Developing knowledge & management of strawberry red leaf disorder – Hort Innovation project: BS19001

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Red Leaf Disorder (RLD), characterised by reddish/maroon discolouration of strawberry leaves, has become more noticeable since its first sightings in 2014 in cultivar 'Fortuna'. It is now present in several commercial cultivars grown during Queensland's winter production.

Photo credit: Michelle Paynter, DAF

The cause of RLD is unknown. In 2019, over 40% of the growers surveyed estimated up to 20% of plants were affected by RLD. These plants typically display reduced vigour and yield. The implications for industry may potentially be significant if the cause of this disorder is not identified and managed.

Currently, there is no definitive scientific evidence of the cause of RLD in strawberry, making diagnosis based on symptoms alone challenging. Investigations to date covering a wide range of potential causes of RLD by the Department of Agriculture and Fisheries (DAF), University of Queensland (UQ) and AgriBio have found no obvious single causal agent, suggesting that the disorder and mechanisms behind its transmission may be quite complex. Thus, there is currently no standard for strawberry producers and advisors to accurately identify and manage plants with RLD. Running in conjunction with the ongoing DAF investigation, a new Hort Innovation funded project (BS19001), was established in August 2020, to identify and better understand possible causes of RLD in strawberry via expanded genetic studies.

The major focus of the project will be to:

- Identify the cause of RLD conducting detailed DNA analyses of strawberry plant samples coupled with pathology and microscopy studies
- Improve knowledge on RLD identification and collate a potential management guide to provide growers with tools for identification and management of RLD
- Establish a network and communication channel as part of a 'Communities of Practice'
- Present project updates at industry meetings/events
- Develop a pathway for a potential RLD PhD study

Through a close collaboration between DAF and UQ, this project is divided into two phases. Phase 1 (6 months) will expand on existing discovery-driven next generation sequencing analyses undertaken by DAF, UQ and AgriBio to identify potential pests and diseases common to plants with RLD symptoms. In addition to DNA analyses, which will include an expansion in the number of farms and severity of RLD sampled, gene expression studies will be undertaken. Understanding how symptomatic plants are responding to RLD may help identify potential causes of the disorder. This phase of the project will complement DAF's existing multi-disciplinary research activities investigating epidemiology (i.e. incidence and spread), potential causative agents, nutrition and economic impact of strawberry RLD. Outcomes from Phase 1 will include information back to growers on potential causes of RLD and be used as the basis of a proposed collaborative DAF/UQ four-year study (Phase 2). It is proposed that Phase 2 will be underpinned by a PhD project, to fully research the causal mechanisms and provide management options for the industry.

The team, led by Joanna Kristoffersen and Michelle Paynter, consists of a large cross-organisational and multi-disciplinary team from DAF (Dr David Innes, Apollo Gomez, and Dr Jodi Neal), UQ (Professor Peer Schenk, Reuben Brown, Kapah Alu) and AgriBio (Dr Fiona Constable and David Lovelock).

Each have extensive experience including plant pathology, bioinformatics, data analysis and information management of genomic, metagenomic, pangenomic and transcriptomic data for diverse applications including diagnostics and discovery.