Can RTB seed systems learn from each other?

Jorge Andrade, Graham Thiele et al.

Led by

7th Annual SPHI Technical and Steering Committee Meeting
ILRI Campus, Addis Ababa, Ethiopia
8 Oct 2016
Background

• Planting material (seed) RTB crops:
  • Accumulation of diseases leading to degeneration
  • Relatively low multiplication rates
  • Perishability, bulkiness

• Farmer-based seed systems 95+% of planting materials

DRC, Photo by Carl Walsh. Great Lakes Cassava Initiative
Background

• Challenges:
  • *Improve quality & access*
  • *Improve dissemination of new varieties*
  • *Commercially sustainable*

• Analysis gender blind

• Many interventions, little systematic learning

• Can RTB seed systems learn from each other?
Partners
1. Stakeholder framework – seed security

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Availability/supply</th>
<th>Accessibility</th>
<th>Quality, variety (incl. biodiversity)</th>
<th>Health, genetic purity, physiological age &amp; physical quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Policy makers</td>
<td></td>
<td></td>
<td>Allowed the project to continue</td>
<td></td>
</tr>
<tr>
<td>National research</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>International research</td>
<td>IITA &amp; CRS project</td>
<td></td>
<td>Susceptible, commercial varieties</td>
<td>The technology had problems</td>
</tr>
<tr>
<td>Traders (local markets)</td>
<td>Not involved</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Private seed sector</td>
<td>Not involved</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Farmer organizations</td>
<td></td>
<td></td>
<td></td>
<td>Farmers found other ways to get healthy seed</td>
</tr>
<tr>
<td>NGOs</td>
<td>CRS was a key partner</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Private sector processors</td>
<td></td>
<td></td>
<td>Keen market demand for the fruit</td>
<td></td>
</tr>
<tr>
<td>Seed users</td>
<td></td>
<td></td>
<td>May have been little impacted</td>
<td></td>
</tr>
<tr>
<td>Crop and country</td>
<td>Leading institution</td>
<td>Main focus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------------</td>
<td>---------------------</td>
<td>------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Potato, Ecuador</td>
<td>CIP</td>
<td>A local farmers’ organization produces quality declared potato seed for accessing high value markets</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Potato, Peru</td>
<td>CIP</td>
<td>Clean potato seed with funding from a mining company</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Yam, Nigeria</td>
<td>IITA</td>
<td>Researchers improve an on-farm technique for planting more land with less seed yam</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Sweetpotato, Tanzania</td>
<td>CIP</td>
<td>Delivering varieties, producing clean seed off-farm, managing vines on-farm, for nutrition and other outcomes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Sweetpotato, Rwanda</td>
<td>CIP</td>
<td>Similar to case above, with additional pull from a sweetpotato buyer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Potato, Kenya</td>
<td>CIP</td>
<td>Disseminate new varieties and clean seed with rationalized regulations permitting quality declared seed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Cassava, Nicaragua</td>
<td>CIAT</td>
<td>New varieties for cassava awaken government and farmer interest after a lull of several years, in response to demand by agro-industry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Potato, Malawi</td>
<td>CIP</td>
<td>Gender and seed. Men have better access to land and seed, but a new project fails both genders equally</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Cassava, W&amp;C Africa</td>
<td>IITA</td>
<td>Disseminating new, disease-resistant varieties in seven countries</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Banana, East Africa</td>
<td>IITA</td>
<td>Helping to establish nurseries where communities can harden tissue cultured bananas to sell to farmers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Banana, East Africa</td>
<td>Bioversity</td>
<td>A new multiplication technology and training to help farmers manage a new crop disease</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Lessons case studies (13):

Feasability of integrated seed health strategy

Plant resistance 6
On-farm management 11
Get clean seed - certified/QDS 13

Thomas-Sharma et al., 2015
Lessons case studies (13)

• Theory of change: smallholders specialize in producing quality planting materials & become entrepreneurial suppliers
  – Few case studies explicitly estimated farmer demand for clean seed

• Seed systems projects need action-research:
  – formulation of explicit assumptions
  – plan for collecting information

• Seed purchase linked to ware market:
  – esp. if industry demands a new variety
2. Seed degeneration

- Yam, nematodes
- Sweetpotato, SPVD
- Cassava, CMD
- Potato, *Ralstonia*
- Banana, *Xanthomonas*
Risk assessment framework for seed degeneration: integrated seed health strategy for vegetatively-propagated crops

Thomas-Sharma et al., 2016
A risk assessment framework for seed degeneration: Informing an integrated seed health strategy for vegetatively-propagated crops

Thomas-Sharma et al., 2016
Modelling seed degeneration at crop level, starting with potato

Effect of environment, management practices and host genotype on virus incidence in 3 growing seasons in Ecuador

Cv. Superchola

<table>
<thead>
<tr>
<th>Growing season</th>
<th>Random selection</th>
<th>Positive selection</th>
<th>Negative selection</th>
</tr>
</thead>
<tbody>
<tr>
<td>2700 masl</td>
<td><img src="#" alt="Graph" /></td>
<td><img src="#" alt="Graph" /></td>
<td><img src="#" alt="Graph" /></td>
</tr>
<tr>
<td>3000 masl</td>
<td><img src="#" alt="Graph" /></td>
<td><img src="#" alt="Graph" /></td>
<td><img src="#" alt="Graph" /></td>
</tr>
<tr>
<td>3400 masl</td>
<td><img src="#" alt="Graph" /></td>
<td><img src="#" alt="Graph" /></td>
<td><img src="#" alt="Graph" /></td>
</tr>
</tbody>
</table>

Cv. I-Fripapa

<table>
<thead>
<tr>
<th>Growing season</th>
<th>Random selection</th>
<th>Positive selection</th>
<th>Negative selection</th>
</tr>
</thead>
<tbody>
<tr>
<td>2700 masl</td>
<td><img src="#" alt="Graph" /></td>
<td><img src="#" alt="Graph" /></td>
<td><img src="#" alt="Graph" /></td>
</tr>
<tr>
<td>3000 masl</td>
<td><img src="#" alt="Graph" /></td>
<td><img src="#" alt="Graph" /></td>
<td><img src="#" alt="Graph" /></td>
</tr>
<tr>
<td>3400 masl</td>
<td><img src="#" alt="Graph" /></td>
<td><img src="#" alt="Graph" /></td>
<td><img src="#" alt="Graph" /></td>
</tr>
</tbody>
</table>

Kromann et al., in preparation

Buddenhagen et al., in preparation
Sweetpotato degeneration trial Tanzania

Nyasenga

Virus incidence for Kabode in Nyasenga

Kwame and Kreuze
Sweetpotato degeneration trial Tanzania

Root yields in Mwasonge

NT: net tunnel
OP: open field

Kwame and Kreuze
“breeding for this attribute [reversion] will be the best strategy for achieving long-term control of most sweetpotato viruses.”

“emphasizes the need to refocus management efforts in developing countries on improving the health status of seed tubers in the informal system by integrating disease resistance and on-farm management tools with strategic seed replacement.”
3. Impact network analysis (INA)

Platform for evaluating system management strategies (seed systems or integrated pest and disease management)

- Impact **OF** research products
- Impact **ON** spatial ecological processes
- Impact **THROUGH** communication and decision-making networks, and linked biophysical networks
Impact network analysis

Socioeconomic network
(exchange of ideas and money)

Seed production technologies

Integration of socioeconomic and biophysical components
Heterogeneity
Phenotypes
Constraints

Biophysical network
(exchange of seed and potentially pathogens)

Outcome: yield, profit, system resil, etc.

Garrett, in review
Multilayer networks supporting potato seed systems: The CONPAPA case in Ecuador (Nopsa et al. in preparation)
Knowledge management: Community of users
RTB Program Structure

FP1  Enhanced genetic resources

FP2  Productive varieties and quality seed

FP3  Resilient crops

FP4  Nutritious food and added value

FP5  Improved livelihoods at scale

Outcome Orientation
foresight/horizon scanning

Outcome Support
partnership scaling models, client specific and gender-differentiated, customization of RTB technologies

Providing livelihood context
# Flagships and their Clusters of Activities

<table>
<thead>
<tr>
<th>DISCOVERY</th>
<th>DELIVERY</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FP1:</strong> Enhanced genetic resources</td>
<td><strong>FP2:</strong> Productive varieties &amp; quality seed</td>
</tr>
<tr>
<td>DI1.1 Breeding CoP</td>
<td>CC2.1 Quality seeds &amp; access to improved varieties</td>
</tr>
<tr>
<td>DI1.2 Next generation breeding</td>
<td>BA2.2 User preferred banana cultivars/hybrids</td>
</tr>
<tr>
<td>DI1.3 Game changing traits</td>
<td>CA2.3 Added value cassava varieties</td>
</tr>
<tr>
<td>DI1.4 Genetic diversity</td>
<td>PO2.4 Seed potato for Africa</td>
</tr>
<tr>
<td></td>
<td>PO2.5 Potato varieties for Asia</td>
</tr>
<tr>
<td></td>
<td><strong>SW2.6 User preferred sweetpotato varieties</strong></td>
</tr>
<tr>
<td></td>
<td>YA2.7 Quality seed yam</td>
</tr>
</tbody>
</table>

**FP 5: Improved livelihoods at scale**

- **CC5.1** Foresight, impact assessment and co-learning
- **CC5.2** Sustainable intensification and diversification for improved resilience, nutrition and income
- **CC5.3** Gender equitable development and youth employment
- **CC5.4** Scaling RTB agri-food system innovations
Cross Cutting Cluster: Knowledge management

FP2: Productive varieties & quality seed

CC2.1 Quality seeds & access to improved varieties
BA2.2 User preferred banana cultivars/hybrids
CA2.3 Added value cassava varieties
PO2.4 Seed potato for Africa
PO2.5 Potato varieties for Asia
SW2.6 User preferred sweetpotato varieties
YA2.7 Quality seed yam

• Identification of needs
• Validation
• Feedback

• Tools
• Approaches

Evidence-based recommendations to partners
Piggybacking on and adding value to new and existing projects

<table>
<thead>
<tr>
<th>Project</th>
<th>Donor</th>
<th>Phase</th>
<th>Tools being used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potato seed systems in Georgia</td>
<td>ADA</td>
<td>Design</td>
<td>ISHA, MSHF, INA, SDM</td>
</tr>
<tr>
<td>Potato seed systems in India</td>
<td>GIZ</td>
<td>Design</td>
<td>ISHA, MSHF</td>
</tr>
<tr>
<td>Potato seed systems in Guatemala</td>
<td>USAID</td>
<td>Design</td>
<td>ISHA, INA</td>
</tr>
<tr>
<td>PhD thesis in the Andes</td>
<td>McKnight</td>
<td>Design</td>
<td>ISHA, INA, SDM</td>
</tr>
<tr>
<td>PhD thesis in Kenya</td>
<td>WUR, RTB</td>
<td>Design</td>
<td>ISHA, INA, SDM</td>
</tr>
<tr>
<td><strong>Cassava in Nigeria - BASICS</strong></td>
<td><strong>BMGF</strong></td>
<td><strong>Implementation</strong></td>
<td><strong>INA, MSHF</strong></td>
</tr>
<tr>
<td>Sweetpotato in Africa (countries?)</td>
<td>???</td>
<td>Implementation</td>
<td>SDM?</td>
</tr>
<tr>
<td>Cassava in Cambodia and Vietnam</td>
<td>RTB</td>
<td>Implementation</td>
<td>MSHF</td>
</tr>
<tr>
<td>Banana in East Africa</td>
<td>RTB</td>
<td>Implementation</td>
<td>MSHF</td>
</tr>
</tbody>
</table>

ISHA: Integrated seed health approach
MSHF: multi-stakeholder framework
INA: Impact network analysis
SDM: degeneration modelling
Outcomes

- 3+ seed companies selling high quality early generation seed:
  - Processor led multiplication
  - National Program (NRCRI)
- Two seed loops:
  - Processor outgrowers
  - Village seed entrepreneurs
Piggy backing

- Seed network maps
- Control: current seed system
- Interventions:
  - Processors loop (factories)
  - VSE loop (gari)
- Gender differentiated network map
Knowledge management:
Other options
Sweetpotato Seed System Community of Practice

• “Outer membership” 120+ members
• Smaller group 20-30 interacting on a regular basis
• Google discussion groups
• www.sweetpotatoknowledge.org portal
• Face to face meetings
• Learning journeys
Cassava seed tracker

Integrated ‘seed resource’ management software for ‘seed sector’

Users
Producers Researchers Traders
Regulators Extension specialists Logistics/input dealers

Potential official tool for seed registration, inspection and certification

Flexible and customizable to end user needs, other crops, and country seed regulations
Can RTB seed systems learn from each other?
Answer – part 1

- Yes!
- Strong progress in “rulers” for cross crop learning and modelling
- Knowledge Management:
  - RTB cross crop dedicated seed cluster
  - connect with sweetpotato seed system CoP
Answer – part 2

• BUT
• Limitations “ex-post” case studies
  – On-going seed system projects
• Missing rulers:
  – Profitability/willingness to pay
  – Multi-crop seed tracker
Thanks!