Banana blight

Why bananas could disappear from our fruit bowls

Best loved fruit

Bananas are the number one fruit crop in the world. They are the fourth largest crop overall, after wheat, rice and corn. They share a problem with all these cultivated plants, however, and that is susceptibility to disease. This is a particularly severe problem for plants propagated vegetatively, such as bananas. All bananas are genetically very similar, so a pathogen that affects one of them will be able to damage all of them — something that would not be the case if bananas were genetically variable. The black Sigatoka fungus causes the worst problems. Its name comes from the Sigatoka Valley in Fiji where it was first identified in 1912. Over the next 40 years, the disease spread to all banana-producing countries. Black Sigatoka appeared in Central America in 1934 and in 2 years had destroyed more than 8900 hectares of banana in Honduras and Suriname.

Without intervention, this fungus can devastate whole plantations, causing up to 100% fruit loss.

Black Sigatoka life cycle

Figure 1 shows the asexual life cycle of the fungus. If a spore is splashed on to the leaf of a neighbouring plant, within 2–3 hours it produces a germ tube, invisible to the naked eye. This grows on the surface of the leaf until it encounters a stoma, whereupon it grows inside and starts colonising the leaf. For up to 40 days there is no sign that anything is amiss, then gradually lesions start to appear (see Figure 2). By this time, spore-producing tissues have emerged from stomata and started to release yet more spores (see Figure 3). It is the sugars produced by the leaves that fuel the development of fruits, and so plants infected with the fungus produce fruit of such poor quality that they cannot be sold.

What can be done?

The only treatments that can thwart the fungus are fungicides, and in many parts of the world these are sprayed from planes over huge swathes of banana plantations — in some regions up to 50 times every year. In addition to the obvious environmental impact, there are several problems with this approach. The greatest drawback is the selective pressure the fungicides exert on the fungus, favouring the emergence of resistant strains. Many farmers in developing countries cannot afford fungicides. Many consumers are keen to obtain organic produce — uncontaminated by agrochemicals. So plant researchers are working hard to develop varieties of banana that are resistant to the fungus. This might be relatively straightforward if it were possible to cross-breed different varieties or strains and select for resistant progeny. This is not feasible with edible bananas, however, as they do not produce viable seeds.

The resistance movement

There are two main approaches being used to generate Sigatoka-resistant bananas. One uses non-edible bananas which are resistant to the fungus. In 2012, researchers in Ecuador isolated the genes responsible for conferring resistance. Since then, laboratories around the world have been working with genetic transformation techniques to engineer these genes into edible bananas. The second approach is to bombard plantlets of edible banana with gamma rays and X-rays, which cause DNA mutations, some of which by chance will confer resistance. There are currently three mutants which, in laboratory conditions, show resistance to the fungus. If these plants prove resistant to the fungus in plantation conditions, and generate fruit that matches that of the conventional crop, plant geneticists will have saved our best loved fruit for future generations to enjoy.

Further reading

To see how edible bananas are propagated without using seeds see: www.youtube.com/watch?v=sLoZbDnAPIk Is the means of combating Sigatoka described in this video ‘natural’? www.youtube.com/watch?v=lb8_f_VwPhc

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