Better quality wines without environmental compromise

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The Gimblett gravels (GG) are situated in the heart of the Hawke's Bay Region. The soil is free-draining gravel with little organic matter and a very low water holding capacity. About 800 ha of land are currently planted in premium red grape varieties. Effective management of water and nutrients is a challenge to the growers, both economically (finding the best way to maintain consistent wine quality) and environmentally (minimising the high-risk of leaching from excessive or inappropriate use of water and fertilizers).

Grapes from the GG often have very low levels of yeast-available nitrogen (YAN). This can result in a stuck or sluggish fermentation and may increase the risk of contamination by other micro-organisms. HortResearch is running a 3-year trial at Craggy Range vineyards. The research is being carried out as part of the Focus Vineyards studies in the Hawke's Bay. The aim of the trial is to achieve acceptable levels of YAN in the grape juice by applying nitrogen in such a way that grape yield, wine quality and the receiving environment are not compromised.

A range of nitrogen treatments has been established to help identify environmentally sustainable management options. The control nitrogen treatment receives a single dressing of ~25 kg N/ha in the autumn, followed by a spring dressing of 5 kg N/ha as CAN. Additional nitrogen treatments include compost (100-200 kg N/ha), fertigation (40 kg N/ha in 2 sprays) and foliar applications of Urea (5% as 1 to 5 sprays applied from flowering to 16^{o} Brix), and Wuxall-amino (3 sprays between flowering and 16^{o} Brix). Micro-vinification is being carried out on batch samples of grapes at harvest (~50 kg per treatment) to assess treatment effects on wine quality. Supporting data are being collected to describe the microclimate, changes in soil-moisture and soil-nitrogen, and to monitor the growth, biomass allocation and nitrogen budget of the vines. These data are being used to develop a model for the water and nitrogen budget of the vines, and to assess the environmental 'footprint' of vineyard production.

Results to date have not been too encouraging. Compost (at the full rate) applied in Year-1 was the only treatment that gave a significant increase in juice YAN. However, by Year-2 the old compost treatment was no better than the control, and no treatments produced the required level of YAN. All YANs were lower in 2004/05 because of delayed maturity and early harvest brought on by persistent late rainfall. Additional (higher N) treatments including incorporation of compost into the soil, plus a closer examination of YAN development, are being considered for next year.

This presentation will discuss major findings from the first two years of the trial. Funding for this study comes the Ministry of Agriculture and Forestry's Sustainable Farming Fund with additional support from NZ Wine Growers, Hawke's Bay Regional Council, and the Gimblett Gravels Technical Group.

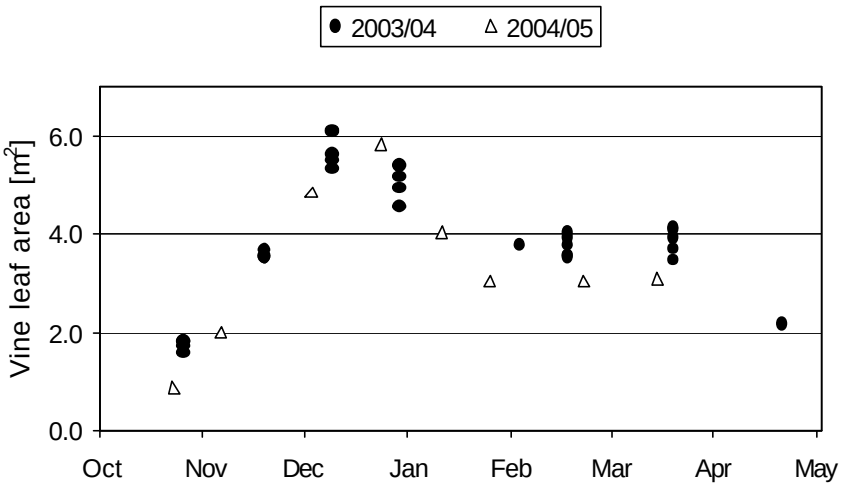

Figure 1. A destructive harvest of shoots is being made every 2-3 weeks to determine vine leaf area (shown above). This information helps us to calculate the water use of the grape vines. Harvested plant material (leaf, shoot and bunch) is also being analysed to determine the carbon and nitrogen budget of the vines. The vines in Year-2 maintained a bigger leaf area (less vigorous leaf plucking near verasion) in the later part of the season. Models are being developed here, and in Marlborough, to relate vine leaf area to irrigation demand.

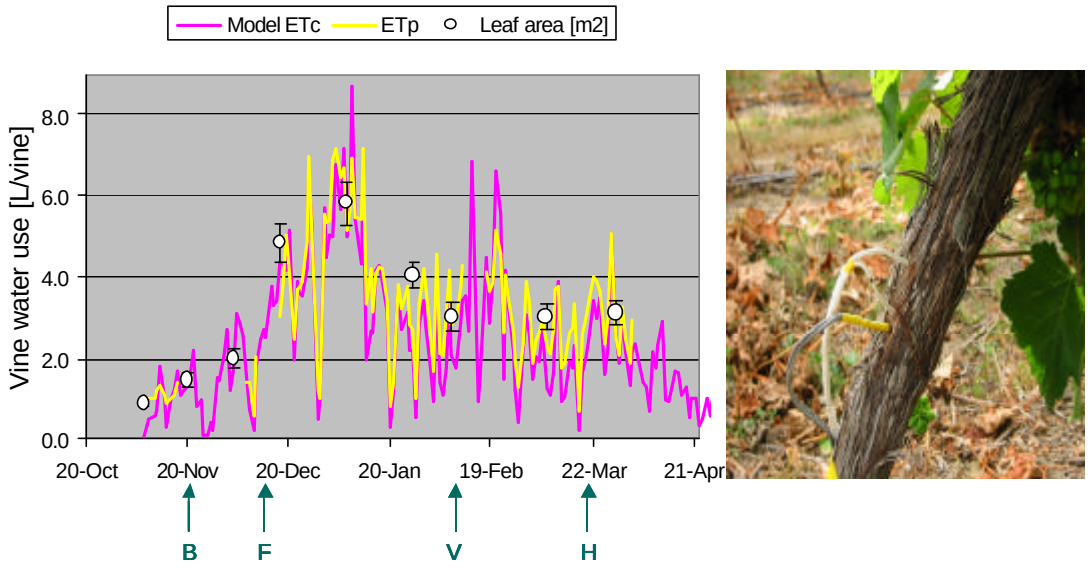

Figure 2. Sap flow sensors in the vine stem are being used to determine daily transpiration losses from the grape vines. Weather data recorded on site is used to calculate the potential evaporation losses. When water is non-limiting, vine transpiration is determined mostly by leaf area and the prevailing microclimate. Trimming in early January reduced leaf area from about 6 m^2 to 4 m^2 per vine. There was a concomitant reduction in daily sap flow dropping from about 6 L/vine to 4 L/vine, on average. These results are helping to define the vine's irrigation needs. Craggy Range is monitoring soil moisture levels and developing critical 'set points' to schedule their irrigation.

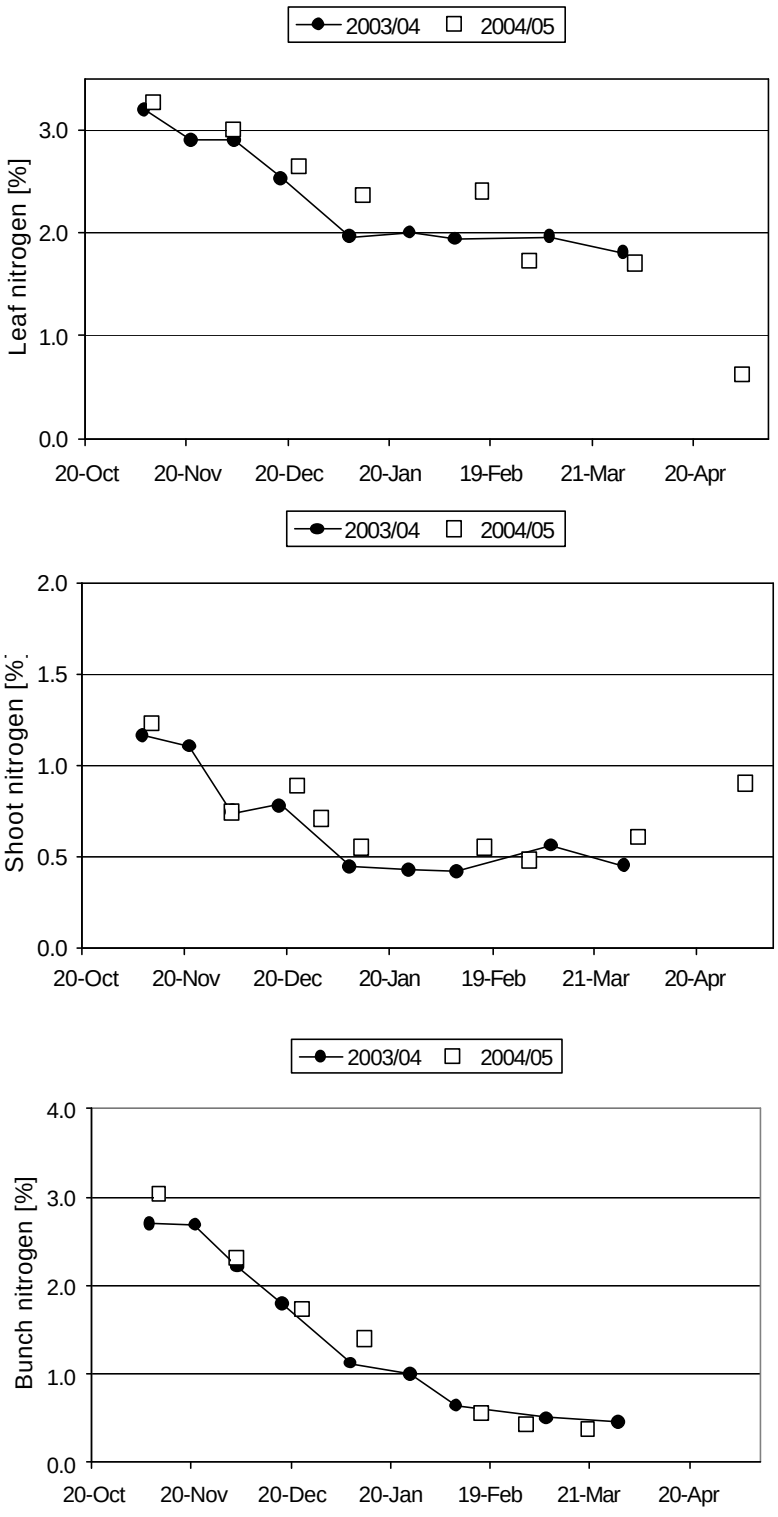

Figure 3. Seasonal development of nitrogen in leaves shoots and bunches of the control vines. The nitrogen content of plant material declines over the season. Leaf-N drops rapidly after harvest as nitrogen is transferred from the leaves (leaf-N halves) to the shoots (shoot-N doubles). Leaf nitrogen was slightly higher in Year-2, yet the bunch nitrogen was slightly lower. These results can be multiplied by the respective dry-matter contents to determine the vine N budget.

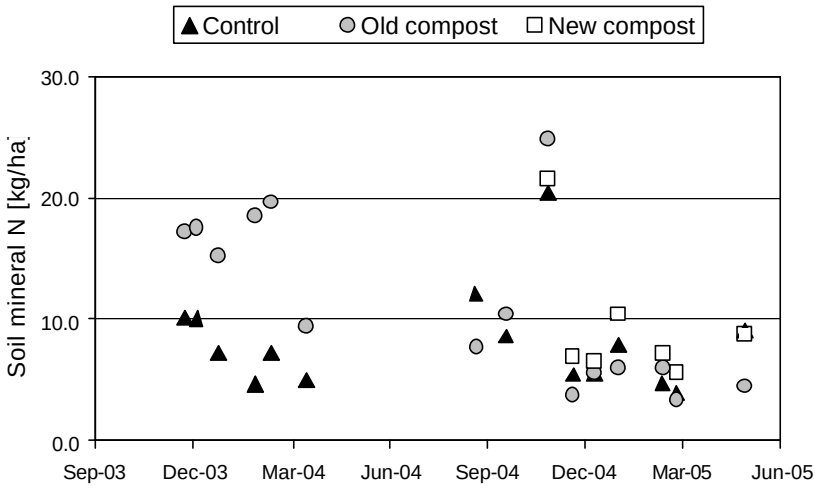

Figure 4. Total mineral nitrogen was measured in the top 20 cm of soil. The dd compost (spring 2003) was applied at a rate of ~200 kg N/ha. The new compost (spring 2004) was applied at half that rate. The old compost has all but gone by Yr-2.

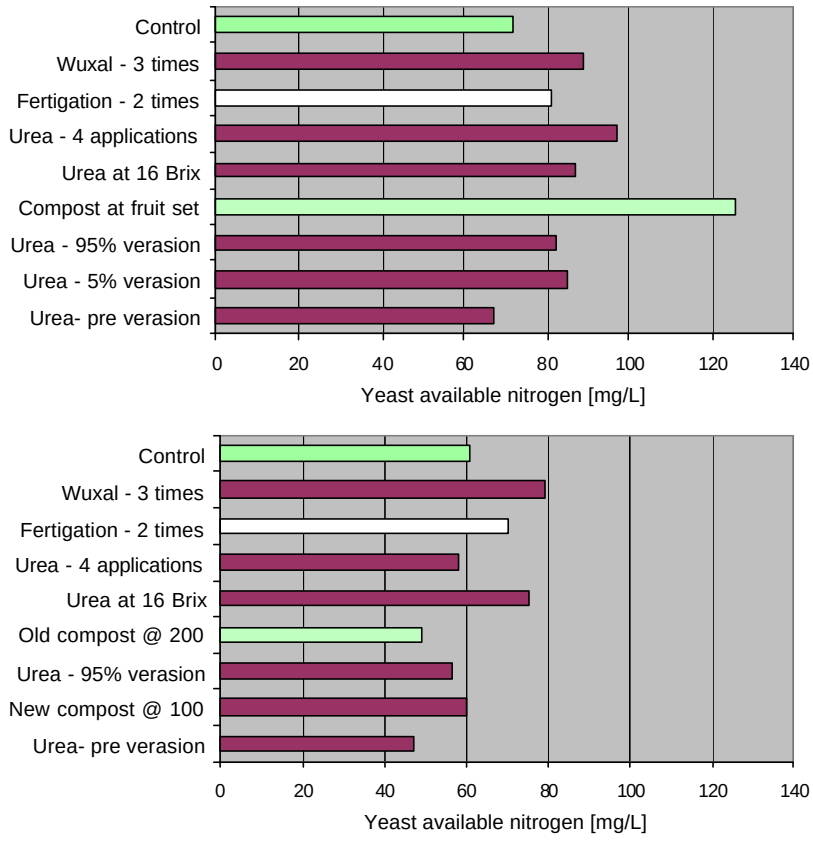

Figure 5. (Upper graph 2003/04, lower graph 2004/05) Yeast-available nitrogen of fruit was measured at final harvest. A value less than approximately 140 mg N/L is associated with a greater chance of a fermentation problem. Compost (full rate) applied in Year-1 was the only treatment that gave a significant increase in YAN. By Year-2 the old compost treatment was no better than the control. All YAN levels were lower in 2004/05 because of delayed maturity and early harvest brought on by persistent late rainfall.