COCONUT (*Cocos nucifera L.*) GENETIC COLLECTIONS IN NIGERIA

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ABSTRACT: Coconut (*Cocos nucifera L.*), a subsistence food crop of the humid tropical zone is a life-supporting species in the coastal ecosystem of Nigeria. Improvement efforts of this crop would depend on the available genetic resources existing within the species. The Nigerian collections consist of 637 accessions (101 Dwarfs and 536 West African Tall) while the introduced collections consist of 131 accessions (58 Dwarf and 73, West African Tall). These collections are being maintained as field gene banks (*ex situ*) at two locations; NIFOR main station, Benin City and Badagry, Lagos State. The exploitation of the variability within these gene banks would be essential for selection and hybridization for bringing about improvement in the traits of interest.

INTRODUCTION

The genetic diversity of a vast number of plant species in Africa and elsewhere is being eroded at an alarming rate due to habitat loss. Development diseases and in the case of economic trees such as Coconut and Oil Palm, "thinning" to make way for food crops are major contribution to this habitat loss (Ataga *et al*., 2003).This phenomenon of habitat loss or genetic erosion formed the impetus for coconut genetic collections in Nigeria mainly for conservation and exploitation. The coconut palm, unlike the oil palm is not indigenous to Nigeria. The early missionaries introduced the crop into Nigeria (Akpan, 1989). It is believed to have originated in the Indo-Malayan region (Indonesia, Malaysia and Philippines) and Coralline from where its dispersed mainly via oceanic currents to sandy tropical coasts where it got established (Augustine et al 2010).

It is a subsistence food crop of the humid tropical zones. Its cultivation is restricted to the coastal areas of the country where it thrives best, with more than 80% of the coconut population within this ecosystem consisting of the West African Tall (WAT) varieties (Sangare *et al*, 1992). Several ecotypes of this WAT at various times have been collected in addition to various exotic genotypes introduced into the field gene banks in the early 1970's for the sole purpose of developing Tall x Dwarf hybrid varieties (Akpan, 2000).

The Nigerian Institute For Oil Palm Research (NIFOR) is about to initiate a comprehensive breeding programme for coconut improvement and thus, an inventory/catalogue of available germplasm has become imperative.

This study attempts to catalogue the various coconut genetic collections (assembling the total variability in the species) as a pre-requisite in the formulation of an improvement programme for the crop.

GENETIC MATERIALS/COLLECTIONS

It is very fundamental that the genetic resources form the back bone for undertaking any crop improvement programme (George and Nirel, 2010) and it does follow that the success of any crop improvement programme is dependent to a very large extent on the amount of available germplasm in the species. Therefore, the variability within the gene pool is essential for selection and hybridization for bringing about improvement in the traits of interest. The Nigerian Institute for Oil Palm Research Station has a modest coconut genetic collection which has been conserved in field gene banks (*ex situ*) at various times on the Main Station, Benin City, Ubiaja and Badagry, Nigeria.

Inventory of the collections

The Coconut gene bank of NIFOR is composed of 42 indigenous collections (Table 1a), 16 exotic collections (Table 1b) and 4 hybrid materials (Table 1c).

Table 1a: Indigenous Collections

S/NO	COLLECTION	ORIGN	VARIETY	NO OF ACCESSION	NO OF PALM PLANTED	DATE OF PLANTING
1.	Evboneka Tall	Nigeria	Tall	8	70	1970
2.	NIFOR Tall	Nigeria	Tall	5	33	1971
3.	Iguedaiken Tall	Nigeria	Tall	7	92	1970
4.	Obazuwa Tall	Nigeria	Tall	5	51	1970
5.	Okunvbe Tall	Nigeria	Tall	6	61	1970
6.	Ekiadolor Tall	Nigeria	Tall	7	98	1970
7.	Ubiogiobo Tall	Nigeria	Tall	8	95	1970
8.	Uwan Tall	Nigeria	Tall	23	132	1970
9.	Moor Plantation Tall	Nigeria	Tall	15	34	1968
10.	Iyowa Tall	Nigeria	Tall	14	175	1970
11.	Utekon Tall	Nigeria	Tall	8	139	1971
12.	Eko-Abetu Tall	Nigeria	Tall	4	39	1970
13.	Aihuobabekun Tall	Nigeria	Tall	11	139	1970
14.	Koko Tall	Nigeria	Tall	7	64	1970
15.	Opobo Tall	Nigeria	Tall	16	99	1972
16.	Badagry Tall	Nigeria	Tall	34	272	1967/68
17.	Ekenvbore Tall	Nigeria	Tall	9	165	1971
18.	Uyo Tall	Nigeria	Tall	19	117	1972
19.	Abak Tall	Nigeria	Tall	10	59	1972
20.	Ikot Ekpene Tall	Nigeria	Tall	16	92	1972
21.	Degema Tall	Nigeria	Tall	23	-	1972
22.	Eket Tall	Nigeria	Tall	13	71	1972
23.	Igwikhinmwin Tall	Kwara	Tall	4	50	1970
24.	Oyun Tall	Kwara	Tall	23	-	1970
25.	Ilorin Tall	Kwara	Tall	20	-	1970
26.	Irepodun Tall	Kwara	Tall	18	-	1970
27.	Kogi Tall	Kogi	Tall	16	-	1970
28.	Okene Tall	Kogi	Tall	175	-	1970
29.	Umuahia Green Dwarf	Abia	Dwarf	18	-	1970
30.	Abakaliki Red Dwarf	Ebonyi	Dwarf	6	-	1970
31.	Abak Green Dward	Akwa-Ibom	Dwarf	33	-	1970
32.	Uwan Green Dwarf	Edo	Dwarf	21	-	1970
33.	Ughelli Red Dwarf	Delta	Dwarf	19	-	1970
34.	Imasabor	Nigeria	Tall	6	85	1970
35.	Isiuwa	Edo	Tall	1	13	1971
36.	Ajalli	Amambra	Dwarf	4	43	1972
37.	Ahoasa	Rivers	Tall	19	172	1972
38.	Calabar	Cross River	Tall	5	38	1972
39.	Ilse	Nigeria	Tall	1	3	1972
40.	Omorogieva	Edo	Tall	1	3	1972
41.	Emoyon	Edo	Tall	1	10	1970
42.	Obarenren	Edo	Tall	1	10	1970
				637		

The indigenous collection is made up of 637 accessions (101 Dwarfs and 536 West African Tall) while the exotic collection comprise 131 accessions (58 Dwarf and 73 West African tall). The representativeness of the accession and size of populations are indications of a broad genetic variables of the species in the gene bank: 81.7% of the accessions are from Nigeria and 17% from South East Asia and Pacific. These ecotypes originated from countries of the different ecosystems. All the accessions are being maintained as field gene banks for the assessment of their genetic variability within and between the populations.

Table 1b: Exotic collections

S/NO	COLLECTION	ORIGIN	VARIETY	NO OF ACCESSIONS
1.	CmDG	Cameroon	Dwarf	8
2.	MDG	Malaysia	Dwarf	25
3.	MDY	Malaysia	Dwarf	19
4.	MDR	Malaysia	Dwarf	6
5.	Nylor Gading	India	Tall	2
6.	Bengal Tall	India	Tall	3
7.	Gon Thembili	India	Tall	3
8.	Mysore Tall	India	Tall	3
9.	Gangabondam	India	Tall	3
10.	Spicata	India	Tall	3
11.	Novasi	India	Tall	2
12.	Bombay Tall	India	Tall	3
13.	West Coast Tall	India	Tall	3
14.	Regia	Srilanka	Tall	16
15.	Pumila	Srilanka	Tall	16
16.	Ebumea	Srilanka	Tall	16

Table 1c: Hybrid collection of progenies of Tall x Dwarf

S/NO	COLLECTION	ORIGIN	VARIETY	NO OF ACCESSION	NO OF PALM PLANTED	DATE OF PLANTING
1.	*NIFOR Main Station	Edo	T & D	NA	631	1968/69
2.	NIFOR Main Station	Edo	T x D	16	52	1970
3.	NIFOR Main Station	Edo	T x D	5	175	1972
4.	NIFOR	Edo	F_1 D	NA	64	1972

*Including 48 dwarfs planted in 1969

OUTCOME OF PREVIOUS EVALUATIONS

The evaluation of performance of both indigenous and exotic dwarf coconut genotypes (Akpan, 1989) revealed high variability with respect to yield and its components (Tables 2 and 3). The yield of these materials was low when compared to other materials elsewhere. The poor yield might be due to poor soil condition and high water deficit during the dry season. However, there was great variation in bunch production of Umuahia Dwarf Green (UMDG), Malaysian Dwarf Yellow (MDY) and Cameroon Dwarf Green (CmDG) when compared with Malaysian Dwarf Red (MDR) and Malaysian Dwarf Green (MDG). This trend was maintained in the number of nuts/palm and weight of nuts respectively.

Table 2: Yield summary of selected dwarf coconut palms

CULTURAL/ORIGIN	NO OF PALMS STUDIED	NO OF BUNCHES/PALMS		NO OF NUTS/PALM		WEIGHT OF NUTS/PALM (KG)	
		MEANS	CV(2)	MEAN	CV(2)	MEAN	CV(2)
UMDG/NIGERIA	18	5.8	29.9	36..5	37.7	33.2	40.2
UWDG/NIGERIA	14	6.7	26.6	44.8	39.8	51.5	45.2
MDG/MALAYSIA	7	8.2	16.5	35.6	19.	28.7	23.4
MDY/MALAYSIA	17	5.3	24.3	22.6	37.5	12.7	41,.4
MDR/MALAYSIA	6	8.1	12.7	29.3	19.3	23.4	18.8
CmDG/CAMEROUN	8	5.4	22.4	29.4	17.7	18.6	29.3

Source: NIFOR Annual Report, 1989,

Similarly, high variability was observed for yield components among the tall coconut genotype in NIFOR with emphasis on the genotype of Badagry Tall (Akpan, 1994). The mean number of bunches/palm, nuts/palm and weight/palm for the tall coconut genotypes are presented in Table 3. The mean number of bunches/palm and nuts/palm were lower than those reported in Ivory Coast for precocious tall palms.

Table 3: Yield of tall coconut genotypes

Population/State of Origin	No of palms studied	No of bunches/palm		No of nuts/palm		Weight of nuts/palm (kg)	
		X	CV (%)	X	CV (%)	X	CV (%)
NIFOR Tall-Bendel	175	3.6	24.1	40.5	36.1	48.2	37.0
Okunvbe Tall-Bendel	43	3.6	22.3	39.4	33.5	49.0	29.6
Ugbogiobo Tall Bendel	63	3.2	25.6	42.1	29.9	34.6	29.2
Uwan Tall – Bendel	90	3.0	26.3	39.1	32.8	53.1	32.3
Utekon Tall – Bendel	117	3.1	19.4	39.4	24.4	41.8	22.3
Iguedaiken Tall-Bendel	80	3.5	31.8	37.5	34.7	41.3	34.7
Aihuobabekun Tall-Bendel	120	3.3	23.5	39.2	34.7	32.2	38.0
Obazuwa Tall – Bendel	37	2.9	17.7	38.0	27.1	46.4	22.6
Koko Tall – Bendel	130	3.3	30.4	37.8	33.9	42.5	34.2
Moore Plantation Tall OYO	14	4.5	25.8	43.7	30.9	45.0	30.6
Opobo Tall-Akwa Ibom	69	3.1	23.6	37.3	24.8	33.4	27.5
Badagry Tall Lagos	232	4.3	24.0	44.7	31.8	47.4	34.1

Source: Akpan 1994

The Coconut Lethal Yellowing Diseases (LYD) is the most important disease affecting this crop on a world wide basis and is of major concern because of its devastating effect in coconut groves in some regions of the country. Observation from on-farm screening trials at the NIFOR main station at Benin, and the experimental station at Ubiaja has shown a higher (56.72%) incidence of the disease at NIFOR Benin (Table 4). The WAT is very susceptible (59.7 and 40.72%) to the disease while the MDG ecotype with 39.72 and 12.8% infection rates was the most tolerant. Consequently, this MDG will be the source for the gene that will confer resistance to LYD disease in the NIFOR breeding programme.

Table 4: Incidence of LYD in Four Varieties of Coconut palms At NIFOR main station and Ubiaja experimental station

NIFOR MAIN STATION **UBIAJA EXPERIMENTAL STATION**

COCONUT VARIETY	NUMBER SAMPLED	NUMBER AFFECTED	NO DEAD	INFECTION (5)	NO SAMPLED	NO AFFECTED	NO DEAD	INFECTION (%)
WAT	724	432	12	59.7	430	1775	4	40.7
DY	283	158	0	55.8	36	10	1	27.8
DR	124	62	0	50.0	37	9	0	24.3
DG	141	56	0	39.7	37	6	0	12.8
TOTAL	1272	708	12	55.7	550	200	5	36.4

Source: NIFOR Annual Report 1998.

CONCLUSION

Broad-based germplasm resources are imperative for successful improvement programmes. The size and geographic diversity of the NIFOR coconut genetic collection is an indication of the high variability inherent in the materials. The variability observed in the collection is large enough to enable the breeder initiate the process of selection and breeding for improved varieties resistant to the lethal yellow disease of coconut.

REFERENCES

Akpan, E. E. J. (1989). Evaluation of dwarf genotype within the Nigeria coconut germplasm Bank. In Proc. International Conference on Palms and Palm Products 21-25, Benin City Nigeria.

Akpan E. E. J (1994). Evaluation of tall coconut genotype within the Nigeria coconut germplasm banks. Oleagineux 49:1: 13 – 20

Akpan, E. E. J. (2000). The Nigerian Coconut germplasm Bank. In Proceedings of the 2nd Int. Coconut workshop for Africa. Mombassa, Kenya. 8-12, Pp 71-81.

Ataga, C. D., Okwuagwu, C. O., Okolo, E.C. and Okoye, M. (2003): Interrelationships among vegetative, bunch and fruit traits in an oil palm germplasm collection. In Proc. Of the PIPOC. Inter. Palm Oil Congress. Malaysia (Ed. Rajanaidy N. et al). Pp706-711

Augustine, J., Damadaran, B. U., Niral, V and Nair, R.V. (2010). Exploration for diverse coconut types in Andaman and Nicoher islands- a report on special coconut types. Abstract: In Inter. Conf. on Coconut biodiversity for prosperity. Kerale, India 25-28.

Georg. V.T. and Niral, V. (2010). Current status and scenario: Coconut biodiversity in India. In lnter. Conf. on Coconut biodiversity for prosperity. Kerala, India. 25-28.

NIFOR, 1989: 26th Annual Report
NIFOR, 1998 :35th Annual Report.

Sangare, A., de Taffin, G. de Frangue ville, Arkhuist, E.D and M Pomier (1992). Coconut lethal yellowing in Ghana: Initial result on planting materials performance in the field. Oleagineux (47)12:699-704