Forecasting Mango and Citrus Production in Nigeria: A Trend analysis

Yusuf, Sulaiman Adesina and Salau, Adekunle Sheu
University of Ibadan, Oyo Sate, Nigeria

05. April 2007

Forecasting Mango and Citrus Production in Nigeria: A Trend analysis

Sulaiman Adesina Yusuf and Salau Adekunle Sheu
Department of Agricultural Economics,
University of Ibadan, Ibadan

Abstract

This paper provides the prediction of future production of citrus and mango in the medium term up to 2010. The prediction was based on the assumptions that past trends (area planted and yield) and existence of normal weather pattern will hold. Time trend model with specific emphasis on growth model was employed. The analysis delineated three different eras (period between 1961 and 2003, 1986 – 2003, and 1991-2003). These eras were used to simulate the different policy regimes of Regulation, Structural Adjustment era and Liberalization era. In general, output of citrus and mango maintained upward trend over the years. However, the growth rate was highest for the era including Structural Adjustment. Following from this, output predictions over the medium term are highest for the analysis with Structural Adjustment era.

Introduction

World production and trade of fresh tropical fruit is expected to expand over the next decade. Developing countries account for about 98 percent of total production, while developed countries account for 80 percent of world import trade (FAO, 2004). According to the report, the major tropical fruits account for approximately 75 percent of global fresh tropical fruit production. Even though, Mango, pineapples, papaya and avocado are the dominant tropical fruit varieties produced worldwide, the citrus species is also grown worldwide.

Global production of mangoes is concentrated mainly in Asia and more precisely in India (number one producer in the world). Mangoes are grown in 85 countries and 63 countries provide more than 1000 metric tones a year. Total world production was 24 420 116 metric tonnes in 1999 (FAOSTAT, 2000) with developing countries accounting for about 98% of total production. Despite lack of encouragement as to large scale production of tropical fruits in the country, Nigeria still occupies the 8th position in the world ranking of mango producing countries as at 2002 (see table 1). This is instructive as it suggests the potential of tropical fruits in Nigeria. The main producing states in the country include Benue. Jigawa, Plateau, Yobe, kebbi, Niger, Kaduna, Kano, Bauchi, Sokoto, Adamawa, Taraba and FCT

Table 1: World Mango Production (Top 20 Countries)

Ranking	Country	Production (Metric Tonnes)
1	India	11,400,000
2	China	3,130,000
3	Thailand	1,750,000
4	Mexico	1,523,160
5	Pakistan	1,036,000
6	Indonesia	891,566
7	Philippines	880,000
8	Nigeria	730,000
9	Brazil	542,000
10	Egypt	326,063
11	Haiti	260,000
12	Madagascar	210,000
13	Viet Nam	209,400
14	Cuba	207,770
15	Democratic Republic of the Congo	198,226
16	Sudan	194,000
17	United Republic of Tanzania	190,000
18	Guatemala	187,000
19	Bangladesh	187,000
20	Dominican Republic	185,500

Source: FAO STAT

Both fresh and processed mango are been exported to the European countries with France as the major importer followed by the United States. Both account for 70% of the world mango import. Asia accounts for over 85 percent of the world exports of processed tropical fruits. According to FAO, the top mango exporters reported in 1997 are: Mexico, Brazil, South Africa, Haiti, Guatemala, Venezuela, Peru, Nicaragua and Dominican Republic. However, Nigeria is not made mention of in terms of export of mango despite our enviable 8th position in the world.

World production of citrus fruit has experienced continuous growth in the last decades of the 20th century. Total annual citrus production was estimated at over 105 million tons in the period 2000-2004. Oranges constitute the bulk of citrus fruit production, accounting for more than half of global citrus production in 2004. The rise in citrus production is mainly due to the increase in cultivation areas and the change in consumer preferences towards more health and convenience food consumption and the rising incomes. (UNCTAD, 2005). Citrus fruits are produced all around the world. According to FAO data, in 2004, 140 countries produced citrus fruits. However, most production is concentrated in certain areas. Most citrus fruits are grown in the Northern Hemisphere, accounting for around 70% of total citrus production. Main citrus fruit producing countries are Brazil, the Mediterranean countries, the United States (where citrus fruits for consumption as fresh fruit are mainly grown in California, Arizona and Texas, while most orange juice is produced in Florida) and China. These countries represent more than two thirds of global citrus fruit production. According to the FAO (2004) as reported by UNCTAD (2005), the main producing countries of citrus species are indicated in Table 2.

Table 2: Major Producing Countries of the different Types of Citrus Fruits

Oranges	Brazil, United States, Mexico, India, Spain, China, Iran, Italy, Egypt, Indonesia.
Small citrus	Nigeria, China, Syria, Guinea, Japan, Saudi Arabia, India, Sierra Leone, Angola, Tunisia.
Lemons and limes	Mexico, India, Iran, Spain, Argentina, Brazil, United States, China, Italy, Turkey.
Grapefruit	United States, China, South Africa, Mexico, Israel, Cuba, Argentina, India, Turkey, Tunisia.

Source: UNCTAD, 2005

From the table, it can be seen that Nigeria ranks first in small citrus production. The country indeed produces 3% of total world citrus output between 2000 and 2004. This ranks the country ninth thereby making it a major producer of citrus. In the Mediterranean countries, citrus fruits are produced mainly for fresh fruit consumption. Spain is the leading producing country in the area. USA and Brazil are the leading producing countries of processed citrus fruits. In United States most of the production is

consumed domestically. Actually, domestic consumption of orange juice is higher than US production. However, they still play a role as fresh citrus fruits exporter although the share of these exports versus domestic production remains at a relatively low level, between 5% and 7% in the early 2000s. In Asian countries production of citrus fruits is mainly consumed domestically. Production of citrus in Nigeria is mainly for local consumption.

Arising from the assumed importance of Nigeria in global production of citrus and mango it becomes imperative to provide a short-to-medium projection of the fruits. This paper focuses on forecasting the trends in citrus and mango production in Nigeria. Generally, the essence of projecting or forecasting is to improve the quality of decision making. Since there are future events, which are unknown at present but are crucial to making decisions, it becomes imperative for projections to be made for the future. The basis for projecting is to assume that past trends of events will continue to the future. For the purpose of the exercise at hand, we assumed normal weather patterns and the continuation of past trends in planted area and yield.

In the rest of the paper, section two discusses the methodology while section three is on the forecast. Section three is further sub-divided into trend analysis of citrus and

Methodology

Sources of Data and Method of Data Analysis

Essentially, the paper used secondary data that covered the period of 1961-2003 spanning 43 years. The data were sourced from the FAO production year or FAOSTAT.

Descriptive statistics and growth model are used in the analysis to provide basis for the forecast over the medium term of 2004 to 2010. Though, there are different ways of forecasting, this paper utilizes the time trend model with specific emphasis on growth model. The projections were made up to 2010. However, it must be realized that the quality of projection is dependent on the available data and may not tally with reality since some or all of the factors assumed away might change over time (Olayide and Olayemi, 1977; Yusuf and Falusi, 2000).

The estimated equation is given by:

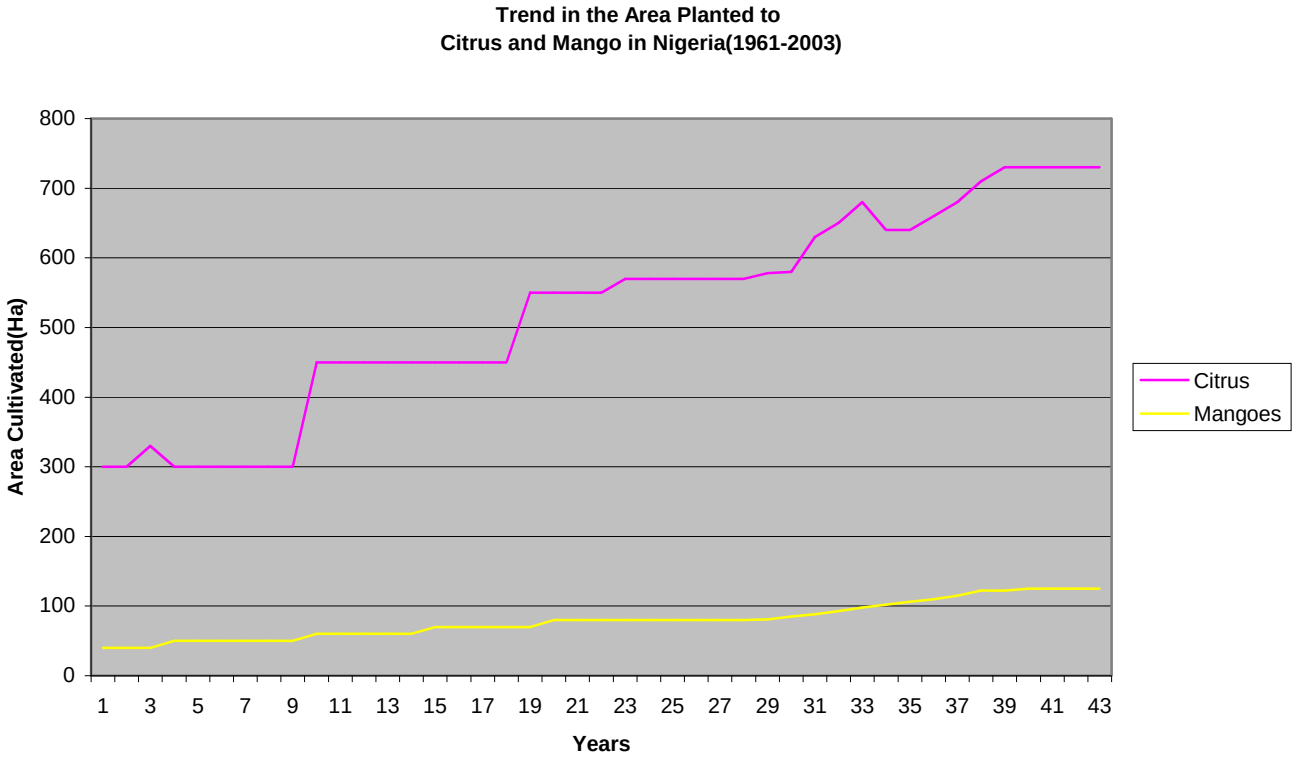
$$LnY_t = b_0 + b_1T$$

Where Y_t is the production output of citrus and mango for year t
b_0 is the autonomous production output (constant term)
b_1 is the growth rate for the period under consideration
T is the time trend for years of interest
Ln is natural logarithm

In order to adequately capture some structural changes in the economy, the data set was divided to all periods (1961-2003), Structural Adjustment Period (1986-2003) and Liberalization period (1991-2003). The idea is to be able to determine the growth rates given the different scenarios.

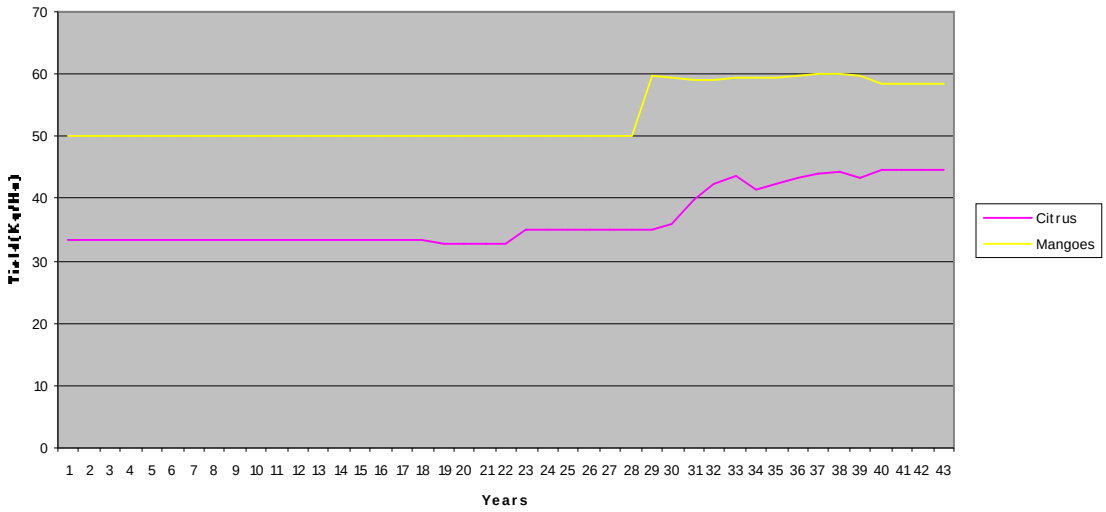
Forecast of Mango and Citrus Production in Nigeria

Area of Citrus increases steadily at about 72000 hectares in year 1999 from as low as 30000 hectares in 1961. For Mango, the output increased steadily from as low as about 3,200 hectares in 1961 to as high as 12,000 hectares as from 1998. This is depicted by figure 1.



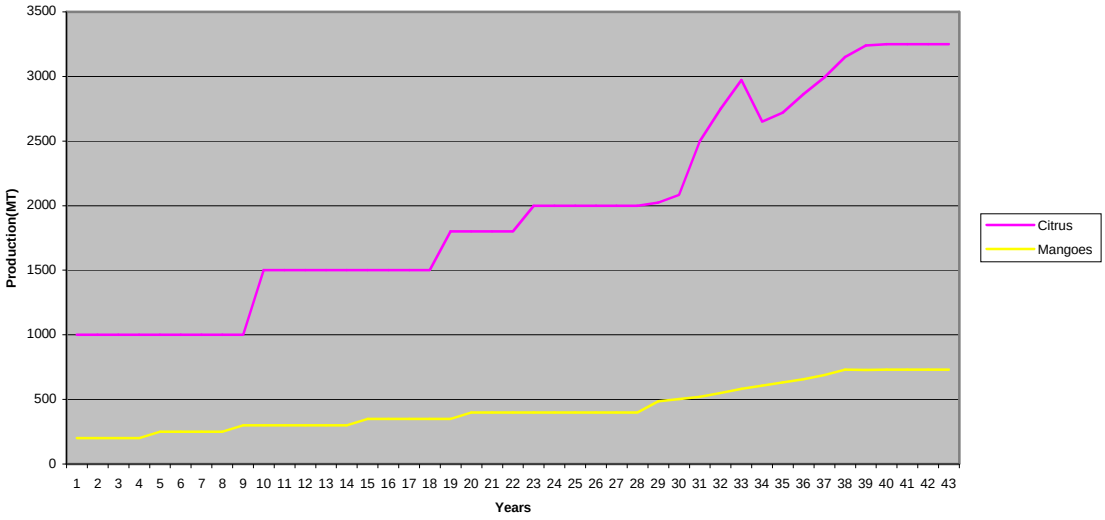
In terms of yield, not much appreciable change was recorded before 1988 for both Mango and Citrus. However, sharp yield increases were recorded for both crop species between 1988 and 1989. This thereafter stabilized and even fluctuated between 1998 and 2003.the yield of mango actually declined from 59.75kg/ha in 1999 to 58.4kg/ha in 2000.

Trend in Yield of Citrus and Mango in Nigeria(1961-2003)



In general, output of Citrus is almost four times that of mango throughout the period between 1961 and 2003. Output of Citrus increased steadily from a low of 1000 Mt in the 1960s to as high as 3250Mt in the early 2000. Indeed the increment represents more than 200%. The same trend of increment in mango is recorded over the years. In fact, Mango output increases by more than 3.5 times in the 2000 compared with the situation in the 1960s. However, for many years, Citrus output tends to stagnate at the same level while mango maintained consistent but small increase.

Trend in Citrus and Mango Production in Nigeria(1961-2003)



Forecast of Output of Mango and Citrus in Nigeria

The regression equations used for the forecast are shown in table 3. All the equations have high goodness of fit with coefficient of determination ranging from 0.792 to 0.970. This indicates that at least (79 percent and up to 97 percent) of the variations in Mango and Citrus output is explained by the time trend. The model also performs well as indicated by F-Values. Within the delineated periods, the SAP period delineated shows that Citrus output growth rate would have been 3.4 percent against mango output growth rate of 4.0 percent. The figure for 1991-2003(which indicates the period of full economic liberalization with intermittent switches to economic regulations) was low for both species. Thus, the growth rate in output in 1991-2003 was 2.1 percent for Citrus and 2.9 percent for mango. By and large, output of both species would record lower rates if situations in 1991-2003 remains compared with continued SAP and the era of regulation.

Table 3: Regression Result of Citrus and Mango Production in Nigeria

Period	b_o	b_1	R^2	F
1961-2003(All)				
Citrus	6.8124 (0.025993)	0.0316 (0.001029)	0.958	941.89
Mango	5.2893 (0.21978)	0.0318 (0.000870)	0.970	1332.68
1986-2003 (Sap Period)				
Citrus	7.5675 (0.035118)	0.034 (0.003244)	0.873	110.09
Mango	5.9946 (0.033217)	0.040 (0.003069)	0.914	170.21
1991-2003 (Liberalization Period)				
Citrus	7.8513 (0.025557)	0.0210 (0.003220)	0.792	42.58
Mango	6.2859 (0.026836)	0.029 (0.003381)	0.871	74.21

Figures in parentheses are standard errors
Source: Computer print out

The predicted values of citrus and mango in Nigeria are shown in Table 4, figures 4 and 5

Table 4: Projected Production of Citrus and Mango in Nigeria (2004-2010)

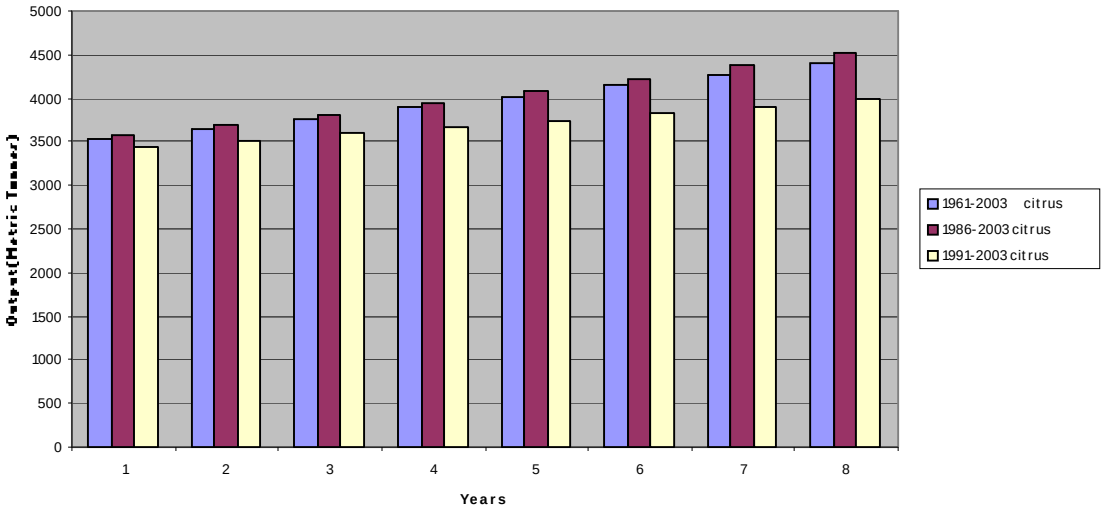
	1961-2003 (All)		1986-2003(Sap Period)		1991-2003(Period Of Liberalization)	
Projected Year	Citrus	Mango	Citrus	Mango	Citrus	Mango
2004	3651.16	803.12	3690.44	858	3520.29	829.56
2005	3768.38	829.07	3818.07	893.01	3595	853.97
2006	3889.36	855.85	3950.12	929.4	3671.3	879.1
2007	4014.23	883.51	4086.73	967.39	3749.21	904.97
2008	4143.1	912.05	4228.07	1006.87	3828.77	931.6
2009	4276.11	941.52	4374.29	1047.96	3910.03	959.01
2010	4413.4	971.95	4525.58	1090.73	3993.01	987.23

Source: Computed from Growth model

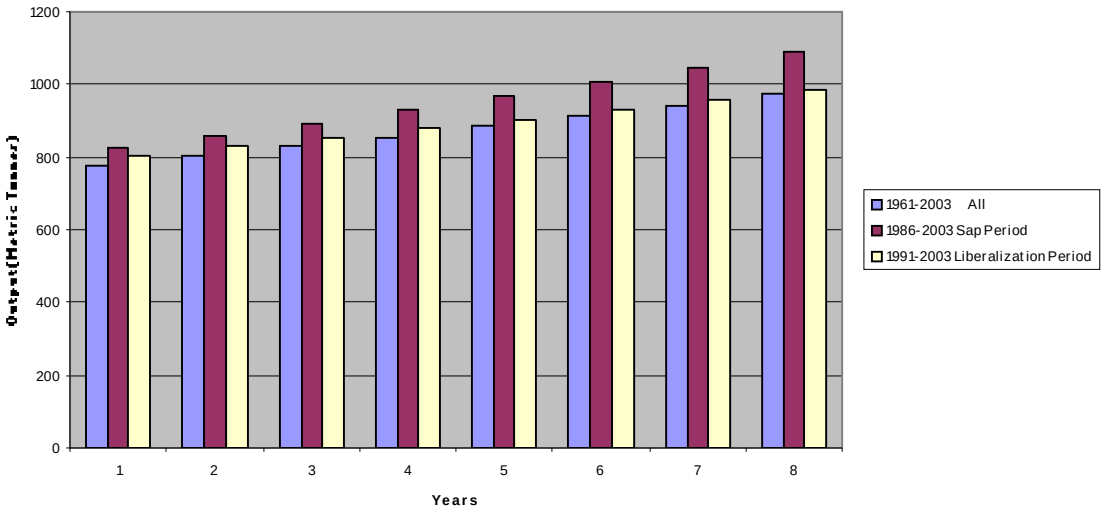
From the table above, the predictions using the three different era showed that SAP included era has the highest output over the projection years whereas the liberalization era has the lowest values. Using the data for all the years maintained middle of the course. More importantly, however, is that output of Citrus and Mango regardless of the era used for the forecast would increase over the projection period of 2004-2010. Nonetheless, this projection as shown in the introductory part of the paper holds only if the assumptions remain. Given the changing taste and the policies of government banning importation of Juice among other agricultural products, it is expected that output of these two crop species-Citrus and Mango will continue to increase even much more than our prediction. This is borne out of the fact that some fruit juice manufacturing companies are beginning to take advantage of the import ban to engage in import substitution of the banned items. This, thus, have a multiplier effect as most companies may have to go into a number of strategies ranging from out grower scheme, contract supply and backward linkages to ensure adequate capacity utilization of their respective plants.

More so, when consumption of fresh and canned fruits (either as substitute or compliment) increases, there must be a way of meeting the rising demand. Thus, in the immediate, we might witness the rehabilitation and maintenance of existing Mango and Citrus plantations while in the medium to long-term, new plantations may emerge. All these positive steps can lead to increased yield; increased hectarage cultivated and ultimately increased output of Citrus and Mango beyond the projected values. But this is possible only within the ambit of sustained and favorable policy climate for increasing output and enhancing the purchasing power of Nigerians. Further policy instruments aimed at encouraging exportation of fruits and their products will boost output.

Forecasted Production for Citrus in Nigeria(2003-2010)



Forecasted Production of Mango in Nigeria (2004-2010)



Summary and Conclusion

This paper provides the prediction of future production of citrus and mango in the medium term up to 2010. The prediction is based on the assumptions that past trends and existence of normal weather pattern will hold. The paper uses time trend model with specific emphasis on growth model. The analysis delineated three different eras (period between 1961 and 2003, 1986 – 2003, and 1991-2003). These era were used to simulate the different policy regimes of regulation, structural Adjustment era and liberalization

era. In general, output of citrus and mango maintains upward trend over the years. However, the growth rate is highest for the era including Structural Adjustment. Following from this, output predictions over the medium term are highest for the analysis with Structural Adjustment era. However, the paper noted that the forecasts can be surpassed given the prevailing situation in the country.

References

An assessment of Philippine mango industry (http://www.philipine.com.ph/webdev/da-amas/mango.html)

Australian Mango Industry Association (2004): Mango Industry Strategic Plan (2004-2009)

IMpho Compendium Chapter 20 Economic and social impact of mangoes

London Fruits Inc (2003): Health Benefits of Mango (http://freshmangos.com/aboutmangos

Olayide S.O and Olayemi J.K. (1977): Forecasting the Nigerian Cocoa Economy Technical Report AETR No 77.1 Department of Agricultural Economics, University of Ibadan, Ibadan

Omole,A.J, Ayodele I.O and Raji, M.A(2004):The Potential of Peels of Mango, Plantain, coco yam and Pawpaw as diets for growing snails. Journal of Livestock Research for Rural Development 16(2) Dec.2004

Raw Materials Research and Development council (2005): Tropical Fruits and Vegetables (http://www.rmrdc.org/Agrorawmaterials/Tropical fruits vegetables.htm

UNCTAD (2005): Info Comm Market information in the commodity area

Yusuf S.A. and Falusi A.O. (2000) Trend Analysis of the Performance of Agriculture in Nigeria (1970-1998) Nigerian Agricultural Development Studies Vol. 1 No. 2 pp1-19