The race to save banana

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ABSTRACT

Fusarium wilt of banana caused by the soil borne fungus *Fusarium oxysporum* f. sp. *cubense* was first recorded in Australia in 1874, but its spread to Panama in 1890 was the start of the first global epidemic. The disease affected a susceptible variety dominant at the time, Gros Michel. By the 1950s Gros Michel was replaced by a variety resistant to the disease: the Cavendish banana. A silver bullet solution was rapidly adopted around the world. Then in 1967 symptoms of Fusarium wilt appeared on Cavendish in Taiwan. Tropical Race 4, the race that affects Cavendish in any environment, was named in the 1990s. In 2019 it appeared in Colombia, establishing it in every banana-growing region globally. This is a race the disease is winning in turtle-like fashion. Despite this, banana remains an important export and also provides nutrition and livelihood benefits to growers and communities around the tropics. What can we learn from our biosecurity responses to races 1 and 4 to provide a competitive advantage against any future race? Both technical and behavioural strategies are necessary, to be prepared for inevitable change. Solutions must offer hope to growers and smallholders that production can be maintained despite the presence of the disease as the return to business as usual becomes a distant dream.

I am going to tell you a story about when I first encountered Fusarium Tropical Race 4 in Queensland, March 2015. And I am going to tell you a few of the things that I learnt about it on the way. I was working with Queensland Department of Agriculture and Fisheries at that time.

Even though we had prepared and we had worked with ACIAR to research the disease and get to know it in our neighbour countries where it was endemic, the reality of the incursion completely changed the game. Despite the preparation, somehow the simple questions posed by farmers did not have clear or practical solutions: What do I actually have to do to keep my farm clean, and keep growing bananas? I have got the disease on part of my farm; I have always been a banana grower; how do I keep growing bananas?

It was finding practical answers to these questions that began the race to save Cavendish bananas in Far North Queensland.

It is very important to notice that this race is against a very slow-moving opponent that can be stopped ('unless man or flood intervenes Fusarium moves at a tortoise pace', said RH Stover in 1970). As noted by Stover, the main carrier of the disease is humans. The solutions had to address both human and pathogen behaviour – and this is really the key message that I want to share

This record has been prepared from a transcript and the slides of the presentation.

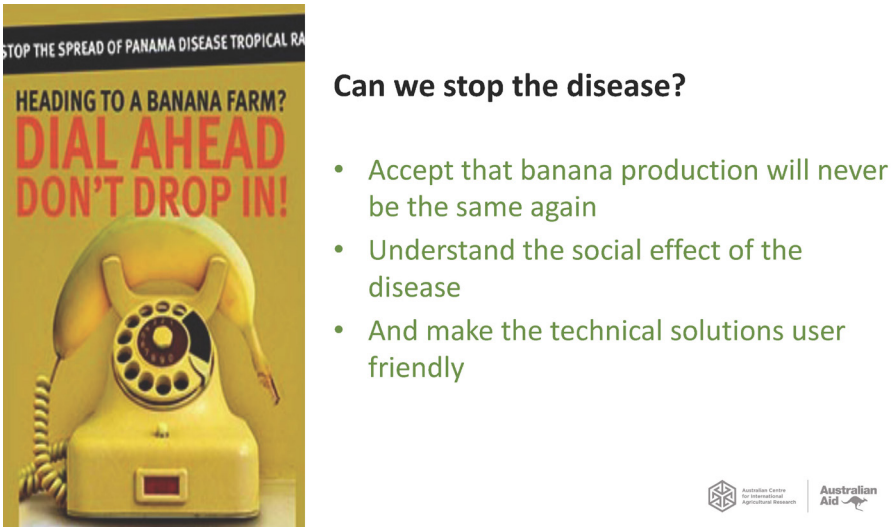

Figure 1. Do not 'drop in' on a banana farmer in Far North Queensland!

about my Fusarium story: the race needs to be run with research looking at the system from a biological, a social, an economic, *and* a policy perspective.

First reactions

Right from the start, the research and regulatory teams worked together with farmers to design the biosecurity barriers, the washdown facilities, and the rules that are the now-universal welcome to commercial banana farming businesses. Researchers fact-checked the many cures proposed (we were overwhelmed by cures!). Researchers also identified effective disinfectants, as well as looking at farm design to manage farm access, ensuring only clean equipment and gumboots could enter and leave farms, and that people could easily comply with the systems proposed.

The banana industry also acknowledged, very early on, that being a banana farmer would never be the same, and that a major part of the solution would involve supporting human behaviour in the response. Queensland campaigns, such as the one shown in Figure 1, were very important: asking everyone not to drop in on a farmer.

The social changes that biosecurity compliance imposed on North Queensland are easy to say but hard to implement. The social impact of not visiting your neighbour, and of having to wash your vehicle every single time you move on or off your farm – it is real! It is like social distancing, but it is forever.

It was critical that research – to control the disease and provide solutions – was multi-disciplinary, bringing social scientists and technical scientists together, supported by the regulators when necessary. The technical solutions were still very important, and the technical solutions are really part of maintaining hope in the system.

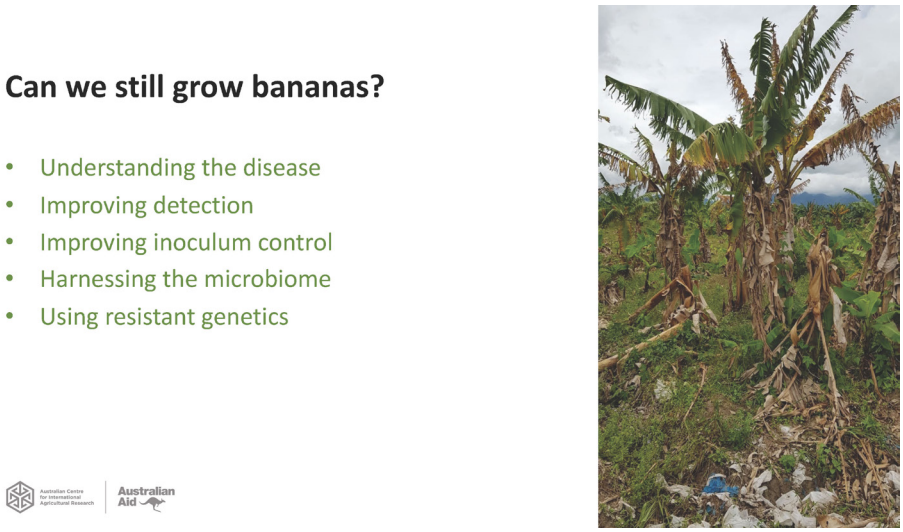

Figure 2.

Technical approaches researched

It is important to maintain hope in a banana-growing future, and so the investment in technical research was ramped up very quickly. It covered many of the research gaps. The improved research improved technical and system efficiencies (Figure 2).

Researched topics included better detection, and the potential for remote and proximal sensing, and managing inoculum build up, including by destroying banana plants using urea rather than by the burning that had previously been practised. Also:

- characterising the banana microbiome, which is one of the really exciting areas of research ACIAR is investing in now;
- understanding how our production system is favouring the pathogen, and rebalancing that system to allow bananas to keep growing through adjustments to management; and
- research to discover and understand and test resistance.

The third of these is where the industry probably had its hopes pinned – that is, on testing resistant varieties that would be able to replace Cavendish, and checking options such as local somaclone selections of Gold Finger. However, although Gold Finger is a banana that we have in Australia and is resistant to Tropical Race 4, it is not able to be marketed successfully. Therefore it has not even been considered as a potential solution.

Can we save banana?

Do you think we can save banana (Figure 3)? I refuse to believe that we will be in a world without bananas. Science is very much the key to that solution, and the research collaboration globally over this time of pandemic has been exciting. Our ACIAR microbiome project is now working with people in the Philippines,

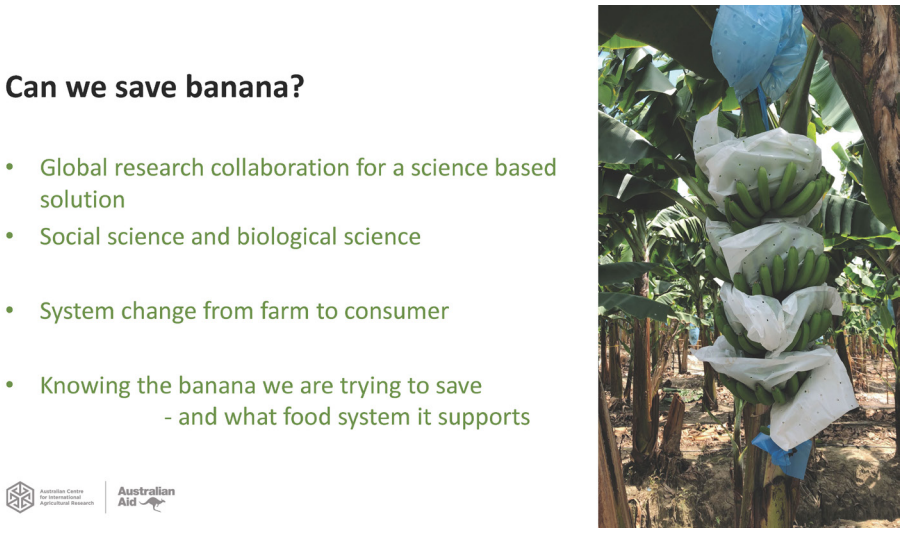

Figure 3.

Laos and Indonesia and Australia, and Malaysia is joining, and we are talking to researchers in China. We are working together. The research must continue to be multi-disciplinary, focusing on biological, social, economic and policy aspects, and it must consider the banana system from the farm through to the consumer, because this is ultimately a food system challenge.

I want to leave you with a last thought: the business that banana supports is worth over US$12 billion in exports per year. It is big, and it is still growing significantly. Banana producers from developing countries are feeding the global north with a cheap, nutritious and universally loved product. Yet that trade, however big, represents much less than a third of total banana production.

We need to put this race to save Cavendish into perspective. Saving banana is not just about saving Cavendish and its role in our food system; it is about keeping bananas on the menu for everyone, and developing tomorrow's system for growing bananas.

Irene Kernot manages the Horticulture research portfolio at ACIAR. Before joining ACIAR, Irene worked in northern Australia as an agronomist in the Northern Territory and in Queensland as an extension horticulturist in tropical fruit systems. In Queensland Irene managed a Tropical Fruit research group that included Market Access and Banana researchers. This gave Irene a solid grounding in the importance of biosecurity and the importance of good science in incursion response and management. In that time the research team supported responses to Panama TR4, black sigatoka and oriental fruit fly as well as to non-biotic damage from cyclones Larry and Yasi.