TITLE

FORECASTING - A TOOL FOR EFFECTIVE MANAGEMENT DECISION MAKING. A CASE STUDY OF FEDERAL OFFICE OF STATISTICS (FOS).

BY

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APPROVAL

We, the undersigned certify that the project report was carried out by AGBAWN SULEIMAN A., read, supervised and approved as meeting the requirements for the award of post graduate diploma in Mathematics/Computer Studies, in the department of Maths/Computer studies, Federal University of Technology, Minna.

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DEDICATION

This project is dedicated to the memory of my SHAIKH, SULTAN AWLIYA'U LLAHI, GHAWTH ATH – THAQALAYN ABDUL – QADIRI JILANI, Quddisa sirruhu Wa Rahmatullahi Alayhi.

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My infinite gratitude to ALLAH Jalla wa azza. I cannot praise Him the way worthy of Him, but, I am praising Him the way He praises Himself. AL – HAMDU LILLAHI KAMA HUWA AHLIHI.

May the Blessings and Mercy of ALLAH be upon His Messenger, the chosen MUHAMMAD, Who is a guide to my life and my hopeful intercessor in the hereafter.

I am indebted to my supervisor, Professor, K.R. Adeboye for his suggestions and corrections, which structured this project work. My thanks goes to the Head of the Department of Maths/Computer Science and all the lecturers in the department for their relentless efforts.

I express my appreciation to all my friends too innumerable to mention.

Finally, I am thanking all that contributed positively and negatively to my life.

AGBAWN SULEIMAN A.

ABSTRACT

This project is carried out on Forecasting-A tool for effective management Decision Making. The domain of the study, are the output/yield of five food crops from 1993/94 to 1997/98 courtesy of the Federal Office of Statistics (FOS). The project is written in partial fulfillment of the requirement for the award of Post Graduate Diploma in Mathematics/Computer Science. The report consists of five chapters, with Time series Analysis as a statistical Techniques used for the analysis and the forecasts.

TOPIC: FORECASTING – A TOOL FOR EFFECTIVE MANAGEMENT DECISION MAKING; A CASE STUDY OF F O S

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CHAPTER ONE

1.0 INTRODUCTION

1.1 BACKGROUND TO THE STUDY

Since the period of his existence on earth, perhaps two million years ago, man has lived as a hunter and gatherer of fruits, nuts and berries. He has depended on the natural bounty of the forests, savanna lands, rivers and lakes, just as all other living animals have been doing. It is only as recently as perhaps ten thousand years ago that man began attempts at domesticating animals and plants, and began the transition from primitive hunter and gatherer to herder of animals and tiller of the land. He did this by selecting those strains of animals and plants, which he knew to be useful to his needs. At first he did this unconsciously but as time passed, he consciously selected the better forms of animals and plants for breeding purpose. This process has continued to accelerate down to modern times when man contrary to the beginning of his existence is compelled to farm for satisfaction as the natural source cannot meet his growing food demands. Hence the process of management, decision making, planning and forecast added a new phase to the history of man and food.

Food serves three (3) main functions. First it provides the basic substances necessary for the growth and repair of the body. These substances are called proteins and are derived principally from meat, although they can be obtained in high quantities from certain plant foods, such as beans, soyabeans, guinea corn (sorghum) e t c.

Secondly, food provides energy necessary for work, for the movement of various parts of the body and for nourishment of cells. This energy is obtained from carbohydrates and fats. Thirdly, food provides substances called minerals and vitamins, which are necessary for the healthy functioning of each part of the body. These protein, carbohydrates, fats, minerals and vitamins present in food are called nutrients. No single item of food contains all these nutrients and for this reason a variety of foods must be eaten to provide what nutritionist called a balanced diet. Hence, varieties of food must be grown to meet the nutritional requirements of the people. If they are not grown in sufficient quantities, they must be imported, and West African countries with their financial/economic stand will find it difficult to import these items, therefore shortage of food will inevitably result in malnutrition.

Children suffering from malnutrition have a low resistance to disease and frequently die of common childhood diseases, hence malnutrition is a strong factor leading to child mortality, protein shortages in the early years of life also impair growth of the brain and central nervous system, and consequently reduce learning capacity. Thus some effects of malnutrition in the early years of life are permanent and irreversible hence, the need for government and its organs to make decision on what quantity and quality of food to produce to welcome her projectable future population over a given time period hence in one of World Bank's publication in 1984, "The Planning and Management of Agricultural Research" it was said 'Food output in developing countries during the next two decades has to increase between 3.5 and 4.0 percent a year to improve the standard of living of people in the agricultural sector as well as the quality of the diet of the entire population in these countries. In the past few years, however, output has increased by only about 2.9 percent a year. This was enough to maintain the global per capita food supply except in Africa, but is not enough to advance the economic situation and to improve the diet of the rural and urban population. In the past agricultural production was increased largely by expanding the area under cultivation. Possibilities of continuing this trend have been nearly exhausted, and future increases in production have to come almost entirely from increases in productivity. Thus agriculture has become a science-based industry, and its growth depends on innovations in chemical, biological and mechanical technologies. This demands a heavy emphasis on agricultural research and connected with it, on-communication between farmer and researchers to determine researchable problems and disseminate research results'. For this to be successful the past has to be cast into the future effectively, hence the need for this research work.

1.2 STATEMENT OF THE PROBLEM

The data for this study is collected on annual basis from 1993/94 – 1997/98 and consist of estimated yield per hectare of five (5) major crops.

We shall employ Time Series Analysis Technique to plot the appropriate time series component, compute the component (i.e. trend) equations and using mathematical equations method of trend analysis to forecast our future yield per hectare.

We shall design a computer program for the mathematical equations.

1.3 AIMS/OBJECTIVES O F THE STUDY

(i) To compute the trend equations and or curves for each of the yield of the five (5) food items.

(ii) To forecast the future yields of these food crops.

(iii) To determine likely effects(s) of the yield of these food crops on the population of Nigeria.

(iv) To make appropriate decisions towards boosting the production of these food crops to meet the growing need of the rapid growing population of the country.

(v) To observe contribution of management towards stable or increase food production.

1.4 IMPORTANCE OF THE STUDY

The purpose of this research work is to examine the yields of these five (5) food crops, using data obtained from Federal Office of Statistics (FOS) from 1993/94 to 1997/98, and using trend of the yield to be able to forecast what their yield will be in the future, if the conditions in the past still hold into the future.

We expect this forecast as a base towards helping government to make decision to keep pace with the rising demand for food due to rapid population growth.

Due to increased food demand of her rapidly growing population, this study is expected to furnish the government with information to boost her effort on family planning.

This study will help government to improve on the techniques of food production currently in use to meet the expected growing needs of her future population.

Lastly, it is expected that this study will be useful to the University Library as a means of information and reference to researchers.

1.5 LIMITATIONS OF THE STUDY

The study focuses on the yields of five (5) food crops from 1993/94 – 1997/98 on annual bases as obtained from the Federal Office of Statistics. Since the data is collected on annual bases, we cannot observe the seasonal and cyclical effects of the yield of these crops.

The data is not primarily collected by the researcher, so, the accuracy and reliability of the data is assumed perfect.

We are employing analysis of Time series to compute the trend equations and hence the forecast.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 FOOD, POPULATION AND HEALTH.

In Introduction to Tropical Agriculture by Anthony Youdeowei, et al, it was stressed that one of the major problems facing developing countries in the tropics is the production of sufficient food, fibre, fuel and shelter for their large populations. For example, in the 1960's, Nigeria was estimated to have a population of 85 million, India 700 million, Brazil 120 million, Indonesia 145 million, Ethiopia 27 million and Egypt 40 million. In some of these countries, people starve for lack of adequate food and nourishment, and starvation and poverty go hand in hand. Increase of the human population at a rate that is considerably higher than the increase in food production continues to widen the gap between demand and supply of food.

The greatest challenge that faces developing countries today is to eliminate hunger and to overcome poverty. The challenge is greatest in rural areas where employment and supplies are not so readily available as in the towns.

Food production is therefore very important in the economies of tropical developing countries, and agriculture provides the means to increase food production.

In 'Population Reports' a publication of John Hopkins University School of Public Health, U.S.A. the following expressions was made: " While food is abundant in many areas, millions of people in developing countries are undernourished. Each year about 18 million people, mostly children, die from starvation, malnutrition, and related causes. An estimated two billion people suffer from malnutrition and dietary deficiencies, some 840 million of them are chronically malnourished. In sub – Saharan Africa as many as 70% of all women are anemic.

About 200 million children under age five – 40% of all children of this age in the developing world lack sufficient nutrition to lead fully active lives. One indicator of chronic malnutrition among children is the percentages that are stunted – that is, short for their age compared with international standards set by the World Health Organization (WHO). Stunting among children ages 3 months to 3 years varies widely among countries, but at least one child in every three was stunted in over 40% of countries surveyed by the Demographic and Health Surveys between 1987 and 1996 (UNICEF, The Progress of Nations 1997, NY UN).

Recent projections by the International Food Policy Research Institute (IFPRI) indicate that child hunger and malnutrition are not likely to be reduced much over the course of the next several decades. According to IFPRI, 150 million children under the age of six will still be malnourished in 2020, just 20% fewer than in 1993. In Africa the number of malnourished children is expected to increase by 45% between 1993 and 2020, reaching 40 million (PINSTRUP – ANDERSEN, et al, The World Food Situation Washington D.C., 1997).

Logically, population growth must stop at some point or the earth would become overcrowded and it's resources eventually would be depleted. There is no way to predict how large the population could become, however ,before it overwhelmed the planet. Nor is there any way to predict the quality of life in the future under the almost infinite variety of scenarios for population growth, consumption patterns, food production, technological change, natural resource use, air and water pollution, land degradation, and many other factors. (COHEN J., How many people can the earth support? New York 1995).

2.2 MANAGEMENT AND DECISION MAKING.

The manager "makes" or "breaks" a business. 'Brains are more important than brawn'. We often read these in farm magazines. They all emphasize an important factor in the operation of a farm or ranch in today's world. Management is important. This does not mean that management was not important in the past. However, in agriculture, which is highly mechanized, uses many technological innovations and operates with large amounts of borrowed capital, management takes on new dimension and importance.

Why do some farmers make money than others? Why do some farm businesses grow and expand while others struggle to maintain their current size? Good or bad luck cannot explain all the differences observed in the profitability of farms and ranches even among those which have about the same amount of land and capital available. Why the difference? Observation and analysis often lead to the same conclusion. The difference is due to management.

These differences in management can show up in three areas; Production, Marketing and Financing. Production differences include the choice of agricultural commodities to be produced and how they are produced. Marketing differences include the when, where and how of purchasing inputs and selling commodities. Financial differences covers not only borrowing money and the related questions of when, where and how much, but also the entire area of how to acquire the resources necessary to produce agricultural commodities. There is risk to be considered in all three areas – how farm managers adapt to and handle this risk can have a major impact on profit.

Ronald D. Kay, in his book ' Farm management, planning, control and implementation.' 1988, adopted this definition; 'Farm and ranch management is the decision – making process whereby limited resources are allocated to a number of production alternatives to organize and operate the business in such a way as to obtain some objectives.

This definition therefore suggests that management is a problem – solving and decision – making activity. Therefore management can yet be said to be a continual process that solve or give answers to these questions, what to produce? , How to produce? , and How much to produce?, in a farming business.

Unfortunately, research facilities and programs in developing countries are not well established, and few yet on a par with those in developed countries. The greatest deficiencies include excessive fragmentation of research activities among governmental agencies, the low priority assigned to research by governments, and inadequate institutional structures for and extension (World Bank, The Planning and Management of Agriculture Research, 1981).

Research staff in developing countries are often small, do not have a balance of disciplines, and usually lack adequate budgets. In many cases there is no planning or management to direct the scarce resources available towards the most appropriate research priorities.

Research planning not only has to fit the overall objectives of the national and sectoral plans but also has to fit available resources, such as manpower and facilities, into the national plan. This is no easy task and requires the research manager to be a Politician, Scientist, and the Manager simultaneously. Systematic organization of planning is necessary, and the supply of knowledge to it strengthens the manager's judgment, leadership and vision.

2.3. STATISTICAL TECHNIQUE

For the analysis of the data Time series Analysis technique would be employed.

2.3.1. TIME SERIES ANALYSIS

Time series denote observation, information, experimental results, financial transactions, etc collected at regular time intervals. E.g. the yearly admission intake into the department of maths/computer, the yearly or monthly financial report of an organization, etc

Time series are sometimes studied because of historical interest, but mostly they are studied because of interest in predicting the value of interested variable at a future date, e.g. the yearly admission into the department of Maths/Computer can be studied over past years, a trend equation of this is computed and can be used to predict the likely future value of the intake at/in a later year.

However, it is worth noting that any movement in a time series consists of four (4) main contributions. These are known as components of a time series.

2.3.2. COMPONENTS OF THE TIME SERIES

These include;
i. Trend,
ii. Seasonal,
iii. Cyclic,
iv. Irregular or Random variation.

2.3.2.1. TREND COMPONENT.

This involves a broad long – term movement, such as a general increase in the level of production over years. A time series is said to exhibit trend if the mean of the series changes systematically with time. The systematic change could be linear, exponential, quadratic or any other function. We denote it by T_t the amount of trend in series X_t. One important problem in the analysis of time series is isolation of the trend so that reasonable prediction/forecast about the future can be made. The fluctuations of the series are then obtained from this trend line.

2.3.2.2. CYCLICAL COMPONENT

This is the long – period fluctuations about the trend line and is caused by a complex combination of forces affecting the equilibrium of the phenomena under study. The fluctuations are not exactly periodic because the period may vary from one cycle to the other. Usually the period is greater than five (5) years. An example of this component is the business cycle, which may be referred to as 'four phase' cycle, composed of period of prosperity, recession, depression and recovery. This swing from prosperity to recovery and back again to prosperity varied both in time and intensity.

Statistical techniques are employed to isolate those disruptive fluctuations and to analyze the conditions surrounding them, so that business owners or Government may take such measures as are feasible to prevent the deterioration of mild recessions or early crises into deep depressions or collapsing economy and keep the swings of prosperity within reasonable limits without developing into stormy speculations. The value of cyclical variations at time t is denoted by C_t.

2.3.2.3. SEASONAL COMPONENT

This is the identical pattern which a time series appears to follow during specific month of successive years. Such movements are due to events like harvest, Xmas, Sallah, Weather, Semester, etc the amount of seasonal variations at time t is denoted by S_t.

2.3.2.4. IRREGULAR COMPONENT

This component occurs as a result of random causes too numerous to keep track of and are obviously unpredictable. Because they do not follow statistical regularities they cannot be directly isolated. It is therefore obtained by isolating the other components from the series X_t.

Irregular variations in the series at time t is denoted by I_t. e.g. war, earthquake, fire – outbreak, gas explosion, etc.

2.3.3. USES OF TIME SERIES

i. It helps in understanding the past behaviour of the variable under study and in determining the rate of growth and extent and direction of periodic fluctuation.

ii. From the study of the past behaviour of the variables, it enables us to predict future values. Such prediction provides basis for stock control, production and manpower budget control.

iii. The knowledge of behaviour of a variable may enable us to iron out intra year variations.

iv. The determination of the impact of the various forces influencing different variables facilitate their comparison.

2.3.4. ANALYSIS OF TIME SERIES

This refers to the isolation of the different components of the series so that the contribution of each to time series variable can be evaluated. This will depend on the time series model used.

2.3.5. TIME SERIES MODELS

There are two type of model used in the analysis of time series, these are;

i. Multiplicative model, and

ii. Additive model.

The multiplicative model is expressed as product of the components of time series denoted by; $X_t = T_t \times S_t \times C_t \times I_t$.

The Additive model is expressed as the sum of the components of time series denoted by; $X_t + S_t + C_t + I_t$

2.3.6. ANALYSIS OF THE COMPONENTS

2.3.6.1ANALYSIS OF THE TREND COMPONENTS

By observation of the time series plot, one can determine whether there is trend in the series, however, the various method of estimating the trend are:

i. Free – hand method
ii. Semi – Average method
iii. Moving Average method
iv. Mathematical Equation method.

i. **Free – hand Method**: The procedure is to plot the time series on the graph and fit a straight line through the plotted points by mere inspection.

ii. **Moving Average Method**: This method in general, tends to smoothing out all other variations present in the series except trend. This is why tackling-moving average is sometimes called smoothing time series. In monthly or quarterly data, irregular and seasonal variations are removed and we are left with trend value. In annual data, irregular and cyclical variations are removed leaving only trend, since annual data do not contain seasonal variations.

<u>Choice of Moving Average Order:</u>

Given quarterly data we calculate a moving average of order four (4) and given monthly data we calculate moving average of order (12) i.e [MA (12)] depending on the length of the cycle. It is therefore essential that order of moving average coincide with the length of cycle. It is therefore essential that order of moving average coincide with the length of cycle in the series. If n (number of observed values) is not equal to the periodicity of the cycle, cyclical problem will not be completely eliminated. (Periodicity of the cycle is the duration of time between successive peak of successive curve.)

The method of moving average suffers drawback among which are;

(i) Data at the beginning and end are lost,

(ii) It generates cycles not in the original data.

(iii) **Mathematical Equations Method**: The most commonly used type of tread curve under this method may be grouped under 3 main headings

1) Polynomial.

2) Exponential.

3) Modified Exponential.

1) Polynomial: A polynomial equation is one involving the power of t, in general form it is expressed as; $Y = a_0 + a_1t + a_2t^2 + \dots + a_nt^n$

Where n is the order of the polynomial.

<u>Normal Equation</u>

When n = 1; Y = a + bX

Normal Equations are;

$\sum Y = na + b\sum X$ ....(1)

$\sum XY = a\sum X + b\sum X^2$ ....(2)

In time series the time variable X can be coded such that;

$\sum X = 0$ to ease calculations

if $\sum X = 0$, then (1) becomes $\sum Y = na$

$$\therefore a = \frac{\sum Y}{n}$$

$$= \bar{Y}$$

From (2), the equation becomes,

$$\sum XY = b\sum X^2$$

$$\therefore b = \frac{\sum XY}{\sum X^2}$$

2) Exponential Curve: The fitted equation Y = a + bx described a constant amount of growth, b-positive or b-negative per unit time. Rather than exhibiting a constant amount of change as depicted by the linear model above, many economic business series exhibits a constant rate of change.

In such relationship, if the series Y is plotted against time X, a linear trend will not appear since values are in geometric rather than arithmetic progression. But if log of Y is plotted against X, a linear trend appear suggesting a straight line relationship between the natural value of X and the logarithmic value of Y. The relationship existing between X and Y in this case is exponential and the mathematical equation is; $Y = ab^x$

$$\Rightarrow \log Y = \log a + X\log b$$

normal equations are:

$$\sum \log Y = n\log a + \log b \sum X \text{ ....(1)}$$

$$\sum X\log Y = \log a \sum X + \log b \sum X^2 \text{ ......(2)}$$

Imposing $\sum X = 0$

Then from equation (1) $\sum \log Y = n \log a$

$$\text{Log } a = \frac{\sum \log Y}{n}$$

$$\therefore a = \text{antilog}\left[\frac{\sum \log Y}{n}\right]$$

From equation (2);

$$\sum X \log Y = \log b \sum X^2$$

$$\log b = \frac{\sum X \log Y}{\sum X^2}$$

$$b = \text{antilog}\left[\frac{\sum X \log Y}{\sum X^2}\right]$$

3) Modified Exponential: The exponential curve just described suggests that the series go on increasing indefinitely at the same proportional rate. This is not realistic in all the cases because situation exists when the beginning of the growth is very small and the curve continues to grow more slowly approaching an upper limit but not reaching it. In such a case, it is logical that the exponential relationship discussed before be modified to accommodate the new development. Such modified exponentials are otherwise called growth rates. The three (3) common types of such curves are;

(a) Simple Modified exponential which is expressed as; $Y = K + ab^t$

Where $b < 1$ and $a < 0$, K is called the asymptote.

This curve does not only describe a growth pattern, which decline by a constant change from period to period but the curve reaches an upper limit.

(b) Gompertz Curve: expressed as;

$$Y = Ka^{bx}$$

$$\Rightarrow \log Y = \log K + bx \log a$$

This describes a situation in which the percentage rate of increase in Y is declined by a constant proportion from period to period.

(c) Logistic Curve: This curve describes a series in which increase or first difference is reciprocal of Y declined by a constant proportion. It is expressed as, $1/Y = K + ab^t$.

2.3.6.2 ANALYSIS OF SEASONAL VARIATIONS

When data are for part of years they would always have seasonal effect, that is, the data may be recorded daily, weekly, monthly or quarterly. However, if data are collected by years or long time period the effect of the season disappears automatically. When data are collected for part of year as exampled above, seasonal effect is always of interest. For such a data attempt is not usually made to isolate the cyclical effect. Such data is represented as $Y = T.S.I$ or $Y = T + S + I$ multiplicatively and additively respectively, implying that it contains only seasonal, Trend or Irregular variations.

The various methods used in estimating seasonal variations are;

(i) Simple Average/Average Percentage Method.

(ii) Link Relative method.

(iii) Ratio to moving Average Method

(iv) Ratio to Trend Method, etc.

(i) Simple Average Method

The steps involved are;

(a) Compute the average for each year.

(b) Express each figure as percentage of their average for the year.

(c) Average result in step (b) over corresponding month or quarter as the case may be.

(d) Express these means in step (c) as percentage of their own average and the results represent the required index.

(ii) **Ratio to Moving Average Method**:

The steps involves;

(a) Obtain 12-months or 4-quarterly centered moving average for monthly and quarterly data respectively.

(b) Divide each original figure by the corresponding moving average and express as percentage.

(c) Compute the mean percentage of each month or quarter as the case may be.

(d) Express each mean percentage as the percentage of their own average and the results represent the required index.

(iii) Ratio to Trend Method:

The steps involved are;

(a) Compute monthly or quarterly trend figures by method of least square.

(b) Express each figure as percentage of the corresponding trend figures.

(c) Find out the mean percentage for each month or quarter as the case may be.

The result in Step (c) expressed as a percentage of their average gives the seasonal index.

2.3.6.3 ANALYSIS OF CYCLICAL VARIATIONS

If data were given in weeks, months or quarterly, the interest is on seasonal variations. If data were given on yearly bases, the interest will be on trend and cyclical effects, should the data be over many years. Annual data consists of Trend, Cyclical and Irregular effects and may be represented by Y = TCI multiplicatively. This implies that if original values are divided by trend values, an estimate of CI is obtained for each year, that is, Y/T = TCI/T = CI.

If CI values are appropriately averaged, the irregular component will be eliminated leaving only the cyclical component. A plot of CI against time would remove the cyclical fluctuation in the series.

2.3.7 FORECASTING

The ultimate aim of time series analysis is to forecast the future behaviour of the series. The calculation of the forecast is in two (2) stages. If the data were annual estimate of the trend, it is computed either by moving average or mathematical equation method. This estimate multiplied by the estimate of the cyclical variation gives the required forecast i.e. Y = TC

If data were collected daily, weekly, or monthly trend estimate for the period whose forecast is required is computed. Such trend estimate is then multiplied by the seasonal index for the day, week or month as the case may be.

It should be noted that forecasts are on the assumption that series will continue to exhibit the same behavioural pattern as it did in the past, however, environmental factors may change the future behaviour of the series from the past pattern.

For this study we are employing mathematical equation method for our forecast.

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 BRIEF HISTORY OF FEDERAL OFFICE OF STATISTICS (FOS)

The federal Office of Statistics (FOS) was established in 1947 under a different name called central statistical collecting Bureau. It was charged with the responsibility of collecting, tabulating and analyzing essential statistics. The Bureau would seem to have monopolized this function of data collection and analysis within the country until independence when the name changed to Federal Office of Statistics and other bodies were also charged with the responsibility for statistics gathering in their areas of influence.

Data collection by FOS takes place through primary and secondary sources. Various surveys are conducted on a fairly regular basis designed to provide primary data, while secondary data from other agencies are also solicited for from time to time.

In terms of agricultural data, FOS started collecting agricultural data in 1950/51 in response to the FAO's request that the country should participate in 1950 World census of Agriculture. However, the exercise was done as sample survey in parts of Northern Nigeria. This was made to cover the whole nation simultaneously in 1960.

The scope of Agricultural Statistics basically covers the traditional and modern holding sectors, with the type of data collected including structure of house holds, acreages and land tenure, farm equipment, credit facilities, employment in Agriculture etc.

At the onset, the design was made a two – stage Stratified sample design meant to cover the period between 1962 and 1974. in 1978 plans were made to restructure the survey into a five – year survey programme with the UN – sponsored National Household Survey Capability programme (NHSCP). The first five – year programme was launched for 1981/86 design. The design was a two – phase, two – state design with the Enumeration Areas as the first stage unit. However, equal probability proportional to size was utilized at second stage.

The 1987/92 design became the second attempt of the 5 – year programme design. The current design of 1993/98 has added facility of implicit stratification in the rural area and Enumeration Area measure of size was used for probability proportional to size rather than number of Enumeration Areas as in the 1987/92 design.

3.2 METHODS OF DATA COLLECTION

Data (singular, Datum) simply mean lists or sets of (numerical) information in its unrefined state. Based on their methods of collection they are divided into primary and secondary data.

Let us look into these in turn before we discuss the methods of their collection.

i) Primary data are those collected by the user him/herself which is effected through observation/experimentation, interviewing, questionnaire etc. It has the advantage of been confident, the user can go to the source for verifications where there is suspected mistake, however, it is costly and time consuming.

ii) Secondary data are the ones collected by persons other than the user and for reasons, which may be different from that of the user. It is effected through checking of records, which may be published or unpublished. It is cheap to obtain and may make some detailed information, but its disadvantage include concealing a bias on the compiler and sometimes may not be exactly what is required and there is lack of opportunity to return to the source for investigation. There are principally three techniques of data collection and these are; (a) Observation (b) Interviewing and (c) Checking of records.

Let us look into these in turn;

a) Observation Method: - this is where mere look, experimentation forms the bases of data collection e.g. a farmer used counting to ascertain the number of sacks of maize he has in a year's farm season.

b) Interviewing Method: - this seems to be the best method of collecting information from an individual, but it is the most expensive and time/labour consuming. The method consists of (1) Structured personal interview and (2) Questionaire (Mailed and Unmailed).

   Structural personal interview involve the going out of interviewers personally to collect his data through interviewing the person intended for the inquiry. He (interviewer) collects the raw information/data by means of discussion.

Questionnaire method, on the other hand, involve a prepared list of questions, against each a space is provided for an answer which take the form of Yes or No in the most. Copies of these lists called questionnaires are sent to intended persons with the request that they answer and return them. It is one of the best ways of collecting personal data as it cost les and give quick elaborate result.

There are however two (2) ways of the method , the above discussed is the unmailed case, while the mailed case involve sending the questionnaire by post to the respondent with a view to fill/answer them and mail or post it back to the Inquirer.

c) Checking of Records: - this is secondary type of data collection. Here the user depend on records or documents for the collection of his/her data. This is one of the major source of demographic, social and economic data. However, there are two (2) main sources of data generated from this method, published and unpublished data.

    1) Published data: - This refers to the raw data published by various central Statistical Offices of

different Countries, research institutions and individual researchers. They include such publications as Statistical abstracts/bulletin/reports from FOS, CBN, FAO etc.

2) Unpublished data: - These refer to raw data which exist in their original form but yet in files, record books or forms of government and non – government agencies. Such data if obtained serve as check on published data but the process of obtaining data from this source is normally difficult due mainly to poor storage and partly because of bureaucratic bottlenecks.

3.3 METHOD USED TO COLLECT DATA FOR THIS STUDY

The method used for collecting data for this study is purely secondary as the data was obtained from Federal Office of Statistics as published data in Statistical Abstract 1999. The data is on Estimated yield of major crops in tonnes from 1993/94 to 1997/98 on annual bases. The focus of the study is on five (5) of these crops.

3.4 PRESENTATION OF DATA.

ESTIMATED OUTPUT OF MAJOR AGRICULTURAL CROPS IN NIGERIA.

Crops	1993/94	1994/95	1995/96	1996/97	1997/98
Guinea Corn	6,145	6,917	7,608	7,959	8,430
Beans	1,463	1,593	2,143	2,488	2,875
Yam	22,709	22,632	23,947	24,766	25,008
Rice	2,943	3,514	3,712	3,521	3,602
Melon	108	466	547	488	487

Source: Federal Office of Statistics

COMMENTS:

The above data consist of output/yield of five (5) major Agricultural food crops in thousand metric tones from 1993/94 to 1997/98 on annual bases.

3.5 METHOD OF DATA ANALYSIS

As stated in chapter two (2.3) we will analyze the data using Time series analysis to compute the trend equations of the yield of each of these five (5) food crops and from the trend equations make our forecast. A computer program will be written for these trend equations. Graphics of the trend values of each of these outputs will be plotted to show the nature of the trend curve.

CHAPTER FOUR

4.0 DATA ANALYSIS AND INTERPRETATION OF RESULTS

4.1 TREND VALUES OF THE YIELD/OUTPUT OF RICE FROM 1993/94 TO 1997/98 BY MATHEMATICAL EQUATIONS (POLYNOMIAL) METHOD.

YEARS	Y	X	XY	X^2	$\hat{Y}c$
1993/94	2,943	-2	-5886	4	3193.4
1994/95	3,514	-1	-3514	1	3325.9
1995/96	3,712	0	0	0	3458.4
1996/97	3,521	1	3521	1	3590.9
1997/98	3,602	2	7204	4	3723.4
	17292		1325	10	

Origin: 1995/96

X unit: 1 year

$Y = a + bX$

$$\hat{a} = \frac{\sum Y}{n} = \frac{17292}{5} = 3458.4$$

$$\hat{b} = \frac{\sum XY}{\sum X^2} = \frac{1325}{10} = 132.5$$

$\therefore \hat{Y} = 3458.4 + 132.5X$

To forecast for 2000/2001; 2001/2002 trend values

For 2000/2001, X = 5

$$\hat{Y}_c = 3458.4 + 132.5\ (5) = 4120.9$$

For 2001/2002, X = 6

$$\hat{Y}_c = 3458.4 + 132.5\ (6) = 4253.4$$

COMMENTS

From the computed trend values it is evident that the output of Rice increased fairly from 1993/94 to 1997/98 and this is so into the predictions which gives the output of Rice as 4120900 metric tonnes for the year 2000/2001 and 4253400 metric tonnes for the year 2001/2002.

4.2 TREND OF THE YIELD/OUTPUT OF BEANS FROM 1993/94 TO 1997/98. BY MATHEMATICAL EQUATIONS (POLYNOMIAL) METHOD.

YEARS	Y	X	XY	X^2	$\hat{Y}_C$
1993/94	1,463	-2	-2926	4	1368.6
1994/95	1,593	-1	-1593	1	1740.5
1995/96	2,143	0	0	0	2112.4
1996/97	2,488	1	2488	1	2484.3
1997/98	2,875	2	5750	4	2856.2
	10562		3719	10	

Origin: 1995/96.

X Unit: 1 Year

$Y = a + bX$

$$\hat{a} = \frac{\sum Y}{n} = \frac{10562}{5} = 2112.4$$

$$\hat{b} = \frac{\sum XY}{\sum X^2} = \frac{3719}{10} = 371.9$$

$$\therefore \hat{Y} = 2112.4 + 371{,}9X$$

To forecast for 2000/2001, 2001/2002

For 2000/2001, X = 5

$$\therefore \hat{Y}_c = 2112.4 + 371.9\,(5) = 3971.9$$

For 2001/2002, X = 6

$$\hat{Y}_c = 2112.4 + 371.9\,(6) = 4343.8$$

COMMENTS

The forecast for 2000/2001 is 3971900 metric tonnes and for 2001/2002 it is 4343800 metric tonnes which shows a fair increase over the years.

4.3 TREND VALUES OF THE YIELD/OUTPUT OF MELON FROM 1993/94 TO 1997/98 BY MATHEMATICAL EQUATIONS (POLYNOMIALS) METHOD.

YEARS	Y	X	XY	X^2	$\hat{Y}_c$
1993/94	108	-2	-216	4	263.2
1994/95	466	-1	-466	1	341.2
1995/96	547	0	0	0	419.2
1996/97	488	1	488	1	497.2
1997/98	487	2	974	4	575.2
	2096		780	10	

Origin: 1995/96

X Unit: 1 Year

$Y = a + bX$

$$\hat{a} = \frac{\sum Y}{n} = \frac{2096}{5} = 419.2$$

$$\hat{b} = \frac{\sum XY}{\sum X^2} = \frac{780}{10} = 78$$

$$\therefore \hat{Y} = 419.2 + 78X$$

To forecast for 2000/2001 and 2001/2002

Trend values

For 2000/2001, X = 5

$$\therefore \hat{Y}_c = 419.2 + 78(5) = 809.2$$

For 2001/2002, X = 6

$$\therefore \hat{Y}_c = 419.2 + 78(6) = 887.2$$

COMMENTS

The forecasts are 809200 metric tonnes and 887200 metric tonnes for 2000/2001 and 2001/2002 respectively, which shows fair increase of output over the years.

4.4. TREND VALUES OF THE YIELD/OUTPUT OF YAM FROM 1993/94 TO 1997/98 BY MATHEMATICAL EQUATIONS (POLYNOMIAL) METHOD

YEARS	Y	X	XY	X^2	$\hat{Y}_c$
1993/94	22,709	-2	-45418	4	22466
1994/95	22,632	-1	-22632	1	23139.2
1995/96	23,947	0	0	0	23812.4
1996/97	24,766	1	24766	1	24485.6
1997/98	25,008	2	50016	4	25158
	119062		6732	10	

Origin: 1995/96

X Unit: 1 Year

$$\hat{a} = \frac{\sum Y}{n} = \frac{119062}{5} = 23812.4$$

$$\hat{b} = \frac{\sum XY}{\sum X^2} = \frac{6732}{10} = 673.2$$

$$\therefore \hat{Y} = 23812.4 + 673.2X$$

To forecast for 2000/2001 and 2001/2002

Trend values

For 2000/2001, X = 5

$$\therefore \hat{Y}_c = 23812.4 + 673.2(5) = 27178.4$$

For 2001/2002, X = 6

$$\therefore \hat{Y}_c = 23812.4 + 673.2(6) = 27851.6$$

COMMENT

The predicted outputs of yam are 27178400 metric tonnes and 27851600 metric tonnes for the years 2000/2001 and 2001/2002 respectively, which depict fair increase in output into the future.

4.5. TREND VALUES OF THE YIELD/OUTPUT OF GUINEA CORN FROM 1993/94 TO 1997/98 BY MATHEMATICS EQUATION (POLYNOMIALS) METHOD

YEARS	Y	X	XY	X^2	$\hat{Y}_c$
1993/94	6,145	-2	-12290	4	6289.4
1994/95	6,917	-1	-6917	1	6850.6
1995/96	7,608	0	0	0	7411.8
1996/97	7,959	1	7959	1	7973
1997/98	8,430	2	16860	4	8534.2
	37059		5612	10	

Origin: 1995/96

X Unit: 1 year (12 months)

$Y = a + bX$

$$\hat{a} = \frac{\sum Y}{n} = \frac{37059}{5} = 7411.8$$

$$\hat{b} = \frac{\sum XY}{\sum X^2} = \frac{5612}{10} = 561.2$$

$$\hat{Y} = 7411.8 + 561.2X$$

To forecast for the years 2000/2001 and 2001/2002

We have;

For 2000/2001, X = 5

$$\therefore \hat{Y}_c = 7411.8 + 561.2 = 10217.8$$

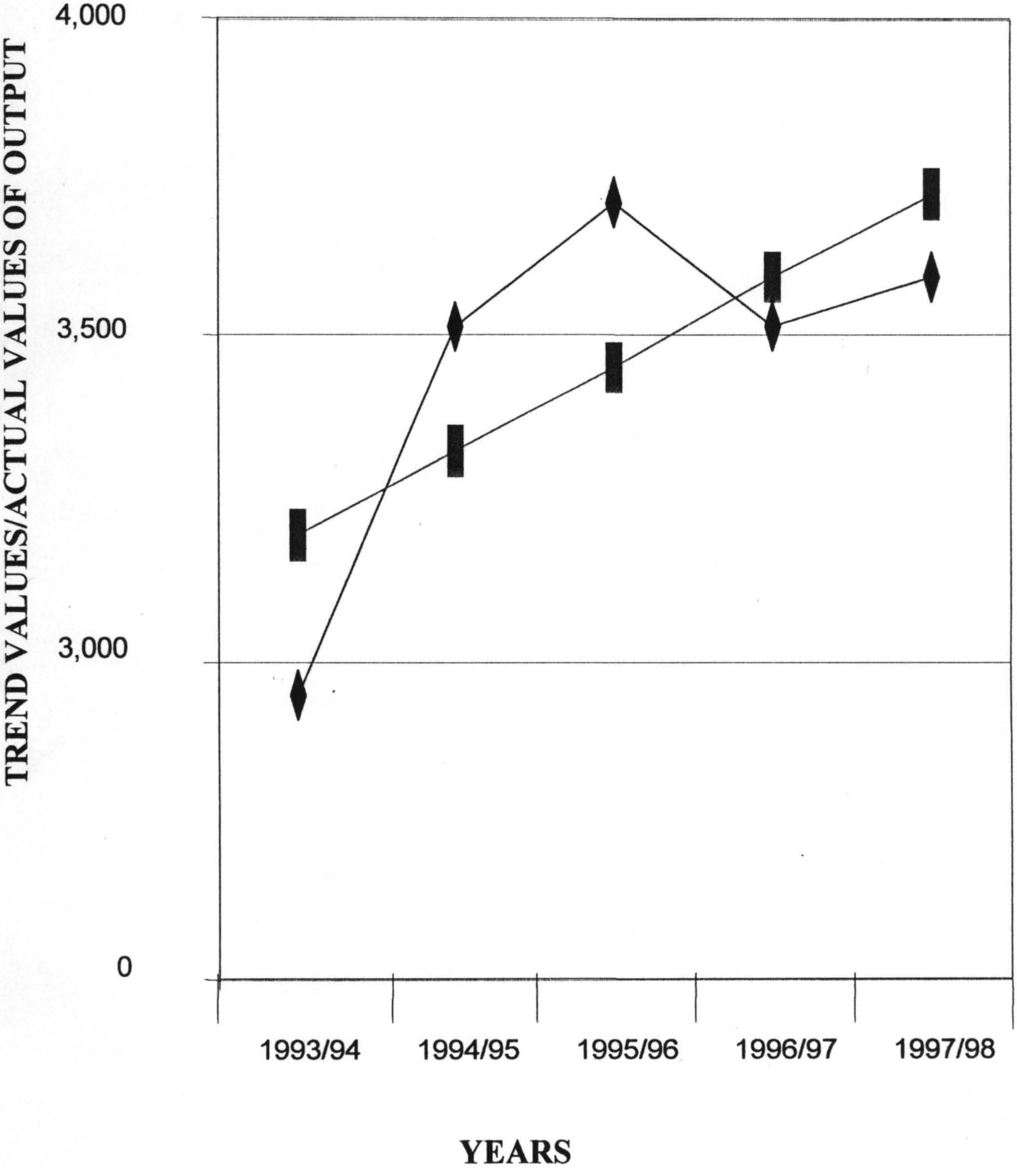
For 2001/2002, X = 6

$$\therefore \hat{Y}_c = 7411.8 + 561.2(6) = 10779$$

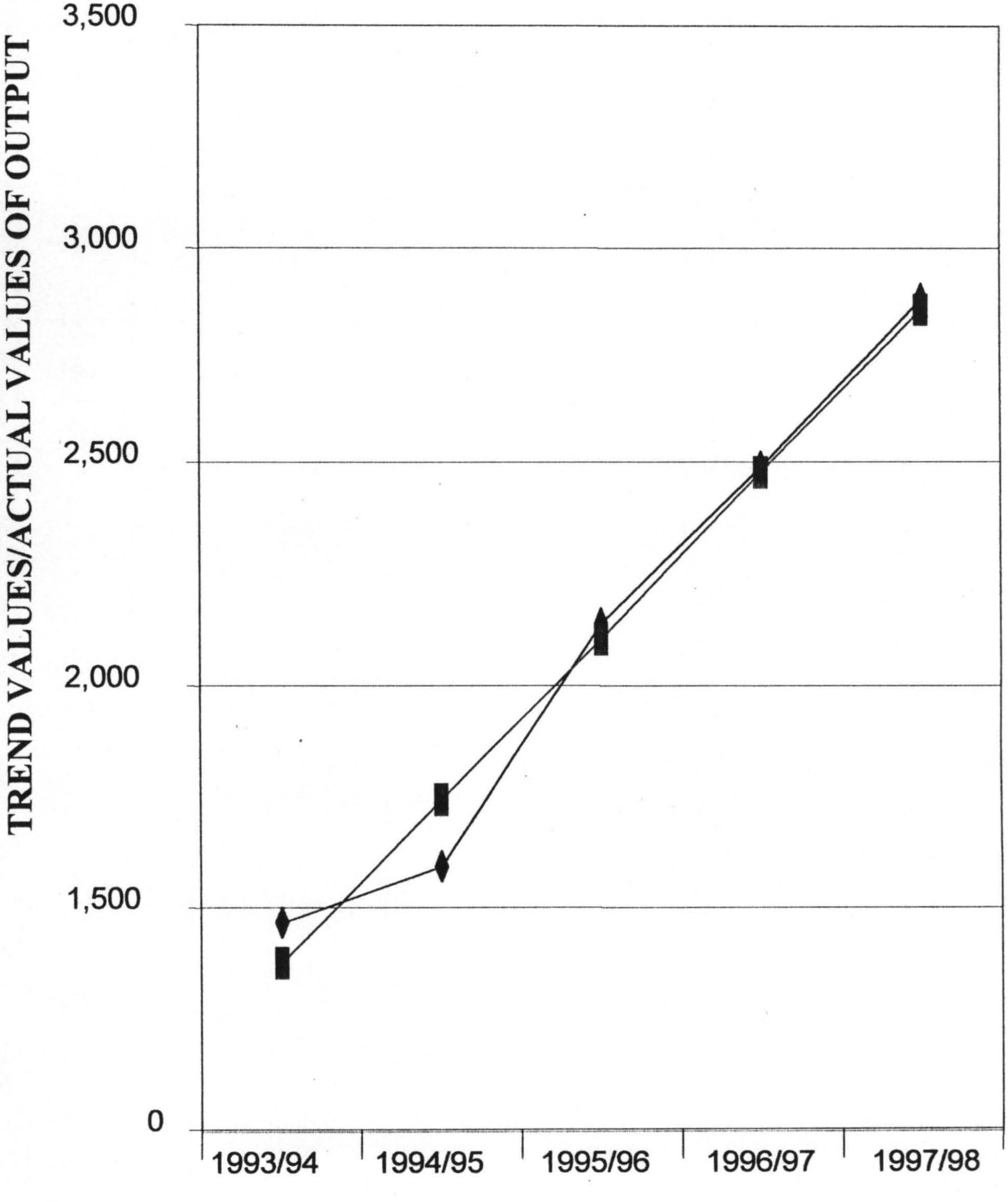
COMMENT

From the computed trend values it is shown that the output of Guinea – Corn fairly increases into the predictions.

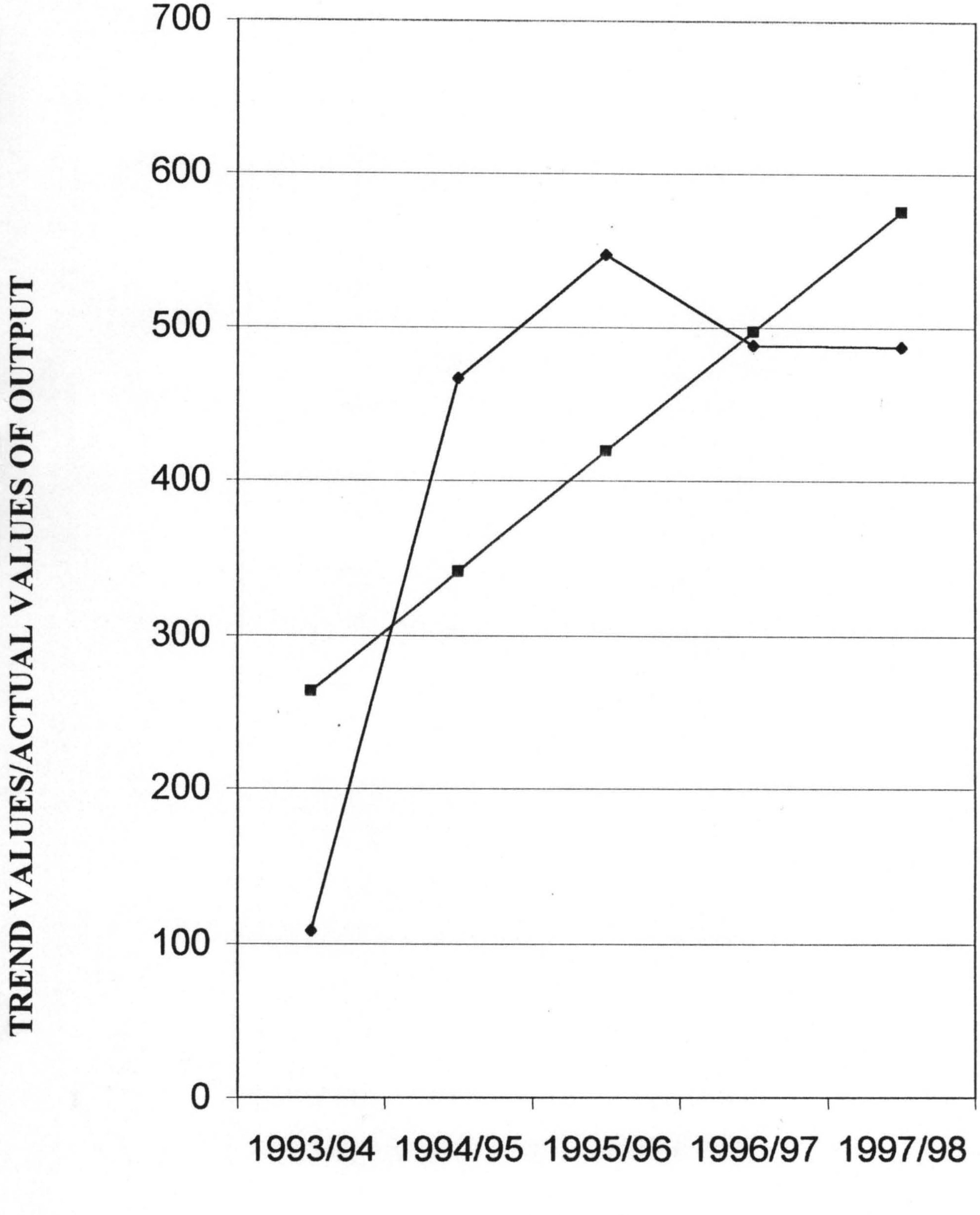
4.6 GRAPHS OF TREND VALUES/ACTUAL VALUES OF OUTPUT OF RICE FROM 1993/94 TO 1997/98



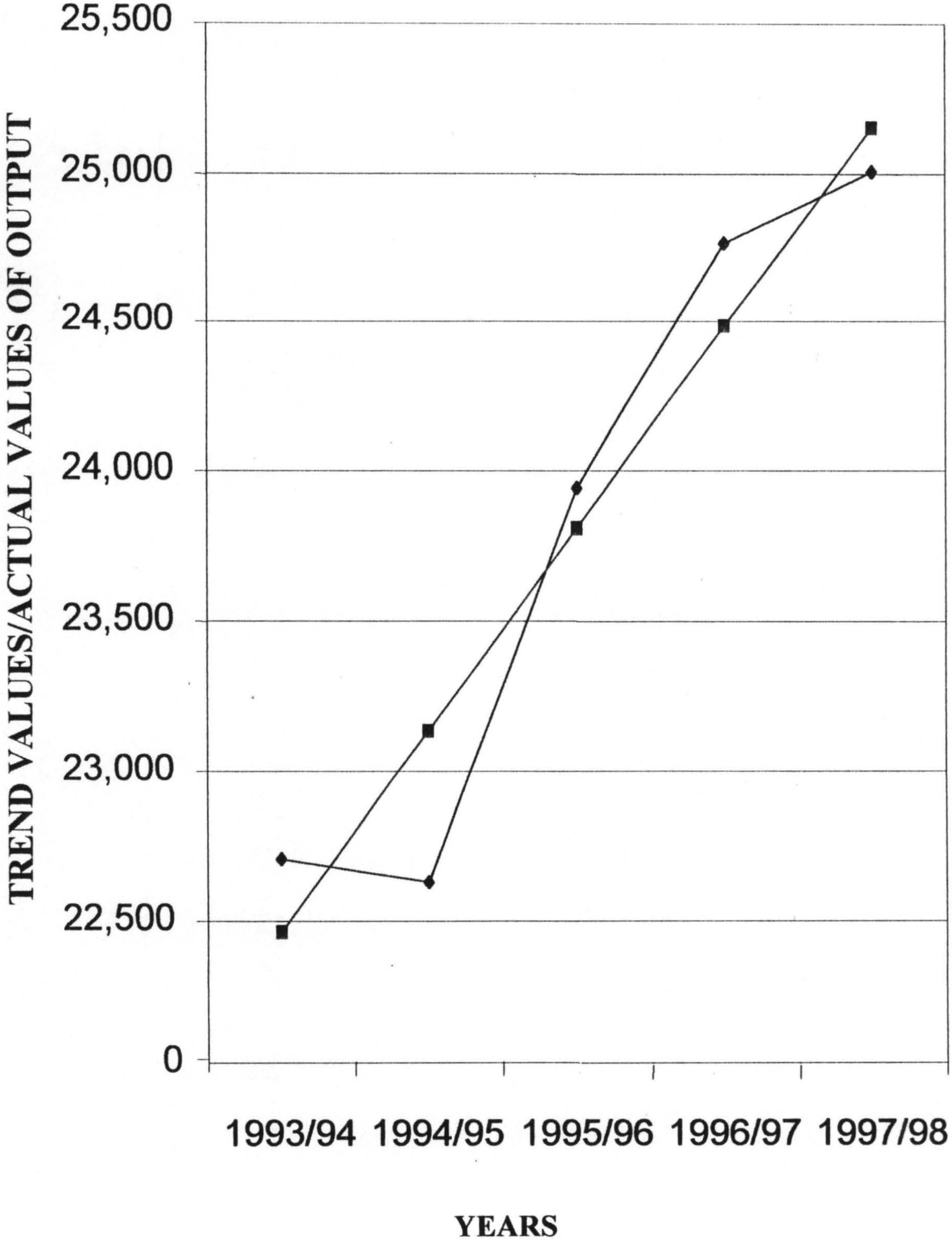
4.7 GRAPH OF TREND VALUES/ACTUAL VALUES OF OUTPUT OF BEANS FROM 1993/94 TO 1997/98



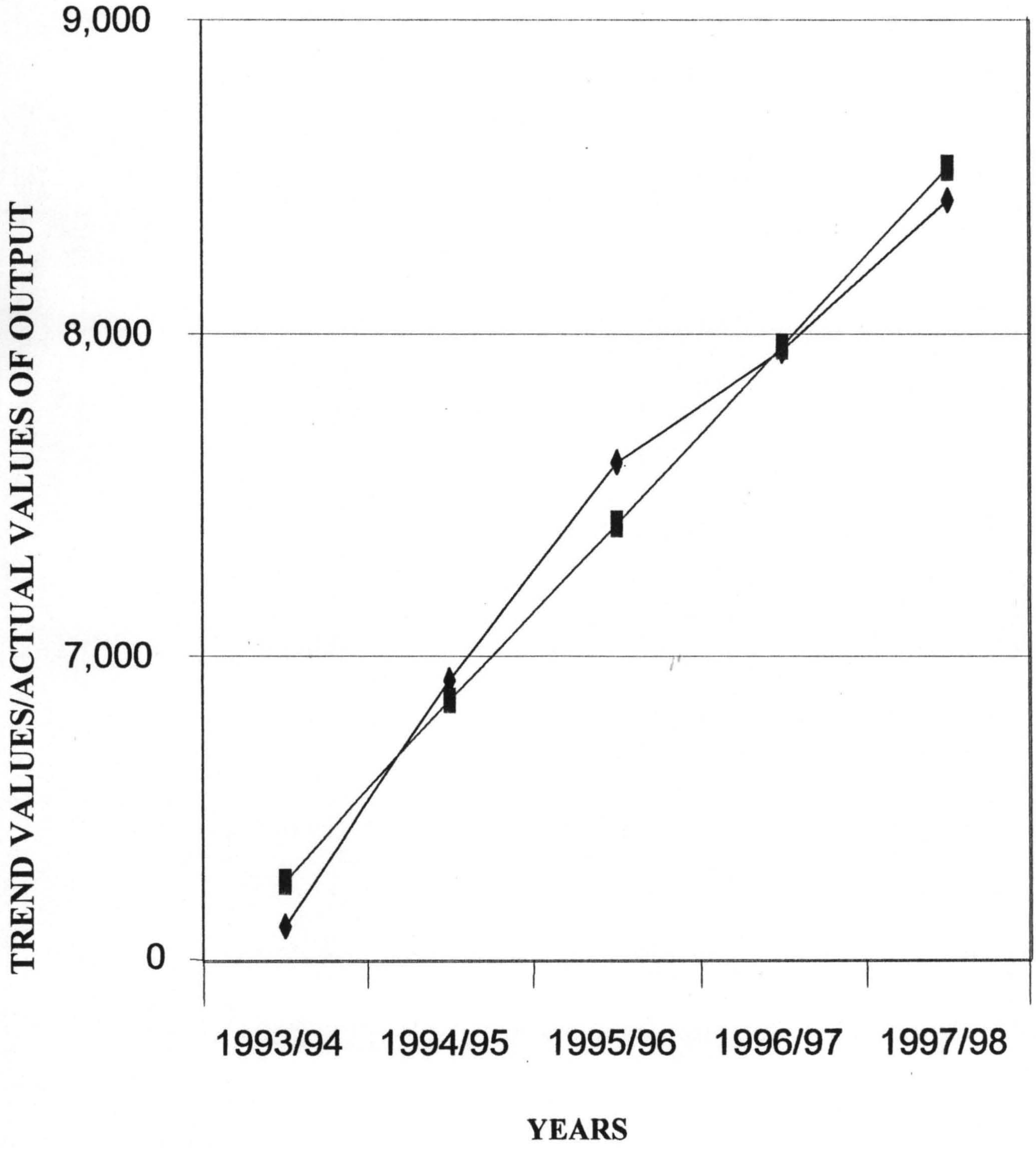
4.8 GRAPH OF TREND VALUES/ACTUAL VALUES OF OUTPUT OF MELON FROM 1993/94 TO 1997/98



4.9. GRAPH OF TREND VALUES/ACTUAL VALUES OF OUTPUT OF YAM FROM 1993/94 TO 1997/98



4.10 GRAPH OF TREND VALUES/ACTUAL VALUES OF OUTPUT OF GUINEA CORN FROM 1993/94 TO 1997/98



CHAPTER FIVE

5.0 FORECASTS, FINAL DECISION AND RECOMMENDATIONS

5.1 FORECASTS

Time series Analysis Technique is used to compute the Trend equations and hence the trend values of each of the yield of the five food crops as well as the forecasts.

From table 4.1, the trend equation for Rice is $\hat{Y} = 3458.4 + 132.5X$. This equation is used to forecast for the years 2000/2001 and 2001/2002 which gives the values 4120900 and 4253400 metric tones respectively.

Table 4.2 shows the trend values of the yield/output of Beans with trend equation, $Y = 2112.4 + 371.9X$ with forecast for 2000/2001 and 2001/2002 as 3971900 and 4343800 metric tones respectively.

Table 4.3 shows the computation of trend values and equation of the yield of melon, the trend equation is $Y = 419.2 + 78X$ and the forecasts are 809200 and 887200 metric tones for 2000/2001 and 2001/2002 respectively.

Table 4.4 is a computation of the trend values and equations of the yield of yam with trend equation, Y = 23812.4 + 673.2X and the forecasts are 27178400 and 27851600 metric tones for 2000/2001 and 2001/2002 respectively

Table 4.5 shows the computation of trend equation and values for yield of Guinea Corn with forecasts for the years 2000/2001 and 2001/2002 as 10217800 and 10779000 metric tones. The trend equation is Y = 7411.8 + 561.2X

5.2 THE FINAL DECISION

All the food crops studied showed an increase in the output. And the rate of increase is at arithmetic progression that is a fairly steady increase over the period of our study.

The population of Nigeria increases tremendously however at geometric rate, therefore, the rate of output of these food crops will not sufficiently meet the desire of the population and hitherto price will be on the increase abnormally.

Malnutrition, sicknesses and social vices can result in the population.

5.3 RECOMMENDATIONS

To curb the problems explored in 5.2 above, we are suggesting the following:

1) The government should boost agricultural production, perhaps, launch another "Green Revolution" to increase food production.
2) The government should provide social amenities in the rural areas where these food crops are produced, so as to discourage Urban migration in search of white collar job, a measure that will encourage active labour group to participate in agriculture.
3) The government should help in readily making available fertilizers and pesticides and measures to educate the farmers on the use and application of these fertilizers and chemicals, so as to boost production.
4) Mechanization should be encouraged to replace Orthodox technique; this will lessen labour and increase production.
5) Loans and financial aid schemes should be provided to the farmers' group or associations.

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```
REM TREND VALUES FOR THE YEILD OF RICE FROM 1993/94 TO
1997/98 BY
REM MATHEMATHECAL EQUATIONS (POLYNOMIAL)METHOD

CLS

DIM YEARS$(5)
DIM Y(5)
DIM x(5)
DIM XY(5)
DIM X2(5)
DIM Yc(5)
DATA 1993/94,1994/95,1995/96,1996/97,1997/98
DATA 2943,3514,3712,3521,3602
DATA -2,-1,0,1,2
PRINT "TREND VALUES FOR THE YEILD OF RICE FROM 1993/94 TO
1997/98 BY"
PRINT "MATHEMATHECAL EQUATIONS (POLYNOMIAL)METHOD"
PRINT TAB(10); "YEARS";
PRINT TAB(25); "Y";
PRINT TAB(36); "X";
PRINT TAB(46); "XY";
PRINT TAB(57); "X^2";
PRINT TAB(70); "Y^C"
FOR J = 1 TO 5
     READ YEARS$(J)
NEXT J
FOR J = 1 TO 5
     READ Y(J)
NEXT J
FOR J = 1 TO 5
     READ x(J)
NEXT J

FOR J = I TO 5
X2(J) = x(J) ^ 2
NEXT J

SUMY = Y(1) + Y(2) + Y(3) + Y(4) + Y(5)
a = SUMY / 5
FOR J = 1 TO 5
XY(J) = x(J) * Y(J)
NEXT J
SUMXY = XY(1) + XY(2) + XY(3) + XY(4) + XY(5)

b = SUMXY / 10
FOR J = 1 TO 5
```

```
Yc(J) = a + (b * x(J))
NEXT J
FOR J = 1 TO 5
PRINT

PRINT TAB(8); YEARS$(J); TAB(23); Y(J); TAB(35); x(J);
TAB(46); XY(J); TAB(57); X2(J); TAB(68); Yc(J);

PRINT

NEXT J
SUMX2 = X2(1) + X2(2) + X2(3) + X2(4) + X2(5)
PRINT
x = 5
Yc = a + (b * x)
PRINT "FORECAST FOR 2000/2001 WHERE x=5  AND Y^C ="; Yc

x = 6
Yc = a + (b * x)
PRINT "FORECAST FOR 2001/2002 WHERE x=6 AND Y^C ="; Yc
PRINT : PRINT
```

OUTPUT OF PROGRAM

TREND VALUES FOR THE YEILD OF RICE FROM 1993/94 TO 1997/98 BY MATHEMATHECAL EQUATIONS (POLYNOMIAL)METHOD

YEARS	Y	X	XY	X^2	Y^C
1993/94	2943	-2	-5886	4	3193.4
1994/95	3514	-1	-3514	1	3325.9
1995/96	3712	0	0	0	3458.4
1996/97	3521	1	3521	1	3590.9
1997/98	3602	2	7204	4	3723.4

FORECAST FOR 2000/2001 WHERE x=5 AND Y^C = 4120.9
FORECAST FOR 2001/2002 WHERE x=6 AND Y^C = 4253.4

```
REM TREND VALUES FOR THE YEILD OF BEANS FROM 1993/94 TO
1997/98 BY
REM MATHEMATHECAL EQUATIONS (POLYNOMIAL)METHOD
CLS
PRINT "TREND VALUES FOR THE YEILD OF BEANS FROM 1993/94 TO
1997/98 BY"
PRINT "MATHEMATHECAL EQUATIONS (POLYNOMIAL)METHOD"
DIM YEARS$(5)
DIM Y(5)
DIM X(5)
DIM XY(5)
DIM X2(5)
DIM Yc(5)
DATA 1993/94,1994/95,1995/96,1996/97,1997/98
DATA 1463,1593,2143,2488,2875
DATA -2,-1,0,1,2

PRINT TAB(10); "YEARS";
PRINT TAB(25); "Y";
PRINT TAB(36); "X";
PRINT TAB(46); "XY";
PRINT TAB(57); "X^2";
PRINT TAB(70); "Y^C"
FOR J = 1 TO 5
     READ YEARS$(J)
NEXT J
FOR J = 1 TO 5
     READ Y(J)
NEXT J
FOR J = 1 TO 5
     READ X(J)
NEXT J

FOR J = 1 TO 5
X2(J) = X(J) ^ 2
NEXT J
SUMX2 = X2(1) + X2(2) + X2(3) + X2(4) + X2(5)
SUMY = Y(1) + Y(2) + Y(3) + Y(4) + Y(5)
a = SUMY / 5
FOR J = 1 TO 5
XY(J) = X(J) * Y(J)
NEXT J
SUMXY = XY(1) + XY(2) + XY(3) + XY(4) + XY(5)

b = SUMXY / SUMX2
FOR J = 1 TO 5
```

```
Yc(J) = a + (b * X(J))
NEXT J
FOR J = 1 TO 5
PRINT

PRINT TAB(8); YEARS$(J); TAB(23); Y(J); TAB(35); X(J);
TAB(46); XY(J); TAB(57); X2(J); TAB(68); Yc(J);

PRINT

NEXT J

PRINT
X = 5
Yc = a + (b * X)
PRINT "FORECAST FOR 2000/2001 WHERE x=5  AND Y^C ="; Yc

X = 6
Yc = a + (b * X)
PRINT "FORECAST FOR 2001/2002 WHERE x=6 AND Y^C ="; Yc
```

OUTPUT OF PROGRAM

TREND VALUES FOR THE YEILD OF BEANS FROM 1993/94 TO 1997/98 BY MATHEMATHECAL EQUATIONS (POLYNOMIAL)METHOD

YEARS	Y	X	XY	X^2	Y^C
1993/94	1463	-2	-2926	4	1368.6
1994/95	1593	-1	-1593	1	1740.5
1995/96	2143	0	0	0	2112.4
1996/97	2488	1	2488	1	2484.3
1997/98	2875	2	5750	4	2856.2

FORECAST FOR 2000/2001 WHERE x=5 AND Y^C = 3971.9
FORECAST FOR 2001/2002 WHERE x=6 AND Y^C = 4343.8

```
REM TREND VALUES FOR THE YEILD OF MELON FROM 1993/94 TO
1997/98 BY
REM MATHEMATHECAL EQUATIONS (POLYNOMIAL)METHOD
CLS
PRINT "TREND VALUES FOR THE YEILD OF MELON FROM 1993/94 TO
1997/98 BY"
PRINT "MATHEMATHECAL EQUATIONS (POLYNOMIAL)METHOD"
DIM YEARS$(5)
DIM Y(5)
DIM X(5)
DIM XY(5)
DIM X2(5)
DIM Yc(5)
DATA 1993/94,1994/95,1995/96,1996/97,1997/98
DATA 108,466,547,488,487
DATA -2,-1,0,1,2

PRINT TAB(10); "YEARS";
PRINT TAB(25); "Y";
PRINT TAB(36); "X";
PRINT TAB(46); "XY";
PRINT TAB(57); "X^2";
PRINT TAB(70); "Y^C"
FOR J = 1 TO 5
     READ YEARS$(J)
NEXT J
FOR J = 1 TO 5
     READ Y(J)
NEXT J
FOR J = 1 TO 5
     READ X(J)
NEXT J

FOR J = I TO 5
X2(J) = X(J) ^ 2
NEXT J

SUMY = Y(1) + Y(2) + Y(3) + Y(4) + Y(5)
a = SUMY / 5
FOR J = 1 TO 5
XY(J) = X(J) * Y(J)
NEXT J
SUMXY = XY(1) + XY(2) + XY(3) + XY(4) + XY(5)

b = SUMXY / 10
FOR J = 1 TO 5
Yc(J) = a + (b * X(J))
```

```
NEXT J
FOR J = 1 TO 5
PRINT

PRINT TAB(8); YEARS$(J); TAB(23); Y(J); TAB(35); X(J);
TAB(46); XY(J); TAB(57); X2(J); TAB(68); Yc(J);

PRINT

NEXT J
SUMX2 = X2(1) + X2(2) + X2(3) + X2(4) + X2(5)
PRINT
X = 5
Yc = a + (b * X)
PRINT "FORECAST FOR 2000/2001 WHERE Bx=5  AND Y^C ="; Yc

X = 6
Yc = a + (b * X)
PRINT "FORECAST FOR 2001/2002 WHERE x=6 AND Y^C ="; Yc
```

OUTPUT OF PROGRAM

TREND VALUES FOR THE YEILD OF MELON FROM 1993/94 TO 1997/98 BY MATHEMATHECAL EQUATIONS (POLYNOMIAL)METHOD

YEARS	Y	X	XY	X^2	Y^C
1993/94	108	-2	-216	4	263.2
1994/95	466	-1	-466	1	341.2
1995/96	547	0	0	0	419.2
1996/97	488	1	488	1	497.2
1997/98	487	2	974	4	575.2

FORECAST FOR 2000/2001 WHERE Bx=5 AND Y^C = 809.2
FORECAST FOR 2001/2002 WHERE x=6 AND Y^C = 887.2

```
REM TREND VALUES FOR THE YEILD OF YAM FROM 1993/94 TO 1997/98
BY
REM MATHEMATHECAL EQUATIONS (POLYNOMIAL)METHOD
CLS
PRINT "TREND VALUES FOR THE YEILD OF YAM FROM 1993/94 TO
1997/98 BY"
PRINT "MATHEMATHECAL EQUATIONS (POLYNOMIAL)METHOD"
DIM YEARS$(5)
DIM Y(5)
DIM X(5)
DIM XY(5)
DIM X2(5)
DIM Yc(5)
DATA 1993/94,1994/95,1995/96,1996/97,1997/98
DATA 22709,22632,23947,24766,25008
DATA -2,-1,0,1,2

PRINT TAB(10); "YEARS";
PRINT TAB(25); "Y";
PRINT TAB(36); "X";
PRINT TAB(46); "XY";
PRINT TAB(57); "X^2";
PRINT TAB(70); "Y^C"
FOR J = 1 TO 5
     READ YEARS$(J)
NEXT J
FOR J = 1 TO 5
     READ Y(J)
NEXT J
FOR J = 1 TO 5
     READ X(J)
NEXT J

FOR J = I TO 5
X2(J) = X(J) ^ 2
NEXT J

SUMY = Y(1) + Y(2) + Y(3) + Y(4) + Y(5)
a = SUMY / 5
FOR J = 1 TO 5
XY(J) = X(J) * Y(J)
NEXT J
SUMXY = XY(1) + XY(2) + XY(3) + XY(4) + XY(5)

b = SUMXY / 10
FOR J = 1 TO 5
Yc(J) = a + (b * X(J))
```

```
NEXT J
FOR J = 1 TO 5
PRINT

PRINT TAB(8); YEARS$(J); TAB(23); Y(J); TAB(35); X(J);
TAB(46); XY(J); TAB(57); X2(J); TAB(68); Yc(J);

PRINT

NEXT J
SUMX2 = X2(1) + X2(2) + X2(3) + X2(4) + X2(5)
PRINT
X = 5
Yc = a + (b * X)
PRINT "FORECAST FOR 2000/2001 WHERE Bx=5  AND Y^C ="; Yc

X = 6
Yc = a + (b * X)
PRINT "FORECAST FOR 2001/2002 WHERE x=6 AND Y^C ="; Yc
```

OUTPUT OF PROGRAM

TREND VALUES FOR THE YEILD OF YAM FROM 1993/94 TO 1997/98 BY MATHEMATHECAL EQUATIONS (POLYNOMIAL)METHOD

YEARS	Y	X	XY	X^2	Y^C
1993/94	22709	-2	-45418	4	22466
1994/95	22632	-1	-22632	1	23139.2
1995/96	23947	0	0	0	23812.4
1996/97	24766	1	24766	1	24485.6
1997/98	25008	2	50016	4	25158.8

FORECAST FOR 2000/2001 WHERE Bx=5 AND Y^C = 27178.4
FORECAST FOR 2001/2002 WHERE x=6 AND Y^C = 27851.6

```
REM TREND VALUES FOR THE YEILD OF GUINEA CORN FROM 1993/94 TO
1997/98 BY
REM MATHEMATHECAL EQUATIONS (POLYNOMIAL)METHOD
CLS
PRINT "TREND VALUES FOR THE YEILD OF GUINEA CORN FROM 1993/94
TO 1997/98 BY"
PRINT "MATHEMATHECAL EQUATIONS (POLYNOMIAL)METHOD"
DIM YEARS$(5)
DIM Y(5)
DIM X(5)
DIM XY(5)
DIM X2(5)
DIM Yc(5)
DATA 1993/94,1994/95,1995/96,1996/97,1997/98
DATA 6145,6917,7608,7959,8430
DATA -2,-1,0,1,2

PRINT TAB(10); "YEARS";
PRINT TAB(25); "Y";
PRINT TAB(36); "X";
PRINT TAB(46); "XY";
PRINT TAB(57); "X^2";
PRINT TAB(70); "Y^C"
FOR J = 1 TO 5
     READ YEARS$(J)
NEXT J
FOR J = 1 TO 5
     READ Y(J)
NEXT J
FOR J = 1 TO 5
     READ X(J)
NEXT J

FOR J = I TO 5
X2(J) = X(J) ^ 2
NEXT J

SUMY = Y(1) + Y(2) + Y(3) + Y(4) + Y(5)
a = SUMY / 5
FOR J = 1 TO 5
XY(J) = X(J) * Y(J)
NEXT J
SUMXY = XY(1) + XY(2) + XY(3) + XY(4) + XY(5)

b = SUMXY / 10
FOR J = 1 TO 5
Yc(J) = a + (b * X(J))
```

```
NEXT J
FOR J = 1 TO 5
PRINT

PRINT TAB(8); YEARS$(J); TAB(23); Y(J); TAB(35); X(J);
TAB(46); XY(J); TAB(57); X2(J); TAB(68); Yc(J);

PRINT

NEXT J
SUMX2 = X2(1) + X2(2) + X2(3) + X2(4) + X2(5)
PRINT
X = 5
Yc = a + (b * X)
PRINT "FORECAST FOR 2000/2001 WHERE Bx=5  AND Y^C ="; Yc

X = 6
Yc = a + (b * X)
PRINT "FORECAST FOR 2001/2002 WHERE x=6 AND Y^C ="; Yc
```

OUTPUT OF PROGRAM

TREND VALUES FOR THE YEILD OF GUINEA CORN FROM 1993/94 TO 1997/98 BY MATHEMATHECAL EQUATIONS (POLYNOMIAL)METHOD

YEARS	Y	X	XY	X^2	Y^C
1993/94	6145	-2	-12290	4	6289.4
1994/95	6917	-1	-6917	1	6850.6
1995/96	7608	0	0	0	7411.8
1996/97	7959	1	7959	1	7973
1997/98	8430	2	16860	4	8534.2

FORECAST FOR 2000/2001 WHERE Bx=5 AND Y^C = 10217.8
FORECAST FOR 2001/2002 WHERE x=6 AND Y^C = 10779

```
REM TREND VALUES FOR THE YEILD OFFOOD COMMODITIES FROM
1993/94 TO 1997/98 BY
REM MATHEMATHECAL EQUATIONS (POLYNOMIAL)METHOD

CLS

DIM YEARS$(5)
DIM Y(5)
DIM X(5)
DIM XY(5)
DIM X2(5)
DIM Yc(5)
DATA 1993/94,1994/95,1995/96,1996/97,1997/98
INPUT "ENTER THE NAME OF THE FOOD ITEM"; ITEM$
INPUT "ENTER THE YEILD FOR THE YEAR 1993/94"; YEILD93
INPUT "ENTER THE YEILD FOR THE YEAR 1994/95"; YEILD94
INPUT "ENTER THE YEILD FOR THE YEAR 1995/96"; YEILD95
INPUT "ENTER THE YEILD FOR THE YEAR 1996/97"; YEILD96
INPUT "ENTER THE YEILD FOR THE YEAR 1997/98"; YEILD97
Y(1) = YEILD93
Y(2) = YEILD94
Y(3) = YEILD95
Y(4) = YEILD96
Y(5) = YEILD97
DATA -2,-1,0,1,2
PRINT "TREND VALUES FOR THE YEILD OF "; ITEM$; " FROM 1993/94
TO 1997/98 BY";
PRINT "MATHEMATHECAL EQUATIONS (POLYNOMIAL)METHOD"
PRINT TAB(10); "YEARS";
PRINT TAB(25); "Y";
PRINT TAB(36); "X";
PRINT TAB(46); "XY";
PRINT TAB(57); "X^2";
PRINT TAB(70); "Y^C"
 FOR J = 1 TO 5
     READ YEARS$(J)
NEXT J
FOR J = 1 TO 5
     READ X(J)
NEXT J

FOR J = I TO 5
X2(J) = X(J) ^ 2
NEXT J

SUMY = Y(1) + Y(2) + Y(3) + Y(4) + Y(5)
a = SUMY / 5
```

```
FOR J = 1 TO 5
XY(J) = X(J) * Y(J)
NEXT J
SUMXY = XY(1) + XY(2) + XY(3) + XY(4) + XY(5)

b = SUMXY / 10
FOR J = 1 TO 5
Yc(J) = a + (b * X(J))
NEXT J
FOR J = 1 TO 5
PRINT

PRINT TAB(8); YEARS$(J); TAB(23); Y(J); TAB(35); X(J);
TAB(46); XY(J); TAB(57); X2(J); TAB(68); Yc(J);

PRINT

NEXT J
SUMX2 = X2(1) + X2(2) + X2(3) + X2(4) + X2(5)
PRINT
X = 5
Yc = a + (b * X)
PRINT "FORECAST FOR 2000/2001 WHERE x=5  AND Y^C ="; Yc

X = 6
Yc = a + (b * X)
PRINT "FORECAST FOR 2001/2002 WHERE x=6 AND Y^C ="; Yc
PRINT : PRINT
```

Table: 252

ESTIMATED OUTPUT OF MAJOR AGRICULTURAL CROPS IN NIGERIA

'000 Metric Tonnes

Crops	1993/94	1994/95	1995/96	1996/97	1997/1998*
Millet	4,738	5,660	5,921	5,917	6,317
Guinea Corn	6,145	6,917	7,608	7,959	8,430
Groundunt	893	2,329	2,647	2,392	2,535
Beans	1,463	1,593	2,143	2,488	2,875
Yam	22,709	22,632	23,947	24,766	25,008
Cotton	214	262	301	308	348
Maize	6,816	6,989	6,211	6,473	6,839
Cassava (Old)	31,005	31,404	32,928	33,495	34,094
Rice	2,943	3,514	3,712	3,521	3,602
Melon	108	466	547	488	487
Cocoyam	1,164	1,293	1,492	**1,500**	1,602
Plantain	1,665	1,632	1,608	**1,715**	1,811

Source: Federal Office of Statistics.

* Provisional

The data have been revised