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Assessment of weather risk on chestnut production

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Meteorological conditions play a fundamental role during entire chestnut tree vegetative cycle. Chestnut trees are well adapted to mean year temperatures of 8-15ºC, requires monthly mean temperatures greater than 10ºC during 6 months (Gomes-Laranjo et al. 2008) and its pollen only germinates at relatively high temperatures of 27-30ºC (Bounous, 2002). Photosynthesis of an adult tree is highly dependent of temperature. Photosynthesis is maximal at 24-28ºC but it is inhibited for temperatures greater than 32ºC (Gomes-Laranjo et al., 2005, 2006). Furthermore, there are significant differences between chestnut trees cultivated in northfaced orchads in relation to those cultivated in the southfaced and between leaves from different sides of the chestnut canopy because they receive different amounts of radiant energy and consequently they grow under different mean daily air temperature.
The objective of this work was to assess the role of weather on chestnut production variability. This study was performed for the 28 years period defined between 1980 and 2007 and it was based on annual values of chestnut production and total area of production, at national level, provided by INE, the National Institute of Statistics of Portugal. The meteorological data used was provided by Meteored (http://www.meteored.com/) and includes daily values of precipitation, wind speed, and mean, maximum and minimum air temperature. All meteorological variables were tested as potential predictors by means of a simple correlation analysis. Multiple time intervals were considered in this the analysis, which consist in moving intervals of constant length and forward and backward evolutionary intervals.
Results show that some meteorological variables present significant correlation with chestnut productivity particularly in the most relevant periods of the chestnut tree cycle, like the previous winter, the flushing phase and the maturation period. A regression model based on the winter (January to March) precipitation, the number of days with maximum temperature between 24ºC and 28ºC and the number of days of May with minimum temperature below 0ºC is able to model the chestnut productivity with r2 equal to 0.79. It should be pointed out that the relation between weather/climate and chestnut productivity may change over time. Finally, it is important to express objectively the effects of temperature and precipitation extremes on the chestnut productivity since temperature is one of the global circulation models predicted variables with less uncertainty. With these tools will be possible to assess the weather related risk on chestnut production as well as infer about evolution of the adequate conditions to the chestnut trees in the actual plantations and about the expansion of this specie.

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