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Production and Utilization of Cassava in Nigeria: Prospects for Food Security and Infant Nutrition

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Abstract

Cassava is the chief source of dietary food energy for the majority of the people living in the lowland tropics, and much of the sub-humid tropics of West and Central Africa. Therefore, its production and utilization must be given prime attention in food policy. The adoption of high yielding varieties and the resulting increase in yield have shifted the problem of the cassava sector from supply to demand issues, such as finding new uses and markets for cassava. In this paper, analysis is done based on empirical results of surveys on various aspects of cassava production, demand and utilization. Data were sourced from survey reports published by FAO, USDA, FOS, IITA, CBN and the World Bank. The analysis revealed that because of its high carbohydrate content and low expenditure elasticities, cassava provides greater proportion of energy for low-income households than any other food item. It was further shown that cassava is used in the preparation of several household foods and derivatives, such as paste, biscuits, bread sagos and sauce. Cassava starch is also industrially modified to provide products with physical and chemical properties for specific applications, including the preparation of baby food, jelly, thickening agents, gravies, custard powders, glucose, and confectioneries. To make cassava more relevant for maternal and infant feeding, it is recommended among other things, to introduce some innovations which may be necessary to increase acceptability and nutritional content of locally prepared cassava-based baby foods, in our indigenous industries.

Keywords: *Cassava, Production, Utilization, Food security, Infant feeding.*

Introduction

Today, the amount of food available per person on a global basis is 18 percent higher than 30 years ago. Most developing countries benefited from this development with the result that their nutrition has witnessed very tremendous improvement. As impressive as this improvement is, about 800 million people worldwide still suffer from chronic hunger; and one quarter of this population resides in Africa. The situation gets worse every year and can lead to a catastrophe if it is not possible to increase food supply at a rate faster than that at which the world population increases (Knirsch, 1996a).

Cassava is the chief source of dietary food energy for the majority of the people living in the lowland tropics, and much of the sub-humid tropics of West and Central Africa (Tsegia *et al,* 2002). Therefore, its production and utilization must be

given prime attention in food policy. Even though farmers have not yet attained the desired technical efficiency in cassava production as a result of weak access to external inputs such as fertilizers and herbicides (Ezedinma *et al*, 2006), the wide-scale adoption of high yielding varieties and the resulting increase in yield have shifted the problem of the cassava sector from supply (production) to demand issues, such as finding new uses and markets for cassava. The government of Nigeria considers a transition from the present status of usage to the level of industrial raw material and livestock feed as a development goal that can spur growth with increase in employment. This consideration underscores the various research and policy initiatives in cassava improvement, production, and processing.

Estimates of industrial cassava use in Nigeria suggest that approximately 16 percent of cassava root production was utilized as chips in animal feed, 5 percent was processed into a syrup concentrate for soft drinks and less than 1 percent was processed into high quality cassava flour used in biscuits and confectionery, dextrin, adhesives, starch, and hydrolysates for pharmaceuticals and seasonings (Ene, 1992). At present, a wide range of traditional cassava forms (such as *gari, fufu,* starch, *lafun, abacha,* etc) are produced for human consumption (Kormawa *et al,* 2003). In view of the renewed emphasis on cassava production (supply), processing and utilization in Nigeria, it becomes necessary to assess the production, demand and utilization patterns of cassava, and its prospects especially in combating hunger and raising food security among vulnerable groups including women and infants. Accordingly, the objective of this paper is to examine and evaluate the supply and demand trends of cassava and its potentials of ensuring food security in Nigeria.

Food Security: Definition and Application

The definition of food security adopted in this work is based on the FAO (2000) recommendation of 2300 kcal per adult per day. In this concept, food security is defined in terms of the household. A household is said to be food secure when all its members have access to 2300 kcal of energy or more per day, all the year round, or most times of the year, without facing the possibility of loosing the access in the future. Modifying the concepts of McDonald and Moffit (1980) and Omonona (2001), the food security status of households can be expressed notationally as follows:

$$Fsec_n = 0 \quad \text{for } X_n < Z \qquad (1)$$

$$Fsec_n = 1 \quad \text{for } X_n \geq Z \qquad (2)$$

where,

$Fsec_n$ = food security status of household n

X_n = per capita calorie consumption of household n

Z = recommended daily minimum energy requirement of 2300 Kcal

Equations (1) and (2) express the status of a household as being food insecure or food secure. In equation (1), food security is zero because households in the category have per capita calorie consumption (X_n) less than the recommended minimum of 2300kcal per adult per day. Households represented in equation (2) are those that have per capita calorie intake of more than or equal to this recommended minimum requirement.

The degree of deviation of a household from this minimum requirement indicates their level of food lack. This level of food deprivation is estimated with the shortfall or surplus index, which captures the severity of hunger and gives a rather tentative indication of the extent of corrective measures needed to address food insecurity situation of a particular population. Furthermore, to determine the proportion of the population that is below or above the food insecurity line, the headcount ratio is adopted.

Materials and Methods

Study area and scope

The analysis done in this paper is based on data derived from surveys on various aspects of cassava production, demand and utilization in Nigeria.

Data requirements and sources

Data required for the study were primarily of the secondary form. In line with the broad and specific objectives of the study, data needed included levels of cassava production, agronomic characteristics of cassava, types of cassava products, and demand elasticities, cassava demand estimates, consumption pattern, and utilization prospects. These relevant data were sourced from journals, magazines, bulletins, manuals, and other publications. In particular survey reports published by FAO, USDA, FOS, IITA, CBN and the World Bank were of much relevance.

Analytical Technique

The study is qualitative in approach. Data from the sources listed above were closely examined, and deductive analysis was done following established empirical knowledge and theory.

Results and Discussion

Cassava production profile in Nigeria

Nigeria grows more cassava than any other country in the world. The production of cassava is concentrated in the hands of numerous smallholder farmers located primarily in the south and central regions of Nigeria. A significant population of cassava growers in Nigeria has made the transition from traditional production systems to the use of high-yielding varieties and mechanization of processing

activities (Nweke *et al,* 2002). According to Berry (1993), Nigeria and Zaire possess both large and small scale farms on which cassava is grown by full-time and part-time farmers. In these farming areas, an average of about 45 percent of cassava field were cultivated for commercial purposes, but this varied from 0 to 100 percent (Nweke, 1989).

Table 1: Levels of Cassava Production from 1990-2003 (tons)

Year	Nigeria	Cameroon	Togo
1990	19,043,008	1,587,872	592,867
1991	26,004,000	1,622,000	510,528
1992	29,184,000	1,636,000	452,093
1993	30,128,000	1,648,000	389,448
1994	31,005,000	1,715,000	531,526
1995	31,404,000	1,780,000	607,222
1996	32,050,000	1,848,000	548,316
1997	32,695,000	1,918,000	595,792
1998	32,698,000	1,965,950	579,381
1999	32,070,000	1,889,191	693,998
2000	32,810,000	191,830	7,000,699
2001	32,586,000	1,947,266	651,530
2002	34,476,000	2,200,000	729,708
2003	33,379,000	2,619,142	724,000

Source: FAO (2004)

FAO (2004) provides statistics of cassava production in three countries, Nigeria, Cameroun and Togo, for the period 1990 to 2003 (Table 1, Figures 1, 2 and 3). The data show that cassava production witnessed increases in the three countries with Nigeria being clearly in the lead. As shown in figure 1, these data were subjected to graphical analysis to further demonstrate production trend in the three countries. The slope of the graph indicates that Nigeria records an annual production increase of about 1.3 million tons, while Togo recorded an increase of about 31,000 tons per annum for the same period. Nigeria's immense potential for cassava production is further shown by the high positive intercept, which suggests high productivity levels.

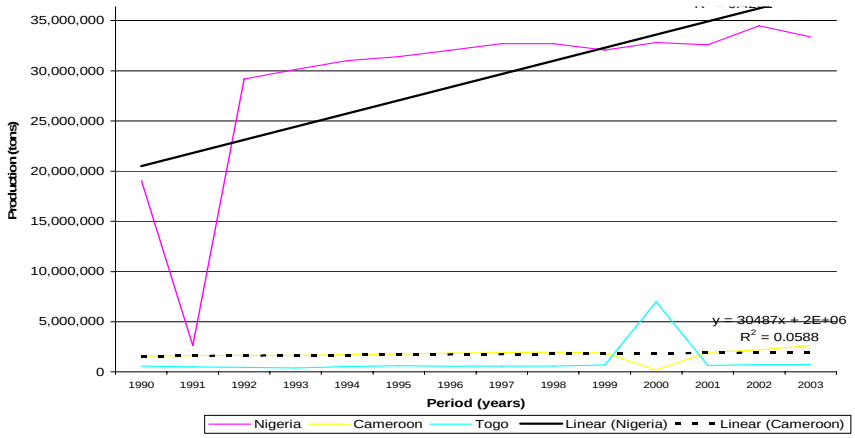


Figure 1: Cassava Production Trend for Nigeria, Cameroun and Togo (1990-2003)

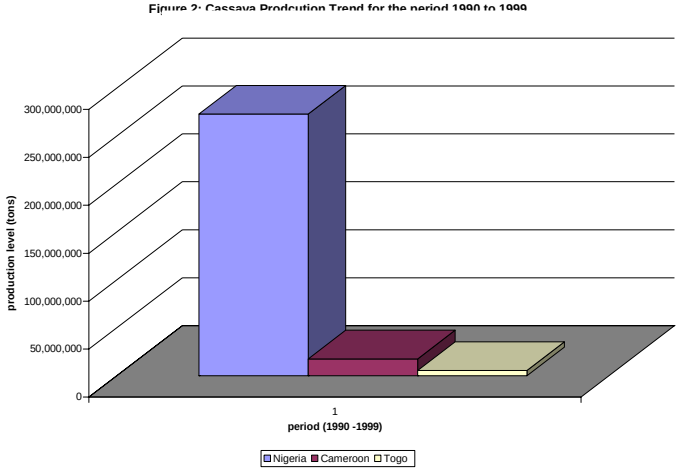


Figure 2: Cassava Production Trend for Nigeria, Cameroun and Togo, 1990-1999.

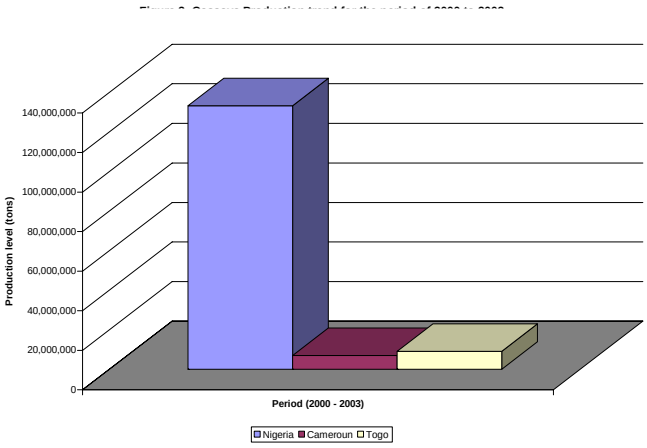


Figure 3: Cassava Production Trend for Nigeria, Cameroun and Togo, 2000-2003.

Several factors were believed to have facilitated the rapid spread of cassava cultivation in Nigeria. First, the agronomic and nutritional advantages of cassava over other staples, and second, the vastly superior storage potential of cassava products. Other desirable qualities that aided the high distribution of cassava in Nigeria include its adaptability to relatively marginal soil and erratic rain-fed conditions. Also, there is the certainty of obtaining some yields even under the most adverse conditions and its flexibility with respect to time of planting and harvesting.

Agboola (1968) gave an outline of the agronomic characteristics of cassava, a summary of which was given by Wheatley *et al* (1995) as shown in Table 2 below.

Table 2: Agronomic characteristics of cassava

Characteristic	**Period**
Growth period (month)	9-24
Optimal temperature (^{0}C)	25-29
Optimal rainfall (cm)	100-150
Optimal pH	5-6
Fertilizer requirement	Low
Planting material	Stem

Source: Wheatley *et al* (1995)

Determinants of Supply and Demand for Cassava

For a given level of income, the quantity of commodity consumed becomes a function of its price (Bouse, 1994). Generally, the demand for a commodity depends not only on its price and the consumer's income, but also on the price of all other commodities (Adegeye *et al,* 1985). It is based on this assumption that a consumer's objective is to maximize his utility in the consumption of a commodity within his budget constraint.

Let a constrained utility function be expressed as:

$$U = Q_1Q_2 + \lambda(Y_0-P_1Q_1-P_2Q_2) \quad (3)$$

Where U = Total utility

Q_1,Q_2 = Commodities consumed

P_1,P_2 = Prices of commodities

Y_0 = Consumers income that imposes setting a constraint on total expenditure of Q_1Q_2. The partial derivatives of the above equate to zero, in line with first order condition for optimization. Thus we have:

$$\delta u/\delta Q_1 = Q_2 - \lambda P_1 = 0 \quad (4)$$

$$\delta u/\delta Q_2 = Q_1 - \lambda P_2 = 0 \quad (5)$$

$$\delta u/\delta \lambda = Y_0 - P_1Q_1-P_2Q_2= 0 \quad (6)$$

Solving for the utility maximizing Q_1 and Q_2 (assuming that the second order satisfaction is satisfied). We have:

$$Q_1 = Y_0/2P_1,\ Q_2 = Y_0/2P_2 \quad (7)$$

These expressions provide the basic definition of demand function (Hengyum *et al,* 2003).

Reasoning in a similar manner, Kormawa (2002) and Kuo *et al* (2003) reported that household income, prices of commodities, preference and other socio-demographic variables such as age, household size, education level etc affect calorie supply and

demand across households. Fresho (1993) however showed that the determinants of supply and demand for cassava products were urban-based and related to marketing mechanisms, income elasticity, alternative (non-food) markets, and relative prices. Nweke (1998) obtained a similar result for the expenditure elasticity of demand for cassava products to be relatively low at higher income. This characteristic agrees with the Working Lesser demand model and shows that the present forms of cassava products make the commodity appear inferior in the household consumption bundle. The result obtained by Nweke (1998) was a confirmation of an earlier result by Eagleston (1992), as shown in Table 3.

Table 3: Expenditure Elasticities of Staples in Nigeria

Item	All households	Low Expenditure households	High Expenditure households
Fufu	0.78	1.42	0.39
Garri	0.83	0.87	0.70
Coarse grain	1.54	1.81	1.14
Rice	1.13	1.47	1.62
Wheat	1.15	0.91	1.52
Meat	1.31	1.62	1.84
Fish	0.80	0.67	1.04
Fruit	0.04	0.49	1.85
Yam	1.29	1.69	0.39

Source: Eagleston (1992)

Utilization of Cassava Products in Nigeria

Cassava products are used in various forms for human consumption, livestock feed, and manufacturing of industrial products (Ene, 1992). Cassava contains about 92.2 percent carbohydrates and 3.2 percent protein in its dry matter, and is said to have high energy content. According to IITA (1990) cassava products are also important feed stuff for livestock feed formulation. For example, cassava has a capacity of substituting up to 44 percent maize in pig feed without any reduction in the performance of pigs. Okeke (1998) also observed that in compounding feed for pigs, broilers, pullets and layers, cassava meal plays a significant role. Eagleston *et al* (1992) provided evidence (as contained in Table 4) that the whole cassava plant, boiled root, cassava root meal, chips and pellets could be used in compounding livestock feed. The roots could be dried, ground and fed to ruminants and it could be used as substitutes for maize in poultry feed.

Table 4: Animal Feed Rations using Cassava Meal

Types of feed	Percentage cassava meal	
	Cautius	**Maximum**
Broiler starter	5	10
Broiler finisher (4 wks)	10	20
Chick starter	5	10
Pullet starter	10	25
Layer	25	40
Piglets	5	10
Pigs (8-18 wks)	10	25

Source: Eagleston *et al* (1992)

Furthermore, cassava starch, cassava flour, cassava juice and fermented cassava are now used in industries (Terry *et al*, 1983; Ene, 1992; Olomu, 1995). For instance, cassava starch is used in making products such as biscuits, bread and derivatives such as sagos and sauce. Cassava starch has also been industrially modified to provide products with physical and chemical properties for specific applications, including the preparation of jelly, thickening agents, gravies, custard powders, baby food, glucose and confectioneries (Ene, 1992).

Apart from being used in variety of paste products such as spaghetti and macaroni, cassava flour has been identified to be useful in the manufacture of cassava beer in the brewery industry (Olomu, 1995). In addition, Terry *et al* (1983) noted that since the rapid escalation of energy cost, especially liquid fuel prices, considerable attention has been given to cassava as a source of ethanol with particular example in Brazil, where enormous effort had been put into production of alcohol using sugarcane and cassava as biological resources.

Demand Estimates of Cassava Supply in Nigeria

The tolerance of cassava to extreme stress conditions, its low production resource requirements, its biological efficiency in the production of food energy, its availability throughout the year and its stability for farming systems, will make cassava products gain more popularity in Nigeria (Kormawa *et al,* 2003). Sequel to this consensus view, Eagleston *et al* (1992) submitted that cassava will have better yield and quality improved varieties, cultural practices and processing technology. As shown in Table 5 and figure 4, FAO (2004) made projections on the demand for cassava in the foreseeable future.

Table 5: Cassava Demand Estimates by 2007 (tons)

Product	Export	Import	Total
Food	5,700,000	1,825,000	**7,525,000**
Starch	1,770,000	3,200,000	**4,970,000**
Livestock feed	15,622,000	75,621,248	**91,243,248**
Ethanol	900,000	2,700,000	**3,600,000**
Total	**23,992,000**	**83,346,248**	**107,338,248**

Source: FAO (2004)

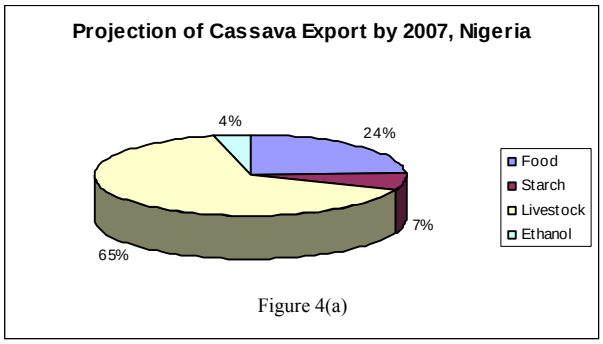


Figure 4(a)

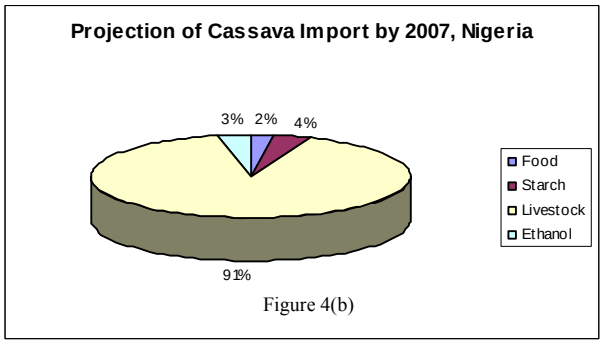


Figure 4(b)

Figure 4: Projection of Cassava demand (a) export and (b) import, for Nigeria in 2007.

The estimates for the potential growth of Nigeria's urban and rural demand are based on population growth projections and the maintenance of current average per capita consumption. Knipscheer (2003) gave conservative estimates of cassava future demands in Nigeria as presented in Table 6.

Table 6: Conservative Estimates of Cassava Future Demands (tons) in Nigeria

Sector	Current alternative Product use	Substitution (%)	Equivalent in fresh cassava root
Food	1,180,000	20	1,000,000
Starch	67,100	100	350,000
Livestock	1,200,000	20	1,000,000
Ethanol	20,900	100	2,000,000
Total	**2,468,000**		**4,350,000**

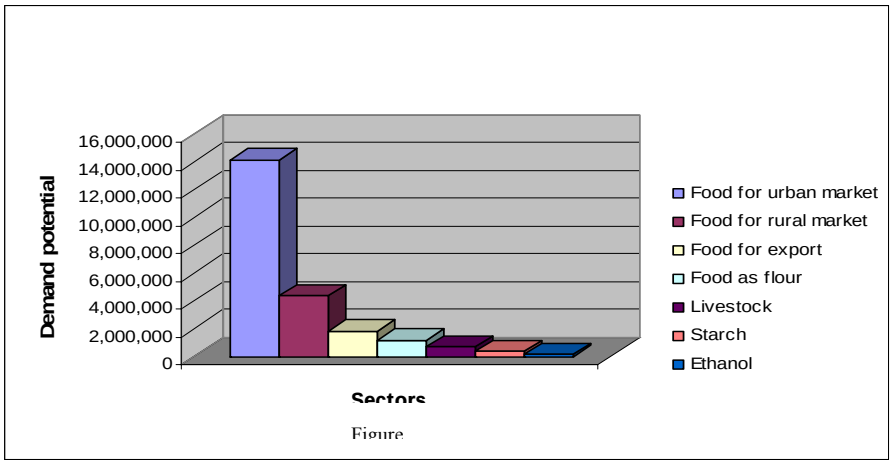
Source: Knipscheer, (2003)

Besides the estimates in the previous tables, Kormawa (2003) presented what can be referred to as "middle of the road" estimate of potential demand for cassava (tons) in Nigeria. These estimates are presented in Table 7, figure 5 below:

Table 7: Estimate of Potential/Demand for Cassava (tons) in Nigeria

Sector	Potential/ Market
Food for urban market	14,157,438
Food for rural market	4,378,788
Food for export	1,825,000
Food as flour	1,170,055
Livestock	675,000
Starch	335,000
Ethanol	139,347
Total	22,680,628

Source: Kormawa (2003)



Figure

Figure 5: Cassava demand estimate for Nigeria, according sectors

Trends and Prospects of Cassava in Nigeria's Food Security Needs

Cassava has virtually turned to pure gold in Nigeria. Less than five years ago, the country was desperately looking for export market for the farm produce as a result of glut in the local market. But the situation has changed due to the trade promotion policy of the federal government (Ojeagbase, 2005). Stressing the influence of the presidential initiative on cassava in Nigeria, Anga (2005) observed that the trade promotion policy of the federal government has created a very strong domestic demand and market. So strong is the demand that big-time cassava farmers now earn almost as much money from the produce locally than they could make if they exported the commodity. Ojeagbase (2005) reported that on the international market, a ton of cassava was selling for US$120 (about ₦15,000). By contrast, the price was US$130 (₦16,000) within Nigeria. This gives a difference of $10 and without the stress of getting the product ready for export. All the processors of feeds are now

finding cassava an effective option for maize and there is a move to replace or partially replace maize with cassava chips.

USDA (2001) projected that developing countries will represent a larger share of orld food demand and wil be the major force driving trade in calorie. Rising per capita income in developing countries over the coming decade will lead to a greater demand for high-value products. Aromolaram (2004) posited that shifts in food consumption patterns tend to vary across countries based on their level of economic development. He noted that at the highest income levels, per capita consumption of both cereals and roots and tubers decreased between 1961 and 1981, while consumption of meat products increased substantially. In low income countries where food security remains a concern despite recent economic gains, decreases in root and tuber availability were more than offset by dramatic increases in per capita supply of all other food products.

Differences in total food availability between developed and developing countries are also reflected in their respective food budget shares. In low income countries, food accounts for a greater portion (47 percent) of consumers total budget than in wealthier countries where, on average, food expenditures account for only 13 percent (USDA, 2001). Staple food products such as cassava products, rice and yam account for larger shares of the total food budget in low income countries.

In Nigeria, cassava can be processed into different forms utilizable by man. IITA (2002) identified and highlighted the characteristics of the common forms of cassava products available in Nigeria. These include gari, fufu, cassava chips, cassava flour, starch, farina, tapioca, macaroni, cassava bread and pudding. A survey conducted by the Federal Ministry of Health the results of which are shown in Table 8 below indicates that the frequency of consumption of cassava products is high in some states of the country.

Table 8: Frequency of Cassava Consumption in Nigeria

State	1-2 times (%)	3-4 times (%)	More than 4 times (%)
Osun	29	36	33
Akwa Ibom	29	39	33
Bayelsa	21	15	51
Edo	21	25	53
Imo	24	21	43
Kaduna	74	18	4
Kano	57	37	4
Kebbi	84	15	0
Kwara	27	38	35
Borno	65	28	4
Taraba	37	25	33
Zamfara	43	27	30

Source: Federal Ministry of Health, Nigeria (2004)

Table 9: Consumption Pattern of Cassava Products in Nigeria

Zone	Order of Preference
South South	Gari, Akpu/Fufu
South West	Gari, Lafun, Akpu/Fufu
South East	Gari, Fufu, Akpu
North Central	Gari, Fufu, Starch
North East	Gari, Fufu, Akpu, Abacha

Souce: Kormawa and Akoroda (2003)

Furthermore, consumption pattern of cassava products by zone is given below in Table 9. The above tables suggest that cassava is fast changing from an inferior food to a necessity in Nigeria. Gari for instance is becoming the most popular form in which cassava is consumed. Tsegai *et al* (2002) agrees that cassava is an excellent source of dietary energy, and it smacks of short-sightedness to consider cassava solely a subsistence food crop.

Conclusion and Policy Implications

As consensus continues to grow with regard to the appropriate strategies for combating food insecurity in Nigeria and Sub-Saharan Africa in general, it becomes necessary to evaluate trends of production and utilization of major staples. It is by so doing that the imbalances in domestic production and demand are spotlighted and adequate remedies sought. Food supply and demand have their influences on each other. An adequate effective demand for food is needed to sustain the growth in food production because producers need market for their products. Because of the high cost of production of other crops, coupled with their high agro-climatic requirements, they are more expensive compared to cassava and may not be accessible to the urban poor at some periods of the year. Thus, with the growing population in Nigeria and declining real incomes, cassava has the potential of combating human hunger among adults and infants alike and hence will remain a pillar of food security for the citizenry.

Suggestions

The market potential of cassava depends on technological transformation. The development of appropriate and cost-effective farm-level technologies is critical for expanding the production and market for cassava now and in future. A dual policy approach is therefore recommended in which the government of Nigeria should encourage backward integration for greater industrial utilization and at the same time, support existing small-holder production systems through an effective input delivery system.

Development of cost effective and nutritionally sound technologies for cassava processing and storage need not be over-emphasized. In order to effectively appropriate the food security potentials of cassava, it is important that changing

tastes and preferences must form the basis for exploring new products and processing techniques. In this connection, it is recommended that greater capacity must be built for multi-disciplinary research and development. Such research and development efforts will undoubtedly reveal a host of cassava based products and alternative processing technologies that will diversify household nutrition base and infant feeding.

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