ECONOMIC ANALYSIS OF IMPROVED INPUTS ON PRODUCTION OF FOOD CROPS IN ONDO STATE, NIGERIA.

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ABSTRACT

This study examined the economic analysis of improved inputs on production of food crops in Ondo State of Nigeria. The study examined the socio-economic characteristics of the farmers; profitability of food crop production; resource-use efficiency farms with and without improved input use; and factors influencing adoption of agricultural input technologies among respondents.

A multi-stage random sampling technique was used to select two categories of food crops farmers; 100 Improved input users and 100 Non-improved input users through the use of a structured questionnaire

In examining the socio-economic characteristics of the farmers, the analysis revealed that more than 60% of the farmers were more than 50 years and above, which implies that food crop production is dominated by old farmers. Majority of the farmers were males and household size ranged between 6-20 persons. The farmers had low educational status as over 60% attended primary school. Almost all farmers were small-scaled operators, owing less than 5.0 hectares of farmland. In the profitability analysis of farmers, the findings revealed that Improved input users earned an average gross margin of ₦41,290.08 per hectare, while the Non-improved input users earned an average gross margin of ₦18,126.98 per hectare in the farming season. The implication of this is that food crop production was a profitable business in the study area, and more profitable for Improved input users.

The production function analysis revealed that the Returns to Scale showed an increasing return-to-scale in food crop production for Improved input users, there by

implying that further expansion of the existing production scale could lead to better efficiency among Improved input users. The study revealed that resources were not being used in an optimally efficient manner. For improved input users, the MVP/UFC ratio was higher than one, which implies that more of the resources should be used except for agrochemicals. Whereas for the Non-improved input users, less of all the resources should be used in the production process.

Finally, the probit analysis conducted showed that the probability that a farmer will adopt any of the improved farm input increased with age, farm size, education, farm income and family labour. The probability of adoption decreased with hired labour and household size. On this basis, it is recommended that, government should encourage youth to go into food crop production, timely supply of inputs at subsidized rate is highly necessary and expansion of extension services, farmers should be assisted to own more farmland as this will enhance adoption and more research should be carried out on food crop production.

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At first, I am full of thanks and praises to the ALMIGHTY GOD for his mercies, kindness and blessings and great deliverance from troubles. "If it had not been the LORD who was on our side, when men rose up against us: Then they had swallowed us up quick, when their wrath was kindled against us" Then the waters had overwhelmed us, the stream had gone over our soul ..... Our help is in the name of the LORD, who made heaven and earth" (Psalm 124: 2-8).

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Finally, unto God be the glory, great things he hath done.

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CERTIFICATION

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DEDICATION

This work is dedicated to ALMIGHTY GOD, for his unfailing love and mercies. And to my darling wife, Sister Lucy Akinbola, my loving children Oluwagbemisola, Olasubomi and Eniola.

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CHAPTER ONE

1.0 INTRODUCTION

1.1 Performance Of Nigerian Agriculture

1.1.1 Historical Perspective:

Agriculture is the most important sector of the Nigerian Economy because it is responsible for providing food for the entire populace. It is needless to state that apart from air, "food" is an inevitable possession in the life of any individual. A man that is deprived of food is invariably deprived of life itself, hence we all need regular supply of food for survival. It is of little wonder that the Food and Agricultural Organization FAO (1998) reaffirmed the right of everyone to have access to safe and nutritious food, consistent with the right to adequate food and the fundamental right of everyone to be free from hunger.

Agriculture plays other important roles, such as; providing job for over 70% of the population; supplying adequate raw materials to a growing industrial sector; constituting a major source of foreign exchange earnings and providing market for the products of the industrial sector. In spite of these role, the growth of the Agricultural sector is nonetheless lower than the 5.0% aggregate growth target for the sector as contained in the 1999 – 2001 National Rolling Plan.

1.1.2 Constraints to Agricultural Production

Agricultural production has been unable to keep pace with the accelerating demands of increasing population and rising incomes. In Nigeria, there is low level capacity for Agriculture to satisfy the food and fibre needs of the country (Oyatoye, 1986). The dwindling trend in agricultural production vis-à-vis population increase can be attributed to shortfall in the supply of fertilizers and other farm inputs such as agro-chemicals, farm tools and implements. The resultant effect of this situation is increased costs of production.

Other constraints of the agricultural sector are, lack of funds for extension services to provide needed services to farmers, reported cases of flooding of lands and destruction of crops, poor implementation, policies and strategies of government, the use of primitive tools for cultivation. Others are small and fragmented farm holdings, mass illiteracy among the rural dwellers and especially the farming population, poor genetic quality of seed and animal stock; and poor pricing policy(Oyatoye, 1986). Consequently, annual food shortages have grown dramatically over the past few decades. To meet the shortfall between domestic production and demand, the government has resorted to massive importation of food. The value of food imports has risen from an annual average of N45 million for the period 1960-65 to an average of N1.3 billion between 1982 and 1984 (Osakwe and Ojo, 1986). Adesimi (1991), asserted that food import bills

continued to rise rapidly until the end of 1985, when the government imposed drastic restrictions on food imports to check the rapid drain on foreign exchange reserves and arrest the mounting burden of foreign debt. A decade later, in 1985, the food import was N88.3 million which rose steadily to ₦102 million and ₦103.4 million in 1988 and 1999 respectively (CBN,2000). Budgetary allocation to agriculture in 1990 was ₦1,966.6 million and rose to ₦7,929.6 million in 1997. The significance of the agricultural sector as the watershed to the development of Nigerian Economy is indisputable. Thus, the major challenges of the Nigerian Economy is self-sufficiency in food production. Equally important was the design of various institutions and projects to remove what was regarded as structural bottlenecks retarding the growth of food production.

Successive governments in the country have embarked on several projects aimed at boosting agricultural production. Some of the important institutions and projects are; River Basin Development Authority (RBDA) 1974, Agricultural Development Projects (ADP) 1974, Agricultural Credit Guarantee Scheme (ACGS) 1978, Green Revolution Programme (GRP) 1980, Directorate of Food, Roads and Rural Infrastructure (DFFRI) 1986. One of the central objectives of these programmes was to spur agricultural production by providing farm inputs in form of subsidy, equipment and storage facilities. But the input programme have generally been inefficiently run and there is evidence that a substantial portion of

subsidies have not been enjoyed by farmers but by middle men (Osakwe and Ojo, 1986).

1.2 Food Crops Industry And The Nigerian Economy

The Food and Agricultural Organization FAO (1998), indicates that 828 million people in developing countries are undernourished for the period 1994-1996. Countries with an inadequate food supply which are generally those with a higher proportion of undernourished people are heavily concentrated in sub-Saharan Africa. In West Africa, despite above – average 1997 harvests in coastal countries, food supply difficulties are reported in several countries.

Nigeria is similarly plagued with food shortages, hunger and undernourishment. Food crop production and consumption are necessary for their high energy and protein content.

1.3 Meaning Of Agricultural Inputs

Agricultural production in Nigeria is still predominantly based on simple farming methods. Hence changes must be made in production methods, and new technologies are increasingly being viewed as the vehicle for solving agricultural problems (Sofranko, 1984). Agricultural input could be considered to be any

material which when applied to agricultural processes result in increased output of food and products for industrial processing.

Agricultural inputs include; high-yielding varieties, agro-chemicals (pesticides, fungicides and herbicides), fertilizers and mechanical inputs.

Agricultural inputs are critical to accelerated self-sufficiency in food production of a nation. The use of modern inputs have been recommended by various agricultural researchers and authorities in increasing farm output in the short-run. Okorie (1984) pointed out that increased food production will involve a judicious use of a new package of complementary inputs, including: biological farm inputs; high-yielding varieties and seedlings; agro-chemical inputs; fertilizers, pesticides, fungicides and herbicides; mechanical farm inputs; equipment, machinery and implements; and improved management practices.

Application of farm inputs can be carried out in almost all facets of agricultural activities such as farm clearing, soil tillage, planting, weed control, soil fertility improvement, control of pests and diseases, harvesting and storage with the resultant effect of increased farm yield. This explains one of the main reasons why the Ondo State Government established the Agricultural Input Supply Project (AISP) as a vehicle to provide greater opportunity for farmer to purchase and use farm inputs and services. Agricultural inputs supply is thus, view as a strategy for a dynamic technical and economic opportunities for farmers to increase their farm

production capacity. It is interesting to note that, in the United States, one factor in the success of Agriculture has been the availability of high quality seeds, agro-chemicals to meet specific needs, and the ability of machinery companies to provide a wide variety of machines, and just as important, spare-parts (Watts, 1984).

Agricultural inputs of concern in this work are, tractor hiring (mechanical inputs), fertilizers, agro-chemicals (insecticides, pesticides and herbicides) and improved crop varieties (seeds/cuttings).

1.4 Problem Statement

Domestic food crop production in Nigeria is not meeting up with demand. While food production grows at a rate of 2.5%, food demand grows at a rate of 3% thus leaving a widening demand-supply gap. Even though more hectarages of land are continuously being put into production, production and productivity continue to be low because of the usage of low yielding inputs for production. Faced with the need to improve total factor productivity and production in the food crop subsector, the various governments in Nigeria had initiated many policies and programmes that could lead to improvement in the food crop subsector. One of such programmes is the establishment of the Ondo State Agricultural input supply

project which ensures that essential Agricultural inputs such as tractor hiring, fertilizer, agrochemicals and improved crop variaties get to the farmers on demand. This study therefore looked at the effects of improved inputs on production of food crops to justify government efforts at improving factor productivity and production through the provision of Agricultural inputs at subsidized rates to farmers on demand.

1.5 Objectives Of The Study

The broad objective of the study was to carry out an economic analysis of effects of improved inputs on the production and productivity of food crops in Ondo State of Nigeria.

The specific objectives are to;

(i) Examine the socio-economic characteristics of the food crops farmers in the study area.

(ii) Examine the profitability of food crop production under Improved input and Non-improved input users in the study area.

(iii) Examine the resource-use efficiency of food crop production under Improved input and Non-improved input users in the study area.

(iv) Investigate the factors influencing adoption of agricultural inputs technologies among respondents.

(v) Make policy recommendations based on findings of the study.

1.6 Justification Of The Study

The study would provide useful information to farmers, policy makers and researchers on the effects of improved inputs on productivity and production of food crops in Ondo State.

1.7 Hypotheses Tested

The following Null Hypotheses were tested:

(i) The use of Improved Inputs for food crop production had no effect on the profitability of food crop production in the study area.

(ii) Resource use efficiency under Improved Inputs Users was in the efficient stage of the production function.

(iii) The farmers socio-economic characteristics had no effect on adoption of Improved Inputs for food crop production.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Agricultural Inputs Supply And Distribution In Nigeria

There is increasing awareness on the use of improved agricultural inputs for increasing crop yields in Nigeria. Nwosu (1995) observed that there is high and rising budgetary commitment to fertilizer procurement, distribution and research. Fertilizer supply in Nigeria is derived from local production and imports. Domestic production is carried out in major fertilizer plants such as National Fertilizer Company of Nigeria (NAFCON), while import is carried out by the Fertilizer Procurement and Distribution Division (FPDD) in the Federal Ministry of Agriculture and Rural Development.

In spite of the increasing awareness on the use of fertilizer in Nigeria, the rate of application per hectare is still very low. The average use of fertilizer per hectare in Nigeria is less than 11 percent of the world's average, (Nwosu, 1995). In addition, Watts (1984) reported that, a response in 1980 in an African nation indicated that if extension recommended use of a certain fertilizer, it would probably take 11 months before the request could be processed and the fertilizer delivered, if it was still available. He affirmed that this type of delay, and inability to provide the input is a serious disincentive for any extension programme. If a recommended

new varieties proves unavailable, or if the variety has different characteristics or poor germination or if they reach the farmers too late for planting will be counter productive to agriculture. The same is true if a recommended pesticide proves sunavailable or of less than standard quality.

Ogunfowora (1993), claimed that the actual imports of fertilizer range between 60-70% of ordered quantities annually and imports usually arrive later than scheduled. He itemized the causes as, scarcity of foreign exchange, untimely and inadequate release of budgetary allocation both leading to funding constraints, bureaucratic bottlenecks in the procedure for opening letters of credit and, unwillingness of suppliers to advance credit to government.

Thus, it should be stressed that low rate of application of agricultural inputs stems more from supply and distribution problems, and problems associated with government policies than from lack of awareness which was a major reason why government stepped into the fertilizer business in the first instance, (Nwosu, 1994).

Aribisala (1983), noted that the factors militating against the use of modern farm inputs in Nigeria lie mainly in the inadequacy and un-timeliness of supplies and distribution of the inputs. He stated that while agro-service centers have been built by the Federal Government for the states to facilitate the acquisition and distribution of these inputs, many of them are not functioning at all or satisfactorily due to shortage of operating funds and of trained technicians to man them.

Aribisala (1983), further claimed that services for the supply and distribution of inputs would be more effectively run by private institutions than when run by government and that as soon as possible such services should be transferred to the private sector. Ogunfowora (1988) noted that there are different policies and programmes designed by the government to ensure that inputs are made available to all categories of farmers in their right quantity, quality, place, time and at affordable prices through an effective and cost effective procurement-distribution and marketing systems. He emphasized that private sector is better suited to the supply and distribution of crop production inputs. The public sector should provide the regulatory framework. Nevertheless, a private sector dominated input supply may lead to a high price which may discourage adoption. Hence efficient sources of procuring credit is imperative for rapid adoption of purchased inputs.

2.2 Importance of Improved Agricultural Inputs

The judicious use of agricultural inputs has been identified to be invaluable to increased food production. The diffusion of agricultural technology in terms of crop and livestock varieties and better agricultural practices have been a major source of growth in agriculture. The development of High-Yielding Varieties (HYV) of rice, wheat and maize in the tropics is perhaps the most dramatic example of transfer of agricultural technology a couple of decades ago. What led

to the development of HYV were researches carried out from reputable agricultural institutes such as, the International Institute for Tropical Agriculture (IITA), Nigeria, and later in the 1970's there were the establishment of the National Seed Service (NSS), National Institute for Horticultural Research (NIHORT) and the Agricultural Development Projects (ADP's).

Ogundugba (1983), citing Vernon-Johnson (1966), noted that when land is over committed to agriculture, productivity of the land could be raised by planting higher yielding varieties of crops, multiple cropping where possible and better spacing. That means, provision of improved seeds by ADP's, and agro-service centers and their adoption by farmers would increase output considerably. Also, Ogundugba (1983), citing Brown (1975), stated that in India where the "Green Revolution" has been effective, wheat production expanded from 11 million metric tons in 1965 to 27 million metric tons in 1972 thereby giving the country an increase in major crop unmatched by any other country in history. Increased output from the use of new varieties will depend on a suitable agro-climatic condition of growing areas, control of pest and diseases, suitable agricultural practices and diffusion of new technologies.

Fertilizer provides adequate supply of the various plant nutrients essential for proper and healthy crop growth. The main nutrient element supplied are nitrogen, phosphate and potash. Fertilizer use has assumed prominence among other

improved agricultural inputs. Fertilizer application is an alternative to bush fallow system of restoring fertility. The use of fertilizer will extend period of time the parcel of land be cropped and reduced the frequency of having to move to a new parcel of land.

In a study conducted by Kwarmwang (1996) in Bauchi State, Nigeria, he recommended nitrogen fertilizer for both fadama soils and boron fertilization for all fadama soil in order to obtain maximum yield of crops.

It is of interest that researchers and stake-holders in agriculture have observed that agricultural development requires modernization of farm activities of subsistence agriculture by way of farm mechanization-Farm mechanization can be described as the application of machines and modern implements in carrying out agricultural activities. Food and Agricultural Organization (FAO, 1998) observed that in an attempt to increase agricultural productivity in Less Developed Countries (LDC's), tractor cultivation has been introduced to replace draft animals or land hoes. However, there is the contention that a precise assessment of the effects of agricultural mechanization on yield and employment is not possible because the necessary farm-level information is scarce and difficult to isolate.

Abercombie (1973), a Latin American researcher, concluded that what is important in operational terms is to determine the overall technological package that will enable production targets to be met and at the same time provide as much

employment as is feasible. He further observed that the direct effect of tractor use on yields per hectare have been much less than the effects of other yield-enhancing practices such as the use of improved seeds, fertilizer, pesticides, herbicides and water control.

Okigbo and Lai (1978), in a study conducted in the tropics showed that there has been a decline in soil fertility and a deterioration in soil conditions as a result of continuous tractor cultivation. In a study by Ishuza (1991) on the economic assessment of tractor use in Tanzania, he submitted that the several attempts at improving agricultural productivity by the provision of tractors to areas traditionally cultivated by land hoe had not achieved the desired result. Experience from past failure and the urgent need for increased agricultural output led the Tanzania government in 1985 to organize a tractor pilot project in Marogoro region. He conducted a survey on a total of 47 farmers who used tractor for land preparation and 32 farmers who relied on hand hoes. Most farmers in the two categories did not use fertilizer or insecticides. He observed that no statistically significant difference in maize yields per hectare was found between households that did and did not use tractors for the 1986 – 87 season. However, 57% of the surveyed farmers who used tractors reported that they did not receive tractor services in time to meet optimal planting schedule, and other indications of poor tractor services in time to meet optimal planting schedule, and other indications of

poor tractor management were detected. He suggested that essential inputs such as fertilizer and insecticides need to be made available on a timely and affordable basis. Extension agent must assist farmers to maintain proper crops husbandry practices.

In Nigeria, there is a shortage of farm labour, especially during the peak period of farm operations, perhaps due to rural-urban migration, drudgery and the associated demand for labour in non-farm enterprises such as craft-work, petty trading and so on (Akinola, 1987). Consequently, the government initiated "Tractor Hire Service Scheme" which facilitated timely completion of farm operations such as ploughing, harrowing and ridging. However, there is no sustained progress as Akinola (1987) observed that farm machinery procurement and distribution is import dependent this make them expensive and put off private sector participation. That is, the private sector considers that the financial risks involved in importing, stocking, and selling agricultural inputs are too great to attract them into full-scale business.

For improvement in agricultural development through mechanization, Folayan (1980) suggested that the land tenure system in Nigeria should be defined through aggregation of small and scattered holding into fairly large farms. Also the traditional hoe and cutlass should be replaced by mechanical system – initially laying emphasis on the application of small mechanical powered machines. Other

factor that could enhance mechanization is the establishment of mobile and central repair workshops, generous farm credit, subsidy and import tax rebate policies on agricultural machinery.

2.3 Resource – Use Efficiency

The basic goal of any producer is to maximize profit. It is on this premise that various forms of resource allocation efficiency can be adequately measured and tested. Thus, an important issue in food crop production is the tendency to find out whether there is economic efficiency of production. This prompted Imoudu (1995) to ask the question, is the Nigeria farmer an efficient food producer? He was of the view that the answer to this question should serve as a useful basis for identifying needs for adjustment in resource allocation by these farmers. Efficiency in food crops production assumes the optimum combination of and use of resources. Ayanwale (1995) observed that, any plan to achieve this optimality goal will require a thorough knowledge of the resource-use patterns as well as an assessment of the productivities of resources. Such a knowledge will assist policy makers and prospective investors in detecting the possibilities of increasing the level of production by knowing the direction of adjustments in resource use. The analysis of the production function and its three stages have provided very useful means of studying the resource use efficiency of factors

involved in agricultural production. The use of marginal productivity (MP) and the elasticity of production in determining efficiency of resource-use result in distinguishing the three stages of production function.

Assuming a one product-one input production function of the form,'

Stage I: This is the stage of increasing marginal productivity. This stage is considered "irrational" since fixed and variable inputs are increasing in efficiency.

Stage II: This is the stage of diminishing marginal productivity; it is the "rational" zone since optimum efficiency of production (resource-use) is being approached.

Stage III: This is the stage of negative marginal productivity; it is an "Irrational" stage of production because an additional unit of the variable gives smaller total product and negative marginal product.

To test the allocative efficiency of agricultural resources, Adeniyi (1988) suggested we compared the marginal value products (MVP) of each resource with its corresponding price. There is allocative efficiency when MVP equates the unit price of input in question, that is

$MVP_{xi} = P_{xi}$.

When more than one inputs are involved, allocative efficiency is when the ratio of MVP_{xi} and P_{xi}, equals each of the ratios of MVPs and the prices of the inputs (Doll and Orazen, 1978), that is,

$$\frac{MVP_{x1}}{P_{x1}} = \frac{MVP_{x2}}{P_{x2}} = \frac{MVP_{x3}}{P_{x3}} = \frac{MVP_{xn}}{P_{xn}} \quad \ldots\ldots\ldots\ldots\ldots\ldots \text{Eq. 1}$$

An examination of resource-use will indicate whether or not resource adjustment is necessary for the purpose of increasing revenue (output) per unit. If resources are inefficiently allocated resources reallocation will increase output. On the other hand, if resources are efficiently allocated, the output can be increased not by resource adjustment but by other resources such as management skill of the farmers or reducing the technical inefficiency effects in production (Ojo, 2000).

Thus, the ratio of MVP to unit factor cost provides a measure of resource-use efficiency prevailing on the average in any population of producers (farmers). If the ratio is less than one, it indicates that too much of the particular resource is being used, there is negative decreasing returns to scale and to get back to the point of economic optimum less of the resource should be used. If the ratio is greater than one , it shows that too little of a resource is being used and there is increasing returns to scale. To get to point of economic optimum more if it should be used. If the ratio is equal to one, the resource is efficiently utilized (optimum).

Related studies include that of Ogunfowora, et al (1974) who evaluated the efficiency with which Kwara State farmers used their resources in crop production activities. They surveyed 250 randomly selected farmers, and found that the marginal value product of labour and seed were lower than their prices, indicating excessive use of these resources. Oludimu (1982) in his study of resource-use productivity and efficiency of the bread industry in two states (Cross River and

Ogun States) of Nigeria discovered that the ratio of the MVP to unit factor cost showed that too much of capital stock was in use during the period of study. Imoudu (1995) in his study on resource use efficiency on small-scale food crop farms in Ondo State, found that the average sampled farms exhibited inefficiencies in resource use. Land as a resource was underutilized, while there was excessive use of hired labour and capital inputs were also underutilized.

2.4 Adoption Studies In Agricultural Input Technologies

The untiring quest for increasing food production has resulted in the development of new materials, ideas and practices (innovations), which are brought to farmers. The acceptance of a new idea is a complex process (Williams et al, 1984). It involves "diffusions" which is the process by which an innovation spreads and the "diffusion process" as the spread of new idea from its source of invention or creation to its ultimate users or adopters (Ekong, 1988). He defined adoption as a decision to continue full use of an innovation. While Williams et al (1984) explained adoption as the decision of the receiver to make use of the innovation provided it is economically profitable, socially desirable and technologically feasible for him to adopt it. Innovation is a new idea or practice which have been generated and passed down and finally accepted by an adopter (Ekong, 1988). A gap usually exist where the adopter (farmer) will first

proceed through decision making concerning the new technology or innovation. The period of decision-making is a process, otherwise referred to as adoption process. Adoption process per-se is the mental process, which an individual goes through from the time he hears of the new idea and is finally accepted by him (Williams et al, 1984).

Time is an important consideration in adoption. This brings about the concept of adoption rate which is said to be the relative speed with which an innovation is adopted by members of a social system. Njoku (1991) defined adoption rate as the number of farmers using the technology as a percentage of the total number of surveyed farmers. There is a growing literature on the diffusion and adoption of innovations particularly in the field of Agriculture.

Adoption and diffusion are found in studies such as Falusi (1974), Abalu and Yayock (1980), Daramola (1989), Lie Wellyn et al (2001).

Using the Tobit model, Akinola and Young (1985) in their work on analysis of agricultural innovation adoption process, observed that income, size of the regular family force, experience, the input allocation, age and distance of input buying stations affects cocoa spraying chemicals used among the Nigerian coca farmers. The results suggest that the wealthier and younger cocoa farmers are more likely to adopt cocoa spraying chemicals but the availability of the innovation to individual producer is also a significant influence on adoption behaviour.

Daramola (1989) in a study of socio-economic factors influencing fertilizer adoption decisions in Nigeria; discovered that infrastructural factors such as irrigation, storage facilities, accessible input and product markets, distance and institutional factors such as input delivery system, availability of formal credit and extension service, play significant roles in adoption decision of farmers. Equally important are economic factors such as farmsize, farm income, off-farm income, credit available and market surplus. Lapar and Pandey (1999) studied the adoption of soil conservation in the Philippines. They contend that although several soil conservation technologies have been developed and promoted, their adoption of contour hedgerows by upland farmers in the Philippines was conducted to identify the factors that determine adoption. Using probit model, adoption was found to be significantly influenced by the age of household head, ownership of the land, slope, level of education, membership in "Alayon" (cooperative society) and market access. The high cost of establishment, maintenance and the loss of land to hedgerows were considered to be the major constraints to adoption by non-adopters. Studies for an appropriate theoretical framework with which to explain factors that determines the adoption decisions of farmers is in the continuum.

To study the adoption behaviour, limited dependent variable model provides a good framework, and for that, Probit, Tobit and Logit models are found appropriate and used (Shiyani et al. 2001).

In this study, the probit model was used in line with studies by Daramola (1989) and Lapar and Pandey (1999).

In the probit model, the dependent variable is in the form of a dummy variable which takes a value zero if the producer does not adopt the innovation and a value of unity if adoption takes place. The critical level at which adoption takes place will vary from one producer to another (Akinola and Young 1985).

Let Pi represent the probability of adoption of an innovation, and X_j to represent the set of socio-economic factors which influence adoption decisions of the farmer.

The probit model is defined by this equation;

$$Pi = f(Xj^1\beta) = \int_{-\infty}^{xi\beta} f(z)dz \quad \text{..... Eq. 2}$$

Where,

i = 1, 2, 3 ..... n denotes the number of respondents.

Pi = probability of adoption

Xj = a vector of socio-economic factors,

j = 1, 2, ... 7 number of socio-economic factors

$f(Xj^1\beta) = f(z)$ = standard normal density

$F(Xj^1\beta)$ = cumulative standard normal density

The log of the likelihood function of the probit model is given as:

$$\ln L = \sum_{J=1} yi \ln [F(Xj^1\beta) + (1 - yi) \ln [1 - f(Xj^1\beta)] \quad \text{.....Eq.3}$$

The derivative of this is presented as;

$$\delta \ln L = \sum_{J=1} \frac{y_i [F(X_j^1\beta)}{f(X_j^1\beta)} + (1 - y_i), \frac{f(X_j^1\beta)X_j}{f(X_j^1\beta)} \quad \text{.....Eq.4}$$

Setting this derivative equal to zero yields the equation for the maximum likelihood estimator. The estimator is usually obtained by the Newton Raphson interactive procedure. The procedure necessarily converges to the maximum regardless of the initial starting estimate of β.

Given the function $X_j^1\beta$, the probability that the standard normal random variable is less than or equal to $X_j^1\beta$, is given by $f(X_j^1\beta)$,

Since $P = f(X_j^1\beta)$, then for a given x, the probability that the individual belonged to the Y=1 category is given by $F(X_j^1\beta)$

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 Study Area

The study was carried out in Ondo State of Nigeria. The State lies within the tropical region. The state was carved out of the former Ondo State on 1st October, 1996, with Akure as the state capital. Presently, there are 18 local government areas in the state. Ondo State people are predominantly Yorubas and can be broadly put into the following dialectical groups; Akokos, Owos, Ondos, Ikales, Akures, Ijaw- Arogbo and Ijaw-Apoi. The population census of 1991 showed Ondo State to be approximately 2,255,713. The state covers a land area of 14,769.71 square kilometers, (Ondo State of Nigeria, 1998).

Common crops grown in the state include yam, cassava, maize, cowpea, cocoyam, cocoa, oil palm, citrus, mango and kola. Economic trees produced include Iroko, Mahogany, Gmelina, obeche, apa etc. Food crop farming is characterized by fragmented holding with the use of simple farm implements like hoes and cutlasses to till the land. Crops are produced mainly by mixed cropping. The major government institutions involved in agricultural inputs supply is the Ondo state Agricultural Input Supply Project. There are private concerned with input supply, such as, Novatis Limited, SARO agro-chemical Limited. Chemicals

and Allied Products Limited (CAPL) and so on. Ondo state is noted for abundant presence of mineral resources which include; petroleum and Bitumen.

3.2 Data Sources and Collection

Primary and secondary data were used in this study. Primary data were obtained through a farm survey of the area with the aid of well-structured questionnaire . Data were sought under two categories of farmers; Improved Input Users and Non-Improved Input Users. The questionnaire was administered by the researcher and some extension agents of the Ondo State Agricultural Development Project (ODSADEP) who were residents in the respective local government areas. The Secondary data were obtained from periodical reported and other publication of researchers and authors.

3.3 Sampling Procedure And Sample Size

The sampling technique used was multistage sampling technique. The first stage involved the purposive selection of five local government areas from the 18 local government areas of Ondo state to reflect the two agro-ecological zones of the state. The selected local government areas are well known for abundant food crop production in Ondo State.

In each local government area, five villages/towns were randomly picked for survey. Lastly, farmers were sampled using random sampling technique by casting lot. The sample for the study consisted of 100 farmers that were involved in the purchase and use of improved farm inputs (Improved Input Users) with particular reference to inputs such as tractor hiring, fertilizer and agro-chemicals. Another sample of 100 farmers who neither purchased nor used improved farm inputs (Non-Improved Input Users) for food crops production was studied. A total sample of 200 farmers were obtained out of which 197 returned the data that were processed. Table 3.2 shows the detail of questionnaire administration.

Table 3.2 Questionnaire Administration

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LGA	Improved Input Users	Non Improved Input Users	Total
Akoko South-West	20	20	40
Akoko North-East	20	20	40
Akure North	20	20	40
Ondo East	20	20	40
Ile-Oluji/ Okeigbo	20	20	40
Total	100	100	200

3.4 Methods Of Data Analysis

The statistical tool used to analyze the socio-economic characteristics of the farmers was the descriptive statistics which included; means, percentages, frequency distribution and charts.

Gross margin analysis was seed to evaluate the profitability of food crop production of farmers in the study area. It is usually calculated by deducting the Total Variable Costs from the Value of Output. In this study, the variable costs were taken to be expenses incurred by the farmers on tractor hiring, fertilizer, agro-chemicals, depreciation value, labour and maintenance/repairs.

The model used is indicated below;

GM = TR - TVC

Where,

GM = Mean Gross Margin

TR = Mean Total Revenue

TVC = Mean Total variable cost

The advantages of gross margin analysis aside from its use in identifying weakness in farm organization, can also be used to compare the farmer's current level of productivity with attainable potentials at the micro and macro levels (Ada-Okungbowa ,1992)

The Production Function Analysis was employed by using the Ordinary Least Square (O.L.S.) estimation regression techniques to examine the productivity of resource use by food crops farmers in the study area.

Two models were developed for this analysis.

Model 1 shows the relationship between farm revenue (Q_1) in naira (₦) obtained by IMPROVED INPUT USERS and some independent variables.

This statement can be presented functionally in the implicit form as:

$$Q_1 = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8 \ldots\ldots U) \ldots\ldots\ldots\ldots \text{Eq. 6}$$

Where

Q_1 = Farm revenue in naira (₦)

X_1 = Tractor hiring cost in naira

X_2 = Fertilizer cost in naira

X_3 = Agro-chemicals cost in naira

X_4 = Cost of seeds/cuttings

X_5 = Farm size in hectare

X_6 = Depreciation value of equipment using straight line method

X_7 = Family labour mandays

X_8 = Hired labour in mandays

U = Error term

Model II shows the relationship between farm revenue (Q_2) in naira obtained by NON-IMPROVED INPUT USERS, and the independent variables.

This can be presented implicitly as:

$$Q_2 = f(X_1, X_2, X_3, X_4, X_5, \ldots\ldots U) \ldots\ldots\ldots\ldots \text{Eq. 7}$$

Where

Q_2 = Farm revenue in naira

X_1 = Cost of seeds/cuttings

X_2 = Farm size in hectare

X_3 = Depreciation value in naira

X_4 = Family labour in mandays

X_5 = Hired labour in mandays

U = Error term It is assumed to be normally distributed with a zero mean and constant variance

Estimation Procedure

The data collected were fitted to three functional forms, linear, semi-log and double-log that is;

Model I

Linear function:

$$Q_1 = a_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + b_8X_8 \quad \text{Eq.9}$$

Semi –log function:

$Q_1 = a_0 + b_1\log X_1 + b_2\log X_2 + \ldots b_3\log X_3 + b_4\log X_4 + b_5\log X_5 + b_6\log X_6 + b_7\log X_7 + b_8\log X_8$.....Eq. 10

Double – log (Cobb-Douglas) function;

$\text{Log } Q_1 = a_0 + b_1\log X_1 + b_2\log X_2 + b_3\log X_3 + b_4\log X_4 + b_5\log X_5 + b_6\log X_6 + b_7\log X_7 + b_8\log X_8$ ----------Eq. 11

Model II

Linear functions:

$Q_2 = a_0 + C_1X_1 + C_2X_2 + C_3X_3 + C_4X_4 + C_5X_5$. ..... Eq. 12

Semi-log function:

$Q_2 = a_0 + C_1\log X_1 + C_2\log X_2 + C_3\log X_3 + C_4\log X_4 + C_5\log X_5$ Eq.13

Double –log (Cobb-Douglas) Function:

$\text{Log } Q_2 = \text{Log } a_0 + C_1\log X_1 + C_2\log X_2 + C_3\log X_3 + C_4\log X_4 + C_5\log X_5$ Eq.14

Where: a_0 is the intercept, and represents level of output (revenue) at zero input level, while b_1-b_8 and C_1 — C_5 are the regression coefficients of the independent variables for model I and Model II respectively. The lead equations were selected on the basis of magnitude of Coefficient of Multiple Determination, smallness of standard error of overall model and number of significant independent variables.

The probit analysis was used to examine the adoption decisions of farmers. The Probit analysis is defined by this equation.

$$Pi = f(Xj^{1}\beta) = \int_{-\infty}^{Xi\beta} f(z)dz \quad \text{.....Eq.15}$$

Where,

i = 1,2,3..... 197 denotes the number of respondents.

Pi = Probability of adoption of ith respondents

Xi = A vector of socio-economic variable.

j = Number of socio-economic variables; j = 1 ... 7; and for this study,

X_1 = Age of farmers in years

X_2 = Farm-size in hectares

X_3 = Farmer's educational qualification

X_4 = Farm income in naira (N)

X_5 = Family labour in mandays.

X_6 = Hired labour in mandays

X_7 = Household size

F (Xjβ) = F (z) = standard normal density

F (Xjβ) = cumulative standard normal density

3.5 Definition Of Variables In The Empirical Model

(a) Output

This is the value of the output of the farm, otherwise referred to as farm revenue. The monetary value was used because of lack of uniform measurements among the crop enterprises.

Farm income is expected to have positive influence on adoption of new innovations. This is expected because the adoption of an innovation will enhance the profitability of the farm enterprise resulting in increase farm income. Daramola (1989) found positive relationship between adoption and farm income

(b) Tractor hiring:

This is the use of tractor coupled with implements for land clearing. Tractor is hired per operation per hectare, though the Agricultural Development Project advised that tractor should not work more than 2 hectares in a day because of the injector which may be overheated.

(c) Fertilizer:

This was measured in kilograms (Kg).

(d) Agro-chemicals:

These include pesticides, fungicides, seed dressing chemicals and herbicides. They are measured in naira value per litre.

(e) Seeds and cuttings:

These are improved planting materials. Seeds and cuttings are valued in naira. A bundle (30long sticks) of cassava will give 200 cuttings at ₦250.00 per bundle.

(f) Farm size:

This is the area of land cultivated for food crop production. It was measured in hectare. This variable had been shown to influence adoption behavior positively (Akintola, 1987, Njoku 1991), because the owner of a larger farm usually has a higher capital base and, thus can pay for the improved inputs required by a new technology.

(g) Depreciation value

This is permanent decrease in the value of an item (e.g. cutlass, knapsack sprayer, file, etc.) overtime.

$$\text{Depreciation} = \frac{\text{Quantity x Unit cost} - \text{scrap value}}{\text{Life span}} \quad \ldots\ldots\ldots \text{Eq.16}$$

(h) Family and hired Labour

: This is the labour service rendered during production season, measured in mandays. The labour hours of children were converted to manday equivalent using Norman's conversion ratio i.e. One child-day equals half a manday where eight hours of man work equals one manday (Normal, 1993). Labour is expected to have

a negative or positive sign as the case may be. Njoku (1991) observed that labour cost are usually higher than costs for other inputs, this raise cost of production significantly

(i) Age:

The effect of age of the farmer on adoption decision can be taken as a composite of the effect of farming experience and planning horizon. While longer farming experience as equated with older farmers is expected to have a positive effect on adoption, younger farmers, on the other hand, may have longer planning horizons and hence, may be more likely to invest in conservation. The net effect on adoption therefore, could not be determined a priori (Lapar and Pandey, 1999). Nevertheless, the expected relationship is positive.

(j) Farmers Education:-

Studies have shown that the level of education of the farmer is positively related with the adoption of improved varieties as it provides an opportunity for individual to acquire knowledge about new varieties. Shiyani, et al (2002) found positive relationship between education and the adoption of the improved cheakpea varieties in Gujarat region of India. Thus the variable is expected to have a positive sign.

(k) Household size :

This variable is expected to have a positive sign. Where an increased number of family members are engaged in farm operations particularly on full-time basis, farm input technologies are more likely to be adopted.

CHAPTER FOUR

4.0 RESULT AND DICUSSION

4.1 Socio - Economic Characteristics Of The Food Crops Farmers

4.1.1 Age Distribution of Sampled Farmers

The age distribution of sampled farmers in the study area is presented in Table 4.1. The result of the analysis showed that more than 60% of the farmers were more than 50 years while only about 40% belonged to the productive age of 30 — 49 years. Hence food crop production was dominated by old farmers. This would have negative impact on farmers' productive capacity and adoption of new innovations or technologies. Ojo (2000), observed that age has negative influence on technical efficiency as older farmers tend to be risk averse and shy away from adopting new technologies and innovations.

Table 4.1:. Age distribution of farmers

Age	Improved Input Users		Non-improved Input Users		Total	
	Frequency	%	Frequency	%	Frequency	%
30-39	8	8.09	11	11.22	19	9.64
40-49	32	32.32	25	25.51	57	28.93
50-59	33	33.33	32	32.65	65	33.00
60-69	25	25.25	28	28.57	53	26.9
≥ 70	1	1.01	2	2.04	3	1.53
Total	99	100	98	100	197	100

4.1.2 Sex and Household Size Distribution of Respondents

The sex and household distributions of the respondents are presented in Table 4.2. The result showed that of the total population of sampled farmers, both Improved input users and Non-improved input users, 165 (83.76%) were males while 32 (16.24%) were females. Thus, majority of the farmers were males. Females were few because farm operations tend to be tedious for them. This agrees with Abayomi, (2001) that men are more fitted for most farm operations than women, while the women play major roles in the harvesting and marketing of agricultural products. The result further revealed that about 78.20% of the

respondents had household size of between 6 and above 20 persons. This implies that farmers in the study area had large household size, which will enhance regular supply of family labour. Family labour is cheap to supply and less costly than hired labour. Household size is very important to farmers in Nigeria because availability of family labour for farm operations depends to a large extend on the size of the household.

Table 4.2: Sex And Household Size Distribution Of Respondents

	Improved Input Users		Non-improved Input Users		Total	
	Frequency	%	Frequency	%	Frequency	%
Sex						
Male	86	86.87	79	80.61	165	83.76
Female	13	13.13	19	19.39	32	16.24
Total	99	100	98	100	197	100
Household size						
1-5	15	15.15	28	28.57	43.	21.83
6-10	62	62.63	51	52.04	113	57.36
11-15	17	17.17	12	12.25	29	14.72
16-20	3	3.03	5	5.10	8	4.06
-20	2	2.02	2	2.04	4	2.03
Total	99	100	98	100	197	100

4.1.3 Educational Level, Farm Distance and Ranking of Food Crops Enterprise of Respondents

The Educational Level, Farm Distance and Ranking of Food Crops of the respondents are presented in Table 4.3. The result revealed that over.60% of the sampled farmers attended only primary school or had no formal education. There were about 27.41% with secondary school education, while 11.16% had tertiary education. These findings revealed that educational status of the farmer in the study area was generally low, that implies that they would not easily adopt new technologies. It was observed that there were more educated farmers who were Improved input users, whereas the Non-improved input users were less educated. Among the former category of farmers, about 15.15% attended tertiary education, while 7.14% of the latter had tertiary education. This is indicative that the more educated a farmer is, the higher would be his ability to understand and evaluate information and the tendency to make use of new ideas and innovations. Education also enhances the managerial skills of farmers

From the result of the analysis, it was observed that majority of the sampled farmers about 89.94% traveled between 1- 10km to their farm location; while others, about 10.16% traveled 11 -21km. This suggests that some farmers would trek while some would be motorized. Trekking though cheaper could result into

thereby lowering farm labour efficiency. Being motorized however might impose more cost on the farmers.

Furthermore, Table 4.3 shows that majority of farmers about 40.10% in the study area were producers of cassava, This is closely followed by maize production with about 37.56% of farmers cultivating maize as major crop. While cocoyam ranked least about 2.03%. Cassava seems to be more popular than other arable crops probably because cassava farm is easy to manage and less prone to failure and so on. Cassava is not only a staple crop in Nigeria, it is now an export crop to earn foreign exchange. It was observed that cocoyam is least cultivated perhaps because the crop is not a popular staple to the average and high-income earners. This class of people prefer to eat yam which is more palatable when eaten boiled or pounded. But rice production is low with only 5.08% of respondents cultivating it. An appreciable cultivation of rice requires large expanse of land, however the researcher observed that some of the sampled farmers engaged in cocoa production in plantation. This might reduce their interest of producing rice.

Table 4.3: Level of Education, Farm Distance and Food Crops Enterprises Of Respondents

	Improved Input Users		Non-improved Input Users		Total	
	Frequency	%	Frequency	%	Frequency	%
Educational level						
No formal	17	17.17	30	30.62	47	23.86
Primary	36	36.36	38	38.77	74	37.56
Secondary	31	31.32	23	23.47	54	27.41
University	9	9.09	5	5.1	14	7.11
NCE,ND,HND	6	6.06	2	2.04	8	4.06
Total	99	100	98	100	197	100
Farm Distance						
1-5	43	43.44	80	81.63	123	62.43
6-10	40	40.40	17	14.29	54	27.41
11-15	12	12.12	2	2.04	14	7.11
16-20	3	3.03	1	1.02	4	2.03
≥21	1	1.01	1	1.02	2	1.02
Total	99	100	98	100	197	100
Food Crop Enterprises						
Cassava	38	38.38	41	41.84	79	10.10
Yam	12	12.12	18	18.37	30	15.23
Maize	41	41.42	33	33.67	74	37.56
Rice	7	7.07	3	3.06	10	5.08
Cocoyam	1	1.01	3	3.06	4	2.03
Total	99	100	98	100	197	100

4.1.4. Farm-size and Source of Finance of Respondents

The farm-size and Source of Finance distributions of the farmers are presented in Table 4.4. The average farm-size of the farmers was 2.04 hectares and 1.35 hectares for Improved input users and Non-improved input users respectively. Those with less than 5.0 hectares constituted the modal class accounting for almost 98% of the respondents. This implies that majority of the farmers were small-scaled. This agree with Olayide's (1980) classification of farmers. Only 4 of the Improved input users owned farm-size of between 5.00-9.99 hectares, indicating that they were medium-scaled farmers. On the whole, none of the farmers had up to 10 hectares of land.

Also Table 4.4: reveals that about 55.33% of farmers had more than one sources of finance. Those that obtained financial resources from personal savings were about 36.04%.

However, none of the farmers obtained loan from the banks, this may be due to lack of collateral security by farmers, long and cumbersome procedure of obtaining loan from the bank and high interest rate on bank loans.

Table 4.4 Farm-size and Source of Finance of Respondents

	Improved Input Users		Non-improved Input Users		Total	
	Frequency	%	Frequency	%	Frequency	%
Farm-size						
< 5.00	95	95.96	98	100	193	97.97
5-9.99	4	4.04	0	0	4	2.03
Total	99	100	98	100	197	100
Source of Finance						
Personal saving	31	31.31	40	40.82	71	36.04
Money lender	1	1.01	2	2.04	3	1.52
Cooperatives	8	8.08	4	4.08	12	6.09
Friends/Relatives	2	2.02	0	0	2	1.02
> One Sources	57	57.58	52	53.06	109	55.33
Total	**99**	**100**	**98**	**100**	**197**	**100**

4.1.5 Extension Agents Visit and Factors Limiting Increased Production

The Extension Agents Visit and Factors Limiting Increased Production are presented in Table 4.5. It was revealed in Table 4.5 that about 52.53% of the

Improved input users were visited by Extension Agents of the Agricultural Development Project (ADP), while only 23.47% of the Non-improved input users were visited. This indicates that the extension agent pay more visits to the Improved input users in order to introduce and supervise the use of new technologies. It was observed that majority about 61.93% of the sampled farmers were not visited by the extension agents. This would deprive farmers of new technologies which will boost increased food production and standard of living of farmers.

The most noticeable factor limiting increased production of food crops in the study area was inadequate capital. As shown in Table 4.5, about 65.48% of the farmers were constrained by inadequate capital. This implies that respondents were resource poor . Other limiting factors that were observed include high cost of labour, high cost of input, and inadequate farmland.

Availability of capital would enhance food production capacity of farmers by reinforcing their capacity to purchase input factors. Thus the horizon of food crops production would be enlarged.

Table 4.5 Extension Agents Visit and Factors Limiting Increased Production

	Improved Input Users		Non-improved Input Users		Total	
	Frequency	%	Frequency	%	Frequency	%
Extension Visits						
Yes	52	52.53	23	23.47	75	38.07
No	47	47.47	75	76.53	122	62.93
Total	99	100	98	100	197	100
Factors limiting Production						
Capital	55	55.56	74	74.76	129	65.48
cost of labour	20	20.20	18	18.18	38	19.29
Price fluctuation	1	1.01	0	0	1	0.51
Cost of Inputs	14	14.1	0	0	14	7.11
farmland	9	9.09	6	6.06	15	7.61
Total	**99**	**100**	**98**	**100**	**197**	**100**

4.2. PROFITABILITY ANALYSIS

The profitability analysis of food crops production under Improved Inputs and Non-improved Inputs Users is presented in Table 4.6. The important cost items include seeds/cutting cost, that is, cost of planting materials, labour cost, Improved inputs cost which include cost of tractor hiring, fertilizers and agro-chemicals costs. Other cost elements are operating expenses and annual depreciation value.

The mean Total Variable Cost (TVC) and Total Cost (TC) for the Improved Inputs Users were higher at 5% level of significance than that of Non-Improved Inputs Users. The mean Total Revenue of the Improved Inputs Users was higher at 5% level of significance than that of the Non-Improved Inputs Users.

The profitability analysis showed that food crop production was more profitable under the Improved Inputs Users than that of Non-Improved Inputs Users. This was confirmed by the very large Gross Margin per hectare and Net Profit per hectare respectively, that were different from those of Non-Improved Inputs Users. The implication of the profitability analysis is that adoption of Improved Inputs for food crop production would lead to significant increase in food crop output as well as Net Profit and Gross Margin per hectare respectively.

Table 4.6 Profitability Analysis

Variable	Improved Inputs Users	Non-Improved Inputs Users
Farm size	2.04	1.35
Seeds/cuttings	2617.26	1290.00
Labour Cost	5174.75	3116.33
Improved Inputs Cost	4230.46	-
Operating Cost	633.21	189.80
TVC	12655.60	4596.13
Depreciation	927.68	384.18
Total Cost	13583.36	4980.31
Total Revenue	96891.45	29067.55
Gross Margin	84235.85	244171.42
Net Profit	83308.09	24087.24
GM/ha	41292.08	18126.98
NP/ha	40837.30	17842.40

4.3 PRODUCTION FUNCTION ANALYSIS

4.3.1 Econometric Analysis:-

The estimates of the production function analysis for the improved and non improved inputs users farmers are presented in Tables 4.7 and 4.8 respectively. The selected lead equation for each category of farmers was the Cobb-Douglas(double log) for having the largest values of coefficients of multiple determinant(R^2) that were significant at 5% level of significance and for having the largest number of significant estimated coefficients of variables at 5% level of significance. The coefficients of multiple determination of 0.875 and 0.891 for improved and non improved inputs user farmers respectively indicate that about 87.5% and 89.1% variations in the outputs of improved and non improved inputs user farmers respectively were explained by the variations in the included variable inputs of each model.

Each of the estimated R^2 values was large and significant at 5% level of significance with each model having more than three of the variables having significant estimated coefficients. All these imply that the selected functional form fitted the data collected quite well, and thus the estimates from the lead equations were used for further economic analysis.

4.3.2 Economic Analysis

(a) Signs of estimated coefficients

For the improved inputs users, the coefficients of tractor hiring, fertilizer, seeds/cutting, farm size, depreciation, family labour and hired labour had positive sign. This implies that if each of these variables was increased by unity, the value of farm output would increase by the value of coefficient of variable under consideration. The coefficient of Agro-chemicals had negative sign implying that if more agro-chemical was used, the value of farm output would decrease.

For the non improved inputs users, the coefficients of farm size, family labour and hired labour were positive while that of seeds/cuttings and depreciation value were negative. The implication of these signs is that while the use of more of farmsize, family and hired labour increased the value of farm output, increased use of seeds/cutting and fixed inputs would lead to decrease in the value of farm output.

(b) Productivity analysis

The estimated coefficients of the production function models of improved and non improved inputs users were also used as direct estimates of the elasticities of production of the variables. This is one of the uniqueness of Cobb-Douglas functional form that the estimated coefficients also double as the elasticities of production for the independent variables.

For the improved inputs users, the elasticities of production of tractor hiring, fertilizer, seeds/cutting, farm size, depreciation value, family and hired labour were each less than unity but greater than zero. This implies that their use was each a decreasing but positive returns to each factor and the use was in stage II of production function and thus efficiently allocated. The elasticity of production of agrochemical was a negative decreasing returns to the factor and thus its use was in the irrational zone(stage III) of the production function and thus inefficiently allocated.

The Returns to Scale(RTS) which is the summation of elasticities of production for the improved inputs users was 1.31. The RTS was greater than unity, implying that improved inputs users were operating in the increasing returns to scale region of the production function. Thus, farm production by the improved inputs users was in the inefficient region. To bring production to the efficient stage, the use of those factors with negative elasticities of production have to be reduced. Also, production under improved inputs users could be expanded by using more of those factors with positive decreasing elasticities of production.

For the non-improved Inputs Users, the elasticities of production of farm-size, family and hired labour were each less than unity but greater than zero. This implies that the use of these factors was in stage II of the production function and therefore efficiently allocated. The elasticities of production of seeds/cuttings and

depreciation value were in the negative decreasing return to the factors, that is, their use was in the irrational zone of the production function and thus they were inefficiently allocated. The RTS for the Non-improved Inputs Users was 0.68. It was between zero and unity. Production under this category was in the rational zone or efficient stage of the production function. Farm output would increase with continued usage of those inputs with positive decreasing marginal returns at the present level of usage while reducing the quantities of those inputs with negative marginal returns.

Table 4.7: Summary of Production Function Estimates of Improved Input Users

Variable	Coefficient	t-ratio
Constant	0.383	0.209
Tractor hiring	0.213*	3.152
Fertilizer	0.236*	3.471
Agro-chemicals	-0.047	-0.857
Seeds/cutting	0.152*	2.810
Farm-size	0.090	1.416
Depreciation value	0.059	0.933
Family labour	0.434*	3.601
Hired labour	0.174	1.250
Coefficient of Multiple Determination (R^2)	0.875*	
Adjusted R^2	0.862*	
Standard Error	0.1793	
F-Value	13.582	

*Estimate is significant at 5% level of significance

Table 4.8: Summary of Production Function Estimates of Non-Improved Input Users

Variable	Coefficient	t-ratio
Constant	6.746	8.587
Seeds/cutting	- 0.021	- 0.298
Farm-size	0.240*	3.200
Depreciation value	-0.022	-0.338
Family labour	0.160*	3.542
Hired labour	0.310*	4.825
Coefficient of Multiple Determination (R^2)	0.891	
Adjusted R^2	0.880	
Standard Error	0.199	
F-Value	28.064	

* Estimate is significant at 5% level of significance

4.4 EMPIRICAL RESULTS OF THE PROBIT MODEL

Out of the 197 farmers sampled, 110 were categorized as adopters while; the remaining 87 were categorized as non-adopters. A farmer who used tractor hiring, fertilizer, agro-chemicals and seeds/cuttings is considered an adopter. A non-adopter is a farmer who does not use any of the technology for food crops production. The categorization is to enable the application of a Probit analysis on the dependent variable which is dichotomous (binary) in nature. This involves whether or not a particular farmer is an adopter or not of the improved technologies. Table 4.15 shows the estimated regression coefficients for the discrete (probit) model where emphasis is on the determination of factors affecting the decision of a potential adopter whether or not to adopt an agricultural input technology for food crop production.

The probit result for the full model estimating the probability of adoption is presented in Table 4.15. The results showed that all the explanatory variables except hired labour and household size were positively related to adoption decision of farmers. These indicate that the probability that a farmer would adopt any of the farm Improved inputs, increases with age, farm size, education, farm income and family labour. However, the probability of adoption decreases with hired labour and household size. Farmers with appreciable years of farming experience and with some reasonable years of schooling were prepared to take risks in adopting

new technologies. Farmers who owned large hectares of land, good education and an appreciable farm income would adopt the use of improved farm inputs for food crop production "ceteris peribus".

Age and education which could be a proxy for farmers experience will induce farmers to increase their use of the farm inputs, this agrees with Akinola and Young (1985) and Shiyani et. al, (2002). However, if more labour were hired per hectare or numbers of the household increased, there could be indulgence or perharps decreasing marginal returns might set in. Consequently, farm productivity will be reduced. The study revealed that only farm-size was significant to adoption decision of farmers at 5% level. This indicates that farm-size in hectares owned by farmers was more sensitive to farm input adoption to any other variables as observed in table 4.15. This agrees with Flinn and Shakya (1985) who found out that the probability of fertilizer use on wheat increased with farm-size in India. In addition, household size was found to be an important determinant influencing adoption of farm inputs. The variable was found significant at 10% probability level with negative sign. This implies that adoption of any of the farm inputs is expected to be higher if the number of household will be reduced "ceteris paribus". This perhaps means that a large number of household will result to increased number of dependants. This will create an in-road into farm revenue (income), which could have been harnessed for adoption of new innovation.

Of particular interest is the lack of significant of farm income, this is likely to be due to lack of proper account keeping and poor saving habits of the farmers.

Table 4.15: Estimated Probit Model For Factors Influencing The Adoption Of Improved Input Technologies By Food Crop Farmers In Ondo State

Variables	Estimated Coefficient	T- Ratio
Farmers age	0.011	0.969
Farm-size	0.049*	2.744
Farmer's education	0.027	1.353
Farm income	0.53×10^{-6}	0.287
Family labour	0.21×10^{-6}	0.019
Hired labour	-0.004	0.310
Household size	-0.49**	-1.708
Constant	-0.339	-0.617

Log of likelihood function = -131.36

Likelihood ratio test = 7.68380 with Degrees of freedom = 7

*Significant at 5% (0.05) probability level

**Significant at 10% (0.10) probability level

CHAPTER FIVE

5.0 SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary and Conclusion

The study examined the economic analysis of improved Input supply on production of food crops in five LGAs of Ondo State. It specifically examined the profitability of food crop production, resource use efficiency of factors and factors influencing adoption of agricultural improved inputs of Improved Inputs and Non-Improved Inputs User farmers in the study area.

Data were collected and analyzed with the aid of a set of questionnaire from 197 Improved Inputs and Non-Improved Inputs User farmers using multi-stage sampling technique. The data were analyzed using descriptive statistics, budgeting, Production function and Probit model analyses.

The results of the socio-economic analysis revealed that the food crop farmers were ageing as about 60% of them were above 50 years. The educational level of farmers was generally low. This development would limit the adoption of technology. Farmers' ranking of food crops grown showed that cassava was the most cultivated crop, closely followed by maize. Almost all the farmers had farm sizes of less than 5.0 hectares, hence majority of the farmers were small-scaled who owned small and scattered farms. Adoption of new innovations and adequate

extension visits would be hindered. The methods of input procurement by farmers was cumbersome. It was found out that farmers patronized government agencies, cooperative societies and private selling agents. There were price fluctuations of agro-chemicals, high cost of inputs and untimely arrivals of inputs when available. About 53% of Improved input users were visited by extension agents, while 23.47% of Non-improved input users received extension agents visits. This is conspicuously low, farmers need regular extension service. Also it was discovered that credit facilities was the most limiting factor to production by farmers. This would reduce farmers productive capacity.

The results of the profitability analysis of food crops enterprises revealed that total cost of production increased with farm-size, the total cost of production by Improved input users was more than that of Non-improved input users. Similarly, the gross revenue per hectare increased with farm-size. This would motivate farmers' readiness to adopt the new technology, thereby raising their farm income and improved standard of living. It was discovered that gross margin per hectare increased with farm-size. Gross margin per hectare of Improved input users was ₦41,292.08, while the Non-improved input users earned an average gross margin of ₦18,126.98, thus, the gross margin earned by Improved input users was more than double that of the Non-improved input users. Food crop business was

more profitable to the former category of farmers than the latter, hence they would be more disposed to adopt the use of improved technologies.

The results of the production function analysis revealed that for farmers who were Improved input users, the coefficient of agro-chemicals was found negative. However, other variables, that is; tractor hiring, fertilizers, seeds/cuttings, depreciation value, family labour and hired labour were positively related to farm revenue. This implies that the higher the value of agro-chemicals, the lower the revenue obtained, while the higher the use of tractor hiring, fertilizer, depreciation value, and labour, the higher the revenue obtained by farmers.

For farmers that were Non- improved input users, the coefficients of farm-size, and labour were positive and significant at 5% level. More revenue would be earned by farmer by a higher use of these input factors. In both cases, labour was identified to be an important factor in food crop production in the study area.

The RTS of 1.31 obtained for Improved input users showed that there was increasing returns to scale in food crops production, while the RTS of 0.68 for the Non-improved input users indicated a positive decreasing returns to scale.

Finally, the results of the Probit analysis revealed that the probability of adoption of any of the improved farm inputs by a farmer increases with age, farm-size, education, farm income and family labour, while the probability of adoption decreased with hired labour and household size. Only farm-size is statistically

significant to adoption at 5% level. Thus, farm-size is very sensitive to adoption of agricultural inputs by farmers in the study area.

5.2 Recommendations

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

1. Policy instruments should be put in place to encourage younger people (Youths) with higher educational qualifications to go into food crops production.

2. Timely supply of improve agricultural inputs at subsidized rate to farmers is necessary for increased food production.

3. From the observed results of returns to scale, the Improved input users' farms promises maximum returns to inputs in the study area. They should be encouraged to expand their current level of production to further maximize their returns.

4 Government policy should be directed at making input factors such as tractor hire service, fertilizer, agro-chemicals, farm implements available at affordable prices. The Private sector should be encouraged to actively participate in input supply.

6. There is the need for policy support for increased farm-size by making land available to farmers. This is the most important factor that will motivate farmers to adopt improved input technologies.

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APPENDIX

DEPARTMENT OF AGRICULTURAL ECONOMICS AND EXTENSION FEDERAL UNIVERSITY OF TECHNOLOGY, AKURE, NIGERIA.

QUESTIONNAIRE

This questionnaire is solely designed to obtain information which will help to analyze the "Economic Analysis of Improved Inputs on Production of Food Crops in Ondo State, Nigeria".

Any information obtained thereby will be treated with strict confidence and will only be used for academic purpose. Thanks for your anticipated cooperation.

SOCIO-ECONOMIC CHARACTERISTICS

1. Location of Agro-input service centre.....
2. Name of Local Government Area.....
3. Name of Village/Town .....
4. Sex of farm owner (i) Male .....

   (ii) Female.....
5. How old are you? .....Years
6. Marital status: (i) Single..... (ii) Married..... (iii) Widowed....
7. If married, how many wives do you have?.....
8. How many children do you have?.....

9. What is your highest educational level?

(i) No formal education.....

(ii) Primary education.....

(iii) Secondary education.....

(iv) University education.....

(v) Other (Specify).....

10. How long have you been farming?.....

11. Are you engaged in any other business apart from farming?.....

(i) Yes.....(ii) No.....

12. If yes, which other occupation (s) are you engaged in?

(i) .....

(ii).....

(iii) .....

13. Why do you engaged in other occupation (s)?

(i) Farming alone cannot sustain my family.....

(ii) It affords me the opportunity to earn more income .....

(iii) Farming does not occupy all my time .....

(iv) Others (Specify) .....

14. Which food crops do you produce in order of importance?

(i) .....

(ii) .....

(iii) .....

(iv) .....

15. How many hectares of food crops did you cultivated last year?

	Crops	Hectare/Acre/Heaps
(i)	Cocoa	.....
(ii)	Yam	.....
(iii)	Maize	.....
(iv)	Rice	.....
(v)	Cocoyam	.....

16 How many hectares of tree crop do you have?

	Crop	Hectare/Acre/Heaps
(i)	Cocoa	
(ii)	Oil palm	
(iii)	Kolanuts	
(iv)	Citrus	
(v)	Cashew	

17. How far is your food crops farm from your house..... km

18. What type of farming do you undertake?

(i) Sole cropping..... (ii)Mixed cropping.....

19. What type of agricultural practices do you adopt?

(i) Subsistence farming.....

(i) Mechanized farming.....

INPUT SECTION

20. How did you get involved in using agricultural inputs?

(i) Through friends.....

(ii) Through Radio/ TV/Newspapers/posters.....

(iii) Through extension agents.....

(iv) Through cooperatives.....

21 Where do you buy your agricultural input?

(i) From AISP selling agents.....

(ii) From private owned selling agents.....

(iii) From cooperative societies.....

(v) From extension agents of ODSADEP.....

(iv) Others (specify).....

22. How long have you been patronizing AISP agents/Agro service centre?.....

23. What type of agricultural inputs do you buy from them?

(i) Fertilizers.....

(ii) Improved seeds.....

(iii) Insecticides/Pesticides.....

(iv) Tractor hiring.....

(v) Others (specify).....

24. Do you purchase the input on advice?

(I)Yes.....(ii)No.....

25. What type of Agricultural inputs do you use in your farm? Start with the most important.

	Quantity Used	Unit price (₦)	Total Amount (₦)
Traditional Tools (a) (b) c) (d)			
(1) Modern implements (a). (b). (c) (d)			
(2) Improved planting Materials (a) Cassava cutting (b) Yam setts (c) Maize seeds (d) Rice seeds (e) Cocoyam setts			
(3) Agro chemicals (a) Fertilizer (b) Herbicide (c) Insecticide/pesticide (d) Others (specify)			

26. What maintenance cost did you incur on fixed inputs and equipment last year?

(i) Repairs N

(ii) Spare parts replacement N

(ii) Fueling N

(iii) Others (specify) N

27. Do you belong to any cooperative society? Yes.....No.....

28. If yes it is,

(i) Government approved .....

(ii) Not approved by government .....

29. What benefits do you get from the cooperative society?

(i) Increased income .....

(ii) Improved techniques of farming .....

(iii) Higher rate of production.....

(iv) Access to capital .....

(v) Others (specify)

30 State the price you get from difference sources

Inputs	AISP	Extension agents of ODSADEP	Coop society	Private sector
(i) Clearing of 1 ha. of land				
(ii) A bag of seed of (a) Maize (b) Rice (c) Cowpea (d) A bundle of cassava cuttings				
(iii)A bag of fertilizer (iv) A tin/liter of pesticide				

31. Cash income and quantity crops produced.

Produce	Quantity (kg)	Amount (N)
(i)		
(ii)		
(iii)		
(iv)		

32. Cash income from non –farm activities

Source	Amount (Amount) (N)
(i)	
(ii).	
(iii)	
(iv)	

Private information for the following;

(a) Operation	No. of family members used			No. of day worked in year		
	Male	Female	Children	Male	Female	Children
(i) Land preparation						
(ii) Planting						
(iii) Transplanting						
(iv) Fertilizer application						
(v) Weeding						
(vi) Herbicide application						
(vii) Pesticide application						
(viii) Harvesting						
(ix) Processing						
(x) Others (Specify)						

(b) Operation	No. of hired Workers	No.of day worked/ year	Wage rate / day
(i) Land preparation			
(ii) Planting			
(iii) Transplanting			
(iv) Fertilizer application			
(v) Weeding			
(vi) Herbicide application			
(vii) Pesticide application			
(viii) Harvesting			
(ix) Processing			
(x) Others (Specify)			

33. If you use tractor for any operation last year, please answer the following questions:

Operation	No. of day used	Cost per day (N)
(i) Clearing		
(ii) Ploughing		
(iii) Plating		
(iv) Fertilizer application		
(v) Harvesting		

LAND

34. How did you get your farmland?

(i) Inheritance.....

(ii) Gift .....

(iii) Trust .....

(iv) Purchase .....

(v) Tenancy .....

(vi) Pledge .....

36. Which factors limit you mosl in increasing your production?

(i) Inadequate capital.....

(ii) High cost of Labour.....

(iii) Price fluctuations .....

(iv) High cost of inputs .....

(v) Others (specify) .....

37. What problems do you face in obtaining capital?

(i) .....

(ii).....

(iii) .....

(iv).....

38. What is the source of finance to your farming business?

(i) Personal savings .....

(ii) Money lender.....

(iii) Bank loans.....

(iv) Cooperatives.....

(v) Friends,/Relatives.....

(vi) Others (specify).....

39. Which of the sources is favorable to you in purpose and term?

.....

40. Do you think your yield increased t1p~ough the use of agricultural inputs?

(i) Yes..... (ii)No.....

41. Mark (~) any problem listed here to face on your farm through the use of Agricultural inputs:

(i) Cost of agricultural inputs.....

(ii) Non-availability.....

(iii) Fake and ineffective agric inputs.....

(iv) Adulteration.....

(v) Distant selling point .....

(vi) Economics disadvantage.....

(vii) Language barrier .....

(viii) Others (specify).....

USE OF AGRICULTURAL TECHNOLOGIES

43. Please mark(`~) in the appropriate figure in connection with each of these technologies and inputs;

Technologies and inputs	Adoption Situation (See key below)							
(I)Improved seeds (a) Maize (b) Rice (c) Cocoyam	0	1	2	3	4	5	6	7
(ii) Improve cassava cuttings								
(iii) Yam minisets								
(iv) Fertilizer								
(v) Herbicides								
(vi) Seed dressing chemical								
(vii) Pesticides								
(viii) Storage chemicals								
(ix) Tractor hire								

ADOPTION INDEX KEY

0: Don't know about it

1. Know about it, but not interested

2. Not compatible with my farming system or custom

3. Know about it, want to use it, but not available

4. Too expensive

5. Use it before, but no more

6. I used it occasionally

7. Currently using it.

44. State the most important problems you have in relation to the use of these agricultural inputs;

FERTILIZER: (i).....

(ii).....

(iii).....

AGRO-CHEMICALS: (i).....

(ii).....

(iii).....

45. Are you always sold the required type and quantity of input by AISP/Extension agents?

(i) Yes..... (ii) No.....

46. If no, what is your reaction to this inability to meet your demand?

(i) Turn to other sources.....

(ii)Use only the quantity sold to you by the AISP/Extension selling agent...

(iii) Stopped going to the AISP/Extension selling agent.....

(iv) Others (specify) .....

47. Do you always get your inputs at the right time?

(i) Yes..... (ii)No.....

48. What has been your reaction to the change in the price of inputs bought from the AISP/Agro service centre?

(i) Buy from private selling centre.....

(ii) Cut down on the quantity purchased from the AISP agents/Agro Service centre.....

(iii) Increased the quantity purchased from AISP agents/Agro-Service Centre when the prices are lower.....

(iv) Others (specify).....

49. Do the officials from AISP or ODSADEP visit your farm?

(i)Yes ..... (ii) No.....

50 If the visits are not regular how many times did they visit your farm last year?.....

51. What is the reason for their visit?

(i) To supervise the use of inputs.....

(ii) To determine the quantity of inputs to be sold to you.....

(iii) To determine whether you are a genuine farmer or not.....

(iv) To buy food stuffs from your farm.....

(v) Others (specify).....

52. How many times have they supervised you on how to use inputs?

.....

53. How far is the Agro-Service Centre from your farm?.....

Thanks for your cooperation.