Research into Use: Pocket Guide No. 4

Fighting **sweet potato** virus diseases

Research Into Use

Farmers can control damaging sweet potato virus diseases by using new resistant varieties and simple practices in their fields.

Above: Farmers and researchers have worked together to breed sweet potato that is resistant to sweet potato virus disease. Here, the leader of a farmer group in Luwero (Uganda) shows scientists the new types of resistant sweet potato bred by the group.

Sweet potato is an important staple crop in East Africa, where it provides vital food for resource-poor farmers. It is also gaining ground among urban populations, and new orange-fleshed varieties of sweet potato offer hope against crippling and widespread vitamin A deficiencies.

Sweet potato virus disease (SPVD) is the most damaging disease affecting this crop in Africa, sometimes causing huge losses. Plants with SPVD yield 60-98 percent less than uninfected plants. Using a combination of good farming practices and resistant varieties, farmers can control virus diseases and ensure abundant harvests.

Why is sweet potato so important?

In poor African communities, where poverty and malnutrition go hand in hand, sweet potato offers a vital solution. It is a hardy crop that can be cultivated by resource-poor farmers on relatively poor soils. With few inputs other than labour, it produces good yields that can provide nutritious food for a family throughout the year and can even serve as a disaster-relief crop. The starchy sweet potato storage roots and the green leaves of the plant contribute important carbohydrates and vitamins to diets, and surplus roots are easily traded, providing welcome cash for other family needs.

Above: New orange-fleshed varieties, which are popular with children, help to fight vitamin A deficiency. Yet they are also very susceptible to virus diseases. This makes it critical to find effective, practical means of combating SPVD.

Because of these advantages for nutrition and livelihoods, the main growers in Africa are women. Uganda is Africa's number one producer, and Tanzania is second only to Uganda in terms of area planted, although yields there are lower.

The VITA A program is promoting the use of vitamin A-rich orange-fleshed sweet potatoes to help fight vitamin A deficiency, especially among children and pregnant women. This will help them fight off crippling diseases and, in severe cases, avoid blindness and even death.

How do viruses affect yields?

Sweet potato yields in Uganda and Tanzania are seriously reduced by SPVD, which is particularly common in the regions around Lake Victoria. Many of the orange-fleshed varieties are severely attacked by SPVD, as most have been introduced from Latin America, where the disease is not common.

What is SPVD?

SPVD is a combination of two viruses: *Sweet potato feathery mottle virus* (SPFMV) and *Sweet potato chlorotic stunt virus* (SPCSV). Both viruses are carried by infected plants and reproduced through the leafy cuttings that are used as planting material.

Symptoms of SPVD include severe stunting of the plant, much lower production of storage roots (sweet potatoes), and leaves that are very small, often malformed, with a mosaic of pale areas and generally with a yellowish colour (sometimes tinged with purple).

How is SPVD spread?

SPFMV is spread by aphids. When it infects sweet potato by itself, SPFMV does not multiply well and therefore is not a major problem. Yet as soon as SPCSV also infects the plant, SPFMV multiplies uncontrollably. This is why SPVD is so severe.

SPCSV is spread by whiteflies. The whitefly species *Bemisia tabaci*, the most common carrier of SPSCV in Africa, is very common in sweet potato fields. This, combined with its capacity to enable SPFMV to multiply, makes control of SPCSV very important in fighting the SPVD disease complex.

Above: The plants in the foreground show symptoms of SPVD: smaller and wrinkled leaves with a spotty yellow colour.

SPVD is a combination of two viruses: Sweet potato feathery mottle virus **(SPFMV)** and Sweet potato chlorotic stunt virus **(SPCSV)**

Right: The orange-fleshed sweet potato landrace Ejumela, which is high in pro-vitamin A

Resistant varieties and good farming practices—an unbeatable combination

The main need is not so much to reduce the occurrence of SPVD, but rather to enable farmers to grow better, higher yielding crops. Researchers have therefore adopted a twin approach. On the one hand, they are working with farmers to identify resistant varieties that will meet local needs and preferences. Meanwhile, by focusing on how the disease spreads, they have developed simple practices that can help farmers control SPVD even with susceptible varieties.

Working with farmers to breed resistant varieties

Some local African varieties are resistant to SPVD but they are mostly low-yielding and take longer to mature than the susceptible ones. Yet researchers and farmers alike have confirmed that resistance is the best strategy for controlling SPVD in the long term.

Farmers have told researchers the traits they are looking for in new varieties. These traits include high yield, drought tolerance, continuous production of roots for piecemeal harvesting, good taste and market value.

To develop crops with these traits, it was clear to researchers that breeding could not be carried out at the research station alone. They needed to see how the new varieties would respond under the conditions farmers experience in their fields, which are often on marginal land.

The successful solution they adopted was to involve farmers in participatory breeding and selection at decentralized, on-farm sites. As a first step in this process, farmers planted station-tested and local varieties to select the ones with the characteristics they preferred. These varieties were then crossed, sometimes with exotic ones, like the orange-fleshed varieties. The farmers then grew the seedlings on their own land, selecting over several generations in order to find the ones that provide the best blend of traits.

During this process, farmers and researchers learnt a lot from each other. Farmer participation has also helped the new varieties to get an early start in being spread from neighbour to neighbour.

Above: Farmers and researchers created trials to breed virus-resistant sweet potato with the taste and qualities that farmers wanted. Farmers collect cuttings of the best types to take home.

Farming practices

Breeding for resistance and then deploying the new varieties takes time. Meanwhile, farmers in Uganda and Tanzania continue to grow popular, local sweet potato varieties because they give good yields, even though these varieties are susceptible SPVD. To help cut their losses, researchers have come up with a series of control measures that farmers can use to grow these varieties more successfully.

By observing the behaviour of whiteflies, they discovered that these insects tend to fly only short distances. This means that farmers can avoid the spread of the diseases they carry by planting new crops a short distance (at least 15 metres) away from old diseased crops. At this distance, experimental plots have shown only one-third to one-quarter the number of diseased plants of the ones grown immediately next to affected plants. When farmers grow resistant varieties, this also limits the spread of SPVD to nearby areas.

Another way of easily controlling virus disease is to carefully select plants that show symptoms of infection and remove them (an activity known as 'roguing'). Roguing out diseased plants within one month of planting cuts the spread of SPVD in half. Neighbouring plants don't get infected, and so can take over the empty space quickly, making up for the loss of the plants that were removed.

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Breeding for resistance and then deploying the new varieties **takes time**

Eight easy steps

Because most farmers don't realize that virus diseases are transmitted by insects, helping them to understand this is important.

This understanding helps them to appreciate and use a series of simple practices to control the spread of SPVD, reducing their losses when they plant susceptible varieties.

1. Collect cuttings for new crops from healthy plants.
2. Avoid collecting cuttings—even from apparently healthy plants—when the plot has a lot of disease. Also, avoid using cuttings from very old crops, where the disease is less easy to recognize.
3. If available, use cuttings from a variety that isn't strongly affected by the disease.
4. Plant new crops away from old crops.
5. Rotate crops so that sweet potatoes are not planted in the same field from one season to the next. This helps to prevent the spread of the disease from roots or cuttings that may survive in the soil.
6. Remove diseased plants as soon as they appear, especially in young crops.
7. Make sure that trash from old harvested crops, including storage roots, dies.
8. Work with neighbours to extend these practices throughout the community.

Of course, many farmers may experience limitations that don't allow them to practice all of these measures. Depending on how bad the disease is in their area, they may be able to use only one or a few of the measures and still get good results. In particular, careful selection of planting material, planting away from old crops and roguing out new infections are recommended.

The work continues

Meanwhile, participatory breeding continues. A few local orange-fleshed varieties with good resistance to SPVD have been identified, and are being tested for incorporation within the VITA A program.

Teaching farmers about the importance of participating in breeding efforts and helping them to control disease in their crops using the simple techniques outlined in this *Pocket Guide* can make an important contribution to fighting hunger and poverty and ensuring good nutrition in your region.

Tools, guidelines and contacts

If you would like to find out more, here are some resources that may be helpful.

For the VITAA Partnership

Website: http://www.cipotato.org/vitaa/

Manual for Sweetpotato Integrated Production and Pest Management Farmer Field Schools in Sub-Saharan Africa: http://www.cipotato.org/vitaa/manual.htm

Contacts

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Right: Virus disease often means that farmers cannot harvest any sweet potato from their fields: compare the tiny root from a plant affected by viruses in Isaac Mpembe's left hand with the large yield of storage roots from a healthy plant in his right hand. Photo: R. Gibson

About this series

Research into Use *Pocket Guides* showcase new technologies that have been tried and tested, and have proven successful in the field. They were produced to demonstrate the importance of high-quality scientific communication.

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