THE ROLE OF COMPUTER IN STATISTICAL ANALYSIS OF SOME SELECTED CROPS PRODUCTION

(A CASE STUDY OF NIGER STATE AGRICULTURAL DEVELOPMENT PROJECT MINNA).

By

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A PROJECT SUBMITTED TO THE DEPARTMENT OF MATHEMATICS AND COMPUTER STUDIES IN PARTIAL FULFILMENT FOR THE AWARD OF POST - GRADUATE DIPLOMA IN COMPUTER SCIENCE. FEDERAL UNIVERSITY OF TECHNOLOGY MINNA.

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APPROVAL PAGE

This project has been read and approved as meeting the requirements of the school of science and sceinec education, Department of Maths/statistics/computer science, federal university of technology Minna, Niger state, Nigeria.

By

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.....	.....
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DEDICATION

Dedicated to my Parents Alhaji Ibrahim Bello sardauna of Kontagora and Hajiya safiya Ibrahim, my wife Hajiya Rabi and my Dauthers Khadizat and fatima.

ACKNOWLEDGEMENT

The realization of this project would not-have been possible without the assistance of all those who provided me with necessary information and guidance, and when the project becomes a success those that assisted in its compilation are not to be forgotten.

First of all I would like to express my thanks to Almighty Allah" for giving me strenth of doing this work.

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My profound gratitude goes to my abled parents whose support from childhood uptill this moment I have continue to enjoy. May Allah's guidance and blessing continue to usher at their mercy.

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ABSTRACT

In recognition of the advent advantages or characteristics of computer technology, which includes its accuracy reliability, speed, storage facilities, ability to compare and perform arithmetic operations etc, it has been employed in various organisation for information processing and host thus affected all works of life.

Therefore the aim of this project is to delve into the activities of Niger state Agricultural development project using some statistical tools with the help of computer to analyse and draw conclussions from the analysis.

The rapid declining of food production in Niger and Agricultural development projects across the country motivated me to study the activities of the organisation on the five major crops grown in the states. The crops are Guinea corn, maize, rice, yam and groundnut.

Table of contents

CHAPTER ONE

1.0 INTRODUCTION AND BRIEF HISTORY OF NSADP

The Niger state agricultural development project NSADP is an off shoot of the Bida enclave Agricultural development project BADP, Agricultural development project NSADP is a state wide project covering the entire Niger state.

In August, 1991 the project area increased slightly from about 74,000km to about 75,000km as a result of the merger of Borgu local government area formerly of kwara State with Niger state. While merging it with Niger state the area was split into two (2) local government area viz borgu and Agwara. The farming house hold of the state rose slightly from 298,887 to 322,676 as a result of this exercise (estimated from the NSADP and kwara state agricultural development prject. Village listing surveys of 1987 - 88.

This exercise did not however affect the objectives of the project nor her structural organisation as both NSADP and KWADP belong to the same multi-state Agricultural development project NSADP with water supply components which kwara state Agricultural development project has and Niger state Agricultural development project does not have. The newly inherited area was merged with the existing zone III hence not resulting into any organisational (structural) changes.

It is a ten year project to run in area phases of four, three and three years period each, the project is one of the multi-state Agricultural development project ADP II (MSADP II) project to be implemented with the world bank loan No 2988 UNI. The total cost of the first phases of Niger state Agricultural development project NSADP (1988 - 92) was put at $28.54 million equivalent N146.326 million in 1988.

Beeing a tripartite funded project while the world bank IBRD would cover 63% of the total project cost.

The federal and state (Niger) Government shares would be 12.46 respectively. The IBRD contribution is however a loan to the federal government of Nigeria (FGN) for on lending to Niger state government (NGSG) payable over twenty years including five years of grace at standard variable interest rate and it is wholly to cover foreign exchange cost and no local cost while 72.28% of the federal government contributions is for capital cost and the remaining for recurrent cost and the contribution from Niger state goevrnment is for payment of taxes, increamental salaries and allowances as well as general operating expenses including taxes.

AIMS AND OBJECTIVES OF ESTABLISHING NSADP

The overall objectives of establishing Niger state Agricultural development project has been to support increased agricultural production in the state and to raise the living standard of the population the project is designed to render the following key services to farmers.

(a) Extension services:- Using the training and visit (T&V) system under the unified extension to pass across messages on crop, livestock, agroforestry and women in agriculture.

(b) Seed - multiplication:- Involving multiplication and distribution of seeds obtained (after through screeing by the on farm adaptive research unit0 through the use of contact farmers (outgrowers and direct production on the project seed farms).

(c) production of assorted types of forestry and improved tree crop seedlings for use as wind breaks, wood lots, orchards, ally cropping and erosion control.

(d) Animal Traction:- Farmers (and their oxens) are trained and encoureged to adopt the use of animal pourered technologies for farming operations.

(e) Livestock services:- Involves provision of agric menus and drugs to established veterinary clinics and training farmers on livestock feeding, common treatments and also assisting licensed veterinary practitioners to set up clinics in rural areas.

(f) Irrigation and water control:- Development of fadama areas involving construction of diversion modules, tube wells / washbore etc.

(g) Road Development:- Rahabilitation and maintenance of rural roads thereby opening up the rural areas and also reducing transportation cost on feeder roads in the agriculturally productive areas of the state.

(h) Farm inputs sales:- Involves sales of fertilizers agrochemicals, improved seeds, spare parts and agricultural equipments, generators etc and simple farm implements for processing.

(i) credit facilities:- Involves enlightment, establishment and organisation of co-operative society through which credit services can be rendered.

METHODOLOGY

The main aim / objective of the researcher are

i. To find out if there is any significance change in crop production in the state agricultural development project (NSADP)

ii. To computerise the yield of Guinea corn, Rice, maize, yam and groundnut and other components associated with yield such as rainfall and total area put into cultivation.

iii. To identify the problems and difficulties sorrounding the effective performance of (NSADP).

iv) To suggest possible remedies (solution to the identified problems.

Therefore the aim of this research is to apply computer in statistical analysis of Niger state Agricultural development project activities on some selected crops production and bring out the major factors responsible for its progress and set backs and suggest constructive recommedations that will be of help in reaping the benefits from establishing Niger state Agricultural development project NSADP.

SCOPE AND LIMITATIONS

Due to constraints imposed by resources and time , the study was limited to some selected major agricultural crops production beeing grown in the Three (3) zones ie zone I comprising of Lapai, Kutigi, Mokwa, Gbako, Agaie, Kacha, Edati and Bida local government Area with Headquarters at Bida; zone (II) comprises of Chanchaga, Shiroro, Munya, Suleja, Tafa, Paikoro, and Rafi local government with Headquaters at Kuta; while zone (III) comprises Rijau, Magama, Wushishi, Kontagora Mashegu, Borgu and Agwara local governments with Headquaters at Kontagora. Minna is the Headquaters of Niger state Agricultural development project.

Observation and interviews were conducted with the staff of the organisation in various sections to a certain the general impact of computer rechnology in statistical analysis.
The analysis and finings will be given in chapter four.

DEFINITION OF TERMS

1, COMPUTER TECHNOLOGY

This covers not only hardware or physical element, but also the wide variety of software application aids and support services.

TIME SERIES

Statistical data collected, observed and recorded at successive interval of time is referred to as time series.

REGRESSION ANALYSIS

This is the process of finding the linear relationship between two variables, one dependent and the other value of the associated variables is the independent variable.

CORREIATION

This is the process of finding the degree of association between two variables.

MULTIPLE REGRESSION

Is used for testing hypothesis about the relationship between the dependent varibale and two or more independent variables.

NSADP

Niger state agricultural development project.

CROP PRODUCTION

The cultivation of different types of for men and animal use.

CHAPTER TWO

2.1 LITERATURE REVIEW

Statistics is of great importance in the field of agriculture. The analysis of variance which is important instatistics is of immense use in agriculture for testing the differences between different group of data for the purpose of homogenuity.

This method brings out the effect of temperature; rainfall, fertilizer and possible sunshine on crops. In short, statistics is so deeply related to agriculture that the study in the yield of agriculture can't be made without the application of statistics.

But it is regretable to note that with the importance of statistics to agriculture, the bulk of agricultural data collected used to remain unanalysed and in places where it is analysed the analysis does not go beyond yield estimation, projection and calculation of averages and seldom sophisticated statistical tools are utilized.

Mr.M.A. Benzah of monitoring and evaluation section of sokoto Agricultural Development Project, Gusau zone in 1986, made an effort in trying to study on sorghum and cowpea which he considerered dominant in the area.

According to Benzah, yield estimation of the subject that has been under investigation for sometime now, perherps the first study was carried out by molokwo and poet of Bida agricultural development project, conducted for yam and sorghum. One of the conclusions drawn by molokwu and poete was that the method of triangle produces a consistant over estimation as high as 20% but of much lower.

Mr Benzal's study was based on original survey data collected by trained enumerators and the respondents were informed much before the harvest about the exercise and its significance. The produce of the traingle (100 square metres) the identified plots were hervested, made into bundles/sacks and then weighted. He anaysed his data using the triangle (subplot of 100 square meter) which he claimed is the most acceptable and invariably used in Nigeria. He used the triangle yield to estimate the total yield of the plot and also tried to compute the actual yield and estimated yield. He also tried to compute the standard deviation and co-effient of variation for each crop. He also made use of t-test to determine whether difference between whole plot yield and triangle yield measure significance or not. Co-efficient of correlation was computed for the technologies in use.

Benzah concluded his report that yield estimates obtained through triangle method consistently over estimated the whole plot as against what was concluded in molokwo and poete study.

He said yields (kg/he) by triangle technologies shows over estimation ranging from millet 55% to songhum 72% and copea 11%. Therefore, this analysis pose serious doubts, about the usefulness of triangle technologies when it comes to precission and accuracy of the yield data.

In trying to determine what association exists between the whole plot and triangle technologies he discovered that the association is not only positive but reasonably high.

In the final analysis, Benzah did not see any justification (based on his study) of not shurning triangle technology and report to whole plot output method and farmers production of yield.

2.2 ORGANISTAION AND MANAGEMENT

The Niger state agricultural deevelopment project (NSADP) is divided into three (3) zones on the basis of cropping patterns obtained on the project area.

Zone I, is made up of Agaie, Gbako, Lapai, Lavun, Kacha, Edati, Makwa and Bida local government area with Headquaters at Bida.

Zone II, is made up of chanchaga, Rafi, Shiroro, Paikoro sarkin pawa and suleja local government areas with Headquaters at kuta while.

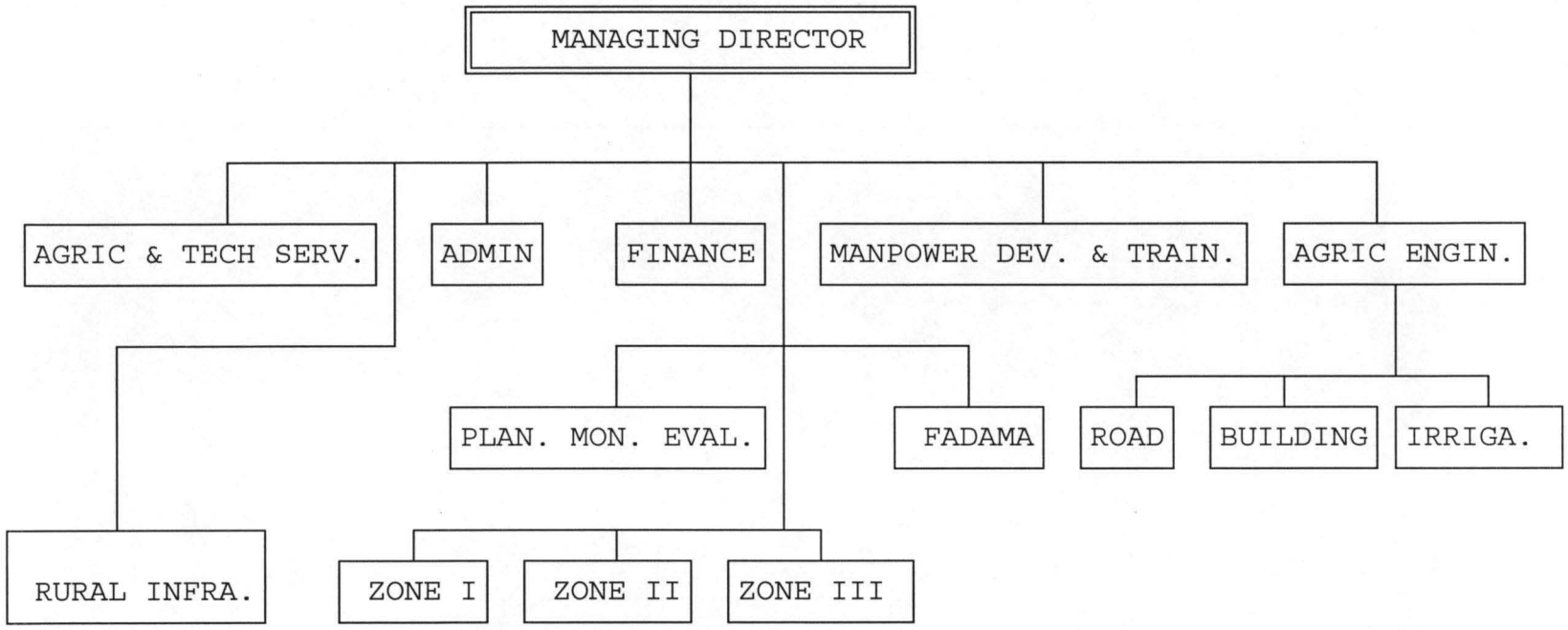
Zone III, is made up of magama, wushishi, Borgu, Agwara, Mashegu, mariga and Kontagora local government area with Headquaters at kontagora.

MANAGEMENT

The project is managed by a management committee chaired by the managing Director who is also the chief executive of the project.

It also has an executive committee under the chair manship of the state Governor.

NIGER STATE AGRICULTURAL DEVELOPMENT PROJECT ORGANISATIONAL CHART



NIGER STATE AGRICULTURAL DEVELOPMENT PROJECT MANAGEMENT UNIT

1,	Managing Director	Chairmen
2,	Director of Agricultural and Technical services	Member
3,	Director of finance and accounts	"
4,	Director planning,monitoring and evaluation	"
5,	Director engineering services	"
6,	The zonal project managers (Zone I, II, and III)	"
7.	Chief manpower Development and training officer	"
8.	Director of Administrative and services matters	"
9.	Principal personel officer Secretary/member	

2.3 FUNCTIONS OF THE MANAGEMENT COMMITTEE

2.3.1 MANAGING DIRECTOR

1, Implementation of agricultural development in the state

2, preparation of annual budgets and work progress/plan for approval by NADPEC

3, Preparation of contracts awards

4, preparation of the project bank accounts

2.3.2**DIRECTOR OF AGRICULTURAL AND TECHNICAL SERVICES**

He is in charge of unification and operation of extension services where all the technology which relate to each farming system be it in production or marketing of plants or animals are channel through a single faucet the village extension agent (VEA).

2.3.3**DIRECTOR COMMERCIAL SERVICES**

He is to decide the right type and the right guantity of fertilizer and other agricultural inputs to be sold to all farmers in Niger state.

To co-operate with the extension staff of NASDP in educating the rural farmers on the correct use of agricultural inputs.

To develop a cost effective transportation and distribution system which will stimulate and encourage a wide-spreed use of fertilizer all over Niger state.

2.3.4**DIRECTOR FINANCE AND ACCOUNTS**

Responsible for budget preparation and work programme based on SAR estimates.

To keep financial records in accordance with sound accounting practice for external audit.

2.3.5**DIRECTOR PLANNING, MONITORING AND EVALUATION**

To provide a sound planning for both on-going and future projects activities through preparation of annual work programme, budget, farm plans and conduction of specific studies for future planning of the project.

To provide timely information on the project progress to the management for sound decision making through establishing and implementation of an integrated management information system (MIS) for the project performance data.

To measure and report performance and impact of the project through administration of core-survey (village listing large scale reconsoinance, agronomic and market prices survey) as well as project specific and collaborative surveys.

2.3.6 **DIRECTOR ENIGINEERING SERVICES**

Increase the role of contractors in rural roads mechanical rehabilitation and maintenance.

Strength the capacity of local government areas to carryout routine manual maintenance of feeder roads.

2.3.7 **CHEIF MAN-POWER TRAINNING AND EVALUATION OFFICER**

To organise regular courses for all categories of staff in order to reflect emerging changes in technology and policy to strenthen management capability of the project.

2.3.8**DIRECTOR OF ADMINISTRTAION AND SERVICES MATTERS**

To provide administrative suport to project for the efficient and effective day to day running of the activities of other sub-programmes.

2.4 **ACTIVITIES OF SUB-PROGRAMMES**

2.4.1 **AGRICULTURAL AND TECHNICAL SERVICES**

The main objective is to introduce a system of sponsored reserach between Agricultural Development Project and National Agricultural research institute unify extension services (crop livestock, agro-forestry and women in Agriculture) assign a cenral role to the private sector and small holders in improved seeds multiplication and distribution and established a commercially viable seed pricing policy.

In addition to this soil erosion control and agro-forestry programme promotion of animal traction licensing of private livestock veterinations and removal of subsidies on animal drugs and vaccines are to be accomplished.

2.4.2 **COMMERCIAL SERVICES**

The objective is to initiate the commercialization of agricultural development project supply operations, limit the operation to whole sale levels only with no more than one store per local government area and increases the role of private traders and co-operatives in input supply at the retail label, provide technical assitance and operational support to improve savings, mobilization lending and trading operation of farmers co-operatives through a co-operative financing agency.

2.4.3**RURAL INFRASTRUCTURES**

The objective is to increase the role of private contractors in rural roads, mechanical rehabilitation and maintenance strenthen the capacity of local government areas to carryout routine mannual maintenance of feeder roads with support from ADP and to organised farmers into water users association to assume responsibilities for istallation and maintenance of small scale irrigation schemes. The project is targettted to rehabilitate 410 km and undertake periodic maintenace of 57 km, recurrent maintenance of existing project building and vehicles are also to be carriedout in the sub-programme.

2.4.4**MAN - POWER DEVELOPMENT AND TRAINNING**

The objective is to train and orient training of extension staff on the use and operation of made equipement as well as development and train all categories of staff.

2.4.5 **PLANNING MONITORING AND EVALUATION**

The objective is to provide a sound planning support for activities of the project, provide timely information on the project progress to management for sound decision making and measure report on the projects performance and impact.

2.4.6 **FINANCE AND ACCOUNTS**

The objective is to keep financial records in accordance with sound accounting practices for external audit, prepare annual budgets, and work programmes based on staff appraised report estimates assists in procurement matters in line with world bank guidelines and ensure assets and stock control.

2.4.7 **MANAGEMENT AND OPERATIONS**

The main objective is to provide administrative to support project for the efficient and effective day to day running of the activities at other sub-programmes.

CHAPTER THREE

3.1 STATISTICAL METHODOLOGY

COLLECTION OF DATA

Statistics deals with the collection, tabulation analysis and interpretation of data, the collection of data in particular is very central to the field of statistics since it provides the basic information on which statistical analysis depends basically on the accuracy of the information collected.

Statistical information may relate to various items, they could be measurement on the quantity of the product of the manufacturing industries, information on agricultural production, information on school attendance, information relate to social and economic variables etc.

Therefore, it is from the results of the analysis of the data when properly integrated that policy decision are taken. Hence in accurate and inadequate data leads to faulty analysis and misleading policy decisions.

3.2.1 SOURCES OF DATA COLLECTION

Data collection can be primary or secondary data refers to the statistical material which the investigator originates for the purpose of the inquring in hand. Data obtain from primary

source can be through (1) Direct personal observation (2) indirect personal interviews (3) information from correspondents (4) marked questionaire and questionaire to be filled by enumerators.

3.2.2 **NATIONAL PUBLISHING SOURCE**

Most published statistical data can be refered as secondary data to the users since users do not collect them by themselves.

These are data already collected by various organisation and government department as well as private sectors. These organisations, government departments and private sectors maintain year books and other records which are available to any person or organisation interested in them. The year books are annual summaries of informations during particular calender year and relating to a particular territory that is these published source could be statistical abstract, Bulletins and reports used by statistics has the responsibilty of publishing data relating to Nigerian economy. Also published source could be research reports and publication in journal of various research institute and organisations.

3.2.2 **INETRNATIONAL PUBLISHED SOURCE**

Data obtainable in an economy are sometimes insufficient. As a result some additional information are obtained from the documents published by the various international organistions. These international source include publication of the international institution like international Bank for reconstruction and development (IBRD ie the world Bank). The international monetory fund (IMF) and other united nations agencies in general, the international agencies extra data from the statistical offices and central bank of different countries and published them periodically. The most comprehensive sources of international statistics or data is the monthly bulletin of statistics and the most comprehensive source of information is the statistical year book of information which is designed to serve as convenient summary of all international economic and social statistics.

3.2.4 **UNPUBLISHED SOURCES**

These includes the data that exist in their original form in the files of many government and non-government departments and corporations. Collections of this type of data is always very difficult and time consuming due to confidential nature of some of the data. However, the main differences between published and unpublished source of data is that published source are more readily or accessible than unpublished source.

3.3.2 **METHOD OF DATA COLLECTIONS**

Data can be colleted in the following ways.

3.3.1 **QUESTIONAIRE METHOD**

In this method planned questions are sent to people (respondents) and they are expected to answer the questions. When interview method is impractical questionaire method is used for example when large nnmbers of people are involved in such cases, the questions are sent out on forms, called questionaire or schedule. These are then filled by the respondents whom the information is required from them. There are two types of questionaire which are closed questionaire which the possible anwers to each question are given that is in this case questions are restricted and each respondent will have to belong to one of the categories to each question.

OPEN ENDED QUESTIONAIRE

This is the type where possible answers to each question have been given that is, in this case the question are open and not restricted and respondent is free to answer his own way.

3.2.2 **OBSERVATIONAL METHOD**

Observational method of data collection is the method of looking at events. This method can be aplied when first hand information about some event is required in this method the research or interviewer observes the phenomenon of interest.

He either based his observation on objectives or subjective approach with the objective approach the researcher based the classification of events in standard on the other hand if the subjective approach is used then there is no standard on which the researcher bases his classification.

Observational method is mostly carried out by trained observers or by using cameras it is widely used in many fields for example in industry, many work study techniques are based upon observing individual or groups of workers to establish the system of movement employed with a view to eliminating wasteful effort.

3.3.3. **INTERVIEW METHOD**

Interview method of collecting data is the method used in is collecting data where the source of information are people under this researcher visits individual or groups of individual and asks them certain planned questions arranged either on questionaire or schedule and the information obtained verbally, This is by far the most common way of collecting data from public.

3.3.4 **DOCUMENTARY METHOD**

This is the method of looking at document and necessary information abstracted. This method is used where sources of information are documents, these documents are consulted and

the relevant information abstracted from it. This method of abstracting information is far the most commonest method of collecting data in organisation.

3.3.5 **INSPECTION METHOD**

Inspection method is used where the sources of information are objects. The objects must be inspected and the relevant information noted. This may be weight, size, colour or any other factor. Inspection can also be performed in many instances including quality control, stock control and undermining agricultural yields (tonnage perace).

Thus the source of data for this project work is a secondary source collected from Niger state agricultural development project. The data was extracted from their annual reports which contain every detail of agricultural activities in the state.

The second source is primary source which the researcher collected by direct interview from the staff of Niger state Agricultural development project.

3.4 **PROBLEMS ENCOUNTERED IN COLLECTING DATA**

As a member of staff of Niger state Agricultural development project, I never envisaged that I would encountered any problem in getting data on the activities of the project. But

to my greatest surprise and dismay the organisation was reluctant in releasing any data to one, rather it demanded for an introductory letter from the school as to what type of analysis is to be done with the data.

Therefore, I had to come back to school for the introductory letter which was promptly given to me.

Another problem faced was during the personal ineterview carried out by me. Some of the staff interview refused to respond at all to the questions asked. I enquire for the reason for failure to respond but I was given the single reason by some of them that they dont want to loose their job because they dont know whether the information they would be given will be disclosed to the management and as such leading them into trouble.

Similarly, a lot of records are termed confidential and such documents are not always made available to the user.

2.5.0 **STATISTICAL TOOLS FOR ANALYSIS EMPLOYED IN THE PROJECT**

TIME SERIES ANALYSIS

A time series is nothing morethan a set of observation on some factor made at specific points in time that's statistical data which are collected, observed or recorded at successive interval. Thus when numerical data are observed is known as

time series. For example when observation is made on agricultural production, over the last ten years, the set of observation formed shall constitute time series.

Hence in the analysis of time series time is the important factor because the variable is related to time which may be either year, month, week, day, hour, minute or second.

However, the term series can be apply to all other phenomenon that are related to time.

There are four components of time series.

1. The trend or secular movements
2. The seasonal movement
3. The cyclical movements
4. The irregular (random or static) movement.

1. **THE SECULAR MOVEMENT**

Secular movement are another name for the trend movement of the series. These indicates a gradual growth or decline of the factor beeing observed. The trend is the general direction in which the time series appears to go over an external period of time. The agricultural and industrial output have an increasing trend demand increase while sales without advertising beeing applied may tends to have a decreasing trend.

2. **THE SEASONAL MOVEMENT**

Seasonal movements are those which follows a particular pattern conciding with the season of the year. There are periods of boom sales at certain points of the year and slack period at others. Sale tend to be high during christmas, sallah and other festivity periods.

3. **CYCLICAL MOVEMENT**

Cylical movement are long term oscillations or swings around the line which follows a pattern of high period followed by low period, followed by high period etc.

These movements results in alternating levels of economic activity. An important example of a cylical movement is the business cycle, this cycle represents period of inflation, recession, depression and recovery.

4. **THE IRREGULAR MOVEMENT**

Irregular movement are ones that can not be explained as a trend, seasonal or cyclical. They are used by such chance events as election, fires, floods, wars or other calamities.

In analysis of time series we attempt to isolate the difference components of the observed values. Each observation should be composed of a trend part, a seasonal part, a cyclical part and irregular part.

The product of these parts equals the observed value.
ie Yt = It x St x Ct x It (multiplication model) some statisticians assume that the parts "during" to the observed value ie Yt = It + St + Ct + It (addivie model).

The multiplication model is mostly accepted because the factors or components are viewed as amplifying each other rather than acting separately as assumed by the additive model.

TREND MOVEMENT

There are about four methods which are often used in trend movement techinique. These include.

1. Freehand or graphical method
2. Semi-average method
3. Moving average method
4. Mathematical method

1. FREEHAND METHOD

Under this method, the data at hand is plotted on a graph and then a trend is fixed with free hand by choosing two points on the plane.

2. SEMI - AVERAGE METHOD

In this method the given data is divided into two parts, preparably with the same number of years in case of odd number the middle year is omitted. After the data have been obtained.

Two points are then obtained each point is plotted at the point of the class interval covered by respective part and then the two points are joined by a straight line which gives the required trend line.

The line can be extended down ward or upward to predict future values.

3. MOVING AVERAGE METHOD

In determining the trend line by the method of moving average the mean value (x) for a number of years (month, weeks) etc is determined and the average is taken as the normal or trend value for point of time falling at the middle of the period covered in the calculation education of the average. The effect of the average is to give smoother curve lessening the influence of fluctuation that pools the annual values away from the general trend. The period of the moving average depends on the analysis choice if the moving average is an even period 4,6, etc year. The moving total and the moving average which are placed at the centre of time span from which are computed fall between two line periods. This inconvenience of planning is over come by sychronising the moving averages and the original data by a process called centering which consists of taking a two period average of the moving average.

4. MATHEMATICAL METHOD OF EVALUATION

a, LINEAR TREND

The simplest form of trend is a linear trend it is defined by $Yt = a + bx$ where Yt is the trend value of the variable under consideration. The constant a is the trend of Y at the original of time (ie where x = D) and the constant b is the increase in Yt per unit of time (ie per unit change in x). We can place the origin of x at any place provided we remember where we have placed it.

The normal equation to determine a by least square are

$$\sum y = N a + b \sum x$$

$$\sum xy = a \sum x + b \sum x^2$$

where N is the number of years covered by the time series if the number of years covered is odd, we can place the origin at the middle years and then $\sum x = 0$.

This is a very convenient for the normal equations reduces to

$$\sum y = Na$$

$$xy = b \sum x^2$$

$$\text{ie } a = \frac{\sum y}{n} = y, \quad b = \frac{\sum xy}{ax^2}$$

b. EXPONENTIAL TREND

The linear trend

$Yt = a + bx$ is one which yt increase by a constant absolute amount per annum. This amount is given by the co-efficient b.

Many other types of trend are available. A commonly used one is where yt increase not by a constant absolute per annum but by a constant percentage per annum such a trend is defined by. yt = AB^X where A and B are constants for example if B = 1. This type of trend is called an exponential trend. An exponential trend is newly fitted by taking logarithm for log yt = log A x XlogB where yt is replace by log A and B is replaced by Log B.

To fit such a curve we write down the logarithms of the Ys and proceeded as before. By suitable choice of the original we shall have log A = $\sum$logy and log b = $\sum$xlogp x/$\sum X^2$

By looking up the antilogarithm of log A and B, we can really ascertain a and b.

c. NON - LINEAR TREND

SECOND DEGREE PARABOLA

A second degree trend equation Y= a + bx + Cx^2 is considered to bean appropriate trend model for the secular trend components of a time series when data appear non to fall in a straight line a text of appropriateness is carried out by the method of second differences.

When the differences are taken of first differences the result is a constant or nearly so, between successive values or observation a second degree equation may be an appropriate model for measuring the secular recular trend.

Hence, a second degree trend equation is given by

$Y = a + b + Cx^2$

$\sum Y = Na + b\,x + \sum x + c\ x^2$ ------ (1)

$\sum xy = a\,x \sum x + b \sum x^2 = c \sum x^3$ ----- (2)

$\sum xy^2 = a \sum x^2 + b \sum x^3 + \sum x^4$ ---- (3)

when the origin is taken at the middle value such that $\sum x = o$, equation (1),(2) and (3) becomes

$y = Na + c \sum x^2$ ------(4)

$\sum xy = b \sum x^2$ ---------(5)

and

$\sum x^2y = a \sum x^2 + c \sum x^4$ ------(6)

which implies

$$a = \frac{\sum y - C \sum x^2}{N}$$

$$b = \frac{\sum x\ y}{\sum x^2}$$

$$C = \frac{N \sum x^2y - \sum x^2 \sum y}{N \sum x^4 - (\sum x^2)^2}$$

For the purpose of this project the researcher will only be concerned with the method of exponential trend, as the other methods are not applicable.

3.5 UTILITY OF TIME SERIES ANALYSIS

The time series analysis is of great - significance for the reasons given below.

1. It helps in understanding past behaviour. Data observed over a period of time helps one to understand what changes have to taken place in the past and such analysis helps in the production of future behaviour.

2. It helps in planning future operations, plans for the future can not be made without forecasting events and relationship they will have.

3. It helps in evaluating current accomplishment the actual performance can be compared with the expected performance for example if expected crop production for 1992, were 100,000 tones and actual crop production were 90,000 tones, we can then investigate the cause for the short fall in achievement.

4. It facilitate comparism. Different time series are often compared and important conclusion are drawn there.

However, one should not be led to believed that by time series analysis one can foretell with 100% accuracy of future events. After statistcians are not foretellers.

3.6 REGRESSION AND CORRELATION ANALYSIS

Regression and correlation analysis deals with relationship between two or more variables. Regression is concerned mainly with the mathematical relationship between variabales and with estimation based in this mathematical, correlation on the other hand measure the closeness of the relationship between the variable, it measure the degree of relationship. A good example which regression and correlation could be used in the yield total of production and total area put into cultivation of this crop the set of data in each unit has two measurements that is the yield and total area cultivated.

The regression problem is to find out either there is any mathematical relations among the two viarables, and if such relation exist then it can be used to estimate the value of one variable giving the value of the other.

With correlation the ideal is to measure the extent of the relationship between the two vairiables, correlation also measure the direction of the relationship may either be negative or positive.

SCATTER DIAGRAM

The commonext and the most convenient method of illustrating set of vivariable data is by scatter diagram.

A bivariate can be treated as a set of z,y co-ordinate plotted on the graph to obtain a set of points.

Usually the x -axis of the scatter diagram represents the independent variable and y - axis represent the dependent variable.

From the scatter diagram it can be observed that smaller value x corresponds with smaller value y, and large value of x corresponds with large value of y. Two variables related into this way are said to be positively or directly related.

On the other hand a set of bivariate data may be relatively or inverse related in which case smaller values of x corresponds to the large value of y and large values of x correspondent to smaller value y.

We can have a bivariate data in which one variable has little or no relationship with other in such a case the regression line fitted to the scatter digram with horizontal and parallel to x -axis

a.Perfect positive correlation b. Perfect negative correlation

c. High positive correlation d. Low negative correlation

e. No correlation variables uncorrelated.

SIMPLE LINEAR REGRESSION

The idea is to find a straight line equation which describes approximately the relationship between the bivariates. The equation of the fitted straight line is of the form.

$y = a + bx$

the uses of the fitted straight lines are

1. To represent the mathematical relationship between the two variables.
2. It can be correspondent value of the other variable.

There are two main ways of a straight line regression to a set of data.

1. Free hand method
2. Least square method.

FREE HAND METHOD

By the free hand method we try to fit an approximate straight line to a scatter diagram in such a way that it will fit a trend as much as possible that help of the points will be above the line and help below it.

LEAST SQUARE METHOD

The procedure for these method are

1. Plot the scatter diagram
2. Compute the means of x variables and y variables.
3. Draw a straight line though a scatter diagram passing through the means (x and y) in such a way that none of the group of point is affected.

After the line has been fitted the equation of the line may be determined by finding the gradient of the line and the intercept when these values are substituted into a general equation line we obtain.

$y = ax + b$

$a = \frac{y_2 - y_1}{x_2 - x_1} = dy/dx$

b = The intercept.

For any set of bivariate data x and y there are two regression line that is, the regression of y on x, and the regression of x on y. These two regressions gives different regression lines hence different equations.

For regression y on x, x is the independent variable while y is the dependent variable, for regression of x on y,

y is the independent varibale and x is the dependent variable. In estimation using regression analysis these two types of regression will be applicable in particuler casses depending on which variable is independent and which variable is dependent.

CORRELATION ANALYSIS

Correlation deals with finding the degree and directing the relationship between two or more variables. This shows whether the linear regression is applicable to a particular set of bivariate data. The co-efficient of correlation is given by

$$y \frac{\sigma xy}{\sqrt{\sigma^2 x \ \sigma^2 y}} = \frac{\sigma xy}{\sigma x \ \sigma y}$$

where $-1 \leq y \leq +1$

also

$\sigma xy = \frac{\sum (x_1 - \bar{x})(y_1 - \acute{y})}{n}$ covariance x

$\sigma x^2 = \frac{\sum (x_1 - \bar{x})}{n}$

$\sigma x^2 y = \frac{\sum (y_1 - \acute{y})^2}{n}$

which is referd to as product moment correlation coefficient

3.7 MULTIPLE REGRESSION ANALYSIS

Multiple regression analysis is used for testing about the relationship between the dependent varioable y and Two or more independent variable, X's.

The complexity most scientific and economic phenomnon is such that in order to be able to predict an important response a multiple regression model is desirable when this model is linear in the co-efficient it is called a multiple linear regression model.

For the case of the x explanatory varibale we have $Y_1 = x_1 + \hat{B}_1$, xii + $\hat{B}_2$ x_{2i} +..... $\hat{B}k$ xk_1 + u.

where $\hat{B}_1, \hat{B}_2$ ..... $\hat{B}k$ are the parameters estimates while U_i is the random components (stochastic term).

The parameter estimates are obtained with least square method for multiple regression analysis the equation are

$$\sum Yi = n + \hat{B}_1 x_{ii} + \hat{B}_2 \sum x_{2i}$$

$$\sum x_{ii} y_i = \alpha \sum x_{ii} + \hat{B}_1 \sum x_{ii} + \hat{B}_2 \sum x_{ii}\, x_{2i}$$

$$\sum x_2 yi = x \sum x^2_{2i} + \hat{B}_i \sum x_{2i} + \hat{B}_2 \sum x^2 2i$$

This equations can be expressed in deviation form which gives

$$\hat{B}_i = \frac{(\sum x_{iy})(\sum x_2^2) - (\sum x_2 y)(\sum x_i x_2)}{(\sum x^2 i)(\sum x_2^2) - \sum (x_i x_2)^2}$$

$$\hat{B}_2 = \frac{(\sum x_2 y)(\sum x^2_2) - (\sum x_2 y)(\sum x_i x_2)}{(\sum x_i^2)(\sum x_2^{2)} - (\sum x_i^2) - (\sum x_i\, x^2)^2}$$

$$\alpha = y - \hat{B},\ x_1 - \hat{B}_2\, x_2$$

The estimates $\hat{B}$, measured the change in y for unit change in x_i while holding any of the x is constant.

These estimated parameters are collected, the partial regression co-efficients are blue (Best linear unbiased estimators).

TESTS OF THE SIGNIFICANE OF PARAMETER ESTIMATES

To test the significance parameter estimates of multiple regression the variance of these parameters estimates are required.

$$\text{Var } \alpha = \sigma u^2 = \frac{1/n + x\ \Sigma x_1^2\ x\ x_2^2\ \Sigma x_1^2 - 2\ x, x_2 \Sigma x_1 x_2}{\Sigma x_1^2\ \Sigma x_2^2 - (\Sigma x_1 x_2)^2}$$

$$\text{var } \hat{B}_2) = \sigma u^2 \frac{\Sigma x_1^2}{(\Sigma,^2)\ (\Sigma x_2^2)^2}$$

$$\sigma u^2 = \frac{\Sigma e_1^2}{n - k}$$

$$\Sigma e_1^2 = \Sigma e_i y_i = \Sigma y_i^2 - \hat{B}, - \Sigma x, y - \hat{B}_2\ \Sigma x_2 y$$

$$\sigma u^2 = \frac{\Sigma y_i^2 - \hat{B}_i\ \Sigma xiy - \hat{B}_2\ \Sigma x_2 y}{n.k}$$

STANDARD ERROR TEST

Standard error $s(\hat{B})$ = var $\hat{B}_1$ are printed under neath the respective estimate for comparism numerical values of the estimate.

ACCEPTANCE OR REJECTION

1, if $s(\hat{B}) \leq 1/2\ (\hat{B})$ accept Ho$\hat{B}$ = 0 is the estimate $\hat{B}$ is not statistically significant at 5% level.

2, if $s(\hat{B}_1) \geq 1/2\ (\hat{B})$ reject Ho $\hat{B}$, = 0 ie $\hat{B}_1$ is statistically significant.

3.8 SYSTEM ANALYSIS AND DESIGN

3.8.1PROBLEM IDENTIFICATION

The present method of keeping copies of file records used by the project is labour intensive and control of the files have proved very cumbersome and costly, inefficient and not adequately responsive to the users need.

The files are also not secured in case of fire-out break or any other natural hazards on the premises where valuable data are kept. Therefore, the need for records computerization arises by having a centrally controlled data base on any of the relevant informations.

FUNCTIONS

HOW THE SYSTEM/ PROGRAMS SHOULD FUNCTION

Like the physical components of the computer which are called the hardware, all other resources of the computer that are not hardware are often referd to as the software.

The computer programs can be classified into two, namely

1, System program

2, Application program

also be very useful for the newly established Niger state Agricultural Development Project.

CURRENT SYSTEM

This relates to the implementation and review in getting the system into operation. Before the new system takes place, the following needs to be taken into consideration.

i) There must be prove of satisfaction by the system analyst
ii) That the managers/analyst should be satisfied with the test feasibility
iii) That the targetted data is achieve.

OTHER TRAINING:- The amount of training required for various categories personnel will depend upon the complexity of the system and the skills presently available.

PROGRAMMING:- The programmer must design programmes which conform to the requirement set out in the system specification.

SYSTEM TESTING:- There is a need to ensure that both the individual programs have been written correctly and that the system as a whole will work.

COST BENEFIT ANALYSIS OF THE NEW SYSTEM

THERE ARE TWO OPERATIONAL GOALS FOR EVALUATING SYSTEM

1. RELIABILITY

A system is reliable if it does not produce dangerous or costly failures when used normally. There are ways to ensure system reliablility.

i. ability to ensure that the system requirement are met

ii. abilility to ensure that the system is actually working.

THER ARE THREE APROACHES TO RELIABLITY

i. **ERROR AVOIDANCE**:- The system design should present error from occuring the software that is used, by careful identification of requirement, by using structured method and techniques

ii. **ERROR DETECTION AND CORRECTION**:- This should built into the system

iii. **ERROR TOLERANCE STATEGIES**:- Keep system running even in the presence of errors, the faults may be ignored.

2. **MAINTAINABILITY**:- The possibility of keeping the system working under any conditions. This involves proper identification of system factors.

INPUTS AND OUTPUT SPECIFICATION

The output of most management information system is a collection of reports that are distributed to managers or directors, these are

a. **SHEDULLED REPORT**:- Are provided periodically or on schedule such as daily, weekly or monthly.

b. **KEY INDICATOR REPORT**:- A special type of schedule report which summaries the previous days control activities and is typically available first thing in the morning of each work day.

c. **DEMAND REPORT**:- Are developed to give certain information at managers request. In other words, these reports are produce when demanded.

d. **EXCEPTION**:- Are automatically produce when a situation is required management action or decision.

INPUTS

The inputs is influence by the needs of output. In designing an input, the following items are put into consideration.

a. **TYPE OF INPUT MEDIA**:- The various input media in use for this project are, keyboard, mouse, scanner etc.

b. **DATA COLLECTION METHOD**:- Important information are collected, collated, processed and disseminated accordingly.

c. **SCREEN DESIGN**:- The screen design covers the file maintenance technique, updating and reports.

CHAPTER FOUR

4.1 PROGRAMMING A COMPUTER FOR STATISTICS

Software does not have the same dramatic history of progress as does hardware. Nonetheless, the development from machine code which were the only language available today, is a substantial achievement. But even if a high level language is available, there is still the problem of how best to organise statistical computing chamb (1980) suggest three main approaches.

i. **SINGLE PROGRAMS**

These single programs are by definition stand alone and self-contained, although some have been grouped together to form program libraries (Unwin and Dawson, 1985). They have the advantage that all the user needs to do is run the program, enter the data and read the output. The main disadvantage with single programs are that they are task specific and that combining programs may be difficult.

ii. **SUBPROGRAMS/SUBROUTINES**

This approach to statistical computing involves the development of algorithms and their implementations as subprograms or subroutines. Individual subprograms/subroutines are then combined together to produce a complete program to

carry out one or more tasks. This approach offers great flexibility since many combination of algorithms are possible and tailor made programs can be developed relatively quickly. libraries of subprograms /subroutines can also be updated frequently as new algorithms are evolved. The main disadvantage to users is that programming skills are required in order to implement the subprogram/subroutines and link them with data it is essential, therefore, when using subprograme/subroutines, that good documentation is available and that the programmer who is implementing them has some knowledge of how a subprograms/subroutines work and what they were designed to achieved.

Cooke, craven and clerck (1982,1985) have developed a series of subprograms, written in Basic, which may be implemented on most types of computers.

iii. **PACKAGES**

Statistical packages are really large complex programs or integrated collections of programs which have a special language for giving instructions. To make full use of a statistical analysis package it is necessary to be familiar with the language syntex and the strength and weakness of the facilities available. Not surprising, package tend more expensive than subprograms or subroutines and programs. Their large size also means that powerful, and therefore expensive

hardware is required to run them. on the other hand they often have a wide range of facilities, they can usually handle large data sets, they usually have good documentation and their high level natural language commands makes them comparatively easy to use.

a. **SPREAD SHEET**

Spread sheets are currently one of the most under utilized of the computer facilities available to Agriculturist. They are a type of generic software which can be adapted to any type of statistical analysis which required repeated calculations to be performed on tables of data. Their most frequent use to data has been in the area of numerical forecast modelling although many other users can be foreseen. The great success of spread sheet packages is demonstrated by the fact that the lotus 1-2-3 spreadsheet packages is currently the worlds best selling microcomputer application package (Maquire D.J. 1989).

Most spreadsheet have facilities to assists sheet set up and data entry. These allows users to replicate slot contents, to provide windows so that parts of large sheets can be displayed together and to protect parts of sheets, such as complex formulae, and so avoid accidental deletion. Some spread sheet allow users to control class to data files or disk (that is, read and write data from and to disk while the sheet is

calculating). This may be important when dealing with large data files. The best spread sheet can also be interfaced to other types of software such as data base management system packages, word processing packages and graphics packages.

b.**SPECIFIC PURPOSE STATISTICAL ANALYSIS PACKAGES**

Specific purpose statistical analysis packages are specific in the sence that their sphere of use is restricted to the analysis of one type of problem.

There are many such packages available to agriculturist for great variety of task numerous to mention here.

Survey analysis packages have many of the characteristics of the statistical analysis software already described. In particular, they are closely allied to spread sheets. Survey analysis packages are worthy of consideration here because of their utility in the analysis of questionnaire type data and other social science survey. number of survey analysis packages are currently available for computers. In general survey analysis packages have facilities for data entry, listing editing as well as analysis, such as cross tabulation, cell counts, descriptive statistic (mean, medium, standard deviation etc) and graphs mainly histograms and charts). Most survey analysis packages can be run in either batch or interractive mode.

C. **GENERAL PURPOSE STATISTICAL ANALYSIS PACKAGES**

General purpose statistical packages provide agriculturist with many of the basic statistical techniques which are required for the vast majority of agricultural research of the packages which are available, spss (statistical packages for social sciences) was the most popular in the 1970's and is still in common use. it is especially useful for the analysis of social survey data.

4.2 ADVANTAGES OF COMPUTER IN STATISTICAL ANALYSIS

There are many advantages in using a computers to carryout statistical analysis most obviously it enables us to do things we could not other wise do, but there are many other benefits.

i. **ACCURACY AND SPEED**: Good computer programs will give the correct answers quickly. Analysis by hand is prone to arithmetical errors, and is painfully slow for all but the simplex task.

ii. **VERSATILITY:**- A computer gives access to a widerange of statistical techniques, many more these already described.

iii. **GRAPHICS**:- Computer programs enable plot of observation or statistical results to be obtained easily. Full advantage diagrams can be used to inspect the raw data, and plots can also be used to study the results from an analysis.

iv. **FLEXIBILITY**:- A major advantage is the ability to make small changes and repeat the analysis for example, it is simple to return an analysis after transforming the data, perherps by taking logs, to perform the same analysis on a sub set of the data, or add some new observation.

v. **NEW VARIABLES**:- It is simple to generate new variables we may calculate a subjects age from their data of birth and the data of the study or the change in a measurement by taking differences between pre-and post -treatment values.

vi. **VOLUME OF DATA**:- Vast amount of data can be handled, indeed that can be analysed.

vii **EASY TRANSFER OF DATA**:- Once data have been entered into a computer file they can easily be transfered between researchers either electronically or by sending a ploppy by post.

4.3.0 ANALYSIS OF YIELD OF SOME SELECTED CROPS

In this chapter which is the analysis of yields of some selected crop production.

The statistical tools discussed in chapter three would be used to analysed the data of the selected crops. The analysis shall cover only five crops that's guinea corn, rice, yam, maize and groundnut which are the major crops grown in Niger State. The crops would be individually analysed.

4.3.1 **TIME SERIES ANALYSIS**

Here we shall consider observation of yields of guinea corn, rice, yam, maize and groundnut over past eleven years in Niger state ie 1989 - 1999 and see their trend movements.

I shall use exponential trend to fit a trend line to all the crops because their first differences of the logarithm tends to be constant.

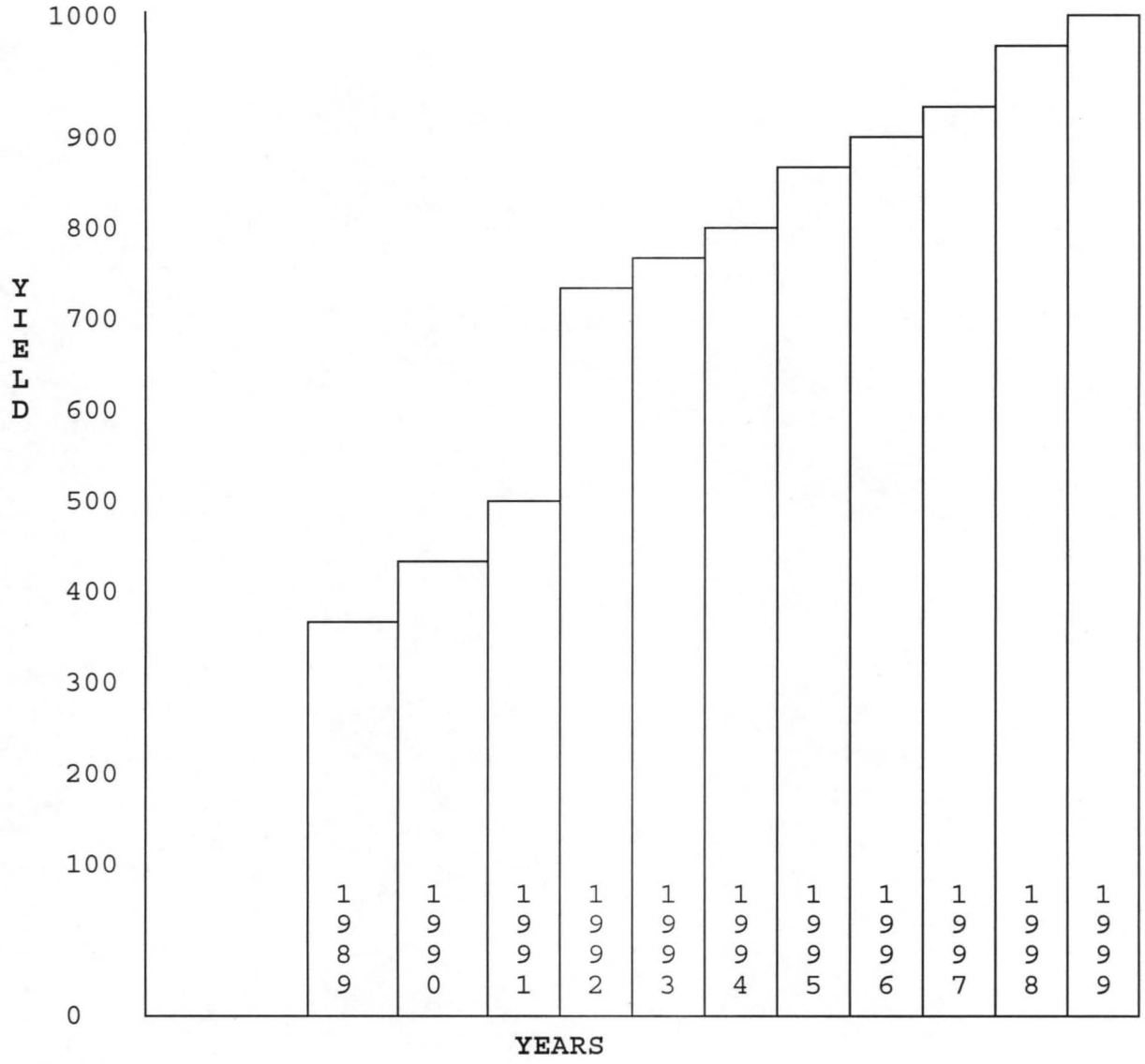
Table 4.3.1

Guinea Corn yield in Niger State (1989-1999)

let Y = Yield of Guineacorn per thousand metric tonnes

YEAR	Y	X	X^2	Log_Y	$XLog_Y$	$Y_c=ab^X$
1989	381.20	-5	25	2.5812	-12.9058	
1990	422.34	-4	16	2.6257	-10.5026	
1991	513.77	-3	9	2.7108	-8.1323	
1992	731.32	-2	4	2.8641	-5.7282	
1993	759.61	-1	1	2.8806	-2.8806	
1994	794.32	0	0	2.8999	0	
1995	850.24	1	1	2.9483	2.9483	
1996	887.82	2	4	2.9295	5.8591	
1997	911.08	3	9	2.9595	8.8787	
1998	965.80	4	16	2.9596	11.9395	
1999	968.59	5	25	2.9861	14.9307	
Total	**8186.07**	**0**	**110**	**31.3707**	**4.4068**	

HISTOGRAM SHOWING YIELD OF GUINEA CORN (1989-1999)



Exponential trend $Y = ab^x$

Which implies that $\log Y = \log a + \log b$

$\sum \log Y = N \log a + \log b \sum X$ --> (1)

$\sum X \log Y = \log a \sum x + \log b \sum x2$ --> (2)

$\log a = \frac{\sum \log Y}{N}$ ==> a =antilog ($\sum \log Y / N$)

$\log b = \frac{\sum \log Y}{\sum x^2}$ ==> b =antilog ($\sum x \log Y / \sum x^2$)

but N = 11, $\sum x^2$ =110, $\sum$ log Y =31.3707 and $\sum$ xlogY=4.4068

Substituting in the formular we have.

$$\text{Log } a = \frac{31.3707}{11} = 2.8519 \Rightarrow a = \text{antilog}(2.8519) = 711.020$$

$$\text{Log } b = \frac{4.4068}{11} = 0.0401 \Rightarrow b = \text{antilog}(0.0401) = 1.0966$$

$$Yc = 711.02\ (1.0966)^x$$

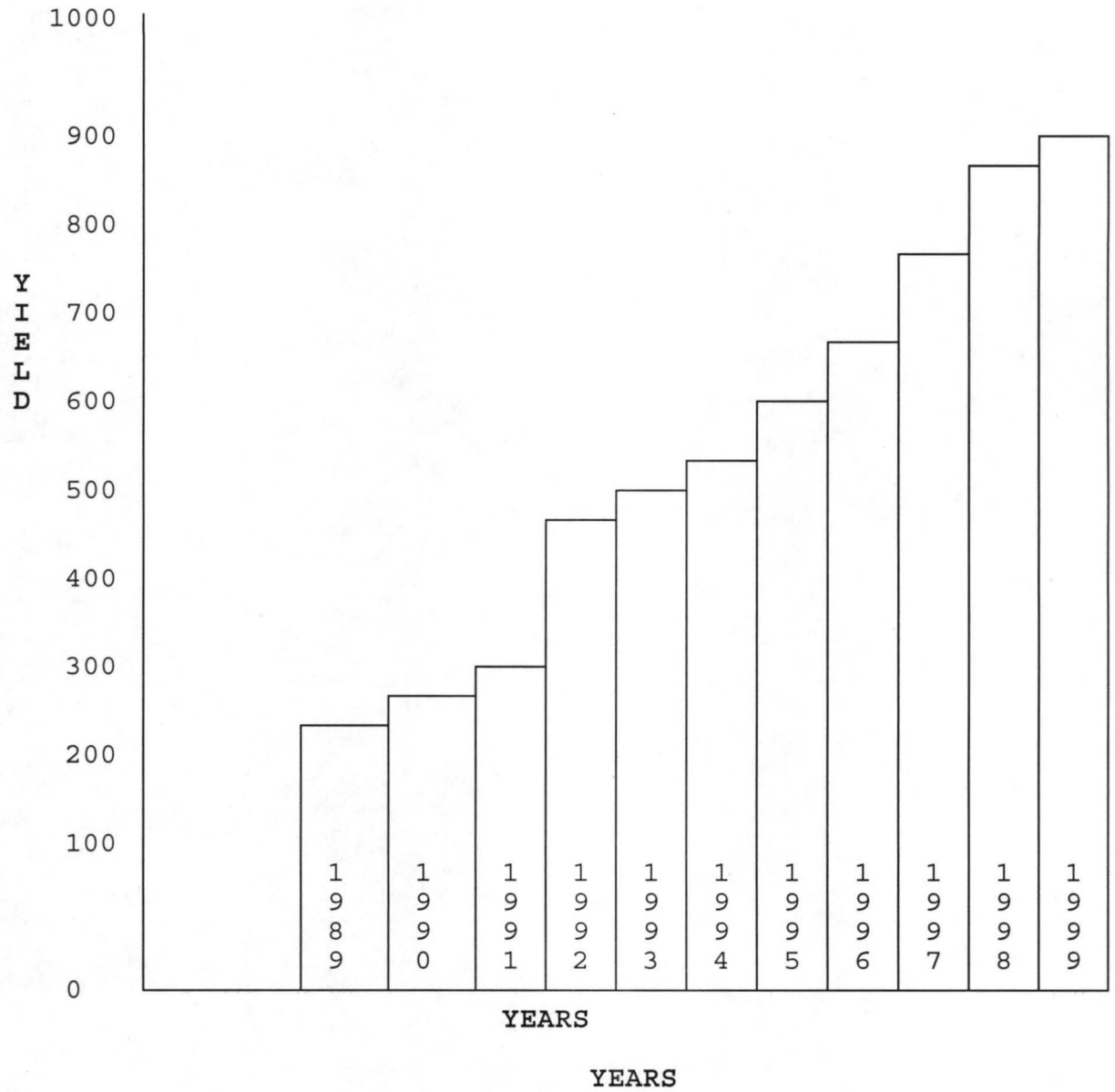
With the regression equation obtained a=intercept on Y-axis ie 711.0200, while b = slope ie (1.0966) we can use the above equation to predict how the future production of guinea corn will be, when given area cultivated as independent variable.

Table 4.3.2

Maize yields in Niger State (1989-1999) let Y = Yield of Maize per thousand metric tonnes

YEAR	Y	X	X^2	Log_Y	$XLog_Y$	$Y_c=ab^x$
1989	234.74	-5	25	2.3706	-7.1118	
1990	256.25	-4	16	2.4087	-9.6346	
1991	263.27	-3	9	2.4204	-12.1020	
1992	470.32	-2	4	2.6724	-5.3448	
1993	482.08	-1	1	2.6813	-2.6831	
1994	535.36	0	0	2.7186	0	
1995	588.64	1	1	2.7698	2.7698	
1996	641.92	2	4	2.8075	5.6149	
1997	730.16	3	9	2.8634	8.5903	
1998	818.17	4	16	2.9128	11.6514	
1999	823.50	5	25	2.9157	14.5783	
Total		**0**	**110**	**29.5412**	**6.3284**	

HISTOGRAM SHOWING YIELD OF MAIZE (1989-1999)



YEARS

N = 11, $\sum X^2$ = 110, $\sum$ log Y 29.5412, $\sum$ x log Y = 6.3284

$$\log a = \frac{\sum \log Y}{N} = \frac{29.5412}{11} = 2.6856 \Rightarrow a = \text{antilog}(2.6856) = 484.80$$

$$\log b = \frac{\sum \log Y}{\sum x^2} = \frac{6.3284}{110} = 0.0575 \Rightarrow b = \text{antilog}(0.0575) = 1.1416$$

Therefore the regression equation is $Y_c = 484.80\ (1.1416)^x$

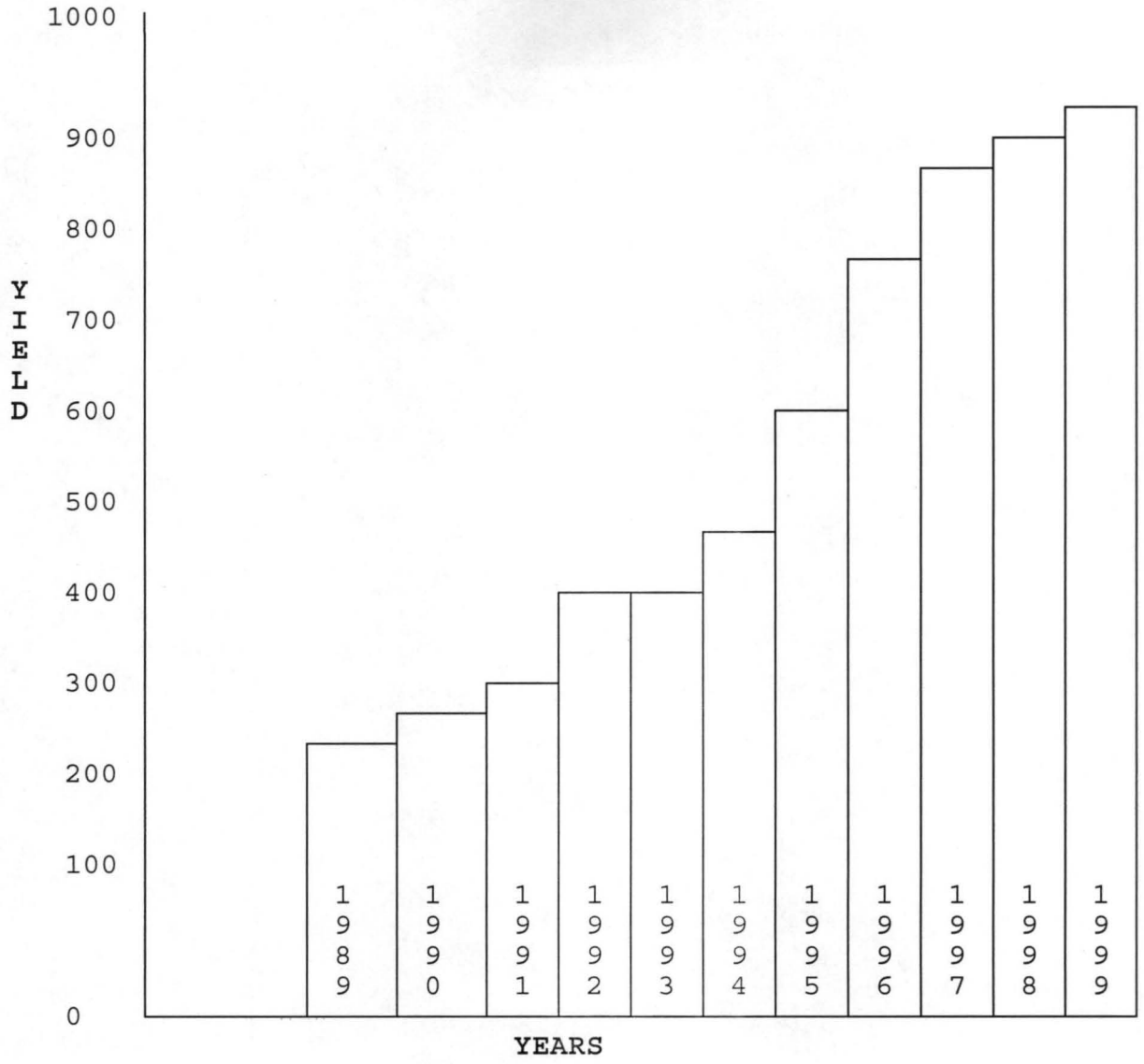
From the regression equation a = intercept i.e (484.80) and b is the slope (ie 1.1416), we can use the above regression equation to provide how future production of Maize will be if given the value of area cultivated.

Table 4.3.3

Yam yields in Niger State (1989-1999) let Y = Yield of yam per thousand metric tonnes

YEAR	Y	X	X^2	Log_Y	$XLog_Y$	$Y_c=ab^x$
1989	223.21	-5	25	2.3487	-11.7435	
1990	264.03	-4	16	2.4217	-9.6868	
1991	278.05	-3	9	2.4441	-7.3323	
1992	397.02	-2	4	2.5988	-5.1976	
1993	397.72	-1	1	2.5995	-2.5995	
1994	448.21	0	0	2.6515	0	
1995	591.35	1	1	2.7718	2.7718	
1996	781.93	2	4	2.8932	5.7864	
1997	862.95	3	9	2.9359	8.8077	
1998	863.14	4	16	2.9361	11.7444	
1999	868.41	5	25	2.9387	14.6935	
Total	**5976.02**	**0**	**110**	**29.54**	**7.2441**	

HISTOGRAM SHOWING YIELD OF YAM (1989-1999)



N = 11, $\sum X^2$ = 110, $\sum$ log Y 29.54, $\sum$ x log Y = 7.2441

$\therefore$ log a $= \frac{\sum \log Y}{N} = \frac{29.54}{11}$ = 2.6856 ==> a=antilog(2.6856)=484.68

log b $= \frac{\sum \log Y}{\sum x^2} = \frac{7.2441}{110}$ =0.0659 ==> b=antilog(0.0659)=1.1637

Therefore Y_c =484.68 $(1.1637)^x$

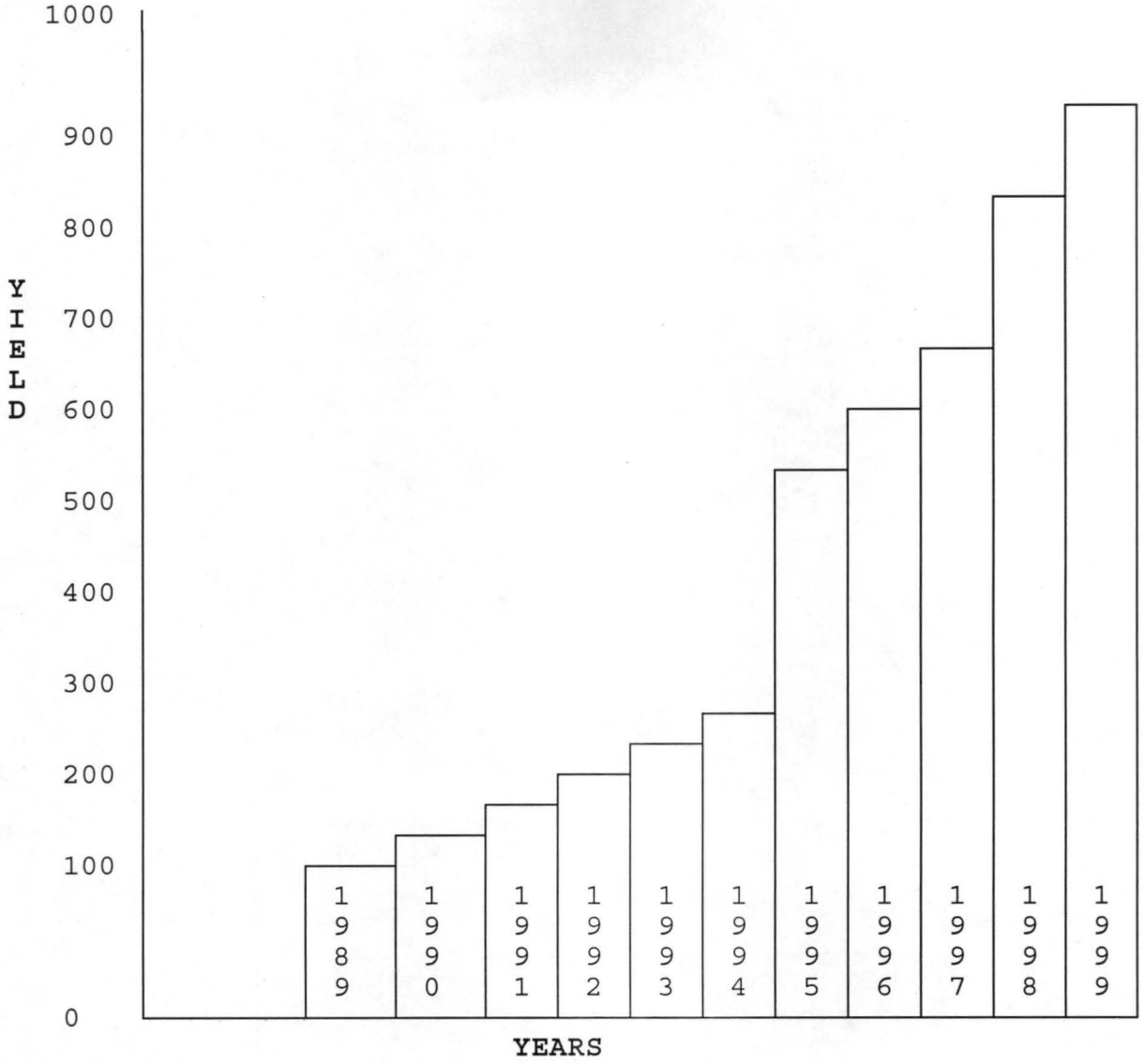
From the regression line obtained a = intercept i.e (484.68) and b which is the slope (ie 1.1637), we can use it to predict how the future production of yam will be at any given area cultivated.

Table 4.3.4

Rice yields in Niger State (1989-1999) let Y = Yield of Rice per thousand metric tonnes

YEAR	Y	X	X^2	Log_Y	$XLog_Y$	$Y_c=ab^x$
1989	119.11	-5	25	2.0759	-10.3797	
1990	163.77	-4	16	2.2142	-8.8569	
1991	191.09	-3	9	2.2812	-6.8569	
1992	198.85	-2	4	2.2985	-4.5971	
1993	203.82	-1	1	2.3092	-2.3092	
1994	206.63	0	0	2.3152	0	
1995	538.88	1	1	2.7315	2.7315	
1996	600.96	2	4	2.7788	5.5577	
1997	648.398	3	9	2.8118	8.4355	
1998	824.63	4	16	2.9163	11.6650	
1999	944.54	5	25	2.9752	14.8761	
Total	**5976.02**	**0**	**110**	**27.707088**	**10.2792**	

HISTOGRAM SHOWING YIELD OF RICE (1989-1999)



N = 11, $\sum X^2$ = 110, $\sum$ log Y 27.7078, $\sum$ x log Y =10.2792

$$\therefore \quad a = \frac{\sum \log Y}{N} = \frac{27.7078}{11} = 2.5189 \Rightarrow a = \text{antilog}(2.5189) = 330.29$$

$$\log b = \frac{\sum \log Y}{\sum x^2} = \frac{10.2792}{110} = 0.0934 \Rightarrow b = \text{antilog}(0.0934) = 1.2401$$

Therefore $Y_c = 330.29\ (1.2401)^x$

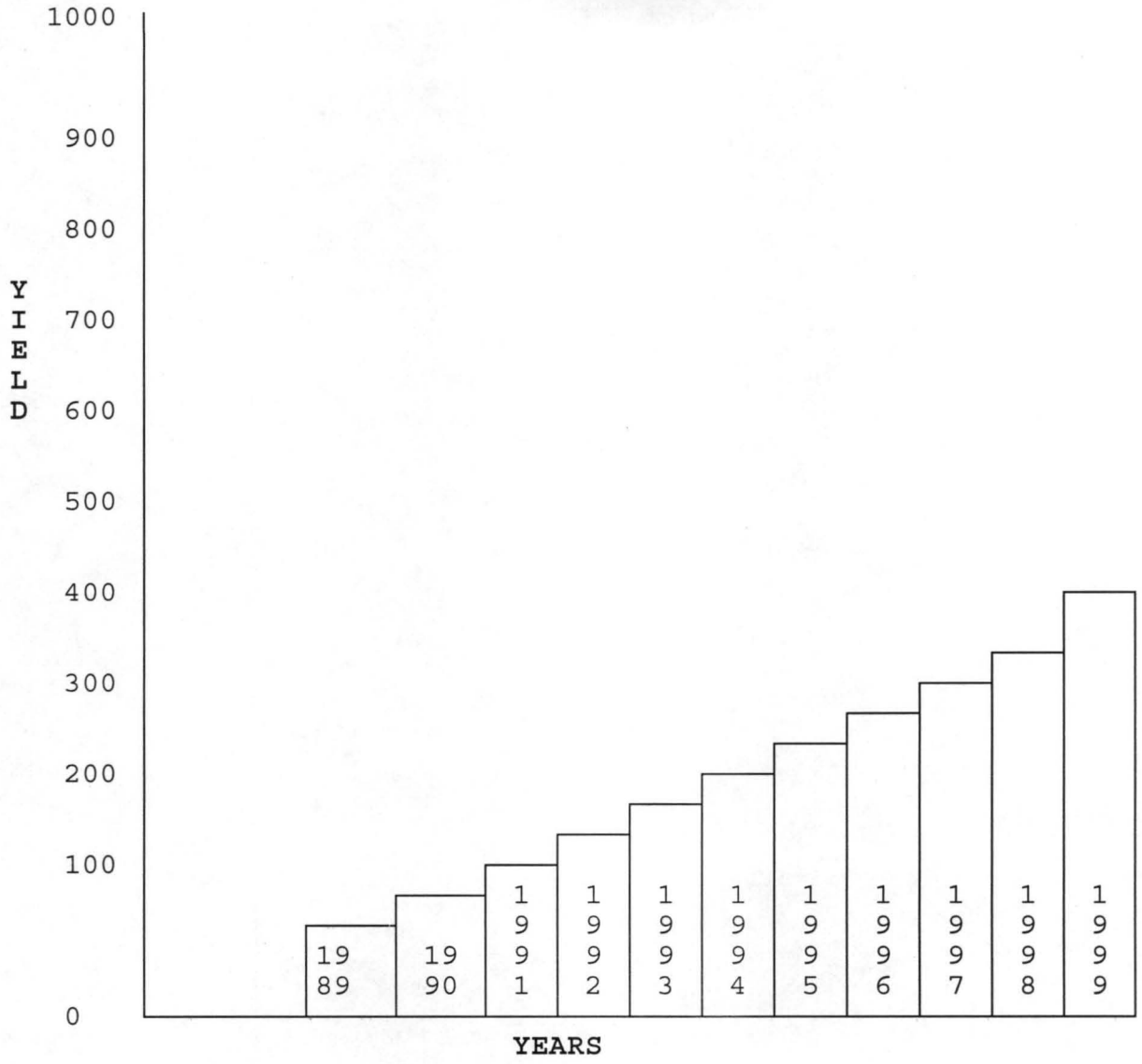
From the regression line obtained a = intercept i.e (330.29) and b which is the slope ie (1.2401), we can predict how the future production of Rice will be at any given area cultivated.

Table 4.3.5

Groundnut yields in Niger State (1989-1999) let Y = Yield of Groundnut per thousand metric tonnes

YEAR	Y	X	X^2	Log_Y	$XLog_Y$	$Y_c=ab^X$
1989	89.72	-5	25	1.9529	-9.7645	
1990	95.74	-4	16	1.9811	-7.9244	
1991	102.10	-3	9	2.0090	-6.0271	
1992	104.15	-2	4	2.0176	-4.0353	
1993	182.29	-1	1	2.2607	-2.2607	
1994	195.69	0	0	2.2916	0	
1995	253.16	1	1	2.4034	2.4036	
1996	262.49	2	4	2.4191	4.8382	
1997	293.75	3	9	2.4679	7.4039	
1998	331.21	4	16	2.5201	10.0804	
1999	349.62	5	25	2.5436	12.7179	
Total	**5976.02**	**0**	**110**	**24.867**	**7.4318**	

HISTOGRAM SHOWING YIELD OF GROUNDNUT (1989-1999)



N = 11, $\sum X^2$ = 110, $\sum$ log Y 24.867, $\sum$ x log Y =7.4318

$$\therefore \quad a = \frac{\sum \log Y}{N} = \frac{24.867}{11} = 2.2606 \Rightarrow a = \text{antilog}(2.2606) = 182.24$$

$$b = \frac{\sum \log Y}{\sum x^2} = \frac{7.4318}{110} = 0.0676 \Rightarrow b = \text{antilog}(0.0676) = 1.1683$$

Therefore $Y_c = 182.24\ (1.1683)^x$

From the regression line obtained after computation a = intercept i.e (182.24) and b which is the slope ie (1.1683), we can predict how the future production of Groundnut will be at any given area cultivated.

4.4.0 SIMPLE REGRESSION ANALYSIS

The primary objective of regression analysis is to predict the value of one variable (the dependent variable) given that the value of the associated variable(s) the independent variable is given

The table is the guinea corn yield and total area put under cultivation (1989-1999). Here our dependent variable is Y(yields per thousand metric tonnes) while area put under cultivation per thousand hectares) will be x

Table 4. 4.1 Guinea corn yield area cultivated

YEAR	Y	Y	XY	X^2	XY
1989	258.09	381.20	98383.91	66610.45	145313.44
1990	282.49	422.34	119306.83	79800.60	178371.08
1991	473.39	513.77	243213.58	224098.92	263959.61
1992	610.93	731.32	446785.33	373235.46	534828.94
1993	626.21	759.61	446785.38	392138.96	577007.35
1994	641.49	794.32	509548.34	411509.42	630944.26
1995	702.61	887.82	623791.21	493660.81	788224.35
1996	142.43	850.24	121099.68	20286.30	722908.06
1997	386.75	911.08	352360.19	149575.56	830066.77
1998	609.98	965.80	589118.68	372075.60	932769.64
1999	640.48	968.57	620349.71	410214.63	938127.84
Total	**5374.85**	**8186.07**	**4199632.84**	**2993206.71**	**6542521.34**

Given $\sum x = 5379.85$, $\sum Y = 8186.07$, $\sum xY = 4199632.84$,

$\sum x^2 = 2993206.71$ and $\sum Y^2 = 6542521.34$

But $Y = a + bx$

Therefore, to estimate the parameters a and b we use the formular below.

$$a = \frac{\sum Y - b \sum x}{n}$$

$$b = \frac{n\sum x Y - \sum x \sum Y}{n\sum x^2 - (\sum x)^2}$$

Therefore, $b = \frac{11\ (4199632.84) - (5374.85)(8186.07)}{11\ (299332206.71) - (5374.85)^2}$

$$= \frac{46195961.24 - 43998898.34}{32925273.81 - 28889012.52}$$

$$= \frac{2197062.5}{4033261.25}$$

$$b = \underline{\underline{0.5447}}$$

$$a = \frac{\sum Y - 3 \sum x}{n}$$

$$a = \frac{8186.07 - (05447)(5374.85)}{11}$$

$$\frac{8186.07 - 2927.87}{11}$$

$$= \frac{5258.2}{11} = 478.02$$

The regression equation becomes Y = 478.02 + 0.5447 x from the regression line a = intercept on Y-axis(ie 478.02), b = slope parameter (ie 0.5447) indicating change in total production of guinea corn for a unit change in area cultivated.

From the above one can deduce and state categorically that there is linear relationship between the two variables ie production and area cultivated.

Table 4.4.2

Maize yields and area cultivated.

Y = maize yield ('000mt)

x = Area cultivated ('000ha)

YEAR	Y	Y	XY	X^2	XY
1989	193.01	263.27	50813.74	37252.86	69311.09
1990	155.10	256.25	39744.38	24056.00	65664.06
1991	258.95	234.74	60785.92	67055.10	55102.87
1992	357.07	470.32	167937.16	127498.98	221200.90
1993	366.00	482.08	176441.28	133956.00	232401.13
1994	476.90	535.36	255313.18	227433.61	286610.33
1995	520.96	588.64	306657.89	271399.32	346497.05
1996	563.14	641.92	361490.83	317126.66	412061.29
1997	292.95	730.16	213900.37	85819.70	533133.63
1998	433.42	818.17	354611.24	187852.90	669402.15
1999	478.75	823.50	394250.63	229201.56	678152.25
Total	**4096.25**	**5844.41**	**2381946.62**	**1708652.69**	**3569536.74**

Given $\sum x = 4096.25$, $\sum Y = 5844.41$, $\sum xY = 2381946.62$,

$\sum x^2 = 17086552.69$ and $\sum Y^2 = 3569536.74$

$Y = a + bx$

$$b = \frac{n\sum x Y - \sum x \sum Y}{n\sum x^2 - (\sum x)^2}$$

$$= 11 \frac{(2381946.62) - (4096.25)(5844.41)}{11 \quad (17086552.69) - (4096.25)^2}$$

$$= \frac{26201412.82 - 2394164.46}{}$$

$$18795179.59 - 16779264.06$$

$$= \frac{2261248.36}{2015915.53}$$

$$b = \underline{\underline{1.1217}}$$

$$a = \frac{\sum Y - b \sum x}{n}$$

$$a = \frac{5844.41 - (1.1217)(4096.25)}{11}$$

$$\frac{5844.41 - 4594.76}{11}$$

$$a = \frac{1249.65}{11} \quad a = 113.61$$

The regression equation becomes Y = 113.61 + 1.1217 x from the regression line a = intercept on Y-axis(ie 113.61), b = slope parameter (ie 1.1217) indicating change in total production of Maize for a unit change in area cultivated.

Table 4.4.3

Yam yields and area cultivated.

Y = Yam yield ('000mt)

x = Area cultivated ('000ha)

YEAR	Y	Y	XY	X^2	XY
1989	102.40	223.21	22856.70	10485.76	49822.70
1990	867.58	264.03	229056.59	752695.06	69711.84
1991	127.58	278.05	35473.62	16276.66	77311.80
1992	100.68	397.02	39971.97	10136.46	157624.88
1993	169.01	397.72	67218.66	28564.38	158181.20
1994	127.21	448.21	57016.79	16182.38	200892.20
1995	141.02	591.35	83392.18	19886.64	349694.82
1996	182.12	781.93	142405.09	33167.69	611414.52
1997	240.82	862.95	207815.62	57994.27	744682.70
1998	324.79	863.14	280339.24	105488.54	745010.66
1999	332.85	868.41	289050.27	110789.12	754135.93
Total	**2716.06**	**5976.02**	**1454596.73**	**1161666.96**	**3918483.25**

Given $\sum x = 2716.06$, $\sum Y = 5976.02$, $\sum xY = 145459673$,

$\sum x^2 = 1161666.96$ and $\sum Y^2 = 3918483.25$ we know that

$Y = a + bx$

$$b = \frac{n\sum xY - \sum x \sum Y}{n\sum x^2 - (\sum x)^2}$$

$$= 11 \frac{(1454596.73) - (2716.06)(5976.02)}{11 \quad (1161666.96) - (2716.06)^2}$$

$$= \frac{26000564.03 - 16231228.88}{}$$

$$12778336.56 - 7376981.92$$

$$= \frac{9769335.15}{5401354.64}$$

$$b = \underline{\underline{1.8087}}$$

$$a = \frac{\sum Y - b \sum x}{n}$$

$$a = \frac{5976.02 - 1.8087\ (2716.06)}{n}$$

$$\frac{5976.02 - 4912.53}{11}$$

$$a = \frac{1063.49}{11} \quad a = 96.68$$

The regression equation becomes Y = 96.68 + (1.8087) x from the regression line a = intercept on y-axis ie(96.68), b is the slope ie (1.8087) this indicating change in total production of Yam for a unit change in area cultivated.

Table 4.4.4

Rice yields and area cultivated.

Y = Yam yield ('000mt)

x = Area cultivated ('000ha)

YEAR	Y	Y	XY	X^2	XY
1989	84.07	191.09	16064.94	7076.76	36515.39
1990	68.71	163.77	11252.64	4721.06	26820.61
1991	109.90	119.11	13090.19	12078.01	14187.19
1992	120.85	198.85	24031.02	14604.72	39541.32
1993	169.41	203.82	34529.15	28699.75	41542.59
1994	348.26	824.63	287185.64	121285.03	680014.64
1995	112.23	944.54	106005.72	12595.57	892155.81
1996	157.54	206.63	32552.15	24818.85	42695.96
1997	233.08	538.88	125602.15	54326.29	290391.65
1998	266.68	600.96	160264.01	71118.22	361152.92
1999	272.02	648.39	176375.05	73994.88	420409.59
Total	**1952.75**	**4640.67**	**986953.00**	**425310.14**	**2962492.18**

Given $\sum x = 1952.75$, $\sum Y = 4640.67$, $\sum xY = 986953.00$,

$\sum x^2 = 425310.14$ and $\sum Y^2 = 2176330.36$

but $Y = a + bx$

$$b = \frac{n\sum xY - \sum x \sum Y}{n\sum x^2 - (\sum x)^2}$$

$$= \frac{11\ (986953.00) - (1952.75)\ (4640.67)}{11\ (425310.14) - (1952.75)^2}$$

$$= \frac{10856483.00 - 9062068.34}{4678411.54 - 3813232.56}$$

$$= \frac{1794414.66}{865178.98}$$

$$b = \underline{\underline{2.0740}}$$

$$a = \frac{\sum Y - b \sum x}{n}$$

$$a = \frac{4640.67 - (2.0740)(1952.75)}{11}$$

$$\frac{4640.67 - 4050.00}{11}$$

$$a = \frac{590.67}{11} \quad a = 53.69$$

The regression equation becomes Y = a + bx ie Y= 53.69 + 2.0740 from the regression line a = intercept on ie(53.69), b is the slope ie (2.0740)indicating change in total production of Rice for a unit change in area cultivated and there is a linear relationship between two variables i.e production and area cultivated.

Table 4.4.5

Groundnut yields and area cultivated.

Y = Groundnut yield ('000mt)

x = Area cultivated ('000ha)

YEAR	Y	Y	XY	X^2	XY
1989	78.98	89.72	7086.09	6237.84	8049.68
1990	138.81	95.74	13289.67	19268.22	9166.15
1991	140.48	102.10	14343.01	19734.63	10424.41
1992	143.98	104.15	14995.52	20730.24	10847.22
1993	223.69	182.29	40776.45	50037.22	38229.64
1994	101.40	195.69	19842.97	10281.96	38294.58
1995	197.16	253.16	09913.03	38872.07	64089.99
1996	201.25	262.49	52826.11	40501.56	68901.00
1997	224.76	293.75	66023.25	50517.06	86289.06
1998	285.69	331.21	94623.38	81618.78	109700.06
1999	291.35	349.62	101861.79	84884.82	122234.14
Total	**2027.55**	**2268.92**	**475581.27**	**422684.40**	**561225.94**

Given $\sum x = 2075.55$, $\sum Y = 2268.82$, $\sum xY = 475581.27$,

$\sum x^2 = 422684.40$ and $\sum Y^2 = 561225.94$ we know that

$Y = a + bx$

$$b = \frac{n\sum xY - \sum x \sum Y}{n\sum x^2 - (\sum x)^2}$$

$$= \frac{11\ (475581.27) - (2027.55)\ (2268.92)}{11\ (422684.40) - (2027.55)^2}$$

$$= \frac{5792619.91 - 4600348.75}$$

$$4649528.40 - 4110959.00$$

$$= \frac{192271.16}{538569.4}$$

$$b = \underline{\underline{0.3570}}$$

$$a = \frac{\sum Y - b \sum x}{n}$$

$$= \frac{2268.98 - (0.3570)(2027.55)}{11}$$

$$= \frac{2268.92 (72384)}{11}$$

$$= \frac{1545.08}{11}$$

$$a = 140.46$$

the regression equation becomes

$Y = a + bx$ ie $140.46 + (0.3570)x\ 140.46$

from the regression equation a = interpt (ie 140.46)

and b = slope (ie 0.3570), this indicate slope inm total providing of Groundnut for a unit charge in area cultivated

4.4.6 CORRELATION ANALYSIS

Correlation attempts to express the degree of association between the variable. When measuring correlation it does not matters which variable is dependent and which is independent.

Correlation co-efficient lies between 1 and - 1. Here we will

try to correlated the yields of these crops area put under cultivation and see their degree of association.

Guinea corn.

For Guinea corn we have $\sum x = 5374.75$,

$\sum Y^2 = 6542521.34$

$$r = \frac{n\sum xY - \sum x \sum Y}{n\sum x^2 - (\sum x)^2 \; n\sum Y^2 \; (\sum Y)^2}$$

$$= \frac{11 \;\; (4199632.84 - (5374.85) \;\; (8186.07)}{\sqrt{11 \;\; (2993206.71 - (5374.85)^2 \;\; 11 \;\; (6542521.34 - (8186.07)^2}}$$

$$= \frac{4695961.24 - 43998898.34}{\sqrt{(32925273.81 - (6374.85)^2 \;\; (71967734.74 - (8186.07)^2}}$$

$$= \frac{2197062.9}{\sqrt{(32925273.81 - 28889012.52)(71967734.74 - 67011742.05)}}$$

$$= \frac{2197062.9}{(4036261.25)(4955992.65)}$$

$$= \frac{2197062.9}{(2009.04)(2226.205887)}$$

$$= \frac{2197062.9}{4472536.75}$$

$$= 0.49$$

From the above calculation shows that there is a week relationship between yield of quineacorn and area cultivated. That is as the value of the dependent variable decreases so also the value of the independent variable decreases.

r^2 0.24 =) 24% variation in yield has been explained by area cultivated and 76% can be attributed to other features.

MAIZE

For maize we have $\sum x = 4096.25$, $\sum Y = 5844.41$, $\sum xY = 2381946.62$, $\sum x^2 = 1708652.69$ and $\sum Y^2 = 3569536.74$

$$r \quad \frac{n\sum xY - \sum x \sum Y}{\sqrt{(n\sum x^2 Y - (\sum Y^2)) - (\sum Y)^2)}}$$

$$= \frac{11\ (2381946.62 - (4096.25)\ (5844.41)}{\sqrt{(11(1708652.69) - (4096.25)^2)\ (11(3569536.74) - (5844.41)^2}}$$

$$= \frac{26201412.82 - 23940164.46}{\sqrt{(18795179.59 - 16779264.06)(39264904.14 - 34157128.25)}}$$

$$= \frac{2261248.36}{\sqrt{(2015915.53)(5107775.89)}}$$

$$= \frac{2261248.36}{\sqrt{(1419.83)(2260.04)}}$$

$$= \frac{2261248.36}{3208871.05}$$

$$= 0.70$$

This indicate a high positive linear relationship between the yield of maize and area put into cultivation.

$r^2 = 49$, in other words 49% of variation in yield has been explained by area cultivated and 5% can be attributed to other factors.

YAM

For yam we have

$\sum x = 2716.06$, $\sum Y = 5644.72$ $\sum xY =$ 2017558.05, $\sum x^2 = 27614.05$ and $\sum Y^2 = 3778419.19$.

$$r = \frac{n\sum xY - \sum x \sum Y}{\sqrt{(n\sum x^2 - (\sum x)^2)\ (n\sum Y^2 - (\sum Y)^2)}}$$

$$= \frac{11\ (2017558.05 - (2716.06)(5644.72)}{\sqrt{11\ (1027614.05) - (2716.06)^2)\ (11(3778419.19) - (5644.72)^2)}}$$

$$= \frac{22193138.55 - 15331398.2}{\sqrt{(11303754.55 - 7376981.92)(41562611.09 - 31862863.88)}}$$

$$= \frac{6861740.35}{(3926772.63)\ (9699747.21)}$$

$$= \frac{6861740.35}{(1981.61)(3114.44)}$$

$$= \frac{6861740.35}{6971605.45}$$

$r = 0.98$

This indicate a high positive relationship between yield of yam and area cultivated.

$r^2 = 0.96$, that is 96% of variation in yield has been explained by area cultivated and 4% can be attributed to other factors.

RICE

For rice we have

$\sum X = 1952.75$, $\sum Y = 4640.67$, $\sum xY = 9869953.00$ $\sum x^2 = 425310.14$ and $\sum Y^2 = 2962492.18$

$$r = \frac{n\sum xY - \sum x \sum Y}{\sqrt{x(n\sum x^2 - (\sum x)^2)(n\sum Y^2 - (\sum Y)^2)}}$$

$$= \frac{11(986953.00) - (1952.75)^2 - (1952.75)(4640.67)}{\sqrt{(11(425310.14) - (1952.75)^2)11(2962492.18) - (4640.67)^2)}}$$

$$= \frac{10856483.00 - 9062068.34}{\sqrt{(4678411.54 - 3813232.56)(32587413.98 - 21535818.05)}}$$

$$= \frac{1794414.66}{\sqrt{(865178.98)\ (11051595.93)}}$$

$$= \frac{1794414.66}{(930.15)(3324.39)}$$

$$= \frac{1794414.66}{3092181.28}$$

$r = 0.58$

From the above calculation it shows that there is a high positive relationship between yield of rice and area cultivated.

$r^2 = 0.34$ =) 34% of variation in yield has been explained by area cultivated and 66% can be attributed to other factors.

GROUND NUT

For Groundnut we have

$\sum X = 202755$, $\sum Y = 2268.92$, $\sum XY = 475581.27$, $\sum Y^2 = 422684.40$ and $\sum Y^2 = 5612225.94$

$$r = \frac{n\sum XY - \sum X \sum Y}{\sqrt{(n\sum x^2 - (\sum x)^2)\ (n\sum Y^2 - (\sum Y)^2}}$$

$$= \frac{11(475581.27) - (2027.55)(2268.92)}{\sqrt{(11(42268.40) - (2027.55)^2)(11(561225.94) - (2268.92)^2)}}$$

$$= \frac{5231393.97 - 4600348.75}{\sqrt{(464952.80 - 4110959)(6173485.34 - 5147997.97)}}$$

$$= \frac{631045.22}{\sqrt{(5385699)10225487.37}}$$

$$= \frac{631045.22}{(733.87)(1012.66)}$$

$$= \frac{631045.22}{743163.36}$$

$$= 0.85$$

This indicates a high positive linear relationship between the yield of groundnut and area put into cultivation.

$r^2 = 0.72$, This shows that 72% of variation in yield has been explained by area cultivated and 28% is attributed to other factors.

Multiple regression analysis

Multiple regression analysis is used for testing hypothesis about the relationship between dependent variable y and Two or more independent variable x's

Multiple regression for yam

Let = Yield of yam

x1 = Area put into cultivation.

x2 = Average rainfall

Year	y	X1	X_2	y1- $\hat{y}$	$x_1 - \bar{x}_1$	$x_2 - \bar{x}_2$	$x_1 x_2$	x_1^2	x_2^2	y^2	x_1y	x_2y
1989	223.21	102.40	124.30	-316.79	-144.51	-95.89	12728.32	10485.76	15450.49	49822.70	22856.70	27745.00
1990	264.03	867.58	160.64	-275.97	620.67	-59.55	139368.05	752695.06	25805.21	6971.84	229067.15	42413.78
1991	278.05	127.58	158.33	-261.95	-119.33	61.86	20199.74	1627.66	25068.39	77311.80	35473.62	44023.66
1992	397.02	100.68	120.40	-142.98	-146.23	-99.79	12121.87	10136.46	14496.16	157624.88	39971.97	47801.21
1993	397.72	169.01	187.66	-142.28	-79.9	-32.53	31716.42	28564.38	32216.28	158181.19	67218.66	74636.14
1994	448.21	127.21	168.22	-91.79	-119.7	-51.97	21399.27	16182.38	28297.97	200892.20	57016.79	75397.89
1995	591.35	141.02	178.32	51.35	-105.89	-41.87	25146.69	19886.64	31798.02	349694.82	83392.18	105449.53
1996	781.93	182.12	203.16	241.93	-64.79	-17.03	36999.50	33167.69	41273.99	611414.52	142405.09	158856.89
1997	826.95	240.82	285..55	286.95	-6.09	65.36	68766.15	57994.27	81538.80	683846.30	199146.06	236135.57
1998	863.14	324.79	392.75	323.14	77.88	172.56	127561.27	105488.54	154252.56	745010.66	280339.24	338998.23
1999	868.41	332.85	442.80	328.41	85.94	222.61	147385.98	110789.12	196071.84	754135.93	289050.27	384531.95
TOTAL	**5940.02**	**2716.06**	**2422.13**	**0.02**	**0.05**	**0.04**	**2643167.52**	**1161666.96**	**646269.71**	**3857646.84**	**1445937.76**	**1535989.86**

$$\hat{y} = \frac{5940.02}{11} = 540.00$$

$$\bar{x}_1 = \frac{2716.06}{} = 426.91$$

$$\bar{x}_2 = \frac{2422.13}{11} = 220.19$$

$\sum Y = 5940.02$

$\sum xi = 2716.06$

$\sum x_2 = 2422.13$

$\sum Y - Yi = 0.02$

$\sum xi - x, = 0.05$

$\sum x_2 - x_2 = 0.04$

$\sum x_2 - x_2 = 2643167.52$

$\sum x_2^2 = 1161666.96$

$\sum x^2 = 646269.71$

$\sum Y^2 = 3857646.84$

$\sum x_1 Y = 1445937.76$

$\sum x_2 Y = 1535989.86.$

To obtain the parameters $\tilde{B}$, and $\hat{B}_2$
we know that

$$\hat{B} = \frac{(\sum xiY)(\sum x_2^2) - (\sum x_2)(\sum x_1 x_2)}{(\sum x_1^2)(\sum x_2^2) - (\sum x_2 x_2)^2}$$

$$= \frac{(1445937.76)(646269.71) - (1535989.86)(2643167.52)}{(116166.96)(646269.71) - (2643167.52)^2}$$

$$= \frac{934465776833.25 - 405987850901.35}{750750169355.78 - 69863345387782.95}$$

$$= \frac{312542732167.75}{6235584369427.17}$$

$= 0.5012221063821 \qquad \hat{B}_1 = 0.050$

$$\hat{B}_2 \frac{(\sum x_2Y)(\sum xi^2) - (\sum xiY)(\sum x_1x_2)}{(\sum xi^2)(\sum x_2^2) - (\sum xix_2))^2}$$

$$= \frac{(1535989.86)(1161666.96) - (1445937)(2643167.52)}{(1161666.96)(646269.71) - (264316.52)^2}$$

$$= \frac{1784308671257.03 - 3821855723173.56}{750750169355.78 - 69863345387782.95}$$

$$= \frac{3267612033134.45}{} = 0.33$$

$\hat{B}_2 = 0.33$

But $Y - \hat{B}_1x_1 - \hat{B}_2x_2$

$= 540 - 0.50\ (246.91) - 0.33\ (220.19)$

$= 540 - 123.46 - 72.66$

$= 343.88$

Therefore the multiple regression equation is given by Yc = $343.88 + 0.50x, + 0.33x_2$

TEST OF SIGNIFANCE

To test for the significance of parameters estimates of multiple regression, the variance of the parameters estimates are required.

$$\text{var } (\hat{B}) = \frac{li^2 \sum x_2^2}{(\sum x_1^2)(\sum x_2^2) - (\sum x_1x_2)^2}$$

$$= \frac{\sigma u^2\ 646269.71}{(1161666.96)(646209.71) - (2643167.52)^2}$$

but $\sigma u^2 = \frac{\sum Yi^2}{n - k}$

and $\sum 1i^2 = \sum Y^2 \hat{B}_1 \sum x_1 Y - \hat{B}_2 \sum x_2 Y$

$$\sigma u^2 = \frac{\sum Y^2 - \hat{B}_1 \sum x_1 Y - \hat{B}_2 \sum x_2 Y}{n-k}$$

$$\sigma u2 = \frac{3857646.84 - 0.50\ (1445937.76) - 0.33(1535989.86)}{11.2}$$

$= 3857646.84\ 722968.88 - 506876.65$

$= 2627801.31$

$$\text{var}\ (\tilde{B}_1) = \frac{2627801.31\ (646269.71)}{(116166.96)(646269.71) - (2643167.52)^2}$$

$$= \frac{1698268390551.32}{750749994862.96 - 6986334538782.95}$$

$$= \frac{1698268390551.32}{623558453919.99}$$

$\text{var}(\hat{B}) = 2723.51$

$$\text{var}(\hat{\beta}) = \frac{u^2 \sum x,2}{(\sum x1^2)(\sum x2^2) - (\sum x1^{2\sum 2})^2}$$

$$= \frac{2627801.31\ (1161666.96}{(1161666.96)\ (6462269.71) - (2643167.52)^2}$$

$$= \frac{3052629959271.72}{750749994862.96 - 6986334538782.95}$$

$$= \frac{3052629959271.72}{623558453919.99}$$

$= 48954.99$

STANDARD ERROR TEST

Standard error test is used to test significance of parameters.

1) If $s(\hat{B}) \leq 1/2\ (\hat{B})$ accept Ho: $\hat{B} = 0$

2) If $s(\hat{B}) \geq 1/2\ (\hat{B})$ reject Ho: $\hat{B}, = 0$

Therefore our hypothesis will be significant at 5% level.

Hi = $\hat{B}$ ie the estimate is staistically significant.

Groundnut

Let = Yield of Groundnut

x1 = Area put into cultivation.

x2 = Average rainfall

Year	y	X1	X_2	$y1-\hat{y}$	$x_1-\bar{x}_1$	$x_2-\bar{x}_2$	x_1x_2	x_1^2	x_2^2	y^2	x_1y	x_2y
1989	89.72	78.98	92.87	-115.73	-105.34	-155.78	7334.87	6237.84	8624.84	8049.68	7086.09	8332.30
1990	95.74	138.81	174.42	-109.71	-45.51	-74.23	24211.24	19268.22	30422.34	9166.15	13289.67	16698.97
1991	102.10	140.48	193.33	-103.35	-43.84	-55.32	27158.99	19734.63	37376.49	10424.41	14343.01	19738.99
1992	104.15	143.98	201.74	-101.30	-40.34	-46.91	29046.53	20730.24	40699.03	10847.22	14995.52	21011.22
1993	182.29	223.69	249.38	-23.16	39.37	0.73	55783.81	50037.22	62190.38	33229.64	40776.45	45459.48
1994	195.69	101.24	175.89	-9.76	-83.08	-72.76	17807.10	10249.54	30937.29	38294.58	19811.66	34419.91
1995	253.16	197.16	250.55	44.71	12.84	1.7	49398.44	38872.07	62775.30	6409.99	49913.03	63429..24
1996	262.49	201.25	273.72	57.04	16.93	25.07	55086.15	40501.56	74922.64	68901.00	52826.11	71848.76
1997	293.75	224.76	305.63	88..30	40.44	56.98	6869.40	50517.06	93409.70	86289.06	66023.25	89778.81
1998	331.31	285.69	395.68	125.76	101.37	147.03	113041.82	81618.78	156562.66	109700.06	94623.38	131053.17
1999	349.62	291.50	421.99	144.17	107.18	173.34	123010.09	84972.25	178075.56	122234.14	101914.23	147536.14
TOTAL	2259.92	2027.54	2735.20	-3.03	0.02	0.005	570572.44	422739.41	775996.23	561225.93	475602.40	649306.99

$$\acute{y} = \frac{2259.92}{11} = 205.45$$

$$\bar{x}_1 = \frac{2027.54}{11} = 184.32$$

$$\bar{x}_2 = \frac{2735.20}{11} = 248.65$$

$\sum Y = 2259.92$

$\sum xi = 2027.54$

$\sum x_2 = 2735.20$

$\sum Y - Yi = -3.03$

$\sum xi-x, = 0.02$

$\sum x_2-x_2 = 0.05$

$\sum x_2-x_2 = 57052.44$

$\sum x_2^2 = 422739.41$

$\sum x^2 = 775996.23$

$\sum Y^2 = 561225.93$

$\sum x_1Y = 475602.4$

$\sum x_2Y = 649306.99$

To obtain the parameters $\tilde{B}_1$ and $\hat{B}_2$

we know that

$$\hat{B} = \frac{(\sum xiY)(\sum x_2^2) - (\sum x_2Y)(\sum x_1x_2)}{(\sum x_1^2)(\sum x_2^2) - (\sum x_2x_2)^2}$$

$$= \frac{(475602.4)(775996.23) - (649306.99)(570572.44)}{(422739.41)(775996.23) - (570572.44)^2}$$

$$= \frac{369065545219 - 37047667359335}{328044188432 - 325552909287}$$

$$= \frac{1411128374.00}{2491279450.0}$$

$$= 0.57 \quad \therefore B_1 = 0.57$$

$$\hat{B}_2 \frac{(\sum x_2Y)(\sum xi^2) - (\sum xiY)(\sum x_1x_2)}{(\sum xi^2)((\sum x_2^2) - ((\sum xix_2))^2}$$

$$= \frac{(787097.61)(1666.96) - (1445937)(2643167.52)}{(1161666.96)(646269.71) - (264316.52)^2}$$

$$= \frac{1784308671257.03 - 3821855723173.56}{750750169355.78 - 69863345387782.95}$$

$$= \frac{3267612033134.45}{} = 0.33$$

$$\hat{B}_2 = 0.33$$

But $Y - \hat{B}_1x_1 - \hat{B}_2x_2$

$= 540 - 0.50\ (246.91) - 0.33\ (220.19)$

$= 540 - 123.46 - 72.66$

$= 343.88$

Therefore the multiple regression equation is given by Yc = $343.88 + 0.50x, + 0.33x_2$

$$\hat{B}_2 = \frac{(\sum x_2 Y)(\sum x1^2) - (\sum x_1 Y)(\sum x1x_2)}{(\sum x^2)(\sum x_2^2) - (\sum x1x_2)^2}$$

$$= \frac{(7870997.61)(425334.69) - (986955.60)(408693.36)}{(425334.69)(546094.91) - (408693.36)^2}$$

$$= \frac{334779917949 - 403362200334}{232273109255 - 167030262508}$$

$$= \frac{65522282385.0}{68242846747.0}$$

$= 1.05$

$\hat{B}_2 = 1.05$

But $y - B_1 x_1 - \hat{B}_2 x_2$

$= 205.45 - (0.57)(184.32) - (1.05)(248.65)$

$= 205.45 - 105.06 - 261.08$

$= 205.45 - 366.14$

$= 160.69$

Therefore the multiple regression estimation is given by

$Yc = - 160.69 + 0.57x_1 + 1.05\ x_2$

TEST FOR SIGNIFICANCE

To test for the significance of parameters estimates of multiple regression, the variance of the parameters estimates are required.

$$\text{var}(\hat{\beta}_1) = \frac{li^2 \sum x_2^2}{(\sum x_1^2)(\sum x2^2) - (\sum x_1^2{}_{x2})}$$

$$\frac{\sigma u^2 \ 775996.23}{(422739.41)(775996.23) - (570572.44)^2}$$

$$\text{but } \sigma u^2 = \frac{\sum Yi^2}{n-k}$$

$$\text{and } \sum li^2 = \sum Y^2 - \hat{B}, \sum x, Y - \hat{B}_2 \sum x_2 Y$$

$$\sigma u^2 = \frac{\sum Y^2 - \hat{B}, \sum x, Y - \hat{B}_2 \sum x_2 Y}{n - k}$$

$$\sigma u^2 = 561225.93 - (0.57)(475602.4) - (1.05)(649306.99)$$

$$= 561225.93 + 271093.37 - 681772.34$$

$$832319.3 - 681772.34$$

$$= 150546.96$$

$$\sigma u^2 = \frac{150546.96}{8}$$

$$= 18818.37$$

$$\text{var}(\tilde{B}) = \frac{(18818.37)(775996.23)}{(422739.41)(775996.23) - (570572.44)^2}$$

$$= \frac{146029891747}{328044188432 - 325552909287}$$

$$= \frac{146029841747}{2491279145.00}$$

$$= 58.62$$

$$\text{var}(\hat{B}_2) = \frac{li^2 \sum x_1^2}{(\sum x_1^2)(\sum x_2^2) - (\sum x_1 x_2)^2}$$

$$= \frac{18818.37\ (422739.41)}{(422739.41)(775996.23) - (570572.44)^2}$$

$$= \frac{795526630.96}{328044188432 - 325552909287}$$

$$= \frac{795526630.96}{24912794.50}$$

$$= \underline{3.19}$$

STANDARD ERROR TEST

Standard error test is use to test significance of parameters.

1. If $s(\hat{B}) \leq 1/2\ (\hat{B})$ acceptt Ho: $\hat{B}, = 0$
2. If $s(\hat{B}) \geq 1/2\ (\hat{B},)$ reject Ho: $\hat{B},0$

Therefore our hypothesis will be

1, Ho: $\hat{B}, = 0$, ie the estimates is not statistically significant at 5% level.

Hi= $\hat{B}, 0$ ie, the estimates is statically significant.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

PROBLEMS SURROUNDING THE EFFECTIVE PERFORMANCE OF NSADP

Majority of the problems surrounding the effective performance of Niger state agricultural development project are as follows:

1. Poor condition of service
2. Transportation problem
3. Lack of Discipline
4. Lack of efficient statistical unit
5. High cost of farm inputs

1. POOR CONDITION OF SERVICE

The nearly one thousand three hundred and forty (1,340) staffs of Niger state agricultural development project, only about three hundred and fifty (350) are housed. That is only about 350/1340% of the working force are housed.

Besides that staff canteens and recreational facilities are conspiciously absent. This is coupled with insecurity of tenure for example during the retrenchment exercise carried out by the project under the directives of Governor Musa Inuwa over one hundred and twenty (120) staffs many of whom included

the very best technical staff were retrenched. Some stafs of the project lamented that the poor condition of service is presently costing the project the loss of many experience workers.

In addition to that, there is no clinic were staffs of Niger state agricultural development project and their families will be receiving medical attention.

2. **TRANSPORTATION**

There is no transportation system for conveyance of staffs to the offices in the morning both at head quarters and the three zonal offices in the state.

Similarly, all the departments of Niger state gricultural devlopment project including the zonal offices are allocated with a Nissan pickup van for the purpose of carrying out project activities. But as at the time of writing this research work, almost all the pick up van are abandoned due to engine problem while some as a result of tyre problem.

3. **LACK OF DISCIPLINE**

Some staffs of Niger state agricultural development project are not discipline due to the fact that they do report to the office late in the morning, while some leave office before the official closing hour is 4pm most especially in the three zonal Headquarters. (Bida, Kuta and Kontagora).

Apart from that, almost all the categories of staff of Niger state agricultural development project were given motorcycle loan, with special consideration given to the staff of Extension and planning departments because they are always in contact with the farmers (respondents) in the village. Those motorcycle was given to the staff to enable them carryout their work efficiently, but as at the time of conducting this research, some staffs diverted their own motorcycle for kabu-kabu ie express instead of using them in their duty stations.

4. **LACK OF EFFIECIENT STATISTICAL UNIT**

There is lacking of efficient statistical department in Niger state agricultural development project activities. Thus if established will greatly aid management decision making.

5. **HIGH COST OF FARMING INPUTS**

There is a high cost of farm inputs which the Niger state agricultural development project suppose to sell out to the farmers at a government subsidize price. But unfortunately it is the other way round. For example a bag of N.P.K fertilizer was sold at ₦900.00, 4 kg bag of improved rice cost ₦450.00, spraying machine cost ₦8,500.00 Irrigation pump cost ₦43.000.00 while ploughing machine cost ₦7,200.00.

As a result of the high cost of inputs majority of the rural farmers prefers old method of farming technology, as such all

the farm inputs provided by the government were left unsold. This bring about a decline in the revenue generated by the project.

FINDINGS/CONCLUSIONS

This chapter is the final and concluding part of this project work, which contains summary, finding and recommendations.

In chapter one, a general perspective of the history of Niger state agricultural development project, aims and objectives, methodology, scope and limitations was looked into.

Chapter two, reviewed a related work on the subject matters, organisation and management and activities of sub programmes are discussed.

Chapter three covers statistical methodology and statistical tools used for the analysis of the data ie Time series, regression and correlation and multiple regression.

Chapter four is the core chapter with all the analysis done with the following findings.

1. Using time series analysis, the production of these crops in Niger state were seen to be having an appreciating trend. Trend equations that's yc = 711.02 (1.0966)x for Guineacorn,

yc = 484.80 (1.1240)x for rice, yc = 530.41(1.1458) x for ycm and yc = 182.24 (1.1683) x for groundnut.

2. Simple regression and correlation analysis was used between yieldsand area put into cultivation and the regression equations for these crops created.

The co-eeficient of correlation of the crops maize, yam and groundnut shows a strong positive relationship while Guinea corn and rice show a weak positive relationship between yield and area cultivated.

In multiple regression analysis the paremeters B_1 and B_2 ie variation in the yield of these crops per unit change in area put into cultivation and rainfall were estimated and tested for signicance at 5% level. While the parameters estimates for government are statistically significant at 5% level.

Thats the variation in the yield of groundnut was influence greatly by the unit change in area cultivated.

The parameter estimates of rainfall for both crops had inverse effcet on the yields of these crops that even if there is sufficient rainfall other factors can still contribute to poor yield these factors could be due to lack of fertilizer application, devaluation of soil fertility or drought caused by pest and rodents.

RECOMMENDATIONS

1. In order to minimize problem encoutered in obtaining the already collected and compilled agricultural data. The ministy of agriculture and other agro allied department should learn to discard the issue of confidentiality at this time the government is seeking all posible means to improve agricultural production.

   I would suggest that such agricultural data be readily made available to any researcher that needs them for any kind of analysis because the analysis may likely bring out factors militating against agricultural poduction.

   Also possible solutions can be drawn from these analysis proper methods of data colection should be employed efficiently and accuracy should be watch in both collection and compilation of these agricultural data.

2. From the analysis above, area put into cultivation determines to a large extent the yield expectation therefore, the farmers should be encourage to put more land in farming and the present farming technology of using hoe should be substituted with modern and more viable methods of farming. The goverment of Niger state should re-introduce the hiring service to aid these peasant farmers since they could not afford it.

3. The living condition of people in the rural areas should be improved so as to control the rural urban drift. This can serve as one of the incentives to the peasant farmers who are the dominant inhabitants of our rural areas. The government can improve their living condition and make them economically active by proving them with some basic infrastructural facilities like portable drinking water electricity, health services, education facilities and good road net work.
4. Good extension service should be provided (Niger state agricultural development project) will have a great role to play here to the farmers on how best to use fertilizer and other chemicals as well as to embrace new farming technology.
5. The government should subsidized all farm inputs like fertilizer, insecticides, herbicides, pestticides and improved high yielding and drought resisting variaties crops to farmers because these farm inputs are now out of the reach of these poor peasent farmers. This will go along way at increasing the area under cultivation and imporoving the yield.
6. Government should encouraged the farmers to produce more farm by giving incentives these incentives could be in the form of agricultural loan so as to enable them commercialize their farming activities.

7. Niger state should gear up effort in the production of guinea corn and rice as analysis indicated poor yields of these crops.
8. The management of Niger state agricultural development project should provide all the necessary infrastructural facilities.
9. The management should set up a diciplnary committee with the objective of purnishing any member of its staff found wanting in his job.
10. Fragmentation of farm holding to un-economic activities should be discouraged.

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IMPLE REGRESSION ANALYSIS OF GUINEA CORN YIELD AND AREA CULTIVATED.

ependent Variable.. Y

ndependent Variable.. X

imple Regression .43946
Square .19313
djusted R Square .10347
tandard Error 200.98093

nalysis of Variance

	DF	Sum of Squares	Mean Square
egression	1	87013.76287	87013.76287
esidual	9	363540.00993	40393.33444

= 2.15416 Signif F = .1762

---------- Variables in the Equation ----------

ariable	B	SE B	Beta	T	Sig T
	.486969	.331789	.439461	1.468	.1762
Constant)	506.245964	173.074861		2.925	.0169

pendent Variable.. Y

dependent Variable.. X

mple Regression	.50465
Square	.25467
justed R Square	.17186
andard Error	271.12387

alysis of Variance

	DF	Sum of Squares	Mean Square
gression	1	226052.66680	226052.66680
sidual	9	661573.37389	73508.15265

= 3.07521 Signif F = .1134

---------- Variables in the Equation ----------

riable	B	SE B	Beta	T	Sig T
	1.658383	.945688	.504649	1.754	.1134
onstant)	128.986107	185.953435		.694	.5054

IMPLE REGRESSION ANALYSIS OF YAM YIELDS AND AREA CULTIVATED

ependent Variable.. Y

ndependent Variable X

mple Regression .03649
Square .00133
djusted R Square -.10963
tandard Error 273.04235

nalysis of Variance

	DF	Sum of Squares	Mean Square
egression	1	894.60197	894.60197
esidual	9	670969.11690	74552.12410

= .01200 Signif F = .9152

---------- Variables in the Equation ----------

ariable	B	SE B	Beta	T	Sig T
	-.042683	.389650	-.036490	-.110	.9152
Constant)	553.813720	126.625006		4.374	.0018

IMPLE REGRESSION GROUNDNUT YIELD AND AREA CULTIVATED

ependent Variable.. Y

ndependent Variable.. X

imple Regression .81287
Square .66076
djusted R Square .62306
tandard Error 69.51864

nalysis of Variance

	DF	Sum of Squares	Mean Square
egression	1	84717.62367	84717.62367
esidual	9	43495.56570	4832.84063

= 17.52957 Signif F = .0024

---------- Variables in the Equation ----------

ariable	B	SE B	Beta	T	Sig T
	1.315414	.314179	.812869	4.187	.0024
Constant)	-46.558869	61.586930		-.756	.4690

Dependent Variable.. Y
Independent Variable X

1.. X

Multiple Regression .71114
R Square .50571
Adjusted R Square .45079
Standard Error 159.69356

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	1	234824.98016	234824.98016
Residual	9	229518.28464	25502.03163

F = 9.20809 Signif F = .0141

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
X	1.131963	.373033	.711136	3.034	.0141
(Constant)	109.782347	147.020570		.747	.4743

End Block Number 1 All requested variables entered.