AVRDC’s eggplant rootstocks show promise to combat 
bacterial wilt of tomato in Honduras

Tomato is the most important cultivated vegetable crop in Honduras, where around 3400 ha are planted annually to produce 120,000 metric tons. A substantial part of the production is destined for local consumption as both fresh and processed produce, and the rest is exported fresh to neighboring El Salvador. Technological improvements in the last decade have accelerated growth of local tomato production and have helped reduce imports from Guatemala. This has helped to regulate supplies and prices for domestic markets and save badly needed hard currency. However, intensification of production has also contributed to the occurrence of formerly inconsequential and/or new problems of an economic, agronomic and phytosanitary nature, of which tomato has its share, just as anywhere in the world. One of these problems is bacterial wilt, a disease caused by the bacteria *Ralstonia solanacearum* that has gradually become a major problem for solanaceous vegetable crops, in particular for tomato and eggplant.

In the last decade, the yield losses caused by bacterial wilt on tomato and eggplant have increased, especially in the Comayagua Valley in Central Honduras where the major production area of both crops is concentrated. The estimated plant mortality due to bacterial wilt fluctuates between 0 to 50%, depending on sites, crops, cultivars and field history. Farmers lack knowledge on disease management and their only control strategy is to plant tomato and eggplant in new fields where the pathogen is apparently not present. As a result, bacterial wilt and insect-vectored virus diseases have become the most damaging phytosanitary problems in Comayagua Valley and there is an increased risk of spreading the pathogens to other important production areas of...
Harvested tomatoes are carried (left) to be sorted and packed under the natural shade beside the fields (below); graded market-ready tomatoes are displayed in a packing shed for sale (right)

Honduras. In response to this, the Honduran Foundation for Agricultural Research (Fundación Hondureña de Investigación Agrícola, FHIA), with scientific and financial support from the USAID-funded Integrated Pest Management Collaborative Research Support Program (IPM CRSP), singled out the management of bacterial wilt as a priority research area in Honduras and started testing different control methods in 2010.

Among several technologies for managing bacterial wilt reported in the international literature, grafting was judged to be the most promising for evaluation in Honduras. The technique was first introduced in Honduras in the early 2000’s by innovative growers and the Taiwan Technical Mission as an approach to control root-knot nematode (*Meloidogyne* spp) in eggplant that is grown for export to the USA. Several grafting methods have been utilized with eggplant, including clip grafting, rubber tube grafting and cleft grafting. The technology was thereafter validated by FHIA and its use was actively promoted and disseminated at that time. Currently the grafting technique is used by some eggplant growers whose fields are located in the Comayagua Valley where soils favor root-knot nematode multiplication and damage to the crops. However, the rootstock utilized throughout this time with eggplant was a landrace of *Solanum torvum* (Devil’s fig), which unfortunately proved to be susceptible to bacterial wilt.

From April to June 2012, tomato grafted onto bacterial wilt-resistant eggplant was first tested with a commercial tomato cultivar in a *R. solanacearum* infested field at FHIA’s Centro Experimental y Demostrativo de Horticultura (CEDEH) in the Comayagua Valley. The tomato cultivar ‘Namib’ from Roger’s (Syngenta, USA) was grafted onto different eggplant and tomato rootstocks, including four AVRDC eggplant rootstocks ‘VI045276’ (EG203), ‘VI046103’ (EG195), ‘VI034845’ (TS03) and ‘VI045571’ (EG192); two tomato rootstocks ‘Emperador’ and ‘61-071’ from Rijk Zwaan, Netherlands; and one eggplant rootstock ‘1098’ from Seminis, USA. The cleft grafting method was utilized. Tomato grafted onto AVRDC eggplant rootstocks showed a much lower mortality rate and higher yield compared to the commercial rootstocks.

Based on these promising results, a new field trial with tomato and eggplant was established at FHIA’s CEDEH in early April 2013 to validate the performance of the four AVRDC eggplant rootstocks for controlling bacterial wilt. In addition, the four AVRDC eggplant rootstocks were planted in an insect-proof nethouse at FHIA’s CEDEH for seed multiplication. It is expected that the rootstock seeds and seedlings will be distributed to growers in early 2014.

**Source and photos:**
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A successful Bangladeshi micro-entrepreneur

Shahidul raises bottle gourd seedlings with compost mixtures in polythene bags (left) and water hyacinth compost balls (right)

Mr. Shahidul Islam is 30 years old and has worked in a garment factory for 12 years. He lives with his family in Potang village, Barisal Sadar Upazila, Bangladesh. However, his dream of being self-employed, coupled with the drudgery and monotonous work in the factory, finally caused him to resign from his job. In June 2010, he invested BDT30,000 (USD375) to establish a tree sapling nursery in his village. He rented 25 decimals (1 decimal = 40 m²) of land for five years at USD50 per year. Unfortunately, the nursery business was not profitable enough to balance his investment and labor cost.

In 2011, Shahidul received training in quality seedling production from the Department of Agricultural Extension, Bangladesh. He learned the improved technology for forest and fruit tree nursery, including soil and bed preparation, composting, grafting, and pest and disease management. His capacity in nursery management was built and expanded. After the training, he invested further to enlarge his nursery, but it was not good enough. He still felt there were gaps in his business knowledge and he did not know where to ask for help.

In 2012, Shahidul was motivated to participate in six Production and Sales Planning Meetings (PSPM) organized by iDE, an international non-governmental organization with a mission to empower farmers to increase their income and create livelihood opportunities. These “linkage meetings” gather producers, input and output market actors, and service providers of selected value chains together to discuss and understand the current market dynamics in terms of demand and supply that would ideally lead to profit maximization for local private sector actors and farmers. The PSPM session was instrumental for Shahidul to truly gauge the demand for quality vegetable seedlings.

After attending PSPM, Shahidul has a much clearer perspective of the specifications from the buyers’ side, including but not limited to variety, volume of demand, supply time and seedling quality. Soon afterwards, Shahidul started his vegetable seedling production business in addition to tree saplings. In the beginning, Shahidul produced 3,000 seedlings of hybrid bitter gourd, snake gourd, papaya and other crops. He retained 530 seedlings for himself and sold the rest to the farmers in the same village.

In March 2013, Shahidul attended a training for micro-entrepreneurs on vegetable seedling production and marketing organized by iDE and Bangladesh Agricultural Research Institute. The training mainly focused on understanding the business plan and linkage with public and private sectors for provision of necessary inputs and technical services. This training stimulated Shahidul's thinking and he began strategizing and considering demand, availability of inputs, technical efficiency, return on investment, profitability, risks, and competitors. Shahidul not only produce the seedlings but also markets them, and integrates a financial and management plan into his business.

Shahidul observing his bitter gourd seedlings
In the last two seasons (Nov 2012 - Apr 2013), Shahidul produced 10,500 seedlings of hybrid bottle gourd, tomato, bitter gourd, snake gourd, eggplant, cucumber, papaya and chili. He kept 1,200 seedlings for his own production and sold 9,300 seedlings with a net profit of BDT12,000 (USD150). Besides the vegetable seedlings, he also raised 20,260 tree and fruit saplings and already sold 25% of them with a net profit of BDT30,000 (USD375). He invested around BDT80,000 (USD1,000) and expected to make around BDT120,000 (USD1,500) as net profit. He has established linkages with three buyers from distant markets (around 7-8 km) to purchase his seedlings. He records daily accounts because he has realized the importance of keeping track of his cash inflow and outflow. His business has been growing at a highly encouraging rate and this has emboldened him to take a loan of BDT40,000 (USD500) from a microfinance institute to expand his nursery area. He has already planned to produce 30,000 tree saplings and 15,000 vegetable seedlings in the coming year.

At present, Shahidul is recognized as a successful micro-entrepreneur. Many farmers from more than 15 neighboring villages rely on him to supply quality vegetable seedlings and tree saplings. His income has increased and his life has changed dramatically. He is now proud and happy that he can afford the quality education for his child and this brings him boundless joy.
AVRDC has implemented a school gardening program in East Java and Bali through a USAID-funded project, ‘Mobilizing vegetable genetic resources and technologies to enhance household nutrition, income and livelihoods in Indonesia’. The aims are to introduce the concept of school gardens, encourage students to plant similar gardens at home, engage students in production of vegetables, and encourage more vegetable consumption.

The public Junior High School no. 2 in Plemahan, East Java is one of 14 schools participating in the gardening program. The school is located in Pohjarak village, Plemahan sub-district, Kediri district, East Java. An arable plot area of 36 m² that can produce on average 750 g of vegetables per day over the course of a year was derived from previous AVRDC projects, and this concept was introduced to the school. The students and teachers enthusiastically welcomed this interesting program.

In 2012, the school garden was established in the central school yard surrounded by classrooms with an area of 68 m², which was divided into 17 plots (1x4 m per plot). Twelve kinds of vegetables were grown, including squash, chili pepper, yard-long bean, tomato, broccoli, cauliflower, amaranth, choysum, kale, shallot, eggplant and okra. Seeds of okra and amaranth were purchased from seed companies and local varieties of other vegetables were obtained from farmers or local seed vendors. Since many benefits are derived from the gardening program such as equipping the students with additional skills on cropping systems, Ms. Wahyu Widyantingsih, the school principal, has decided to include gardening as part of school extracurricular activities, in addition to dancing, singing, painting and others.

All the extracurricular activities are conducted on Fridays. In the beginning of implementing the school garden activity, students of Grade 8 were enrolled. Four to five students

“Students have learned responsibility and cooperation through the gardening activity,” said Ms. Wahyu Widyantingsih, the principal of public Junior High School no. 2 in Plemahan, East Java
Students take turns to take care of the vegetables in the school garden

are assigned to take care of each crop plot. A small group with 20 students was formed to monitor the crop growth, be responsible for pest and disease control and replace the dead plants with healthy seedlings for all crops. Compost or green manure was applied in the garden. A total of 135 kg of vegetables were harvested from the school garden in one growing season.

With the implementation of the school garden, students learn how to cultivate, preserve, cook and enjoy the produce. The harvested vegetables were consumed by students and teachers. Part of the harvest was used for culinary subjects, where students developed their cooking skills. In addition, the students increased their knowledge and consumption of vegetables, learned to grow vegetables at home and be responsible and cooperate with each other on gardening activities.

All the space in the school yards has been utilized to grow vegetables in either polybags or the ground. Vegetables and ornamental crops are placed in front of each classroom, and the climbing vegetables such as bottle gourd, bitter gourd and polesnap beans are currently planted in the school garden. With the continued development of their garden, Ms. Wahyu hopes to be able to inspire other schools to implement school gardens, because it is one of the solutions for making the school greener.

Vegetables were planted in polybags and placed in front of classrooms (top) or around the campus trees (left)

Source and photos:
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