Can Farmer Multipliers Successfully Manage Net Tunnels?

SASHA Sweetpotato Action for Security and Health in Africa

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Farmer groups with designated leaders charged to maintain vine conservation (net) tunnels near their own homes on behalf of the group were best able to maintain the tunnel itself and vine quality during two years. Tunnels managed by youth groups or located near water distant from a member's home and collectively managed by a group were least able.

Conservation tunnels (one per variety) can be seen from the road; often attracting attention of passerbys (credit K. Sindi)

What was the problem?

Sweetpotato is primarily propagated from foliar cuttings. In Rwanda, the main form of vine dissemination is farmers exchanging vines among themselves. The country has a bimodal rainfall and the crop is grown throughout the year. Therefore, planting material (vines) can easily be obtained from existing mature crops. The fact that sweetpotato grows throughout the year increases the buildup of sweetpotato viruses in the seed system. This can lead to lower yields over time. However, getting disease-free, renewed planting material into the system to flush out the diseased material is not easy.

So called "clean" seed is preserved in a tissue culture laboratory or screen house at research stations and they typically do not maintain large amounts unless there is project funding to do so. In addition, private sector participation in sweetpotato seed is limited, as vines are easy to share among farmers. One potential contribution to solving this problem is to improve the quality of the planting material distributed to the farmers coupled with a simultaneous improvement of the smallholder multiplier's ability to keep maintain disease-free planting materials for an extended period. That requires building a seed system where research institute builds up enough stock of the required varieties, assuring they are virus-free and then multiplying them under protected conditions. This typically involves having tissue culture capacity at the research institute to produce clean plantlets. Sweetpotato plantlets are then hardened in a greenhouse or screen house before being multiplied in a primary multiplication plot or in the screen house itself. This clean basic seed is disseminated to decentralized multipliers for secondary multiplication.

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Key Partners

- Rwanda Agricultural Board (RAB)
- Catholic Relief Services (CRS) Rwanda
- IMBARAGA
- Young Women Christian Association (YWCA)

Agronomist Jean-Claude instruction farmers on how to construct the vine conservation tunnel (credit K. Sindi)

A good sweetpotato seed system requires developing capacity to deliver clean planting material to secondary multiplication plots near farmers' fields or markets due to the perishability of the vines. Many research sub-stations do not have screen houses, meaning disease-free material might have to be supplied by a distant, central source. To get more so-called primary multiplication sites with disease-free foundation material, CIP and KARI scientists developed and tested the use of net tunnels at Kenya Agriculture Research Institute's sub-station in Kakamega—a spot renowned for high virus pressure. The net tunnel is a structure 3 m long X 1.8 m wide, covered with the same quality netting used on a screen house. The tunnel is completely closed, and only opened when vines are cut. At the station, it was tested for 33 months and was able to keep material in the tunnel with little to no virus infection.

Clearly, if trained farmer multipliers could maintain clean materials in vine conservation tunnels, they would not have to return frequently to the research station to renew their basic stocks. Tunnels, however, require management and the key question is whether trained multipliers can succeed in successfully producing quality foundation material using net tunnels and use that material to maintain the quality of vines produced for themselves and others. Then the farmers would have easy access to the high quality planting materials.

What did we set out to achieve?

The SASHA project developed a system of Decentralized Vine Multipliers (DVMs). These are individual farmers or farmer groups in the community that have access to water and are willing to multiply sweetpotato vines to distribute to the community. However, even with the development of the secondary multiplication plots through DVMs, virus easily infects the seed because it is difficult to isolate the plots in a smallholder farmer setting. In most cases, good quality seed can only last a few seasons before it degenerates due to increase in viral load in planting materials produced because of free movement of insects and pests in the multiplication plots and the surrounding fields.

The project set out to have a seed system that will deliver clean basic seed planting material to farmers' groups for multiplication. The multiplied material was supplied to other farmers with a guaranteed low viral load. To maintain superiority of sweetpotato varieties distributed to the farmers, the clean vines have to be kept isolated from insects and pests using vine conservation tunnels. The questions we set out to investigate were:

a. Is it possible for farmers to construct vine conservation net tunnels that isolate the clean vines from pests at a reasonable cost?

b. How long can the farmers maintain the vine conservation structures in reasonable condition?

c. How many cuttings will a net tunnel produce from the initial stock of vines in the tunnels before they need replacement?

d. What will be the viral load of the material in the tunnels over an extended period of time?

Where did we work?

The project worked in four districts in Rwanda: Rulindo, Gakenke, Muhanga, and Kamonyi.

How did we implement?

The project trained 40 representatives from farmer's groups in building vine conservation tunnels. Twenty farmer groups and the private sector partner (SINA Enterprises) were provided with anti-aphid netting to construct the tunnels and training on construction. The group members contributed all the labor and other material inputs and by doing so, felt responsible for the tunnels. Sizes of the bed were 1.8 m x 3 m, with a spacing of 10 cm between plants and maintaining a 20 cm distance between rows (9 rows by 30 plants per row) to achieve a plant population of 270. For weed control, farmers used mulching material spread before planting on prepared beds. Mulching ensured that the beds do not become dry, especially during the first five days after planting. Most of the farmer groups practice good

sanitation including removal of weeds around the beds because weeds serve as a host for the pests. The tunnels were irrigated two times a day (early morning and late afternoon) with a watering can without opening the tunnel (pouring from the top through the net). Farmers were taught how to optimize vine production in the tunnels by utilizing organic manure and correctly fertilizing them after opening and spraying against insects and pests after opening before closing them again.

What did we achieve?

On average, after 1.5-2 months, the tunnels produced about 1,192 vines (each 30 cm long) per harvest. Comparing the two provinces, the Southern produces more vines per harvesting of the tunnel—1,204 in the South and 1,095 in the North. The production in the tunnels of the private sector operator, SINA Enterprises, was higher on average than the farmer groups at 1,253 cuttings.

Varietal differences in production per tunnel harvest exist. Vita has the highest production with an average of 1,436 followed by Gihingamukungu with 1,197, then Kabode with 1,141, Cacearpedo with 1,141 and the last being Ukerewe with 998.

Out of 18 tunnels constructed and multiplication vines established in September 2012, one tunnel got destroyed, nine need the vines to be replaced because they have either been infected by viruses or are not producing good vines, and eight are still in good condition, showing good vine vigor. Nineteen additional tunnels were planted between March and November 2013 and all these tunnels are in good condition, with healthy looking vines. In general, all the farmers have been able to keep tunnels in good condition for at least one year and vines looking healthy for the same period. Though 95% of the tunnels around two years old are in good condition only 50% of them have healthy looking vines. Groups consisting of farmers whose sole purpose is agricultural activities were better at keeping the tunnels in good condition and maintaining the vines from being infected by viruses than groups engaged in a range of activities. It was also clear that youth groups were not able to maintain the vines or tunnels in good condition.

Most groups practice the 1-2-3 approach of vine multiplication. That is, for the first stage (1) they produce clean planting material in the tunnels. For the second stage (2), they cut the materials from the tunnels and plant in non-protected secondary multiplication plots. It is from these plots that they take vines to plant for root production on larger plots (stage 3). So far, we have not compared the total root production from the material grown using this approach to multiplication approaches without tunnels involved. The presence of the tunnels in the rural areas with sweetpotato vines is a novel thing and they have raised the awareness of the need for farmers to use clean planting material at planting. However, we are yet to determine if using tunnels has increased the demand for clean planting materials from the groups because overall demand for OFSP vines is so much higher than the current supply in all project areas whether or not tunnels are involved.

Vine growth thrives within the slightly warmer coide (credit J. Low)

Conservation tunnels enable trained farmer multipliers to protect foundation planting material from insects (credit K. Sindi)

Planting material is watered from the outside without opening the tunnel (credit K. Sindi)

Some lessons learnt during implementation include the need to construct tunnels near a home for easy supervision. Initially people are very curious to see sweetpotato in them and some cut small openings just to see what is inside, enabling insects and pests enter and spread disease. Tunnel management can be grouped into four categories. The first category is the tunnels constructed by the groups selecting a natural leader(s) to maintain and manage them on behalf of the group. Generally these are near or at the home of the chosen leader. These tunnels, all lasting beyond two years, are the best maintained in terms of the structural integrity, agronomic practices and the longevity of healthy vines within. The second category consists of tunnels near a member's home or near a water source that are managed collectively by the group members. These are average in maintenance, structural integrity and the quality of the vines. The third category are groups that have tunnels far away from any home and are monitored and managed collectively by the group members. These tunnels are usually poorly maintained and the vine quality is poor. The fourth category is for privately constructed tunnels managed by an individual. These tunnels have the highest production and are well maintained. However, most of these have been in production for only one year, so we cannot conclude yet as to whether they are able to keep clean planting material in the tunnels at least two years before showing virus infection symptoms.

Next Steps

Under SASHA Phase 2 and the SUSTAIN project, support to the groups with tunnels will continue. Leaf samples from the tunnels will be sent to the lab to determine whether key viruses are present. Farmers will be encouraged to expand their secondary multiplication plots and use material from these plots for their own sweetpotato root production and sales to neighbors and other villages to ensure self-sustainability.

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