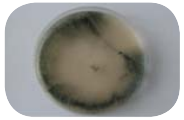
OUTCOMES

Among *Trichoderma* species and strains, several are used in European countries in pruning wound protection: *Trichoderma* atroviride SC1 and I1237, *Trichoderma* asperellum ICC012, *Trichoderma* gamsii ICC 080 and *Trichoderma* harzianum ICC012.

- *Trichoderma* atroviride SC1 has been isolated from dead hazelnut wood and selected for its high colonization capability and its high productivity of Lytic enzimes (chitinases, proteases and cellulases).
- *Trichoderma atroviride SC1 is highly competitive and efficiency antagonizes Phaeoacremonium minimum and Phaeomoniella chlamydospora (P.ch) so is able to reduce the yearly infections on the pathogens associated to esca disease*.
- *Trichoderma atroviride I1237 has the ability to fast colonize pruning wounds, to compete with pathogenic fungi for nutrients and space and properties of antibiosis and mycoparasitism.*
- *Trichoderma asperellum and Trichoderma gamsii ICC080 can act as mycoparasites on GTDs pathogens (especially on P.ch) at 10°C and 15°C respectively. Both species remain viable at 5°C, and able to mycoparasite increasing the temperature.*



T. atroviride (DLR-Rheinpfalz)

Cepa T. atroviride SC1 (DLR-Rheinpfalz)

For future practical applications, experimental trials should be carried out to confirm its efficacy with a wide combination of application conditions.

ADDITIONAL INFORMATION

WINETWORK KNOWLEDGE RESERVOIR

www.winetwork-data.eu

ESCA AND GRAPE TRUNK DISEASES

TRICHODERMA APPLICATION

For protecting grapevine pruning wounds

The pathogens associated with grapevine trunk diseases - a set of taxonomically-unrelated Ascomycete fungi - are able to infect healthy vines mainly by pruning wounds and these wounds can remain susceptible for several months.
The prevention of wound infection applying biocontrol agents is one of an **alternative technique** to control trunk diseases. Species of the **genus Trichoderma** (an ascomycete fungus, originally present in the soil) have been investigated several times as a potential **biocontrol agent** by spatial and nutritive competition.

PRACTICAL APPLICATION

Different species and strains of *Trichoderma* are able to **colonise about 1-2 cm of the pruning wounds** and prevent the penetration (into the wood) of GTDs pathogens. The colonisation depends on the **physiological state** of the vines as well as weather conditions at pruning.
Wounds may **remain susceptible** for a long time, the most critical time for infection ranges from **2 to 8 weeks after pruning**.

Culture of Trichoderme sp. in Petridish

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TIME OF APPLICATION

Trichoderma species are able to start wound colonization at 10° C, but the time of the treatment could improve its efficiency in colonizing wounds and thus, its protection capability. The correct timing is above 0°C temperature, though some Trichoderma species require higher temperature (exceeds 10 °C). It is important to highlight that Trichoderma spp. as a biocontrol agent is susceptible to the frost. The best timing could be as soon as possible after pruning, to limit the wound susceptibility period to new GTDs infections. Better colonization results could be achieved with treatments done within 5 or 6 hours after pruning. Some producers recommend distributing Trichoderma products during bleeding, since the sap presence helps the antagonist in colonizing the wounds faster. At the same time it is important to check the weather forecast before the application because **heavy rain can interfere with the beginning of colonization, washing away the spores**.

MODE OF APPLICATION

Preventive wound protection practices should start in 1-year-old grapevines following the first pruning and continue each year thereafter.
Small and large wounds should be treated with the biocontrol agent, using a canopy sprayer with nozzles targeting the cordon.
When canopy sprayers are used, maximum coverage of wounds can be achieved by turning off fans (no air), applying high water rates at low pressure, selecting spray nozzles that produce large droplet size and focussing nozzles towards the pruning wound zone.
When preparing for the treatment it is highly recommended to clean carefully the tank from previous fungicide residues in order to not 'disactivate' Trichoderma.

IMPORTANT FACTORS

Fungal inoculum represents a potential source of new infections and it may be found on vines with wood/foliar symptoms.
GTD **fungal inoculum** is present on necrotic stems, leaves, desiccated bunches, under the bark of perennial wood (trunk, cordon), dead wood and pruning debris.
Sources of infection, like pruning debris and symptomatic/dead vines, should be removed from vineyard promptly to prevent development of new infections.

Numerous factors could influence the **biocontrol capability** of a *Trichoderma*-based products:

- the *Trichoderma* species utilized
- the method used for its distribution
- the phenological stage of the vines
- the time between the pruning and the *Trichoderma* treatment
- the interaction of the antagonist with the host plant
- the interaction with environmental factors
- the biocontrol activity could vary according to the different cultivar

All the factors, if not properly managed or not taken in consideration, could lead to unsatisfactory results.

If the treatment is correctly done, Trichoderma spp. are able to provide an effective long term protection against a wide range of GTDs pathogens, differently to chemical controls which can be guarantee a short-lasting protective effect (max 15 days) and towards a limited GTDs pathogens.

KEY POINTS OF SUCCESS

Trichoderma have a preventive effect on the infection of grapevine trunk diseases pathogens, to maximise its preventive effect, several conditions need to be respected:

1. Application of *Trichoderma*-based product as soon as possible after pruning
2. Application can be done either by sprayer (canopy sprayer or backpack sprayer) and paintbrush.
3. Respect *Trichoderma* strain characteristics (temperature during application) and if possible apply the product on dry conditions and before rain.
4. To maximise preventive action, start the application of *Trichoderma* on the first year and renew each winter at the pruning period