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Seasonal weather forecasts as a decision support tool in the Douro Wine Region, Portugal

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Weather conditions in a given year largely control wine production, despite all the mitigation measures that can be undertaken in the vineyards and wineries. As such, seasonal weather forecasts can be a valuable decision support tool for assisting winemakers in short to medium-term management, particularly when coupled with wine production models. Adequate and timely agricultural management grounded on predicted wine production will reduce the risks and enhance the efficiency of the sector. In this study, the performance of seasonal weather forecasts of wine production in the Portuguese Douro & Port wine region (D&P WR) is evaluated. However, this concept can be extended to other wine regions worldwide. A predictive logistic model of wine production is developed herein. Monthly mean air temperatures and monthly total precipitation, averaged over the periods of February–March, May–June, and July–September, and an autoregressive component of wine production are taken into account for this purpose. The wine production time series for the D&P WR and over the period 1950–2017 (68 years) is categorized into three classes based on quantiles: high, normal and low production years. The empirical wine production model reveals a correct estimation ratio of nearly 2/3 when applied to independent 10%-random subsamples taken from the complete time series. The performance of the ECMWF 7-month seasonal weather forecasts (issued from February to August) to predict the temperature and precipitation variables used in the wine production model is subsequently assessed. The results show a reasonable performance in predicting these variables. Furthermore, the forecasts from May to August are clearly the best performing, as 1) more observed data is included in the empirical wine production model, and 2) the performance of seasonal forecasts for summer months is higher, owing to the local Mediterranean-type climate characteristics, with typically dry and settled atmospheric conditions in summer. The extension of this approach to other wine regions in Europe, as well as its operational application, are foreseen in the near future within the framework of the European Commission-funded action “Climate change impact mitigation for European viticulture: knowledge transfer for an integrated approach – Clim4Vitis” [grant number 810176].