OCHRATOXIN A IN WINES: CURRENT KNOWLEDGE

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PREVENTION STRATEGIES IN THE VINEYARD

Good efficiency of grape caterpillar control measures

The experiments carried out by the ICV in 2001 and 2002 clearly showed that the efficient control of the grape caterpillar could lead to an 80% reduction in Ochratoxin A levels as compared with a control wine containing over 2 µg/l.

In 2001, several plant protection strategies were compared on this Cabernet Sauvignon plot in a study comprising 4 replicates for every treatment. The grapes obtained from each treatment were vinified in the pilot winery of the ICV and were subject to Ochratoxin A analyses. Among the treatments tested, 8 involved the usage of a preventive ovicidal insecticide (Flufenoxuron), and these ones resulted in an average Ochratoxin A reduction of 82% in the wines upon bottling.

In 2002, we compared different insecticide strategies on the same plot, and according to the same protocol. The 3 treatments compared were:

- application of an ovicide and larvicide (on the basis of Fenoxycarb + Flufenoxuron and Deltamethrine)
- application of a larvicide only (Deltamethrine)
- application of a product based on *Bacillus thuringiensis*, a biological and larvicidal insecticide.

The ovicide treatment led to the same Ochratoxin A reduction in wines as observed in 2001 (- 80%). The other treatments led to significantly lower reductions. It appears that the damage caused during larval migration suffices to explain these differences.

Furthermore, studies carried out in vineyards located in areas with high grape caterpillar incidence have shown that regardless of the strategy, grapes from insecticide treatments always gave wines with lower Ochratoxin A contaminations compared with non-treated controls (the reduction varied between 40 and 60%).

Leaf thinning led to a slight Ochratoxin A reduction, be it for the control or in addition to an insecticide treatment, but the effect was not truly significant.

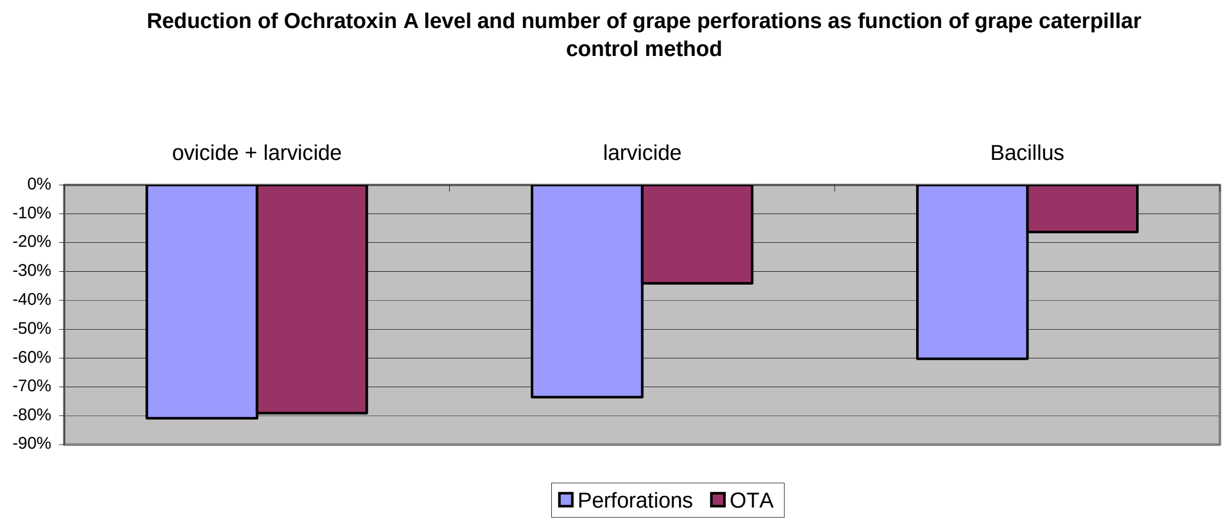

Figure 11: Controlling grape caterpillars by preventive ovicide treatments allows to reduce the Ochratoxin A contamination of wines by 80% (2002 ICV studies).

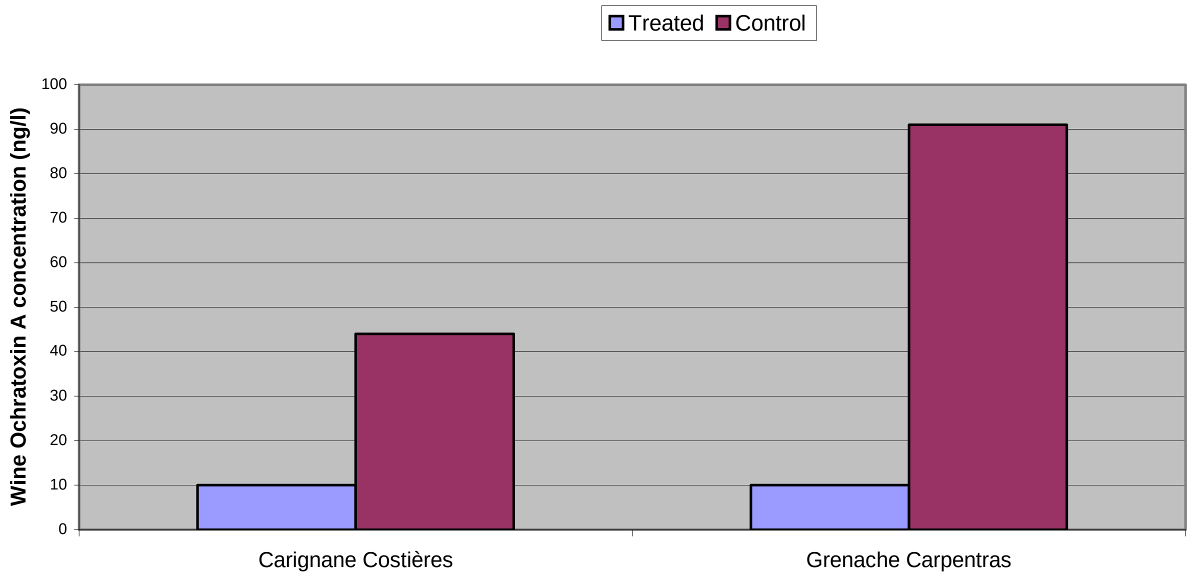

Figure 12 : The study of vineyards shows that grape caterpillar control measures reduce wine Ochratoxin A contaminations significantly (2002 ICV studies).

Fosetyl-Al: effective between setting and bunch closure

Fosetyl-Al is an anti-mildew fungicide known for its secondary action on certain fungi, such as Botrytis. Its effect on Ochratoxin A contaminations has also been evaluated in the studies realized in 2001/02 by the ICV in the same experimental setting as the studies about the grape caterpillar (studies with 4 replicates per treatment), and by comparing different strategies based on Fosetyl-Al (without additional insecticide treatment) with a control.

In 2002, 3 treatments were compared, each with 3 applications of Fosetyl-Al in 12 day intervals.

- before bloom;
- between bloom and bunch closure;
- after bunch closure.

The applications carried out between setting and bunch closure were the ones leading to the largest reduction of Ochratoxin A levels in the wines. The treatments applied before bloom had a much weaker effect.

These results confirmed the observations made in 2001: Fosetyl-Al treatments after setting led to a 50% Ochratoxin A reduction of highly contaminated grapes (in 2001), and a 80% reduction of slightly contaminated grapes (in 2002).

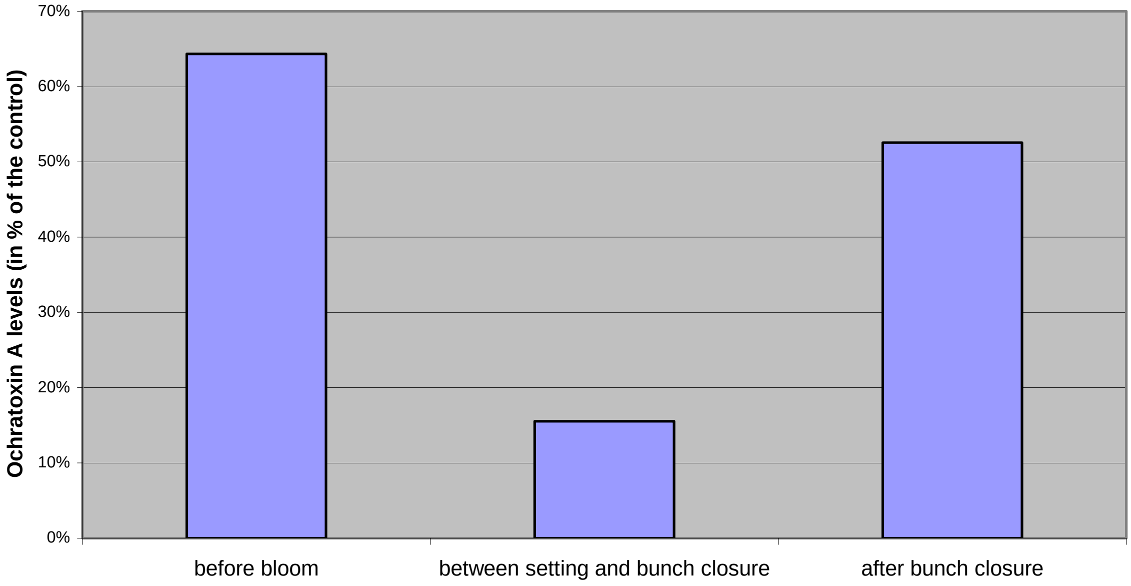

Figure 13: Fosetyl-Al significantly reduces Ochratoxin A levels when treatments are carried out between setting and bunch closure (2002 ICV studies)

Main conclusions of the 2001/02 ICV studies

- There is a strong correlation between the hygienic conditions of grapes and the Ochratoxin A level of wines, particularly because of the damage caused by the grape caterpillar (Eudemis and Cochylis).
- The control of grape caterpillar damage through implementation of protective measures - under consideration of good and reasonable agricultural practices - is sufficient to reduce the contamination levels significantly.
- Ovicide applications seem to bring about more pronounced reductions of contaminations, as compared with the sole application of larvicides (chemical or biological).
- Fosetyl-Al has a considerable secondary effect on the reduction of Ochratoxin A contaminations of grapes and wines if applied after setting.
- This secondary effect of Fosetyl-Al does not justify its application as sole “anti-Ochratoxin” treatment. Above all, its application has to be justified by the need to treat mildew infections. In the latter case, however, Fosetyl-Al application can have an interesting secondary effect.

- Bunch aeration through leaf thinning slightly reduces Ochratoxin A levels, but is not sufficient in cases of strong contaminations.

Effect of fungicides on moulds: preliminary *in-vitro* results.

INRA has studied *in-vitro* the effect of different fungicides used in viticulture on the mycotoxin producing moulds *Aspergillus carbonarius, Aspergillus niger, Penicillium chrysogenum* and *Penicillium expansum* (in Phytoma LdV n° 553, October 2002, pp. 28-31).

In-vitro, certain anti-*Botrytis* compounds had an important effect on moulds, both on conidial elongation and germination, and the mycelial development. These were Fluazinam, Fludioxonil, and especially, Cyprodinil, Mepanipyrim and Pyrimethanil.

Other active compounds had a less noticeable activity

- Folpet and Thiram (and probably, copper) strongly inhibited germination but showed little activity against mycelial development
- Benzimidazoles (Carbendazime, Diethofencarb) did not exert any activity against sporulation, but strongly inhibited mycelial development. However, resistancies were already noticed for *Penicillium*.
- SBI compounds (Spiroxamine, Difeconazole, Fenbuconazole, Tebuconazole) showed some activity

Some active compounds appeared to have little activity or were ineffective

- Strobilurins may have a potential activity, which is to be confirmed in vineyard trials
- Cymoxanil and Metalaxil had no effect
- *In-vitro*, Fosetyl-Al had only little activity, which can be explained by its mode of action (no direct fungicidal activity, but rather reinforcement of plant resistances)

Since field observations can differ significantly from *in-vitro* studies, the fungicidal action against these moulds has to be confirmed with vineyard trials, before an “anti-Ochratoxin A” effect could be assigned to certain active compounds.
The first trials, which are currently in progress, show that certain “anti-botrytis” compounds have a potentially interesting effect on Ochratoxin A. However, the delays required between treatment and harvest, limit the "anti-Ochratoxine A" utilization of these active compounds.