Possibilities in control of Phomopsis cane and leaf spot by biofungicide based on *Trichoderma harzianum* and *Trichoderma viride*

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<table>
<thead>
<tr>
<th>Year</th>
<th>ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>4225</td>
</tr>
<tr>
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<td>2010</td>
<td>4391</td>
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*Statistical yearbook 2012
In Montenegro, predominantly wine varieties are grown (90%) while cultivars for table consumption are less grown (10%). Among the varieties for production of red wines (70%), autochthonous cultivars **Vranac** and **Kratošija** dominate.
Phomopsis cane and leaf spot disease (caused by *Phomopsis viticola* Sacc.) appears every year in Montenegrin vineyards and significantly jeopardizes grapevine growing in Montenegro. Therefore it is of great importance to explore the possibilities for its control, especially in regard to organic production.
Spore release
Shoots with length from 3 to 10 cm are very susceptible to infection (Swart & De Kock, 1994). Grapevine is the most susceptible from the moment when the vegetation begins until shoots reach the length of 15-20 cm, after which the infections are very difficult to be realized (Pearson, 1997).
Biotechnical Faculty
Experimental and Commercial field
22 ha
During 2015 at the experimental field of Biotehnical Faculty in Podgorica the experiment was set up in domestic grapevine variety Vranac in order to examine biological efficacy of biofungicide Remedier (*Trichoderma harzianum* and *Trichoderma viride*) to combat the disease.

First treatment was done in dormant period (BBCH 00), the second at the beginning of vegetation (BBCH 03/05) and the third when shoots were 10 cm long (BBCH 13). As a standard copper oxide was used in dormant period and mancozeb in vegetation period. Control parcels were not treated at all.
Remedier was applied in two doses (3 kg/ha and 2.5 kg/ha). Three treatments were conducted in the experiment with each dose.

<table>
<thead>
<tr>
<th>Active substances</th>
<th>Applied doses (kg/ha)</th>
</tr>
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<tbody>
<tr>
<td>Trichoderma sp.</td>
<td>3.0</td>
</tr>
<tr>
<td>Trichoderma sp.</td>
<td>2.5</td>
</tr>
<tr>
<td>Mancozeb</td>
<td>2.0</td>
</tr>
<tr>
<td>Copper oxide</td>
<td>1.0</td>
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</table>
The average daily temperatures should be in the range 8-18°C, and duration of cane wetness to be between 7-13 hours (Bugaret, 1986).
Evaluation of fungicides efficacy was performed in June (BBCH 75) when 10 shoots were examined per each cane, and four basal internodes per each shoot.

Experiment and evaluation were done according to OEPP methods. Obtained results are statistically analysed (lsd-test).

In all variants in the experiment infection percentage of checked shoots was significantly different than untreated control but also every variant was significantly different with each other.
Efficacy of Remedier applied in the dose of 3 kg/ha was 63.7 % and when it was applied in the dose of 2.5 kg/ha efficacy was 39.9 %. Efficacy of standard combination in the experiment (copper oxide and mancozeb) was 99.0 %.

<table>
<thead>
<tr>
<th>Active substances</th>
<th>Intensity disease (%)</th>
<th>Efficacy (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trichoderma sp. (3 kg/ha)</td>
<td>7.0</td>
<td>63.7</td>
</tr>
<tr>
<td>Trichoderma sp. (2.5 kg/ha)</td>
<td>11.6</td>
<td>39.9</td>
</tr>
<tr>
<td>Copper oxide + mancozeb</td>
<td>0.2</td>
<td>99.0</td>
</tr>
<tr>
<td>Control</td>
<td>19.3</td>
<td>/</td>
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</table>

LSD 0.01 = 1.2
Conclusions

Achieved results indicate that the efficacy of the applied biofungicide was significant in comparison to untreated control, although it was significantly weaker than the efficacy obtained with standard combination of fungicides.

However, application of biofungicide based on Trichoderma sp. should be repeated and tested in forthcoming years especially in a sense of organic based agriculture that is quite perspective in Montenegro.
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Thank you for your attention!