Enhancing Root, Tuber and Banana Crops’ Contribution to Food and Nutrition Security

Speakers:
- Graham Thiele, CGIAR Research Program on Roots, Tubers, and Bananas
- Margaret McEwan, International Potato Center’s Regional Office for Africa
- James Legg, International Institute of Tropical Agriculture
- Frederick Grant, International Potato Center
- Stephen Walsh, USAID Bureau for Humanitarian Affairs

Moderator:
- Zachary Baquet, USAID Bureau for Resilience and Food Security

Date:
- May 27th, 2021
Stephen Walsh, Senior Technical Advisor, USAID Bureau for Humanitarian Affairs

Stephen Walsh is an agriculture advisor with USAID Bureau for Humanitarian Affairs, formerly Office of Foreign Disaster Assistance (OFDA). He has been privileged to work collaboratively with research and development colleagues at national and local levels to develop and implement, research, and advise on impact-oriented seed systems—for both true seed and vegetative propagated crops—for smallholder farmers in more than a dozen countries in sub-Saharan Africa. His seed system interest areas include how to build more responsive demand-driven seed systems, promoting private sector engagement with an emphasis on small and informal sector actors, and strengthening the analytic tools and capacity of practitioners to better understand and design seed systems interventions.
Graham Thiele, Director, CGIAR Research Program on Roots, Tubers, and Bananas

Graham Thiele is Director of the CGIAR Research Program on Roots, Tubers, and Bananas (RTB) led by the International Potato Center (CIP). He has led the RTB program for the last 10 years, making it an example of collaborative research for development in the CGIAR. Graham is a social scientist and expert in targeting, priority setting, and impact and adoption studies of new agricultural technologies. Previously he was the Leader for Social and Health Sciences at CIP. Graham has worked in Bolivia, Ecuador, Peru, Tanzania, Kenya, Benin, Rwanda, Indonesia, and the Philippines. He helped develop, implement, and assess several, novel participatory methodologies designed to link farmers with markets, inform research agendas, and promote innovation in policies, products, and technology uptake. Graham holds a PhD in Social Anthropology and an MSc in Agricultural Economics.
Margaret McEwan, Senior Scientist, International Potato Center’s Regional Office for Africa

Margaret McEwan is a Senior Scientist at the International Potato Center’s regional office for Africa based in Kenya. A social scientist, Margaret has over 30 years’ experience working in multi-disciplinary teams focused on rural development, farming systems research, household food security and nutrition in Kenya, Uganda, Somalia, North Sudan, Zambia and Mozambique. In research for development contexts she is concerned with how to engage multi-stakeholder partnerships in ensuring improved livelihood and nutrition outcomes, and in understanding the conditions required to up-scale technologies for greater impact. She has a MSc in Human Nutrition and is currently pursuing a PhD at Wageningen University and Research, in the Netherlands, focusing on the social-technical interactions which influence the institutional arrangements for sustainable sweetpotato seed systems.
James Legg is a scientist at the International Institute of Tropical Agriculture, with more than 20 years’ experience of working on plant viruses and their insect vectors. Most of James’ professional career has focused on strengthening understanding of cassava viruses and using that improved understanding to develop and facilitate the promotion of control strategies. In addition to playing a direct active role in research, James has also contributed to strengthening African science capacity through producing training materials, leading training workshops and supervising post-graduate students. James has been based at IITA East Africa hub in Dar es Salaam, Tanzania, for the last seven years, and he has been involved in running several regional R4D projects focused on cassava viruses, their whitefly vectors and the development and implementation of sustainable seed systems. James holds a PhD and MSc from the University of Reading, UK.
Frederick Grant, Public Health Nutrition Epidemiologist, International Potato Center

Frederick Kobina Grant is a Public Health Nutrition epidemiologist at the International Potato Center (CIP) with over 15 years’ experience in implementation of nutrition-sensitive programs in SSA and south Asia. He is currently the CIP Uganda Country Manager and Nutrition Scientist. He leads the CGIAR Research Program on Roots, Tubers, and Bananas (RTB) Cluster on Nutritious Sweetpotato for Expanding Markets and Improving Diets. Previously he worked as Nutrition Specialist and Project Manager, Viable Sweetpotato Technologies for Africa (VISTA-Tanzania) and Project Leader, Mama SASHA Project at CIP. Frederick holds a PhD in Nutrition and Health Sciences from Emory University, and a MPhil in Nutrition, University of Ghana.
Importance of RTB Crops for Food Security

GRAHAM THIELE RTB DIRECTOR • AGRILINKS • MAY 27TH 2021
Roots, Tubers and Bananas Program

working globally to harness untapped potential of RTB crops to improve:

food security, nutrition, income, climate change resilience and gender equity of smallholders
Why Roots, Tubers & Bananas?

- Genetic complexity (> grains)
- Vegetative propagated crops (VPCs) carry pests and diseases, similar seed systems,
- Similar role as staples (potential for biofortification)
- Perishability, bulkiness and post harvest/value chain options
Surging production RTB crops in developing countries!

Source: Scott et al 2020, FAOStat data for developing countries in Africa, Asia and Latin America and the Caribbean
Increasingly in Africa

Changing share of total cropped area in developing countries in Africa

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Banana</td>
<td>30</td>
<td>40</td>
<td>50</td>
</tr>
<tr>
<td>Cassava</td>
<td>50</td>
<td>60</td>
<td>70</td>
</tr>
<tr>
<td>Plantain</td>
<td>80</td>
<td>85</td>
<td>90</td>
</tr>
<tr>
<td>Potato</td>
<td>10</td>
<td>15</td>
<td>20</td>
</tr>
<tr>
<td>Sweetpotato</td>
<td>20</td>
<td>25</td>
<td>30</td>
</tr>
<tr>
<td>Yam</td>
<td>90</td>
<td>95</td>
<td>100</td>
</tr>
</tbody>
</table>
% Contribution of RTB crops to food intake in selected African countries in kilocalories (kcal) per capita (2017)

- DR Congo*
- Ivory Coast
- Ghana
- Nigeria FAOStat
- Rwanda
- Uganda

* = year 2008
Asia and LAC, key role in diversity and resilience

**Figure 1** - Track map of Ompong. Points show 6-h intervals. Colors represent wind speeds (red is max category 5 with speed ≥252km/h). Source: Meow (2018)

**Photo 1** - A field affected by typhoon with broken trees and barely damaged sweet potato plants which still stand green and robust.
RTB golden eggs
Build on uniqueness of crops
Constructed with communities of practice of RTB
Key for One CGIAR and other partners

https://www.rtb.cgiar.org/golden-eggs/
Take home messages

- Roots, tubers and bananas expanding, especially so in Africa
- Especially important to vulnerable and disadvantaged, sometimes called “womens crops”
- Local production & short value chains are resilient in face of disruptions eg COVID-19
- Opportunity to build on RTB golden eggs
- Underinvested compared to potential, urgently need more R&D funding for RTB crops!
Thank you
Tools4SeedSystems: building a better seed future - together

MARGARET MCEWAN • CONNY ALMEKINDERS • JORGE ANDRADE-PIEDRA AND RTB SEED COMMUNITY OF PRACTICE

AGRILINKS WEBINAR, MAY 27, 2021
Why seed systems?

“Whatever touches on the seed system, touches on food security,”

Dr Yemi Akinbamijo, Executive Director, Forum for Agricultural Research in Africa (FARA)

• Ensure that improved varieties with market preferred traits reach all farmers
• Seed carries more than genes....
  • Healthy seed
  • Information
  • Social networks
• New beginnings and hope!

Photo: RTB
Understanding what farmers demand?

- **Varieties** with preferred traits – agronomic & quality
- **Availability** of sufficient quantities
- **At the right time**
- **Accessible** in terms of cost and location
- **Pest and disease free** – healthy for better yields

Mr. Twimanye Makoye at one of his seed production plots. Bukombe district, Tanzania. Photo credit: K. Ogero.
Unique characteristics & challenges

- Low multiplication rates
- Bulky and perishable
- Accumulation of seed borne diseases and pests
- Easy for farmers to multiply – so business case for private sector varies by crop & context
- Importance of informal seed systems for different crops & contexts
The Tool Box

https://tools4seedsystems.org/

Replicable, open-source, and backed by science

Tool users:
- Development practitioners, researchers

Information users:
- Program managers, decision makers

- Description sheet
- User guide (G+)
- Case study
- Tool validation
- Peer-reviewed publication
- Technical support available
Attractive seed sources

• Farmer considerations in choosing sources:
  • Cultivar diversity, quantities available, timing
  • Knowledgeable, trustworthiness, transaction conditions, cost of transport

• Implications for designing seed delivery pathways – gender, scale of production, farmers’ multiple production objectives;

Who are the super-spreaders?

- **Seed Tracing** – *farmer-to-farmer* seed exchange
- Ethiopia – better off “model farmers” distributed more seed of new varieties than resource poor households

- **Seed Tracker** – quantities and **quality of seed** distributed through formal system
- **Impact Network Analysis** – scenario building for system management
  - Characterisation of distribution nodes for targeting dissemination of varieties, or disease surveillance
  - Linkages between **formal and informal seed systems**

---

Garrett et al. 2018, Garrett 2021
Kumar, L. *Seed Tracker: How one app can enhance seed systems for many crops*. ISSD Africa
Where to start: project cycle

1. Multi-stakeholder framework
2. Impact network analysis
3. Seed tracker
4. Integrated seed health approaches and models
5. Seed tracing
6. Small N exploratory case studies
7. Four-square method
8. Means-ends-chains
9. Experimental auctions
10. Seed regulatory framework analysis
11. Sustainable early generation seed business tool
12. Gender analysis tools
Where to start: seed value chain

Toolbox web page: https://tools4seedsystems.org/
Use Tools4SeedSystems

• Design and implement more effective seed interventions

• Join us: training & mentoring in use of tools – July – November 2021
  • Development and humanitarian contexts

Building a better seed future - together
Thank you

CGIAR Trust Fund contributors’:
https://www.cgiar.org/funders/
Monitoring Cassava Diseases Using PlantVillage Nuru

AKA: The POWER of KNOWLEDGE

James Legg, Latifa Mrisho, Neema Mbilinyi, Mathias Ndalahwa, Peter McCloskey, Annalyse Kehs, and David Hughes

Agrilinks Webinar: Enhancing root, tuber and banana crops’ contribution to food and nutrition security – May 27th, 2021
• African No. 1 Crop for Total Production

• Food Staple for 500 million Africans
Cassava Mosaic Disease

Cassava Brown Streak Disease
1. Diseases/Pests devastate cassava crops, particularly in Africa
2. To manage them, we need to monitor them
3. To monitor them, we need diagnostics
4. The most important diagnostic technology in 2021 is?
### Diagnostics – Cassava Viruses

<table>
<thead>
<tr>
<th>Method</th>
<th>Application</th>
<th>Duration</th>
<th>Status for cassava pests</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCR-based methods (conventional and real time)</td>
<td>Mainly-lab based</td>
<td>≤ 1 day</td>
<td>Available for all known pathogens</td>
</tr>
<tr>
<td>Antibody-based methods (ELISA &amp; LFDs)</td>
<td>Lab and field enabled</td>
<td>ELISA: ≤ 1 day, LFD: 10 min</td>
<td>Cassava viruses (CMD and CBSD)</td>
</tr>
<tr>
<td>Isothermal amplification methods (LAMP and RPA)</td>
<td>Lab and field enabled</td>
<td>≤ 60 min</td>
<td>CBSD &amp; CMD*</td>
</tr>
<tr>
<td>NGS (sRNA sequencing)</td>
<td>Lab-based</td>
<td>One week</td>
<td>Identification of new viruses</td>
</tr>
<tr>
<td>Digital PCR</td>
<td>Lab-based</td>
<td>≤ 1 day</td>
<td>Virus quantification</td>
</tr>
</tbody>
</table>
New Tech for a New Disease Detection Paradigm

Unique mobile subscribers
- 456m (2018)
- 623m (2025)
- CAGR 2018–25: 4.6%

Mobile internet users
- 239m (2018)
- 483m (2025)
- CAGR 2018–25: 10.6%

Smartphones
- 39% (2018)
- 66% (2025)
Major Cassava Diseases/Pests in Africa

Cassava Mosaic Disease
Cassava Brown Streak Disease
Healthy
Cassava Mite Damage

Cassava Viruses alone cause losses of > US$ 1 billion annually in Africa
Developing a Smartphone App “NuruAI”

TensorFlow

Plant Village

---

1. Learn more about Best Management Practices.

1. Cassava Mosaic Disease
   What is Cassava Mosaic Disease?
   Cassava mosaic disease, also called CMD, is a disease of cassava caused by cassava mosaic viruses. There are several viruses that cause CMD, but they all produce similar symptoms in cassava plants.

   CMD occurs in all cassava-growing areas of Africa, as well as several countries in Asia. The viruses that cause the disease are spread either when farmers take cuttings from the stems of infected plants, or by an insect vector.

   The vector is a tiny whitefly (just over 1mm long) which lives under the leaves of cassava plants. It spreads viruses a bit like mosquitoes spread malaria. It is a whitefly feeding on an infected plant, and then flies to a healthy plant, it can spread viruses from the infected to the healthy plant. The healthy plant may then become infected.

   What does Cassava Mosaic Disease Look Like?
   The leaves of plants affected by CMD have patches of yellow and green, and they may be twisted or deformed. When the disease is severe the plant is also stunted and does not grow well, infected plants give poor yields. The symptoms of...
Key Features of Nuru AI

• **Powered by:** TensorFlow object recognition
• **Hosted in:** PlantVillage phone app
• **Conditions:** CMD, CBSD, CGM, Healthy
• **Usage:** Offline for disease diagnosis
• **Languages:** English, Swahili, French soon
• **Status:** Being scaled across Africa
• **Rollout:** Rolled out on Google’s PlayStore 2018
You are in camera mode, looking at TensorFlow results.
Nuru vs People

% Accuracy in symptom recognition

- Trained
- Untrained

NURU with 6 leaves

NURU with 1 leaf

% Accuracy in symptom recognition

Researchers

Extension Officers

Farmers
Remote Monitoring of Cassava Diseases

- > 5,000 downloads; > 30,000 reports
- Reports from 20 countries in Africa
- Scaling through WAVE and CGIAR-Inspire Projects
Remote Monitoring of Cassava Diseases

Mkuranga

Tanzania

Dar es Salaam

Cassava Brown Streak Disease
Combining Cassava ICT Tools to Deliver Impact

Cassava Seed Tracker ICT platform
• ICT platform for quality seed delivery
• Facilitating cassava seed entrepreneurs
• Promoting quality through certification
• Providing control solution (clean seed) for major cassava disease constraints

Cassava Seed Tracker Users
Helping farmers identify and control the main cassava disease and pest damage types, linked to SeedTracker, and driving demand for high quality cassava seed.

Facilitating delivery of certified cassava seed of disease-resistant varieties through expanding networks of cassava seed entrepreneurs (CSEs).
Links for Impact

**STEP 1.** Trained Nuru users identify cassava disease

**STEP 2.** Nuru app advises to access clean seed of disease resistant varieties

**STEP 3.** Nuru links to Seed Tracker

**STEP 4.** Seed Tracker provides phone/WhatsApp contacts for CSEs

**STEP 5.** Farmers tackle disease through accessing & planting clean seed
Knowledge is Power

ICT Tools will Deliver...
Acknowledgements

- Farmers & Extension of Mkuranga & Serengeti Districts
- Lava Kumar and IITA Seed Tracker team
- Government of Tanzania and TARI
- CGIAR BigData Platform – funded through a CGIAR-INSPIRE Challenge Award
- Roots, Tubers and Bananas Programme of the CGIAR
The role of biofortified sweetpotato in nutrition humanitarian interventions in fragile environments

MAY 27, 2021

FRED GRANT
Important of CIP/CGIAR work in humanitarian settings

= Making our work count for vulnerable populations

Different pathways = One Food System
Entry point:
Biofortified, orange-fleshed sweetpotato (OFSP)

- Rich in itamin A (beta-carotene >200ppm)
- 125gram = 100% daily Vit A needs of a school aged child
- Other vitamins (B6, C, E) and minerals (Fe, K, Mn)
Biofortified sweetpotato

= Resilience during crisis

- Reliable yields (8-20mt/ha)
- Short duration (3-4 months)
- Drought tolerance

Variety selection
Local seed system
Farmer training

6.9 million households in Africa and South Asia since 2010
Biofortified sweetpotato

= Nutritious food systems

• Fresh roots traded country-wide
  • Among most affordable foods

• Puree (cold chain to shelf stable)
  • Versatile use (school meals, food industry innovations)
  • >95% of nutrients

= Nutrition for all

• Vitamin A and other micronutrients
• Calories
• Easy fit in local diets

Guidelines for household utilization
Healthy Baby Tool Kit (6-23 mo)
As part of healthier diets
Updates of Highlights/ Activities with WFP from Kenya & Uganda

CIP: Biofortification Program

WFP: Sustainable Food Systems Program, Agricultural Market Support Program, Nutrition-sensitive Cash Transfer Program, Sustainable School Meals Program

Activities

• OFSP production at household level in ASAL Counties (Kenya) & drought prone areas (Uganda)
• Established seed system through local seed multipliers linked to NARS
• Strengthened technical capacities (GAP) targeting local seed multipliers and extension officers
• Technical support for maternal, infant and young child nutrition through ToT of frontline health workers
Other nutritious crops and foods

- Biofortified beans (high iron) and maize (Vit A)
- Vegetables (incl. traditional leafy veggies)

Integration
Production
Markets
Processing
Kenya

ASAL Counties:
Baringo, Garissa, Isiolo, Samburu, Tana River, Wajir

Uganda

Region
West Nile
South-Western
Western

Districts
Adjumani, Arua, Moyo, Obongi, Yumbe
Kotido, Moroto
Isingiro
Kamwenge, Kikuube, Kyeggerwa

Refugee Settlements:
Adjumani, Palabek, Kiryandongo, Nakivale, Oruchinga
Establishing sustainable seed systems for OFSP through local multipliers linked to quality foundation material NARS

Sweetpotato crops cultivated at the homes of refugees at Palorinya settlement, Moyo District. Credit: R. Ackatia-Armah.
Healthy Baby Toolkit

Improves young child (6-23 mo) feeding OFSP as part of healthy diets
Guidelines for household utilization

1. A bowl with lines and symbols that cue age-appropriate meal frequency and volume for children at different ages: 6-9 mos., 9-12 mos., 12-23 mos.

2. A slotted spoon to guide optimal thickness/texture of infant foods and complementary foods. If the food does not drip through the holes in the spoon, it is thick enough to ensure sufficient energy and nutrient density.
Highlights on achievements (2020): Kenya & Uganda

>300,000 consumers reached with OFSP through humanitarian programs in Uganda & Kenya

>70,000 HHs in fragile environments provided with clean OFSP planting materials in Uganda and Kenya

>50,000 HHs provided with HBTs and trained on improved MIYCAN
New 2-yr project funded by USAID Bureau of Humanitarian Affairs
• Benefit 36,000 households and at least 50,000 children <5y

• This will be linked with our existing partnership with WFP
• These approaches are aligned
Next steps

• New connections with local food systems
• Link OFSP producers and traders to institutional markets
• Utilize locally/regionally manufactured shelf-stable OFS purees

Looking ahead

• Plan to utilize evolving One-CGIAR regional and programmatic structure
  • Expand this approach to capture a broader range of impactful technologies and innovations
Thank you