

Application of Molecular Markers to Broaden the Genetic Base of Tomato for Improved Tropical Adaptation and Durable Disease Resistance

The World Vegetable Center (AVRDC)

| | |
|------------------------------|-----------------------------|
| Country/Region: | India and Thailand |
| German participation: | Leibniz University Hannover |
| Leading scientists: | Dr. Peter Hanson |
| Duration: | March 2006 – September 2009 |

Initial situation

Tomato (*Solanum lycopersicum*) is a high value crop and a valuable source of provitamin A in human diets. However, yields in the tropics average less than 15 t/ha, far lower than those in developing countries in temperate areas. Diseases are a major cause of low tomato yields in the tropics; especially Tomato Yellow Leaf Curl Virus (TYLCV) and Bacterial Wilt (BW). TYLCV is spread by the sweet potato whitefly after it feeds on infected plants. Farmers often spray pesticides



in vain attempts to control the disease, causing harm to themselves and the environment.

The BW pathogen (*Ralstonia solanacearum*) lives in the soil and infects tomato and many other plant species. It causes plants to wilt and die, often just before harvest. BW is so severe in some regions that farmers are not able to grow tomatoes at all.

Approach of the project

Disease-resistant varieties are the most effective, cheapest and easiest way to control diseases to benefit small-scale farmer, but resistance is often unstable and does not work equally well against all pathogen strains or in all environments. The main aim of the project is to develop tomato lines for the tropics with stable BW and TYLCV resistance.

This is done through:

- 1) identification and use of resistance genes from wild and cultivated tomato species;
- 2) design/ adaptation of molecular markers linked to BW and TYLCV resistance genes;
- 3) application of molecular markers (a non-GMO approach) in breeding to develop disease resistant tropical tomato varieties;
- 4) better understanding of the mechanisms of BW resistance.



Major results achieved

The use of molecular markers increases the efficiency of plant breeding for disease resistance by facilitating the selection of multiple resistance genes. Molecular markers have been applied in this project to select within segregating tomato populations for two TYLCV resistance genes. Hybrids with TYLCV resistance genes from this project demonstrated promising resistance in north India in October 2007 trials. Hybrids and inbred lines with multiple TYLCV resistance genes, resistance to BW, heat tolerance, and good fruit quality are under evaluation in the 2007-2008 season trials in

India, Vietnam, Cambodia, Thailand, Mali and Niger. Additional TYLCV and BW genes for resistance are being mapped for future breeding activities.

Expected impact

Improved varieties will benefit small-scale producers and can create additional employment opportunities along the commodity chain. Tomato varieties resistant to TYLCV and BW will increase yield by 30% or more and allow farmers to reduce pesticide application for whitefly control, reducing their production costs and improving product and environmental safety. Rich in micronutrients, tomatoes also help improve the nutritional status of consumers in the tropical lowlands beyond the typical limits of tomato cultivation. The tomato varieties developed through the project are international public goods and will be disseminated by AVRDC - The World Vegetable Center through public and private sector institutions worldwide.

Collaborating institutions: Indian Institute of Horticultural Research, Bangalore India; Kasetsart University, Bangkok, Thailand.

The Advisory Service on Agricultural Research for Development (BEAF) manages Germany's contribution to international agricultural research. Instruments for implementation are project funding, postdoc funding, small grants and liaising between German and international researchers. BEAF is part of GTZ and acts on behalf of the Federal Ministry for Economic Cooperation and Development (BMZ).

Imprint

Published by:
Deutsche Gesellschaft für
Technische Zusammenarbeit (GTZ) GmbH
Advisory Service on Agricultural Research
for Development (BEAF)

Dag-Hammarskjöld-Weg 1-5
65760 Eschborn, Germany
T +49 61 96 79-1435
F +49 61 96 79-7137
E beaf@gtz.de
I www.gtz.de/beaf

Dahlmannstr. 4
53113 Bonn, Germany
T + 49 228 24934 231
F + 49 228 24934 215
E judith.jansen@gtz.de

Pictures by:
The World Vegetable Center (AVRDC)

Contact:
Dr. P. Hanson: hansp@avrdc.org



September 2008