

## Importance of Metiram in the control of *Guignardia bidwellii* on grapes in Italy

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Technical Management APES

Black rot is a widespread grapevine disease, that can cause serious damages on leaves and clusters when conditions are favorable to an early infestation ( $t^{\circ} > 9^{\circ}\text{C}$  and rain). The grape black rot pathogen overwinters in many parts of the grape vine and is able to overwinter on the ground [especially in mummies]. In addition, pathogen can overwinter for at "least 2 years within lesions of infected shoots that are retained as canes or spurs." Rains release the overwintering spores (Ascospores) that form within mummies on the ground and can be blown by the wind. Some of the mummies on the ground can have a significant discharge of ascospores that begins about 2 to 3 weeks after bud breaks and will mature 1 - 2 weeks after the start of bloom. A second type of spore (Conidia) can also form within cane lesions or mummies that have remained within the "trellis, and these are dispersed short distances (inches to feet) by splashing rain drops." Infection occurs when either of the spore types land on green grape tissue and tissue remains wet for a "sufficient length of time, which is dependent on temperature." The period that these overwintering spores are allowed to cause infection depends on the source. If there is a large source for infection, infection will set in early. In the presence of moisture, these ascospores slowly germinate, taking 36 to 48 hours, but eventually penetrates the young leaves and fruit stems (pedicels). The infections become visible after 8 to 25 days. When the weather is moist, ascospores will be produced and released throughout the entire spring and summer, providing continuous primary infection. The control of black rot is today managed in conjunction with powdery mildew and downy mildew protection programs, using polyvalent active substances belonging to the following chemical families: triazoles, QoI and dithiocarbamates (mancozeb, metiram) the last representing more effective control fungicides. Metiram has been registered since several years for the control of *Guignardia bidwellii* (POLYRAM, 70% Metiram) representing one of the most valid control measures of this disease which is increasing its aggressiveness in last decade.

Fungicides are a crucial component of Black rot control, In Italy this disease is often controlled by use of multisite products applied for the control of Downy Mildew

Actually, we know that this disease can be aggressive if spring treatments are not carried out. Integrated management for the control of the disease is a must, based in different aspects:

Control of Guignardia is based on preventative actions with the aim to avoid fast canopy growing and minimizing inoculum by following agronomical practices:

- The first cultural control method is to choose the right grape cultivar for the region that the grape will be grown in
- Remove and burn affected shoots especially mummified bunches
- Bury residues of pruning to avoid further contamination of shoots
- Avoid shoots growing near the ground
- Avoid sprinkling irrigations
- Increase air circulation in the grapeyard with adequate green pruning
- Keep the field well managed, do not allow overgrowth of weeds or plants near the grapes
- Avoid nitrogen overfertilization
- **Make full use of fungicides with different modes of action**: avoid over-reliance on a single fungicide group, use co-formulations or tank mixes of different active ingredients, target specific products to appropriate growth stages and **include multisite fungicides e.g. Metiram, Mancozeb...**

All these practices are important to control the disease but adequate fungicides use (product, spray interval, time of application...) is key in Guignardia control. In Italy there are many products available but multisite active ingredients are an especially important segment.

In 2018 FRAC international (Fungicide Resistance Action Committee) published a document about the **high Importance of multisite fungicides in managing pathogen resistance**. The Use of multisite fungicides (see FRAC Group M) in spray programs in crops with multiple sprays such as fruits, vegetables or potatoes is really important. Due to their mode of action, multisite fungicides are considered as a low resistance risk group. **Therefore, they offer the possibility for use as mixing partners or alternating with single site and other medium to high resistance risk fungicides**. Over the past decades, no cases of field resistance against multisites have been reported. (FRAC, 2018)

There are clear benefits to recommending multi-site fungicides in spray programs:

- **Multisite fungicides display a low risk to develop resistance and are effective mixing/alternating partners for medium to high risk fungicides.**
- **Beyond protecting and prolonging the lifespan of highly effective medium to high resistance risk fungicides**, multisite fungicides provide added levels and spectrum of disease control. With this they can also support the single sites to be even more efficient.
- **Multisite fungicides are considered a valuable tool to manage resistance** by preventing or delaying its development to many pathogens in many crops.

**Restricting the use of multisite fungicides from use in important crops could result in faster development of resistance to single site mode of action fungicides. This in turn could lead to epidemic disease development, serious crop losses, and finally the loss of highly effective fungicides for a sustainable disease management.**

Multi-site fungicides such as Metiram remain important in solo products and also effective mixture partners in anti-resistance strategies.

### **Situation in Italy about multisite role in black control in grape.**

FRAC classifies *Guignardia bidwellii* as a low risk pathogen for fungicides resistance.

However, in many situations in Italy, 4 to 6 applications are required for controlling the disease, in case of susceptible varieties and potential high disease pressure. **Only 2 specific mode of actions are available for controlling this disease ( ), and they are classified as high/medium risk fungicides.**

In this situation, **a potential combined risk, which considers not only pathogens, but also available fungicides and agronomic conditions, is recommended to be taken in account; In the Italian case**, the result of this analysis could be an higher risk. Therefore, also in the case of a low risk pathogen, **an integrated strategy that includes also the use of multisite fungicides could be critical for long term sustainability of the disease management tools.**

Figure 2: Combined resistance risk diagram based on inherent fungicide risk, inherent pathogen risk, and agronomic risk (\* only most important classes and groups mentioned, \*\* medium to high risk) (modified according to Kuck, 2005)

| ↓ Fungicide Classes *   | ↓ Fungicide Risk | Combined Risk  |  |   | ↓ Agronomic Risk                       |
|---|------------------|--|--|---|--|
| benzimidazoles<br>dicarboximides<br>phenylamides<br>QoI fungicides<br>SDHI fungicides** | high = 6         | 6<br>3<br>1.5  | 12<br>6<br>3   | 18<br>9<br>4.5  | high = 1<br>medium = 0.5<br>low = 0.25 |
| SBI fungicides<br>anilinopyrimidines<br>phenylpyrroles                                  | medium = 4       | 4<br>2<br>1  | 8<br>4<br>2  | 12<br>6<br>3  | high = 1<br>medium = 0.5<br>low = 0.25 |
| multi site fungicides<br>(e.g. dithiocarbamates)<br>MBI-R inhibitors<br>SAR inducers    | low = 1          | 1<br>0.5<br>0.25   | 2<br>1<br>0.5  | 3<br>1.5<br>0.75  | high = 1<br>medium = 0.5<br>low = 0.25 |
| Pathogen risk →   |                  | low = 1  | medium = 2   | high = 3  |  |
| Pathogen groups * →   |                  | seed borne pathogens (e.g. <i>Pyrenophora</i> sp., <i>Ustilago</i> sp.)<br>soil-borne pathogens (e.g. <i>Phytophthora</i> sp.)<br>rust fungi<br><i>Rhizoctonia</i> sp.<br><i>Fusarium</i> sp.<br><i>Sclerotinia</i><br><i>sclerotiorum</i> | <i>Erysiphe necator</i><br><i>Gibberella fujikuroi</i><br><i>Oculimacula</i> sp.<br><i>Rhynchosporium secalis</i><br><i>Pyrenophora teres</i><br><i>Septoria tritici</i><br><i>Sclerotinia homoeocarpa</i><br><i>Monilinia</i> sp.<br><i>Cercospora</i> sp.<br><i>Phytophthora infestans</i> | <i>Blumeria graminis</i><br><i>Botrytis cinerea</i><br><i>Plasmopara viticola</i><br><i>Magnaporthe grisea</i><br><i>Venturia inaequalis</i><br><i>Mycosphaerella fijiensis</i> |  |

Table from Pathogen risk list - FRAC

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- **Beyond protecting and prolonging the lifespan of highly effective medium to high resistance risk fungicides**, multisite fungicides provide added levels and **spectrum** of disease control (i.e. for grape, metiram controls black rot and downy mildew with the same application). With this they can also support the single sites to be even more efficient.
- **Multisite fungicides are considered a valuable tool to manage resistance** by preventing or delaying its development to many pathogens in many crops.

**Restricting the use of multisite fungicides from use in important crops could result in faster development of resistance to single site mode of action fungicides. This in turn could lead to epidemic disease development, serious crop losses, and finally the loss of highly effective fungicides for a sustainable disease management.**

Multi-site fungicides such as Metiram remain important in solo products and also effective mixture partners in anti-resistance strategies.

Actually in Italy there are a good number of registered compounds for grape black rot. But there are only 2 specific mode of actions effective against this disease: [REDACTED] and [REDACTED], and only five multisite active ingredients:

→ [REDACTED]: Medium efficacy expected. Strategic active ingredient for downy mildew control and anti-resistance strategy. At the time being only available in mix with Potassium Phosphonate not effective vs this disease..

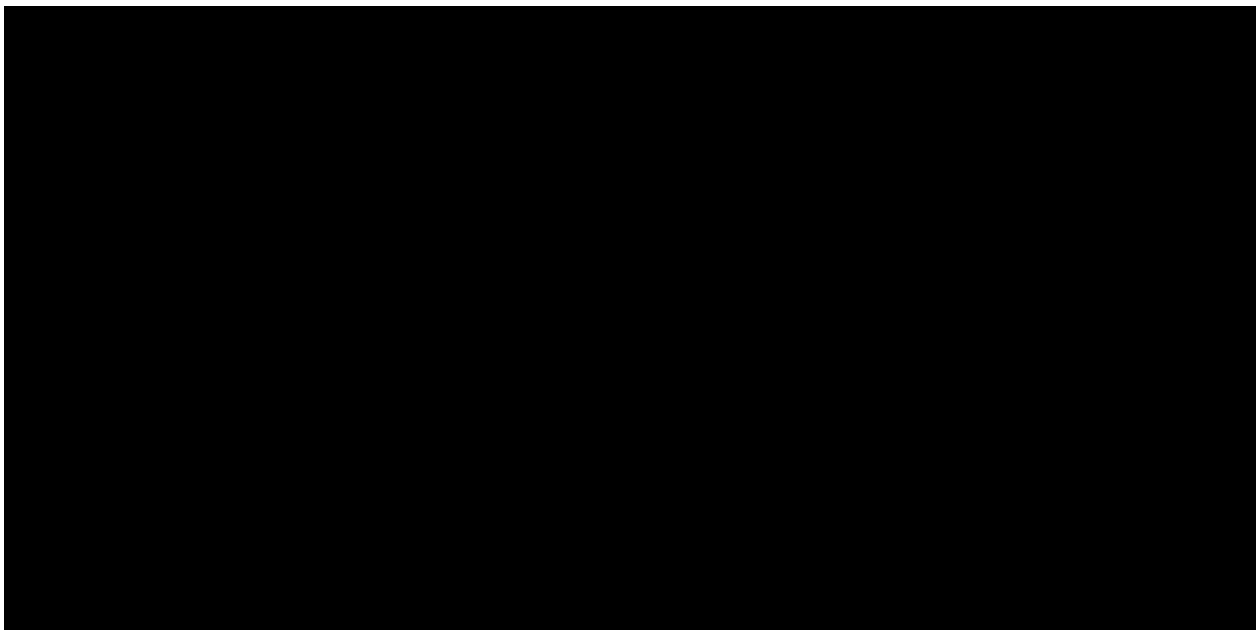
→ [REDACTED]: Medium efficacy expected (lowest than dithiocarbamates). Many folpet based formulations do not have the registration for black rot. Not included [REDACTED].

→ [REDACTED]: Inorganic fungicide with medium – low efficacy. Many compounds do not have the registration for black rot. The limitation in the rate/year/ha will reduce the use. Not included in the regional positive lists for IPM.

→ [REDACTED]: Part of the dithiocarbamates. Has still high efficacy. Is under strong regulatory pressure.

→ [REDACTED]  
[REDACTED] Also is under regulatory pressure.

The efficacy of metiram is confirmed by the results obtained in an open field trial carried out in Friuli in 2013, on merlot variety. In these trials several crop protection strategies designed for controlling downy and powdery mildew, were tested on black rot. The results (table 2) confirm the efficacy of metiram, in spray program with Qol fungicides.



*Table 2 – trial in Friuli 2013 - black rot assessment on bunches*

|                  | Black rot<br>Assessment on bunches<br>27/07/2013 |             |
|------------------|--|-------------|
| trt              | % severity                                       | % incidence |
| 3                | 0,56 a   | 16,0 a      |
| 6                | 0,00 b   | 0,0 b       |
| 7                | 0,00 b   | 0,0 b       |
| 8                | 0,01 b   | 1,0 b       |
| 9<br>(untreated) | 0,50 a   | 19,0 a      |

We can conclude that **multisites have a good efficacy with the advantage of avoid resistance appearance, keeping in this way the efficacy for the future of the others mode of action. In addition, in grape, metiram, applied at the black rot timing combines also a good efficacy on downy mildew.**

## Summary & Conclusions

In the last years Black rot is representing more and more an issue for Italian grape growers especially in the north eastern part of the country.

Even if it is considered a low resistance risk pathogen by FRAC, Guignardia is growing in diffusion faster and faster reaching in some areas infection levels normally registered in France where this disease is already considered a primary pathogen.

Normally weather conditions favorable for Black rot infestations are similar for the appearing of downy mildew infections, both pathogens together could create serious damage on grape production.

Excluding 'multisite' products, are available for the farmers only few actives with just two mode of actions ( ) which are considered not fully effective against this disease.

Considering instead 'multisite' products we still have few families as , these last being the only ones providing reliable level of control, clearly higher than the others.

In these conditions Metiram represents one of the few multisite fungicides registered in Italy for use against Guignardia bidwelli on grapes. The active is considered a very important tool for the Italian farmers to control in a sustainable way black rot and maintain the profitability of the crop in future growing.

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