Sweetpotato seed systems:
A question of quantity and quality

SASHA
Sweetpotato Action for Security and Health in Africa

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Training on virus indexing at KEPHIS led by Segundo Fuentes -CIP virologist

What is the problem?

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

In SSA, the same variety is called different names in different places, complicating management. In addition, farmers in areas with prolonged dry seasons often face great difficulties in obtaining the desired amount of cuttings because the vines have been desiccated. 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. But wet areas are often not widespread and are extremely valuable for dry season production of other crops, so the poor often lack access. Also roots only sprout when the rains come and so adequate supply of vines is delayed by several weeks.

Techniques do exist to remove viruses, multiply plantlets in-vitro in tissue culture labs, and protect this disease-free foundation material in screen houses. This material is relatively expensive; hence the challenge remains to lower the cost of producing clean planting material, prevent its 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 quality and quantity concerns. A 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). On the quantity side, we want to come up with technologies that farmers can easily adopt.

On the quality side, 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. Some varieties seem to get infected only slowly and may even revert to healthy status. To do all this we need novel diagnostic techniques. We want to exploit genetic fingerprinting technologies to help us correctly identify which varieties we are truly dealing with. 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.

CENTRO INTERNACIONAL DE LA PAPA
CIP

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

Researchers demonstrate how to layer roots in a bucket of sand for storage (credit R Gibson)

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 Platform in Uganda, Mozambique, and Ghana. 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?

First, we invested 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 last, 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 in different sub-regions of Africa 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 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. As regards to improving vine quality, initial tests with netting to exclude vectors in the field and with hydroponic production in protected screen houses show that it is possible to maintain planting material as virus free. What is needed is to establish the demand for and potential commercial viability of virus-free planting material.

Net tunnels protecting vines from virus in Western Kenya (credit S. Agili)

Tremendous progress has been made in training national virologists and technicians in virus identification and indexing in Kenya, Mozambique, and Ghana. Virus survey results from Mozambique 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 a suite of novel diagnostic methods for sweetpotato-virus detection continues to be made. Using deep sequencing technology, sequences have been determined for 4 new sweetpotato viruses.

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