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Cocoyam Marketing in Nigerian Economy: Issues and Challenges

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ABSTRACT

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*This study examined the current status of cocoyam (*Colocasia* and *Xanthosoma* spp) in Nigeria. The research found out that cocoyam is ranked after cassava and yam as one of the most important staple food crops among the roots and tubers cultivated and consumed in the country. The crop (cocoyam) is an important source of income and employment for the rural farming households especially in Southeast part of the country. Compared to cocoyam production, cocoyam marketing has received less attention by researchers and policy makers. On the cocoyam global market, China is the leading exporter of cocoyam followed by Mexico, USA and Canada, even though cocoyam production levels in these countries are not as high as those of the top five producers in African countries namely; Nigeria, Cameroon, Ghana, Madagascar and Burundi respectively. Research shows that China (with export value of \$417.18 million) remained the number one exporter of cocoyam, followed by Mexico (\$264.49 million), USA (\$161.01 million) and Canada (\$141.96 million). The low value addition of the cocoyam in the country makes its export competition very low comparable to other nations like China, USA among others. The research recommends that there is need for development of a comprehensive cocoyam marketing strategy in Nigeria.*

Introduction

In Nigeria, cocoyam (*Colocasia* and *Xanthosoma* spp) is ranked after cassava and yam as one of the most important staple food crop among the roots and tubers cultivated and consumed in the country (Okoye, Asumugha, Okezie, Tanko, and Onyenweaku, 2008). With about 40% of the total world production, Nigeria is the largest producer of the crop in the world. Cocoyam production in Nigeria rose from about 0.73 millions metric tons in 1990 to as much as 5.068 million metric tons in 2007, and in 2012 the average production figure for Nigeria is 5.400 metric tonnes which accounts for about 37% of total world have output of cocoyam (FAO, 2012). On the average, Nigeria currently produces about 3.7 million metric tonnes of cocoyam annually. Cocoyam is not only a major source of food but also an important source of income and employment for the rural farming households (Fadipe, Adenuga, and Raji, 2015).

Despite its nutritional qualities and the potentials to improve the livelihoods of many smallholder farmers, the crop has received little attention from both government and research communities. It is of interest to note that among root and tuber crops in Nigeria, cocoyam is the only fully edible because the corms and cornels are eaten in various food forms while the

leaves and flowers are commonly used as a spice to garnish and flavour food. The corms are good sources of carbohydrates with easily digestible starch. Cocoyam is nutritionally superior to major competitors like cassava and yam, in terms of digestibility, contents of crude protein and essential minerals (Ubalua, 2020).

In spite of its economic and nutritional significance, the marketing system for cocoyam in the country like Nigeria is not well developed. Compared to cocoyam production, cocoyam marketing has received much less than sufficient attention by researchers and policy makers. The agricultural marketing system plays a major role in economic development in countries whose resources are primarily agricultural. As the process of urbanization progresses in Nigeria, an increasing share of marketing activities takes place at locations other than where food is produced. The nutritional content and production capacity of cocoyam in Nigeria, its uses and potentials expose it a good raw material in industries for production of different products and a good potential agricultural business product. This is because the crop has been recommended as composite material for production of different products which include bread and biscuit baking, production of pasta, starch, salad cream and



sausage binder (Igbozulike, 2015). These value addition processes by cocoyam is economic sources of income and employment of urban, semi-urban and rural households in Nigeria.

Cocoyam has better nutritional qualities than other root and tuber crops such as cassava and yam, with higher protein, vitamin and mineral content. A versatile staple, cocoyam can also be used as weaning food, while the leaves can be cooked as vegetable. However, these benefits, along with the wide adaptability of the crop and its role in the economy and livelihood of millions of rural poor, have been under-estimated, under-reported, and therefore poorly appreciated. Those who depend heavily on the crop for survival – the most vulnerable groups – have neither the resources nor the voice to influence its future. Following an old eastern Nigeria tradition, female farmers normally have cocoyam farms that sons-in-law are expected to help with. Women are the custodians of cocoyam farming in most African countries including in Nigeria as reported by (Onyeka, 2014).

Colocasia esculenta popularly known as cocoyam is a tropical, perennial crop. It is a starchy tuber crop with three parts namely; corm, stem and leaves, which is grown basically for edible root. It can also be grown as an ornamental plant for the beautification of the environment as well as a medicinal plant. Cocoyam has its origin from Asia or Southeast Asia as some researchers have found out and it is a known staple crop in most developing countries of Africa. It can also be found in India, USA, Japan as well as Singapore (Elenwoke, 2018). Cocoyam can be processed in several ways. It contains digestible starch, protein and other valuable nutrients. Consumption of cocoyam is very high all over Nigeria (Alegbejo, Ameh, Ogala, and Ibrahim, 2008).

Cocoyam is reported to have superior nutritional value over major root and tuber crops, especially in terms of their protein digestibility and mineral composition, but yet its marketing potentials are still low. In many tropical areas, cocoyam plays major role in the lives of many as a food security crop, mainly for smallholder farmers. Cocoyam has overtaken cocoyam (related aroid), in terms of proximate and mineral contents. Cormels of cocoyam are boiled, baked or partly boiled and fried in oil before consumption. The corms are peeled, dried and ground to flour for pastry that can be stuffed with meat or other fillings. The young leaves can be boiled and used as vegetable similar to spinach (Lim, 2015). Recent research shows that marketing of these stated produce/products from cocoyam will help to reduce poverty especially in southern parts of the country

where its production and usage are higher comparable to other locations. Therefore, the study seeks to ascertain the effects, other related issues and predicaments of cocoyam marketing in Nigeria economy.

Concept of cocoyam and Nigerian economy

Cocoyam (*Colocasia esculenta*) is a tuber crop cultivated in many parts of the tropics. It belongs to the family *Araceae* with two members (*Colocasia* and *Xanthosoma*) that are used as staple foods in Africa, Asia and pacific countries. Cocoyam in some Southeast Nigerian village and town communities' offer socio-cultural and entertainment values (Talwana, Serem, Ndabikunze, Nandi, Tumhimbise, Kaweesi, Chumo, and Palapala, 2009). Production of cocoyam in some town communities of southeast Nigeria is gendered-culturally regarded women's crop and immortalized with annual festivals that bore its name such as "Ede Aro" and/or "Ede Opoto". Some of those cocoyam festivals appear raucous, but with entertaining activities that are entwined with cultural exhibitions. For example, in Abagana, a town community in Anambra State of Nigeria, it is observed that cocoyam (*colocasia esculenta*) festival is celebrated in the last week of every December. The cultural activities include cooking and serving of cocoyam meal to family members, friends and august visitors. Meanwhile, during the event, youth and masquerade flogging contests and cultural show day which attracts spectators from many different places are displayed (Enible, Nwobodo, Nworji, and Okonkwo, 2019).

The economy of Nigeria is a middle-income, mixed economy and emerging market, with expanding manufacturing, financial, service, communications, technology and entertainment sectors. The Nigerian economy is one of the largest in Africa. Since the late 1960s it has been based primarily on the petroleum industry. A series of world oil price increases from 1973 produced rapid economic growth in transportation, construction, manufacturing, and government services. Because this led to a great influx of rural people into the larger urban centres, agricultural production stagnated to such an extent that cash crops such as palm oil, peanuts (groundnuts), and cotton were/are no longer significant export commodities.

In addition, from about 1975 till date Nigeria was forced to import such basic commodities as rice and cassava for domestic consumption. This system worked well as long as revenues from petroleum remained constant, but since the late 1970s the agricultural sector has been in continuing crisis



because of the fluctuating world oil market and the country's rapid population growth.

Added to these are the problems of insecurity by farmer-herdsmen crisis among others like kidnapping. Although much of the population remained engaged in farming, too little food was produced, requiring increasingly costly imports. The various governments (most of them military-run) and even present and past administration have dealt with this problem by banning agricultural imports and by focusing, albeit briefly, on various agricultural and indigenization plans (Britannica, 2021).

Challenges of cocoyam marketing

In Nigeria and even other developing countries, the benefits of cocoyam along with the wide adaptability of the crop and its role in the economy and livelihood of millions of rural poor, have been under-estimated, under-reported, and therefore poorly appreciated. Those who depend heavily on the crop for survival – the most vulnerable groups – have neither the resources nor the voice to influence its future. It is also possible that farmers face certain constraints that may hinder them from going into the cultivation of cocoyam on a commercial scale. An understanding of such challenges and their level of severity will assist policymakers in mitigating them and also in creating an enabling environment for the economy growth through cocoyam marketing (Jervis, 2021).

Despite the fact that South Africa is regarded to be self-sufficient in food and even able to export some food items, hunger and malnutrition are still common in many rural and urban areas (Van den Heever 1995). Unlike Asia, the Pacific and other African countries, where cocoyam is a commercialized staple (Miyasaka et al. 2003), the crop is not commercially popular in South Africa. Although several landraces of the crop have been cultivated in some remote parts of KwaZulu-Natal Province for centuries, where they are collectively called *Amadumbe*, cocoyam are not well known like maize (*Zea mays*) and potato, which are the main staples in the country. Rather, the crop is cultivated in association with other subsistence food crops such as sweet potatoes, landrace potatoes and green beans mainly for subsistence. The species is considered as food for the poor, and the commercial farmers have not shown much interest in the crop. Consequently, there is very little information on scientific research carried out on cocoyam in South Africa compared with conventional root and tuber crops such as sweet and landrace potatoes. There is therefore the need for a systematic investigation on the nutritional values of cocoyam in South Africa by comparing this species with potato based on their nutritional values and anti-nutritional factors.

Cocoyam's business and utilization appears to be dwindling and suffer neglect irrespective of its many uses and the country's leading position in its annual production which is estimated at about 40% of annual world output. Tapping the potential of cocoyam as a food and cash crop implies identifying and addressing many constraints, including two important diseases that affect cocoyam production in West and Central Africa: Cocoyam root rot disease (CRRD) and Cocoyam leaf blight (TLB). These diseases impacts move beyond one season of damage because cocoyam's vegetative mode of propagation supports transmission of diseases from one generation to the next. The recycling of infected planting materials from farmers' fields leads to reduced yield and build-up of diseases (Durrux-Malpartida, 2014).

In the study of Nenna, Ugwumba, Obiekwe, and Akubuilu, (2017), on strategies for improving cocoyam production among farmers in Anambra state, Nigeria. They found that the challenges of cocoyam production include high cost of hired labour, Scarcity of fund, high incidence of pests and disease, low soil fertility, inadequate extension services and unavailability of organic fertilizer. It could be inferred generally that most of the factors had links with scarcity of fund and high cost of agricultural inputs. Credit plays a vital role in the economic development of a nation. It is a crucial input required by smallholder farmers to establish and expand farm enterprises with the aim of increasing household income (Idoge, 2013). In the study of Fadipe, Adenuga, and Raji, (2015) on analysis of cocoyam marketing in Sagamu local government area, Ogun State, Nigeria, they found that the challenge of cocoyam marketing include inadequate capital, lack of credit, storage problem, high transportation, seasonality, long distance to market and bad road.

Major challenges of cocoyam marketing among farmers in Nigeria include but not limited to the followings. They are: - poor access to land, lack of access to fund to improve production, processing and marketing activities, high cost of labour, lack of extension contact, poor knowledge of extension agent on adapting cocoyam to climate change, high cost of fertilizers, scarcity and poor access fertilizer. Others are high cost of farm inputs, lack of improved cultivars of cocoyam, lack of disease/pest resistant cultivars, high cost of transportation, poor state of feeder roads, shortage of planting materials and even lack of government support. Furthermore, other critical predicaments are - far distance of fertile farm lands from residential homes, poor knowledge of using improved farm production method, low demand for crop, low price of cocoyam in the market, poor of



improved storage facilities, low soil fertility, limited range of varieties, land tenure system problem, shortage of cultivable land for production expansion, lack of mechanized farming, poor recognition of cocoyam as food, old age may affect cocoyam farming activities and non-existence of cooperative societies in some areas for the crop. Finally, as reported by Ifeanyi-Obi, Togun, Lamboll, Adesope, and Arokoyu, (2017), ineffectiveness of existing cooperative societies in some areas, lack of collateral to secure available credit facilities, existence of some traditional beliefs and practices that hinders effective adaption, poor access to information sources, lack of sufficient farming experience to tackle some climate exigencies and poor access to weather forecast information are equally listed as serious problems of cocoyam marketing in Nigeria.

Economic importance of cocoyam in Nigeria

Cocoyam (*Colocasia esculenta* and *Xanthosoma mafafa*) are important carbohydrate staple food particularly in the southern and middle belt areas of Nigeria. Nutritionally cocoyam is superior to cassava and yam in the possession of higher protein, mineral and vitamin contents in addition to having more digestible starch. Cocoyam which ranks third in importance and extent of production after yam and cassava is of major economic value in Nigeria (Udealor, Nwadukwe, Okoronya, 1996). Edible cocoyam cultivated in the country is essentially species of *Colocasia* (cocoyam) and *Xanthosoma* (tannia). The average production figure for Nigeria is 5,068,000mt which accounts for about 37% of total world output of cocoyam (Food and Agricultural Organization (FAO) 2011). Small scale farmers, especially women who operate within the subsistence economy grow most of the cocoyam in Nigeria. It is highly recommended for diabetic patients; the aged, children with allergy and for other persons with intestinal disorders (Plucknet, 1970). According to Ene, 1992, boiled cocoyam corms and cormels are peeled, cut up, dried and stored or milled into flour. The flour can be used for soups, biscuits, bread and puddings for beverages. The peels can also be utilized as feed for ruminants. Despite the importance of cocoyam, more research attention has been given to cassava and yam (Tambe, 1995).

Skott, Best, Rosegrant, Bokanga (2000), observed that research on cocoyam has trailed behind cassava and yam as root crops in Nigeria and other countries. According to Ezedinma, (1987), the totality of published scientific work on cocoyam is insignificant when compared with those of rice, maize, yam and cassava. However, Skott, Best, Rosegrant, Bokanga, (2000), asserted that it was only in the last decade that

policy makers and national agricultural research systems began to show systematic interest in the crop because of concern over biodiversity. There is a declining trend in cocoyam production as well as a shortage of its supply in domestic markets as a result of a number of technical, socio-economic and institutional constraints, which need to be addressed. Cocoyam farmers are generally found on a small scale and its production has been undermined.

Arising from the foregoing, there is need to have a look into the production and marketing of cocoyam, one of the major roots and tuber crops in Nigeria which is fast becoming an extinction crop. This is due to the general belief that most families no longer consume it because it is not readily available for consumption even during its season, as a result of reduction in its production and marketing level. Production of cocoyam has not been given priority attention in many countries probably because of its inability to earn foreign exchange and its unacceptability by the high-income countries for both consumption and other purposes (Onyenweaku and Ezeh, 1987). Most of what is produced is consumed locally (Mbanaso and Enyinnaya, 1989). The production is labour intensive with most operations carried out manually at the traditional level. There is a dearth of information on the economics of cocoyam production in Nigeria.

Production process of cocoyam

Cocoyams are herbaceous perennial plants belonging to the family *Araceae* and are grown primarily for their edible roots, although all parts of the plant are edible. Cocoyams that are cultivated as food crops belong to either the *genus Colocasia* or the *genus Xanthosoma* and are generally comprised of a large spherical corm (swollen underground storage stem), from which a few large leaves emerge. The petioles of the leaves stand erect and can reach lengths in excess of 1 m (3.3 ft). The leaf blades are large and heart-shaped and can reach 50 cm (15.8 in) in length. The corm produces lateral buds which give rise to tubers or cormels and suckers or stolons. Cocoyams commonly reach in excess of 1 m (3.3 ft) in height and although they are perennials, they are often grown as annuals, harvested after one season. *Colocasia* species may also be referred to as cocoyam, old cocoyam, arrowroot, eddoe, macabo or dasheen and originates from Southeast or Central Asia. *Xanthosoma* species may be referred to as *tannia*, *yautia*, new cocoyam or Chinese cocoyam and originates from Central and South America.

Cocoyam is most commonly grown for its starchy edible roots. *Colocasia* is grown for its corm which is consumed after boiling, frying or roasting. The corms can be dried and used to make flour or sliced and fried



to make chips. The leaves of the plant are also edible and are usually consumed as a vegetable after cooking in dishes such as stews. Xanthosoma species produce tubers much like potato and are boiled, baked,

steamed or fried prior to consumption. The corm of some varieties is also consumed. Young leaves are eaten as a vegetable (Anon, 2008).

Table 1: Status of cocoyam by States in Nigeria

State	Total No. of farm families	2010 cocoyam production in ('000 tons)	Proportion (%) of farm families in cocoyam production	Estimated no of cocoyam farm families
Abia	309,199	142.38	35	108220
Adamawa	494,144	-	-	-
Akwa-Ibom	572,002	192.43	35	200201
Anambra	447,454	137.80	35	156609
Bauchi	671,790	8.13	5	33590
Bayelsa	178,537	48.38	25	44634
Benue	657,767	-	-	-
Borno	676,474	-	-	-
Cross River	532,005	141.87	35	186202
Delta	588,842	102.25	25	147211
Ebonyi	384,855	247.80	35	134699
Edo	434,051	146.19	30	130215
Ekiti	208,161	161.69	25	52040
Enugu	443,973	228.98	35	155391
Gombe	315,479	7.38	5	15774
Imo	475,460	142.61	35	166411
Jigawa	605,963	-	-	-
Kaduna	896,761	10.75	5	44838
Kano	1,031,290	0.94	-	-
Katsina	853,187	-	-	-
Kebbi	474,062	2.33	-	-
Kogi	277,482	6.36	5	13874
Kwara	396,239	-	-	-
Lagos	160,848	-	-	-
Nasarawa	247,230	-	-	-
Niger	627,524	-	-	-
Ogun	489,392	124.70	25	122348
Ondo	432,835	605.71	30	129851
Osun	507,479	189.34	25	126870
Oyo	767,146	107.11	25	191787
Plateau	522,864	102.87	25	130716
Rivers	632,648	99.09	25	158162
Sokoto	516,285	-	-	-
Taraba	301,705	-	-	-
Yobe	438,291	-	-	-
Zamfara	451,502	-	-	-
FCT Abuja	155,155	-	-	-
Total	18,176,082	2,957		2,449,640

Source: Status of Cocoyam by States in Nigeria, (2010)

Table 2: Cocoyam and top producers

	1983-1992		1993-2002		2003-2012	
	Mean	%	Mean	%	Mean	%
World	4.88		8.04		10.72	
Africa	2.74	56.26	5.88	73.13	8.25	76.96
China	1.20	24.62	1.40	17.47	1.61	15.04
Cameroon (C)	0.49	10.14	0.88	10.98	1.40	13.02
Ghana (N)	1.01	20.64	1.53	19.04	1.57	14.62
Nigeria	0.52	10.61	2.60	32.36	4.28	39.91
Total of Cameroon, Ghana and Nigeria	2.02	41.39	5.01	62.37	7.24	67.54

Source: Joseph, (2014)

Table 3: Cocoyam production and economic values in West Africa Countries

Country	Area harvested (ha)	Production (tone)	Price (US\$/tonne)	Value (US\$1,000)
Cote d'Ivoire	68,000	93,639	193.9	18,157
Ghana	251,850	1,688,330	338	570,656
Nigeria	728,000	5,387,000	333.3	1,795,487
Togo	13,221	15,500	616.3	9,553
Total	1,061,071	7,184,469	1,481.5	2,393,853

Source: FAO, (2009)

Global cocoyam production outlook from 2000 to 2019

In many parts of the world, roots and tubers such as cassava, sweet potato, yam, and cocoyam are important staple crops. They are commonly cultivated by smallholder farmers and used as food security and income crops especially in Africa and even in Nigeria. According to FAOSTAT (2021), global cocoyam production stood at 9.76 million tonnes in 2000 and reached 10.54 million tonnes in 2019 (table 4) with Nigeria, Cameroon, China (mainland) and Ghana ranked 1st, 2nd, 3rd and 4th respectively as shown in table 5 below.

Table 4. World cocoyam production from 2000–2019

Year	Production (Tons)	Area Harvested (Ha)	Yield (Tons/Ha)
2000	9,763,562	1,400,008	6.97
2001	9,947,668	1,434,219	6.94
2002	10,525,900	1,508,598	6.98
2003	10,799,794	1,514,534	7.13
2004	10,981,473	1,521,614	7.22
2005	11,509,450	1,546,206	7.44
2006	11,905,642	1,604,675	7.42
2007	11,619,775	1,615,377	7.19
2008	12,13,3765	1,562,163	7.77
2009	9,611,224	1,319,917	7.28
2010	9,441,809	1,351,094	6.99
2011	9,535,315	1,252,564	7.61
2012	9,852,145	1,428,827	6.90
2013	9,627,651	1,414,931	6.80
2014	10,274,254	1,519,899	6.76
2015	10,282,311	1,725,630	5.96
2016	10,378,696	1,780,637	5.83
2017	10,524,371	1,831,379	5.75
2018	10,460,010	1,881,127	5.56
2019	10,541,914	1,957,358	5.39

Source: Authors' Compilation using data from FAOSTAT (2021).

Table 5. Top ten (10) countries producers of cocoyam in 2019

Global Rank	Country	Total Production (Tons)	Percent of Global Production
1	Nigeria	2,860,909	27.14
2	Cameroon	1,909,738	18.12
3	China (mainland)	1,908,830	18.11
4	Ghana	1,518,436	14.40
5	Papua New Guinea	271,981	2.58
6	Madagascar	226,438	2.15
7	Burundi	217,510	2.06
8	Rwanda	171,803	1.63
9	Lao People's DR	154,644	1.47
10	Central African Republic	140,957	1.34
	Rest of the world	1,160,668	11.00
	World	10,541,914	100.00

Source: Authors' Compilation using data from FAOSTAT (2021).

According to FAOSTAT (2021), there are 47 major cocoyam producing countries in 2019. These countries are from Africa, America, Asia and Oceania regions. In Africa, Nigeria is the highest producer of cocoyam (cocoyam) globally with about 2.86 million tonnes and 27.14% share of world total production in 2019 while Maldives had the least production level of 8 tonnes as reported by FAOSTAT (2021). Nigeria, Nicaragua, China (mainland) and Papua New Guinea had the highest production level in Africa, Americas, and Asian and Oceanian regions respectively in 2019 FAOSTAT (2021). Globally, cocoyam production in terms of total area harvested has increased substantially in the last two decades, moving from 1.40 million tonnes in 2000 to 1.96 million tonnes in 2019. Asian region had its highest average yield of cocoyam in 2019 from Palestine (37.00 tons/ha) while the average yield of 9.60 tons/ha from Madagascar was Africa's highest according to FAOSTAT (2021). From the Americas, the highest average yield was from St. Lucia (25.00 tons/ha) while the highest yield of Oceania was 17.57 tons/ha from Kiribati.

Furthermore, as reported by Onyeka (2004), FAO's projection that 70% growth in global agricultural production is required to feed the growing population of an additional 2.3 billion people by 2050 can only be achieved by increasing yields and crop production levels on available farmlands, rather than by

increasing lands used for agricultural production. This is not the case in the African region. The increased production level noticed in the African region depended largely on increased farmland for cocoyam cultivation rather than increased crop yield per hectare.

7.0 Global cocoyam imports and exports outlook

On the cocoyam global market, China is the leading exporter of cocoyam followed by Mexico, USA and Canada, even though cocoyam production levels in these countries are not as high as those of the top five producers in African countries namely; Nigeria, Cameroon, Ghana, Madagascar and Burundi respectively. Meanwhile, China had the highest cocoyam export value in 2018 with \$417.18 million (17.0% world share in US dollars) and about 177 thousand metric tonnes, followed by Mexico \$264 million (10.8% global share in US dollars) with a total of 112.96 thousand metric tonnes (quantity exported) while USA had \$161 million cocoyam export value (6.6% global share in US dollars) and 50.97 thousand metric tonnes quantity exported in 2018 as reported by (Tridge, 2020).. The implication of the above information might be that the cocoyam production in these named African countries cannot be exported across the globe due to low value addition to the produce/product.

Table 6. Top twenty (20) countries exporters of cocoyam in 2018

Rank	Country	Export value (USD)	Exporting share (%)	Exporting quantity (Metric tons)
1	China	\$417.18 M	17.0	177.43 K
2	Mexico	\$264.49 M	10.8	112.96 K
3	USA	\$161.01 M	6.6	50.97 K
4	Canada	\$141.96 M	5.8	-
5	Philippines	\$117.97 M	4.8	61.39 K
6	Thailand	\$112.66 M	4.6	59.75 K
7	Peru	\$71.18 M	2.9	46.08K
8	India	\$67.94 M	2.8	64.21 K
9	Costa Rica	\$67.78 M	2.8	73.97 K
10	France	\$63.93 M	2.6	23.87 K
11	Germany	\$63.05 M	2.6	22.77 K
12	Netherlands	\$53.41 M	2.5	21.50 K
13	Chile	\$52.63 M	2.2	21.62 K
14	South Africa	\$52.81 M	2.2	20.10 K
15	Italy	\$46.15 M	1.9	23.42 K
16	South Korea	\$42.38 M	1.7	6.07 K
17	Ireland	\$41.58 M	1.7	64.10 K
18	Indonesia	\$39.55 M	1.6	20.10 K
19	Guatemala	\$38.82 M	1.6	48.99 K
20	Belgium	\$32.53 M	1.3	12.34 K
World (total)		\$2.46 B		

Source: Author's compilation from Tridge, 2020, Note: M = Million, K = Thousand

Surprisingly, no African countries made the top 20 exporters of cocoyam in 2018 despite being the world leading producers of cocoyam for decades. China and Thailand have consistently maintained their exporting and importing capability on the global crop market just like in cassava global market where Thailand was ranked 1st in export with a total export value of \$1.19 billion and China ranked 1st in cassava import globally with a total import value of \$1.37 billion in 2017 Otekunrin and Sawicka (2019).

However, China's total cocoyam export value increased steadily from \$338.29 million in 2009 to \$417.18 million in 2018 as reported by (Tridge, 2020). Information on the international trade of cocoyam from Africa seem to be very scarce. This may partly be due to the fact that these leading African producers like Nigeria, Cameroon, and Ghana do not have good documentation of trade in cocoyam and also indicative of the fact that cocoyam production in Africa (especially Sub-Saharan Africa) is mainly

hinged on meeting the food security needs at national levels as viewed by Onyeka, (2021).

The global cocoyam import value stood at \$2.46 billion in 2018. United States of America (USA) imported a total value of \$768.68 million in 2018 while Japan, United Kingdom, Netherlands and France are among the top ten (10) leading cocoyam importing countries as recorded by Onyeka (2021). Table 7 revealed the top twenty (20) cocoyam importing countries and their import shares and quantities (metric tons). USA had the highest import value of cocoyam in 2018 with about \$768.68 million (31.3% world share in US dollars) and about 393.68 thousand metric tonnes of importing quantities, followed by Japan with \$227 million (9.3% global share in US dollars) with a total of 93.21 thousand metric tonnes (quantity imported) while United Kingdom had \$157 million cocoyam import value (6.4% global share in US dollars) and 75.85 thousand metric tonnes quantity exported in 2018..

Table 7. Top twenty (20) countries importers of cocoyam in 2018

Rank	Country	Import value (USD)	Importing share (%)	Importing quantity (Metric tons)
1	USA	\$768.68 M	31.3	393.68 K
2	Japan	\$227.10 M	9.3	93.21 K
3	United Kingdom	\$157.17 M	6.4	75.85 K
4	Netherlands	\$131.61 M	5.4	74.36 K
5	France	\$131.61 M	5.2	-
6	China	\$63.29 M	2.6	52.50 K
7	Germany	\$61.77 M	2.5	26.27 K
8	Australia	\$59.11 M	2.4	-
9	South Korea	\$54.23 M	2.2	32.43 K
10	Russia	\$49.32 M	2.0	28.03 K
11	Italy	\$47.02 M	1.9	23.54 K
12	Poland	\$45.93 M	1.9	47.23 K
13	Canada	\$43.94 M	1.8	-
14	Belgium	\$29.61 M	1.2	17.34 K
15	Spain	\$28.79 M	1.2	-
16	Israel	\$28.79 M	0.9	12.15 K
17	Mexico	\$22.74 M	0.9	12.61 K
18	Denmark	\$22.64 M	0.9	12.25 K
19	New Zealand	\$22.55 M	0.9	-
20	Sweden	\$21.9 M	0.9	8.78 K
World		\$2.46 B		

Source: Authors' compilation from Tridge (2020), Note: M = Million, K = Thousand.

Cocoyam viewpoints in African economy

In many parts of the world, (especially, African countries), roots and tubers such as cassava (*Manihot esculenta*), sweet potato (*Ipoemea batatas*), yam (*Dioscorea* sp), and cocoyam (*Colocasia esculenta* and *Xanthosoma sagittifolium*), are important staple crops commonly cultivated by smallholder farmers and used as food security and income crops.

Cocoyam production in Africa (especially SSA) is commonly by smallholder, resource-limited and mostly female farmers according to Onyeka (2021). However, the crop is mostly referred to as “poor man’s crop” because its consumption is mainly by the low income households in the society as reported by Onyeka (2021). As mentioned above, Africa contributed to over 70% of global cocoyam production consistently in the past two decades and accounted for about 76 percent of world share in 2000 but, witnessed a slight decline in production levels in two decades attaining 72.27% (7.6 million tonnes) share of world total production in 2019. Despite the global recognition of cocoyam production in Africa, the crop has suffered serious neglect, receiving little attention from agricultural researchers and government policymakers Onyeka (2021).

The world is faced with enormous task of providing sufficient food for over seven billion people, with 690

million people suffering from hunger globally, Africa region accounted for 73 million out of the 135 million people suffering from acute food insecurity in 2019 according to FAO et.al (2020). Hunger and malnutrition continue to escalate as the world’s food system is being threatened by the emergence of COVID-19 pandemic in December 2019.

The attendant total and partial lockdowns in many countries has led to increased level of hunger and food insecurity. The situation in Africa is the one referred to as “a crisis within a crisis” with very high prevalence of hunger and malnutrition in most Africa countries. African governments need to intensify efforts in boosting agricultural production and keeping the food value chain active in order to stem the tide of hunger and food insecurity in the continent as reported by Otegunrin (2020).

However, one of the means of reducing the level of hunger and protein-energy malnutrition in Africa (especially SSA) is through increased production and consumption of indigenous staples of high energy content such as cocoyam according to Agbelemoge (2013). Cocoyam is recognized as a cheaper yam substitute, notably during period of food scarcity (hunger season) among many households in SSA (especially Ghana and Nigeria) and its production



remained an integral part of many smallholder farming households in many parts of West and Central African countries. It is worthy of note that, most of the output that placed Nigeria as number one cocoyam producer globally and other high producing African countries like Cameroon, Ghana, Madagascar and Burundi are carried out by smallholder rural farmers employing primitive technology and traditional farming practices with limited intensive management system, Onyeka (2021). Cocoyam leaves and tubers possess excellent nutraceutical and healing properties. Thus, its increased production and consumption should be encouraged because of these properties in addition to its usefulness as a food security staple.

Recent cocoyam productivity and yield potential in Africa

Total output of cocoyam has witnessed significant increase in Africa, (mostly in West and Central Africa) where total production level in 2019 reached 7.62 million tonnes (the highest in 2 decades). However, these were largely due to increased harvested area rather than increase in yield per land area according to FAOSTAT, (2021). The average yield per land area (tons/ha) in Africa has consistently remained relatively low, from 6.10 tons/ha in 2000 to abysmally low 4.34 tons/ha in 2019 while Nigeria the leading cocoyam producer was not spared in the declining trend of cocoyam yield per land area in Africa, decreasing from 6.62 tons/ha in 2000 to 2.88 tons/ha in 2019 as recorded by FAOSTAT (2021).

Consequently, while other cocoyam producing regions experienced significant increase in their yield per land area from 2000 to 2019, Africa recorded a monumental decrease in cocoyam yield per land area in this period as recorded by FAOSTAT (2021). African region recorded the lowest cocoyam yield per land area in 2019 as reported by FAOSTAT (2021) when compared with other regions such as Asia (16.50 tons/ha), America (10.41 tons/ha), and Oceania (8.73 tons/ha). This unprecedented yield difference in Africa is indicative of the fact that current yield of cocoyam (cocoyam) in the region (especially West and Central Africa) is far below its potential yield. This could be attributed to the fact that cocoyam production in Africa is largely with limited input and mostly cultivated on marginal lands. The culture of merely increasing production level through increased area of farmland is obviously unsustainable, because it resulted in high demand for available land.

Increased cocoyam production is a worthwhile venture. There are industrial, nutraceutical and healing uses for the crop both within and outside any of the producing countries. Exporting cocoyam to

other countries will boost the revenue base of the producing countries; livelihoods of the smallholder farmers and other actors along the value chain would also be enhanced.

Cocoyam trade potentials in Africa

The unprecedented increase in total output of cocoyam in Africa (especially, West and Central Africa) in the last two decades indicated that there could be further increase in another decade to come. The estimate from Tridge (2020) shows that in 2018 indicated that China (with export value of \$417.18 million) remained the number one exporter of cocoyam, followed by Mexico (\$264.49 million), USA (\$161.01 million) and Canada (\$141.96 million).

However, no top cocoyam producing countries from sub-Saharan Africa, which accounted for over 70% of global share of cocoyam production in two decades (2000–2019), was listed among the top 20 cocoyam exporting countries. This may be due to the difficulty in obtaining consistent and reliable data on cocoyam import and export for most African countries.

Although 65% of the global cocoyam production is accounted for by Africa in 2019 as recorded by FAOSTAT (2021), there is insufficient information on the contribution of cocoyam from these top producing countries to the international cocoyam market. Apart from poor data on trade in cocoyam in Africa, it could also be due to the fact that cocoyam production in SSA is mainly for meeting local needs for food security as reported by Onyeka (2021).

In 2018, the three major importers of cocoyam are USA (\$768.68 million), Japan (\$227.10 million) and United Kingdom (\$157.17 million) as stated by FAOSTAT (2021). Like cocoyam exports, no top producing African countries was listed among the top 20 importers of cocoyam in 2018. There is enormous trade potentials for cocoyam markets in Africa both within (between countries in Africa) and outside the region. There is urgent need to improve cocoyam production and marketing structures in Africa in order to maximize of its gains for economic empowerment according to Nzeh, et. al (2014).

Challenges of cocoyam in Africa

The non-existent of effective research and policy interventions for the increased production and marketing (international trade) of cocoyam in most African countries (especially SSA) has left the crop as an unpopular and under-utilized root and tuber crop when compared with other root and tuber crops such as cassava, yam and potato. The consistent increase in



production levels (although with increasing reduction in yield per land area — of cocoyam in most high producing Africa countries (Nigeria, Cameroon and Ghana) has not attracted the international market for more than three decades as reported by Onyeka (2021) and Nzeh et. al (2014). Cocoyam production in most major African growing areas has remained at subsistence level with farmers depending mainly on traditional farming inputs.

To further worsen the challenges of cocoyam production, consumption and commercialization in Africa, is the emergence of cocoyam leaf blight (CLB) (*Phytophthora colocasiae*) in West Africa in 2009. The outbreak of CLB was opined to have accounted for more than US\$1.4 billion economic loss annually with enormous impact on the genetic erosion of gene pool in the region as recorded by FAOSTAT (2021) and Onyeka (2021). Cocoyam production is facing continuous decline due to rapid prevalence of CLB. This has resulted in continuous low yield, poor quality corms and reduced commercialization in most cocoyam producing countries including Nigeria and even in Enugu State as found out by Nzeh, et. al (2014).

Conclusion and Policy Recommendations

In conclusion, the scarcity and high cost of cocoyam is not only affecting the ability of rural poor across the country, who often depend on cocoyam to feed adequately, but it is also affecting how they live by imposing on them the need to change their feeding culture. Also, diseases are of significant predicaments in developing countries like Nigeria and even Cameroon and Ghana.

Based on these issues and challenges in cocoyam concepts in the country, it is hereby recommended among others that there is need for - development of a comprehensive cocoyam/cocoyam leaf production and marketing strategy in Nigeria and dissemination of existing improved cocoyam/cocoyam leaf varieties through effective extension activities is recommended. Further research on varietal improvement should focus on superior qualities of cocoyam such as early maturing, high yielding, and resistance to disease/pest. Irrigation facilities should also be provided for intensive crop management practices and commercial cocoyam production in the dry season when demand is extremely high. Further research into semi-processing and preservation techniques is needed to enhance commercial production and marketing of cocoyam leaf in the dry season.

The cocoyam production and marketing has been in continuing crisis due to fluctuating world oil market

and currently herdsman issues, thereby, government should try in diversifying the economy by supporting those rural farmers of cocoyam for increase in production and marketing which will help in boosting the gross domestic product of the country.

It is also suggested that farmers should put more effort in cultivation of cocoyam not just for family and locally consumption but for commercialization within and beyond the country. This is because poor effort for cultivation will lead to poor job creation.

There is need for rural road construction for easy transportation of the produced cocoyam to the right destination which if not conveyed on time may lead to damages and decline in income generation.

Furthermore, implications of cocoyam for increased production and international trade need not to be overemphasized. Therefore, increased production of cocoyam has huge implications on African and Nigerian economies and livelihoods. These include substantial foreign earnings from international trade, major addition to available foods commonly used in addressing food insecurity problems in Africa, industrial use as well as nutritional/medicinal values. Therefore, strategies have to be put in place to enhance its production and utilization on the African continent. These strategies as highlighted can include but not limited to:-

- Sensitization on the nutritional/medicinal values and food forms diversities of cocoyam.
- Improving the genetic base of cocoyam in Africa through germplasm exchange
- Cocoyam production should not be targeted only for local consumption (as food security crop) but towards attracting the international (export) market.
- Development of appropriate control measures to eliminate field and storage losses due to TLB and other diseases.
- Fabrication of sustainable storage facilities to extend the shelf-life of cocoyam after harvesting.
- Establishment of regional network to foster effective collaboration and development of robust strategic approach to cocoyam disease management.
- Provision of research funds for agriculture-based institutes and institutions to enable them carry out result oriented researches that will improve the livelihood of both rural and urban households.

References

- Abdulrahman, S., Yusuf, O. and Sulemiman, A.D. (2015), Profit efficiency of cocoyam production in Kaduna state, Nigeria. *American Journal of Experimental Agriculture*, 7(4): 231-241
- Adepoju, A.A. & Awodunmuyila, D.J. (2008), Economics of cocoyam production and marketing in Ekiti east local government area, Ekiti state, Nigeria. *Research Journal of Applied Sciences*, 3(2); 95-98
- Alegbejo, J.O., Ameh, D.A., Ogala, W.N. and Ibrahim, S. (2008), Glycaemic index of boiled cocoyam and stew. *Sahel Medical Journal*, 11(3); 12975.
- Agbelemoge, A. (2013). Utilization of cocoyam in rural households in South Western Nigeria. *Afr. J. Food Agric. Nutr. Dev.* 2013, 13, 7944–7956.
- Amadeo, K. (2020), *GDP definition: how the gross domestic product affects you*. Retrieved from <https://www.thebalance.com/what-is-gdp-definition-of-gross-domestic-product-3306038>
- Anderson, S.G. (2020), *Labour force and its impact on the economy*. Retrieved from <https://www.thebalance.com/labor-force-definition-how-it-affects-the-economy-4045035>
- Anon. (2008), *Growing Cocoyam in Nigeria. International Institute for Tropical Agriculture. Commercial Crop Production Series*. Available at: http://www.cassavabiz.org/agroenterprise/ent%20images/cocoyam_02.pdf.
- Arene, O.B. & Ene, L.S.O. (1987). *Advances in cocoyam research at the National Root Crops Research Institute Umudike (1972-1986)*. Proceeding of the 1st National Workshop on cocoyam, 16-21, Umudike, Nigeria, 58-71
- Boakye-Achampong, S., Ohene-Yankyera, K., Aidoo, R. and Sorensen, O.J. (2017), Is there any economics in smallholder cocoyam production? Evidence from the forest agro-ecological zone of Ghana. *Agriculture & Food Security*, 6(44); 3425
- Bondarenko, P. (2021), *Gross domestic product*. Retrieved from <https://www.britannica.com/topic/gross-domestic-product>
- Boyle, M.J. (2020), *Four real world ways to create more job*. Retrieved from <https://www.thebalance.com/job-creation-ideas-4-ways-that-work-best-3305521>
- Britannica, (2021). *Economy of Nigeria*. Retrieved from <https://www.britannica.com/place/Nigeria/Economy>
- Durroux-Malpartida, V. (2014), *Cocoyam's potential for nutrition and income still to be tapped*. Retrieved from <https://www.rtb.cgiar.org/news/cocoyams-potential-for-nutrition-and-income-still-untapped/>
- Ekanem, A.M. and Osuji, J.O. 2006. Mitotic index studies on edible cocoyam's (Xanthosoma and Colocasia spp). *Africa Journal of Biotechnol.* 5, 846– 849.
- Ekong, E. E. (2005). *Introduction to Rural Sociology. An Introduction and Analysis of Rural Nigeria*, Ugo, Nigeria, Dove Educational Publishers, revised edition. 345pp
- Elenwoke, N. (2018), *Nutritional and health benefits of cocoyam you never knew*. Retrieved from <https://docotal.com/health-benefits-cocoyam-never-knew/>
- Ene, C.I. (1992). A comparative study of fadama and non-fadama crop farmers in Osisioma-Ngwa, L.G.A, Abia State, Nigeria. *Journal of Sustainable Tropical Agriculture Research*, 11
- Enible, D.O., Nwobodo, E.C., Nworji, M.J. and Okonkwo, C.A. (2019), Economic analysis cocoyam marketing in Anambra agricultural zone of Anambra state, Nigeria. *Asian Journal of Agricultural Extension, Economics & Sociology*, 29(3); 1-10
- Eze, C.C. and Okorji, E.C. (2003). Cocoyam production by women farmers under improved and local technologies in Imo State, Nigeria. *Afr. J. Sci.* 5, 113– 116.
- Ezedinma, F.O. (1987), *Prospects of cocoyam in the food system and economy of Nigeria*. In: Arene, Ene L.S.O, Odurukwe, S.O, Ezech No. A (eds.). Proceedings of the 1st National Workshop on cocoyam. 28-32



- Fadipe, A.E.A., Adenuga, A.H. and Raji, U.A. (2015), Analysis of cocoyam marketing in Sagamu local government area, Ogun state, Nigeria. *Trakia Journal of Sciences*, 3, 208-213
- Fadipe, A.E.A., Adenuga, A.H. and Raji, U.A. (2015), Analysis of cocoyam marketing in Sagamu local government area, Ogun State, Nigeria. *Trakia Journal of Sciences*, 3; 208-213
- Fernando, J. (2021), *Gross domestic product (GDP)*. Retrieved from <https://www.investopedia.com/terms/g/gdp.asp>
- Food Agricultural Organization (FAO) (2012). *Root and tuber crops in developing countries*, challenges and opportunities, 11-13.
- Food and Agricultural Organization (FAO) (2011), *Datebase result*. Retrieved from <http://www.fao.org/docrep/014/i2215e/i2215e.pdf>
- FAOSTAT (2021). Food and Agriculture Organisation of the United Nations Statistical Database; Statistical Division; FAO: Rome, Italy, 2021; Available online: <http://www.fao.org/statistics/en/> (accessed on 5 June 2021).
- FAO; IFAD; UNICEF; WFP; WHO (2020). The State of Food Security and Nutrition in the World 2020. In *Transforming Food Systems for Affordable Healthy Diets*; FAO: Rome, Italy, 2020.
- Friedman, M. 2006. Potato glycoalkaloids and metabolites: Roles in the plant and in the diet. *Journal of Agriculture and Food Chem.* 54, 8655– 8681.
- Idoge D.E. (2013). Regionalizing loan repayment capacity of small holder cooperative farmers in Nigeria: exploring South-South Nigeria. *Journal of Biology, Agriculture and Healthcare*, 3(7), 176-183.
- Ifeanyi-Obi, C.C., Togun, A.O., Lamboll, R., Adesope, O.M. and Arokoyu, S.B. (2017), *Challenges faced by cocoyam farmers in adapting to climate change in South-East, Nigeria*. Retrieved from file:///C:/Users/DELL/AppData/Local/Temp/Challenges_faced_by_cocoyam_farmers_in_adapting_to.pdf
- Igbozulike, A.O. (2015), Evaluation of cocoyam corms processing and storage in Nigeria. *International Journal of Scientific and Engineering Research*, 6(7); 259-263
- James, E.O., Peter, I.A., Charles, N.I. and Joel, N. (2013), Chemical composition and effect of processing and flour particle size on physicochemical and organoleptic properties of cocoyam (*Colocasia esculenta* var. *esculenta*) flour. *Nigeria Food Journal*, 31(2); 113-122
- Jasonret, T.C. (2021). *The nutritional and health benefits of cocoyam*. Retrieved from <https://pharmanewsonline.com/8216-2/>
- Jervis, R. (2021), Is cocoyam better than yam? Retrieved from <https://everythingwhat.com/is-cocoyam-better-than-yam>
- Joseph, O. (2014), *Status of cocoyam (Colocasia esculenta and xanthosoma spp) in West and Central Africa: production, household importance and the threat from leaf blight*. Retrieved from <https://cgspace.cgiar.org/bitstream/handle/10568/83409/RTB-Status-of-Cocoyam-in-West-and-Central-Africa>.
- Lim, T. K. (2015) *Edible Medicinal and Non-Medicinal Plants*, in Modified Stems, Roots, Bulbs, 9, 443–453, Springer, New York.
- Mbanaso, E.N.A, and Enyinnaya, A.M. (1989), *Cocoyam germplasm conservation*. NRCRI Annual Report, 60
- Miyasaka, S., Ogoshi, R.M., Tsuji, G.Y. and Kodani, L.S. (2003). Site and planting date effects on cocoyam growth: Comparison with aroid model predictions. *Agron. Journal*, 95, 545–557.
- Morris, S.C. and Lee, T.H. 1984. *The toxicity and teratogenicity of Solanaceae glycoalkaloids, particularly those of the potato (Solanum tuberosum): A review*. *Food Technol. Aust.* 36, 118– 124.
- National Development Agency, (2013), *Income generation: income generating activities for the poor in South Africa: the role of civil society organizations*. Retrieved from <https://www.nda.org.za/publication/income-generation>



- National Root Crop Research Institute (2012). *Cocoyam Programme*. National Root Crops Research Institute, Umudike. National Report, 322-323
- Nenna, M., Ugwumba, C., Obiekwe, J. and Akubuilu, C. (2017), Strategies for improving cocoyam production among farmers in Anambra state, Nigeria. *Discourse Journal of Agriculture and Food Sciences*, 5(5); 60-65
- Nnoke, F.N., Arene, O.B. and Ohiri, A.C. (1987). *Effect of N.P.K. fertilizer on cocoyam declining disease control and yield in Xanthosoma sagittifolium*. Proceedings of the 1st National Workshop on Cocoyam, August 16-21, 1987, Umudike, Nigeria, 222-226.
- Noonan, S.C. and Savage, G.P. 1999. Oxalic acid and its effects on humans. *Asia Pac. Journal of Clin. Nutr.* 8, 64– 74.
- Nwafor, C.U. (2018), *The market channel preference among smallholder cocoyam farmers in South Africa: a food security perspective*.
- Nzeh, E. C., Akogwu, C. I., Ugwu, J. N., and Nzeh, Chika-E. (2014). Cost-return analysis of cocoyam marketing in Nsukka agricultural zone of Enugu State, Nigeria. *Sky Journal of Agricultural Research* Vol. 3(11), pp. 215-222, December, 2014. Available online <http://www.skyjournals.org/SJAR>, ISSN 2315-8751 ©2014 Sky Journals.
- Okeke, G.C. (1982). *Studies on the etiology and symptomatology of root and storage rot disease of cocoyam in Nigeria*. *Beitr Trop Landwirtsch Veterinarmed*, 203: 287-293.
- Okoye, B. C., Asumugha, G. N. Okezie, C. A., Tanko, L. and Onyenweaku, C. E., (2008) Econometric Assessment of the Trend in Cocoyam Production in Nigeria, 1960/1961 –2003/2006. *Agricultural Journal* 3(2): 99-101,
- Olsson, K. 1996. *Occurrence of glycoalkaloids in potato tubers*. *Veroeff. Arbeitsgem. KartotTelforsch.* 18, 45– 53.
- Omotesho, K.F., Kayode, A.O., Adebayo, S.A., Akinrinde, A.F. and Mohammed, A.J. (2020), Potentials for the commercialization of cocoyam in Oyun local government area, Kwara state, Nigeria. *Journal of Tropical Agriculture, Food, Environment and Extension*, 19(3); 8-14
- Onayemi, O. and Nwigwe, N.C. 1987. *Effect of processing on the oxalate content of cocoyam*. *Food Technol.* 20, 293– 295.
- Onyeka, T.J., Nwosu, K.I., Asiedu, R. and Chukwu, G.O. (2008). *Cocoyam root rot disease in Nigeria: what we know and what we need to now*. Paper presented at the 1st International Workshop on Cocoyam, IRAD, Ekonna, Cameroon, 29-31
- Onyeka, (2014), *Cocoyam's potential for nutrition and income still to be tapped*. Véronique Durroux-Malpartida. Retrieved from <https://www.rtb.cgiar.org/news/cocoyams-potential-for-nutrition-and-income-still-untapped/>
- Onyeka, J. Status of Cocoyam (*Colocasia esculenta* and *Xanthosoma* spp) in West and Central Africa: Production, Household Importance and the Threat from Leaf Blight; CGIAR Research Program on Roots, Tubers and Bananas (RTB): Lima, Peru, 2014; Available online: www.rtb.cgiar.org (accessed on 5 February 2021).
- Onyenweaku, C.E., & Ezeh, N.O.A. (1987), *Trends in production, area and productivity of cocoyam in Nigeria 1960/61 - 1981/84: In cocoyam in Nigeria, production, processing and utilization*, NRCRI Umudike, 94-100
- Opata, P.I & Adeosun, K.P. (2016), Performance of cocoyam market chain in South East, Nigeria. *European Journal of Business Management*, 8(3); 2222-1905
- Opata, P.I. (2018), Determinants of the choice of marketing channel among cocoyam farmers in South East, Nigeria. *The Journal of Animal & Plant Sciences*, 28(4); 1142-1151
- Otekinrin, O.A. and Sawicka, B. (2019). Cassava, a 21st Century Staple Crop: How can Nigeria Harness Its Enormous Trade Potentials. *Acta Sci. Agric.* 2019, 3, 194–202.
- Otekinrin, O.A. (2020). COVID-19 and Hunger in Africa: A crisis within a crisis. In Proceedings of the 6th International Conference on Food Science and Technology, Vienna, Austria, 16–17 October 2020; pp. 27–28.
- Parkinson, S. (1984), *The contribution of aroids in the nutrition of people in the South Pacific*. in: Chandra, S (ed.). *Edible Aroids*. Clarendon Press, Oxford, U.K.



- Pharmanews, (2016), *The nutritional and health benefits of cocoyam*. Retrieved from <https://pharmanewsonline.com/8216-2/>
- Phatheka, P.C. (2019), *Assessing the impact of the income generating projects funded by the department of social development in Uitenhage, Eastern Cape*. Retrieved from <https://core.ac.uk/download/pdf/227505158.pdf>
- Plucknet, D.C. (1970), *The status and future of major aroids (colocasia, Xanthosoma, Alocasia, Crystoperma and Amorpholophallus)*. In *Tropical root crops tomorrow*. Proceedings of International Symposium on Tropical Root Crops. Hawaii, 1; 127-135
- Rogers, E.M. (1995). *Diffusion of innovation*, 4th Edition, the free Press, New York.
- Skott, G.J., Best, R., Rosegrant, M. Bokanga, M. (2000), *Root and tubers in some tropical root of the Amercian society for horticultural sciences south pacific*. 17:290-294. In Chandra, S. (ed.). *Edible Aroids*. Clarendon Press, Oxford, U.K, 215-224
- Talwana, H.A.L., Serem, A.K, Ndabikunze, B.K., Nandi, J.O., Tumhimbise, R. Kaweesi, T., Chumo, E.C. and Palapala, V. (2009), *Production status and prospects of cocoyam in East Africa*. *Journal of Root Crops*, 35(1); 98-107
- Talwana, H.A.L., Serem, A.K., Ndabikunze, B.K., Nandi, J.O.M., Tumuhimbise, R., Kaweesi, T., Chumo, E.C. and Palapala, V. (2009). *Production Status and Prospects of Cocoyam (Colocasia esculenta (L.) Schott.) in East Africa*. *Journal of Root Crops*, 35(1): 98-107.
- Tambe, R.E. (1995), *The economics of cocoyam production by small holder farmers in Many Division, South West province of Cameroun*, M.Sc. Project Report Department of Agricultural Economics, University of Nigeria, Nsukka.
- Tridge, T.A. (2020). *Cocoyam in African countries: Recent status*. Available online: <https://www.tridge.com/inteligences/taro/> (accessed on 20 May 2021).
- Ubalua, A.O. (2020), *Cocoyam has huge market but few farmers cultivate it*. Retrieved from <https://www.rtb.cgiar.org/news/cocoyam-has-huge-market-but-few-farmers-cultivate-it/>
- Udealor, A., Nwadukwe, P.O. Okoronya, J.A. (1996), *Management of crop Xanthosoma, Alocasia, Crystosperma and Amorpholosphallus*. In *Tropical Root Crops*.
- Van Den Heever, E. 1995. *The use and conservation of indigenous leafy vegetables in South Africa*. Paper presented at the workshop “Genetic Resources of Traditional Vegetables in Africa. Options for Conservation and Use”, 29–31 August 1995, Nairobi, Kenya.
- Wills, R.B.H., Lim, J.S.K., Greenfield, H. and Bayliss-Smith, T. 1983. *Nutrient composition of cocoyam (Colocasia esculenta) cultivars from the Papua Guinea Highlands*. *Journal of Science and Food Agriculture*, 34, 1137– 1142.