

Big Growth Increases with Vineyards Depend on Soil

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Introduction

The popularity of vineyards has increased steadily over the the nine years since they were first publicised in this journal. Several millions of vineyards are now being used every season in Australia. However, while many growers and consultants have had good success, some have experienced poor growth and other problems, including spindly stems and shoot burn.

Why do some growers do so well, while other, often neighbours, are disappointed? To answer this question, it is important to first understand how vineyards work to increase growth.

How Vineyards Work

Higher temperatures, higher levels of carbon dioxide, and reduced drought stress have all been offered of explanations of how vineyards increase growth. But the best explanation is that wind and buffeting restrict shoot growth by causing stomatal closure, and by increasing the growth of laterals that compete with the main shoot (or "leader").

Strong, rigid vineyards create a still environment which removes the growth restriction caused by wind, and in a sheltered environment growth can be four times more than open grown vines, but only if root growth is not restricted by adverse soil conditions. Well managed vineyards using vineyards have averaged 50 mm/day of thick shoot growth (Fig 1).

Interpreting Scientific Trials

The available vineyard trial results show as much variation as is reported by growers. Do the different results of these trials reflect different soil conditions?

The results of four trials are summarised in Figure 2. Growth increases range from zero to 330%. (The trials were conducted by Ed Weber at Napa, Keith Striegler for Treessentials at Fresno, and Graham Due and Geoff Hardy for Gro-guard in South Australia - see references).

At Napa, Ed Weber's trial site was a single paddock divided into six plots. On one plot the increase was 238%, but the average for all six plots was only 85% - a big variation! The cause of the difference between the plots must be soil, and this trial proves that soil differences have an effect of well over 150%.

At Fresno, the Treessentials trial produced poor growth increases, but growth was poor in all respects. The best growth increase was just 43%, and the shoots grew just 1.9 m - about half the shoot length produced with Treessentials vineyards in similar climates in Australia. Vines in milk cartons also grew shoots half to one third as long as in a similar climate in Australia. The Treessentials trial was obviously conducted on a very poor site.

In Gro-guard's South Australian trials, the largest growth increase was 330% at Kuitpo, and that site was extremely well prepared: callused cuttings grow roots 1m deep after just six



Fig 1. John Rossack, in the Barossa Valley, combined good soil preparation with a vineyard to achieve an average growth rate of 50mm/day. Correct soil preparation is the key to getting the full benefit of a vineyard.

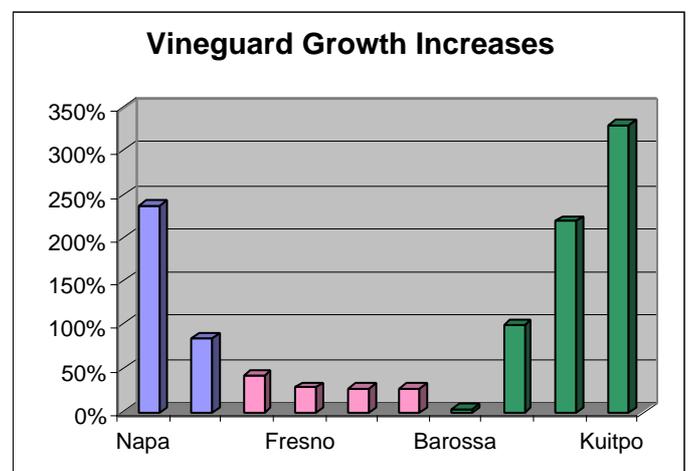


Table 1: Vineyard trials produced increases ranging from zero (Gro-guard) to 238% (Ed Weber) and 330% (Gro-guard). Ed Weber's Napa results are shown in blue, Treessentials' Fresno results in pink and Gro-guard's South Australian trial results are in green. If soil conditions limit growth, then the growth benefit of the vineyard is reduced.

weeks in the ground on this site. The poorest growth increase was "zero" at Lyndoch. The soils there were cracking black clays and, as reported in the original article, "the trial area was a patch in which growth had been inadequate, and own-rooted vines had been replaced...". Clearly, another poor quality site.

These results show that the best soils produced the biggest increases in growth: shoots were 330% longer (i.e. four times as long) compared to unguarded vines. On poor soils there was little or no growth increase. This effect has also been noticed by Mark Potter of Tubex: "**The better the site, the greater the benefit of a shelter**". But what is meant by "a good site"?

The Role of Soil in Achieving Growth Increases

Removing growth restrictions from the shoot is only effective if the root system is not presenting another limit to growth. It is important to realise that if root growth is restricted, then shoot growth is restricted too. This is because roots and shoots grow in very strict proportions which cannot be changed. This is one of the few "laws" of plant growth. The top of the vine – or any plant – inevitably stops growing as soon as the root system is stalled.

The fixed relationship between root and shoot growth is a surprise to many growers. Many believe that by "stressing" a vine, the root system will grow while shoots stay the same size, or that shoots can grow rapidly without any root growth. This is not true; root growth is always 0.7 times shoot growth and what you see above ground is what you have below ground – unless the root system is being rotted off!

The key to achieving growth increases with vineyards is, therefore, to ensure that soil conditions are not restricting root growth. If they are, then plant growth will be stopped and the growth benefit of shelter will be lost.

Specifying Soil for Growth Increases

It is important to appreciate that roots grow through soil very fast: 25-50 mm/day for active young vines. Geoff Hardy has observed roots 1 m deep after just six weeks of spring growth. That is 1 m over forty days – ie 25 mm/day. Allowing for the fact that roots do not grow in straight lines, a figure of 50

mm/day is quite believable. Soil must be very soft to allow root growth rates of 25-50 mm/day and to get the full growth increase possible from a vineyard.

Dr Alfred Cass, working with CSIRO Land and Water, has shown that vine root growth stops when soil stiffness measures more than 2MPa (300p.s.i.) on a soil penetrometer. He advises that for unrestricted growth the optimum is 1MPa, **and each vine should have a rooting volume of one cubic metre of soil with a penetration resistance of less than 1MPa.**

This philosophy of providing "a good root run", was Geoff Hardy's approach to soil preparation at Kuitpo, and produced by far the biggest growth increase in any of the published trials.

Conclusion - Achieving Growth Increases

The shelter provided by vineyards removes a restriction on shoot growth that allows the vine to reach a growth rate that is limited only by the rate of root growth. The maximum rate of root growth depends on soil conditions. If soil restricts root growth rates to below 25 mm/day, then part of the growth benefit of the vineyard will be lost. No vineyard can do anything to improve conditions below ground, and the effectiveness of vineyards depends totally on good soil preparation.

Each vine needs a cubic metre of soil with a penetration resistance of 1MPa. Successful growers are combining vineyards with a suitable rooting volume to get extremely good growth and a machine harvestable crop after eighteen months.

Measurements of penetration resistance can be made with the assistance of local departments of agriculture. Gro-guard can also supply penetrometers to interested growers.

References

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