

TECHNICAL DATA SHEET

Pruning with regard to sap flux

Management of grapevine trunk diseases (GTDs) is oriented to preventive control strategies that reduce new infections and disease spread. Winegrowers are applying new strategies in pruning with a belief that GTDs incidence and severity would be reduced. Even if more detailed scientific results are still missing, this technical datasheet aims to present the current findings and experiences in implementing such approach.



This document is the result of interviews made on field with the principal objective to highlight the diversity of techniques used in field. To date, no assessment, no validation or checking efficacy of this practice was made. In the absence of any assessment, its success in different conditions of the ones exposed is not guarantee and the responsibility of Winetwork partners can't be involved.

Network for the exchange and transfer of innovative knowledge between European wine growing regions



This project has received funding from the European Union's Horizon 2020 research and innovation programme under **grant agreement No 652601**

Pruning in regard with sap flux

Description

1- Traditionnal pruning

Traditional training systems and pruning methods had been primarily oriented to achieve adequate yield and good quality fruit, but **impact of training systems on diseases**, such as fungal trunk diseases, **was neglected**. Factors related to pruning such as training system, weather condition during pruning period, number and size of pruning wounds, location and accumulation of pruning wounds, cane and spur length, wound protection, wound age, period of pruning, pruning debris management potentially contribute to the risk of infections with grapevine trunk diseases fungi (GTD). **Pruning wounds** are one of the fundamental in-

fection pathways of GTD fungi (Úrbez-Torres and Gubler, 2010). To reduce the risk of infections with fungi through pruning wounds, training systems that minimize the number, size and accumulation of pruning wounds on grapevine perennial trunk are preferred (Surico et al., 2008) (Fig. 1 - 2).

Traditional training systems with numerous large and raze pruning wounds on the grapevine trunk potentially interrupted grapevine sap flux and reduced grapevine longevity. If we take into consideration that the pruning potentially induces a 1.5 times larger necrosis in comparison to pruning wound size (Crespy, 2006), the trunk of the vine presented has a significantly reduced sap flux.



Figure 1: Increased number of small and large wounds accumulated on upper part of grapevine trunk of cv Muscat blanc and Istrian Malvasia (indicated by circles). Training system is Guyot-double. (K. Diklić, IPTPO)



Figure 2: Fig. 2: "Return cut" made in old vineyard to replace the cordon training system with Guyot-double training system (A, B) or to lower the cordon (C) (indicated by circles and arrows), (K. Diklić, IPTPO).

2- Innovative/alternative pruning

Pruning in regard with sap routes (Guyot-Poussard, 'modified' spur-pruned cordon and other training systems) is implemented in a more significant scale recently in European winegrowing regions and many winegrowers expect to have significant results with this practice in the upcoming years (Fig. 3 - 5). **The impact of this pruning approach on grapevine trunk diseases**, in comparison with traditional training systems, **still needs to be scientifically evaluated**.

Currently, a diffused **hypothesis** is that pruning in regard with sap routes reduces the probability for new infections thanks to the small size and low number of pruning wounds. Some training systems require retraining and a return cut, common in older vineyards, which could be avoided with this method of pruning. Moreover, large and raze wounds on perennial wood, common on retrained and old vines found in traditional vineyards, appear to be more sensitive to GTD fungi infection than wounds on 1-year-old wood (Moller and Kasimatis, 1980).



Figure 4: Pruning in regard with sap routes implemented in Istria region on cv Teran, pruning made by Coronica winery. (up: prior pruning, down: pruned vine). (K. Diklić, IPTPO)



Figure 5: Pruning in regard with sap routes implemented in Istria region on cv Teran, pruning made by Coronica winery



Figure 3: Pruning in regard with sap routes, pruning made in the area of north Italy. (up: Guyot-Poussard, down: 'modified' spur-pruned cordon). (K. Diklić, IPTPO)

Pruning in regard with sap flux

Technical and scientific data

The cut **diameter of pruning wounds** induces a **1.5 times longer necrosis** on pruned spur or cane (Fig. 6, b) (Crespy, 2006). Large wounds and raze cuts near perennial parts of grapevine cordon and/or trunk induce wood necrosis (Fig. 6, b), that potentially leads to **higher infection rates** with GTD fungi (Úrbez-Torres and Gubler, 2010) and **deterioration of sap flux** (Crespy, 2006). Moreover, there is a hypothesis that deterioration of grapevine sap flux would increase the negative impact of GTD due to higher stress in grapevine physiology (Simonit & Sirch, 2010). Development of necrotic wood tissue may reduce water transport through xylem to leaves (Maher et al., 2012), and high transpiration demand may lead to apoplectic forms (Surico et al., 2005).

It is important to prune correctly in order to minimize the possibility of new infections with GTD fungi (Fig. 7, a) and preserve a functional grapevine sap flux forming a complementary cone of desiccation (Fig. 7, b). Pruning techniques that prioritise a “clean cut” (Fig. 7 c) are aesthetic and most of the time lead to deterioration of grapevine sap flux and formation of large wounds.

Pruning in regard with sap flux was adopted by Lafon (1927), from a training system used in France, and later named **Guyot-Poussard** according to its developer (Lecomte et al., 2011). The main principle and difference of the traditional training systems (Fig. 8) and this training system is the maintenance of the same sap flux from one year to another with pruning that positions wounds only on the upper part of the cordon (Fig. 9).

At our knowledge, pruning in regard with sap routes is implemented in training systems **Guyot-Poussard** and modified **spur-pruned cordon**, but it is in **development process** for training systems **Gobelet and Pergola** (Simonit & Sirch, SICAVAC). Pruning in regard with sap routes has been developed in some winegrowing areas in Europe, where Guyot-Poussard is the most frequent training system that respects sap flux but further implementation of this approach in other training systems may be expected.

More detailed **scientific research** that will provide precise answers on the efficiency of these training systems in GTD preventive management **are in progress** and the **impact of these training systems on GTD is not yet fully understood and needs to be scientifically evaluated!**

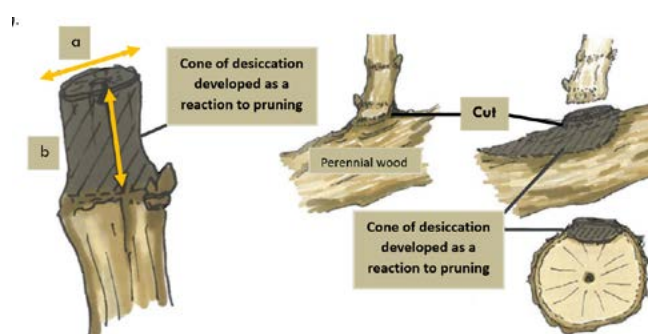


Figure 6: Correlation between pruning wound and necrosis (cone of desiccation) development (left: one year-old spur and cane; right: raze wounds near perennial wood) (Crespy, 2006).

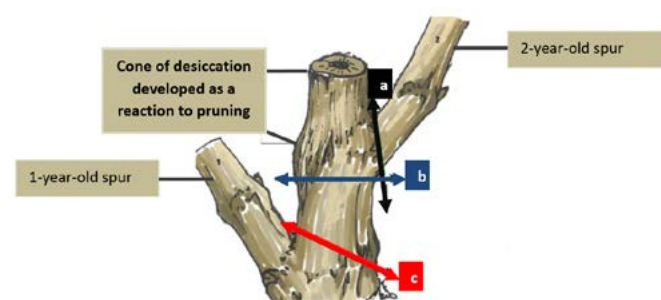


Figure 7: Recommended method of pruning (Crespy, 2006).



Figure 8: Traditional pruning: pruning wounds located on perennial wood causing deterioration of grapevine sap flux (Simonit & Sirch).

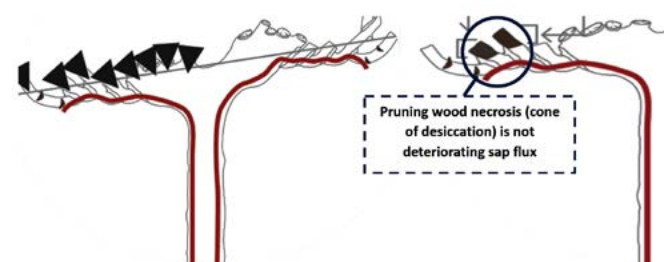


Figure 9: Guyot-Poussard: pruning oriented to preservation of grapevine sap flux. (Abbreviations: black triangles - pruning wounds, red line - sap flux). (<http://simonitesirch.com>)

Guyot-Poussard training system

At the end of the first year after vineyard establishment a fruiting cane, which follows the sap flux, is left and cut on a 2-bud spur. In the second year one developed fruiting cane is left and cut on the height of the first wire (Fig. 10, a - d).

Formation of the central part of the vine – fruiting canes are formed in a central part, one main fruiting cane is selected, bended on the first wire while other are pruned on 2-bud spurs (Fig. 10, e – h). In comparison with standard Guyot, shoots are developed at the same horizontal level from the 1-year-old cane. “Ramification” is formed and horizontal bi-lateral growth is achieved with perennial spurs that ensure continuous sap flux (Fig. 10, i).

In the upcoming years, **pruning cuts are always made on the upper part of the perennial trunk**. The pruning technique that preserves a cone of desiccation that does not alter the sap flux and fruiting cane developed on terminal parts of the perennial structure ensure the longevity of this training system (Fig. 10, l - m).

Application area

Pruning in regard with sap routes is an innovative practice lately implemented in winegrowing regions of Europe (Fig. 11).

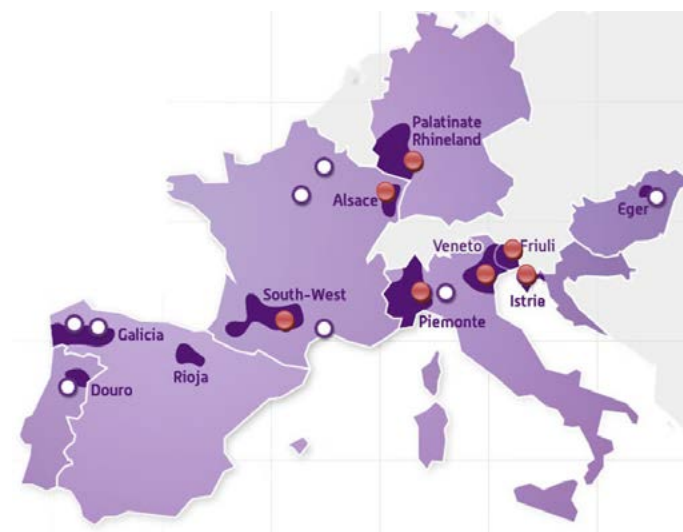


Figure 11: Area of application Guyot-Poussard pruning (signaled by red dot), Results from WINETWORK interviews.

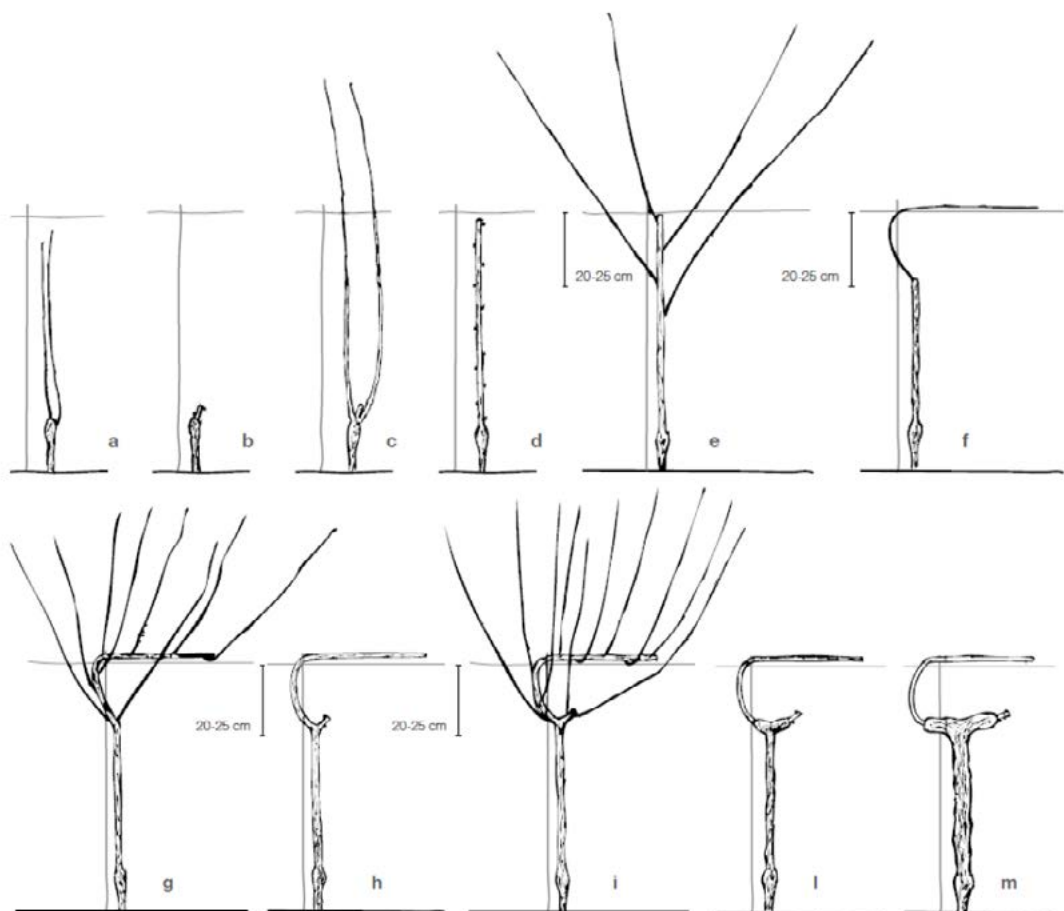


Figure 10: Guyot-Poussard formation (Simonit & Sirch, 2010)

Pruning in regard with sap flux

Innovative aspects

A lot has been done, but a lot more to do!

First partial scientific results from Germany – work in progress!

First results obtained from trials conducted in Germany (Petgen, 2016 a, b) indicate significant differences in the cut surfaces between traditional pruning and pruning in regard with sap routes. Pruning in regard with sap routes results in increased cut surfaces in the annual wood, but the cut surfaces of the perennial wood on central upper part of the trunk, common in Guyot pruning (see Fig. 13) were smaller than in the traditional pruning.

Winegrower's experience with pruning in regard with sap flux

Pruning in regard with sap routes, more precisely Guyot-Poussard training system, ensures a continuous sap flux and horizontal growth along the first wire as a result of continuous horizontal development of adjacent perennial spurs. In comparison with traditional Guyot pruning, where pruning wounds are accumulated in the complete central-upper part of the trunk (Fig. 1), Guyot-Poussard maintains the sap flux because of the location of pruning wounds on upper part of the perennial wood (Fig. 13). This training system is implemented in the production of high quality wines, and it is believed that contributes to more homogenate development of phenological stages, balanced vegetative growth, more balanced ripening (significant for production of red grapes designated for structured red wines). Activities such as shoot removal are more extensive and important to maintain the training system, but leaf removal at phenological stage of flowering or fruit setting requires less man power.



Pruning in regard with sap routes implemented in Istria region on cv Teran (K. Diklić, IPTPO)

Other requirements and costs

The change from the traditional training system to the pruning in regard with sap routes was conducted by Petgen (2016 a, b) at the DLR Rheinpfalz in a seven-year-old vineyard with the grapevine variety Riesling. A higher amount of work in the first years of the training system retraining to Guyot-Poussard was observed. For the Guyot-Poussard pruning there is a need of **37 h/ha** whereas for the traditional pruning only **23 h/ha working time**. These differences occurred **especially because of the lack of long experience** in adopting this training system, in comparison with traditional pruning method. In the following years, after a successful retraining, **time saving is observed in the future pruning**.

The starting situation of a traditionally pruned vineyard plays an important role of the length and success of the change to the Guyot-Poussard training system. Therefore the age, variety and the growth of the grapevines plays a significant role. When there are different starting situations of retraining to Guyot-Poussard, each situation requires an individual approach. There were no significant differences in the Botrytis bunch rot susceptibility and analysis of the grape-must between both pruning methods.

The study indicates that the **change from a traditionally pruned vineyard to the Guyot-Poussard training system** take **several years**. Guyot-Poussard is **a demanding pruning method** and has to be learned before and **temporary workers need to be properly trained**. Because of the long incubation time of the Esca pathogens at least ten years for the first observations and results on the impact of this training system are required.

More information

www.winetwork-data.eu

Technical data sheet: Good pruning practices

Video seminars:

- [Epidemiology and symptomatology of GTDs \(Dr. Vincenzo Mondello, URCA\)](#)
- [Scientific overview on Grapevine Trunk Diseases \(Dr. Vincenzo Mondello, URCA\)](#)

Source of information

Crespy, A. (2006). Manuel pratique de taille de la vigne. (Ed. Oenoplurimedia).

Geoffrion, R., Renaudin, I. (2002). Anti-esca pruning. A useful measure against outbreaks of this old grapevine disease. Phytoma. La Défense des Végétaux (France).

Lafon, R. (1927). Modifications à apporter à la taille de la vigne dans les Charentes. Taille Guyot-Poussard mixte et double. L'apoplexie, traitement préventif (Méthode Poussard). Traitement curatif. Imp. Roumégous et Dahan, Montepellier, 1921.

Maher, N., Piot, J., Bastein, S., Vallance, J., Rez, P., Guérin-Dubrava, L. (2012). Wood necrosis in Esca-affected vines: types, relationships and possible links with foliar symptom expression. J. Int. Sci. Vigne Vin., 46 (1), 15-27.

Moller, W.J., Kasimatis, A.N. (1980). Protection of grapevine pruning wounds from Eutypa dieback. Plant Disease 64, 278–280.

Petgen, M. (2016a). Sanfter Rebschnitt in der Umstellungsphase. Das Deutsche Weinmagazin.

Petgen, M. (2016b). Erste Erfahrungen nach der Umstellung. Das Deutsche Weinmagazin.

SICAVAC http://www.vinopole.com/fileadmin/user_upload/fichiers_vinopole/Maladies_du_bois/Formation_taille_guyot_resume.pdf

SICAVAC, BIVC (2014). Manuel des pratiques viticoles contre les maladies du bois Remise à jour du «Guide pratique de la taille Guyot»

Simonit & Sirch. http://www.aloislageder.eu/sites/default/files/interview_marco_simonit_1.pdf

Simonit, M. (2014): Manuale di potatura della vite Guyot. Ed. L'Informatore Agrario, Verona.

Simonit, M. (2016). Cordone speronato. Ed. L'Informatore Agrario, Verona.

Simonit, M., Sirch, P. (2010). Il metodo Simonit&Sirch, Preparatori d'uva. Potatura ramificata per la logevita dei vigneti: Osservazioni teoriche e guida pratica per Guyot e cordone speronato. http://www.vitevinoqualita.it/files/2013/07/potaturaramificata_it.pdf

Surico, G., Mugnai, L., Marchi, G. (2005). Older and more recent observations on Esca: A critical overview. Phytopathologia Mediterranea, 44, S68-S86.

Surico, G., Mugnai, L., Marchi, G. (2008). The Esca disease complex. In: Integrated management of diseases caused by fungi, phytoplasma and bacteria. (Ciancio A., Mukerji K.G., eds.). Springer Science+Business Media B.V., 119-136.

Úrbez-Torres, J.R., Gubler, W.D. (2010). Susceptibility of grapevine pruning wounds to infection by Lasiodiplodia theobromae and Neofusicoccum parvum. Plant pathology, 60(2), 261 – 270.



Work realized in common by the facilitators agents of Winetwork project. Data came from practice through the help of 219 interviews and from a review of scientific literature.

The practice described in this data-sheet has not been assessed scientifically and the data provided is coming directly from practice.