



Current Status of Yam (*Dioscorea Sp*) Genetic Resources-Case Study of Selected Locations in South-West Nigeria

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Abstract

Yam is an important tuber crop in Nigeria. Some locations in South west Nigeria (Oyo State, Ondo State, Osun State, and Ogun State) were surveyed to find out the existence and the abundance of diversity of white guinea yam (*Dioscorea rotundata*). It was discovered that there are also diversity in other species of landrace yams (*Dioscorea cayenensis*, *Dioscorea alata*, *Dioscorea dumentorum*). One unidentified species of yam was found in Ondo State. This species also exist in Osun State. Some of the yam diversities are endangered. Genetic erosion of these yam diversities is imminent because of the decline of the traditional farmers growing these diversities; also because of modern commercial farms that tend to mono-cropping of improved variety and also because of problem of storage of yams and especially ex-situ conservation of yam genetic resources of yam in Nigeria.

Keywords: Tuber crop; Diversity; *Dioscorea sp*; Endanger; Genetic erosion; Mono-cropping.

1. Introduction

Yam belongs to the family *Dioscoreaceae*. Yam and the foods made from it especially pounded yam is referred to as king of food in Nigeria. The white guinea yam (*Dioscorea rotundata*) is known as isu, abaje, agake, agogo, alade, and agiuni in Yoruba language in Nigeria. It is known as ji-akero, ji-ike, ji-ocha and aga among Ibos in Nigeria. Yellow yam (*Dioscorea cayenensis*) is known as alo, igangan, aginipa and apepe in Yoruba while Ibos call yellow yam Oku-ji-oka, ji-okwu, ocha and okbo. Water yam (*Dioscorea alata*) is known as sakata in Hausa language while Ibos call it ji-abana, mbala, onoko, agadaga, and ngbele. Yorubas in Nigeria call water yam ewura, and other variant names due to accessions such as funfun, onedo and lanshege [1]. Mostly, pounded yam are made from white guinea yam (*Dioscorea rotundata*) and yellow yam (*Dioscorea cayenensis*), but recently some new improved varieties of water yam are also used for pounded yam [2]. Culturally, white guinea yams (*Dioscorea rotundata*) are usually part of dowry price for marrying a woman in Nigeria among the Yorubas and Ibos. Among other things, the parents of the bride normally collect forty-two (42) tubers of yams from the bridegroom among the Yorubas. This underscores the cultural importance of yams and its importance as a food crop in Nigeria. Among the Yorubas,

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pounded yam is more popular as food among the Igbomina, Ekiti and Ijesha races of Yorubas. The elites in Nigeria also take delight in eating pounded yam in restaurants and in occasions. Pounded yam as a food is usually more expensive than other foods in restaurants in Nigeria.

Yams are usually planted on well drained clayed loam but are also planted on Fadamas or water logged soils. The yams especially white guinea yams planted in water logged soils is called 'isu akuro' among the Yorubas. Method of propagation is usually through seed yam or yam setts (whole tuber) or by cutting of yam tuber. Though there are yam seedlings nowadays made through aeroponic system. Early yams are usually planted between October to December towards the end of rainy season while late yams are usually planted between March to April during the onset of rainy season. Yams are usually planted 90cm apart on top of mound or heap and staggered in alternate rows. The planting density is 12000 stands per hectare. One yam sett or seed yam or cut yam is planted per hole. The tubers are covered with about 5cm to 10cm soil layer. This ridge or heap or mound is covered with grass mulch and soil to prevent decay or rotteness of the seed yam or yam setts due to heat as a result of sunlight. Mulching also aids germination of yams. Yams mature eight to nine (8 to 9) months. Harvesting is done by carefully digging out the tubers with aid of sharp tools like cutlass and hoe. Storage are done by tying up tubers in yam barns or in form of dried peeled tubers or processed into yam flour. Yams are marketed by selling locally or by exporting to other countries. Yams are eaten cooked, boiled or roasted or by cooking and prepared as pounded yam or processed into yam flour called "elubo" in Yoruba which is then prepared as dish called 'amala'. Amala and pounded yam are taken with soup especially vegetable and melon (egusi) soup.

Nigeria is responsible for over 72% of global production of yams while the yam belt of West Africa that stretches from the central region of Bandama rivers through the same ecological zones in the republic of Ghana, Togo, Benin and Nigeria down to the Western Cameroun is responsible for about 96% of the global output [3-5]. Constraints to yam production include storage, pests and diseases, marketing, staking, processing and value addition, scarcity of seed yams [4, 6, 7]. However, the seed yams accounts for about 50% of the cost of production especially good quality seed yams [7]. This then underscores the importance of yam genetic resources especially the white guinea yam (*Dioscorea rotundata*). This paper reports the current status of yam genetic resources in some selected places in Nigeria.

2. Materials and Methods

Major yam markets and some of the selected areas where yams are grown were surveyed in South West Nigeria to know the current status of yam genetic resources in Nigeria. Few farmers were interviewed to collect indigenous knowledge of the various accessions within the species of *Dioscorea rotundata* and uses and traditional and superstitious beliefs relating to yams or yam production and to ascertain the status of yams whether they are endangered or not. The status whether they are endangered are based on the information on availability of the accessions. The areas visited include Oyo, Ogun, Ondo and Osun states in Nigeria. The places visited in Ogun state include Kila, and Abeokuta. The places visited in Ondo state include Ifetedo, Ore, Ladapo village, Otu Yegua, and Idi-oro. Kila market was visited thrice (2012, 2016 and 2018) while Bodija market was visited in 2018. The period of survey invariably covered periods between 2012 and 2018. Some of these accessions of yams were collected for conservation in National Centre for Genetic Resources and Biotechnology (NACGRAB) in order to achieve sustainable use of these yam genetic resources. The tools employed for data collection were Focused Group Discussion (FGD) and Key Informant Interview (KII) using a developed research instrument as a guide [8].

3. Results and Discussions

Various accessions of white guinea yam (*Dioscorea rotundata*) were found in various places surveyed. Below are tables summarizing the accessions found.

Table-1. Indigenous Knowledge on existing accessions of *Dioscorea rotundata* collected from Kila, Ogun state

S/No	2012		2016		2018	
	Names of accession	Species	Names of accession	Species	Names of accession	Species
1	Oniyere	<i>Dioscorea rotundata</i>	Iseosi (odo)	<i>Dioscorea rotundata</i>	Aro	<i>Dioscorea rotundata</i>
2	Iseosi	<i>Dioscorea rotundata</i>	Efuru	<i>Dioscorea rotundata</i>	Amula	<i>Dioscorea rotundata</i>
3	Ewura Ibo	<i>Dioscorea alata</i>	Aro	<i>Dioscorea rotundata</i>	Iseosi	<i>Dioscorea rotundata</i>
4			Oniyere	<i>Dioscorea rotundata</i>	Oniyere	<i>Dioscorea rotundata</i>
5			Daka	<i>Dioscorea rotundata</i>	Efuru	<i>Dioscorea rotundata</i>
6			Alo	<i>Dioscorea rotundata</i>		
7			Ndu	<i>Dioscorea rotundata</i>		
8			Igu	<i>Dioscorea rotundata</i>		

Table-2. Indigenous Knowledge on existing accessions of yams collected from Bodija Market, Oyo State 2018

S/N	Names of accessions	Species
1.	Efuru	<i>Dioscorea rotundata</i>
2.	Gbongi	<i>Dioscorea rotundata</i>
3.	Dariboko	<i>Dioscorea rotundata</i>
4.	Sangula	<i>Dioscorea rotundata</i>

The variation in the number of accessions found in various years when Kila and Bodija market were surveyed is probably due to the time of the year when the market was surveyed. The survey in 2012 was done on February 2012, that of 2016 was done on November and that of 2018 was done in October. Bodija market was surveyed on December 2018.

During the survey, the indigenous knowledge gathered regarding the status and the uses of the accessions were as follows:-

Table-3. Status of Yams based on information gathered from farmers and sellers of yams

Period	Location	List of accession	Status	Best Uses
2012	Killa, Ogun state	Oniyere <i>D. rotundata</i>	Not endangered	Good for pounded yam
		Iseosi <i>D. rotundata</i>	Not endangered	Eaten as pounded yam. Eaten as fried yam. Eaten as yam porridge. Also eaten as boiled yam
		Oniyere <i>D. rotundata</i>	Not endangered	Good for pounded yam
		Efuru <i>D. rotundata</i>	Not endangered	Eaten as boiled yam and also good for pounded yam
		Ewura ibo <i>D. alata</i>	Not endangered	Eaten as boiled yam
2016	Kila, Ogun State	Iseosi (odo) <i>D. rotundata</i>	Not endangered	Eaten as cooked yam
		Efuru <i>D. rotundata</i>	Not endangered	Eaten as pounded yam
		Aro <i>D. rotundata</i>	Not endangered	Fried as yam. Eaten as cooked yam and as yam porridge but best as pounded yam
		Oniyere <i>D. rotundata</i>	Not endangered	Eaten as pounded yam
		Daka <i>D. rotundata</i>	Not endangered	Boiled as yam and eaten as pounded yam
		Alo <i>D. rotundata</i>	Not endangered	Boiled as yam and eaten as pounded yam
		Ndu <i>D. rotundata</i>	Not endangered	Boiled as yam and eaten as pounded yam
Igu <i>D. rotundata</i>	Not endangered	Boiled as yam and eaten as pounded yam		
2018	Kila, Ogun State	Aro <i>D. rotundata</i>	Not endangered	Fried as yam chips; eaten as boiled yam; eaten as yam porridge; also eaten as pounded yam.
		Amula <i>D. rotundata</i>	Not endangered	Eaten as boiled yam; also eaten as pounded yam but best as boiled yam.
		Iseosi <i>D. rotundata</i>		Eaten as boiled yam
		Oniyere <i>D. rotundata</i>		Best eaten as pounded yam
		Efuru <i>D. rotundata</i>		Eaten as boiled yam. Also very good as pounded yam.
2012	Ore, Ondo state	Lasinrin <i>D. rotundata</i>	Endangered	Eaten as pounded yam
		Ewura <i>D. alata</i>	Not endangered	Good for making local dishes called ojojo and Ikokore
2012	Ifetedo, Osun state	Amula <i>D. rotundata</i>	Not endangered	Good as yam setts; Good for pounded yam
		Oobia or koro gbara <i>D. rotundata</i>	Probably endangered	Eaten as yam; also very good as pounded yam
2012	Ladapo village, via ore, Ondo state	Igangan <i>D. Cayenensis</i>	Endangered	Eaten as yam; also good as pounded yam
		Idi-oro, Otu yegua, via Ore, Ondo state	Endangered	Eaten as yam; also good as pounded yam
		Dagidagi <i>D. Sp</i>	Endangered	Eaten as yam; eaten as pounded yam
2018	Bodija, Ibadan, Oyo state	Esuru <i>D. rotundata</i>	Not endangered	Eaten as boiled yam.
		Efuru <i>D. rotundata</i>	Not endangered	Eaten as pounded yam. The pounded yam is not brittle but draw very well
		Lasinrin <i>D. rotundata</i>	Endangered	Eaten as pounded yam. The pounded is brittle and do not draw
		Igangan <i>D.</i>	Endangered	Eaten as boiled yam. Eaten as pounded

		<i>Cayenensis</i>		yam
		Jigan <i>D. Cayenensis</i>	Endangered	Eaten as boiled yam. Eaten also as pounded yam
		Gbongi <i>D. rotundata</i>	Not Endangered	Eaten as boiled yam. Eaten also as pounded yam
		Odo <i>D. rotundata</i>	Endangered	Eaten as yam
		Dariboko <i>D. rotundata</i>	Not Endangered	Eaten as yam. Eaten also as pounded yam
		Sangula <i>D. rotundata</i>	Not Endangered	Eaten as pounded yam
		Modahe <i>D. rotundata</i>	Endangered	Eaten as yam. Eaten also as pounded yam
		Marododo <i>D. rotundata</i>	Endangered	Eaten as pounded yam. Need a lot and plenty water while pounding because it swells.

Since farmers are the primary custodian of yam genetic resources in Nigeria, their indigenous knowledge about the uses and status in terms of its availability and whether they are endangered is very important. When farmers, middlemen and marketers interviewed mentioned an accession they used to have before but which is now sparingly available or not available, those accessions are counted endangered. Farmers also highlighted some important knowledge about yam genetic resources. For instance, water yam (Ewura Ibo) found at Kila in 2012, the farmer interviewed said the yam was from a village called Ogunshile. Likewise the water yam (*D. alata*) found at Ore in 2012, the farmer / seller interviewed said the yam was from Kishi, Oke – Ogun area in Oyo state. Also, white guinea yam (*D. rotundata*) found in Ore in 2012, the farmer/seller interviewed said the yam was from Fulani farm in Kishi, Oke-Ogun area in Oyo state. Likewise, the farmer/seller interviewed about Oobia or Koro gbara yam (White guinea yam: *D. rotundata*) found at Ifetedo in Osun state, said that the yam was from Geria near Kaiama in Kwara state. Other information given about Oobia or Koro gbara include the fact that the yam is good if eaten boiled or pounded. However, the farmer highlighted the poundability of the yam thus- that only a strong man or woman can pound the yam and the more the yam is pound, the more the pounded yam increase in size or swells. It also needs a lot of water during pounding the farmer emphasized. Also, the farmer hinted that the pounded yam get hardened if left for a long time before eaten.

The farmer interviewed at Bodija market also, apart from mentioning that Marododo (White guinea yam: *D. rotundata*) is endangered, he also mention that marododo is eaten as pounded yam and that it needs a lot of water when pounding and swells, expands and increases in size as you pound. These attributes make marododo and oobia or koro- gbara desirable genetic resources for conservation, since they are used for pounded yam and also the two of them are endangered.

The movement of yam genetic resources from one community to another through sale or sharing is corroborated by [Halewood, et al. \[9\]](#), who stated that farmers have been engaged in collective systems of conservation and innovation- openly sharing of planting materials and conserving them through use – since the earliest domestication.

Apart from the indigenous knowledge possessed by yam sellers and farmers, the sellers also displayed the seed yams specifically produced by farmers for sale as seed yams or yam setts. This is also supported by what [Halewood, et al. \[9\]](#) stated that certain farmers play a predominant role in germplasm conservation, generation and supply. They further stated that some farmers or even villages specialized in seed production and supply for certain crops. Those farmers are known for reliably and regularly producing and supply seed [\[9-12\]](#).

Also, matters arising as a result of this survey include:-

- (1) Most of these accessions of *Dioscorea rotundata* have potential to be endangered and those endangered have potential to go into extinction because most of the old traditional farmers planting these yams are becoming old and many of them are dying. These old farmers are mostly subsistence or semi-commercial farmers who employed traditional methods and who believed in diversity of accessions. However, the modern commercial farmers replacing these old traditional farmers tend to practice mono-cropping of one accession or one variety of yam that is believed to command good market price and such farms may take hectares of land thus leading to loss of valuable genetic resources. [Gautam \[13\]](#) stated that genetic resources that have potential or actual value are being lost at an alarming rate due to habitat destruction, land degradation, over exploitation of water resources, forestry practices, urban expansion, changing social and cultural norms, and adoption of improved varieties/ other technologies of intensive agriculture by the farmers. This erosion has caused losses of several desirable and potentially useful genes, and has thereby, jeopardized food security, and also added social costs.

Diversity is very important in plant genetic resources because of its value for breeding for yield increase, disease resistance, pests' resistance and other economic, aesthetic and social values. Therefore the loss of diversity is a concern all over the world. However this diversity is being replaced by a certain genetically uniform improved and modern varieties [\[14-17\]](#). This concern for need of ex-situ conservation of diversity all over the globe has led to establishment of gene banks [\[14, 18, 19\]](#). However, yam conservation is problematic. Yam conservation is a problem because (1) yam is a recalcitrant 'seed'. It cannot be stored in cold storage like orthodox seeds (2) Yam can be stored basically three ways (a) tubers are tied up in barns (b) in form of dried peeled tubers (c) in form of flour. The second and last option cannot serve the purpose of genetic resources conservation. The first options especially that will serve the purpose of securing the national conservation of yam genetic resources require large capital outlay. This is

difficult to come by except there is donor funding especially in Nigeria national Genebank where the fund from government have to be shared between power supply to power the seed genebanks and other pressing needs. Another option would be on-farm conservation of yam with the traditional farmers [14, 15, 20]. However, this option seems not to be feasible especially with regard to yam conservation. This is especially so, because most of the traditional farmers planting these yams are old. When these farmers die, the succeeding generation may not have interest in farming especially farming of yams and this may lead to the end of these yam genetic resources. This is in the first instance what led to endanger of these varieties and why many have gone into extinction.

Another matter arising from the survey is the need to molecularly characterize these yams. This will confirm the intra-specific differences in *Dioscorea rotundata* highlighted by the farmers which led to identification of various accessions. It will also help in confirming the intra-specific differences in *Dioscorea cayenensis* and *Dioscorea alata* and also help in the identification of unknown species. This is because farmers identified differences even in this unknown white yam species which the farmers called dagidagi. Among the accessions identified include Isu-Mose and Isu-Timo. This unidentified species of white yam is endangered and the tubers are usually big but when eaten as yam or pounded yam, the quality in taste is not as acceptable as that of white guinea yam (*Dioscorea rotundata*). It will also clarify some issues like having different names for the same accessions in different communities while calling them different accessions when rather they are the same.

4. Conclusion

There is intra-specific diversity in various species of yams in Nigeria. However this diversity is threatened due to genetic erosion caused by modern agriculture, death of old traditional farmers, climate change, yam pests and diseases, storage problems and emphasis on agri-business. There is need to arrest the genetic erosion by ex-situ conservation of these yam genetic resources in National Centre for Genetic Resources and Biotechnology (NACGRAB), Nigeria. However there is a storage problem and the capital outlay for befitting and secured yam storage is beyond the reach of the Centre due to diverse needs jostling for the paltry sum of money in the annual budgetary allocation of the Centre. The other option which is on-farm conservation of yams is not feasible due to the age of the farmers who when deceased may lead to the entire loss of the genetic resources. Conservation in the tissue culture would have been another viable option, but contamination of the media and cost of consumables and competing and conflicting demand of other crops for commercial propagation for the same material resources and consumables does not favour conservation of yam in tissue culture especially in national programs where funding is constraint.

However, there are still few diversities of yams being conserved in National Centre for Genetic Resources and Biotechnology, Ibadan, Nigeria.

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