Tropical Agriculture, Afghanistan

Posted by steven.reynolds | January 11, 2012

Fast, Cheap, and Accurate: Improved Virus Detecting Test Helps Check Spread of Cassava Disease

The Nigerian poet and novelist Flora Nwapa calls it “Mother Cassava.” A fundamental staple in the diet of nearly a billion people, the cassava plant produces a root that is processed in a wide variety of ways to produce foods and beverages. After rice and beans, cassava is the most important subsistence crop grown in the tropical regions of South America, Asia, and Africa.

In many parts of Africa, cassava’s hardiness allows it to be grown on land unsuitable for the cultivation of cereals or other staple crops. African farmers like cassava because, on a per acre basis, it produces higher yields than other crops, thus assuring that their families have food and income.

Unfortunately, cassava mosaic disease, or CMD, threatens the crop. The disease was the cause of at least one serious famine in Africa already. CMD causes leaves to become twisted, misshapen, or not to develop at all. Reduced leaf area in turn reduces the size of tubers. Reduced yields mean less food for families depending on the plant’s roots for sustenance. In Africa, seven

distinct viruses spread by whiteflies and via vegetative cuttings cause CMD.

"Part of the problem with managing CMD has been in accurately detecting these viruses," said Naidu Rayapati, a plant virologist based at WSU's Irrigated Agriculture Research and Extension Center in Prosser. "If these viruses can be detected in vegetative cuttings, it should be possible to quarantine contaminated plant material and supply farmers with clean cuttings for new plantings."

Cassava mosaic is a severe disease impacting the sustainability of cassava production in sub-Saharan Africa. Cassava affected with the disease (left) produce severely deformed leaves with mosaic symptoms and only a few small or even no tubers when compared to a healthy plant (right).

Cassava is propagated via cuttings from existing plants, so if the parent plant has CMD, so too will the daughter plants. Rayapati has long been involved in the business of insuring that growers use clean, healthy planting stock. In Washington, he leads a project working to contain the spread of grapevine leafroll, a complex virus disease that damages valuable wine grapevines.

Rayapati and his Nigerian graduate student, Olufemi J. Alabi, collaborated with Lava Kumar, a virologist at the International Institute of Tropical Agriculture in Nigeria, to address the problem of CMD detection in cassava. A USAID-Linkage grant funded their project. "Previous methods of virus detection in plant tissue required commercial kits that were expensive and involved handling toxic or carcinogenic materials," Rayapati explained. The special training and facilities required to handle the materials, coupled with the expense, made it extremely impractical to use on a wide enough basis to effectively help manage CMD in African countries. "What we did is replace the dangerous materials used in the extraction of plant tissue with safe ones which are also cheaper. When you don't have facilities or protocols for handling the dangerous stuff, you really need this sort of alternative."

Rayapati had previously helped develop a method whereby plant samples could be easily and inexpensively transported from remote agricultural areas

Rayapati conducting a workshop for African scientists on diagnosis of cassava mosaic disease at the International Institute of Tropical Agriculture (IITA), Nigeria, in collaboration with Dr. P. Lava Kumar, virologist at IITA, to transfer technologies generated in Rayapati's lab at WSU-IAREC.

in Asia and Africa to laboratories capable of conducting analysis. Now, though, the testing can be done at regional hubs, thus speeding up the process of detecting the presence of disease-causing viruses. "What we essentially did was transfer the technology to the people who really need it," Rayapati said.

The modified testing technique not only replaced the expensive and toxic ones with materials that are safe and cheap, it combined separate tests for individual viruses into one test, further reducing the cost of detecting CMD-causing viruses.

"We adapted a protocol developed here in Prosser that we were using to detect the presence of viruses in grapes," Rayapati said. Typically, plant material must be purified in particular ways in order to reduce the volume of material that has to be screened for the presence of viruses. "We thought, why eliminate all the 'junk'? That's just another added expense. The test is quite specific in that it looks for particular molecules that signal the presence of disease-causing viruses in cassava. It's like feeling around for a needle in a haystack. Even if it's surrounded by hay, you will know when you sit down if there is a needle in there."

Rayapati is quick to point out that having an inexpensive means to detect the viruses that cause CMD is only a first step, albeit a critical one. Because CMD is transmitted by whitefly, new plantings need to be done when the whitefly population is low as well as with clean plant material, he said.

"But there is no 'one size fits all' solution," Rayapati said. "There has to be an adaptable and flexible strategy that combines the ancient farming practices of native people with modern ones developed by researchers."

-Brian Clark

Learn more about WSU research in plant pathology by visiting http://plantpath.wsu.edu/. Learn more about Naidu Rayapati's virus research at http://bit.ly/mBO1Y8.

WSU Efforts to Improve Afghanistan Agriculture

Continue

Washington State University's work to help secure and improve agriculture in war-torn Afghanistan will continue with two new initiatives recently funded by the U.S. Department of Agriculture's National Institute of Food and Agriculture and the US Agency for International Development.

Working as part of a consortia led by the University of California-Davis, WSU will receive $3.12 million to help strengthen the Afghani Extension system. It will receive an additional $895,500 from a project led by Purdue University to improve the skills of agriculture-oriented faculty members at Afghan colleges and universities.

"These new programs build on our efforts to increase both human and institutional capacity in Afghanistan through previously implemented programs," said Chris Pannkuk, director of WSU's International Research and Development in the College of Agricultural, Human, and Natural Resource Sciences.

Afghani visitors in Wenatchee, Wash.

The Afghan Agricultural Extension program is a three-year project intended to build the capacity of the Afghanistan Ministry of Agriculture, Irrigation and Livestock Extension service to deliver programs on the ground. WSU's role in the project includes establishing training to enhance the technical and management skills of Extension in high impact priority areas such as wheat and grain storage, fresh market and processing value changes, use of legumes in grain crop rotation, protecting food production for high value urban markets, and livestock production for improved household health and well-being. "We'll also be working to establish an integrative communications model to ease the development of Extension policy, management, training, and information exchange with our Afghan stakeholders," Pannkuk explained.

For the five-year "Strengthening Afghan Agricultural Faculties" project, WSU will help develop faculty capacity, agronomy courses and curriculum, labs that are integrated into educational programs, and developing ag production activities on student and research farms. Specifically, WSU faculty will

- Develop a series of annual technical assistant/training workshops

targeting course curriculum development, lab development, applied research and staff visits. The project calls for 10 visits by WSU faculty to Afghanistan–two for each of the five project years. During those visits, they will meet with their Afghani counterparts and students.

- Provide graduate education to five Afghan faculty–two earning master's degrees and three earning their doctoral degrees in agronomy.
- Host a mid-career senior Afghan faculty member as a visiting scholar for four months each year.

WSU has had a working presence in Afghanistan for the past eight years, working on a variety of projects aimed at developing human and institutional capacity.

–Kathy Barnard

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