

## **“Optimisation of downy mildew (*Plasmopara viticola*) control in organic viticulture with low copper doses and new formulations, results of four years of on farm research”**

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### **Abstract**

*In three different wine growing regions in Germany, due to weather and infection conditions several fungicide (copper formulations) and plant strengtheners (Myco-Sin VIN®, Kendal®, Frutogard®) applications against downy mildew are required in order to obtain satisfactory disease control. Results of the four years of on farm trials confirmed good efficacy of the copper based substances like copper hydroxide, partly in combination with two or three applications of potassium phosphonate, new copper-hydroxide formulation or copper oxychloride used in a low doses of copper and alternative products like Myco-Sin-VIN® (clay with high aluminium content) in combination with Kendal® (plant extract).*

### **Introduction**

An organic vineyard is a complex living system where the grower actively tries to encourage the self regulation of the ecosystem and the health of this organism. In organic viticulture one of the primary is to grow healthy and disease tolerant plants. With the help of plant strengtheners, which are accepted by organic standards, and with the correct soil- and plant management the regulation of fungal diseases through the induction and enhancement of the plant's own defence mechanisms, can be approached. Only as a last step chemical fungicides (copper and sulphur) are used to manage fungal problems.

For most winegrowers, organic and integrated as well, downy mildew is one of the major disease problems. Organic winegrowers pay more attention on this disease: they follow official advices and protection methods, conduct field observations and are keen on preventive control strategies. Especially in organic viticulture it is not easy to control this disease because only a few products with the desired efficacy are available. The most common product is copper. The copper ion is very immobile in soil, therefore, copper applications result in an accumulation of this element in the soil. That is the reason why organic winegrowers try to reduce its use.

Under the Council Regulation (EEC) 2092/91 Annex II the annual input of copper in organic production is limited to 6 kg / ha (average of 30 kg 5 years/ha), in Germany not more than 3 kg / ha (average of 15 kg 5 years/ha) are allowed.

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## Materials and methods

On farm field trials were conducted from 2004 to 2007 on four organic vineyards under practical conditions. In these three wine growing regions in Germany different climatic and infection conditions for downy mildew are present. The trials were spitted in two replicates / treatment with two replicates / row (long-plot method). Plot size varied from 900 – 1700 m<sup>2</sup>. Spray volumes ranged from 400 to 1600 l/ ha. 8 – 12 applications were made using the farm vineyard sprayer. The dose of copper was adjusted to the phenological stage (50 – 400 g/ha) and 1,5-3 kg /ha pure Cu in total. The on farm trials were done without an untreated control. The infection conditions were predicted by the use of specific forecast systems like "VitiMeteo Plasmopara" (Bleyer et al 2006).

## Results and discussion

The results showed that products like copper hydroxide, new formulated copper hydroxide with low copper content (1,5 – 2 kg/ha/year) or alternative products like Myco-Sin VIN® give good results under medium infestation pressure. The combination of copper hydroxide in low doses with two or three applications of K-Phosphonate (Frutogard®) from last pre flowering until fruit setting showed a very good control of *P. viticola*. These results are compare to some long term on farm (Hofmann, 2003) and research trials (Kast 1996; Kauer 2003). Nevertheless, in case of severe infection conditions, which were present on one of the pilot sites (Württemberg-Germany) in most of the years, Myco-Sin VIN® as well as the low copper concentrations were not successful (Tab.1). In 2006 high damage was caused by a severe infection after a longer rainy period on July 8<sup>th</sup>. The effect of all treatments was very low with a disease incidence of 50%. There was no different between the treatments. In the year 2007 the high damage was caused also by severe infection after a longer rainy period. The highest attack was found in the plots that had been treated with Myco-Sin VIN® in combination with Kendal®. The three applications of Frutogard® from last pre flowering until fruit setting reduced the infection from 79 to 18%.

**Table1: Disease incidence and disease severity (%) of *Plasmopara viticola* infection on clusters of the variety Trollinger in the years 2006 and 2007 at Korb, Württemberg (Germany).**

|      | Treatments  | N°. App.    | Disease incidence % | Disease severity % | Cu ++ rate kg/ha |
|------|---|-------------|---------------------|--------------------|------------------|
| 2006 | Cuprozin® fl. 0,05%                               | 10          | 50,0                | 15.5               | 1.8              |
|      | Algin Biovital® III,                              | 10          |                     |                    |                  |
|      | new copper-hydroxide formulation 0,1%             | 10          | 50.0                | 15.8               | 1.2              |
|      | Myco-Sin VIN® 0,5%<br>Kendal® 1%<br>Cuprozin® fl. | 9<br>9<br>1 | 50.0                | 15.,8              | 0.6              |
| 2007 | Cuprozin fl. 0,05%                                | 11          | 18.0                | 11.8               | 1.9              |
|      | Frutogard ® 1%                                    | 3           |                     |                    |                  |
|      | new copper-hydroxide formulation 0,1%             | 11          | 47.0                | 16.7               | 1.9              |

|  |                    |    |      |      |     |
|--|--------------------|----|------|------|-----|
|  | Myco-Sin VIN® 0,5% | 11 |      |      |     |
|  | Kendal ® 1%        | 11 | 76.0 | 24.3 | 0.0 |

## Conclusions

In three out of four on farm trials with low or medium infestation pressure in the years 2004 to 2007 the application against downy mildew with low copper content < 2 kg/ha and with plant strengtheners like Myco-Sin VIN® were successful. Only on one farm with higher infection pressure depend on the specific weather conditions (higher rainfall) downy mildew could infect clusters and leaves with now different disease incidence between the treatments. Only the combination of low rate copper formulation in combination with K-phosphonate until fruit setting could reduce the infection. Up to now, it is not possible under high infection pressure of downy mildew (*P. viticola*) to reduce the copper level lower than 3 kg.

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