

AfricaYam Annual Progress Review and Work Planning Meeting 2022

2021 progress report and work plan for 2022
CSIR - Savanna Agricultural Research Institute,
Tamale, Ghana



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Primary Outcome 1

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

Conference /workshop attended, or international breeding company visited

- Two team members and a Technical Officer (Food & Nutrition) participated in the Africa Yam/RTB foods training workshop on Yam Quality Evaluation at UAC, Cotonou, Benin from 22nd to 26th November 2021.



Primary outcome 1 cont'd...

- The PI visited the National Crops Resources Research Institute (NaCRRI) and Makerere University, Uganda as part of a study visit to familiarize and monitor the field trials and progress of the Ph.D programme of Mr. Emmanuel Amponsah Adjei, a member of the Africa Yam team from 17 to 23 October 2021.
 - Some yam germplasm given to NACRRI, Uganda
 - Presentation on yam breeding and production in Ghana
 - ideas for future collaboration on the advancement of yam breeding in Uganda
 - Opportunity for joint proposal writing
 - Opportunity for the exchange of research materials
 - Opportunity to introduce Uganda to the Yam Community of Practice (YCoP)





Primary out come 1 cont'd...

- **Status of Installation and use of SAH infrastructure at CSIR - SARI**
- Training on plant establishment and management of SAH in June, 2021
- The SAH will rapidly produce high quality seed yam for early generation testing
- The system has been tested and optimized for tissue culture and plantlets from botanical seeds at CSIR - SARI



Primary outcome 1 cont'd...

- Botanical seeds from crosses and OP established in SAH
- TDrMeccakusa x TDr9501932
- TDr97000917 x Leusi
- SDr1403003 (OP)
- SDr1403020 (OP)

SAH materials	Quantity
Plants in the Lab	2,030
Mini tubers planted in the field	1,920
Plants in the screenhouse	3,163
Total	7,113



Figure : Plants arranged on shelves in the SAH facility



Primary outcome 1 cont'd...



A= Tubers from SAH planted in nursery bags in the screen house and
B= Seedlings transplanted in a box in the screen house

Primary outcome 1 cont'd...



Figure : A= Tubers in SAH container 60 DAP and B: Tubers harvested from the nursery 100 DAP

Primary outcome 1 cont'd ..

- Status of yam barns, screen houses built or upgraded
- A new yam barn was constructed at CSIR SARI in 2020/2021
 - The yam storage facility is currently in use though not 100% completed
 - Consists of :
 - Yam storage area
 - Two store rooms
 - A cold room (not operational yet)
 - An office
- A screen house constructed in Phase 1 was renovated and is in use



Primary outcome 1

- Status of the field vehicles, tricycles and motorcycles provided for national programs
- Acquired in 2020 are in very good condition and in use for field activities
- Toyota Hilux (1)
- Tricycle (1)
- Motorcycle (1)



Insect
picture
of motor
bike
here

Primary Outcome 3

- Next-generation of superior yam varieties for traditional and emerging products/markets
- Report on survey to document farmer's and consumers trait preferences and demand for improved yam per NARS partners
- The survey was conducted in 3 regions in Northern Ghana
 - Savanna Region
 - Upper West Region
 - Northern Region
- 10 major yam producing districts
- 5 major yam growing communities / villages per district
- 4 farmers per community
- 200 farmers
- Soft copy of data submitted for analysis



Primary outcome 3

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*

First clonal generation evaluation of white yam

- 170 genotypes from 12 populations made up the plant materials
- These materials emanated from botanical seeds received from IITA
- Selections from the 2020 seedling nursery showing no or low symptoms of YMV and YAD were advanced to the first clonal evaluation stage for further assessment and selection
- The genotypes were established as family rows on mounds spaced 1.2 x 1.2 meters apart for individual plant assessment



First clonal generation evaluation of white yam

- Average yam mosaic virus severity scores for the test lines ranged from 2 (resistant) to 4 (susceptible)
- 74 genotypes showed resistant reaction to YMV, 89 were moderately resistant while the remaining 7 were susceptible
- 52 genotypes expressed high resistance to YAD, 108 were resistant
- Number of tubers per plant varied from 1 to 7
- Total tuber weight of the genotypes varied from 0.1 kg to 3.6 kg
- Genotypes with tuber yield above 1 kg and YMV severity scores of 2.0 to 3.0 within each family were selected
- This led to the selection 79 (46.5%) out of the 170 genotypes for further assessment in second clonal generation evaluation trial in 2022.



Evaluation of *D. rotundata* clones in preliminary yield trial

- 79 promising clones advanced from previous 2nd clonal generation trial were advanced to the preliminary yield trial stage for further evaluation
- The 79 lines and 2 checks (TDr8902665, Pona) were arranged in a 9 x 9 triple lattice design with three plants per plot
- Genotypic differences among the clones was significant for most of the key traits assessed
- YMV severity scores for the clones ranged from 2 to 3
- Tuber yield varied from 10 t/ha to 20.1 t/ha
- The standard check variety (TDr8902665) recorded a total tuber yield of 8.0 t/ha while the local check (Pona) had 5.7 t/ha
- The standard check ranked 57th for tuber yield, hence outperformed by 56 breeding lines with yield advantages of 0.7 % to 152.4%



Evaluation of *D. rotundata* clones in preliminary yield trial

- Stringent selection could not be carried out as it ought to be at this stage because of severe plucking of leaves of the yam plants by birds at Sambu
- Genotypes that expressed extremely low tuber yield as well as very severe yam mosaic virus disease were eliminated
- The severe leaf loss influenced the disease severity ratings as new leaves were almost always taken away by birds
- Additionally, tuber dry matter content was not assessed due to insufficient quantity of tubers that would also be used as seed for next season planting
- This trial was therefore repeated in 2022 at Nyankpala station



Primary outcome 3

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

Multi – locational evaluation of Advanced white yam clones

- 16 high yielding and disease tolerant lines from the previous PYT were advanced to the MLT stage for further evaluation and selection
- Two checks: Pona (local) and TDr8902665 (standard)
- Evaluated at 2 locations in Northern Ghana (Sambu and Kabache)
 - Evaluated at 2 locations due to insufficient seed yam
- Entries: TDr15042020, TDr15042013, TDr15042014, TDr15042016, TDr15042021, TDr15042043, TDr15042078, TDr15042088, TDr15042110, TDr15042112, TDr15042113, TDr15042132, TDr15042133, TDr15042151, TDr15042157, TDr15042163



Multi-locational evaluation of *D. rotundata* cont'd...



- Significant ($p < 0.05$) genotypic differences was observed for plant vigour, YMV and tuber yield
- Locational effect was significant only for average tuber weight and tuber yield
- G x E was significant for only tuber yield
- YMV scores ranged from 2 to 3
- 11 breeding lines recorded YMV score of 2
- Tuber yield ranged from 11.2 to 35.7 t/ha
- 6 clones outperformed the checks with yield advantages of 8% (1.4 t/ha) to 94% (17.3 t/ha)
- TDr15042021, TDr15042112, TDr15042132, TDr15042157, TDr15042151, TDr15042020

Multi-locational evaluation of *D. rotundata* cont'd...

- The MLT trial is been repeated in 2022 at 3 locations to assess the stability in performance of the clones
- Tuber dry matter content, Oxidation and food quality would also assessed



RVT evaluation of advanced *D. rotundata* clones at three locations in Northern Ghana



- 14 advanced white yam clones from IITA and 2 checks (Pona, TDr8902665)
- Evaluated at 3 locations (Nyankpala, Sambu and Kabache)
- 4 x 4 lattice design, 2 reps of 10 plants per plot
- ANOVA revealed significant genotypic differences among the clones for yield, vigour, YAD, YMV, tuber dry matter content and oxidation
- G x E interaction significant for YAD, YMV, dry matter
- YAD and YMV severity scores for the clones ranged from 2 to 4
- 5 clones exhibited no oxidation 30 minutes after cutting just as “pona” (check)
- 10 breeding lines showed moderate to high oxidation 180 minutes after cutting

RVT *D. rotundata* evaluation cont'd...

- 4 breeding lines (TDr1418006, TDr1414005, TDr1439018 and TDr1443002) showed very slight oxidation 180 minutes after cutting
- Averaged across the 3 locations, tuber dry matter content ranged from 26% (TDr1428017) to 39.9% for Pona (local check)
- Across the 3 test sites, TDr1436015 gave the highest tuber yield of 15.8 t/ha while TDr1443002 recorded the lowest of 7.45 t/ha.
- The standard check, TDr8902665 was surpassed by 10 breeding lines for total tuber yield
- This trial is been repeated this year to ascertain the performance and stability of the genotypes
- Food quality assessment for pounded and boiled yam would be carried out this year



On-farm evaluation of advanced *D. rotundata* clones

- The on-farm mother - baby trial approach was utilized to evaluate 15 white yam clones on farmers' fields
- A mother trial of the 15 clones was established in RCBD with 3 reps
- The baby trials were established on 15 farmers' fields with three genotypes per farmer
- Total tuber yield ranged from 15.69 t/ha for SDr1403032 to 36.17 t/ha for TDr9518544 for the mother trial
- Tuber yield on the farmers' fields was lowest for Labako (check) with 5.5 t/ha while TDr09/00067 was highest with 24.6 t/ha
- Based on the tuber yield, disease tolerance and food quality assessment 5 clones were identified by the farmers to be superior
- TDr8902475, TDr1000344, TDr1000459, SDr1403032 and SDr1403002



On-farm evaluation of advanced *D. rotundata* clones

- These 5 superior clones are currently being multiplied and characterized in preparation for their release soon
- Efforts are also on-going to initiate the materials in tissue culture and subsequently to SAH for rapid multiplication



Variety release

- The NVRRC of Ghana approved 5 yam varieties for release
- These varieties combine high tuber yield with end-user preferred food quality
- SDr1403004 is preferred mainly for its early maturity and superior food quality
- SDr1403003, SDr1403005, and SDr1403074 combine high tuber yield with long shelf-life and good food quality, especially after long storage
- SDr1403031 is high yielding, stores well and produces multiple medium sized tubers that are ideal for the export market

S/N	SARI code	Proposed names
1	SDr1403003	SARI-Nyamenti
2	SDr1403004	SARI-Pona
3	SDr1403005	SARI-Tila
4	SDr1403031	SARI-Fuseinibila
5	SDr1403074	SARI-Olondo



5 varieties approved for release



SN	SARI Code	Value for cultivation and use
1	SDr1403003	Yield: 32.2 t/ha, tolerant to YAD & YMV, DM: 32.6 %, Excellent 'fufu', good boiled yam, long shelf – life
2	SDr1403004	Yield: 23.1 t/ha, tolerant to YAD and YMV, DM: 43.5%, Excellent 'fufu', excellent boiled yam
3	SDr1403005	Yield: 23 t/ha, tolerant to YAD & YMV, DM: 42.4 %, good 'fufu', good boiled yam, long shelf – life
4	SDr1403031	Yield: 30.4 /ha, tolerant to YAD & YMV, DM: 43.4 %, good 'fufu', good boiled yam, multiple medium sized tubers for export market
5	SDr1403074	Yield: 27.3 t/ha, tolerant to YAD & YMV, DM: 41.9 %, good 'fufu', good boiled yam, very long shelf – life

Acknowledgements



Thank you

