

Identifying the Potentials of Turmeric for Food Security in Nigeria

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This paper is aimed at identifying the potentials of turmeric for food security in Nigeria. The paper examined the production, processing, marketing, potentials and increasing popularization of the crop for food security in Nigeria. It relied on information from secondary sources such as documented relevant review literature on turmeric, NRCRI Annual Reports and field experience of Researchers. The main goal of food security is for individuals to be able to obtain adequate food and food accessories needed at all times, and to be able to utilize the food to meet the body's needs. Food security is multifaceted. The three pillars underpinning food security are food availability, food accessibility, and food utilization. Agriculture remains a major driver of food production and security in Nigeria and Turmeric is one of the minor root and tuber crops produced in National Root Crops Research Institute, Umudike and the institute has the capacity for repositioning the crop for achievement of agricultural transformation in Nigeria and

globally. If exploited, Nigeria is capable of leading the world turmeric market and to further provide platform for wooing the private investors into the crop production, processing and marketing. This is because it has diverse economic and health importance and highly valued at the international market. Turmeric is used as a food spice and a major component of curry powder, as medicine for the prevention and treatment of diverse kinds of diseases, as cosmetics and as dye for colouring fabrics but this potential has not been fully tapped as the techniques needed for its production have not been properly understood by the farmers which have led to low production and utilization. This paper therefore X-rayed the potentials of turmeric for food security in Nigeria.

Keywords: Turmeric, potential, food security

INTRODUCTION

Turmeric (*curcuma longa* Linn) is an important spice both locally and globally. Its main active ingredients oleoresin and turmeric oil are used for a wide range of culinary, confectionary, and pharmaceutical purposes (Amadi *et al.*, 2017). It is traded globally in various forms such as fresh, preserved, dried, and powdered turmeric. Turmeric also enters the global market as processed products like turmeric oil, turmeric oleoresin, turmeric candy, turmeric soft drinks, turmeric shreds, turmeric prickles, ginger chutney etc (Nwaekpe *et al.*, 2015). Nigeria can play a leading role in turmeric production considering the prevailing favourable soil and climatic conditions in the country. Turmeric like ginger is now one of the main cash crop supporting the livelihood and improving the health and economic level of many turmeric growers and users in the main producing areas.

Turmeric is a tropical perennial monocotyledonous herb belonging to the family *Zingiberaceae* and consists of many species (Jilani *et al.*, 2012; Olajide *et al.*, 2012). It is valued for its underground rhizome which contains a yellow coloured phenolic pigment called curcumin which is used as natural colouring agent for food, cosmetics, dye and as an active ingredient in some medicine (Amadi *et al.*, 2015; Singletary, 2010; Karim *et al.*, 2010). Olojede and Nwokocha, (2011) reported that in Nigeria, turmeric can be found growing from low altitude (5m above sea level (asl)) in the Southern coastal plains of the rainforest to the mid-altitude (823m asl) in the Derived Savanna within Longitude 3°02'E - 09°30'E and latitude 4°37'N – 10°04'N. The Derived Savanna covers about 10% of Nigeria's land area and extends southwards from the southern guinea zone into the forest zone. In spite of

increasing demand for derived products of turmeric in Nigeria which makes its large scale production attractive, it is still cultivated mainly in small plots around homes (Olojede and Nwokocha, 2011) and to the wild (Olife *et al.*, 2013).

Turmeric is a shallow-rooted crop and an herbaceous plant with thick and fleshy rhizomes (Nwaekpe *et al.*, 2015). Its origin has been traced to south and southern Asia and it has been used in India for at least 2,500 years. *Curcuma Longa* Linn is the highest yielding turmeric of commercial value. In Nigeria, turmeric is cultivated mostly on subsistent bases in about 19 states and given different local names depending on the area. It is called atale pupa in Yoruba; gangamau in Hausa, nwandumo in Ebonyi; ohu boboch in Enugu (Nkanu East); gigir in Tiv; magina in Kaduna; turi in Niger state; onjonigho in Cross River.

Food security is very important to the development of a nation. Food security occurs where the quantity and quality of food is sufficient and available to the citizens of a country (Salman and Akinbosoye, 2013). On the other hand, food insecurity is the inability of the citizens to have regular access to enough food to meet up the daily nutritional requirements for a healthy and productive life (Uko- Aviomoh, 2005; Okelola *et al.*, 2015). There are four dimensions to this: availability of sufficient amount of food which is a function of food production; stability of supply over time which depends on the ability to preserve/ store produced food and supplement available food through imports if necessary; access to the available food which depends on income levels and its distribution and food utilization which encompasses procurement, ingestion and digestion all of which are dependent on nutritional quality, education and health (Tollens, 2000; Okelola *et al.*, 2015).

To address the problem of food insecurity, a number of agricultural development institutions were set up and special programmes and projects were launched and fashioned to develop agriculture, reduce rural poverty and earn foreign exchange. A few of these programmes made positive impact to the economy while others could not. They include: National Accelerated Food Production Programme (NAFPP) in 1972, Operation Feed the Nation (OFN) in 1975, Agricultural Credit Guarantee Scheme (ACGS) in 1977, River Basin Development Authority RBDA in 1978, Green Revolution (GR) in 1980, National Directorate of Employment (NDE) in 1986, Rural Agro-Industrial Scheme (RAIDS) in 1990, Directorate of Food, Roads and Rural infrastructure (DFRRI) in 1986, Nigeria Agricultural Credit Bank (NACB) in 1973, National Agricultural Land Development Authority (NALDA) in 1991, Agricultural Projects Monitoring and Evaluation Unit (AMPEU) in 1984, National Tree Crops Development Unit NTCAU, in 1984, Agricultural Development Programme (ADP) in 1975, Nigerian Agriculture Insurance Co-operation (NAIC) in 1990, National Accelerated Industrial Crops Programme (NAICP) in 1981,

Special Rice Programme (SRP) 1997, National Fadama Development Project (NFDP) in 1992, Agricultural Research Council of Nigeria 2007, Sasakaw Global (SG) 2000, Universities of Agriculture, and Agricultural Transformation Agenda 2011 (Eke-Okoro *et al.*, 2014).

To date, much work has not been formally done on turmeric for cultivation by Nigerian farmers due to lack of information on the suitability of turmeric cultivars for cultivation in different agro- ecologies of the country. The motivating factor for production is the use of the crop as a source of food spice, medicine and income. Turmeric has often been viewed as irrelevant and uneconomic solutions to global nutritional problems. Little or scattered and documented information exist on their economic importance, production, cultural, agronomic practices, having suffered research neglects over the years. However, the potentials of turmeric in terms of health value, economic imperatives have been unveiled locally and globally. This paper therefore aimed at taking a close look into the potentials of turmeric for food security in Nigeria with a view of identifying the contribution of National Root Crops Research Institute (NRCRI), Umudike in turmeric production, processing and marketing in Nigeria.

Turmeric production, processing and marketing in Nigeria

Turmeric is one of the fourteen (14) minor root crops currently receiving research attention at the National Root Crop Research Institute (NRCRI). The crop belongs to the family *Zingiberaceae* and genus *Curcuma*, Consisting as many as 133 species. *Curcuma longa lin* is the highest yielding turmeric. Natural plants like turmeric have been used throughout human history for various purposes. About ten thousand of these products are produced as secondary metabolites by higher plants as natural defence mechanism against diseases and infection. Medicines derived from the plant turmeric have played a pivotal role in the health of humans. In the Indian medical culture turmeric plant is used to treat various ailment and diseases (Daniel-Ogbonna *et al.*, 2018). There were about 76 cultivars of turmeric in the germplasm of the NRCRI, Umudike.

Ten out of these are being evaluated on multi-locational trial. They are: NCL41, NCL58, NCL39, NCL14, NCL52, NCL04, NCL25, NCL60 and NCL36 (Amadi *et al.*, 2017). In Nigeria, turmeric is cultivated mostly on subsistent bases in about 19 states and given different local names depending on the area.

It is called atale pupa in Yoruba; gangamau in Hausa, nwandumo in Ebonyi; ohu boboch in Enugu (Nkanu East); gigir in Tiv; magina in Kaduna; turi in Niger state; onjonigho in Cross River (Nwaekpe *et al.*, 2015). The production, processing and marketing of turmeric in NRCRI, Umudike Nigeria are stated below as:

Production of turmeric

Site preparation/ planting

A well drained, fertile, loamy soil ranging from sandy loam to clay loam should be selected (Nwakor *et al.*, 2014). Land preparation starts with site selection and land clearing. Beds should measure 3m x 2m to minimize human traffic on the beds during farm operations. Turmeric is commonly planted on beds, ridges or even on mounds. Turmeric is propagated by rhizomes. The fresh mother rhizome is the propagation material. Primary and secondary rhizomes of turmeric can also be used as planting materials. Turmeric is planted vegetatively with setts (rhizome) of 10-15 g with one or two buds. About 1 ton of setts are required to plant in a hectare or about 50 stands in a bed measuring (4 x 3) m. In Kaduna state Nigeria, turmeric is inter-cropped with ginger in large quantities (Nwakor *et al.*, 2014). Turmeric is planted from the onset of rainy season around April and May till first week in June. Turmeric should be planted 10 cm deep at a spacing of 50 cm.

Mulching

Mulching of beds is very important in turmeric production, first should be immediately after planting and second mulching should be done 8 weeks after planting. The mulch help to conserve moisture, promote germination, suppress weeds, regulate soil temperature, supply nutrients to the soil and improve soil and improve soil physical fertility for maximum yield. Turmeric should be mulched with elephant grass (straw) at the rate of 12 t/ha.

Weeding

Weeding is done within 4-6 weeks after planting depending on when weeds appeared in the farm. Yield loss due to weed interference in turmeric ranged between 3 and 55%, while critical period of weed interference is between 8 and 12 weeks after planting. Pre emergent herbicide can be used to control weeds in turmeric farm.

Fertilizer application

This can be done immediately after weeding at 2 weeks after planting. Turmeric field should be fertilized 2 weeks after planting at the rate of 60 kg N, 13 kg and 25 kg K/ha on a sandy loam Ultisol. This recommendation translates to application of 200kg/ha N P K 15:15:15 and augmenting with 30 kg N/ha (Olojede and Nwokocha, 2011). When inorganic fertilizer is not available, the use of animal dung or droppings is also encouraged to boost soil fertility. Most research experiments and studies have

shown that Umudike soils are Ultisols and are classified as Arenic Kandiudult (Amadi *et al.*, 2018). The application of poultry manure influenced the rhizome yield of turmeric. Nwokocha *et al.* (2009) on the other hand reported that application of 60 kg N/ha + 13 kg P/ha + 25 kg K/ha optimized the rhizome yield of turmeric in an Ultisol.

Pest/diseases control

Many pests attack turmeric in the farm and should be controlled, such pests are leave roller, shoot borer, scale insects among others. The diseases of turmeric in Nigeria are leaf Blotch, Leave spot and Rhizome. They appear as small oval, rectangular or irregular brown spots on either side of leaves and soon become dirty brown. They reduce yield, though they are controlled by spraying chemicals.

Harvesting

Turmeric matures 7-9 months after planting. The crop is ready for harvesting when leaves turn yellow and start drying up. Harvesting is done by digging out the whole rhizome with spade or hoe. The rhizomes are collected and cleaned. The mother and finger rhizomes are separated after harvesting.

Yield

The yield of turmeric ranges from 20-22 tons per hectare. Some cultivars under research-managed farms have recorded yields of 35,000 tons per hectare (Nwakor *et al.*, 2014).

Processing/storage of turmeric

Cleaning

Harvested turmeric rhizomes are cleaned off mud and other extraneous material adhering to them and cured 2-3 days after harvest so as to ensure the quality of the end product.

Boiling

This involves boiling the rhizomes to soften them and remove the raw odour. After boiling, the starch is gelatinized, which reduces the drying time required and the colour is uniformly distributed throughout the rhizome. The boiling time is dependent on the age, variety, size and thickness of the rhizomes. The National

Root Crops Research Institute, Umudike recommends boiling in water or 45 minutes until froth appears at the surface and the typical turmeric aroma is released. It is recommended to use perforated containers with a capacity of 50-75kg rhizomes. The benefits of boiling turmeric include the following: reduction of drying time; even colour distribution throughout the rhizome; a more attractive product that is easier to polish and sterilization of the rhizomes before drying.

Drying

The cooked rhizomes are dried until they have a final moisture content of 5-10%. Sun drying or artificial drying can be used. The optimum drying temperature is about 60°C.

Grinding/milling

This is a method of adding value to a product. Grinding is a simple process that involves cutting and crushing the rhizomes into small particles, then sifting it through a series of screens of different mesh to get a fine powder. For higher quality ground turmeric, the grinding temperature should be kept as low as possible. Grinded turmeric should be sieved and packaged in a tight container and put away from sunlight to prevent fading of the colour during storage (Nwakor *et al.*, 2014). Turmeric can be stored in processed forms. The rhizomes are kept in an airy shaded environment to keep it fresh till the time of processing into various products. Fresh turmeric can be stored in barns, house, in the farm. Dry and powdered turmeric is stored in an air tight container. The shelf life of processed turmeric powder is up to 12 months. Today, turmeric juice drink is a value addition product which people drink on daily basis, before meal or after meal.

Marketing of turmeric

Due to globalization there is an increasing need for agricultural marketing. Turmeric is marketed in local and international markets in the world, especially in India and China. The primary product of turmeric traded in the world market is dried rhizome, turmeric powder, oils and oleoresin. In Nigeria turmeric powder is sold at various local markets for 1kg at ₦1,250 per pack, while 50 kg costs about ₦62,500 (Nwakor *et al.*, 2014). The unprocessed rhizomes are sold in the rural and urban markets. About 1 kg of fresh turmeric rhizome costs ₦150-₦200. Production of turmeric is economical at Umudike with a Benefit Cost Ratio (BCR) of 3.3 and a net income of ₦320,918.22 for every naira invested in turmeric production, you get a return of ₦220.14 (Nwakor *et al.*, 2014) (Figures 1-3).

Potentials of turmeric as food secured root crop

Turmeric contains several micro-nutrients such as carotene, thiamin, riboflavin, vitamin C, iron, zinc, calcium, selenium and magnesium in varying concentration (Olojede *et al.*, 2005). Turmeric also has a very high protein content more than other root and tuber crops and also the fat content in turmeric can stand out as a foreign exchange earner as obtained in India. Turmeric is eight times better than vitamin E in preventing lipid peroxidation. Turmeric is one of the most important natural anti-inflammatory substances available (Daniel-Ogbonna *et al.*, 2018). Reducing food insecurity continues to be a major public policy challenge in developing countries. Almost 1 billion people worldwide are undernourished, many more suffer from micronutrient deficiencies, and the absolute numbers tend to increase further, especially in Sub-Saharan Africa (FAO, 2008). It is obvious to note that turmeric is food and food accessories, the value addition products of turmeric such as medicine, turmeric juice and drink, turmeric species are food. Turmeric complements food such as rice, beans, soup, tea, pap, and stew among others. The potentiality of turmeric as a food secured crop manifests in different ways which include the following:

Food

Turmeric powder is the major constituent of curry powder used in confectionery industries for food seasoning and in the international market as a functional food due to its health promoting properties. As spice, turmeric is used in adding flavor and color to dishes. Turmeric is an important ingredient in curry powder. The turmeric content in curry powder blends ranges from 10-15% to 30%. Typical Indian curry powder for meat and fish dishes contains 20-30% turmeric while curry mixes for vegetarian dishes contain less turmeric, in the range of 5 to 10%, because of the bitter flavor it would impart to the dish (Nwaekpe *et al.*, 2015; Amadi *et al.*, 2018).

Medicine

Research results reveal that Curcumin, a polyphenolic compound, found in turmeric may inhibit the multiplication of tumor cells, including multiple myeloma, pancreatic cancer, and colon cancer. It contains health benefiting essential oils such as termerone, curlone, curumene, cineole, and p-cymene (Nwaekpe *et al.*, 2015). These compounds have applications in cosmetic industry. Curcumin, along with other antioxidants, has been found to have anti-amyloid and anti-inflammatory properties. Thus; it is effective in preventing or at least delaying the onset of Alzheimer's disease. The root herb contains no



Figure 1. A section of turmeric farm in Extension Demonstration Plot of NRCRI, Umudike, 2018.



Figure 2. A section of turmeric farm in Extension Demonstration Plot of NRCRI, Umudike, 2017.



Figure 3. Turmeric rhizome and powder.

cholesterol; however, it is rich in anti-oxidants, and dietary fiber. Together, they help to control blood cholesterol levels, offer protection from coronary artery disease and stroke risk. Early laboratory studies have

been suggestive that turmeric is liver protective, anti-depressant, anti-retroviral effects (Nwaekpe et al, 2015). It has been in use since a very long ago as an important ingredient in traditional Chinese and ayurvedic medicines

for its anti-microbial, anti-inflammatory, carminative, and anti-flatulent properties (Nwaekpe et al, 2015). Little or no toxicity is reported for humans receiving large (8 g/day) therapeutic doses of curcumin, an important major component of turmeric. All these revelations about the potentials of turmeric make it a good crop for development of pharmaceuticals, nutraceuticals, or food ingredients with functional properties. Turmeric is efficiently used in the treatment of circulatory problems, liver diseases, dermatological disorders and blood purification (Nwaekpe et al., 2015).

Cosmetics

On account of its flavour and medicinal properties, turmeric is also used in the preparation of cosmetics, soaps, ointments, face cream, toothpastes etc.

Dried rhizome

Rhizomes appear as fingers, bulbs and splits. Rhizome quality is judged by a clean and smooth skin, uniform skin and flesh colors, and a clean snap when broken. Turmeric is mainly imported whole and then Processed into powder or oleoresin used in the industrial sector and in confectionaries (Nwaekpe et al., 2015).

Conclusion

To date, the potential of turmeric as a food secured crop is hidden. Recent discoveries about this minor root crop are not only nutritious but have the capacity to keep human body 68% fit each day. Nigeria can play a leading role in turmeric production considering the prevailing favourable soil and climatic conditions in the country. However, turmeric is one of the minor root crops that are underutilized, even though improved production and processing technologies have been developed for it. Furthermore, the production of turmeric in Nigeria is still low because of little or no attention from researchers as a result of inadequate funding of research activities and consequently its potentials is being underexploited and the poor knowledge on proper cultivation technology affects farmers. The underutilization of this crop is largely due to lack of awareness. It is therefore, necessary to popularize this crop among the farmers, processors, marketers and consumers for eventual adoption. The National Root Crops Research Institute, Umudike has taken steps to make turmeric a crop of national and international interest in Nigeria. However, despite its success in developing appropriate technologies to improve overall efficiency, a lot need to be done especially in storage and processing to achieve food security.

REFERENCES

- Amadi C, Olojede AO, Obasi M (2015). Growth and yield of turmeric in a derived savanna agro-ecology of Nigeria. *International Journal of Agricultural policy and Research* vol.3(11):388-395.
- Amadi POE, Ibe, MN, Kalu CI (2017). Turmeric research in Nigeria: Challenges and Prospects for Economic Growth. *Proceeding of the 51st Annual Conference of the Agricultural Society of Nigeria, Abuja 2017. Pp 19-21.*
- Amadi POE, Adiele-Ezekiel C Ibe MN, Nzeakor FC (2018). Turmeric Production, Processing and Marketing for Sustainable Agricultural Development in Nigeria. *Journal of Community & Communication Research (JCCR). ISSN:2635-3318. www.jccr.org.ng.*
- Eke-Okoro ON, Njoku DN, Mbe JO, Awah JI, Amanze NJ, Eke-Okoro OC (2014). Contribution of Root and Tuber Crops in the Agricultural Transformation Agenda. *ARP Journal of Agricultural and Biological Science.*
- Food and Agricultural Organization (FAO) (2008): The State of Food Insecurity in the World (2008) *FAO, Rome.*
- Jilani MS, Waseem H, Ur-Rehman Kiram M, Ghazanfarullah, Ahmed J (2012). Performance of different Turmeric cultivars in Dera Isrualkhan. *Akistan. Journal Science (2012): 47-50.*
- Karim MR, Abedul H, Khairul A, Nurshad AS, Kazi A, Zahangir H, Ekhtear F, Abul A, Anwarul H, Seiichiro H, K(2010). Protective effects of the dietary supplementation of turmeric (*Curcuma longa* L.) on sodium arsenite-induced biochemical perturbation in mice. *Bangladesh Med Res Council Bull 36: 82-88.*
- Nwakor FN, Asumugha GN, Nwokocha CC, Ekedo TO (2014). Guide to Turmeric Production, processing and marketing in Nigeria. Extension Guide No. 28. Extension Services Programme. *National Root Crops Research Institute, umudike, Nigeria. Pp. 1-11.*
- Nwaekpe J, Anyaegbulam H, Okoye BC, Asumugha GN (2015). Promotion of Turmeric for the food /pharmaceutical industry in Nigeria. *American Journal of Experimental Agriculture 8(6):335-341.*
- Nwokocha CC, Olojede AO, Ano AO, Chukwu, GO, Korioecha DS (2009). NPK Requirement for Turmeric production on an Arenic Hapludult in Southern Nigeria. *Proceedings of the 33rd Annual Conference of the Soil Science Society of Nigeria. Held at University of Ado-Ekiti. 2009. Pp.166-170.*
- Ogbonna-Daniel C, Ewuziem, JE, Nwokocha CC, Obasi CP, Ironkwe AG (2018). Enhancing Value Chain in Development for Turmeric (*Curcuma longa*) in Nigeria. *Book of Readings In honour of Dr. JC Okonkwo. Theme: Structural Transformation in Root and Tuber Research for Value Chain Development and Employment Generation in Nigeria. June 2017. Pages 322-324.*
- Okelola OE, Olabode AD, Ariyo OC, Usanga UJ (2015). Agriculture: a panacea to food security. *MOUAU Extension Centre, MOUAU-Umudike, Abia State, Nigeria. Pp.308-312.*
- Olajide OT, Akinlabi BH, Tijiani AA (2012). Agriculture Resource and Economic growth in Nigeria. *European Scientific Journals. 8(22):103-115.*
- Olife IC, Onwualu AP, Uchegbu KI, Jolaoso MA (2013). Status Assessment of Spice Resources in Nigeria. *J. Biol. Agric. Healthcare 3(9):12-18.*
- Olojede AO, Nwokocha CC. (2011). A Decade of Research on Minor Root and Tuber Crops at NRCRI: The contribution towards Food Sufficiency and Economic Empowerment in Nigeria. Pp. 387-395.
- Olojede, A.O, Iluebbey.P., Dixon, A.G.O (2005). IITA/NRCRI collaborative germplasm and data collection on minor root and tuber crops in Nigeria. *NRCRI, Annual Report 2015. Pp.77-81.*
- Salman KK, Akinbosoye OO (2013). Food Security Status among Cooperative and Non Cooperative Family Households in Rural Akinyele Local Government Area of Oyo State. *Nigerian Journal of Rural Extension and Development 7(2):35-45.*
- Singletary K (2010). Turmeric: An Overview of Potential Health Benefits. *Nutrition Today 45:216-220.*
- Tollens F(2000). Food Security: Incidence and Causes of Food Insecurity and Vulnerable Groups and Coping Strategies. *In CTA,(2000). Food Security in ACP Countries, Proceedings of a CTA Seminar, Pp. 27-50.*
- Uko-Aviomoh, EC (2005). Family Education, Vocationalism and Food Security of the Nigerian Child. *Journal of Home Economics Research. Vol. 6 No 2.*