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Multifunctional irrigation for viticulture adaptation to climate change: a case study in northern Italy

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The last decades have been characterized by an important development of viticulture in Italy, especially in Lombardy, where this sector is focusing on improving grapevine production, by enhancing quantity and, even more, quality. The increasing frequency of extreme meteorological events that has been observed in recent years has started raising concerns about the risks for grapevine quality and production, caused by summer heat waves and late spring frosts. The role of over-vine sprinklers in frost protection is well known; less so is their effect on heat stress protection. In fact, recent studies have shown that evaporation of sprayed water in the canopy layer during heat waves can reduce local air temperature through latent heat absorption by water evaporation. Moreover, in order to minimize the temperature-related stress, water spraying can be combined with the control of soil water content through drip irrigation, to lower soil temperature and enhance turgor maintenance.

The ADAM project (<http://www.adam-disaa.eu/IT/DEFAULT.ASP#>) fits into this research framework. The objective of the project is to develop a multifunctional irrigation strategy combining controlled soil water content and protection from temperature-related stress conditions. An experimental activity has started in the 2019 season in a Chardonnay vineyard located in the Colli Morenici area (Lombardy, northern Italy). Four irrigation management strategies have been compared, namely: no irrigation (NI); farmer's drip irrigation (IT); automated drip irrigation, based on tensiometer measurements (IG); automated drip plus over-vine micro-sprinkler irrigation based on tensiometer measurements, temperature measurements and short-term forecast (IS). In the latter case, irrigation is activated before heat wave occurrence, based on 5days-ahead temperature forecasts (with 3 h refresh period).

At the end of the first year of experiment, we have obtained interesting preliminary results: while the first three strategies did not lead to significant differences in grape quality (in terms of sugars content, acidity and pH of musts), differences were found in all three parameters for the IS strategy. Specifically, pH and acidity are higher and sugars content is lower. Further analysis, including micro-vinification, are ongoing in order to assess the effects on wine quality. The experimental activity will continue in 2020 and 2021 with the aims of: collecting enough data to define a preliminary protocol for multi-functional irrigation management; assess the irrigation

water requirements and the energy consumptions; test the effectiveness of VIS/NIR techniques for the quick measurement of crop conditions; verify the sustainability of the different strategies, both at the farm and district scale.