Assessing Virus Degeneration of Clean Sweetpotato Planting Material maintained in Net Tunnels under Farmer-management in the Lake Zone, Tanzania

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Introduction

Sweetpotato production at the Lake Zone, Tanzania, is hampered by high virus incidences. Sweet potato virus disease (SPVD) caused by synergistic interaction between *Sweet potato feathery mottle virus (SPFMV)* and *Sweet potato chlorotic stunt virus (SPCSV)* can cause up to 98% yield losses and is difficult to control. Being vegetatively propagated, the crop accumulates viruses with each generation. Propagation through cuttings leads to a build up of virus infection over generations. Multiplication of virus-free planting material sourced from virus-indexed tissue culture (TC) plantlets may contribute to improving the situation. However, farmers face a challenge in maintaining the disease-free status after the material leaves the tissue culture laboratory. Low cost insect-proof net tunnels can be used to protect the vines from attack by white flies and aphids which are the disease vectors. However, the number of generations the material in the net tunnels can stay virus-free under farmer-management is unknown. The aim of this research was to determine how long net tunnels can be utilized to produce clean planting material under farmer-multiplier management.

Materials and Methods

This research was conducted at two locations: Mwasonge (high virus pressure area) and Nyasenga (low virus pressure area) villages, Lake Zone, Tanzania. The high virus pressure site was an area where sweetpotato was intensely cultivated whereas the low virus pressure site had minimal sweetpotato production. Two net tunnels and two open beds were established in each area in farmer multipliers' fields. Then Virus-indexed TC derived planting material of two sweetpotato varieties, Kabode and Polista, were planted at a spacing of 10cm by 20cm. Vine harvesting was done after every 60–80 days and vine yields determined. Leaf samples were collected simultaneously and screened for begomovirus, potyviruses and SPCSV using polymerase chain reaction (PCR), reverse transcriptase PCR (RT-PCR) and quantitative real time PCR respectively. Weather conditions and presence of virus vectors were also monitored. Due to the small land size common with smallholder farmers in sub-Saharan Africa the number of replications was limited.

Photos 1 & 2: Clean planting material multiplied in a net tunnel (1) and virus-infected material in a farmer's field (2). Mwanza, Tanzania. Photo credit: K'Ogero

Results

The number of vines harvested decreased through generations for the different sites and varieties for both net tunnels and open fields (figure 1). However, this was only significant for Kabode variety in Nyasenga, the low virus pressure area (p-value 0.0160).

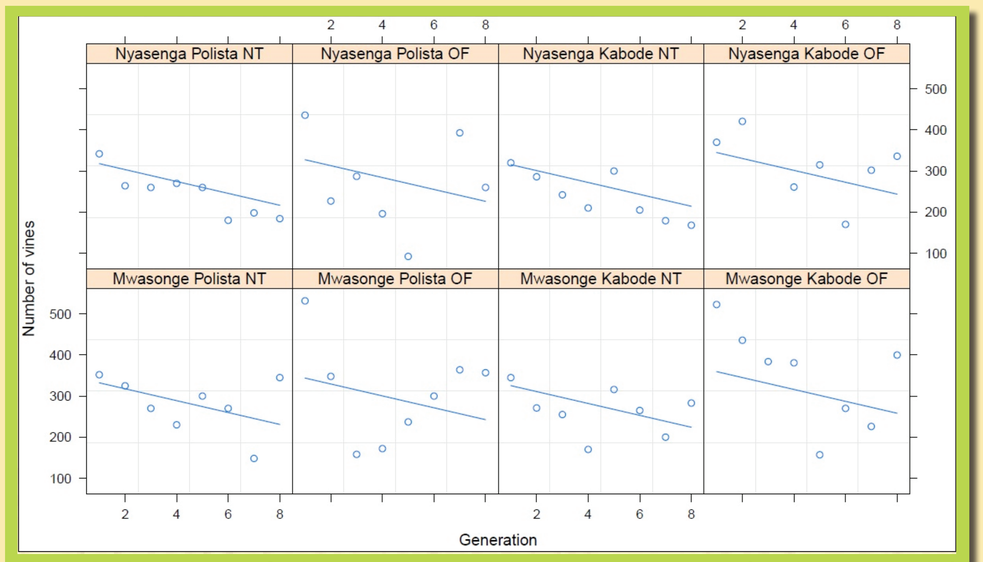

Fig. 1: Number of vines produced by sweetpotato planting material multiplied in net tunnels compared with that multiplied in open field over eight generations

- All samples from the first 5 generations tested negative for all viruses.
- 6th, 7th and 8th generations had samples that were infected with SPFMV, SPCSV and SPVD (Fig. 2).
- The open field vines had more infected samples compared to net tunnel material.
- The net tunnel material that tested positive for viruses were only from the high virus pressure site, Mwasonge.

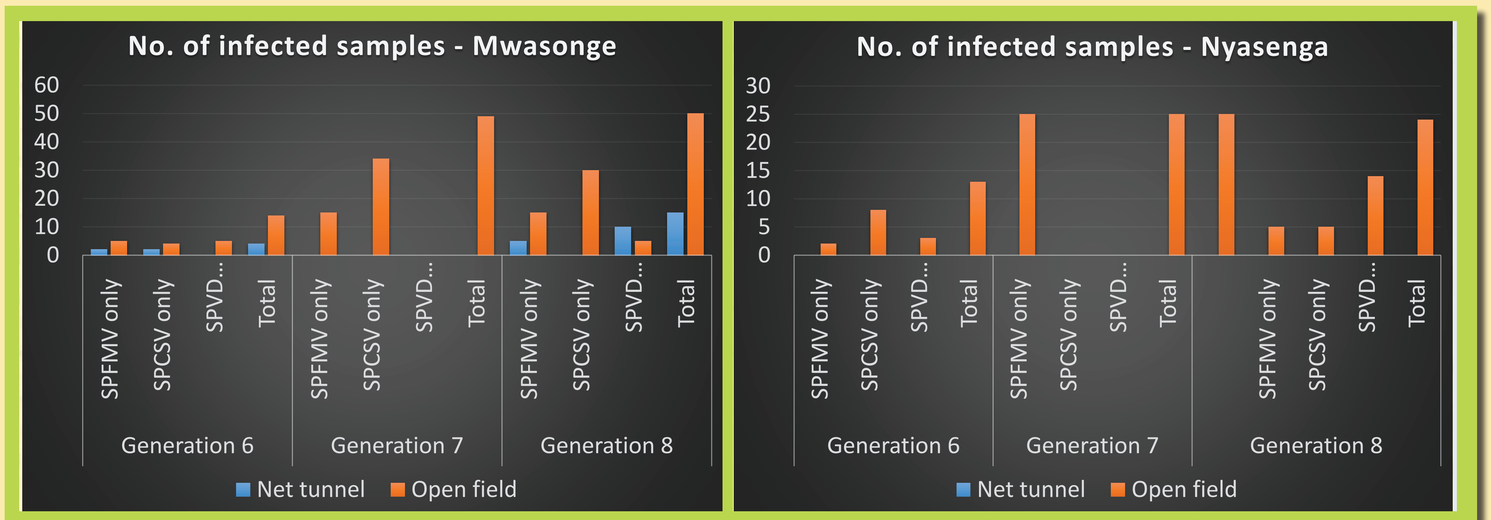

Fig. 2: Number of samples from generations 6, 7 & 8 that tested positive for various viruses

Discussion

- With good agronomic practices farmer multipliers should be able produce clean planting material using the net tunnels.
- The low virus infection rate in the net tunnels shows that they can be used for more than 18 months provided that there is good management.
- Decrease in vine production in NTs not always associated with virus presence (samples from the first 5 generations were all clean).
- Multipliers need to adopt strategies that will curb the consistent decrease in the number of vines produced over time e.g by uprooting and replanting after every harvest.
- Degeneration of sweetpotato planting material due to virus infection also depends on the prevailing weather conditions. For instance, good rainfall and high humidity favours buildup of external virus inoculum which can lead to high infection rate and rapid deterioration.
- The samples from generations 1–5 might have also tested negative due to the dry conditions experienced in Mwanza for the larger part of 2015, which led to low cultivation of sweetpotato and hence a reduction in external disease inoculum.
- Only a few sweetpotato plants were planted near the two sites between June 2014 and December 2015. Additionally, there was minimal whitefly presence for the most part of the experiments. The population of whiteflies at both sites started to increase in August 2015 which corresponds with the positive results from some of the sampling points.

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