

VINEYARD MANAGEMENT



- Enlargement of disease area from grapevine to grapevine
- Infected grapevines can be multiplied by 10 each year
- Infected grapevines constitute an inoculum source for the spread of FD

Keep under surveillance potential reservoirs

Wild vines, abandoned vineyards are **reservoirs for FD vector and phytoplasma**.

Phytoplasma can live in host plants as Clematis and Alnus and can be transmitted to grapevine by other insects' vectors but frequency of such transmission is very low. Rootstock regrowth must be suppressed, as they can host the phytoplasma but don't express the symptoms.

Regulatory aspect

FD is a quarantine disease at European level and a disease of mandatory fight. Regulation should allow to keep disease under control at vineyard scale. **Any contaminated grapevine must be uprooted**. In defined perimeters, insecticides treatments are mandatory. **From 20% of infected grapevines on a plot, total vine-plot uprooting is mandatory.**

Additional information:
WINETWORK KNOWLEDGE RESERVOIR
www.winetwork-data.eu

Monitoring must be done at large scale with a **collective implication**. Each plot need to be inspected, by **observing grapevines from all rows**. To be more effective, monitoring can be organized and controlled by a dedicated organism. Symptomatic grapevine are marked then suppressed from the plot. In case of doubt, leaves sample must be taken and sent for laboratory analysis, the only way to distinguish FD from Bois Noir.

The sooner infected vine is uprooted, the better it is, in this way, *Scaphoideus titanus* can't feed on infected grapevine and won't propagate the disease.

Leaving infected grapevine on the plot will increase considerably infection level in the coming years.



Efficiency of FD management depends on the cohesion between actors

Photographer credit
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FLAVESCENCE DORÉE ACTIONS, MEANS AND TIMING OF CONTRAST

How to manage the disease with more precision?

Flavescence dorée (FD) is the most important and destructive phytoplasma disease of grapevines. FD induce severe impacts, including reduced vitality of vines, yield reductions and reduced wine quality. Without control measures, the disease spreads rapidly, affecting up to the totality of vines in a few years. A good management of FD go through a combination of methods working both on the vector, *Scaphoideus titanus* and on the disease, once grapevines are contaminated by the phytoplasma.

ACTIVITIES TO MANAGE FLAVESCENCE DORÉE:

- Vector control by insecticide treatments respecting the timing
- Contentious monitoring of the vineyard
- Suppress any symptomatic grapevines
- Collection and analysis of grapevine samples for identification of Flavescence Dorée phytoplasma in case of doubt
- Monitoring in collaboration with local competent authorities



VECTOR MANAGEMENT

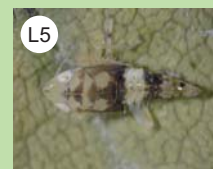
Time, a key factor

Application time is the key of success in managing *Scaphoideus titanus* population in vineyard. The leafhopper transmits FD phytoplasma from one grapevine to another very quickly. In order to slow disease's propagation, a good control of the vector and management of the vineyard at a large scale are necessary.

Several methods allow to know when apply insecticides treatments: Emerging cages, modelling, monitoring nymphal stages, monitoring adults with traps. The first treatment is the most important and need to be correctly positioned.

Recognize the vector

Scaphoideus titanus (Hemiptera: Cicadellidae) is a univoltine insect. Eggs are laid at the end of summer inside the bark of 1-year old wood and hatch after a diapause stage. After hatching, 5 nymphal stages (L1-L5) follow each other in 5 to 8 weeks. *Scaphoideus titanus* nymphs are white colour to translucent, then stain with ageing. Nymphs are identifiable thanks to two symmetrical black points in dorsolateral position at abdomen posterior end. The nymph, when disturbed, show a typical behaviour: it tends to jump away. *Scaphoideus titanus* adult size range from 4,8 to 5,8 mm, has brown colour and stripes on the head (from 1 to 3, according gender).



Treatment strategies

According to the region and even to the country, several treatment strategies exist. The first treatment need to be positioned **one month after hatching** (when nymphs first feed on an infected grapevine there is an incubation time of one month for the nymphs begin infectious), then a second treatment is **positioned at the end of product's remanence** in the objective to cover end of hatching. A third treatment can be applied, on adults, according to rules defined in each country or region. **Late control of vector leafhopper population** (with traps) is **important to decide the opportunity of an additional insecticide against adults**.

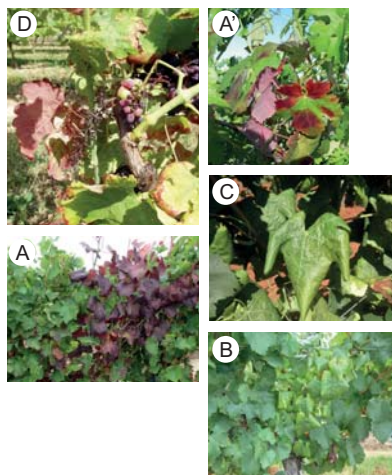
Vector management in organic production

In organic viticulture, only few insecticides treatments are available (based on natural pyrethrin and on azadirachtin) and their efficacy are highly variable. They need to be applied with high precision, respecting certain specific requirements and renewed after one week. The control of vector's population need to be **complemented with a regular vineyard monitoring, suppressing any symptomatic grapevine as soon as symptoms are visible** and informing local authorities.

Without any insecticide treatments, *S.titanus* population can attain 10 000 individuals per hectare!

FLAVESCENCE DORÉE SYMPTOMS

- Shoots with reduced growth
- Leaf colour aberrations, **reddening** (red varieties) (A) or **yellowing** (white varieties) (B) or yellowing (white varieties) (A')
- **Leaf roll** downwards (C)
- Premature leaf fall caused by FD phytoplasma
- **Desiccation of inflorescences** approximately after flowering (D)
- **Desiccation of berries** approximately after fruit set or later during berry softening
- **Shoot gummosis and lack of lignification** on several/all shoots developed on the fruiting cane
- Thickening of leaf blade, symptomatic **leaves are brittle and cracks when folded in hand**



HOT WATER TREATMENT (HWT)

Hot water treatment allow to **cure dormant wood material from phytoplasmas** and limit inoculum propagation.

HWT 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 for treatment by acclimation at room temperature.

Duration of treatment: material is emmerged in hot water for **45 minutes at 50°C**.

HWT can induce a **budburst delay** on grafted rootlings.

HWT is effective on **FD phytoplasma**, Bois Noir phytoplasma, bacterial diseases, *Phylloxera*, *Xylella fastidiosa*, has partial effect on *Scaphoideus titanus* eggs and allow to reduce grapevine trunk disease pathogens.

