Advancing Sustainable & Technology Driven Apple Orchard Production Systems

PIPS
Apples & Pears
PRODUCTIVITY IRRIGATION PESTS AND SOILS

AP19003

Optimising yield, quality & labour efficiency through improved crop load understanding & use of technologies in new & emerging apple cultivars within the context of an increasingly variable climate.

Lead Agency: Agriculture Victoria
Project Leader: Dr Ian Goodwin, Research Leader Crop Physiology

Project Background

Australia has a unique climate characterised by relatively high temperatures and light intensity. Light interception and resultant carbohydrate availability are fundamental in defining the optimal number of fruit that a tree should hold to consistently maximise fruit quality and yield. However, light can also be detrimental to fruit quality and photosynthesis, particularly in a variable climate of extreme heat events.

Apple is generally susceptible to biennial bearing which is the tendency to alternate years of high flower initiation followed by a year of low initiation. Previous studies on crop load management of the cultivars 'Rosy Glow' and 'Nicoter', showed that there is an inverse correlation between fruit number on trees and the subsequent season's flower number. Furthermore, most aspects of fruit quality (size, soluble solids concentration & colour) and maturity were inversely correlated with crop load. These previous studies found that biennial bearing is controlled at tree level from a combination of genetics (flower induction genes) and environment (carbohydrate availability), most likely mediated by metabolites that act as chemical signals to either stimulate or inhibit the activation of the genes.

How is the research being undertaken?

Physiological studies and the development of sensing tools are being undertaken in the Sundial apple orchard at Agriculture Victoria's Tatura SmartFarm and on a commercial orchard in Ardmona (Goulburn Valley). At these locations, experiments and trials are conducted to:

- Determine relationships between fruit position and light exposure on colour development, sunburn damage, fruit quality and floral initiation.
- Identify chemical signals that determine the impact of high crop load on floral initiation and differentiation, and fruit size in the subsequent season.
- Develop a rapid orchard assessment tool using a ground-based mobile sensing platform equipped with LiDAR and optical cameras (Green Atlas Cartographer™) capable of objectively measuring fruit size, fruit colour and tree size, and advising crop load distribution in an orchard.

The novel Sundial orchard (right) provides a unique resource to explore relationships between sunlight within a tree canopy and apple fruit development starting from when a vegetative bud first turns into a flower bud through to when the fruit is harvested.

The project is collaborating with Green Atlas. The Cartographer™ technology (right) is already being commercially used to map variation in fruit number in apple, almond, cherry, kiwifruit and wine grape crops. This project is taking the technology to the next by examining its accuracy in new metrics.

Project Outcomes for industry

- Increased knowledge on orchard design to reduce sunburn damage and improve product quality.
- Developed management options to stabilise floral initiation.
- Improved crop load management options to deliver premium fruit.
- Calibrated & validated sensing tools to measure in situ fruit number, size &colour.

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