

EXECUTIVE SUMMARY

Better wine quality without environmental compromise: a summary of trial results from the Gimblett Gravels project (Year 3)

Report to New Zealand Winegrowers and the Gimblett Gravels Technical Group

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Most vineyards on the Gimblett Gravels face the problem of very low levels of yeast-available nitrogen (YAN) in grape juice at harvest. This can result in a stuck or sluggish fermentation and may also increase the risk of contamination by other micro-organisms. Low levels of YAN appear to be related to a combination of vine water stress at key development times as well as poor vine nutrition. Effective management of water and nutrients has been identified as a key research priority. The challenge for the growers is both economic (finding the best way to maintain consistent wine quality) and environmental (minimising the high risk of leaching from excessive or inappropriate use of water and nitrogen fertilizers).

Over the past three years, HortResearch has carried out nitrogen trials at Craggy Range Vineyards with the aim of improving vine nutrition and increasing the YAN content of grape juice at harvest. A range of nitrogen treatments was trialled including foliar applications of urea, the addition of organic compost, manual applications of a urea solution to mimic fertigation, and a banded N fertilizer treatment applied directly under the drip line. Whole shoots were sampled at 3-4 week intervals to determine treatment effects on dry matter allocation, and the nitrogen content of leaves, shoots and bunches was measured throughout the growing season to calculate a nitrogen budget. Juice analysis (YAN, pH, TA, Brix) was made at harvest, and wine was made from a 50 kg sample of grapes from each treatment.

The YAN results from the nitrogen trials are summarized in Figure 1. In almost all cases our nitrogen treatments failed to achieve the target level for YAN (i.e. $>140 \text{ mg L}^{-1}$). The two exceptions were banded fertilizer (applied in Year 3 only), while the compost treatment (Year 1 only) came close to the target YAN in one season only. Unfortunately, none of the foliar applications and none of the subsequent compost treatments (derived from a different source of material) were able to provide a significant improvement in vine nutrition compared with that of the control. One treatment to mimic fertigation was also unsuccessful in all three years of this trial, perhaps because the nitrogen was applied at one time only, in the spring. A different fertigation regime (e.g. applying less N more often) may have been more successful by retaining a greater fraction of the applied nutrients in the root-zone soil.

Additional trials over subsequent seasons are recommended to confirm whether banded mineral N fertilizer will consistently solve the issues of low juice YAN. Alternatively, it may be a case of applying the nutrients at the right time (cf. between budburst and fruit set rather than in the autumn, as is currently the case). Furthermore, some questions remain about how much mineral N is sustainable on these stony soils. For example, the successful results from last season were achieved by applying some

60 units of N as two split applications. This amount of nitrogen may be excess to vine requirements since each grape harvest removes between 15-20 kg N ha⁻¹ and a further 30-40 kg N ha⁻¹ is returned to the soil during leaf fall and winter pruning. It may be prudent, for the environment, to try using less nitrogen but we do not know what effect that would have on juice YAN.

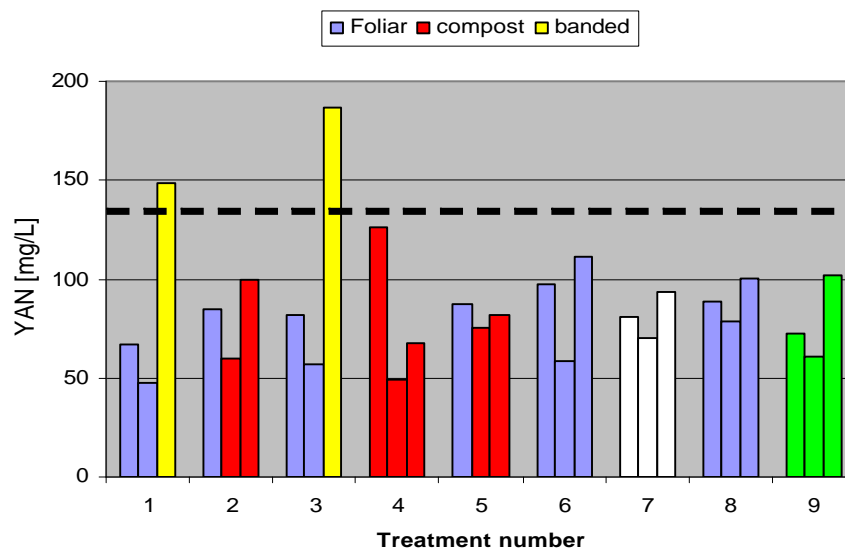


Figure S1. Yeast-available nitrogen (YAN) results at harvest from the nitrogen trials at Craggy Range vineyard. There are three bars for each treatment representing Years 1, 2 and 3 of the trial. The target is YAN >140 mg/L. Only the banded fertilizer (shown in yellow) achieved this target. Treatment 1 used banded ammonium sulphate and treatment 3 used banded calcium ammonium nitrate (CAN) applied in two split dressings of 30 kg/ha at fruit set and veraison. The fertigation treatment is shown by the white bars (Treatment 7) and the control treatment (Treatment 9) is shown by the green bars.

In the long term, a combination of compost with either banded N fertilizer and/or fertigation promises to be the most successful approach. The compost would promote more microbial biomass in the soil and this would eventually improve soil organic matter and thereby increase the soil's water holding capacity. But the soil microbes would require some nitrogen to help them break down the organic matter and incorporate it into the soil biomass. More research is needed to quantify the N requirement of such a system, and to predict the environmental footprint in terms of the vineyard nitrogen budget and losses.

There is also a need to better understand the seasonal pattern of YAN development e.g. in the last four weeks before harvest, and relate that to other measurements of fruit maturity (i.e. Brix) that are routinely used to decide the time of harvest. Such knowledge would help to quantify the value of delaying harvest (e.g. for a week) to allow YANs to hit the target level needed for a natural ferment to be successful. This could lead to better quality juice arriving at the winery door. The data would also allow us to develop and test a model for YAN development in Merlot, driven by soil and climate of the region, and moderated by the nutrient status of the vines.

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