2.3.6 **Population Growth and Technical Advance**

The rate of population growth in a country or in agriculture may affect the value productivity of agricultural resource. Firstly, population growth for nation as a whole,

interacts with technical advance to cause resource returns to increase or decrease. As an example, a rate of expansion in population and hence the demand for food without an upsetting change in technology will lead to an increase in the value productivity of agricultural resources etc. Population growth within agricultural and, specified seqments of agriculture leads to an increase in labour supply in agric which consequently presses resource returns to low levels (law of diminishing returns). Value productivity is equally pulled downwards, due to the derived demand for agricultural products which is particularly low.

2.3.7 Income and Firm Household Complex

The low level of income in most households prevents families from accumulating any sizeable amount of capital and thus also restricts their credit base which explains why differentials in resource returns and farm income may persist over long periods. Infact, low incomes restrict the acquisition of additional capital and more seriously inhibits investment in human capital (training, health, education etc) and hence productivity.

The high entrepreneurial requirements of the farm firm can only be badly afforded by such farming families which consequently forego the latent source of productivity improvements accompanying the adaption of innovations. Immobilities of farming families also result in low

productivity due to overcrowding on the farm.

The reasons for these immobilities are:

1. High transportation cost to area with employment opportunities.
2. Lack of finance to pay the "dead period"
3. Ignorance of economic opportunities elsewhere.
4. Farm families place a high subjective discount on alternative returns off-farm, because of limited experiences "away from home".
5. Rejection of non-farm ways of living.
6. Community ties etc.

The firm household complex helps explain why low capital and low income farms are perpetuated in areas relative to others.

2.3.8 Labour Supply Function

A major portion of the labour supply used in agric comes from the farm operator and his family with a very low supply price hence labour is expected to be used for less remunerative farm work than in the city. This justifies the disequilibrium in value productivity of farming on the one hand and alternative occupations on the other.

2.3.9 Monopoly Structure

The market for farm output is often considered to be perfectly competitive especially given the large number of atomistic farmers. The idea of monopoly is not limited to output alone but equally extends into the labour market for

non farming firm where such restrictive activities like close shops; trade unionism; initiation fees; apprenticé rules etc, serve to limit the supply of labour to such profession leading to high wages which in part explains the differences between farm income and off-farm income. Of equal importance is the bargaining power of trade unions for wage increase, a practice which is rare in agriculture.

2.4 Ways of Reducing Inefficiency

i. Reduction of uncertainly by preventing economic instability.

ii. Education directed at increasing productivity on small low income farm through the following ways:-

(a) More intensive education for all farm family members increase audience for communicative sources of information to include low income farm families

(b) Increase extension service.

iii. Credit for acquisition of capital and expansion of farm size.

iv. Job training and transfer assistance.

v. Steps to eliminate differenes in cost and returns to individual and society.

vi. Industrialization and part-time farming.

While it is true that the income of farm family depends on:

(a) the quantity of resources at its command

(b) the manner in which these resources are combined, the

quantity of the resources owned by many farm families is simply so small that the supply of labour from the family household produces a very small product and a low income. The agricultural production economist has an important role to play in increasing the welfare of these persons and of society generally through aiding the re-organization of resources in agriculture to other occupation where productivity of labour and family income and welfare can be increased.

CHAPTER THREE

METHODOLOGY

3.1 General Information on the Study Area

Bomo area lies within the Northern guinea savanna ecological zone. It has a savanna woodland vegetation with underlying grass species of Andropogon and Hyperhernia. Due to intensive agriculture as well as slash and burn type of farming practice, the vegetation is partially or totally (in some cases) replaced by grasses. Few standing tress (e.g Mango, Locust bean) are found on the farms.

Soils-

Bomo area which is within Zaria district has a leached ferruginous tropical soil with a well developed textural B. horizon containing 30 - 40 percent clay. However, rainfall wind and topography of land interplay to determine the colour and soil texture found in this area. At the highest levels of soil surface, reddish fine loan clay soil is predominant. Half way down the landscape brownish to yellow soil are normally found. Consequently, the soil texture gets heavier at this level due to the increasing silt content. In the low lying valleys (commonly referred to as fadama) where the soils are more developed are found greyish to black coloured heavy textures soils. They contain a lot of clay material. As a result drainage is heavily impeded in those lowlands.

Climate:-

Bomo area has a dry sub-humid climate characterized by

distinct wet and dry season. The wet season with an annual rainfall mean or 1103mm (43.4 inches) occurs during the month of April to September and at times extending to October. The dry season starts from October to April. Mean annual temperature fluctuates from 31°C (88°f) and dry season to 18°C (65°f) and minimum temperatures as low as 7.8°C (42°f) are not uncommon.

Relative Humidity:-

This varies from 5 - 10% in the afternoon to rather high values or 40 - 60 percent in the morning. Tomato grows well between 15 - 35°C and is best when day temperatures are higher than night temperatures. Disease incidence are relatively minimal in dry season but tomato crops planted during the rains in Zaria area and in the Northern States in general are particularly vulnerable to attack on the foliage and stem by Alternaria solani and Septoria lycopersicum.

3.2 Sample Selection

A total of ninety four farmers were involved in dry season tomato production for the year 1992/93. Each farmer grew mainly tomato in the small farm plot. From this ninety four, a random sample of thirty farmers were taken for the study. All the farmers are residents of Bomo Village. The sample was limited to thirty because of financial constraint.

3.3 Data Collection and Interview Procedure

The collection of data started in mid-December 1992 and

ended in March 1993. It was jointly done by the author and a trained staff enumerator in the Department of Agricultural Economics and Rural Sociology. Institute for Agricultural Research, Ahmadu Bello University, Zaria. The Enumerator has a lot of experience with administering questionnaires and is verse in Hausa language as well as familiar with the environment. Field activities were observed by the author and the enumerator and 94 farmers were interviewed. Entries of farmers daily activities were recorded in the irrigation area with regards to input usage. Farmers were visited twice during the transplanting period and weekly during the harvesting period.

3.4 Data Analysis

The method involved interviewing a sample of thirty farmers out of ninety four twice a week during transplanting to once weekly at harvesting operations.

In the analysis two different methods were developed. First in the estimation of cost of inputs, outputs and prices of tomato production in Bomo area. The farm budget model was used to determine the net farm income. Secondly, the production function model was used in estimating the input output relationship. The individual farmers unit area for the cultivation of tomato was determined by the pace factor. This involves walking in the farm site and calculating the distance from one foot to the other multiplied by the length and breath of each plot area.

3.5 Analytical Framework

The estimation of input - output relationship involves the specification of a production function which depicts the factor product relationship (Dillon, 1968). Given the existence of the production function, certain physical quantities like the marginal productivities of each resource used, return to scale etc. which have economic implication can be derived (Ofojekwu, 1982). Various functional forms can be used to characterize agricultural production under different environmental conditions. Ofojekwu (1982) noted however that the algebraic forms of the functions and the magnitude of its coefficients will vary with soil, climate type and variety of crop being used. Selection of any specific form of equation to express production function automatically imposes certain constraint or assumptions on the relationship involved and the optimum quantity of resources which will be specified. A number of algebraic models can therefore be used to estimate the relationship between tomato output and resources used in the production such as Square root, Quadratic and Cobb-Douglas function.

Sample of the functions used for this study.

1. Cobb-Douglas. $Y = box_1^{b1} X_2^{b2} X_3^{b3} e$

   The logarithmic form is given by

   $\log Y = \log bo + b_1 \log X_1 + b_2 \log X_2 + b_3 \log X_3 + \log e.$

2. Quadratic form.

   $Y = b_o + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_1^2 + b_5x_2^2 + b_6x_3^2$

Where Y = Yield

X_i = 1,.....n, = inputs

E = Error term.

(1) The Cobb-Couglas form is easy to calculate in its logarithmic form. It may show diminishing marginal returns. However, it does not give a defined maximum response at all input level which restricts its usefulness.

(2) The Quadratic form allows for diminishing and negative marginal productivity, changing elasticities of response and a defined maxium. At very higher or low level of input the function may predict negative total product. The form also requires large number of regression coefficients to be estimated for a given number of various inputs.

3.6 Expected Information from Production Function Analysis

The use of production function model provides certain physical quantities that are of economic importance.

i) The coefficients b_i are unknown parameters and their estimators $\hat{bi}$ obtained from any of the selected function gives an insight into the direction and magnitude of change when input is changed by one unit. The level of output when input is zero is b_o the constant factor.

ii) The knowledge of marginal value product (MVP) of each resource from the production function will provide insight into the efficient use of resources when compared with their respective price factor. The marginal value product of input

x_i $MVPX_i$ is the addition to the total value of production resulting from the last unit of resources. If $MVPX_i = x_i$ then the resources x_i is efficiently utilized.

iii) The information on the nature of return to scale whether the system is associated with increasing, constant or decreasing return to scale.

iv) The coefficient of multiple determination R_2 will be determined. This is a measure of goodness of fit. It is the percentage of the total variation of the dependent variable that can be explained by the variation of independent variable. The equation with higher R^2 value explains the variation well and is regarded as better fit if other conditions are met (Ofojekwu, 1982). Since there is a paucity of knowledge on the resource use in the project area such information will assist planners to understand how efficiently resources are being used in tomato production in the area. This will enable planning how best to deliver the underutilized or over-utilized resources. The extension service requires such information in order to educate the farmers on the use and control of resources in production.

3.7 <u>Variables and Reasons for Selection</u>

(a) Irrigation hours:- This is used as a proxy for the amount of water applied to the plots.

(b) Labour:- It was expected that the higher the labour input the greater the output.

(c) Fertilizer quantity:- This variable was included in

order to understand how output is influenced by the fertilizer used.

(d) Finally the inclusion of the error term(s) in the model is done to represent those factors which are not quantifiable and which have not been included. All other factors not included in the model are regarded as exogenous or are considered as a result of outside forces thus are they taken on by the error term.

3.8 Cost-Return Analysis

In the estimation of costs and returns of tomato production under the irrigation area the farm budget model of analysis was used. The model gives an estimate of costs and returns for a given production period. It has been used in a number of studies (Olukosi, 1972, Ofojekwu, 1982) in analyzing the profitability of farm production practices. Such information on the profitability of tomato enterprise was considered vital to the farmers in the area. The model will also be used to provide information on the effect of prices and yield on the return to tomato production.

i) **Information from the model**

Net farm income.

This is obtained by substracting the total cost of production from total returns.

NFI = TR - (TVC + TFC (₦)

Where:

NFI = Net Farm income (₦)

TR = Total Revenue (₦)

TVC = Total variable cost (₦)

TFC = Total Fixed Cost (₦)

ii) Cost. In the use of the model, the following cost items were identified.

iii) Variable cost:- These costs incurred during the production period and they include cost of inputs, such as seedlings, fertilizer, labour and water.

iv) Fixed Cost:- These included mainly depreciation on the use of implements. The depreciation associated with durable goods like hoes were calculated using the straight line method over the period of use in tomato production.

3.9 **Variable Cost Analysis**

Family Labour:- In the evaluation of cost of family labour, economic opportunity cost principle was employed. It was assumed that the cost of family labour was equal to the average wage rate paid to a hired labourer working in tomato field.

3.10 **Non-Durable Goods**

These included the cost of seedlings and fertilizer. Farmers in the project area purchased inputs from different sources and the cost of inputs were recorded accordingly. Inputted cost were used in some cases where farmers used inputs from their stock. This cost were based on market cost of inputs.

CHAPTER FOUR

AGRICULTURAL CONDITIONS IN BOMO

4.1 Sequence of Operation on the Irrigated Points

In the 1992/93 growing period. Plots earlier cultivated for maize and rice after harvest are smoothened up by use of hoes to make the soil loose and friable. Hoes are also used to make the farm beds. This operation is done by the use of family labour.

The activity involves ploughing, leveling and ridging. Prior to this operation seedling are normally planted in nurseries which are later transplanted after the farm bed preparation. The moisture content of each farm bed is met by the nearby lakes. This is aided by the use water pumps.

4.2 Planting

Transplanting of tomato seedlings started in November and ended in December 1992. This is an activity that takes place in the early mornings or evenings. This is with the view of retaining the moisture content of the seedlings before transplanting. Normally the farm beds are irrigated with water before transplanting.

4.3 Fertilizer and Water Application

Farmers in Bomo area used N.P.K 15:15:15 as well as sheep and goats droppings. The application of fertilizer started during transplanting among most respondents and the amount

varied among them. Water application started in many farms either before or during transplanting. It was expected that each farmer could irrigate his farm at least once a week.

4.4 Weeding

This operation started barely three weeks after transplanting and the activities continued at an average rate of once a month. Hand and hoe weeding was practiced.

4.5 Harvesting

This activity started in the first week of march, 1993 and continued even beyond march to April 1993. During this period, the number of farm visits were increased to enable accurate record of yields and quantity sold. Yield of each respondent was recorded on daily basis and it was observed that basket sizes of 24 kg and 38kg capacity were used in selling the tomatoes on the farm and for evacuation respectively.

4.6 Market and Price

The prices of output were recorded. Most farmers sold at farmgate. Prices were not constant. At the beginning of the harvest price were high and later on as more farmers harvest their tomato the prices came down. At the end of the harvesting period it picked up slightly. The method involved in pricing include higgling and haggling. Example at the beginning of the harvest, price of 24kg basket at farmgate ranges between N70.00/basket during the first week

N50.00/basket at mid season and N55.00/basket towards end of the season. While that of 38kg basket at farmgate ranges between N80.00 per basket at early harvest to N65.00 per basket at end of season.

A large proportion of the tomato harvest were being sold at farmgate (90%) while an insignificant number is given out as gift (10%) and a little quantity is being consumed. Tomatoes not sold at farmgate were sold at Samaru market. It was noted that cost of transporting tomato to Samaru was N5/basket and loss due to damage on transit was minimal. Pick-up vans were used for transporting tomato to Samaru about 3kms away.

4.7 Factors of Production in the Study Area

The resources used in the production of tomato in Bomo area could be classified as land, labour, capital management and water resources.

4.8 Land Use Among Sampled Farmers

Land is one of the most important resource readily available for production in developing countries. The mode of acquisition of land in Bomo Village is by traditional inheritance. Thus the land is usually fragmented with the decease of a family head. An area of about five hectares was being cultivated for farming. Out of this an area of about 1.4 hectares was being used by the sampled tomato farmers for irrigated tomato production. Other areas were cultivated by other non sampled farmers. The land is fragmented to small

plots ranging from less than 0.009 ha to 0.3ha.

Table 4.1: Land Use Among Sampled Farmers

Size of Farm	Number	Total Farm Size (m^2)	Percentage
0.009	4	330	13.3
0.01 - 0.09	24	735	80
0.1 - 0.3	2	4700	6.6

Source: Survey data, 1993

4.9 Labour:-

Labour is a very important factor in traditional agriculture (Norman, 1972) and more important in agriculture. In Bomo area, males adult number influence labour availability. Family labour constitute the principal source of labour in tomato production in the area. This is more so as the unit size of the tomato farm is usually small. One or two family members were involved in most of the labour operation. The labour was expressed in man hours. This ranges from two hours a day during land preparation to three minutes at mulching period.

4.10 Capital:

Capital is one of the most limited resources used in developing agriculture. This study considered both durable and non durable goods used in the production. The most common durable capital used by the farmers in the area were hoes

(large and small). The depreciation that was inputted to the implements were calculated by use of the straight'line method for periods ranging from one to seven years. The formula is given below

$$D = \frac{PP - S}{N}$$

Where

D = Depreciation

PP = Purchase price

S = Salvage Value

n = number of years of the asset.

For non durable capital like seedlings, sources varies. They are acquired either by gift or purchase or owned. About 73% of the farmers in Bomo Village purchased their seedlings in the open market while 27% were given as gift.

Fertilizer was sourced from the open market. Sheep and Goats droppings from animals privately owned were also used by some farmers.

4.11 Water Resources

This is one of the most important resources in dry season cropping. Without assured and adequate water supply, tomato yield would be adversely affected (Orewa, 1978) in Bomo area, water used for tomato irrigation was made available from a lake located at the outskirts of the village. Private water pump owners supply the farmers with water. Irrigation hours ranges from half an hour to one and a half per farmers plot per week.

CHAPTER FIVE

COSTS AND RETURNS OF TOMATO PRODUCTION IN BOMO

5.1 Costs of Production of Tomato

This chapter focuses attention on the costs and returns of tomato production in Bomo area. In the analysis, the budgeting model was used. Input quantities factor prices, physical output and total returns were derived. Factors of production were valued at the existing market price. The budget data developed for the tomato production were used to calculate the Net Farm income.

Table 5.1: Cost of Production of Tomato in Bomo among 30 farmers.

Variable Inputs	Total Cost	Cost/Ha (₦)	% Contribution
Seedlings	2180.00	1557	21.16
Inorganic Fertilizer	4574.40	3267	44.40
Family Labour	2136.65	1526	20.73
Water Cost	1101.65	786	10.68
Fixed Inputs			
Hoe (Small)	106.00	75	1.02
Hoe (Large)	207.80	147	2.00
Total	10305.7	7358	100

Source: Survey data, 1993

The Table shows that variable cost contributed 96.97 of the total cost of production while fixed cost contributed 3.0%. This indicated that fixed input is not significant in

terms of capital use. Variable inputs constitute the most significant cost items in tomato production in Bómo area.

Furthermore Table 5.1 indicates that seedlings contributed 21.16% of the total cost of production while water cost contributed 10.68% respectively. Nursery activities were difficult to monitor as most respondents either purchase their seedlings or are given free as gift.

Organic fertilizer mainly saved from goats and sheep droppings were used by some farmers. These animals were privately owned. To compute the actual cost was difficult as such organic fertilizer was not used in the study.

5.2 Distribution of Inputs Among the Farmers

Table 5.2 shows the distribution of inorganic fertilizer, seedlings and labour among the farmers in Bomo area.

Table 5.2: Distribution of Inorganic Fertilizer, Seedlings and Labour Among Bomo Tomato Farmers.

Farm Size (Ha)	Inorganic Fertilizer		Seedlings		Labour
	(Kg)	(₦ spent)	Kg/ha	Man/hr	(₦ spent)
0.009	1575	3781	5151	5909	13539
0.01-0.09	1384	3445	1900	2236	19025
0.1-0.3	1276	3063	744	751	9369

Source: Survey data, 1993

The cost of labour is noted to contribute more than other

cost items on the farm. This is closely followed by cost of inorganic fertilizer.

Table 5.3: Farm Sizes and Yield/Hectare.

Farm size	No of Farmers	% Contribution	Kg/Ha	NFI (₦)
0.009	4	13.3	458	503.21
0.01-0.09	24	80	265.8	6806.05
0.1-0.3	2	6.6	1499.5	548.3

Source: Survey data, 1993.

It could be noted from Table 5.3 that among respondents, there are variations in total yields and net farm income due to differences in farm sizes, quantity and prices of output as well as input prices.

5.3 Net Farm Income

The net farm income was calculated for the 30 sampled tomato farmers involved in irrigation in Bomo area. As shown in Table 5.4 the net farm income was calculated as total revenue less total valuable cost and total fixed cost. The net farm income was ₦7856.8.

Table 5.4: Result of Cost Analysis

Item	Value (₦)
Total value of tomato	37403.50
Total variable cost	29223.7
Total fixed Cost	323.00
Net farm Income	7856.8
Total yield per 1.4 ha	32176

Source: Survey Data, 1993.

Factors Affecting Cost

The labour profile as presented in the Table below shows differences in labour requirements for each operation.

Table 5.5: Labour Input Operation

Operation	Total Man-Hour	% Contribution
Land preparation	915.00	36.24
Transplanting	183.40	7.27
Irrigation	594.50	23.55
Weeding	425.05	16.84
Moulding	71.95	2.85
Fertilizer application	192.02	7.61
Harvesting	134.00	5.31
Mulching	8.30	0.33
Total	2524.22	100

Source: Survey data, 1993.

Land operation, irrigation and weeding were dominant in the use of labour. The three operations took 36.2%, 23.6% and 16.8% respectively.

The high requirement of labour for land preparation was due to the manual nature land preparation was carried out. Studies have shown that the use of tractor for land preparation reduces the man-hours by four to five hours per hectare (Ofojekwu, 1982). It is noted that irrigation was also dominant in the use of labour. The need for water by tomato under dry season farming can not be over-emphasized. The role played by weeding is justified due to the significance of weed free farm as regards competition for light, water and nutrients in the soil. Fertilizer application contributed 7.60% of the man-hours for production of tomato in Bomo area. Others are transplanting 7.3%, harvesting 5.3%, moulding 2.9% and mulching 0.3% respectively.

5.5 Factors Affecting Returns

Factors like climatic, biological and input use were known to influence tomato yield in dry season production (Ofojekwu, 1982). The total yield of tomato was found to be 22 tons per hectare. Yield compares favourably to 30-40 tons per hectare (Orewa, 1978). This implies that higher yield would be achieved by efficient use of resources and proper management. The high cost of irrigation by private water pump owners also affected return. Water was used for irrigating

tomatoes for periods ranging from November 1992 to March 1993.

5.6 Time and Place of Selling

It was observed that prices of tomato varied depending on the time and locality sold. Farmgate price was not uniform or constant. This is so because at the onset of harvesting prices of tomato were higher than mid season. Farmgate prices starts with ₦50.00 at the beginning of season for a 24kg basket. Bigger baskets of 38kg attract higher prices of ₦65.00 to ₦80.00. Respondents who sold at Samaru sold at higher prices. The cost incurred in transporting a basket of tomato to Samaru was ₦5.00. The pricing system is not standardized. It featured a prominence of higgling and haggling. Consequently farmers sold their products after reaching a compromise with the would-be customer.

CHAPTER SIX

INPUT/OUTPUT RELATIONSHIP IN TOMATO PRODUCTION

6.1 Production Function Analysis

In the process of analysis, the multiple regression technique was used. Numerous production functions (Cobb-Douglas, Square root and Quadratic) were used and fitted to same sample of input-output data. However, for the purpose of this study Cobb-Douglas functions was selected for analysis based on the following criteria.

a. The value of R^2 (coefficient of variation)

b. Significant level of F-values

c. Significant level of individual variables

d. The appropriateness of the signs of the regression coefficients.

The Cobb-Douglas function, a non linear function was transformed into the linear model by use of logarithm as follows:

$$Y = box_1^{b1} X_2^{b2} X_3^{b3} e$$

The log form or linear form is given as:

$$\text{Log } Y = \log b_o + b_1 \log x_1 + b_2 \log x_2 + b_3 \log x_3 + \log e$$

Y = Dependent Variable = Output quantity in kilogramme

Independent Variables

X_1 = quantity of fertilizer in kilogrammes

X_2 = Irrigation labour in man-hours

X_4 = Labour in man-hours excluding irrigation labour.

Table 6.1: Results of Regression Analysis Using Cobb-Douglas Production Function.

Variables	Variable Definition	Estimated Coefficient	Standard Deviation
X_1	Fertilizer	0.09293	0.05904
X_2	Irrigation	0.5104	0.1144
X_4	Iabour	0.14470	0.07604

Source: Survey data, 1993.

R^2 = 77.5%

The value of R^2 implies that 77.5% of the variation in the dependent variable could be explained by the variations in the independent variable included in the model. From Table 6.1, it could be observed that the elasticities of production for fertilizer, irrigation, labour and farm size were less than one which implies that they are inelastic. the estimated elasticities were all positive. This implies that 1% change in any one of the input variable while holding others constant will result in a change in the quantity of output equal to the coefficient of the variable in the same direction as the change in the input. For example, a 1% change in increase in fertilizer use will result in 0.09293 increase in output.

6.2 Return to Scale

The sum of the elasticities of production generally indicate the nature of scale associated with the production system. From Table 6.1 the sum of elasticities was found to

be one. This implies that the production is characterized by increasing return to scale. The economic implication is that if all inputs included in the model are increased by 1%, output will increase by one.

6.3 Marginal Value Product

In this study, the marginal value product of factors were derived and compared with their respective prices in order to determine how efficiently resources were being used in the production. A given resources is said to be efficiently used if its marginal value product is just sufficient to offset its acquisition price.

$MVP = Px_i$

MVP = Mariginal Value Product of Input x_i

In the case of Cobb-Douglas function, the marginal value product is usually fitted into the formula below:

$$MVP = \frac{bi\ \bar{Y}}{\bar{X}}$$

b_i = regression coefficient associated with the independent variable.

$\bar{Y}$, $\bar{X}$ = Values of log Y and log X when they assume their arithmetic means.

Tables 6.2 and 6.3 show the marginal value product of inputs and their respective unit prices.

Table 6.2: Marginal Value Product of Inputs and their Respective Arithmetic Means and Standard Errors

Variables	$\bar{Y}$	$\bar{X}$	bi	$\frac{bi\bar{Y}}{\bar{X}}$ = MVP
Fertilizer	4.0875	0.2330	0.09293	16.30
Irrigation	4.0875	0.07767	0.5104	26.86
Labour	4.0875	0.3347	0.14470	1.76

Table 6.3: Factor Unit Prices

Variables	Unit	Unit Prices (₦)
Fertilizer Quantity	Kilogrammes	2.40/kg
Irrigation labour	Man-hour	17.50/hour
Farm labour	Man-hour	7.5/hour

The average price of a bag of fertilizer at the time of study was one hundred and twenty naira. By dividing 120 by the 50kg (weight of fertilizer) the price per kilogramme was computed where as the prevailing charge per man hour of irrigation, labour and other farm labour was ₦17.50 and ₦7.50 per man-hour respectively. It was not possible to get the value of land since the farmers do not actually pay for the land. Hence it was not possible to determine how efficiently land was used.

6.4 Analysis of the Marginal Value Product

1. Irrigation:- The marginal value product of Irrigation

was found out to be 2688. This is higher than the unit price of irrigation man-hours (₦17.50). This implies that irrigation labour was under utilized. Additional naira spent on irrigation would increase output by more than the unit increase. Irrigation man-hours if reduced would result into more increase in output.

2. Fertilizer:- Looking at the table, the marginal value product of fertilizer was 16.30. When compared with the unit price of fertilizer, it is found to be higher than the unit price. This implies that additional naira spent on fertilizer will result in increase in output by more than the unit increase. Fertilizer quantity if increased would result in an increase in output.

3. Farm Labour:- The marginal value product of farm labour was found to be 1.76. This is lower than the unit price of farm labour which is ₦7.50. This indicate that farm labour is over utilized. Additional naira spent on labour will increase output by less than 1.76. The implication in the region of production is that as successive quantities of irrigation and fertilizer are increased, output is increased up to a point where the average physical product is equal to the marginal physical product. At this point, labour must have been stretched beyond its limit. Additional increase in fertilizer and irrigation produce no yield advantage. Hence profit maximization is not attained beyond this region. Therefore, it does not make economic sense to keep adding more of

irrigation and fertilizer inputs. The tendency is to move to the region of higher profitability. The quantity of fertilizer and irrigation has to be decreased in order to achieve economic efficiency. Higher output can be obtained by a decrease in the use of irrigation and fertilizer. The high use of labour by the farmers can be explained by the availability of surplus labour during the dry season as this is the major economic activity during this part of the year in the study area.

Moreso the fact that labour used is family owned, its use is regarded as free thus no cost is incurred by the farmer, therefore the magnitude of labour cost is not realized by the farmer.

CHAPTER SEVEN

SUMMARY AND CONCLUSION

7.1 SUMMARY OF FARM BUDGET ANALYSIS

From the cost-return analysis, variable cost constituted 96.97% to the total cost of production in Bomo area, while fixed cost constituted 3.0%. Similar studies by Ofojekwu, (1982) shows that variable cost are significant in dry season tomato production. Among the variable inputs labour constitutes 20.73% to cost of production per hectare. A profile into the labour operations shows that land preparation, weeding and irrigation constituting the major element of cost 36.24%., 16.84% and 23.6% respectively.

Smaller values of 2.13% were obtained for land preparation by Orewa (1978) due to the tractor hire service supplied by the Ministry of Agriculture, Zaria for land cultivation, clearing and harrowing. Hence the use of tractor hiring service will reduce man-hours in land preparation. Other operations include fertilizer application 7.6%, transplanting 7.3%, harvesting 5.3%, moulding 2.9% and mulching 0.3%.

Fertilizer was found to contribute 44.40% to the cost of production per hectare. At the period of study, the cost of fertilizer ranges from ₦100.00/50kg bag to ₦120/50kg bags.

Yield was found to be 22 tons per hectare. Studies have shown that 28 tons/ha was obtained Orewa (1978). This shows that under good and efficient use of resource higher output

could be obtained.

The net farm income was found to be ₦6806.05 for farmers with size between 0.1-0.009 and ₦548.3 for farmer with sizes between 0.1-0.3. The differences result mainly from the high quantity in fertilizer use, man-hours in labour by the larger farm size category.

Total man-hour for labour was found to be 2524.22 when compared with other studies, is found to be lower, Orewa (1978) found out that total man-hours in Tsugugi and Cadbury were 5594.91 and 1176 respectively. This shows that private irrigated tomato farming consume fewer man-hours than the organised government controlled. Total man-hours used for irrigation was 594.5 man-hours. Studies by Orewa (1978) using the shaduf method of irrigation, 2808.3 man-hours was used for irrigation. This shows that lesser man-hours is used using the water pump under private use.

The net farm income was found to be ₦7856.8 in Bomo irrigation area. This shows that the net return picture of private organized dry season tomato irrigation is good and can be improved upon. Orewa (1978) concluded in his studies that the net return picture in terms of efficiency in tomato production, private individual organization is relatively better in spite of total production cost arising from the use of labour intensive traditional tools. However, the introduction of tractor hiring services will correct the imperfections in terms of high labour requirement for land

preparation.

7.2 Summary of Input-Output Analysis

From the input-output analysis, the following conclusions were drawn.

i. Fertilizer and irrigation exhibited positive regression coefficient of 0.09293 and 0.5104 respectively. This implies that increase in the use of fertilizer and irrigation operation will result in an increase in quantity of output by 0.09293 and 0.5104 respectively.

The marginal productivities of the two variable were 16.30 and 26.86 respectively. These were found to be higher than their unit prices of ₦2.40/kg and ₦17.50/hour indicating that these resources were being under utilized.

ii. From the analysis, the regression coefficient of farm labour is positive (0.14470). This indicates that addition of more labour hour by one unit will result in a decrease in output by 0.14470.

7.3 Policy Implication

i) One implication of these findings is the need for the Ministry of Agriculture, Irrigation Division, Zaria to provide effective tractor ploughing and ridging operations in Bomo area. This is important in order to reduce the man-hour needed for such operations. Consequently, land preparation was not done properly and hence required additional man-hour.

ii) Due to the potentials in this area there is a need for the irrigation division of the Ministry of Agriculture to set

up proper irrigation system to check exploitation by private water pump owners.

iii) Since the majority of the farmers are small producers, they stand a better chance to obtain higher prices for their tomatoes by forming a cooperative body.

iv) There is a need to encourage other farmers having the same setting as Bomo to produce tomatoes because of its success.

7.4 Limitations of the Study

The data refers to a single dry season production. Variations in output from one dry season to the other is quite common in agriculture, e.g. changing price structure, vagaries in nature which in turn influence production decisions. The use of cross sectional survey rather than well kept farm records relating to input and output by farmers is another limitation. Despite the bi-weekly visit, it was not possible to interview all the respondents weekly. It would be wrong to assume that laps of memory on the part of respondents (i.e. tomato farmers) in regards to details about operations and resource utilization could be completely overcome. The use of labour for simultaneous operations also presents a limitation e.g. weeding while irrigating. Other factors that limited the scope included inadequate finance and manpower. The sample size (30) was small due to inadequate enumerators and finance. However, such a sample size allows for in-dept interview and adequate farm visit.

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