



Project annual report CNRA

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*AfricaYam Annual Progress Review -
Technical Advisory Committee and Work Planning Meeting*

15 - 17 September, Abuja, Nigeria

Outline

1. Primary Outcome 1. Enhanced capacity for more efficient and effective yam breeding programs in Ghana, Nigeria, Benin, Côte d'Ivoire and IITA.
2. Primary Outcome 3. Next-generation of superior yam varieties for traditional and emerging products/markets.

Outcome 1: Primary Outcome 1. Enhanced capacity for more efficient and effective yam breeding programs in Ghana, Nigeria, Benin, Côte d'Ivoire and IITA.

Activity 1.1. Training course held for researchers and technicians

- Two (2) participants (M. Kobenan N'Da Fabrice, technician, and Dr Diby N'nan Syvie, Food scientist) from CNRA attended the training organised in November 2021 at Cotonou, Benin.

Activity 1.2. Conference /workshop attended, or international breeding company visited

- AfricaYam Project progress report by CNRA 2020
- Product advancement & refinement meeting 2021

Outcome 1: Primary Outcome 1. Enhanced capacity for more efficient and effective yam breeding programs in Ghana, Nigeria, Benin, Côte d'Ivoire and IITA.

Activity 1.3. Status of Installation and use of SAH infrastructure in national programs

- The SAH equipments were installed the 30 November to 10 December, 2021 by M. Pelemo OLUGBOYEGA of IITA. He trained 10 scientists, students and technicians.
- 14 varieties were multiplied: TDa11/00316, TDa11/00201, TDr89/02665, PLDahomey, C20XTDr00/00380, C18, TDr01/00406, R3, Taba (improved varieties) and N'za, Krengle, Pahinté, Kponan, Kangba, Trela (popular landraces).

Outcome 1: Primary Outcome 1. Enhanced capacity for more efficient and effective yam breeding programs in Ghana, Nigeria, Benin, Côte d'Ivoire and IITA.

Activity 1.7 Exchange visits for staff of yam breeding programs in Ghana, Benin, Cote d'Ivoire and Nigeria during the year.

- Dr Agre from IITA, Ibadan visited CNRA Bouaké and Abidjan 14 to 16 October 2021.
- Dr Kouakou Amani Michel participated to the national workshop of the YAMSYS project leaded by Centre Suisse de Recherche Scientifique, 16 and 17 November 2021 at Yamoussokro, Côte d'Ivoire.

Activity 1.8. Webinar attended under YCoP.

- AfricaYam Project progress report by CNRA 2020
- Product advancement & refinement meeting 2021

Outcome 1: Primary Outcome 1. Enhanced capacity for more efficient and effective yam breeding programs in Ghana, Nigeria, Benin, Côte d'Ivoire and IITA.

Activity 1.4. Status of yam barns, screen houses built or upgraded

- The existing yam barn is still functional, but a new one is necessary to store all the clones

Activity 1.5. Status of equipment such as tablets, barcode scanners and printers, and pollination materials provided in each national program.

- 11 tablets were acquired and used by technicians to improve data collection on the field.

Activity 1.6. Status of the field vehicles, tricycles and motorcycles provided for national programs

- The vehicle was bought in 2015 and is getting old. 2 motorcycles and 1 tricycle bought in 2020 are in good state.

Outcome 1: Primary Outcome 3. Next-generation of superior yam varieties for traditional and emerging products/markets.

Activity 3.1 Report on survey to document farmer's and consumers trait preferences and demand for improved yam per NARS partners

- The survey started in September 2021. It took place in two regions with high yam production. The Gbêkê region in the Centre and the Gontougo region in the East. A total of 52 people were interviewed in Gbêkê and 98 in Gontougo.
- The data collected includes socio-economic informations on participants, information on yam farmers' preferences, yam production and seed acquisition, marketing and risk perception, and demand for yam seeds.
- In the Gbêkê region, 94.23% of the respondents were men, whereas they were 86.76% in the Gontougo region. The average age of the entire sample is 44 years. The respondents have a very low level of education, only 3.26 years on average, and most of them are heads of household (92%).

Outcome 1: Primary Outcome 3. Next-generation of superior yam varieties for traditional and emerging products/markets.

Activity 3.1 Report on survey to document farmer's and consumers trait preferences and demand for improved yam per NARS partners

In the Gbêkê region,

The first 06 most important choice criteria are:

- plant vigor, Resistance to disease and pests, Tuber yield, Price of seed yam, High rate of sprouting after planting, High field establishment rate

The least important criteria are those related to processing capacity:

- Cooking quality (fast cooking), Fried yam quality (aroma, taste, firmness/mealiness), Tuber flesh color, Boiled yam quality(aroma, taste, firmness, mealiness, color).

***Outcome 1:* Primary Outcome 3. Next-generation of superior yam varieties for traditional and emerging products/markets.**

Activity 3.1 Report on survey to document farmer's and consumers trait preferences and demand for improved yam per NARS partners

In the GONTOUGO region,

The first 7 characteristics of choice are :

- Tuber yield, Cooking quality (fast cooking), Pounded yam quality (taste, aroma, moldability, firmness, color, stretchability), Seed yam Hygiene (tubers clean or not), High germination, Boiled yam quality (aroma, taste, firmness, mealiness, color), Resistance/Tolerance to low soil fertility (grows well in all soil type)

Producers in Gontougo pay much more attention to the quality of pounded or boiled yam in their choice of varieties.

Outcome 1: Primary Outcome 3. Next-generation of superior yam varieties for traditional and emerging products/markets.

Activity 3.2 Report of the popular farmers varieties identified per NARS program.

- Eight (8) major regions of the yam production basin in Côte d'Ivoire with 23 localities, 150 farmers, sellers and consumers were prospected in January and February 2020.
- 57 accessions of *D. rotundata* and 16 accessions *D. alata* were collected and planted on station. Morphological and agronomic traits are scored on them. The same varieties are followed on farm for the same traits.



Outcome 1: Primary Outcome 3. Next-generation of superior yam varieties for traditional and emerging products/markets.

Activity 3.2 Report of the popular farmers varieties identified per NARS program.

- ✓ **Agronomic characteristics** :*Earliness, relative productivity, preferred type of soil, resistance to drought, storage aptitude, susceptibility to diseases and other biotic factors;*
- ✓ **Culinary characteristics** :*Oxidation after peeling, quality of pounded yam, quality of boiled yam, etc.;*

Activity 3.2 Report of the popular farmers varieties identified per NARS program.

Table 1: Agronomic and culinary characteristics of the popular farmers varieties identified per NARS program

Species	Varieties	Regions	Agronomics characteristics				Culinary characteristics			Market value
			Earliness	Yield	Storage	Diseases	Oxidation	Quality of pounded yam	Quality of boiled yam	
<i>D. rotundata</i>	Kponan	North and North-East	Early maturing	Good	Moderate	Tolerant to YMV	Not	Good	Good	High
	Assawa	North and North-East	Early maturing	High	Moderate	Tolerant to YMV	Not	Good	Good	Good
	Krengle	North, North-East and Centre	Early maturing	High	Good	Tolerant to YMV	Not	Good	Good	Good
	Tréla	Centre	Early maturing	High	Good	Tolerant to YMV	Not	Good	Good	High
	Lôgôbère	Centre	Very early maturing	Good	Moderate Mean	Tolerant to YMV	Not	Good	Good	High

Activity 3.2 Report of the popular farmers varieties identified per NARS program.

Table 2: Agronomic and culinary characteristics of the popular farmers varieties identified per NARS program

Species	Varieties	Regions	Agronomics characteristics				Culinary characteristics			Others characteristics
			Earlines	Yield	Storage	Diseases (Anth)	Oxidation	Quality of pounded yam	Quality of boiled yam	
D. Alata	Florido	All areas	Late	High	Good	Tolerant	No	Good	Good	low water requirement/easy to harvest
	C18	Noth, Central, East-central	Late	High	Good	Susceptibility	No	Good	Good	low water requirement/easy to harvest
	Bête-bête	Central, East-central and East	Late	High	Good	Tolerant	No	Good	Good	low water requirement/easy to harvest
	Suidié	Central East-central	Late	High	Good	Tolerant	No	Good	Good	low water requirement/easy to harvest
	N'za	Central, East-central, East	Earlier than the other <i>D. alata</i>	High	Good	Tolerant	No	Good	Good	low water requirement/easy to harvest

Outcome 1: Primary Outcome 3. Next-generation of superior yam varieties for traditional and emerging products/markets.

Activity 3.2 Report of the popular farmers varieties identified per NARS program.

✓ ***Agro-morphologics characteristics of popular yam varieties in Côte d'Ivoire***

For D. alata : 6 varietal groups were found : Florido, C18, Azaguié, Bètè-bètè, Suidié and N'za.

Characteristics : the Bêtê-Bêtê group is very popular and is characterized by the production of large tubers, dense foliage, a high number of branchings on the tuber, long blades, compressed leaves, a dark green color of the blade, long petioles and a cylindrical shape of the tuber.

Outcome 1: Primary Outcome 3. Next-generation of superior yam varieties for traditional and emerging products/markets.

Activity 3.2 Report of the popular farmers varieties identified per NARS program.

✓ **Agro-morphologics characteristics of popular yam varieties in Côte d'Ivoire**

For *D. rotundata* : 12 varietal groups collected : Krenglè, Kponan, Assawa, Logoberè, Tréla, Anader, Kpassadjo, Koudjan, Sopèli, Longbo, Koffi-Kan, Kloungbé

Characteristics : the group that is the most represented on farm is Krengle. This group is characterized by short spines on the stem, a slight variation of the tuber, the presence of dark red spots on the petiole, the presence of bloom, and a low sensitivity to diseases.

Outcome 1: Primary Outcome 3. Next-generation of superior yam varieties for traditional and emerging products/markets.

Activity 3.4 Report on new crossing blocks established, seedling and tuber progenies generated from previous crosses of white yam; crosses made, seedling and tuber progenies harvested for both *D. alata* and *D. rotundata*.

Table 3: Breeding by intraspecific crosses of *D. rotundata* species from 2016 - 2021

Years	<i>D. rotundata</i>		
	Number of pollinated flowers	Number of hybrids retained after selection	Stages of progress
2017	814	129	24 = participatory yield trial
2018	252	53	40 = preliminary yield trial
2019	1209	128	37= G3 preliminary yield trial
2020	124	8	8 = G2 (multiplication)
2021	465 seeds	nursery	nursery

Outcome 1: Primary Outcome 3. Next-generation of superior yam varieties for traditional and emerging products/markets.

Activity 3.3 Report of promising varieties established in SAH system per program

A laboratory has been equipped in December 2021. 6 varieties of *D. alata* (TDa11/00201, Taaba, N'za, C18, TDa11/06316) and 10 of *D. rotundata* (TDr89/02665, TDr95/19273, C20xTDr00380, R3, Krengle, Pahinté, Kangba, Tréla, TDr01/00406 and OP from Dahomey) have been propagated.

Activity 3.4 Report on new crossing blocks established, seedling and tuber progenies generated from previous crosses of white yam; crosses made, seedling and tuber progenies harvested for both *D. alata* and *D. rotundata*.

- 386 hybrids resulting from each year crossing, since 2017 to 2020 are at different breeding stages: 299 clones after the first clonal propagation, 70 clones after preliminary yield evaluation and 17 at advanced yield trial were selected.

Outcome 1: Primary Outcome 3. Next-generation of superior yam varieties for traditional and emerging products/markets.

Activity 3.4 Report on new crossing blocks established, seedling and tuber progenies generated from previous crosses of white yam; crosses made, seedling and tuber progenies harvested for both *D. alata* and *D. rotundata*.

Table 4: Breeding by intraspecific crosses of *D. alata* species from 2016 - 2021

Years	<i>D.alata</i>		
	Number of pollinated flowers	Number of hybrids retained after selection	Stages of progress
2017	96	17	17 = participatory yield trial
2018	0	0	0
2019	264	70	36 = preliminary yield trial
2020	299	48	8 = G2 (multiplication)
2021	432 seeds	Nursery	Nursery

Outcome 1: Primary Outcome 3. Next-generation of superior yam varieties for traditional and emerging products/markets.

Activity 3.5 Report of the elite breeding lines of *D. alata* and *D. rotundata* identified for multi-location testing and validation

Many clones are at different breeding stages (from nursery to advanced yield trials).

- 386 hybrids resulting from each year crossing, since 2017 to 2020 are at different breeding stages: 299 clones after the first clonal propagation, 70 clones after preliminary yield evaluation and 17 at advanced yield trial were selected.

Activity 3.6 Number of botanical seeds of breeding populations collected or shared among partners

No realised

Outcome 1: Primary Outcome 3. Next-generation of superior yam varieties for traditional and emerging products/markets.

Activity 3.7 Report on the sharing, initiation and multiplication of promising advanced clones (14 test clones and one standard variety, and one check) for seed bulking per program for white and water yam.

- 14 Varieties introduced from IITA for regional trial is conducted in four (4) agro-ecological zones :
(Bouaké - Gagnoa - Dimbokro and Bondoukou) with 14 varieties introduced from IITA and two controls, one in each locality.
- These clones were evaluated for tolerance or resistance to viruses and tuber yield in the field on the 4 sites and the dry matter content after harvest

Outcome 1: Primary Outcome 3. Next-generation of superior yam varieties for traditional and emerging products/markets.

Activity 3.7 Report on the sharing, initiation and multiplication of promising advanced clones (14 test clones and one standard variety, and one check) for seed bulking per program for white and water yam.

Table 1. Descriptive statistics of 16 genotypes of *D. alata* in 4 localities

Statistique descriptive	VARIABLES			
	Yield	Dry matter	Virus	Anth
Mean	19,57	27,51	1,11	2,2
Standar diviation	15,09	4,34	0,23	1,02
Minimum	0,8	18	1,06	1
Maximum	55,10	41	2	4
CV %	77,13	15,77	21,45	46,34

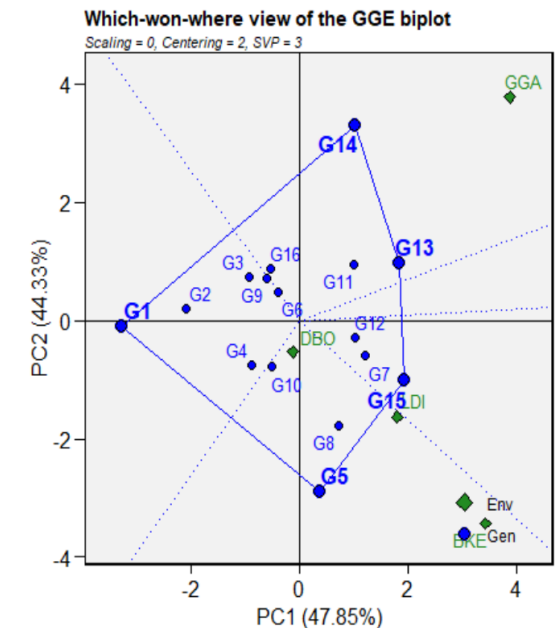
- The average yield of the evaluated genotypes was 19.57 ± 15.9 t/h.
- The average dry matter content was 27.51 ± 4.34 .
- The average severity of viral and fungal attacks was respectively 1 and 2, indicating a relative resistance of the evaluated genotypes.

Outcome 1: Primary Outcome 3. Next-generation of superior yam varieties for traditional and emerging products/markets.

Activity 3.7 Report on the sharing, initiation and multiplication of promising advanced clones (14 test clones and one standard variety, and one check) for seed bulking per program for white and water yam.

- Six out of 16 genotypes gave the highest yields: G1 (Taaba), G15(Tda1520009), G14 (Tda1520008), and G13(Tda1520002) at the top of each polygon have the best yields in the localities

- Thus, genotype G5 (Tda1510010) gave a better yield in Bouaké, Dimbokro and Laoudiba while G13 (Tda1520002) and G14 (Tda1520008) were better in Gagnoa. The G6 genotype (Tda1510043) is the most stable



Outcome 1: Primary Outcome 3. Next-generation of superior yam varieties for traditional and emerging products/markets.

- EFFECT OF LOCALITY, GENOTYPE AND LOCALITY X GENOTYPE ON YIELD, DM, VIRUS AND ANTHRACNOSE

Table 3. Sum of squared means (ANOVA) for variables in 4 locations.

Source de variation	Mean squares				
	DF	Yield	DM	Virus	Anth
Localité	3	4673***	41,45***	0,0003	41,12***
Génotypes	5	87	70,88***	0,14	0,09
Localité X Génotype	45	55	26,81***	0,05	0,05
Résidual	64	68	00	0,04	0,09

- Effect of locality on yield, dry matter content (DMT) and fungal attacks
- Genotype effect on DM
- The genotype x locality interaction was highly significant for this trait, indicating that DM will indeed vary from one locality to another. No genotype x locality interaction for yield stability of genotypes

Outcome 1: Primary Outcome 3. Next-generation of superior yam varieties for traditional and emerging products/markets.

Activity 3.7 Report on the sharing, initiation and multiplication of promising advanced clones (14 test clones and one standard variety, and one check) for seed bulking per program for white and water yam.

Table 1. Descriptive statistics of 16 genotypes of *D. rotundata* in 4 localities

Statistique descriptive	Variables			
	Yield	Dry matter	Virus	Anth
Mean	11,83	30,21	2,15	1,53
Standar diviation	7,90	4,84	0,51	0,61
Minimum	1,4	14	1	1
Maximum	32,5	48	4	3
CV %	66,81	16,03	23,83	0,40

- The average yield of the evaluated genotypes was 11.83 ± 7.90 t/h.
- The average dry matter content was 30.21 ± 4.84 .
- The average severity of viral and fungal attacks was respectively 2 and 1, indicating a relative resistance of the evaluated genotypes.

Outcome 1: Primary Outcome 3. Next-generation of superior yam varieties for traditional and emerging products/markets.

➤ **EFFECT OF LOCALITY, GENOTYPE AND LOCALITY X GENOTYPE ON YIELD, DM, VIRUS AND ANTHRACNOSE**

Table 3. Sum of squared means (ANOVA) for variables in 4 locations.

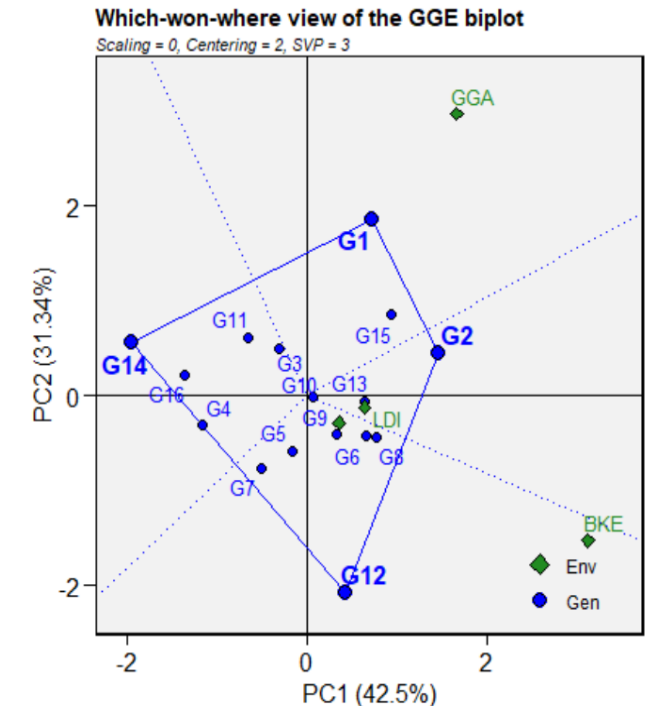
Source de variation	Mean squares				
	DF	Yield	DM	Virus	Anth
Localité	3	2137,5 ***	95,31***	1,005 *	12,17 ***
Génotypes	5	17,6	73,08 ***	0,16	0,1
Localité X Génotype	45	12,1	33,97***	0,26	0,1
Résiduel	64	11,3	1,11	0,25	0,09

- Effect of locality on yield, dry matter content (DMT) and fungal attacks
- Genotype effect on DM
- The genotype x locality interaction was highly significant for this trait, indicating that DM will indeed vary from one locality to another. No genotype x locality interaction for yield: stability of genotypes

Outcome 1: Primary Outcome 3. Next-generation of superior yam varieties for traditional and emerging products/markets.

Activity 3.7 Report on the sharing, initiation and multiplication of promising advanced clones (14 test clones and one standard variety, and one check) for seed bulking per program for white and water yam.

- In Figure 2, genotype G12 (Tdr1440001) had the most unstable yield when G2 (Tdr100021) followed by G15(Tdr1444003), G1(C20) and G14 (Tdr1440035) were respectively the most stable
- the yield of G1 (C20) is higher in Gagnoa, that of G12 (Tdr1440001) in Bouaké and Dimbokro and G2 (Tdr100021) in Laoudiba.



Outcome 1: Primary Outcome 3. Next-generation of superior yam varieties for traditional and emerging products/markets.

Activity 3.8 On-farm testing network established per program with at least 25% female members.

- The training on the tricot approach and ClimMob digital platform was not organized. Nevertheless, On Farm Trial are undertaken with 12 varieties (6 *D. alata* and 6 *D. rotundata*) in a network of 6 farmers out of 40. The availability of seed yam limited the extension to the other farmers. The farmers are located in Bouna and Bondoukou (North East) for *D. alata* and *D. rotundata*, and Mankono and Bouandougou (Center North) for *D. alata*.

Outcome 1: Primary Outcome 3. Next-generation of superior yam varieties for traditional and emerging products/markets.

Activity 3.7 Report on the sharing, initiation and multiplication of promising advanced clones (14 test clones and one standard variety, and one check) for seed bulking per program for white and water yam.

Consumers' preference was accessed

- at Bouaké. Clones TDr14/39018 and TDr14/40035 are stable accross the 4 sites for tuber yield. C20 (chek) gave highier yield (14.14 t/ha)
- at Gagnoa, TDr14/40001 yielded the most (29.17) at Bouaké, TDr14/40035 had highier yield (13.21 t/ha) at Dimbokro and TDr89/02665 with a yield of 10.85 t/ha performed the best at Laoudi Ba (Bondoukou).

Outcome 1: Primary Outcome 3. Next-generation of superior yam varieties for traditional and emerging products/markets.

Activity 3.9 Test clones (at least six) identified – (three alata and three rotundata), planting material or seed yam estimate for on-farm testing determined, and planting material or seed multiplication initiated.

- Five (5) tons of foundation seed of 7 yam varieties were produced (CNRAIGN3, AMADOUO, TABA, Ma01, TDa01/00090, TDa01/00002 and TDr10/00360)

Thanks

