



TECHNICAL DATA SHEET

TRUNK RENEWAL

A practice applied in field to limit GTDs incidence



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



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Trunk renewal

Introduction

Grapevine trunk diseases (GTD's) are very old and present in vineyards since Antiquity. They cause damage all over the world by attacking the vine stocks, going for more or less long term, until the death of the vine. The symptoms are visible on the foliage, but also in the wood with the presence of several types of necroses. It is in the wood of the trunk that the pathogenic fungi responsible for the GTD's are concentrated. The technique of trunk renewal is consist to replace the old trunk by a new one that is healthier.

Description

The trunk renewal technique is used to **reform a new trunk with a basal sucker. The advantage is to have a new trunk, but with the well-developed root system of a vine in production.** Moreover, the renewed vine will return to production faster than a young plant. **The effectiveness of this technique is very good against Eutypa** (BNIC-INRA Bordeaux, 1989). The efficacy against **Esca and Botryosphaeria dieback** is **partial** because part of **the renewed vines can express symptoms again in the following years.**

Several protocols are possible. Trunk renewal can be **preventive**, thus carried out before the appearance of symptoms of GTDs, or used **when symptoms are observed.** The two techniques can be complementary on the same plot. The success of this method is related to the cultivar, disease, region and other parameters described later in this technical data sheet.

Scientific data

There is evidence that trunk renewal is **effective in fighting Eutypa** by numerous scientific publications. The experiments are sometimes old because Eutypa tends to decline in most regions, unlike the Esca and BDA. (BNIC, Chamber of Agriculture, 1989) (BNIC, INRA Bordeaux, 1989) Mette L. and al., 2004) (Sosnowski Mark R. and al., 2011)

On the contrary, there is **less scientific data on the effect of trunk renewal on the Esca and Botryosphaeria diseases.** The technique would seem **less effective on these two diseases.** Indeed, part of the vines whose trunk was renewed express symptoms again in the following years and anyway shows a very low vigour (Calzarano et al., 2004). Results could be very much improved with the application of

In nature, and for about 40 million years, Eurasian vines have been forest dwellers; vines have been multi-trunked and unpruned. It is probably in the past 5,000 years or so that vineyards have been monocultures, with each vine trained to a single trunk. Multi-trunks are a practice used commercially in places with severe winters to replace cold-damaged trunks and it can be used to fight trunk diseases, too (Smart, 2015.).

triazoles after the trunk renewal operation. Especially if the renewal of the trunk has been carried out on a diseased vine and especially for the apoplectic forms. (Larignon P., Yobregat O., 2016.) (French National group of wood diseases, 2007) The renewal of the trunk only works if it is carried out **early enough.** Effectively on a vine expressing severe symptoms it is often too late. (SICAVAC, BIVC, 2015).

However, many testimonials from winegrowers show that they are satisfied with the results. (Chamber of agriculture, Alsace, Burgundy, 2017) (DAL François, SICAVAC, Sancerre, 2017). Moreover, it can be seen that this practice is very common in the regions of the Winetwork project, which shows that it must provide some satisfaction.

Application area

Technique of trunk renewal is used in all regions of the Winetwork project. It's a really **popular practice.**



Figure 1: Regions where trunk renewal is currently apply. Data from interviews done during Winetwork project in 10 wine-growing regions

Practical application

In the vineyard, there may be several scenarios where trunk renewal can be applied. The renewal of the trunk may be justified on a healthy vine that has risk factors for the development of GTD. We may have the case of a vine at the beginning of the disease that expresses the first symptoms of GTD, or completely diseased vines.

There are also two types of trunk renewal, to be used according to the situation: “**the classic renewal**”, when a vine shoot grows while keeping the whole vine in production, or “**the forced renewal**” when the vine is decapitated to force the development of suckers.

1) Vines expressing GTDs symptoms: a forced trunk renewal

It is possible to renew the trunk of a sick GTD vine and therefore **to replace an infected trunk with a healthy wooden trunk**. This helps improve yield and may slow the spread of disease by removing potential inoculum sources from a vineyard. There is, however, **no guarantee that re-infection will not occur**, and wounds made by cut must be protected by fungicide application (Smart, 2015.), or bio-control agents.

It is possible to decapitate the trunk before the harvest, as soon as the first symptoms of GTD are observed. Indeed, the technique seems **more effective when the disease is not in apoplectic form** but rather in slow form and at the beginning of symptoms expression.

If the diseased vines have been identified, they can be cut during the winter. Different cultivars can react in a very different way to the winter cut as regards new shoots formation

in spring (figure 2).

The important thing is **to cut the trunk below GTD necrosis**, to remove all the inoculum or at least (Calzarano et al., 2004) to apply effective fungicides after the treatment on the wound.

If trunk renewal is done in winter, the wound need to be protected to limit other infections into the wound (for example *Eutypa lata* fungi) (Larignon and Yobregat, 2016).

Explanation of the different steps:

1. Make this technique on **suitable grape varieties**, or vines that produce enough suckers. (Look at the references at the end of the TDS)
2. **Remove the symptomatic part of the trunk** implementing a cut on the wood with a saw (or other appropriate tools like hydraulic vine shears). **Protect the pruning wound** (with fungicide application, bio-control agents...) and wait for the spring.
3. In spring, **select a well-developed sucker** from the basal part of the trunk. Be careful; don't take a develop a sucker that belongs to the rootstock.
4. **Grow the sucker**. If necessary, protect it against chemical and mechanical weeding, for example with a plastic grows tube.
5. **Disbudding of suckers** on the stem, to stem training.
6. **Prune** the plant like a young vine. In order to form the desired training system.

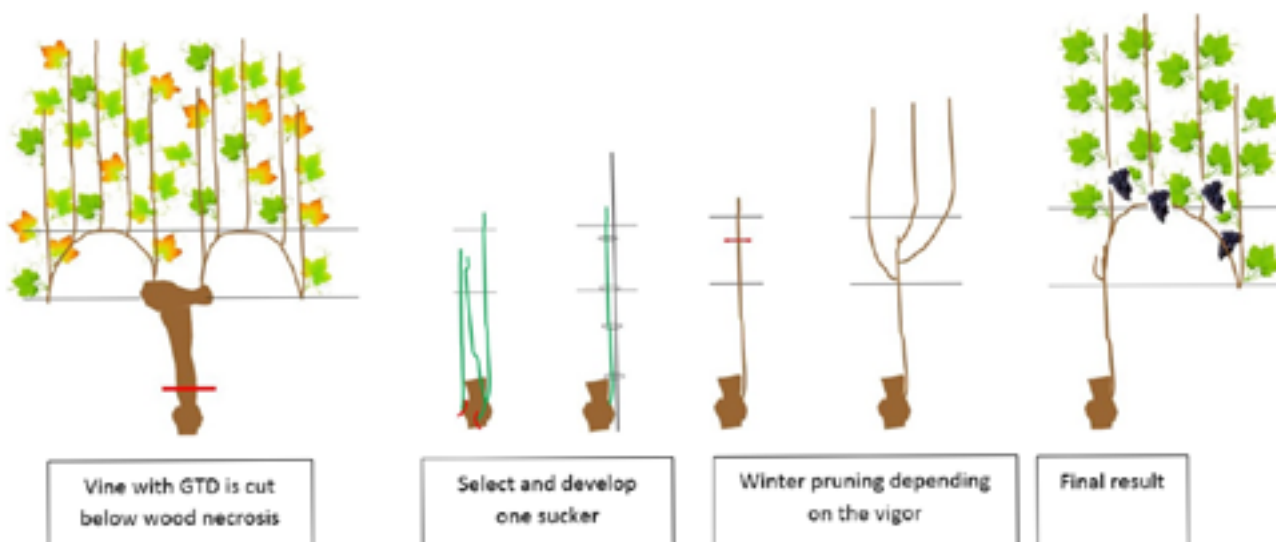


Figure 2: Proceedings of trunk renewal (IFV Alsace).

Trunk renewal

Results :

This technique is very **effective against Eutypa**. For Esca and BDA, this technique is more effective when the vines are affected by the slow form. Indeed, for the vines affected by apoplexy form, **a part of new vines show symptoms again after 2 years**. On the vine that were not apoplectic but with chronic form we observe a good recovery of the vine but mortality after 4-5 years it possible. (Larignon P., Yobregat O., 2016.) (French National group of wood diseases, 2007.) **New trunks can be free of trunk disease infection if located sufficiently low on the trunk, below wood necrosis due to the trunk pathogens.**



Suckers of 1 year old being lignified after renewal of old trunk. One selected sucker will form the new trunk (IFV South-West)

Recommendation :

Renew as soon as first foliar symptoms appears. Do not keep the old trunk as a stake, as necrosis are coming from the top of the trunk, where pruning wounds are located, and going down, new trunk can be contaminated.



Wrong example of trunk renewal using the old affected trunk as a stake. New trunk is affected now by GTDs (IFV South-West)

2) Vines with no symptoms of GTDs but with factors favoring the development of GTDs

This technique consists of **reforming a new trunk before observing symptoms of GTDs**. This is used to rejuvenate the trunk to prevent GTD development. This can be done on a whole plot or on only vines depending on several parameters.

When a young plot (less than 15-20 years old) **begins to express symptoms of GTD**, it is likely that the wood of a **majority of the vines is strongly necrotic** and that the **sap flux are altered**. Invariably, the **mortality rate will increase** in subsequent years. On these plots it is possible to restore the sap flux by renewing the trunks of all the vines of the plot. To best renew the trunks, it is necessary to choose a sucker as low as possible, to remove a maximum of inoculum. (SICAVAC, BIVC, 2015).

In this situation, the old vine trunk is preserved and continues to produce with the **double trunk method**, it can even serve as a tutor to attach the sucker (figure 3). It is interesting to **renew the trunks of a whole plot**, because the maintenance of vine leaves requires a specific manual work, almost similar to a young plantation. It is **easier to manage** trunks renewal if it is done uniformly.

It is also possible to renew preventively only a few vines, to **make timely trunk renewal** when identifying vines with problems that may favor GTDs, such as many or large size of pruning wounds, lots of dead wood on the trunk, insufficient or disturbed sap flux.

As in the previous case, the wound need to be protected which will limit pathogens penetration into the wound.



Trunk renewal in Istria, Croatia (IPTPO, K. Diklić)

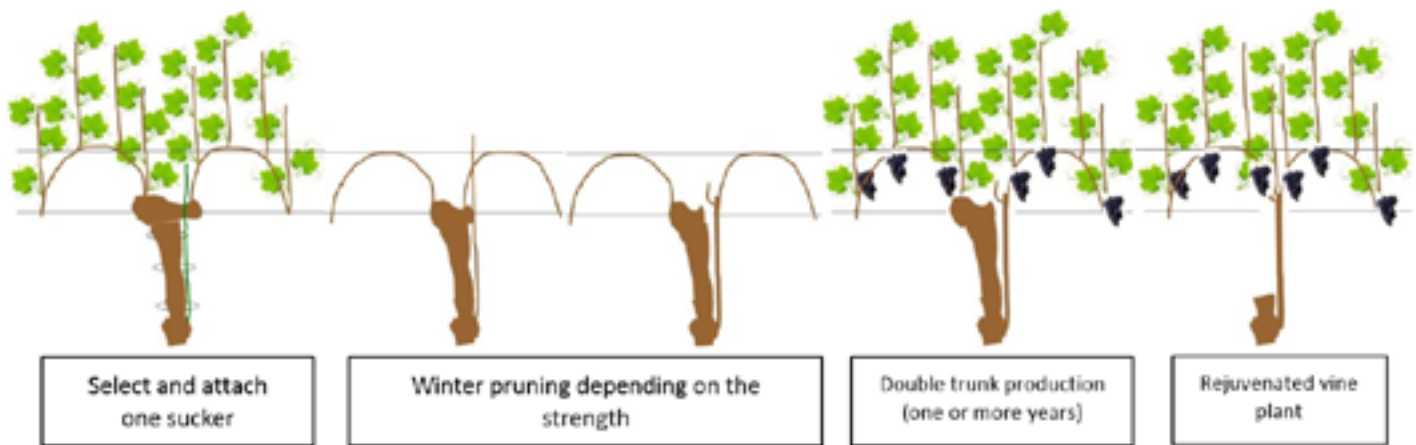


Figure 3 : Proceedings of preventive trunk renewal (IFV Alsace).

3) Timely trunk renewal

The technique was developed by Mr Richard Smart and aims to retain health and recover yields before yield loss and manage GTDs in vineyard at an early stage of infection.

Protocol :

1-Assess GTDs infection by counting vines expressing foliar symptoms (we can also have different level of assessment accuracy, for visual rating to counting symptoms) and record also dead and missing vines. Timing of inspection depends on the predominant disease in the vineyard. For Eutypa it can be done in spring and for Esca and Botryosphaeriaceae it can be done at end of summer, before harvest.

2-Evaluate disease's risk : according to cultivar there is different susceptibility to GTDs

3-Combining risk and infection to decide management strategy.

According to the risk of the plot (cultivar susceptibility, global management) and the present infection rate of the plot 4 management strategies were proposed by Richard Smart:

- S1 (low risk, low infection): remove dead vines, keep suckers in the vine presenting the symptoms of GTDs, and renew them.
- S2 (low risk, medium infection; medium risk low infection): pre-harvest inspection to identify early stage of symptomatic vines, remove dead vines, trunk renew symptomatic vines and adjacent vines if clumping and staining are evident
- S3 (low risk, high infection; medium risk, medium and high infection; high risk, low and medium infection): same as S2 but all trunks of the plot will be replaced within one or two years.
- S4 (high risk, high infection): for all vines Winter-prune very hard, remove all trunks in spring and replace all trunks (or replant)

Key points for succes

The presence of suckers at the base of the trunk is a key point for success and depends on several factors:

- **the cultivar:** some cultivar are not suitable for trunk renewal because they have very low production rate of new suckers on the base of the trunk. (Becker Arno, 2012)

(Examples of suitable cultivars: Colombard, Merlot, Gewurztraminer, Auxerrois / no suitable: Ugni Blanc, Riesling, Portugieser...)

- **the mode of cultivation** : remove suckers with chemicals is not favorable to the regrowth of suckers. In the same way, a very rigorous remove suckers every year is not favorable to the development of buds from the old wood.

- **the age of the vines:** the younger vine produce more suckers. With the increasing age of the grapevine you have less and less sleeping buds around the grafting point. You should do the trunk renewal not later than the age of 20 years of the vine to get positive results. (Becker Arno, 2016)



Renewed trunk in Eger, Hungary (Eszterhazy Karoly University)

Trunk renewal

Help to bud burst the eyes of the base of the trunk :

If buds are present at the base of the trunks, it is possible to **help** them to **budburst** by eliminating the excess thickness of dead bark and by making a superficial notch with the pruning shears just above the zone where a departure of sucker is desired (SICAVAC, BIVC, 2015)

Method : remove the old bark from the trunk and make a notch two millimeters deep on 3-4 centimeters long at the base of the trunk (figures 4 and 5).

Other key point: Good knowledge of GTDs symptomatology about foliar symptoms and internal symptoms. When cut is done, it is important to know to identify necrosis, and if there is one, to cut below.



Figure 4: Remove bark (SICAVAC- BIVC)



Figure 5: Making a notch (SICAVAC- BIVC)

Practice cost

GTDs cause significant economic damage. They can reduce the yield and quality of the grapes. This reduces the quantity and quality of the wines produced and therefore the profitability of the vineyard. For table grapes, symptoms with black punctures on the berries can make the production unmarketable. Some of the economic losses can be offset by techniques that limit damage.

Overall, **the implementation of preventive practices to fight against GTD's is profitable**. Indeed, using preventive practices early makes it possible to lengthen the period of profitability of the vineyard. In some cases it increases profitability immediately. In any case, using preventive practices, before GTD's appear is positive economically. (Kaplan J. and al., 2016)

The cost of remediating vines by working or re-grafting will be less than the cost of replacing vines. The sooner preventive practices begin, the greater the future benefit. (Sosnowski M. and Mundy D., 2016)

According to Becker (2012) profitability of the trunk renewal depends on the expected price of the wine and on the remaining useful life of the vineyard. **The trunk renewal is economically justified if the remaining useful life time of the vineyard is ten years**, wine price of 0,8 € per liter and a success rate of the trunk renewal of 20%. When trunk renewal is applied with 60% of success (symptomatic vines were 'converted' into asymptomatic vines), the cost of trunk renewal resulted in 3 € per vine. Replacement of a symptomatic vine by a young plant costs 9 €/vine.

Concrete example:

Quantification of a trunk renewal cost according to a survey of winegrowers in the South West of France, in the Winetwork project:

In the case of a plot planted with 4500 vine / ha, and an average of **250 vines to be renewed** :

- Practice cost : personal cost around **15€/hour** (gross cost), around 10 hours of work/ha (to realize the trunk renewal)
- Stake: 0.10€ in wood (bamboo) and 0.30€ in iron, plastic protection: 0.20€

Total cost: **225€/ha/year maximum** (with bamboo stake) to 275 €/ha (with iron stake).

Source of information

Becker Arno, DLR Rheinhessen-Nahe-Hunrück, Oppenheim, Germany, 2016. «Alte Reben – Neues Leben», «Landwirtschaftliches Wochenblatt LW 7/2016», page 38 to 41.

Becker Arno, DLR Rheinhessen-Nahe-Hunrück, Oppenheim, Germany, 2012. «Esca-Sanierung durch Stammrücknahme lohnt», «Der Deutsche Weinbau, Nr.3», page 22 to 24.

BNIC-Chamber of agriculture, 1989. « Le recépage, ça marche ! » « The trunk renewal, it works ! », experimental results.

BNIC-INRA Bordeaux, 1989. « La pratique du recépage dans la lutte contre l'eutypiose » « The practice of trunk renewal in the fight against eutypa », Le paysan Français, n°861 november 1989.

Calzarano F., Di Marco S., Cesari A., 2004. Benefit of fungicide treatment after trunk renewal of vines with different types of esca necrosis. Phytopathologia Mediterranea, 43(1), 116-124.

Groupe National Maladies du bois ; French National group of wood diseases (IFV, INRA, ENITAB, Minister of Agriculture, Viniflor), 2007. «Note nationale: les maladies du bois» ; «National note : Diseases of wood » . page 5.

Kaplan J, Travadon R., Coper M., Hillis V., Lubell M., Baumgartner K., 2016. "Identifying economic hurdles to early adoption of preventative practices : the case of trunk diseases in California winegrape vineyards."

Larignon P., Yobregat O., 2016. «Cahier pratique: comment lutter contre les maladies du bois de la vigne?» «Practical notebook : how to fight against the diseases of the wood of the vine» IFV,

page 7.

Mette L., Creaser, Wicks Trevor J., 2004, «Short-term effects of remedial surgery to restore productivity to Eutypa lata infected vines», Phytopathologia Mediterranea, 2004, 43, 105-107.

Richard Smart, 2015. Timely trunk renewal to overcome trunk diseases, practical winery and vineyard, oct 2015, p 64-70.

Sosnowski M. and Munday D., 2016. Sustaining vineyards through practical management of grapevine trunk diseases, NZ Winegrower, August/september 2016, page 85 to 88.

Sosnowski M., Wicks Trevor J. and Scott Eileen S., 2011, «Control of Eutypa dieback in grapevines using remedial surgery», Phytopathologia Mediterranea, 2011, 50 (supplement), S277-S284.

SICAVAC, BIVC, 2015. «Manuel des pratiques viticoles contre les maladies du bois», «Handbook of wine-growing practices against wood diseases», page 85 to 90.

More information

www.winetwork-data.eu

Technical datasheets:

- Good pruning practices
- Pruning with regard to sap flux

Video seminars:

Epidemiology and symptomatology of GTDs (Dr. Vincenzo Mondello, URCA)

Scientific overview of Grapevine Trunk Diseases (Dr. Vincenzo Mondello, URCA)



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.

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