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VALIDATION OF A NEW MULTI-PEST INTEGRATING INDICATOR OF PESTS AND DISEASES DAMAGE IN GRAPES

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Introduction

Vineyards, as high value crops, use large inputs of pesticides so that they are protected against yield loss caused by several pests and diseases. However, recent social and environmental constraints aim at reducing pesticide inputs to reduce chemical pollution, while maintaining a sustainable income to growers. To find acceptable trade-offs between grape protection and pesticide reduction, tools are needed to choose, implement and assess innovative protection strategies. Along with indicators for pesticide use, such as EEP (Wijnands, 1997) or FTI (Butault *et al*., 2010), we propose an Assessment Indicator of Damage in grape Clusters (AIDC, Fermaud *et al*., 2016), to quantify the overall result of pests and diseases incidence and pesticide sprays for a given year at the plot level. The objective of this work is to validate this multi-pest integrating indicator, primarily developed on Merlot noir cv., with other grape cultivars and to characterize the relations between AIDC and grape yield components.

Materials and Methods

The Assessment Indicator of Damage in Grape Clusters consists of two main components. The inflorescences may be damaged by downy mildew (severity: YDMF) and grey mold (YGMF) early in the season (before flowering). Further damage may be caused later to remaining clusters by downy mildew (YDMB), powdery mildew (YPM), grey mold (YGMB) and tortricid moths (YTM). The AIDC represents the proportion of remaining healthy clusters and is computed as

$$AIDC\ (\%) = 100-[100 - (YDMF + YGMF)] * [1 - (YDMB+YPM+YGMB+YTM)/100]$$

The data used were collected between 2006 and 2008 in two vineyards near Bordeaux (France), planted with Cabernet franc. The full details of the experimental conditions were presented in Savary *et al*. (2009). Major pests and diseases were monitored, *i.e.* powdery and downy mildews, *Botrytis* and incidence of berry moths. Different levels of protection against pests and diseases were applied, to obtain contrasted situations. The grapevine phenology and plant development were monitored, and yield components were measured at harvest. Based on these data, the AIDC values were computed on each vineyard × year combination.

Results and Discussion

Among the 108 subplot x year combination, we obtained a whole range of AIDC values, from 100% to 0%. The total yield per plant varied from 2.29 kg to 0 (average: 0.74 kg). In 45 cases out of 108 (42%), AIDC was lower than 10%, indicating a rather low incidence of pests and disease on the subplot. The average yield in cases with AIDC <10% was 1.17 kg, and average yield was lower (0.43 kg) in the 63 cases with AIDC >10%.

The total yield per plant (and all yield components measured) is negatively correlated with AIDC. The highest correlation was found between AIDC and cluster mass (Pearson correlation: -0.82; Figure 1.

Relationships observed on these data were similar to those previously found on Merlot cv. when this indicator was developed (Fermaud *et al*., 2016). This confirms the feasibility of extending its field of use.

Conclusions

Through this study, we validated the use of the integrating AIDC indicator under different viticultural (experimental site, cultivar) and seasonal conditions from those in which it had been developed (Fermaud *et al*., 2016). These data and analyses have allowed us to establish some relationships between the AIDC and different components of grapevine yield. Further work will be needed to extend the field of application of AIDC to other pests and diseases than those presently taken into account, in order to use it in different grapevine growing regions worldwide and/or with emerging pests and/or diseases. A next step will also consist in investigating the potential relationships between AIDC and qualitative variables of the grape must at harvest.

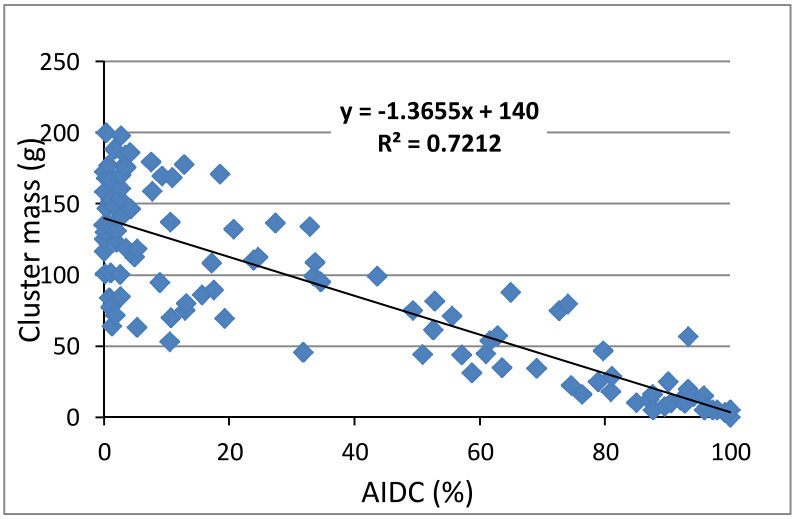

Figure 2: Relationship between AIDC and cluster mass in 108 subplot x year combination between 2006 and 2008, and linear regression.

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