Outcomes of a virus degeneration study in sweetpotato in the Lake Zone of Tanzania

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Dr. Nessie Luambano collecting leaf samples in the field

2010 saw the start of a large project in the Lake Zone of Tanzania which was called Marando Bora and sought to test whether we could distribute virus-free planting material of sweetpotato on a large scale to farmers there. Several thousand virus-free tissue-cultured sweetpotato plantlets were brought from Kenya through customs to the Agricultural Research Institute (ARI) Maruku in the Lake Zone of Tanzania and, through a hardening off process, transferred to field conditions there. Vines from the resulting plants were then moved to ARI Ukiriguru, near Mwanza, where they were further multiplied before distributing them to decentralized vine multipliers (DVMs) located in regions around the eastern and southern shores of Lake Victoria. These then multiplied them further and distributed them to farmers. Five varieties were brought: two local Tanzanian varieties, Polista and Ukerewe, two Ugandan varieties, Ejumula and Kabode, and one American variety called Jewel.

We needed to test whether these vines remained virus-free through all these stages of multiplication: this work was done by Dr Joseph Ndunguru and Dr Nessie Luambano at ARI Mikocheni. They checked for viruses in two ways: by visual inspection of plants and by using a specific laboratory test of sample leaves called NCM-ELISA (Nitro-cellulose membrane enzyme-linked immune-sorbent assay). However, there were too many samples to test them against all sweetpotato viruses; the laboratory testing was limited to the two main viruses affecting sweetpotato in Tanzania: *Sweet potato feathery mottle virus* (SPFMV) and *Sweet potato chlorotic stunt virus* (SPCSV). Also it was impractical to test all DVMs so testing was done only at 8 DVMs plus ARI Maruku and ARI Ukiriguru. The DVMs were located across what the team considered were low, medium and high virus spread areas. Four generations were tested (though the first generation was not tested by NCM-ELISA), starting with the first generation delivered to the DVMs.

The first outcome that was realised was that virus disease (assessed visually) spread rapidly, affecting 20% of plants within the first generation (Table 1). It increased to 30% by the second generation but then it declined. However, of course the scientists at ARI Maruku and ARI Ukiriguru and the farmer vine multipliers were working hard to combat the spread of the disease – by selectively using only disease-free planting material and by removing diseased plants (roguing). What this shows is that this can work!

Table 1. Changes in virus disease incidence (%) during the course of the trials

Variety	1st Generation	2nd Generation	3rd Generation	4th Generation	Average
Ejumula	31.5	41.2	32.3	26.5	32.9
Jewel	24.3	32.7	29.2	55.5	35.5
Kabode	10.7	17.7	9.4	8.9	11.7
Polista	8.4	24.3	0.8	18.3	12.9
Ukerewe	27.8	38.8	47.1	23.6	34.3
Average	20.5	30.9	23.8	26.6	25.4

Testing for viruses at the Mikocheni lab, Tanzania

However, there were also big differences between varieties. Ejumula, Jewel and Ukerewe were all relatively susceptible and many of their plots had to be culled completely. Kabode and Polista proved relatively resistant and few of their plots had to be culled.

Table 2. Percent virus incidence in the different varieties as measured by NCM-ELISA

SPFMV

	2nd Generation	3rd Generation	4th Generation	Average
Ejumula	11.1	20.0	47.5	26.2
Jewel	8.8	7.1	33.3	16.4
Kabode	8.8	7.1	15.0	10.3
Polista	8.6	15.6	40.0	21.4
Ukerewe	7.5	14.4	40.0	20.6
Average	8.9	12.9	35.2	19.0

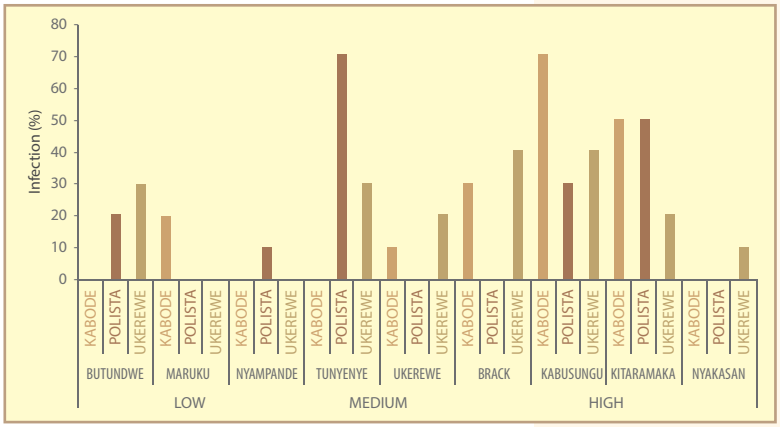
SPCSV

	2nd Generation	3rd Generation	4th Generation	Average
Ejumula	14.1	10.0	22.5	15.5
Jewel	38.8	17.1	20.0	25.3
Kabode	15.0	18.6	22.5	18.7
Polista	18.6	10.0	10.0	12.9
Ukerewe	28.8	14.4	36.7	26.6
Average	23.0	14.0	22.3	19.8

In order to appreciate the significance of Table 2, it needs to be explained that SPCSV is a severe virus that causes visual symptoms that farmers can recognise whilst SPFMV does not. As a consequence, roguing and selection of clean planting material only works against SPCSV – and their effectiveness is seen by its relatively stable incidence across the generations (as also seen in Table 1). However, the incidence of SPFMV steadily rises along with generation – because it cannot be removed by roguing and selection of clean planting material. Kabode once again is unusual in that its incidence hardly rises, confirming its general virus resistance.

The value of roguing and selection of clean planting material is also seen in Fig 1. This shows the disease incidence in different varieties in different locations, judged by agroecology to be likely to have different rates of virus spread. Nyakasanga, where ARI-Ukiriguru multiplies its planting material, is judged to be a high spread area but the incidence is amazingly low – showing what expert roguing and selection of clean planting material by the researchers at ARI-Ukiriguru can do even in a high spread area.

Figure 1. Summary of virus Infection for each variety in each site subdivided by virus pressure



Conclusions

Overall, this large trial does not really show the benefits of virus-free planting material because it was fairly quickly overwhelmed by spread from outside. This conclusion was also consistent with trials comparing the yields of generation 4 Polista with farmer-derived Polista – there was no significant difference.

However, what this trial has shown is that a combination of a fairly resistant variety (e.g., Kabode) plus roguing and selection of clean planting material, preferably by researcher-trained farmers, can maintain a good degree of health. **This is an approach which we can all manage to practice, making it a highly practical outcome.**

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