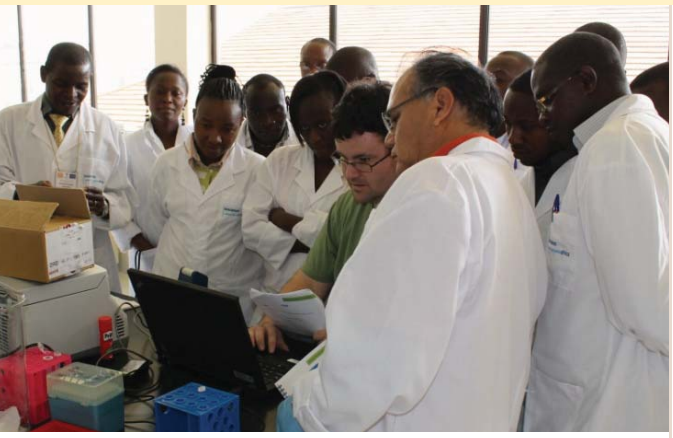
Sweetpotato seed systems:
A question of quantity and quality

SASHA
Sweetpotato Action for Security and Health in Africa

AUG 2013

Thus far, major breakthroughs have been to lower the cost of maintaining disease-free planting material at field level and to help farmers in drought-prone areas produce vines for the beginning of the rains. These achievements may truly help break the bottleneck of timely access to planting material for farmers.



Learning how to use the ClonDiag Array to detect viruses

What is the problem?

Sweetpotato is a vegetatively propagated crop grown in a 4 – 6 month cropping cycle, with each cropping cycle started by planting cuttings. Only breeders use "true" seeds. Crops propagated vegetatively accumulate diseases, such as viruses, through each successive generation which can lead to significant declines in yield. Throughout Sub-Saharan Africa (SSA), most farmers source planting material from their own fields or from neighbors. While some farmers avoid using virus-infected vines, many do not. Moreover, many viruses are symptomless, impeding farmer selection of disease free or "clean" planting material.

In addition to these issues, farmers in areas with prolonged dry seasons often face great difficulties in obtaining the desired amount of cuttings as the vines have dried out. This is currently addressed by maintaining vines in irrigated or swampy areas or by waiting until the rains stimulate the production of shoots from roots left unharvested. However, wet areas are not widespread and are extremely valuable for dry season crop production, so the poor often lack access to them.

Techniques do exist to remove viruses, multiply plantlets *in-vitro* in tissue culture labs, and protect this disease-free foundation material in screen houses. However, this material is relatively expensive; hence the challenge remains to lower the cost of producing clean planting material, prevent re-infection and demonstrate that farmers who utilize such materials reap worthwhile gains.

What do we want to achieve?

We want to achieve a seed system that ensures that growers have ready access to adequate quantities of planting material of the varieties they want, of the quality they need, at the time they are ready to plant and at a reasonable price.

We want to resolve key bottlenecks in the existing system, addressing concerns of both quality and quantity. The whole system, from tissue culture to farmer multiplier must be improved. One major investment is testing whether establishing trained vine multipliers with quality material at the village level is a viable approach for improving access (*see the detailed flyer for Marando Bora*).

In regards to quantity:

- We want to design technologies that farmers can easily adopt.

In regard to quality:

- We want to develop lower cost, more productive techniques for producing disease-free, high quality first generation foundation material and have a much deeper understanding of the diversity of viruses in different agro-ecological zones of SSA.
- We want to develop clear recommendations on how often farmers need to renew their planting material with clean stock. We want to exploit genetic fingerprinting technologies to help us correctly identify which varieties we are truly dealing with.

And, in all of these areas, we want to increase the capacity of SSA virologists, crop management specialists and technicians to conduct research for development in this critical area and maintain disease free foundation stocks.

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Partners include:

- International Potato Center (CIP)
- Natural Resources Institute (NRI)
- Mikocheni Agricultural Research Institute (MARI)
- Kenya Plant Health Inspectorate Service (KEPHIS)
- Lake Zone Agricultural Research and Development Institute (LZARDI)
- Agricultural Research Institute Maruku
- Food and Environment Research Agency (FERA)
- Kenya Agriculture Research Institute (KARI)-Kakamega

Where are we working?

- For field work with farmers, we are working in north-eastern and Central Uganda, the Lake Zone of Tanzania, and in Western Kenya.
- For virus research and germplasm management, we are working closely with the KEPHIS in Kenya, Mikocheni in Tanzania, and host institutions for the Sweetpotato Support Platforms in Uganda, Mozambique, and Ghana.
- And high end diagnostic tools are being developed at CIP headquarters in Peru and at FERA in the UK.

How are we going to make it happen?

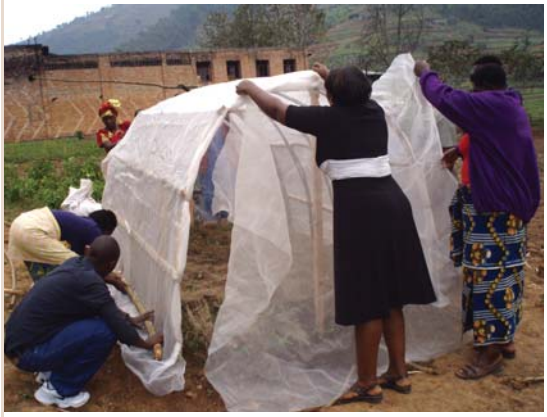
This project began with an investment in understanding existing methods used by farmers to conserve and multiply their planting material. We identified the need for better water management, better protection of foundation planting material, and how to improve upon the existing practice of using sprouting roots as focus areas of research.

For the latter, we emphasize conducting research on-farm to ensure that farmer's needs are addressed. Given the high cost of producing first generation, disease free planting material, we are exploring ways to increase initial output at a lower cost and delay infection.

To improve virus detection methods, we are determining exactly which viruses are present using next generation sequencing technology and developing sensitive yet easy to use diagnostic methods based on a combination of DNA amplification for sensitivity and pregnancy type tests for ease of interpretation of the test result. We are also examining the rates of virus degeneration in improved varieties and landraces to better understand how often material needs to be refreshed.

What have we achieved so far?

- We have made substantial progress in understanding current practice (with published findings) and addressing the need for planting material in areas with prolonged drought.
- We have validated that poorer, women farmers can store roots for several months in containers of dry sand kept in a dry, cool place. Dubbed the Triple S method (Storage in Sand and Sprouting), the roots are then planted out 6 to 8 weeks before the expected arrival of the rains, in a fenced garden. With this system, at least 40 cuttings can be generated per root. A brochure is available on the Sweetpotato Knowledge Portal and findings are published. The method is being further tested in other projects in Uganda, Malawi, and Zambia.
- We clearly demonstrated that small net tunnels can successfully exclude insects spreading virus in the field at a reasonable cost and there are substantial yield gains (30-50% higher) from using vines protected in these tunnels compared to those outside the tunnel. Now, the net tunnels are being tested with farmer multipliers in Rwanda, testing whether the use of tunnels can help drive market demand for virus-free planting material. The brochure is on the Knowledge Portal.
- Results from Tanzania demonstrated that it is possible to implement a community based sweetpotato Quality Declared Plant Inspection Scheme; however the feasibility of meeting the FAO tolerance levels will vary by variety, agro-ecology and management practice.
- Virus degeneration research findings reinforced the importance of breeding for virus resistance to obtain varieties that can withstand virus pressure at least for several years.
- Tremendous progress has been made in training national virologists and technicians in virus identification and indexing in Kenya, Mozambique, Ethiopia, and Ghana and virus survey results from Mozambique and Ghana are now available.
- We have identified and validated the five most informative simple sequence repeat markers capable of confirming whether two genotypes of African germplasm are the same.
- Progress towards developing novel diagnostic methods for sweetpotato-virus detection continues to be made and 17 African scientists were trained in these new techniques in January 2012. The third iteration of the ClonDiag array is now ready and undergoing further testing.
- Using deep sequencing technology, sequences have been determined for several new sweetpotato viruses.



Farmers group constructing net tunnel in Rwanda (credit K. Sindi)

Testing whether SmartPhones can be used in Virus Detection

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