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TRENDS IN GENETIC RESOURCES UTILIZATION IN NIGERIA NATIONAL GENE BANK

Eunice OLAJIRE*, Dickson Junior NWOSU, Olabisi ALAMU, David Olusegun COKER, Sunday Ezekiel ALADELE

National Centre for Genetic Resources and Biotechnology, P.M.B. 5382, Moor Plantation, Ibadan, Nigeria.

Abstract

Reservoirs of variation offered by conserved germplasm are required by plant breeders, agricultural researchers, research students and farmers for crop selection, improvement and production to ensure food security needs of the world's rapidly rising population. The establishment of large, crop-genepool-specific collections at NACGRAB (National Centre for Genetic Resources and Biotechnology) gene bank, Ibadan, southwest Nigeria was based mostly on targeted collections over the years and donations. Conservation and utilization of plants genetic resources are important components of ex-situ collections. This article describes the utilization of conserved germplasm in NACGRAB gene bank as expressed from seed collection data of various end user institutions in the country over three years. The results show an increase in number of accessions of different crop species collected over the period under review. However, most collecting institutions are in close proximity to the gene bank. Highlighted were the need for improvement of utilization of gene bank materials in Nigeria through organization of campaign and public awareness programmes aimed at sensitizing the populace on germplasm utilization and improvement in networking to pivot some of the exploration activities based on their needs, and collaboration with other stakeholders to undertake germplasm characterization and evaluation in order to reduce cost.

Keywords: *Genetic resources; Conservation; Utilization, Gene bank, NACGRAB.*

Introduction

Plant Genetic Resources (PGR's), which include primitive forms of cultivated plant species and landraces, modern cultivars, obsolete cultivars, breeding lines and genetic stocks, weedy types and related wild species [1-3], are the most important components of agro-biodiversity. Over the last several decades, gene banks have collected large numbers of samples, aiming to represent the broad range of diversity that exists within each species or primary gene pool [4, 5]. Along with collections, gene banks strive to obtain reliable "passport" information about the origin or source of those samples [6], to conserve viable seed stocks representing each sample, and to distribute healthy seeds to users upon request [2, 7, 8].

The Nigerian Government recognizes the fact that important genetic resources make up a principal asset with huge prospects to food and nutrition security. Hence, the establishment of National Centre for Genetic Resources and Biotechnology (NACGRAB) in 1987, as a focal

* Corresponding author: bisdos@yahoo.com

point for the conservation and sustainable utilization of the Nation's vast genetic resources and to conduct research, gather and disseminate technological information on matters relating to genetic resources conservation, utilization and biotechnology applications. The Centre also regulates the seed, livestock and fisheries industries through its Varietal Release Committees (VRC).

Germplasm are acquired through explorations which involve collection from 'farmers' field and other target areas, donations from International Research Institutes and National Agriculture Research Institutes (NARIs) within the country. The seed gene bank in NACGRAB is made of both the active and base collections which are maintained at the short and long term gene banks respectively and the facilities have thousands of accessions of about 125 crop species. The gene banks aims at providing perfect storage environment (18^{o}C at 30-40% RH) in the short term storage; (-18^{o}C at 10% RH) for long term storage for basically orthodox seeds to maintain and prolong their mean viability periods. However, maintaining these conditions is sometimes an expensive task due to the challenge of power supply in Nigeria. The Centre relies most times on generating sets to keep the gene banks functional. The conserved germplasm which are maintained either as active or base collection in the short and long term gene bank respectively as mentioned earlier are made available for multiplication and distribution. Borokini [9] had noted earlier that gene banks are not built just to conserve genetic resources; but also intended to ensure that these resources are used, either in farms, breeding programs or research institutions. Germplasm (seed) distribution which relates to supply of available seed materials in the gene bank for intending users based on their request, is one of the most essential operations of the gene bank and serves as link between conservation and utilization [10-12].

Articulated information on seed distribution by gene banks and other research institutions for research purposes in Nigeria is scarce at best and unavailable at worst. This paper, pioneer work, is a report of seed distribution for local utilization and tends to create awareness on the rate of germplasm availability and supply by NACGRAB for crop improvement and other research purposes.

Materials and methods

Overtime, NACGRAB's seed gene bank has been able to make these conserved germplasm (especially, orthodox seeds) available to various groups of people that include breeders, research scientists, graduate and undergraduate students, farmers and other stakeholders for various research work and study in the field of plant breeding, agronomy, genetics, physiology, biotechnology and others with fewer requests from farmers. The information that could be obtained on some of the accessions includes passport data, characterization data and evaluation data. Recently, this information are being updated electronically and made available for intended users based on request. This paper tends to show the trend of NACGRAB's orthodox seeds distribution for 2010, 2011, and 2012. This paper, a first of its kind from the Centre, shows requesting institutions, number of accessions and crop types collected. Data was gotten from seed requisition forms filled out by several requesting individuals from different institutions (All seed requests are addressed to the office of the Director/Chief Executive Officer of the Centre and upon approval sent to the Seed Gene bank Unit where a desk officer in-charge of seed requests and distributions attends to it). The information collected over the three year period (2010-2012) was presented in table and bar charts.

Results and Discussions

Seed distribution for 2010

In 2010, a total of 649 accessions (Table 1) of 16 crops were supplied to 13 institutions (Figure 2), comprising three research institutes and 10 institutions of higher learning. Most of these institutions patronizing the national gene bank are located in the same (South-western) region as the national gene bank. Few institutions outside this region requested germplasm in 2010. Of the 16 crop types Maize had highest distribution (145 accessions) followed by Amaranth (113) accessions (Figure 1). The crops least supplied were pigeon pea, sesame and wheat with 3, 5 and 5 accessions respectively (Table 1). The highest number of accessions (430) amounting to 66.26 % of the total accessions distributed in 2010 were collected by FUNAAB (Figure 2). The least distribution of 3 accessions (0.46 %) came from National Agricultural Quarantine Services (NAQS) (Figure 2).

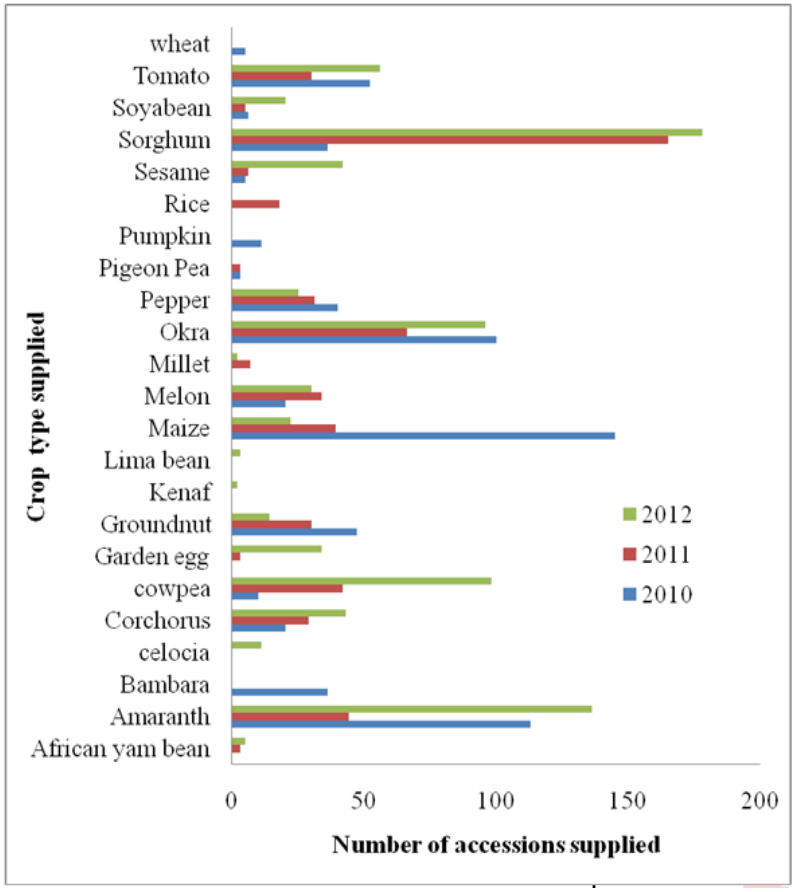

Fig. 1. Accessions of different crops distributed by NACGRAB in 2010-2012

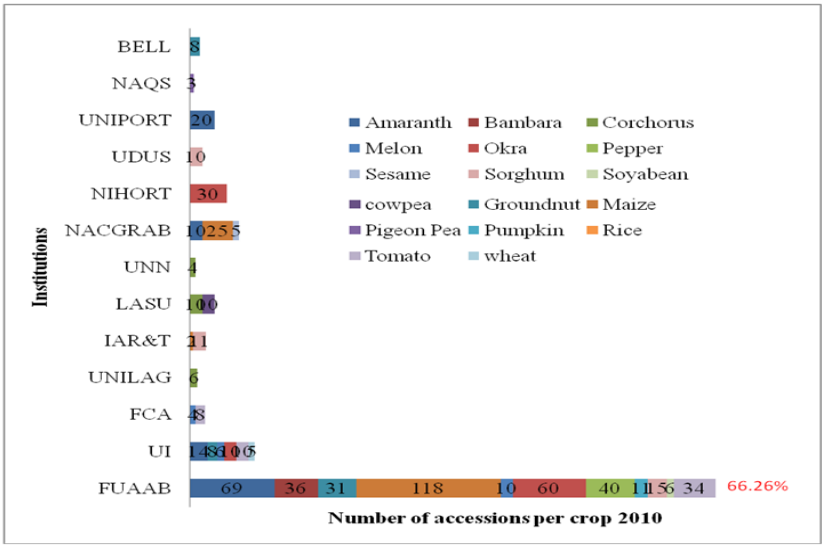

Fig. 2. Accessions of different crops collected by different institutions in 2010

Seed distribution for 2011

A number of 555 accessions (Table 1) of 17 crops were supplied to 15 utilizing institutions (Figure 3). This is 14.48 % less the number of accessions distributed in 2010. Sorghum had the highest number of accessions given out (165) followed by Okra (66) (Figure 1). Amaranth (44), cow pea (42) and maize (39) also recorded reasonable number of accessions supplied. African yam bean, garden egg and pigeon pea had the least distribution of 3 accessions each in 2011.

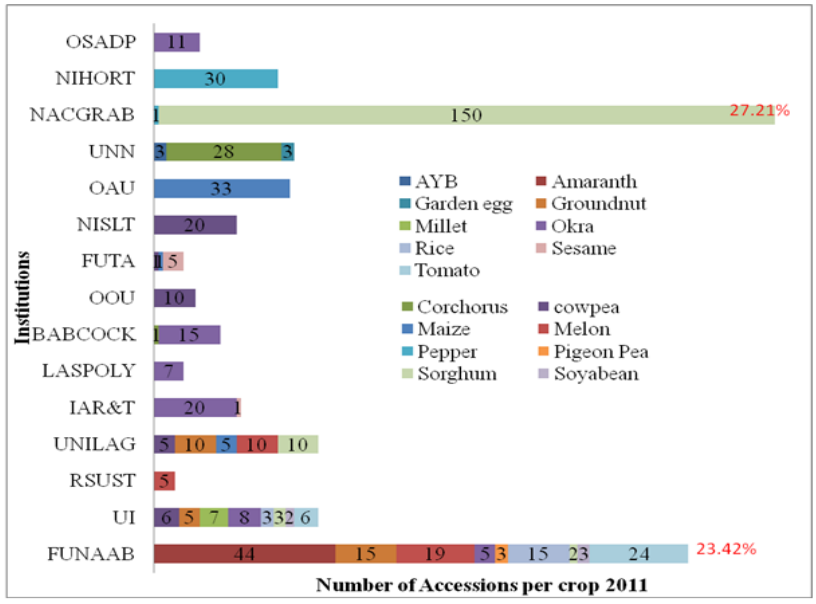

Fig. 3. Accessions of different crops collected by different institutions in 2011

The number of institutions supplied seeds increased from 13 in 2010 to 15 in 2011. Of the 15 requesting institutions, NACGRAB and FUNAAB received the highest accessions of

151 (27.21 %) and 130 (23.42 %) supplies respectively of the total distribution for 2011 (Figure 3). The least number of accessions for the year under review were collected by River State University of Science and Technology (RSUST).

Seed distribution for 2012

A preview of seed supply by the national gene bank in 2012 showed that 817 accessions (Table 1) of 18 crop species were supplied to 13 institutions (Figure 4). Sorghum and amaranth came top of crops distributed with 178 and 136 accessions respectively (Figure 1). Accessions of cowpea and okra supplied were 98 and 96 respectively. Kenaf, Millet, Lima bean and African yam bean were the least supplied crop types having only 2, 2, 3 and 5 accessions dispensed in 2012. FUNAAB collected the highest number of accessions in the year under review (196) followed by NACGRAB (163) and University of Ilorin (93). These supplies made up 23.99 %, 19.95 % and 11.38 % respectively for the year under review (Figure 4).

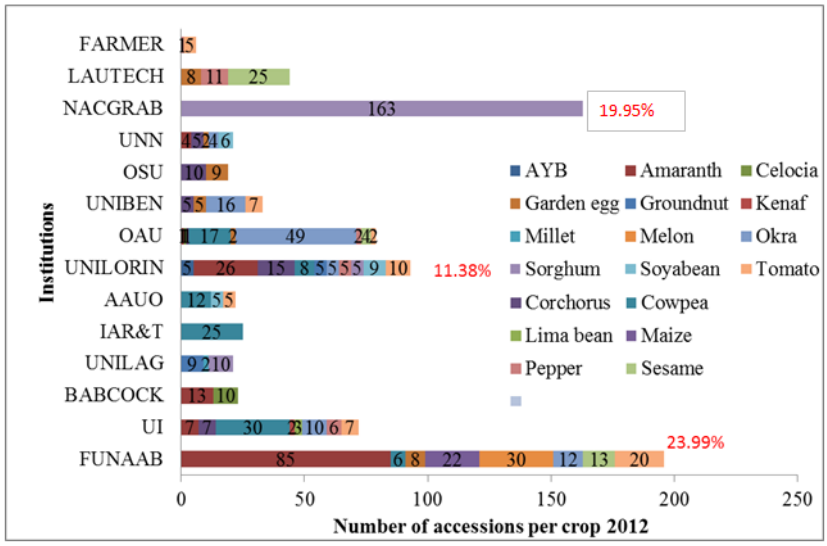

Fig. 4. Accessions of different crops collected by different institutions in 2012

Results of this study showed that seed supplied reduced from 649 accessions in 2010 to 555 accessions in 2011, but increased steeply to 817 accessions in 2012 (Table 1). There was also more geographical spread of institutions that collected germplasm from NACGRAB in 2012. The Federal University of Agriculture Abeokuta (FUNAAB) maintained the highest patronage for germplasm collection for the 3 years (2010-2012) (Figures 2, 3 and 4). This may be as a result of the institution proximity to the Centre and the high degree of collaboration between scientists at the Centre and the lecturers of the University. The utilization of sorghum was the highest 379 accessions (18.75 %) over the 3- year period (Table 1) as a result of the molecular characterization of the 313 sorghum accessions by the Center's molecular laboratory. Also shown in Table 1 is Amaranth with 293 accessions (14.5 %) as next on the list of the highly supplied crops followed by okra with 262 accessions (12.96 %). These two horticultural crops are in the category of the highly distributed crops probably as a result of the collecting Institutions' interest in these crops.

The high request on maize and amaranth in 2010 may be due to the fact that these are among the major staple food in this region, serving as common sources of carbohydrate and vitamins respectively and therefore the need to study them. The low request recorded in 2011 for African yam bean, garden egg and pigeon pea, may be due to underutilization of these crops. Kenaf, Millet, Lima bean and African yam bean were the least supplied crop types in

2012. This may be attributed to their low utilization in the South-west region where the National Gene bank is located.

Table 1. National Genebank seed distribution of assorted crop types for 2010 to 2012

Crop	Seed supplied 2010-2012			Total
	2010	2011	2012	
African yam bean (*Sphenostylis stenocarpa*)	0	3	5	**8**
Amaranth (*Amaranthus* spp)	113	44	136	**293**
Bambara groundnut (*Vigna subterranea*)	36	0	0	**36**
Celocia (*Celocia* spp)	0	0	11	**11**
Jute mallow (*Corchorus olitorius*)	20	29	43	**92**
Cowpea (*Vigna* spp)	10	42	98	**150**
Garden egg (*Solanum* spp)	0	3	34	**37**
Groundnut (*Arachis hypogea*)	47	30	14	**91**
Kenaf (*Hibiscus cannabinus*)	0	0	2	**2**
Lima bean (*Phaseolus lunatus*)	0	0	3	**3**
Maize (*Zea mays*)	145	39	22	**206**
Melon (*Cucumis melo*)	20	34	30	**84**
Millet (*Pennisetum typhoides*)	0	7	2	**9**
Okra (*Abelmoschus* spp)	100	66	96	**262**
Pepper (*Capsicum* spp)	40	31	25	**96**
Pigeon Pea (*Cajanus cajan*)	3	3	0	**6**
Pumpkin (*Cucurbita* spp)	11	0	0	**11**
Rice (*Oryza* spp)	0	18	0	**18**
Sesame (*Sesamum* spp)	5	6	42	**53**
Sorghum (*Sorghum bicolor*)	36	165	178	**379**
Soyabean (*Glycine max*)	6	5	20	**31**
Tomato (*Solanum lycopersicon*)	52	30	56	**138**
Wheat (*Hordum vulgare*)	5	0	0	**5**
Total	**649**	**555**	**817**	**2021**

Conclusions

Paucity of fund has been one of the major constraints limiting germplasm utilization in Nigeria National gene bank. It has made it impossible to adequately characterize and/or evaluate all available germplasm. This has resulted in scarcity of published information on economic traits of various orthodox materials in NACGRAB gene bank. Exiguous use of germplasm has been observed in breeding programs as mainly due to lack of information on economic traits and no passable method of exchanging data [2, 8, 13, 14]. Also fund was recognised as the greatest tool for effective management of gene banks [14, 15]. Indications show that credits are seldom given to germplasm providing institutions and this has resulted in poor relationship between the donor and the users [2]. Khoury and colleagues suggested that there should be acknowledgement of germplasm provider (benefit sharing) by the users [14] to enhance relationship and improve cooperation [16]. The Centre however, through its institutional mandate to register and release new varieties has formulated and enact benefit–sharing policies that would encourage collaboration among stakeholders.

Other efforts to be implemented in the improvement of utilization of gene bank material in Nigeria include: Organization of vibrant branding campaign and public awareness programmes in order to sensitize the populace on germplasm utilization; improvement in networking and relationship with different users in order to pivot some of the exploration activities based on their needs; and collaboration with other stakeholders to undertake evaluation in order to reduce cost. Moreover, the Centre's schedule that allows for the identification of genetic materials of distinct traits to aid research and encourage users should be expanded and robustly funded.

Conclusively, greater funding and more capacity building by the government, corporate bodies and other stakeholders would help increase the accessibility of germplasm management and penetration of utilization efforts of this gene bank.

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Abbreviations for Institutions mentioned in the paper

UI	University of Ibadan
UNILAG	University of Lagos.
FUNAAB	Federal University of Agriculture, Abeokuta.
UNILORIN	University of Ilorin.
UNIBEN	University of Benin.
UNN	University of Nigeria Nsukka.
OAU	Obafemi Awolowo University, Ife.
OSU	Osun State University, Osogbo.
AAUO	Adekunle Ajasin University, Ondo.
IAR & T	Institute of Agriculture Research & Training.
LAUTECH	Ladoke Akintola University of Technology, Ogbomoso.
BABCOCK	Babcock University, Ilishan.
NACGRAB	National Centre for Genetic Resources& Biotechnology
BELL	The Bell University, Ota.
LASU	Lagos State University Ojo.
NIHORT	National Horticultural Research Institute, Ibadan.
UDUS	Usman Dan Fodio University Sokoto.
UNIPORT	University of Port Harcourt.
NAQS	Nigeria Agricultural Quarantine Services, Ibadan.
FCA	Federal College of Agriculture.
OSADP	Osun State Agricultural Development Program.
NISLT	National Institute of Science Laboratory Technology
FUTA	Federal University of Technology,Akure.
OOU	Olabisi Onabanjo University, Ago-Iwoye.
LASPOLY	Lagos State Polytechnic, Isolo.
RSUST	Rivers State University of Science & Technology.