Coonawarra rootstock trial: vintage 2019 and results so far

Grapes have been picked, wines have been made and results will soon be available from the Coonawarra Rootstock Trial. In this article, Vinehealth Australia explains the importance of this trial to the future of the Australian wine industry. This report is an overarching summary with some early viticultural results. A full report will be completed by the founding parties at the conclusion of the wine tasting.

Australia has some of the oldest grapevines in the world used for winemaking. This important resource has manifested over time largely due to absence of many of the damaging pests and diseases impacting vineyards overseas.

One of these pests is grape phylloxera, a small insect that damages vines by feeding on their roots. Vine death can result within five years of an infestation. There is currently no chemical or biological control for phylloxera.

Other than carrying out strong farm-gate hygiene practices to prevent its entry, the only mechanism grapegrowers can employ to combat phylloxera is to plant vines grafted to American rootstocks. These *Vitis* sp. convey a level of tolerance to the pest while own-rooted vines (European *Vitis vinifera*) are highly susceptible. Planting grafted vines however is a costly exercise, at around $60,000 per hectare.

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A rise in phylloxera detections in Australia over the past 13 years, particularly in the Yarra Valley in Victoria, has seen grapegrowers around Australia consider planting (or replanting) a proportion of their vines to rootstock as an insurance policy, as well as to confer other benefits. This activity is occurring in conjunction with heightened awareness of best practice farm-gate hygiene activities to prevent phylloxera and other pests and diseases from entering vineyards.

Rootstocks are used to combat more than just phylloxera. They can also:

- improve drought tolerance
- decrease or increase vigour
- improve tolerance to saline, calcareous or acidic soils
- improve tolerance to waterlogging
- reduce potassium uptake
- combat plant parasitic nematodes.

With high awareness by viticultural industries of the effects of climate change on grape production, growers are placing more value on drought tolerance and water use efficiency in situations where water for agricultural uses is limited and/or cost-prohibitive.

The Coonawarra Rootstock Trial partnership

The Coonawarra Rootstock Trial, established in 2009, is a long-term partnership between Vinehealth Australia, Treasury Wine Estates and Coonawarra Vignerons. Additional

funding support in 2019 from the Limestone Coast Grape and Wine Council through Wine Australia's Regional Grant Program will assist in this year's inaugural small lot winemaking.

It is the only standing curated rootstock trial that Vinehealth Australia is involved in. The trial is gaining traction in the Limestone Coast and regional leaders are realising the potential of the trial as a significant resource for the region.

The trial includes a range of eight rootstocks and an own-rooted control planted in a randomised, replicated manner. The scion is Cabernet Sauvignon clone CW44, which as a variety represents 63% of the total area of winegrapes planted in the Coonawarra wine region[1]. Included in the trial are three CSIRO Merbein-bred rootstocks for low potassium uptake (M5489, M5512, M6262), Börner – a rootstock touted as having the highest resistance to grape phylloxera – as well as 140 Ruggeri, 1103 Paulsen, Ramsey and 110 Richter.

The trial was devised to facilitate industry consideration of rootstocks as a risk management tool for new plantings to combat the risks of phylloxera and climate change. It provides local grapegrowers and winemakers with a hands-on learning experience about the attributes that the planted rootstocks can convey to scions, to see if they adequately reflect the desired wine quality and style of the Limestone Coast region, compared to the traditionally planted own roots.

The three Merbein rootstocks and Börner are only planted in small pockets commercially, and therefore the trial allows for a unique learning experience which cannot be gained elsewhere.

Coonawarra, like other grapegrowing regions in South Australia, has had a historically low level of rootstock use, currently at 13.6% of area under vine. Despite larger companies in the Limestone Coast making the shift in recent years to plant a proportion of their redevelopments on rootstock, this trial is of particular importance for small producers who do not always have the capacity to test new planting material and are not always privy to new industry information.

Table 1. Rootstock Field Walk participant observations.

Rootstock	Observations
1103 Paulsen	Large canopy, noticeable lateral shoots, lot of second crop dropped, smaller yield, open bunches, some bunch stem necrosis, small berries, good fruit set, crunchy skins, fine tannins, moderate greens, lacking flavour to good balanced flavour.
140 Ruggeri	Vigorous canopy, dark green foliage, less second crop dropped, big bunches, big berries, very little to some bunch stem necrosis, good fruit set, tough skins, lovely soft tannins, green flavours and phenolics, quite acidic.
110 Richter	Vigorous and green canopy, canopy comparable with 140 Ruggeri but with lower yield, small and loose bunches with poor fruit set or big and tight bunches – depending on panels assessed, large berries, low amount of bunch stem necrosis, better fruit set and leaf colour than Ramsey, bitter flavours.
Ramsey	Open and moderately vigorous canopy, good shoot length, moderate stress with some vines showing basal leaf yellowing, comparatively light yield, lot of second crop dropped, longish loose bunches due to moderate fruit set, even set, good flavor.
Börner	Small canopy with lots of bunches and yellowing leaves, short shoots, canopy looks stressed and is losing leaf and open, good yield, some bunch stem necrosis, inconsistent berry size but generally small, some shrivel, lower acid, lean flavours, slightly flat, skinny graft union.
M5489	Big canopy, balanced, no visual stress, high yielding, a lot of second crop dropped, bunch architecture variable from open to compact, moderate to large bunch size, good fruit set, biggish berries, some bunch stem necrosis, tough (thick) skins and tannin, robust flavor, high acid.
M5512	Moderate vigour canopy, even shoot development, good balance, some basal leaf yellowing but appears to have handled seasonal conditions well, big bunches, good fruit set, lots of second crop dropped, smaller berries than M5489 but bigger overall crop load, very thick skins, good flavour, a little shrivel.
M6262	Small canopy and especially for the crop load, very stressed canopy (a lot of leaf yellowing, very open canopy, observations consistent across all replicates), very short shoots, thin trunks in comparison to other rootstocks, lots of bunches, lacking fruit flavours.
Own roots	More open canopy with short shoots, small canopy, leaf yellowing indicative of drought stress, lighter crop load but good for canopy size, fewer second crop bunches dropped, looser bunches, poorer set – similar to Börner, some bunch stem necrosis, smaller berries, good flavour.

Fostering community involvement in the trial

The trial also aims to create a forum for discussion on rootstocks and their potential value to viticulture. Another key aim is building a sense of community ownership of the trial. This is achieved in a number of ways, including hosting field walks of the trial site and industry tastings of the wine made from the trial scheduled for later this year.

Field Walk

The second public field walk of the trial was held on 21 March this year, two and half weeks prior to the trial being harvested for winemaking. There were 38 grapegrowers and winemakers in attendance, including some students from the University of Adelaide. Funding support from the South East National Resources Management Board for the trial assisted with hosting the field walk and promoting rootstocks as a tool for adapting to climate change.

The field walk proved a positive experience, with clear rootstock differences noted by all attendees. With the trial rows irrigated 'to the average', distinct rootstock differences were evident (see Table 1), especially in terms of canopy

Hand harvesting the rootstocks. Image courtesy Coonawarra Vignerons.

stress. The lowest vigour rootstocks of M6262 and Börner as well as the own-rooted control, were suffering significant water stress with yellowing canopies and reduced yield across all replicates. The improved water use efficiency demonstrated in the remaining rootstocks is an important observation when addressing future climate variability. Additionally, considering this observation, the ability to measure any impacts of this stress on the resultant wine quality will be an important outcome for the trial when winemaking is complete.

Other differences of note observed between rootstocks included levels of bunch stem necrosis and levels of second crop. The second crop had been dropped. For bunch stem necrosis, M5489, 1103 Paulsen and 110 Richter had a significantly higher proportion of bunches per vine, quantitively determined, showing bunch stem necrosis compared to all other rootstocks except 140 Ruggeri. For second crop dropped, 110 Richter, 140 Ruggeri and 1103 Paulsen had the highest number of bunches dropped.

Refer to Table 1 for a summary of common descriptions of the rootstocks taken from completed observation sheets. Note, there was some variance in the observations, in part due to the different trial rows the participants walked. Only 30% of respondents shared an actual preference for a rootstock. M5512 received 38% of the votes, followed by own roots as 23%, followed by Ramsey and M5489 at 15% each, and Börner at 7%.

Collection of viticultural measurements

Data collection from the Coonawarra Rootstock Trial for 2019 has also encompassed a number of viticultural measurements from the rootstock treatments. Collected prior to harvest, these included yield components (yield per vine, yield per metre, bunch number per vine, bunch number per metre, bunch weight, berry number per bunch, berry weight), berry anthocyanins, phenolics and tannin, canopy leaf area index and porosity, evaluation of second crop dropped and evaluation of bunch stem necrosis.

Juice samples were also collected at harvest for chloride and full cation analysis. Pruning weights, bud numbers per vine and trunk diameter are scheduled to be collected in winter.

Preliminary results

Full cation and chloride (awaiting results) analyses are being undertaken on grape juice samples from each rootstock, collected as free-run juice. The CSIRO Merbein rootstocks included in this trial were selected for low potassium uptake. Merbein 6262 is not being included in the winemaking for 2019 due to its demonstration of consistently poor yields and canopy growth and reduced ability to exclude salt. Juice potassium levels of the M5489 and M5512 were shown to be significantly lower than all rootstocks other than 110 Richter (Figure 1). With potassium being the most abundant cation in the grape berry, the own-rooted control had the highest average berry potassium level in the

Delivery of harvested grapes for small lot winemaking. Image courtesy Vinehealth Australia.

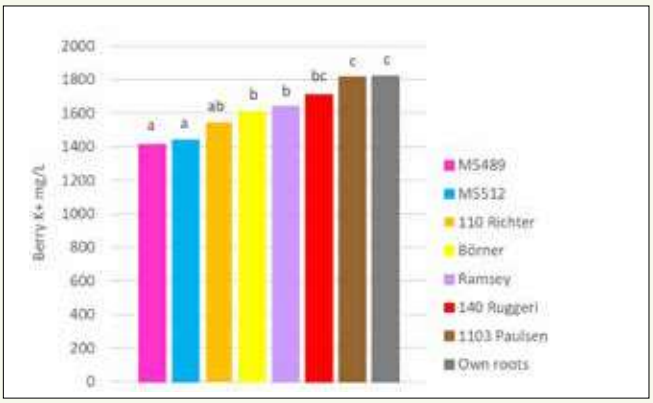


Figure 1 Berry potassium on free-fun juice. Different letters represent significance at 95% level.

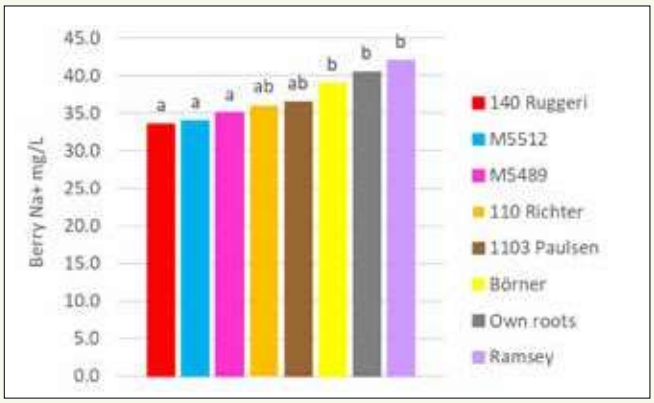


Figure 2 Berry sodium on free-run juice. Different letters represent significance at 95% level.

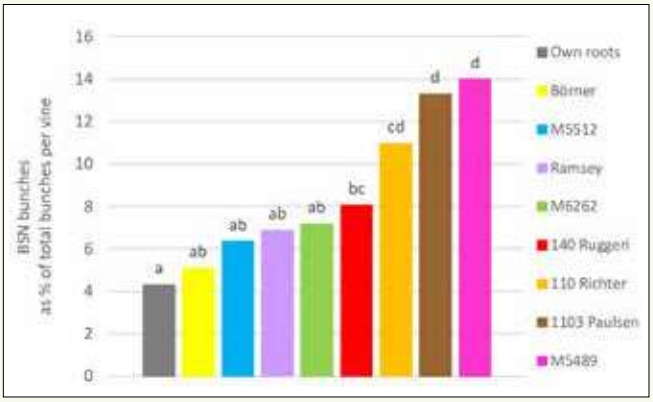
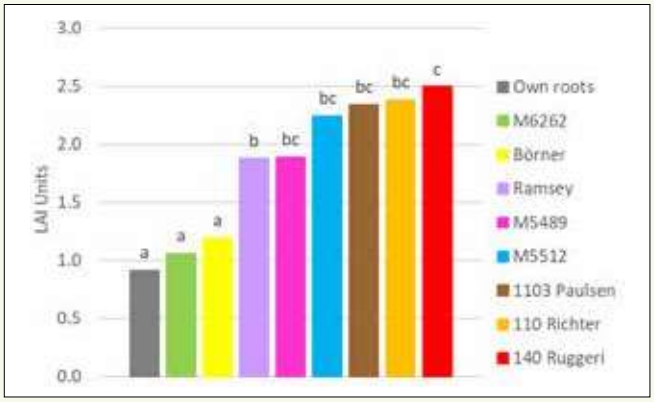


Figure 3 Average percentage of bunches per vine showing bunch stem necrosis (BSN) symptoms. Different letters represent significance at 95% level.



Average Leaf Area Index (LAI) as measured by a ceptometer. Different letters represent significance at 95% level.

trial (Figure 1). In addition, the two Merbein rootstocks, along with 140 Ruggeri, showed significantly lower berry sodium than Börner, own roots and Ramsey (Figure 2).

The prevalence of bunch stem necrosis (BSN) was noted by some participants on the Field Walk (Table 1). Quantitative determination of the proportion of bunches per vine visually affected by BSN did show significant differences in BSN levels between rootstocks. The own-rooted control had significantly lower levels of BSN and 1103 Paulsen and M5489 had significantly higher levels of BSN, compared to other rootstocks (Figure 3). Further nutrient analysis is being undertaken by Dr Zeyu Xiao from the National Wine and Grape Industry Centre, NSW, as part of the 2018 Wine Australia Incubator Initiative, which we hope may shed more light on the BSN observations.

Real-time Leaf Area Index (LAI) (canopy leaf area) was collected for the first time as part of the trial using a ceptometer (Accupar LP-80 PAR/LAI ceptometer, Decagon Devices, Pullman, WA, USA). The ceptometer converts a measure of photosynthetically active radiation (PAR) into LAI, based on above and below canopy PAR measurements, and also provides a canopy porosity measure. Canopy porosity can be loosely equated to canopy vigour, assuming that high vigour canopies will absorb more PAR, allowing less light to reach the ground. Canopy size was recorded by Field Walk participants in Table 1 as one of the most obvious visual differences between rootstocks. This observation was well backed up by the ceptometer measures of canopy porosity and LAI. The own-rooted control, M6262 and Börner showed significantly lower LAI (Figure 4) and significantly higher canopy porosity (not shown) compared to the other rootstocks.

Harvesting for winemaking

Grapes were hand-harvested by rootstock across the trial area and tipped into four 15kg labelled crates per rootstock for transport. All rootstocks were harvested on the same day and trucked up to the Australian Wine Research Institute in Adelaide the following morning.

Yields this year facilitated wines to be made in duplicate from each rootstock. Wine anthocyanins, phenolics and tannins are forecast to be completed at the conclusion of the winemaking. Tasting of the small lot wines will provide industry with a great opportunity to match observations gathered during the Field Walk to wine preferences determined during a range of tastings.

These small lot wines will also be formally assessed by a group of local winemakers, further adding to the community involvement.

References

[1]SA Winegrape crush survey (2018) Regional Summary Report. Coonawarra Wine Region.