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# The reduction of vine vigour in cabernet sauvignon (*Vitis Vinifera L.*) decreases bunchstem necrosis.

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## Introduction

Bunch stem necrosis (BSN) is a complex physiological problem in grapes. It results in shrivelled unripe berries which are detrimental to wine quality (Ureta *et al.*, 1981). Symptoms occur at any time after berry ripening (veraison) and include the appearance of dark necrotic spots on the pedicel, rachis or peduncle (Fig 1) which can then spread and girdle the affected area (Morrison and Iodi, 1990). Results from research into this problem tend to be contradictory and therefore no one conclusive explanation for the disorder has been found, though environmental factors are believed to contribute. These include weather conditions (Holzapfel and Coombe 1995) as well as the nutritional status of the soil, vine or bunch (Christensen and Boggero, 1985).

**Figure 1: Bunch of healthy Cabernet Sauvignon grapes (left) and a BSN affected bunch (right).**

## Hypothesis

Increased BSN incidence is related to high vine vigour because of the shift in the source-sink relationship between the vegetative canopy and developing fruit.

**Figure 2: Treatments applied to Cabernet Sauvignon vines at Montana vineyard, Hawkes Bay, New Zealand. Shade cloth and reflective mulch treatments are readily apparent.**

## Materials & Methods

### Treatments

Thirteen treatments were imposed on Cabernet Sauvignon vines on SO4 rootstock on a Montana vineyard in Hawke's Bay, New Zealand in the 2002/2003 and 2003/2004 season (Fig 2):

- Root pruning 25 cm on either side of the vine to a depth of 60 cm, prior to bud break (2002/2003 season only).
- Heading back of cordons by half prior to bud break.
- Reflective mulch (Extenday) 0.5 m wide both side of the vines prior to bud break and left until leaf fall.
- Shade (50%) three weeks prior to full bloom (FB) for three weeks.
- Shade (50%) post FB for three weeks.
- Interactions of the main treatments were included but the number of treatments used did not allow a full factorial experimental design.

Treatments were arranged in a randomised complete block design, with five-vine-plots in eight blocks, although only one selected vine within each bay was used for the assessments.

### Assessments

- Vine vigour: Leaf layer number (LLN) of the canopy measured by point quadrant method (Smart and Robinson, 1991).
- BSN severity: percentage of BSN per bunch estimated visually. Scores were then averaged over all bunches on vine.

## Results

### Vine vigour

The treatments had a significant impact on vine vigour. Root pruning, although imposed only at the start of the first season, markedly reduced vine vigour in both years. The reflective mulch consistently enhanced vigour, while shading had little impact. Different prevailing environmental conditions in each of the two seasons markedly impacted on vine vigour overall. In year two, where rainfall was higher between flowering and veraison, vigour was much higher and vine trimming was more severe and more frequently applied in order to contain growth.

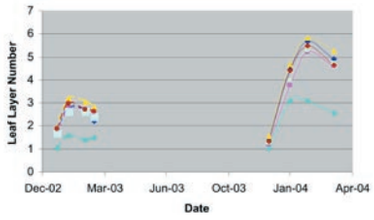


**Figure 3: Average vigour of vines for seasons one (dotted lines) and two (solid lines). Treatments are Control - dark blue, Root pruned - turquoise, Headed back - pink, Extenday - yellow, shade pre FB - red, Shade post FB - light blue.**

### Bunch stem necrosis

The severity of BSN varied widely amongst treatments from minor amounts (<5%) to very significant amounts (>25%). Control values indicated the amount of the disorder was typical for this variety on this vineyard. The patterns of severity amongst the treatments were generally similar between seasons.

A strong positive relationship between vine vigour (LLN) and BSN incidence was determined in the first season ($R^2$=0.76), but a weaker relationship was determined in the second season ($R^2$=0.15).

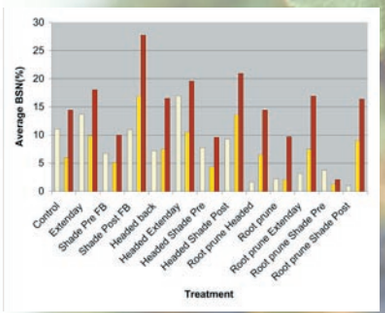


**Figure 4: Average BSN severity for three different dates over two seasons. White, week of harvest season 1 (27/03/03); Yellow, one week prior to harvest season 2 (24/03/04); Red, week of harvest season 2 (1/04/04).**

The severity of BSN was always high in those treatments that stimulated vegetative development (such as Extenday and Heading) and lowest in those treatments that suppressed vigour (especially Root pruning). Where interactions were studied, one factor tended to dominate the observed response.

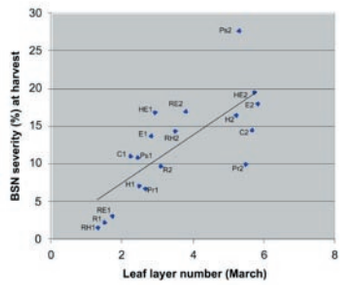


**Figure 5: The relationship between BSN severity and vine vigour. $R^2$=0.568 in the two seasons of the study. 1=season one, 2=season 2, C=control, E=Extenday, H=headed back, R=root pruned Pr= Shade pre FB, Ps=Shade post FB.**

## Conclusions

There is strong evidence that the vigour of vines influences the severity of BSN. It is suggested that this is due to a shift in the source-sink relationship between the vegetative canopy and the developing fruit, probably through the amount of key elements such as calcium, potassium and magnesium available to the developing berries. Management techniques that influence this source-sink relationship through suppressing vine vigour may therefore be used to reduce the BSN severity within those vines. Therefore, practices such as root pruning may be available in some vineyards to manage this disorder. However, the effectiveness will be influenced by the prevailing environmental conditions especially around the time of flowering. Further research into how vigour affects the source-sink relationship and therefore BSN incidence, is being carried out.

## Literature

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