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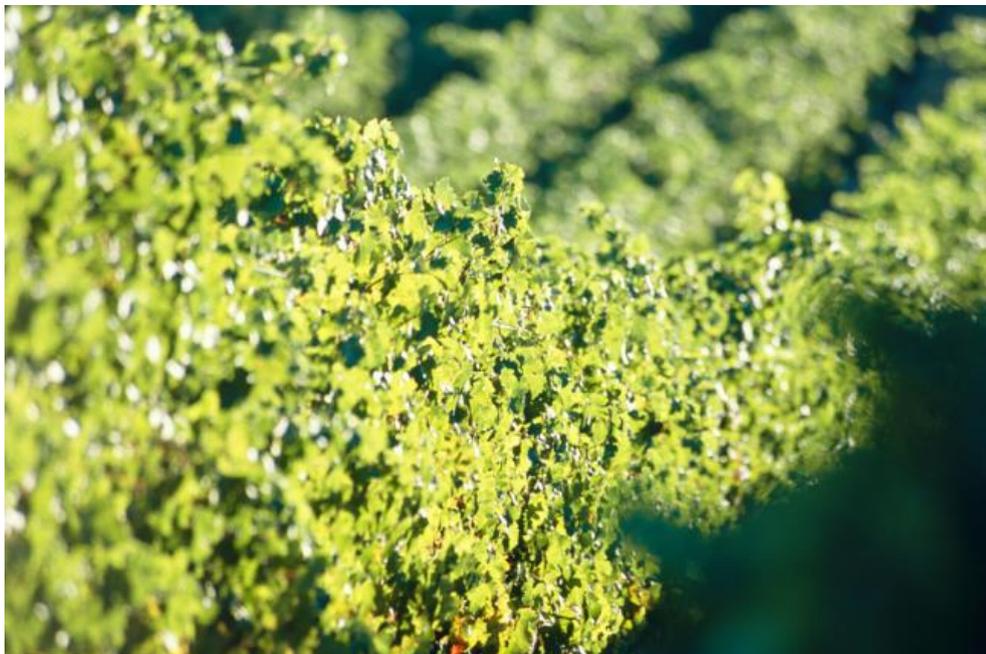


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COPPER-CONTAINING FUNGICIDE AND THE EFFECT ON THE 3-MERCAPTOHEXANOL CONCENTRATION



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[Basic Wine](#)

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Copper is widely used in spray form to combat various types of fungal infection in agriculture, such as downy mildew and blackspot. However, **excessive copper residues in grape must can adversely affect wine quality** and winemakers are often reminded to **use copper with caution**.

Copper can **react** with certain wine constituents or **mediate oxidation reactions** that can decrease the intensity of wine aroma. The reactivity of the fruity volatile thiols with copper led a research team to investigate the effect of copper-containing fungicide spraying in the vineyard on the volatile thiols of the resulting wines¹.

MATERIALS AND METHODS

Sauvignon Blanc vineyards located in the Bordeaux area in France were sprayed with two fungicides over two growing seasons. The fungicides were sprayed over the entire canopy except where specified otherwise.

→ **Folpet**

Used as a reference fungicide. Commercial formulation FOLPAN80 WDG, 80% active ingredient, Makteshim Agan, Israel, 1500 g of active ingredient per hectare

→ **Copper-based fungicide**

Bordeaux mixture RSR, copper sulphate, 20% of active ingredient, Elf-Atochem, France, 3000 g of active ingredient per hectare

Standard vinification strategies were employed. The juice was fermented using commercial yeast VL3 from Laffort.

VINEYARD TREATMENTS

1) Folpet only

Applied every ten days from the phenological stage where the leaves unfold up to 30 ± 5 days before harvesting.

2) One copper-based fungicide spray

Folpet was sprayed as in treatment 1 with the copper-based fungicide sprayed instead of folpet at

- the onset of veraison

3) Two copper-based fungicide sprays

Folpet was sprayed as in treatment 1 with the copper-based fungicide sprayed instead of folpet at

- the onset of veraison and
- at the end of bunch closure

4) Copper-based fungicide sprayed on the upper canopy only

Here it is unclear exactly when the copper spray was applied as well as the dosage used, however, it is stipulated that the fungicide was only sprayed on the top part of the canopy, intentionally avoiding direct contact with the grapes.

RESULTS

COPPER CONCENTRATION IN THE MUST

Typically, if no copper-based vineyard sprays are used, then the level of copper in the juice is likely to be less than 0.5 mg/L. If copper-based sprays are used, then the **level of copper can vary depending on the number of applications, total dose applied and the time between the last application and harvest**. The copper content of the juice could therefore typically range from less than 1 mg/L to higher than 15 mg/L.²

In this study¹, the **overall copper concentration in the must was proportional to the number of copper sprayings**.

- Spraying only with folpet resulted in less than 2 mg/L copper in the must.
- Spraying with one and two copper-based sprays resulted in 3-8 mg/L and 8-15 mg/L copper in the must, respectively.
- Spraying of the upper part of the canopy resulted in a copper concentration of 3.5 mg/L in the must. The results from spraying the upper part of the canopy would suggest that there is some migration of copper from the leaves to the grapes. However, it is unclear how effective the spraying regime was in avoiding direct contact with the grapes. Preferably, the clusters should have been covered to avoid contact to ascertain this migration.

3-MERCAPTOHEXANOL

For each of the vintages and all the plots studied, the 3-mercaptohexanol (3MH) concentrations in the wines made from the copper-based sprayed vines were much lower compared to the wines made from vines sprayed only with folpet.

- A single copper-based spray application led to an 89% decrease in 3MH for the first year and a 33% decrease for the second year.
- The decreases were even more pronounced when two copper-based sprays were applied with the first vintage resulting in a 94% decrease and the second vintage in a 90% decrease in 3MH.
- Spraying only the upper canopy resulted in similar 3MH concentrations when compared to the folpet treatment.

CONCLUSION

Copper-based agrochemicals are a major source of copper in grape juices. It seems that the **copper present on the grapes predominantly causes the decrease in 3MH** in the resulting wine (and not the migration of copper from the leaves). This is supported by results obtained in an additional trial, done by the same research group¹, where covering Cabernet Sauvignon grapes with plastic bags before spraying the entire canopy with copper-based fungicide, resulted in wines with similar 3MH content when compared to the wines made from grapes grown on folpet only sprayed vines.

The **copper residues** present on the grape surface can either **react with the 3MH** formed during alcoholic fermentation or **prevent the formation** to begin with (perhaps by reacting with precursors in the must). However, the **interference of copper present on the grapes on the biosynthesis** of some volatile thiol precursors during grape maturation cannot be ruled out especially considering that copper can penetrate the berry skin¹.

The copper residues on the grapes can perhaps be minimised by ensuring that the copper-containing fungicide is **only sprayed on the leaves, avoiding direct contact with the bunches**.

REFERENCES

- (1) Darriet, P.; Bouchilloux, P.; Poupot, C.; Bugaret, Y.; Clerjeau, M.; Sauris, P.; Medina, B.; Dubourdieu, D. Effects of Copper Fungicide Spraying on Volatile Thiols of the Varietal Aroma of Sauvignon Blanc, Cabernet Sauvignon and Merlot Wines. *Vitis* **2001**, *40* (2), 93–99.
 - (2) The Australian Wine Research Institute. Copper.
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