



## **Spatial variability of cv Tempranillo phenology within the Ribera del Duero DO (Spain) related to soil type and plot characteristics**

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Vineyards in the Ribera del Duero area (Spain) date back to the roman time, with significant fluctuations throughout the centuries, reaching consolidation and stable production in the 10th and 11th centuries. The present Ribera del Duero Designation of Origen (DO) started in 1980 and has increased from less than 6,000 ha planted to more than 21,000 ha planted by 2010 and becoming one of the top regions for wine production in Spain with success in the global wine market. Vineyards of Ribera del Duero are found along 115 km of the Duero River. Within this distance, differences in elevation and topography produce differences in climate, which provide the means by which a zonification for vineyard management can be assessed. In this work, the differences in phenological growth characteristics for the Tempranillo variety were analyzed within the Ribera del Duero DO and related to soil and plot characteristics. Phenology dates, referenced to different Baggioolini classification stages, were evaluated in 20 control plots distributed throughout the Ribera del Duero DO during the period 2004-2012. These years presented different climatic characteristics, which were analyzed from daily temperature and precipitation series recorded from 1980 to 2012 at five stations located along the Duero River. Most vineyards were cultivated under rainfed conditions. In order to evaluate the spatial variability in phenology, climate and soils, the plots were classified using a hierarchical cluster multivariate analysis. Parameters such as the elevation, the distance to river and the soil type were taken into account in the classification. According to the WRB classification (2006) the main soil types in the area are Calcaric Cambisols, Eutric Cambisols, Calcic Luvisol, Calcaric fluvisols, Eutric fluvisols and in less proportion Lithic Leptosols and Calcaric Rogosols. Four different groups were observed, with differences in elevation, distance to the Duero River and the soil type. The differences in phenology among groups started in stage G and were observed until the end of the growing cycle. Despite the high variability driven by the year to year in climate characteristics, it was possible to define the soil and plot characteristics that favour advanced phenology within the Ribera del Duero DO.