POWDERY MILDEW, DOWNY MILDEW AND BOTRYTIS DISEASES FORECASTING TO INCREASE VINE CULTIVATION SUSTAINABILITY

VITICAST

VITICAST is a Spanish supra-autonomous Operational Group whose aim is to develop innovative solutions for the prediction of fungal diseases in grapevine

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The project develops a tool for the forecasting of possible infections whose implementation will facilitate the work of cooperatives and wine cellars, contributing to the production of a higher quality wine and a more sustainable production by minimizing the impacts on the environment related to the application of phytosanitary products.

What is VITICAST?

By developing a tool which combines meteorological data measured at the vineyard level, the phenological stage of the vine and the concentration of spores and inoculum necessary for the infection to occur, VITICAST will forecast possible fungal infections. This tool will allow to reduce antifungal treatments applied in the vineyard. Therefore, it will facilitate the work of cooperatives and wine cellars, contributing to the production of a higher quality wine. It will also contribute to a more sustainable production by minimizing the impacts on the environment related to the application of phytosanitary products through the innovation in the management of fungal diseases of higher incidence (downy mildew, powdery mildew and botrytis).

To carry out this initiative, an supra-autonomous Operational Group has been created. It is comprised by a total of 11 participants including partners from Galicia and Castilla y León (specifically in the A.O. Rías Baixas, Ribeiro, Valdeorras and Ribera del Duero), as well as subcontracted members and collaborators.

***Figure 1**. One of the plots under study (A.O. Ribeiro).*

Objectives

The main objective of the VITICAST project is to optimize the use of phytosanitary treatments in the most important bioclimatic regions in the Spanish northwest through innovative solutions in the management of the fungal diseases of higher incidence (downy mildew, powdery mildew and botrytis) in order to achieve:

- Reduction of antifungal treatments.
- Improvement of wine quality.
- Greater protection of the environment.
- Optimization of production costs.

***Figure 4**. Aerobiological sensor station at the vineyard level.*

***Figure 5**. Aerobiological sensor.*

Results attained

Identification of the propitious moments of infection based on meteorological conditions

Downy mildew

For downy mildew, the 2020 campaign began calculating the conditions for the maturation of the winter oospore. Once its maturation is completed, the meteorological conditions leading to the first primary infection are assayed. This first primary infection was first identified on march the 1st in the A.O. Rías Baixas. The associated incubation process was completed on march the 18th (tagged 2), and the first symptoms were observed two days after. After the first incubation is completed, the meteorological conditions leading to the first sporulation are reckoned (tagged 3). Alike, when the first sporulation is completed, the meteorological conditions leading to the secondary infection (tagged 4), and its associated incubation and sporulation, are calculated

This cycle is repeated throughout the campaign, allowing the identification of the propitious moments of infection based on meteorological conditions.

***Figure 2**. Prediction models for downy mildew.*

Powdery mildew

In the case of powdery mildew, two models have been developed: the first assays the pressure of powdery mildew considering meteorological conditions while the second model evaluates the pressure considering not only meteorological conditions, but also the phenological stage of the vineyard. The objective of this second model is to weigh the risk when the bunch is more susceptible to be infected. Thus, the second model is focused on protecting the bunch, whereas the first model is centred on protecting the plant.

For the 2020 campaign, as depicted in Figure 3, on June the 29th, a high risk of infection (100.00%) was provided by the first model, while the second model (which also considers phenology), provided low risk of infection (16.27%).

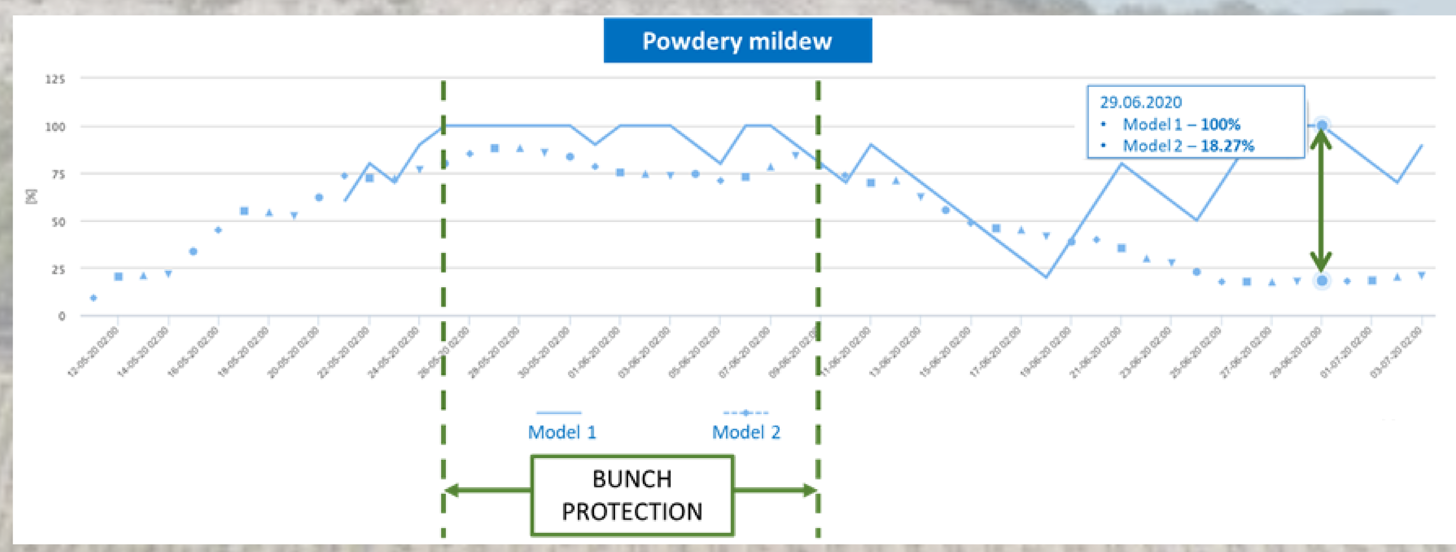

***Figure 3**. Comparison or the two powdery mildew models developed.*

Identification of the risk of infection based on the presence of spores

To determine the presence of spores in the environment, aerobiological sensors set on each plot of the project are used (Figure 4). The collected spores are afterwards counted in the laboratory under microscope (Figure 5).

A preliminary model using Artificial Intelligence (AI) techniques was developed. The inputs to the models are the data measured with the meteorological stations and the output is an indicator of the risk of disease on the specific day. This risk was assayed based on the concentration of spores in the air and the information provided by the technicians of the moments in which symptoms of disease were observed in the vineyard.

To fully develop these models, the information was divided into two groups of data: a group called training, which is used to generate the model; and a test group, to check if the model learned from the trained data. The performance of the models obtained for each of the three fungal diseases under study is based on the probability of success, which was 95.0% for the model of downy mildew, 94.4% for powdery mildew and 97.0% for the botrytis model. This results indicates that AI techniques are viable to provide the risk or disease in the vineyard.

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Updated information, news and dissemination materials: www.viticast.es

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