TASMANIAN INSTITUTE OF AGRICULTURE

More Profit from Nitrogen

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Cherry nitrogen nutrition

Key Points

- **A national study to improve nitrogen use efficiency** and improve productivity of quality fruit in cherry orchards
- **Labelled nitrogen (^{15}N)** is used to **track and measure** the movement of nitrogen in the soil-plant-atmosphere system of the cherry orchard
- **We apply labelled nitrogen at different times** to understand how nitrogen is stored, distributed and remobilised and how this impacts on fruit production
- **Are different forms of nitrogen effective** and is this nitrogen used **efficiently** or lost to the **environment**?

Optimising the efficient use of nitrogen in cherry orchards

This project aims to maximise nitrogen use efficiency in the Australian cherry industry to increase productivity, profitability and improve environmental management.

The research aims to measure cherry tree demand for nitrogen and track its cycling through the soil-plant-atmosphere system. This will guide the development of management strategies for increasing the quantity and quality of cherry yields whilst effectively mitigating loss of nitrogen to the environment.

The research team includes Dr Peter Quin and Dr Nigel Swarts, who have been working in close collaboration with commercial orchard managers James Clements and Andrew Hall.

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TIA is a joint venture of the University of Tasmania and the Tasmanian Government

Nitrogen uptake and storage

Nitrogen (N) is an essential nutrient for cherry tree development and fruit production, but the timing of a tree's demand for N is not clear. Nor is it known how much N a tree stores during dormancy for use in the following season. To help answer these questions a three year trial has been established at Wandin Valley Orchards, Rosegarland, using 6-year old Lapins on Colt rootstock.

Nitrogen sources

Cherry trees can access nitrogen from three sources: **Soil Nitrogen,** including the soil solution; **Stored Nitrogen,** in roots, trunk, branches, buds, leaves and fruit; and **Supplementary Nitrogen,** applied to the tree as fertiliser.

By supplementing the tree with labelled ^{15}N calcium nitrate, we can answer many questions about how N is used, distributed, stored or lost to the environment over time and which source of N is most important at any given time. The first series of trials traces the fate of labelled N applied at various times throughout the growing season and how this relates to uptake and storage.

Nitrogen (N) timing 2017/2018

The four treatments received a total of 90 kg N /ha split into four equal applications over the season, applied at different times (Fig 1). Labelled ^{15}N calcium nitrate was applied by drip fertigation to the treated cherry trees. The first application was on November 8, 2017.

Timing of N	Pre Harvest					Post Harvest			
Week	1	2	3	4	Harvest	1	2	3	4
Pre Harvest	N	N	N	N					
Post Harvest						N	N	N	N
Split	N		N			N		N	
Control (0N)									

= 22.5 kg N/ha applied as Calcium nitrate

Fig 1: Nitrogen treatments applied to cherry trees.

We analysed the total N and ^{15}N content of leaf samples taken throughout the season followed by fruit at harvest and falling leaves captured with nets after harvest. Fruit yield and quality was also assessed at the normal harvest time.

Digging up whole trees in the name of science

We will excavate whole trees in winter 2018 and again just before harvest in late 2018. This will establish how much stored N has been remobilised and how much the tree has drawn from soil resources. This will help pinpoint critical times for nitrogen application and the formulation of efficient N-application strategies for growers.

Does nitrogen timing affect fruit quality?

At this early stage, no significant differences were found in fruit quality that related to the timing of N application. ^{15}N analysis will reveal if previously existing soil N or N stored in the trees from the previous season is masking this effect.

Rainfall and nitrogen loss

After heavy rainfall in December 2017 we measured significant losses of nitrogen as emissions to the atmosphere as the potent greenhouse gas nitrous oxide (N_2O). Over an 8-day period the emissions spiked with an equivalent of 334 g/ha/day of N_2O-N emitted from above the drippers of trees fertigated a week earlier. This rate of emission was more than 12 times greater than a similar period experiencing average rainfall. This emphasises the importance of trying to avoid N-fertilisation when heavy rain is imminent, especially as leaching of nitrate-N is known to remove large quantities of N to below the root zone.

Rates and sources of nitrogen application

An additional three year trial has been established at Reid Fruits' Honeywood Orchard at Jericho, to examine the effect of different rates of calcium nitrate application on tree development. It will also compare a standard rate of this fertiliser with an equivalent quantity of N applied from organic sources. Another treatment includes a microbial soil inoculant, to test its influence on N uptake.

More information

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