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Wrapping permanent cordon arms tightly around the cordon wire negatively impacts vine performance

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In certain winegrowing regions, it is a common practice to wrap canes very tightly around the cordon wire during the establishment of permanent cordon arms. This method of training may result in a constriction of the vascular system, leading to numerous deleterious impacts on vine growth, production, and longevity. This article summarises some of the key findings of previously published research regarding the use of this training method in South Australian vineyards.

Training methods

A trial was carried out at two commercial vineyard sites from 2018-2022, one featuring newly planted 4-year-old Cabernet Sauvignon vines on 1103 Paulsen rootstock at 3 m x 2 m inter-row and intra-row spacing and the other featuring newly reworked 20-year-old Shiraz vines on own roots at 2.8 m × 1.8 m spacing. Three permanent cordon training techniques were applied on the newly planted vines including tightly wrapping the cordon arms around the wire, placing the cordon arms on top of the wire, and weaving the cordon arms through a plastic clip system centred between two parallel wires (Figure 1A-C). A fourth technique applied to the reworked vines involved wrapping the cordon arms loosely around two parallel wires (Figure 1D).

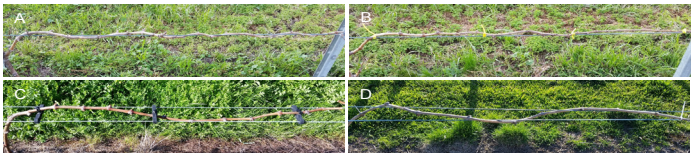


FIGURE 1. Applied cordon training methods. (A) Cordon wrapped tightly around wire, (B) Cordon placed on top of wire with gentle binding, (C) Cordon woven through clip system, (D) Cordon trained around parallel wires.

Impact on vegetative growth

Tightly wrapping the cordon arms around the wire seemed to impede the vegetative growth of newly planted Cabernet Sauvignon vines. Assessing six replicates of three panels of three vines each (54 vines per treatment), cordon circumferences were measured at three points along each arm, indicated as proximal, intermediate, and distal. In the later seasons of observation, the circumferences of the tightly wrapped cordons were reduced significantly compared to the other training methods. These results are in line with those obtained in a previous study conducted by Caravia *et al.* (2015)[1], who found that measurements of arm transversal area were lower in the distal portion of wrapped arms relative to non-wrapped arms in a similar trial after one growing season. In this study, no differences in cordon circumference were observed after the first season. However, over the subsequent seasons, the tight wrapping appeared to restrict growth, leading to a noticeable development of constriction. Additionally, lower pruning weights were observed in canes collected from the distal portion of the arms in the later season of the trial, further supporting the notion that the tight wrapping had a growth limiting impact[2]. As this portion of the arm is at the furthest extremity of the cordon, it requires the greatest distance of transport for water and nutrients, and, logically, any negative consequences resulting from an impediment of transport would be the most apparent in this area of the arm.

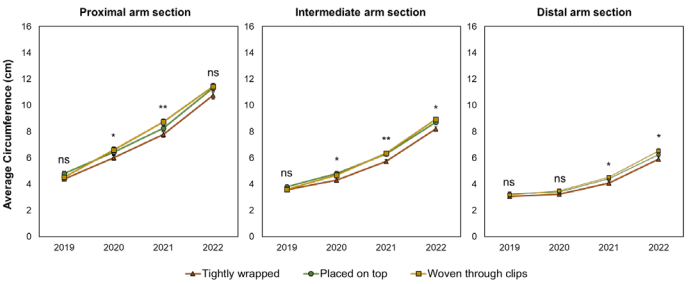


FIGURE 2. Average circumference measurements collected from the different cordon arm sections of Cabernet Sauvignon vines. Means were separated by ANOVA. *, ** indicate significant differences at $p \leq 0.05$ and 0.01. ns = not significant. This figure was adapted from data previously published in (O'Brien *et al.*, 2023c[2]).

Impact on cordon xylem morphology

X-ray microtomography (micro-CT) was used to quantify the morphological properties of the xylem conduits of the cordons trained using the various described training methods[3]. Observing the newly planted Cabernet Sauvignon vines, cordons that were wrapped tightly around the cordon wire had a significantly lower xylem conduit volume relative to total cordon volume than those that had been woven through the plastic clip system centred between parallel wires. The woven cordons in turn had a lower xylem conduit volume than those trained on top of the cordon wire and secured in place with plastic ties. This makes sense, as out of all the methods of training assessed in this trial, placing the cordon on top of the wire and securing it in place with ties was the least constrictive. Cordons tightly wrapped around the cordon wire had significantly thinner xylem vessels, fewer vessel connections per unit volume and lower theoretical specific hydraulic conductivity compared to other treatments. These findings indicate that the capacity of the tightly wrapped cordons for normal hydraulic function was compromised to an extent, even after the short time frame of the trial.

Relationship with trunk disease symptom expression

A survey was conducted over two growing seasons at ten additional vineyard sites featuring cordons ranging in age from 14-24 years old to visually assess vines displaying varying dearees of cordon

The translation of this article into English was offered to you by Moët Hennessy. Moët Hennessy

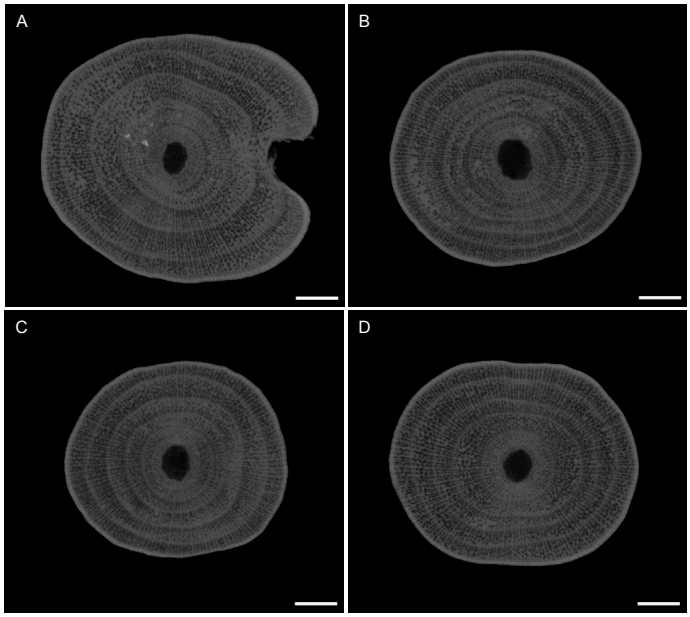


FIGURE 3. Cross-sectional view of micro-CT of cordons. (A) Cordon wrapped tightly around wire, (B) Cordon placed on top of wire, (C) Cordon woven through clip system, (D) Cordon trained around parallel wires. Resolution = 35 µm. Scale bars = 4 mm.

strangulation, cordon dieback, and characteristic foliar symptoms of Eutypa dieback caused by the fungal pathogen *Eutypa lata*[4]. A surprising trend was observed where vines displaying the greatest degree of strangulation displayed the lowest severity of dieback. This was an unexpected result given that dieback is a condition which is normally associated with advanced cordon age, and a correlation was also observed between the degree of strangulation and vine age. A trend was observed for increased Eutypa dieback foliar symptoms with increased cordon strangulation. Determining the exact cause of this trend is challenging, as the occurrence of foliar symptoms can be influenced by multiple factors including varying climatic conditions. It is therefore inconclusive as to whether the severely strangled cordons were suffering from a reduction in vine defence response exacerbating the onset of their trunk disease symptoms.

Conclusion

Throughout the study, the cordons that were wrapped very tightly around the cordon wire performed worse than the cordons which were trained using less constrictive training methods. This outcome was more pronounced on the newly planted Cabernet Sauvignon vines than the reworked Shiraz vines. Although notable results were obtained over the limited timeframe of the project, the negative trends observed with the tightly wrapped cordon arms would likely continue to become more pronounced over time, as cordon constriction is a condition that worsens over time. The poorly developed vascular systems, likely resulting from this training method, with xylem conduit volumes 44 % smaller than those of cordons trained using the less constrictive method of placing the cordon on top of the wire, suggest that this approach may hinder vine growth potential and cordon longevity. Therefore, it may be advisable to avoid its use to preserve maximum growth and vitality. ■

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