

Key points

- Semillon exhibits anisohydric stomatal control.
- Poor stomatal regulation results in higher transpiration rates.
- High night-time transpiration rates limits overnight rehydration.

Semillon grown on an unirrigated site in the Hunter Valley.



Behind Semillon's thirsty tendencies

By Shayne Hackett¹, Suzy Y. Rogiers¹,
Dennis H. Greer¹ and Ron J. Hutton¹

Semillon is a variety that originated from the Bordeaux region of France, a region categorised by a climate with relatively mild average summer temperatures, high relative humidity and ample rainfall. Semillon grown in some Australian vineyards is exposed to climatic conditions far removed from those in France. In the drier grapegrowing regions of Australia, Semillon can exhibit symptoms of wilting and partial dieback of the leaf margins, which can be further aggravated by hot, dry conditions during ripening.

Other varieties grown adjacent to Semillon and managed similarly do not tend to suffer to the same extent.

Research staff went about determining the causes of Semillon's vulnerability to drier climates. Transpiration (the loss of water from plant surfaces) can be controlled by small pores (stomata) on the leaf. In order to conserve the plant's water status, stomata are able to close in response to dry soil but this mechanism is not as efficient in some varieties as in others. Varieties with isohydric behaviour are able to maintain tight control of plant water status over a range of environmental conditions, whereas varieties with anisohydric behaviour fluctuate in water status in response to the prevailing environmental conditions.

To better understand the water relations of Semillon, it was compared with eight other winegrape varieties, including Cabernet Sauvignon, Chardonnay, Grenache, Merlot, Pinot Noir, Riesling, Sauvignon Blanc and Shiraz. Two tablegrape varieties - Flame Seedless and Sultana - were also included. These vines were grown in a drip-irrigated block located in the Riverina, NSW. A field survey of Semillon grown in the Hunter Valley and Riverina was also included in this project.

Plant water status

Pre-dawn and midday leaf water status results indicated that the field-grown Semillon vines were, on average, more water stressed than the other nine varieties examined. This is despite similar soil moistures, vine age and vine management. Semillon vines in this experiment were average in size compared with the other varieties, both below and above ground.

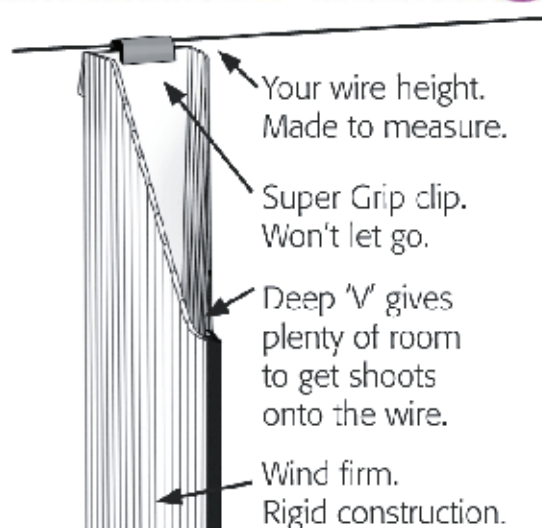
Daytime transpiration

The range in transpiration rates of the varieties measured was not extensive. However, Semillon vines exhibited the highest daytime rate and was comparable to Pinot Noir, Chardonnay and Sultana. Daytime stomatal conductance showed a similar trend between varieties with Semillon again having the highest values.

Night-time transpiration

In a field study it was found that warm and windy nights contributed to incomplete vine rehydration prior to dawn. Night-time transpiration and stomatal conductance as measured in potted vines were about one tenth of their daytime rates.

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¹National Wine & Grape Industry Centre, Locked Bag 588, Wagga Wagga, New South Wales 2678. Email: suzy.rogiers@industry.nsw.gov.au



Leaf burn after a water deficit treatment in Semillon.

There was a strong varietal difference with both transpiration and stomatal conductance of Semillon leaves which was greater than in Grenache leaves.

Diurnal transpiration

Comparisons of diurnal trends in stomatal conductance and transpiration of Semillon with Grenache under moderate soil

water deficit conditions indicated that Grenache stomata were quicker to respond to daytime increases in light. Early morning conductance was higher for Grenache, but by mid-morning, conductance had reached a plateau. Conductance of Semillon leaves, however, continued to increase until midday and remained higher for the rest of the day and night. Across the whole day, Semillon vines transpired 30% more water than Grenache vines.

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Berry composition

The role of water stress on berry composition was highlighted in a pot trial. With only two days of deficit irrigation during the post-veraison period, berry fresh and dry weight were smaller. This was accompanied by lower berry titratable acidity and total soluble solids. Berry pH was higher.

Recommendations

The lack of tight stomatal control indicates that Semillon vines are suited to regions with consistent water supplies and without extremes in temperatures. Avoidance of north-south rows is advised since the western side of the canopy is most often afflicted with leaf burn. In hot regions, minimise bunch exposure and reduce sunburn by encouraging shading. Drought-resistant rootstocks with nematode-resistant attributes are recommended since Semillon is susceptible to root-knot nematode.

Summary

When compared with other varieties grown in similar conditions, Semillon leaves had large stomatal conductances. Significant transpirational water loss occurred during the day and this, along with incomplete night-time rehydration, resulted in excessive dehydration and low vine water status. As such, Semillon can be classified as anisohydric.

The full research report can be accessed from
<http://jxb.oxfordjournals.org/cgi/content/abstract/60/13/3751>