

Common Bean Virus Diseases Project Impacts



Researchers and farmers in the Southern Highlands Agricultural Research Zone, Nkasi district, Tanzania, collecting samples for the Common Bean Virus Diseases Project, 2015

What is CBVDP?

Funded by the Bill & Melinda Gates Foundation and the government of Tanzania, the Common Bean Virus Diseases Project (CBVDP) worked with agricultural research institutes from 2014 to 2018 to describe the molecular structure and epidemiology of common bean plant viruses, and develop diagnostic and detection tools. The common bean is an important legume crop in Tanzania as a cheap nutritional source and vital cash crop. But its production is constrained by insect pests, diseases and droughts that lower yield by up to a third. It is particularly vulnerable to the *Bean common mosaic virus* (BCMV) and *Bean common mosaic necrosis virus* (BCMNV). CBVDP aimed to establish scientific understanding of viral diseases affecting the common bean to prepare the ground for better crop management, boosting yields and livelihoods across the country.

CBVDP's work in Tanzania

The Common Bean Virus Diseases Project (CBVDP) is headquartered at the Tanzania Agricultural Research Institute (TARI-Mikocheni) in Dar Es Salaam. At project completion, Dr Deusedith Mbanzibwa (Principal Agricultural Research Officer) reflects on how the project laid the foundations for a scientific understanding of common bean viruses in Tanzania.

Charting bean epidemiology

Given the significance of the common bean as a source of food and income, and the threat that viruses represent – cutting yields from a potential 1500 kg/ha to 991 kg/ha (FAOSTAT 2017) – a key CBVDP objective was to describe the prevalence, incidence and distribution of common bean viruses across five growing regions in Tanzania. The project collected and assessed about 8,000 samples from almost 300 fields, focusing on pathogens considered to be the most damaging to the common bean: *Bean common mosaic virus* (BCMV) and *Bean common mosaic necrosis*

virus (BCMNV). Molecular analysis revealed that these two viruses had an incidence of 0 to 76%. Though this is lower than incidence assessed visually (0 to 98%), CBVDP researchers confirmed that BCMV and BCMNV are major constraints to common bean production in Tanzania.

Crucially, researchers also found that the *Southern bean mosaic virus* (SBMV) and *Cowpea mild mottle virus* (CPMMV) represented a serious threat. “We used to focus on BCMV and BCMNV,” Dr Mbanzibwa noted. “When farmers saw symptoms of disease, they used to say it was nutritional

deficiency or just ‘mosaic virus’ but we were able to show there are many different viruses involved”.

Molecular characterisation

Next generation sequencing conducted on a selection of samples revealed that common bean plants were infected by 15 viruses from 11 genera; 45 new sequences were produced for 6 viruses. Only one such sequence from Tanzania was previously available, and raw data is now accessible to researchers across the world. CBVDP used these sequences to produce diagnostic tools that are key to the management of viral diseases, particularly in the early stages of infection.

“Farmers used to say it was nutritional deficiency or just ‘mosaic virus’ but we were able to show that there are many different viruses involved”

Assessing dispersal and risks

The use of infected plant material is often a key factor in the dispersal of plant disease. CBVDP collected, germinated and monitored bean seed samples for symptoms. It was found that only two non-pathogenic viruses were efficiently transmitted. CPMMV was transmitted but with a very low incidence. More studies were recommended.

The project team also detected many other viruses in the wild plants around bean fields during sample collection. These included viruses known to infect the common bean as well as unrelated crops such as sweet potato. This information could be useful in developing diagnostic primers and preventing the spread of certain viruses to the common bean plant.

Capacity building

Tanzania’s technical and human capacity was significantly boosted by CBVDP: six personnel



CBVDP Researcher extracting nucleic acids from samples at the TARI-Mikocheni lab

(including a PhD and a MSc student who are currently working for the government) were trained in molecular virus diagnosis and detection at the University of Helsinki (Finland), and they in turn trained local staff at TARI-Mikocheni. A range of activities helped build the capacity of stakeholders from students to senior staff, and collaboration within Tanzania and international institutions created networks that will be key to furthering work in this area.

Dissemination and next steps

CBVDP was mainly lab-based, and outreach to farmers for management of common bean viral diseases was beyond its scope. Nonetheless, this was the most comprehensive survey of common bean viral diseases that has taken place in Tanzania, and findings were disseminated through publication in journals (*Plant Disease*, *PLOS One*, *African Journal of Agricultural Research*), poster displays and presentations. The keen interest of the scientific community in these findings suggests that the project has laid solid foundations for continued work to characterise problem viruses. This could lead to a science-based programme of disease management to reduce the burden on the agricultural sector in Tanzania, particularly the smallholder farmers, mostly women, who rely on the common bean for food and income.

Contact us

Email: m.millan@agshare.today

Tel: +44 (0)20 8672 597