WINETWORK

European Knowledge Transfer

TECHNICAL DATA SHEET

Hot Water Treatment (HWT)

Prevent from propagation of Flavescence Dorée phytoplasma

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

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Hot Water Treatment

Introduction

Flavescence Dorée (FD) is a type of grapevine yellow and a serious disease caused by phytoplasma. FD is spread by an insect vector, a leafhopper *Scaphoideus titanus*, and it has been shown that it can be transmitted by using infected propagation material, scions and/or cuttings collected from diseased plant during a period of symptom latency. Hot water treatment of propagation material could prevent from this danger.

Principle

Hot water treatment is proposed to **cure** **dormant wood material from** **phytoplasmas** and to supress surface parasite and pests. Pathogenic agent, the phytoplasma is heat-sensitive. Time and temperature need to be such as supress phytoplasma **without affecting plant development** capacity. Hot water treatment was proposed first in 1966 by Caudwell to cure dormant woody plant material from phytoplasma (both FD and Bois Noir). Several scientific experiences have demonstrated the effectiveness of this treatment against pathogens (Caudwell et al, 1990; Tassart-Subirats et al, 2003; Mannini et al, 2009). Soaking plants into hot water is an essential **additional treatment to limit the distribution of FD** (and Bois Noir) by guaranteeing its **sanitary quality**.

Objective

Eliminate Flavescence Dorée phytoplasma from planting material in order to limit inoculum propagation without affecting vegetative development.

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Conditions of application

Duration of treatment

Treatment duration is from 45 to 65 minutes according to temperature. According to the country, different times and temperatures are used:

- **45 min at 50°C** (Mannini et al 2009; Caudwell et al, 1990; Caudwell et al, 1997; Tassart-Subirats et al, 2003). These parameters allow to **eliminate phytoplasma** and have a **partial effect on *Scaphoideus titanus* eggs** (presents under bark on the **one year old plant material**) (Caudwell et al, 1997; Linder et al, 2010).

- 65 min: **25-35°C during 10-20 minutes**, then **50°C during 45 minutes**. The first bath allow to prepare wood cuttings by soaking tissues at the real treatment of 50°C during 45 minutes (Piano S. and Costa C., 2017).

Operational process

Hot water treatment need to be realized at the step of storage in cold room, before grafting (for **scions**) or before planting (for **grafted rootlings**).
Material need to be prepared before treatment by **acclimation at room temperature** 12 hours before, then put back in store room with high humidity.
Do not make fungicide treatment in the same time as hot water treatment.
If the treated material is transported, use aerated packaging with good hydration and controlled temperature.

Recommendations:

Use adapted material and immerge dormant cuttings and grafted rootlings into a hot bath for **45 minutes at 50°C. Using other parameters of time and temperature can induce symptoms expression, lack of vitality of treated plants**. Store cutting material before hot water treatment in cold room at 5°C with high humidity and right after treatment, store again in cold room (Piano S. and Costa C., 2017; GTNFD, 2006). Control efficiency of the equipment and in particular the possibility of a pre-heating of the material prior to the proper HWT to prevent termic shocks, and the **continuous and regular** flowing of the hot water around the wood cuttings.

Outcomes

Plants treated with hot water treatment at 50°C for 45' showed after one year **vitality up to 75%** (Mannini et al, 2009) and **no FD symptoms**. On the contrary, treatment at 52°C for 45' can induce as a side effect almost 10% reduction of take (Mannini et al, 2009). One **side effect of HWT** is that it can induce a **budburst delay** until one month on grafted rootlings.

Hot-water treatment has also an effect on **Bois Noir phytoplasma** (treatment at 52°C), **partial effect on FD leafhopper eggs**, thrips, bacterial diseases (*Agrobacterium vitis, Agrobacterium tumefaciens*, bacterical necrosis, *Xylophilus ampelinus*) (Bazzi et al, 1991; Hamilton R., 1997; GTNFD, 2006), Phylloxera and is effective on **Xylella fastidiosa** (EFSA, 2015, Bloy, 2016). HWT also allow to reduce grapevine trunk diseases pathogens on grafted plants as *Phaeomoniella chlamydospora* (Pch), *Diplodia seriata* (Ds), *Neofusicoccum parvum* (Np), and *Botryosphaeriaceae* sp. (Larignon et al, 2009; Viguès et al, 2009; Elena et al, 2015) Effectiveness of HWT is linked to material age, and is better on one year old planting material.

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Key points for success / risks

HWT complete insecticides treatments action, suppress state standing carriers of contaminated rootstocks, supplement absence of chemical treatment against phytoplasmas. In order to insure treatment efficiency and preserve propagating material several conditions need to be respected:

- **Quality of propagating material**

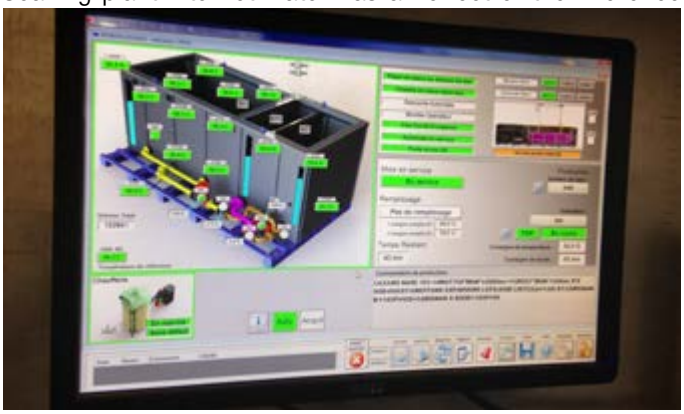
Wood cuttings need to be lignified and present the best possible reserves. Cuttings should have been stored in the best conditions of temperature and hygrometry after picking time and haven't suffer from any desiccation or reserves losses. Pay attention to varietal sensitivity, (due probably to a greater or lesser diameter of the shoots, the marrow more or less expanded, different content of reserve substances).

- **Reliability of treatment material**

Temperature inside the bath need to be kept constant and homogenous (probes are controlling temperature in the bath) with an accepted variation of +/- 0.5°C (GTNFD, 2006). It is important to renew frequently water, according to treatments frequency. A factor determining operation success is the control of time and temperature combination, monitored during treatment.

- **Operational process**

Soaking plant into hot water has an effect of thermic choc



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that can modify physiological state of propagating material. The above operation need to be respected in order to avoid any problems of bud-burst and mortality.

- **Prohibition of circulation of phytoplasma-infected material**

FD is a quarantine disease and might be dangerous for other phytoplasmas, since potential vectors may exists in the area of introduction.

Purchasing Hot Water Treated nursery material is strongly recommended to European growers, in particular for areas where FD is not present yet. In presence of the vector, a **single infected plant can generate a wide infection**.

Combination of time and temperature is the **most important factor** in HWT efficiency. If combination of 50°C for 45 minutes is not respected, buds can present localized cellular degeneration and total alteration up to 60°C.

HWT at 50°C does not no influence damage of the conductive tissues, or to any significant disturbances of hydraulic conductivity degeneration are observed (Remolif et al, 2014).

Source of information

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More information on

www.winetwork-data.eu

Technical datasheets :

- **Guide of good practices in FD management**
- **How to manage with more precision FD**

Video seminar: State of the art of scientific research on Flavescence Dorée (François-Michel Bernard, IFV)

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