Multifactorial analysis of disease pressure and pesticide use in viticulture: reduction possibilities in South-western Europe

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INTRODUCTION

Wine consumer preferences, along with the increasingly more restrictive regulations in pesticide use, represent a challenge for the European winegrowers and their viticultural practices, as well as for the winemaking sector competitiveness. The VINOVERT project integrates phytopathology, agronomy, economy and enology in order to develop feasible solutions for viticulturists in Spain, France and Portugal. This study evaluates the possibilities in the pesticide reduction at vineyard scale and the effect of such reductions in the quality of the resulting wines.

MATERIALS AND METHODS

The experimental layout consisted on a total of 30 commercial vineyards, distributed in Bordeaux, Galicia and Catalunya, half under conventional and half under organic management (Figure 1). Monitored variables (Figure 2) included epidemiological, agronomical, managemental and oenological parameters.

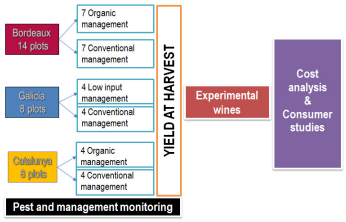

Figure 1: Experimental layout in the three regions

- **Epidemiological Variables:** Assessment Indicator of Damage in Bunches (AIDB) % : Powdery and downy mildew, *Botrytis, Lobesia botrana* and wood diseases (WD)
- **Agronomical Variables:** Yield and vineyard characteristics
- **Grapegrower Variables:** Treatment Frequency Index (IFT), Crop Protection Practices Index (IPP) and Cost Analysis
- **Oenological Variables:** Organoleptic quality, Molecular markers for wine defects; residues analysis

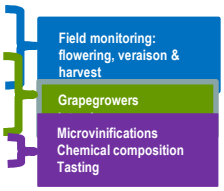

Figure 2: Variables measured for the multifactorial analysis

RESULTS AND DISCUSSION

The phytopathological profile (fig. 3) shows the diversity among regions and locations within each regions. In General in Bordeaux, the most severe attack is by *Lobesia* and *Botrytis*, in Catalunya, by *Lobesia* and Powdery mildew, and in Galicia there is mainly Downy mildew just in two locations. The AIDB was higher in Catalunya than in Bordeaux and in both higher than in Galicia (fig. 4 left top), because a lower IFT in Catalunya than in Bordeaux and lower in both than in Galicia (fig 4 left bottom). The AIDB was not significantly different between the organic (weak IFT) and the conventional (strong IFT) vineyards (fig 4 right top), but the calculated IFT was lower in the organic than in the conventional vineyards as expected (fig. 4 right bottom). Analyzing in detail the relationship between the pathologies (AIDB) and the treatments IFT (fig. 5 left) we can see a significant negative relationship but only explaining the 25%. There are many cases where the relationship is not accomplished, suggesting the need for more detailed and wider sample number. 2017 was also an atypical year with dry and hot spring and summer. There is high variability within each region and there is also a high variability of AIDB within the same range of IFT, indicating other factors due to the grape grower: we must take a deeper insight in the management practices: Crop Protection Practices Index (IPP) and grower's Technical Skills Index (ICT). The relationship between the Yield Achievement Rate (YAR,%) and the AIDB only shows the preliminary results not including Galicia. The pest pressure only explains the 25%. Other causes can be assumed to be due to water and nutrient requirements, uncertainty in measurements or grapegrowers statements, or the own relationship of each pathology to the actual yield loss. It appears to be a positive relationship between the organoleptic quality and the pathology pressure (fig. 6 left), but in this case the most of the high AIDB values are due to *Lobesia* attacks not inducing secondary infections, so with no much impact in the cumulative liking score. When relating the *Botrytis* pressure with the cumulative liking (fig. 6 right), the relationship is negative, being *Botrytis* the cause of lower liking scores.

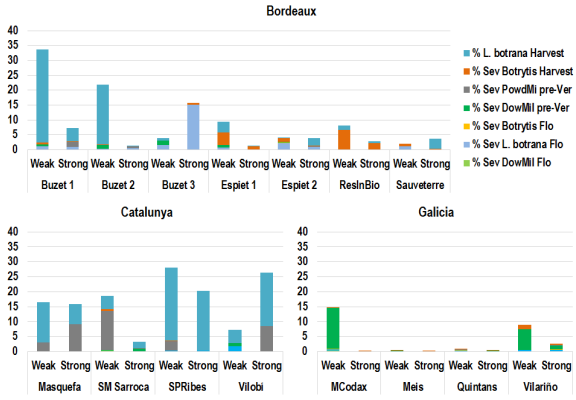

Figure 3: Phytopathological profile in the 3 regions, for each location, one organic (weak IFT) and one conventional (strong IFT) vineyard is shown for the monitored pests and diseases.

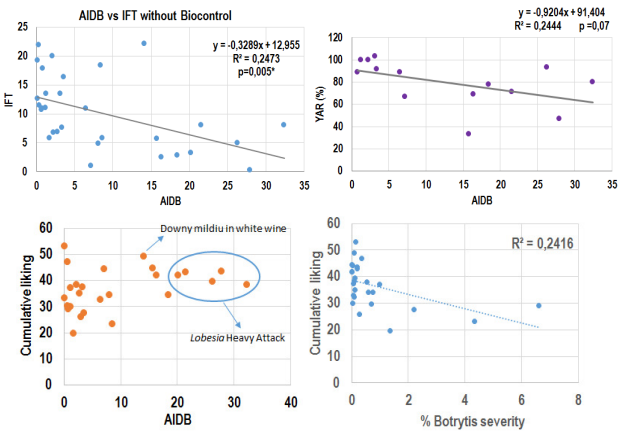

Figure 5: AIDB vs IFT without biocontrol (left) and AIDB vs YAR (%) Yield Achievement Rate, as (Obtained yield / Expected Yield)*100 (right).

Figure 6: Organoleptic quality: AIDB vs Cumulative liking (left) and % of Botrytis severity (%) vs Cumulative liking in the young experimental wines

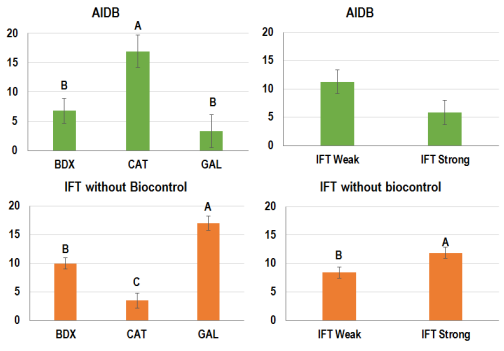

Figure 4: AIDB and IFT without biocontrol products, mean for the three regions (left) and for the organic and conventional managements

CONCLUSIONS

The indicators used in this study allow the evaluation of the pest pressure and pesticide use in a complex system in three regions. In 2017 we were able to see different patterns in pest type and pressure and in pesticide use in the different regions, significant relationships between pests and treatments. The variability in the relationships pest/treatments offers options for the reduction in pesticide use from the basis of the current practices. There is complexity in the factors that affect not only to wine quality, but also to yield. A new multipathogen approach in the field vs wine quality is tested. The multifactorial analysis will allow to evaluate the reduction in pesticide use in relation with the cost analysis and consumer preferences. 2018 has been a rainy spring and a rainy and hot summer, with a very different preliminary AIDB and IFT, which will provide a different range of results.

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