Tackling Virus Resistance

SASHA
Sweetpotato Action for Security and Health in Africa

AUG 2014

Sweet potato virus disease (SPVD) resistant parents have been included in two crossing blocks, one with 80 parents and a smaller one with 50 parents at Namulonge in Uganda. The two populations (in physically separated crossing blocks) were previously differentiated on the basis of simple sequence repeat (SSR) markers. The crossing blocks have been used to generate populations for SPVD resistance and molecular marker development. The procedure to discriminate SPVD susceptible, tolerant and resistant varieties has been optimized.

Sick plants (in front) with severe virus symptoms are easy to distinguish from healthier plants (in back) (credit R. Gibson)

What is the problem?

Virus infection, by different types of viruses, but primarily Sweet potato chlorotic stunt virus (SPCSV) and Sweet potato feathery mottle virus (SPFMV), is among the most important constraints of sweetpotato production globally and especially in Sub-Saharan Africa (SSA). Dual infection by SPCSV and SPFMV causes SPVD. SPVD is devastating, causing up to 98% yield loss in susceptible varieties. The complex genetics and large number of chromosomes (90) in sweetpotato, and the presence of multiple virus infections complicate breeding for virus resistance in sweetpotato using standard breeding and molecular methods.

What do we want to achieve?

We would like to use more accurate and targeted breeding strategies to achieve high levels of resistance in progeny populations and varieties by increasing the frequency of individuals with SPVD resistance. We would like our breeding methods to be more efficient in producing improved populations with high expression of SPVD resistance and quality characteristics desired by farmers and consumers.

Where are we working?

Three Sweetpotato Support Platforms (SSPs) have been established, with CIP sweetpotato breeders

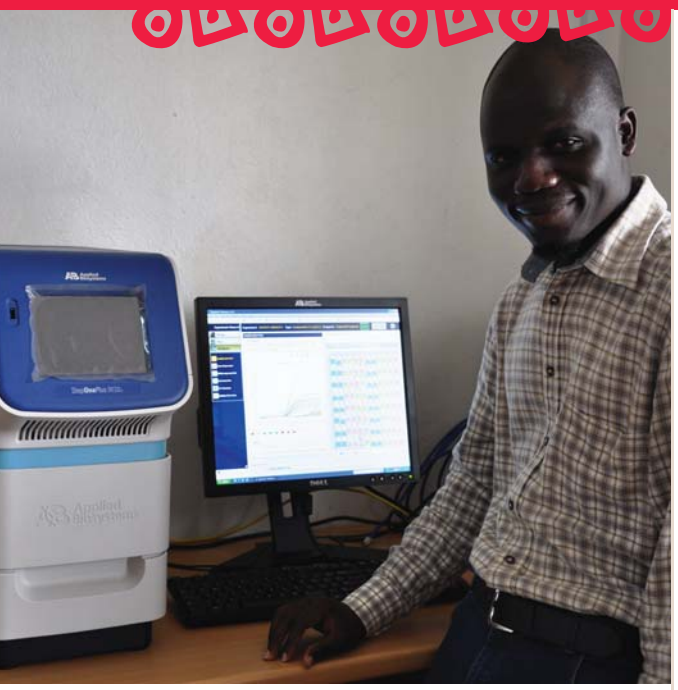
CENTRO INTERNACIONAL DE LA PAPA
CIP
A member of the CGIAR Consortium

NaCRRI
National Crops Resources Research Institute

SPHI
Sweetpotato for Profit and Health Initiative
Reaching 10 million African households by 2020

Key Partners

Major partners are the national sweetpotato programs in the target countries. The Sweetpotato Support Platform (SSP) for Eastern and Central Africa is based at the National Crops Resources Research Institute (NaCRRI) in Uganda and the Kenyan Plant Health Inspection Service (KEPHIS). For Southern Africa, the SSP is based at the Agrarian Research Institute of Mozambique (IIAM) in Maputo. The West Africa platform is located at the Council for Scientific and Industrial Research-Crops Research Institute (CSIR-CRI) in Kumasi, Ghana.



Real-time PCR machine determines levels of different viruses present (credit J. Low)

based in national breeding programs in Uganda, Mozambique, and Ghana. The SSP in Uganda leads the SPVD resistance work in collaboration with CIP, Lima and the National Crops Resources Research Institute (NaCRRI) in Uganda. The SSPs provide technical backstopping in breeding at the sub-regional level for the 17 countries targeted under the Sweetpotato for Profit and Health Initiative.

How are we making it happen?

We are developing a new way of breeding sweetpotato using a combination of methods, one of which focuses on breeding for virus resistance. SPVD resistance has different components, including reduced symptom expression, tolerance (giving reasonable yield despite being infected and showing symptoms, and/or high virus titer), recovery (the ability to recover partially or completely from virus symptoms), and reversion (the ability to recover from virus infection). We are identifying and increasing the number of resistant parents for breeding, and are developing molecular markers to use to speed up the process of identifying and selecting plants that have resistance to SPVD, the most important disease of sweetpotato in SSA. We expect that improved populations with SPVD resistance from the East African SSP when will have value in other sub-regions when evaluated to select superior varieties.

What have we achieved so far?

These have been the major virus resistance sweetpotato breeding achievements to date:

a) Parents with SPVD resistance have been identified and used to generate progenies for national programs and for studies to answer and confirm methods used in other crops (heterosis, and polycross vs controlled cross, genotype by sequencing).
b) The ability to determine the relative amounts of virus in plants was enabled through the purchase and installation of a real-time polymerase chain reaction (PCR) machine at NaCCRI.
c) The procedure to discriminate SPVD susceptible, tolerant and resistant varieties has been optimized using the real-time PCR.
d) Resistance to SPVD in some genotypes (potential varieties) introduced from CIP HQ to Uganda has held up under field conditions at levels comparable to the most resistant Ugandan clones. There is a strong possibility that the frequency of SPVD resistant genotypes in breeding populations will increase significantly in the near future.

What are the next steps?

During the next five years, we hope to develop molecular markers to efficiently increase the frequency of parents with SPVD resistance in the East and Central Africa sweetpotato support platform, and send true seed to NARS partners facing high virus pressure. We plan to exploit heterosis in virus-resistant parents.

Symptoms vary in severity depending on variety (credit C. Wasonga)

CONTACTS

For East and Central Africa
Robert Mwanga
r.mwanga@cgiar.org

For CIP-Headquarters
Wolfgang Grüneberg
w.gruneberg@cgiar.org