SEED YAM QUALITY ASSURANCE

Lava Kumar*, N Maroya, B Aighewi, E Zidafamor, Eric Quaye, P Olusegun Ojo, B Osundahunsi, T Oviasuyi, B Ogunya, O Joshua, O Oresanya, O Oluwole, B Morufat, D Mignouna, R Asiedu & YIIFSWA-II team

*L.kumar@cgiar.org
Outline

1. Development and adoption of QMP-V2
2. Reinfection studies in seed yam plots
3. Assessment of demonstration plots
4. Yam seed tracker and capacity development
5. Conclusions
Conventional yam propagation material (seed)

Formal Standards

ECOWAS Certification Standards for Root and Tuber Plant Seed

C/REG.4/05/2008

Regulations and quality assurance scheme for field propagation of seed yams
New Products

- Tissue culture plants
- SAH Plants
- Micro-tuber
- Mini-tuber
- Vine seedlings
- Vine cuttings
# New seed products and certification standards

<table>
<thead>
<tr>
<th>Production</th>
<th>Technique</th>
<th>Products</th>
<th>Certification standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lab</td>
<td>• TIBS • Vivipak • SAH</td>
<td>• Plantlets • Microtubers</td>
<td>X</td>
</tr>
<tr>
<td>Screenhouse</td>
<td>• Aeroponics • Hydroponics • Single node vine cuttings</td>
<td>• Vine cutting • Vine seedling • Bulbil • Mini-tubers</td>
<td>X</td>
</tr>
<tr>
<td>Nursery</td>
<td>• Vine seedlings (year round)</td>
<td>• Mini-tubers</td>
<td>X</td>
</tr>
<tr>
<td>Field</td>
<td>• Conventional setts &amp; min-setts (BS, FS and CS)</td>
<td>• Mini-tubers • Tubers (setts)</td>
<td>✓</td>
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</tbody>
</table>
Certification Challenges

- Quality standards for field-based seed production
- Inspection procedures based on ware yam crop cycle
- Many certification parameters unsuitable for new propagation methods
- Objective was to establish new procedures for certification of seed yams from new propagation methods
Approach

• Product definition

• Parameters and maximum thresholds for quality influencing parameters for inspection and certification

• Drafts standards and stakeholder consultation

• Provision adoption of standards and drafting formal standards
Yam QMP-V2

9 to 10 October 2018

Nigeria
29 – 30 Aug 2019

Ghana
19-20 Aug 2019
Types of Seed Yam Propagation Materials

Product Definition

- **Seed tuber**: Whole seed yam tuber
- **Sett**: Sliced portion of a tuber of about 100 to 250 g
- **Mini-sett**: Sliced portion of a tuber of 30 to 100 g
- **Single node vine cutting**: Unrooted 1 node vines from aeroponics, SAH, Hydroponics and other methods, used for rooting and plant regeneration
- **Vine seedling**: Rooted plants generated from 1 node cut vines under screenhouse
- **Micro-tuber (<0.5 cm to 1 cm in dia)**: Tubers of *in vitro* plants and TIBS
- **Mini-tuber (<1 cm to 10 cm dia)**: Tubers generated from vivipak, SAH, vine seedlings, aeroponics, hydroponics and bulbil (tuber in leaf axil)
Yam QMP-V2

Certification of seed yams from various methods

**Laboratory Propagation**
- Nucleus seed

**Screenhouse Propagation**
- Breeder Seed

**Field Propagation**
- Foundation seed
- Certified seed

**Conventional Certification**

- BS1 → BS2 → F1 → FS2 → CS1 → CS2 → CS3
## Yam QMP-V2

### Seed standards

<table>
<thead>
<tr>
<th></th>
<th>Nucleus seed</th>
<th>Breeder seed</th>
<th>Foundation seed</th>
<th>Certified seed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Propagation</td>
<td>Lab</td>
<td>Screenhouse</td>
<td>Field</td>
<td>Field</td>
</tr>
<tr>
<td>Certification type</td>
<td>Accreditation</td>
<td>Accreditation</td>
<td>Conventional</td>
<td>Conventional</td>
</tr>
<tr>
<td>Registration</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Source seed verification</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Inspections</td>
<td>Compliance check</td>
<td>Compliance check</td>
<td>3 inspections</td>
<td>3 inspections</td>
</tr>
<tr>
<td>Re-use</td>
<td>Perpetual*</td>
<td>Perpetual (BS1-BS2)</td>
<td>FS1, FS2</td>
<td>CS1, CS2, CS3</td>
</tr>
<tr>
<td>Virus</td>
<td>0</td>
<td>0</td>
<td>5% of ≤2</td>
<td>Mean severity ≤2</td>
</tr>
<tr>
<td>Anthracnose</td>
<td>0</td>
<td>Mean severity ≤2</td>
<td>Mean severity ≤3</td>
<td>Mean severity ≤3</td>
</tr>
<tr>
<td>Nematodes</td>
<td>0</td>
<td>0</td>
<td>Mean severity ≤2</td>
<td>Mean severity ≤2</td>
</tr>
</tbody>
</table>
Revised Nigeria Seed Act (2019)

- Quality assurance of seed produced under lab and screenhouse conditions
- Electronic certification (Seed Tracker)
- 3rd Party Certifiers (decentralized system)
Understanding Reinfection to Protect Seed Yam Production

• White yam varieties are susceptible to Yam mosaic virus (YMV), a persistent threat to yam in West Africa

• Studies conducted to understand reinfection rates to design protection methods
Tuber yield and symptom severity

- Mean for 3 year trials (2016-17, 2017-18, 2018-19)
- **40 to 50% yield loss** in plants with severe mosaic

**Mean fresh tuber weight (kg/plant)**

- Adaka
- Aloshi
- Alumaco
- Ame
- Daribkor
- Ekpe
- Faketa
- Hembakwase
- Lasiri
- Makakusa
- Mean
Reinfection of virus-free seed

Estimating percent reinfection in a season

Assessment
- Symptom severity
- Virus confirmation by RT-PCR / PAS-ELISA
- Semi-quantitative ELISA

Rooted vine cuttings
Virus indexing
Field planting
YMV reinfection studies

2016-17  TDr 95/19177

Feb-17

Mar-17

Apr-17

A

B

C

Virus incidence (%)

start  Dec  Jan  Feb  Mar  Apr

Observations

2016-17

0  0.2  0.4  0.6  0.8  1  1.2
YMV reinfection studies

2018 TDr 95/19177 TDr 89/02665

Jun-18

Aug-18

Oct-2018
YMV reinfection studies

2019 field (TDr95/19177)

Yam fields

Yam field

15 m
70 m
75 m

August, 2019

September, 2019

October, 2019

45
40
35
30
25
20
15
10
5
0

Virus incidence (%)

start(June)

Aug

Sep

Oct

Observation

2019

60 m

58 m
YMV reinfection studies

- Reinfection rate: 2% to 40%
- Mean severity: 2.3
- Least infection during off-season
- Highest infection in yam plots sown downwind of infected fields
- Advice isolation distance and barrier crops
YMV reinfection studies

• Reinfection rate between 2% to 40%
• Mean severity 2.3
• Least infection during off-season
• Highest infection in yam plots sown downwind of infected fields
• Advice isolation distance and fast growing cereals as barrier crops to trap aphids
3. Pest and Disease assessment in Demonstration Plots in Nigeria

- Surveys at ~5 months old plants
- 15 Oct to 15 Nov 2019
- 10 States
- Varieties: Asiedu, Kpamyo, Swaswa and local varieties check
- 11,335 plants assessed on 1 to 5 rating scale
- Virus diagnostics on representative samples per field

Distribution of demonstration plots assessed
Assessment of Demonstration Fields

Incidence (%) per state

- KADUNA
- NIGER
- FCT
- NASSARAWA
- BENUE
- ENUGU
- EBONYI
- ABIA
- OYO
- OGUN

Incidence (%)

- Asiedu
- Kpamyo
- Local check
4. Capacity development in Seed Yam Quality Assurance

- Development of Yam Seed Tracker for seed quality assurance and inventory management
- Improve capacity for virus disease diagnostics and ICT applications for Seed Tracker used and management
YST and Capacity Development

- Organize seed production information
- Enable seed quality monitoring and certification
- Digital integration of seed yam value chain to foster quality seed production for high productivity and profit
- Building on the established capacity at NASC and new development in Ghana
Yam Seed Tracker™

- **Producers**: Registration and seed inventory
- **Regulator**: Seed certification, traceability and seed inventory
- **Buyers**: Access to seed producers
YST and Capacity Development

- Detection & quantification in plant and tubers
- Lab and Field
NACGRAB Diagnostics and phytosanitation

• Workflow assessment
• SOP
• Training in situ
Capacity Development

Upgrading diagnostics and ICT facilities at PPSRD (Ghana) and NASC (Nigeria)

- Needs assessment
- Procurements
- Installation
- Training
NASC
Conclusions

• Revised standards for seed yam certification established and adopted

• Main causes for seed reinfection identified to develop integrated methods to protect seed yam fields

• Pest and disease thresholds in demonstration plots were within acceptable limits for seed certification

• YST developed and being installed at NASC and GSID

• Diagnostics and ICT equipment procured and being installed at NASC and GSID
Acknowledgements

Thanks for your attention

Contact
E-mail: L.kumar@cgiar.org