



Tackling crown rot in apples

Identifying resistance to
Phytophthora diseases in apples.



Collar rot in apples.

Crown rot in apples.

Phytophthora is a group of soil, air or water borne plant pathogens that pose major challenges to global biosecurity. *Phytophthora* pathogens affect an increasingly broad range of hosts worldwide that with the rapid movement of organic material between countries, has escalated the proliferation of diseases they cause.

Scion's *Phytophthora* research programme focuses on three diseases that are seriously impacting our primary industries and conservation estates: apple root, crown and collar rot, red needle cast and kauri dieback.

Apple root, crown and collar rot

Apple root, crown and collar rots are caused by *Phytophthora cactorum* and other *Phytophthora* species. They can cause 1-20% tree loss within the first three years of planting, and ongoing losses from there. This significantly impacts New Zealand's second largest fresh fruit export, worth \$500 million per year.

The pathogens can attack all parts of the tree: root, crown (root-trunk junction), and collar (scion). They can also cause fruit rots and shoot blights, and sub-lethal 'root nibbling', which has an ongoing effect on productivity.

Phytophthora cactorum has a wide host range and is present in most apple orchards. Resistant root stocks are considered the best long-term strategy for control.

Research questions

- What makes *Phytophthora* species such successful pathogens?
- Can we identify and select for broad resistance to *Phytophthora*?
- Enabling Technology - can we develop a method that is applicable to disease management of other systems?

Research objectives

1. To develop a technology platform, using both traditional and modern technologies, that will enable the characterisation of host-pathogen interactions from the molecular level through to tree scale.
2. To apply the knowledge gained from this enabling technology platform to breed for broad resistance against *Phytophthora* in trees, improve disease management and develop targeted diagnostic tools.

Benefits to industry

- Improved survival rate of young apple trees.
- Increased productivity through the deployment of genotypes with resistance to a broad range of *Phytophthora* species.

- Genus-wide strategies for managing *Phytophthora* diseases in preparedness for future disease incursions.

Understanding *Phytophthora*

In addition to apple root, crown and collar rot, there are two other major *Phytophthora* diseases in New Zealand:

- Red needle cast (caused by *Phytophthora pluvialis*), a new disease of radiata pine, can cause serious losses on some sites.
- Kauri dieback (caused by *Phytophthora agathidicida*), a disease that poses a serious threat to our indigenous kauri.

We are taking a *Phytophthora*-wide approach to disease breeding, management and research, building on our existing programmes for red needle cast, kauri dieback and other *Phytophthora* species.

Scion has been allocated \$10 million funding from MBIE over the next six years (2013-2019), with significant co-funding from sector groups, to lead a collaborative research programme addressing the biosecurity threat of *Phytophthora* species to New Zealand's forestry, agriculture, horticulture and natural ecosystems.

Project collaborators

The project is led by Scion's Forest Protection team and encompasses a range of disciplines across the organisation.

National collaborators: Plant & Food Research, Landcare Research, local Māori groups, Massey University, Auckland University of Technology and the University of Auckland.

International collaborators: Murdoch University, Australia; the University of British Columbia, Canada; Oregon State University, USA; and the University of Exeter, England.

Co-funders: Ministry of Business, Innovation and Employment, Forest Growers Levy Trust, Radiata Pine Breeding Company, Kauri Dieback Programme.

Programme leaders: Dr Ian Horner and Dr Vincent Bus, Plant & Food Research; Dr Nari Williams, Scion.

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Scion is the Crown research institute that specialises in research, science and technology development for forestry, wood and wood-derived materials, and other bio-material sectors.

Plant & Food Research is a New Zealand-based science company providing research and development that adds value to fruit, vegetable, crop and food products. Their goal is to underpin the growth of plant-and marine-based industry through the successful application and commercialisation of research-based innovation.

