

ManaGTD – FA1303: Sustainable control of Grapevine Trunk Diseases

WG4: Disease management

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NEW APPROACHES ON GRAPEVINE TRUNK DISEASE CONTROL: A CONTINUING CHALLENGE

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The challenge: development of control strategies towards an old, **unusual** and complex disease...

“Sodium arsenite was the sole effective fungicide”

“Sodium arsenite prevented or reduced the foliar expression”

Dosage

Treatments are usually applied by spraying or painting the trunks and main branches with a sodium arsenite solution (12.5 g/liter).

Strategy

Treatments should be applied for 2 consecutive years, at least 2 weeks after pruning and not later than 3 weeks before sprouting (15). In the third and fourth years, the treatment can be omitted but must then be repeated in the following 2 years, and so on.

Threshold

The treatment threshold, i.e., percentage of affected vines in a vineyard at which intervention is required, varies from 0.5 to 2%.

mode of action of arsenites was not understood



Unusual...

Since November 2001 sodium arsenite was banned in every sector of agriculture ...

Development of a substitute:
how did the sodium arsenite act against
the “Esca complex disease”?

- 👉 **Little effect** on mycelial growth (Santos et al., 2005) **lower than the one showed by other fungicides** (Jaspers, 2001; Gramaje et al., 2009)
- 👉 **No effect** on defence mechanism (Larignon et al., 2008)
- 👉 **Accumulation** in the wood (Larignon et al., 2008)
- 👉 **Certain reduction of wound fungal contamination** (Larignon et al., 2008)

Mechanism is not completely cleared yet



Post-arsenite: evaluation of a treatment

TREATMENT

ASSESSMENT

'70s Dinitro-orthocresol

Limited number of years of investigation

'80-90 Triazole applications
Injector pole through the soil
Syringe in the trunk

Single treated vines: masking symptoms not considered

Many-year trials

'00-10 Fosetyl Al

Many-year trials on large number of vines
Masking symptoms
Artificial inoculations
Plant physiology parameters

'04-14 Pruning wound protection
by BCA (Remedier®) or
chemicals

Many-year trials on large number of vines
Masking symptoms
Artificial inoculations
Effect on foliar symptom and wood infection

Improving the understanding of the disease

Improvement of a correct *approach* and *evaluation* of control strategies over the time: more parameters available
There is much more potential for a treatment to be effective

New environmentally friendly approaches in control strategy

COST objective: “The goal of this Action would be to develop **new management protocols and biocontrol approaches”**



Selected foliar fertilization or defence response inducers for the reduction of foliar symptoms



Treatments with formulations of copper that seem able to penetrate woody tissues



Soil application of a charcoal produced by biomass pyrolysis and associated with clay

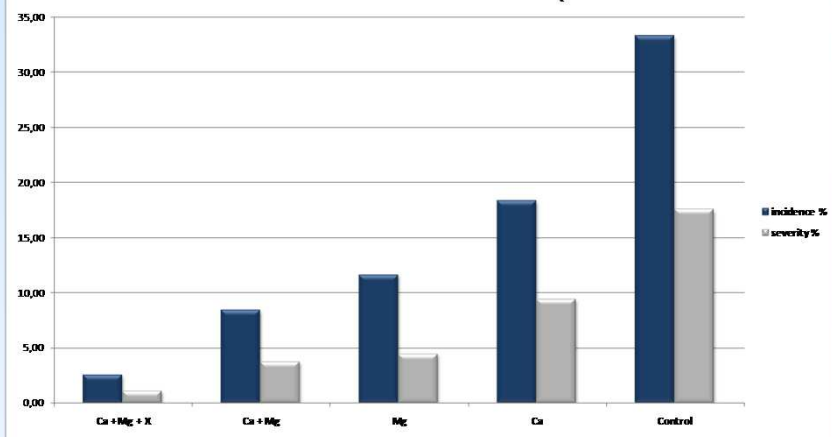
Selected foliar fertilization in a strategy for the reduction of GLSD foliar symptoms (“Esca”)

- ✓ **Formulation of a foliar fertilizer** (presently being patented) **based on calcium, magnesium and a complex to facilitate their bioavailability**
- ✓ **Application protocol:** nine Treatments were carried out at 10-day interval, from "five leaves unfolded" to "bunch closing"
- ✓ **Assessments**
 - ✓ incidence and severity of leaf symptoms over the years
 - ✓ quantitative and qualitative yield parameters
 - ✓ leaf micromorphology
 - ✓ content of trans-resveratrol
 - ✓ effect on canopy



Selected foliar fertilization in a strategy for the reduction of GLSD foliar symptoms (“Esca”)

Significant decrease in the expression of foliar symptoms

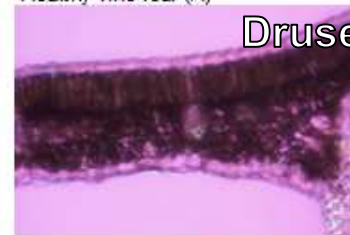


The activity may be due to different mechanisms probably including the reinforcement of histological barriers as well as a different response of the plant by the increase in trans-resveratrol

Leaf investigations

- Druse crystals were higher in number per unit area in treated leaves if compared to untreated leaves
- Flavonoids were accumulated in leaf tissues
- Increase of trans-resveratrol content (both at flowering and at bunch closing)

Healthy vine leaf (A)



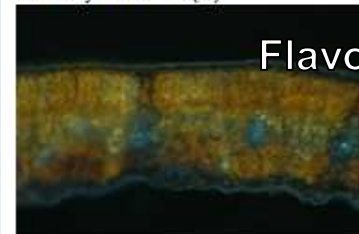
Druse

Treated asymptomatic vine leaf (C)



crystals

Healthy vine leaf (A)



Flavonoids

Treated asymptomatic vine leaf (C)



Foliar treatments with new formulations based on copper

Copper compounds are formulated in order to allow a penetration in woody tissues, in most of the cases authorized in organic agriculture

Copper and plant extracts formulated with potential carriers and drug-delivery agents of functional molecules

Very important to assess the best time of treatment

ongoing assessments:

Decrease in the expression of foliar symptoms
and death of vines

Wound protection

Decrease of inoculum



The potential activity might be due to different mechanisms probably ranging from effects on fungal toxins, wound protection, until to defence response of the plant. In some cases formulations *might be* linked to sodium arsenite putative mechanisms...

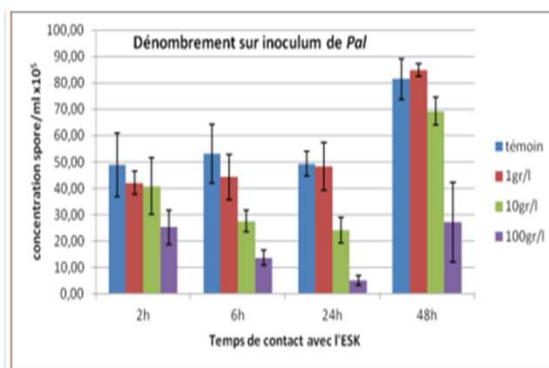
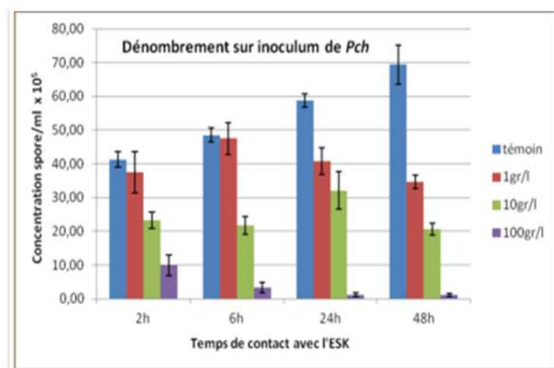


Soil application of a formulation based on charcoal associated with clay

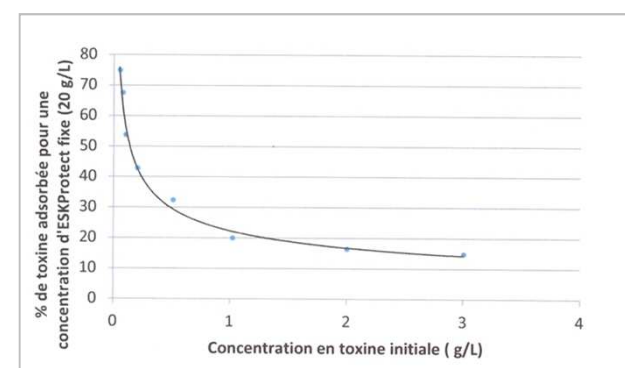
Charcoal (obtained by wood pyrolysis) and clay, both selected according to their adsorption and absorption properties respectively (ESK®)



Reduction in conidial sporulation



Effect on fungal toxins



Data by



La + value végétale

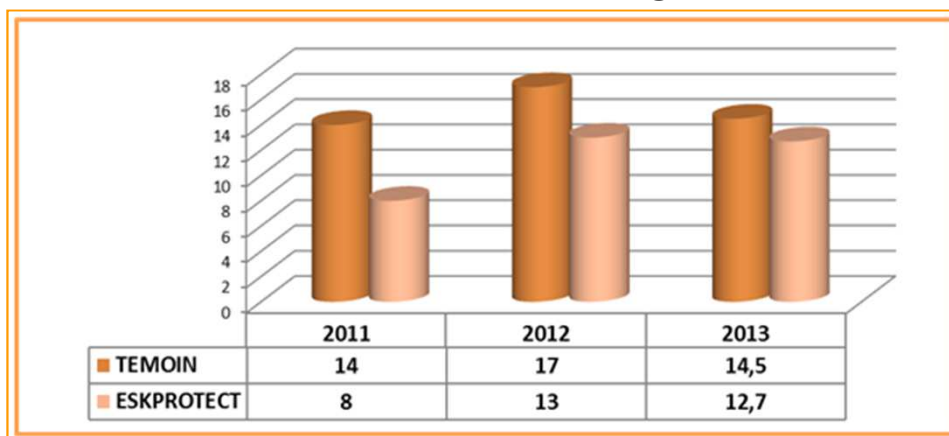
Absorption and adsorption = trap effect?



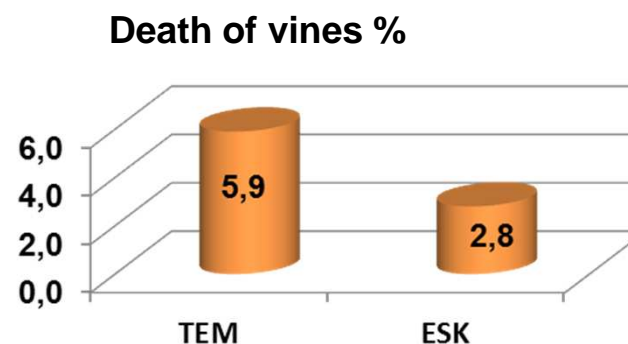
Soil application of a formulation based on charcoal associated with clay



Reduction in the expression of foliar symptoms (especially in young vineyards)



Reduction in the death of vines






The putative activity (if confirmed) might be due to the interaction among the formulation and the host-plant and (?) pathogens:

- Improving “favorable” nutritive substances absorption by roots?
- “Trap effect”?
- ????



The challenge goes on ...

-  Goal within the COST action: discussing and sharing the approach of control trials strategy
-  Improving the understanding of the disease, increases the chances of finding “new” treatments, their correct evaluation and, likely, their efficacy
-  We will finally know *if* and *why* a treatment really works...



Thank you for your attention

