VITICAST: PRODUCTION OPTIMIZATION AND SUSTAINABLE DEVELOPMENT OF THE VINE CULTIVATION THROUGH FUNGAL DISEASES PREDICTION

Lucía Lloret[1], Débora Franco[2], David Rey[2], Rosa Pérez[3], Carmen Salinero[3], Carlos Alberte[4], Francisco Javier Rodríguez Rajo[5], Vicente Abete[6], Victor Vendrell[7], Sonia Villanueva[7]

[1]Fundación Empresa-Universidad Gallega (FEUGA), [2]Monet Tecnología e Innovación S.L., [3]Estación Fitopatolóxica Areeiro (Diputación Pontevedra), [4]Viña Costeira S.C.G., [5]Universidad de Vigo, [6]Bodega Hacienda Monasterio S.L., [7]Bodega Matarromera S.L.
lloret@feuga.es

VITICAST is a Spanish supra-autonomous Operational Group whose purpose is to provide innovative solutions for the prediction of fungal diseases in vineyards.

Its objective is the optimization of the production and the sustainable development of the vine cultivation in the most important bioclimatic regions in the Spanish northwest (vineyards under study are located within the following Appellations of Origin: Rías Baixas, Ribeiro, Valdeorras and Ribera del Duero) through the innovation in the management of fungal diseases of higher incidence (downy mildew, powdery mildew and botrytis).

The project develops a tool for the forecasting of possible infections which combines: meteorological data measured at the vineyard level, prediction of the phenological stages of the vine and concentration of spores and inoculum necessary for the infection to occur. This tool will allow estimating the crop production in advance, as well as reducing 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 and a more sustainable production by minimizing the impacts on the environment related to the application of phytosanitary products.

EIP-Agri Operational Groups

Operational Groups are the main actors in the implementation of the EIP-Agri (European Innovation Partnership for Agricultural productivity and sustainability), and one of the key tools for the execution of the National Rural Development Programme 2014-2020 for promoting innovation in the agri-food and forestry sectors within the European scope. They gather agents of different profiles with common interests, such as farmers, companies, researchers, advisers or training and dissemination actors, who are associated to implement an innovation project in order to provide a joint and multi-sectorial response to a problem or need.

VITICAST innovation project receives a total grant of 599,957.11 eur (total project budget 615,249.11 eur), 80% co-funded by the European Agricultural Fund for Rural Development (EAFRD) of the European Union and 20% by the Spanish Ministry of Agriculture, Fisheries and Food, within the framework of the National Rural Development Programme 2014-2020.

VITICAST consortium

In order to carry out this initiative, a multidisciplinary operational group with supra-autonomous character has been created. It is comprised by total of 11 participants including beneficiaries/partners from Galicia and Castilla-Leon (specifically in the Appellations of Origin: Rías Baixas, Ribeiro, Valdeorras and Ribera del Duero), as well as subcontracted members and collaborators.

VITICAST is coordinated by the company Monet Tecnología e Innovación S.L. and counts with the participation of the cellars: Viña Costeira S.C.G., Bodega Hacienda Monasterio S.L., Bodega Matarromera S.L., as well as the Estación Fitopatolóxica Areeiro (Diputación de Pontevedra), the University of Vigo (Plant, soil and subproducts utilization research group) and the Galician University-Enterprise Foundation (FEUGA).

The research group of Chromatography and Chemometrics, from the University of Santiago de Compostela, participates as a subcontracted member. The Wine Technology Platform (PTV), the Association of Ribeiro Bottling and Harvesters (ACER) and the Galician Association of Viticulture (AGV) act as collaborators.

General and specific objectives of the project
The general objective of the VITICAST project is to optimize the production and the sustainable development of grapevine cultivation in the most relevant bioclimatic regions in the Spanish north-west through innovative solutions in the management of fungal diseases of higher incidence: downy mildew, powdery mildew and botrytis, in order to achieve:

- Improvement of wine quality
- Greater protection of the environment
- Optimization of production costs

For this, a warning tool for the forecasting of possible infections will be developed, and the following specific objectives are established:

1. To determine the start of the different phenological stages in the studied areas based on grape variety, through field observation and phenoclimatic models; the trends of the phenological parameters will be evaluated to assess the impact of the various climate change scenarios predicted by the IPCC on the vine cultivation.
2. To establish predictive models for the concentration of spores in the vineyard atmosphere necessary for the infection to occur, to determine risk thresholds in each Appellation of Origin and to evaluate the symptomatology.
3. To develop specific algorithms for each Appellation of Origin with the recorded meteorological data to identify the most likely periods of phytopathogenic fungi incidence.
4. To establish in each Appellation of Origin a warning tool for possible infections to optimize the integrated and sustainable cultivation of the vine, which combines phenological data (objective 1), prediction of spores concentration necessary for the infection to occur (objective 2) and the algorithms that allow prediction from meteorological information (objective 3).
5. To optimize the chemical phytosanitary treatments in viticulture, which will result in a reduction of production costs, an increase in the wine quality and an improved protection of the environment.

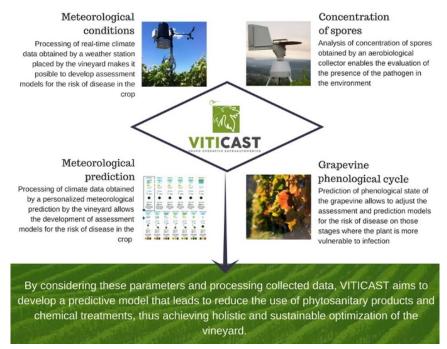The infographic representing VITICAST project is depicted in Figure 1:

Figure 1. VITICAST project infographic.

Results and benefits to be attained

As the general objective of the project is the development and implementation of innovative solutions for the prediction of fungal diseases in vineyards, the expected results are the following:

1. Established phytoclimatic models for the phenological stages evolution, for each vineyard under study and grape variety.

2. For this study, we count with a 15-year database in the Appellations of Origin Rías Baixas (Eurosiberian Region) and Ribeiro (Mediterranean Region) which, along with the data compiled during the VITICAST project execution, will allow the assessment of the impact that the various scenarios of climate change predicted by the IPCC will have on the cultivation of grapevine in both bioclimatic regions.

3. General model for the spores prediction for each studied phytopathogen.

4. Determined thresholds of spores concentration in the air against lesions and leaf spots a days later.

5. Determined thresholds of infection for the warning tool based on climatic and phenological conditions and spores concentration in the atmosphere.

6. Efficiency of post-harvest treatments assessed through comparison with the soil analytics at the beginning of the campaign.

7. Models for calculation of fungal diseases risk adjusted according to the geographical and climatic characteristics of the vineyard location the grape variety.

8. Warning tool for fungal diseases which provides forecasting of possible infections.

Figure 2. Equipment installed in the vineyards under study within VITICAST project located in the Appellations of Origin (from left to right): Ribera del Duero, Valdeorras and Rías Baixas.

Also, the following results will be obtained in order to evaluate the benefits of the implementation of the prediction and warning tools in the studied Appellations of Origin:

- A model to determine the annual cost savings per hectare, obtained by reducing the chemical phytosanitary use and achieving new crop management practices, through the technology applied in the project.

- The quantification of the improvement in the wine quality by comparing multi-residue analyses from the control vines and from those in which the phytosanitary treatments are applied by the conventional procedure without taking into account the warning information provided by the tool.

A direct transfer of the knowledge generated within the project concerning the main cultivation in the Spanish north-west will be carried out to the productive sector: Regulatory Councils and ecological agriculture, Councils for Rural and Environmental Affairs, companies in the wine-growing sector in the Appellations of Origin and wine producers in general.

The characteristics of the potential end-users of the tool proposed in this project are detailed below, along with their motivations for its use and the impacts on their sector:

- Winegrowers: in Spain there are about 70,000 winegrowers, who sell the harvest to wineries or to the cooperatives of which they are members. These wineries usually pay according to weight and grade, although an increasing quality criteria is being imposed. The cooperatives demand traceability control tools that are easily accessible so that their winegrowers can register the phytosanitary treatments and the management carried out in the vineyard so that these aspects can be controlled by the winery technicians. In this case, the potential user does not generally count with extensive training in the use of technologies, so the information provided by the tool must be easy to interpret. The motivation for using the tool proposed in this project will be determined by the increase in profitability: the reduction in costs due to the decrease in the number of treatments and the increase in income when using a system that allows the traceability of the grapes and, therefore, guarantee the quality of the product facing the buying winery.

- Wineries: wineries with their own vineyard, more than 4,000 in Spain, will be the main end-users of the warning tool proposed. They are users with a great knowledge of the biology of diseases and, generally, with training in the use of technologies. The motivation for using the warning tool will be determined by increasing profitability and by carrying out more environmentally sustainable farming practices. The increase in profitability will be reflected in a reduction of costs and a reduction in the loss of the harvest, both factors derived from greater control over the optimal moment of application of the phytosanitary treatments, as well as from the possibility of increasing the price of wine by improving the perception of the final consumer regarding sustainable environmental practices.

In terms of social impact, the implementation of the VITICAST solutions will favour:

- The creation of a competitive and profitable agricultural production system, which can be translated into a new and innovative industrial and commercial sector.
- The population fixation in rural areas through the creation of reliable economic activities that are capable of contributing work and income.
- Inform the results and technify the farmer or landowner through informative talks, free training courses and informative articles.
- Instill respect for the environment and the use of sustainable, ecological and low input management, for a competitive agriculture, always relativizing the efficiency of production systems based on their impact on the environment.
- Avoid abandoning land next to small population centers; with this it would be possible to avoid risks of massive fires, since the plots without cultivation and work are usually an aggravating factor.

For further information: llloret@feuga.es

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