Key Points

• A two year study of potted Pinot Noir is set up in the Horticulture Centre of the University of Tasmania

• This project integrates three different areas to develop a holistic management approach to monitor the seasonal movement of nitrogen.
  1. Experimental Design
  2. Nutrients and Pesticides Application
  3. Vines and Fruit Analysis

• Young 1 year old vines will be obtained from the commercial Jansz Parish Vineyard nursery for the research.

Improving the Understanding of the Seasonal Movement of Nitrogen in Grapevines

Wine production requires high nutrient inputs. However, fertiliser application must be managed effectively to ensure an adequate balance between vegetative growth and reproductive output, i.e. the fruit, to make good quality wine. Fertiliser is often applied based on standard recommendations irrespective of irrigation requirement, crop load, vine size, quality specifications, and the soil's capacity to retain and supply nutrients and minimize off-site impact (United States Environmental Protection Agency 2017). Therefore, there is potential to optimise nutrient inputs and timing to improve fruit quality and the resulting wine quality.

This project will use labelled-nitrogen ($^{15}$N) to examine whether the timing of nitrogen application affects the assimilation and partitioning of nitrogen to different plant organs, and how this influences wine quality. It will thereby indicate how nitrogen management can be best optimised in the vineyard to have the greatest advantage.

It is anticipated that the findings from this project will have an impact on vineyard profitability and sustainability through the influence of targeted nitrogen application and its impact on both yield and wine quality.
Experimental Design

50 Pinot Noir vines will be set up in a pot-trial to compare the effect of nitrogen application timing.

Setting up a pot trial avoids confounding variables, thus all the vines can be carefully monitored to accurately account for all nitrogen within the system. This study will improve the understanding of seasonal movement of nitrogen in grapevines for vine health, yield and grape/wine quality.

Vines and Fruit Analysis

The vines will be monitored throughout the season and fruit-set will be analysed. The vines will be set up for destructive harvest sub sampling to establish the rate of $^{15}$N uptake and movement through the vine.

At dormancy, whole vines will be destructively harvested and the organs separated. The wet weight and dry weight of the vine organs will be obtained before grinding to a fine powder. Grapes will be harvested and crushed to obtain a sub sample for $^{15}$N analysis. Nitrogen stable isotopes from all harvested samples will be analysed using flash combustion isotope ratio mass spectrometry at the Central Science Laboratory, University of Tasmania.

Nitrogen uptake efficiency for application timing will be determined as the percentage of $^{15}$N recovered from the applied amount. Allocation of $^{15}$N to storage will be determined by comparing differences in $^{15}$N recovery from storage organs and to improve interpretation accuracy, fertiliser recovery will be standardised for vine size using dry weight measurements.

Crushed grapes (skin and pulp) will be used for micro-vinification. A 50ml juice sample will also be obtained to determine YAN, total soluble soils, pH and total acidity. Fermentation rate, determined by weight, will be monitored daily to determine treatment effects. At the end of fermentation, total phenolics, anthocyanins and tannins will be determined.

Nutrient and Pesticide Application

All vines will be supplied with a standard Hoaglands solution minus nitrogen. In the early stage of the experiment, Hoaglands solution will be applied frequently by hand to provide sufficient nutrients for young vine development. Once the young vines are more established, the amount of Hoaglands solution will be decreased and drip-irrigation will be installed to supplement water supply.

Nitrogen fertiliser will be applied at a rate of 12 g N/vine, in which 6 g N will be obtained from 5% enriched $^{15}$N fertiliser and the other 6 g N from Ca(NO$_3$)$_2$. The nitrogen fertiliser will be applied at four different application timings (budburst to flowering, flowering to veraison, veraison to harvest, and weekly intervals across the whole growing season). Each treatment will contain 12 replicates, which will be analysed in either the first or second year to assess nitrogen storage and movement across two seasons.

Sulphur will also be applied on a regular basis to protect them from disease.

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