

## USE OF *SALVIA OFFICINALIS* EXTRACT TO CONTROL GRAPEVINE DOWNY MILDEW: TESTS IN GREENHOUSE AND FIELD

Giovannini O., Dagostin S., Formolo T., Pertot I.

Department of sustainable agro-ecosystems and bioresources, Fondazione Edmund Mach (FEM), via E. Mach, 1, San Michele all'Adige 38010, Italy

Herbs and aromatic plants could be potential sources of natural compounds usable in agriculture against the main diseases. The antimicrobial activity of essential oils of these plants has been studied extensively for medical use while there are still few studies on the control of plant pathogens. The vast family of Lamiaceae includes several interesting plants for the high level of secondary metabolites. One of these is *Salvia officinalis* L., whose essential oil has antifungal, antibacterial and antioxidant features. In this work the effectiveness of sage extract was tested against grapevine downy mildew (*Plasmopara viticola*) under greenhouse and field conditions. Moreover, the persistence and rain fastness of sage extract were also investigated on treated grapevines in relation to its effectiveness against downy mildew. This extract was obtained from dried leaves of *S. officinalis* which were extracted with 99.8% ethanol in a Soxhlet extractor. The sage extract at 5%-dosage has showed high levels of effectiveness in greenhouse condition, reducing the disease severity (96.1%), similar to a formulation of copper hydroxide (93.4%). Furthermore the activity is prolonged over time and the efficacy of sage is very similar to copper sprayed on leaves 6 days before the inoculation of downy mildew. Unfortunately the rain fastness is rather low showing a significant reduction of activity (25%) with only 10mm-artificial rain. The sage extract was tested in two different vineyards of Trentino (Rovereto and S. Michele a/A) and in two different years (2006 and 2012) in order to evaluate the real potential of the product. In 2006, the weather conditions were highly conducive for infection in the final part of the season. Sage extract effectively controlled downy mildew, reducing the AUDPC of disease severity on leaves by 63% and reducing the incidence of disease on bunches of grape berries by 94%. The results obtained for sage extract were not significantly different from those obtained for copper hydroxide. In 2012 the first primary infections of downy mildew were been early and very strong (especially on grapes and shoots) that were evolved in a high level of disease at the end of June (96% of incidence on untreated leaves). The numerous and intense spring rains have severely tested the efficacy of crude vegetable extract provided only 20% reduction in disease incidence and 35% reduction in AUDPC of disease severity, on berries and leaves respectively, reaching a level of disease control significantly different from that provided by copper hydroxide and untreated control. Overall, in a not very rainy season, the crude *S. officinalis* extract controls effectively grapevine downy mildew and could be a promising alternative to the copper fungicides used in organic viticulture. A formulation of sage extract with a high level of rainfastness should be developed for improving retention, enhancing spray adhesion, avoiding run-off, and encouraging an even spreading of active ingredients on the leaf tissue. Moreover, to obtain a commercial product, it will be necessary to improve the current extraction process, which is too expensive and time consuming.

This research was supported by the EU project CO-FREE (theme KBBE.2011.1.2-06, grant agreement number 289497) and the Envirochange project funded by the Autonomous Province of Trento.