Sweetpotato research at the Natural Resources Institute

Andrew Westby (on behalf of colleagues and collaborating organisations and researchers)
History

• NRI has worked on sweet potato for several decades
• Focus is mainly on Africa but also elsewhere
• From farm to fork and almost all aspects of the value chain
• Work in partnership with collaborating organisations and donors
NRI Programme on Root and Tuber Crops in Development

- Programme develops strategies which are economically beneficial, environmentally, culturally and socially appropriate and gender sensitive.
- Over 20 staff with experience and expertise in RTC - in value chain analysis, production, marketing, working with private enterprises, storage, processing, gender, socio-economics, consumer preferences and nutrition.
- Funded by BMGF, Harvestplus, CGIAR and EU, DEFRA, DFID and others.
NRI work involves the whole value chain and includes technical, socio-economic and market inputs. The work is in partnership with many organisations and institutions.

- **VALUE CHAIN**
  - **FARM**
    - Improved resistance to weevils
  - **PROCESSING**
    - Reducing losses of Vitamin A during processing & storage
    - Improved storage systems
    - Better transportation – electronic sweet potato
  - **CONSUMER AND MARKETS**
    - Consumer preferences and behaviour
    - Value Chains and understanding markets

**OUTCOMES**
- Better nutrition and health
- Better markets
- Higher yields
- Reduced pest and disease

**Partnerships worldwide: Donors & collaborators**

**Training and capacity building including early career scientists**
Transport – Electric SP

Farm

Electronic sweet potato

Market

Handling

Humidity Datalogger
Temperature Datalogger
Shock Datalogger

Housing
Sensor measurements and damage to sweet potato

- Is a relationship between sensor and damage
- Can track consignments over long distances
- Reduced sack weight to 100kg in some markets

<table>
<thead>
<tr>
<th>Number of impacts (0.2 to 2 g)</th>
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</thead>
<tbody>
<tr>
<td>1400</td>
</tr>
<tr>
<td>1000</td>
</tr>
<tr>
<td>600</td>
</tr>
<tr>
<td>200</td>
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<td>-200</td>
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<table>
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<tr>
<th>Skinning injury (total score)</th>
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<tbody>
<tr>
<td>160</td>
</tr>
<tr>
<td>140</td>
</tr>
<tr>
<td>120</td>
</tr>
<tr>
<td>100</td>
</tr>
<tr>
<td>80</td>
</tr>
<tr>
<td>60</td>
</tr>
<tr>
<td>40</td>
</tr>
<tr>
<td>20</td>
</tr>
<tr>
<td>0</td>
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</tbody>
</table>

Cultivar
- SPN/0 (main season)
- Polista (main season)
- Polista (low season)
- Total Population
Varietal selection – location and seasonal effects

- New varieties of sweet potato higher yields, better disease resistance, better nutritional and health benefits, etc..
- Tested varieties over range of locations and over two seasons in Tanzania
- Consumers reported wide variation in acceptance by variety, year and location
- Developed models to map acceptance by location and year.
- Can help plant breeders
## Consumer acceptability of orange-fleshed sweet potato in Uganda/Tanzania/Mozambique

<table>
<thead>
<tr>
<th>Question</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are changes in appearance, taste and texture of sweet potato a barrier to consumer acceptance – especially if a primary staple?</td>
<td>Not for most consumers. However, 18% of consumers did not prefer orange to traditional (need alternative sources of vitamin A?)</td>
</tr>
<tr>
<td>Is orange colour an advantage for promoting a bio-fortified crop?</td>
<td>It is an advantage because the trait is visible. Good for branding</td>
</tr>
<tr>
<td>Does acceptance differ between rural and urban locations? What are the behavioural differences?</td>
<td>Yes, acceptance probably differs. Rural consumers have higher acceptance for all type of sweet potato (a staple). Urban consumers more discriminating.</td>
</tr>
</tbody>
</table>
Consumer acceptability of orange-fleshed sweet potato in Uganda/Tanzania

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<th>Result</th>
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<td>Is acceptance related to the provitamin A content?</td>
<td>Only for 23% of consumers tested (orange likers) and only weakly.</td>
</tr>
<tr>
<td>Will consumers pay more for OSP?</td>
<td>Yes if given nutrition information. But amount they would pay varied according to the way the experiment was conducted.</td>
</tr>
</tbody>
</table>
Impacts of processing and storage on provitamin A retention?

- Roots
- Storage
- Drying
- Dried chips
- Preparation
- Dried & stored chips
- Food ready for consumption
Drying

Losses after drying were low (9%). There were no differences between solar and sun dryers.

Storage of OSP chips

Losses highly influenced by storage temperature (and oxygen level)

75% loss after 4 months (ambient temperature 23°C)

No simple technological solution. Control by limiting storage time (e.g. 2 months)
Experiences of OFSP Marketing in Mozambique and Uganda
OFSP Marketing Strategy

Farmers (Market-oriented and selling surplus)

Sweet potato traders (Assemblers and retail)

Consumers (Rural & urban)

NGOs: Facilitate & develop existing SP market links via:
- Farmer marketing training
- Linking producers to traders
- Radio commercials & programmes
- Trader database
- Formation of marketing groups

to:
- Create confidence; increase skills; reduce risk
- Raise awareness; increase profit
- Raise awareness; increase consumption

- Trader training
- Linking traders to producers
- Radio commercials
- Village road signs

- Radio commercials with jingle & programmes
- Promotion events, market signs and murals
Lessons Learned: Generic

• Where marketing linkages made, traders trained and product promotion undertaken possible to create market for OFSP
• Main reason for planting OFSP was household consumption, but important that market exists so can sell surplus
• Traders vital in seeking out trading opportunities and were willing to embrace OFSP if given information about it
• High % of farmers expressed intention to increase OFSP production to take advantage of market opportunities
• >85% of consumers in both countries reported they would purchase OFSP in future
• Marketing not uniform because of different levels of market access
• Advantage to be market led rather than production led
Commercializing Clean Sweetpotato Seed Production in Areas with a Long Dry Season

• Project has had successes with promoting improved white & orange-fleshed varieties, use of fertilizer and compost, use of planting on the flat both for increased vine production and improved irrigation, record keeping and business planning and exploring new markets and new ways of marketing.

• Funded by the Bill and Melinda Gates Foundation
The effect of different rates of NPK fertilizer on the production of vines and profitability

<table>
<thead>
<tr>
<th>Fertilizer rates (kg/ha)</th>
<th>Cost (-/) of fertilizer/ha *</th>
<th>Harvest of vines/plot** (3 cuts)</th>
<th>Incremental vine yield/plot</th>
<th>Incremental vine yield/ha</th>
<th>Value (-/) of additional vines/ha***</th>
<th>Cost (-/) of additional fertilizer</th>
<th>Return on cost of fertilizer</th>
</tr>
</thead>
<tbody>
<tr>
<td>N 0 0 0</td>
<td>0</td>
<td>123 ± 21</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50 25 25</td>
<td>340,000</td>
<td>196 ± 21</td>
<td>73</td>
<td>608,176</td>
<td>10,199,119</td>
<td>340,000</td>
<td>x30</td>
</tr>
<tr>
<td>150 75 75</td>
<td>1,020,000</td>
<td>288 ± 21</td>
<td>92</td>
<td>765,490</td>
<td>12,837,266</td>
<td>680,000</td>
<td>x19</td>
</tr>
<tr>
<td>250 125 125</td>
<td>1,700,000</td>
<td>297 ± 21</td>
<td>9</td>
<td>75,840</td>
<td>1,271,836</td>
<td>680,000</td>
<td>x2</td>
</tr>
</tbody>
</table>

*Cost of 100kg of 20:10:10 NPK fertilizer was 136,000/-Tz

** Values are ± standard error of the mean; plot area harvested was 1.2m²

*** The mean value of 1 vine was estimated to be 16.8/-Tz
Role of mobile phones in vine selling

We are investigating and promoting the role of mobile phones in vine selling:

- The benefits to multipliers in being able to contact their customers
- The benefits to town sellers of being able to order new supplies of vines when they want them and also to be contacted by their customers
- The benefits to transporters of being able to be phoned when transport is needed
- And mobile money helps all of them
The multipliers are starting to have mobile phones.
Town sellers: their banner has a mobile phone number for customers to ring
The town sellers have mobile phones.
Transporter: He of course has a mobile phone
Resistance to sweetpotato weevil

NRI, (Phil Stevenson)

NaCCRI (Gorrettie Ssemakula/Benard Yada/Milton Otema Anyanga)

CIP (Robert Mwanga)

North Carolina State University (Craig Yencho)
Laboratory bioassays

- Farmers report New Kawogo to be resistant.

Laboratory experiments support field data. Therefore resistance is not simply escape as suggested by Stathers et al., 2003.
C16/C18 caffeic acid esters on the surface of different sweetpotato varieties.
Bioassay to evaluate the effect on oviposition and feeding of *Cylas* spp. by hexadecylcaffeic and coumaric acid on root surface.

- Root plugs (1.5cm diam) of susceptible variety Naspot1
- + one ♀ adult
- 50ul of compound (10mg/ml) applied to each well ≡ 0.5mg/cm²

Control root plugs
Feeding and oviposition of *C. puncticollis* on Naspot (susceptible) periderms treated with hexadecylcaffeic acid (0.5mg/cm²)
On going research - Mapping New Kawogo x Beuaregard (NKB)

NKB-Weevil resistance population, 287 progeny (NaCRRI, Uganda) to be screened for chemical differences corresponding to quantitative trait loci (QTLs).

<table>
<thead>
<tr>
<th>Trait</th>
<th>New Kawogo</th>
<th>Beauregard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry matter (%)</td>
<td>30-34</td>
<td>18-20</td>
</tr>
<tr>
<td>Flesh color</td>
<td>White</td>
<td>Orange</td>
</tr>
<tr>
<td>SPVD resistance</td>
<td>Resistant</td>
<td>Susceptible</td>
</tr>
<tr>
<td>Weevil resistance</td>
<td>Resistant</td>
<td>Susceptible</td>
</tr>
</tbody>
</table>

Use trait loci for weevil resistance as a breeding tool to produce resistant varieties with other good agronomic and food quality trait
Conclusions for NRI work

- Diverse range of skills and expertise
- Collaboration with partners vital for our work to work along the value chain. Covering pests, markets, preferences, transport, storage, varietal selection and others.