



Stopping the wilt

Wilt diseases have devastated banana crops in Indonesia. Two ACIAR projects are attempting to manage the invasion—and protect unaffected neighbours

BY JENNI METCALFE

When Cyclone Larry crossed the north-eastern coast of Australia in March 2006, it destroyed most of Australia's commercial banana crop and sent consumer prices rocketing. The cyclone cost Australia's banana growers almost \$500 million in lost production and re-establishment costs.

So imagine the devastation if a disease such as *Fusarium* wilt, especially the virulent Tropical Race 4 (TR4) strain, were to hit northern Queensland. An outbreak of the disease would require eradication and regrowth of clean crops, putting even more financial strain on the region. ↪

PHOTO: PETER FANLOR

A bunch of bananas cut open to reveal symptoms of blood disease.



Project staff discuss on-farm disease management with a banana grower near Baso, Sumatra.

When TR4 hit the Northern Territory's banana growers, wiping out most of their production in 1997, the rest of Australia's production area was understandably nervous.

Fusarium wilt is caused by a fungus, which turns the outer leaves of a banana plant yellow before it moves to the younger leaves. When the stem at the base of the plant is cut, brown streaks are visible where the invading fungus releases toxins, blocking the water-conducting vessels of the plant and killing it. Fusarium wilt affects almost all varieties of banana, including the popular Cavendish.

Fusarium wilt and a second wilt disease, blood disease, have devastated banana crops for smallholder farmers and backyard growers in Indonesia, where export income from bananas fell from a high of \$22 million in 1996 to just \$150,000 in 2002.

Blood disease is caused by the blood disease bacterium (BDB), which is carried to the plant by insects visiting the male flowers. The bacteria multiply in the flowers and grow down the stem of the plant towards the fruit, turning the flesh into red ooze. Generally, the symptoms of wilting and yellowing appear first in the youngest leaves of the plant.

Dr Siti Subandiyah, from Indonesia's Gadjah Mada University, says the two wilt diseases are still the most severe disorders affecting bananas in Indonesia, and have

spread across many provinces.

"The last severe infection was in late 2006 in South Kalimantan when most banana crops, especially the cultivar Kepok, were severely damaged by BDB," Dr Subandiyah says. Given that bananas are Indonesia's most important horticultural crop and an important staple food, these sorts of disease invasions are devastating.

The need to protect unaffected countries and regions, as well as to find better ways of managing the diseases once they do invade, is driving two ACIAR projects in Indonesia and Papua New Guinea.

"It is important that every country in the region knows what kind of wilt diseases they have and where they are distributed," says Dr Augustin Molina, ACIAR project coordinator and Bioversity International's regional coordinator for Asia and the Pacific. "This knowledge leads to the development of rational inter-country as well as intra-country quarantine policies to prevent the further spread of diseases. For example, many of the important banana varieties grown in Papua New Guinea may be susceptible to TR4. Knowing what disease types are already present in PNG, and neighbouring Indonesia, helps to prevent TR4's invasion."

Bob Williams of the Queensland Department of Primary Industries and Fisheries (QDPIF), the ACIAR project leader, believes it is important to know how

to live with such diseases if they do strike Australia.

"By working in Indonesia and PNG we're getting a better indication of the movement of disease, and how and when it might arise and what path it might take," Mr Williams says. "We can better understand how we could live with the disease if it did come to Australia, what management practices will minimise impacts, and how to change production practices and make conditions unfavourable for disease."

The first ACIAR project began in 2005 at the request of the Indonesian Government, which was concerned about smallholder banana growers dealing with the devastating effects of wilt diseases. Project leader Dr Peter Taylor believes the Indonesian research will also help Australia if any of these diseases enter the country.

"We have made considerable progress in understanding these diseases. And we now have improved diagnostic tests for detecting them," Dr Taylor says.

The project has improved the robustness of a polymerase chain reaction (PCR) test aimed at detecting BDB even if plants have not started to visibly 'ooze'.

"We have established best-practice management options for wilt diseases," Dr Taylor says. "We'll be working with extension agencies and the Indonesian Banana Wilt Task Force to get these results



PARTNER COUNTRIES: Papua New Guinea, Indonesia

PROJECTS: CP/2005/136: Mitigating the threat of banana Fusarium wilt; CP/2004/034: Diagnosis and management of wilt diseases of banana in Indonesia

CONTACTS: Dr Peter Taylor, peter@tsac.com.au; Dr Augustin Molina, a.molina@cgiar.org

Farmers and students from Andalas University in Padang, West Sumatra, led by researchers from the Indonesian Banana Research and Development Center, inspect an area infected by wilt diseases at Agam that will be used for ACIAR research.

PHOTO: NASRIL NASIR

out to farmers through existing networks and farmer discussion groups.”

The project has also set up field trials to test biocontrols against Fusarium wilt and to use as demonstration plots for BDB control measures.

Mr Malin, a farmer in Baso, Sumatra, and chairman of a local group of farmers, says nearly 70% of the bananas have been infected by wilt diseases in his region since 2002. Most attempts to re-establish banana crops in the region have failed, but

Mr Malin says that the ACIAR banana plants were “higher and healthier” than other plants in the region after three months.

The second ACIAR project, managed by Dr Molina, began last year to complement the first project and focus specifically on various forms of Fusarium wilt disease. It aims to map out the geographic spread of the various forms of the disease, validate diagnostic tools and produce a disease-management manual of farmer-evaluated methods. In particular, it aims to promote

national strategies that improve the region’s capacity to exclude, contain and control Fusarium wilt.

The project has already surveyed the major banana-producing areas of Indonesia and collected infected plants. A similar survey is about to start in PNG. The project has also selected sites in Lampung and East Java in Indonesia to develop and test disease-management methods that are appropriate for local conditions.

The ‘best-bet’ methods recommended by researchers will be packaged to include resistant plant varieties, biocontrol, use of low-cost tissue cultures for planting, routine monitoring and eradication, and use of annual cropping systems. These will be compared with farmers’ existing practices.

Dr Molina believes it is essential to involve farmers in such tests. “By involving farmers right from the start, in a participatory approach to developing or validating disease-management strategies, we are able to improve the relevance of our project, making sure that it answers their needs. It makes them own the project. Then the farmers can serve as effective ‘extension agents’ to other farmers.”

The work in Indonesia, and now PNG, is just the start of regional and even global efforts to manage threats to banana growers from diseases such as Fusarium wilt and blood disease. ■

PHOTO: AGUSTIN MOLINA



External symptoms in the pseudostem of a banana plant with Fusarium wilt show rotting of the vascular tissues that eventually leads to wilting of the plant.