Título: VID Y CAMBIO CLIMÁTICO: ESTUDIO DEL PROCESO DE MADURACIÓN DE LA BAYA EN ESQUEJES FRUCTÍFEROS DE TEMPRANILLO EN RESPUESTA A LA INTERACCIÓN DE CO2, ESTRÉS HÍDRICO Y TEMPERATURA ELEVADA

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> FISIOLOGIA VEGETAL

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Resumen: It is expected that the CO2 concentration could increase from the actual 379 ppm to approximately 700 ppm at the end of the century. Also, it is believed that climate change could increase plant water stress (WS) affecting crop production. If CO2 emissions continue at high levels, temperature (T) is predicted to increase 1.8 - 4.0 ºC. Grapevine photosynthesis (AN), as in other C3 plants, is CO2-limited. Any CO2 increase could promote its growth rate and yield. Grapevine physiology is expected to respond to climate change during its whole growth period.

The aim of this work was to investigate effects of stress factors associated to climate change (CO2, T and WS) on leaf physiology and grape quality of Vitis vinifera cv. Tempranillo during ripeness under greenhouse-controlled conditions. Grapevine cuttings were collected from vineyards in Olite (Navarra, Spain). Fruiting cuttings were obtained as described by Mullins (1966) and modified by Ollat et al. (1998) and Santa María (2004). Plants were grown in greenhouses-growth chambers or temperature gradient greenhouses (TGG). Plants were exposed to simulation of climate change from veraison to maturity or from fruit set to maturity. Gas

exchange, chlorophyll fluorescence and A/Ci curves measurements were performed. Plants were harvested at maturity and samples obtained were used for berry quality, antioxidant status and biochemistry parameters assays.

It was observed that a CO2 increase, acting simultaneously to the other stress factors, produced increases in total soluble solids accumulation in berries, shortening maturation times. T increment affected berries quality, decreasing in most experimental conditions malic acid content. However, marked effects in phenolic compounds concentrations were not observed or changes were not consistent and depended on experimental conditions. Also, the three stress factors decreased the CO2 mesophyll conductance in leaves that could be related with mesophyll structural changes, leading to a reduction in the chloroplastic CO2 concentration values of water-stressed plants with respect to well watered ones. The ETR/An ratio was decreased in leaves of plants exposed to elevated CO2. Under WS this ratio increased, suggesting increased photorespiration rates and increasing the risk of oxidative damage. The antioxidant enzymes activities were increased under WS. Also, it was observed that, during the first days of treatment, the elevated CO2 inhibited lipid peroxidation, although at maturity it was increased. AN was increased transiently by the elevated CO2 when applied from veraison to ripeness and was maintained high when applied from fruit set to veraison. TGG studies revealed that this increased AN was inhibited at long-term and that Vc,max and Jmax values had similar decrease patterns, which suggest AN acclimation. This was observed in plants treated from veraison but was not as clear in those treated from fruit set. From veraison to ripeness, there was a generalized decrease in photosynthetic rates. It could be attributed to leaf sugar concentration, which was maintained or increased from veraison to maturity since sugars could act as AN down-regulators, or could be attributed to the nitrogen mobilization from flowering to harvest, perhaps inducing a re-mobilization of nitrogen to sink organs.

The use of different greenhouse types for the experiments allowed us to conclude that greenhouses-growth chambers are a good first approach for determinations of the combined effects of climate change-related stress factors acting simultaneously. The TGGs allow more detailed evaluations of these stress factors acting independently or in interaction.

In summary, a future climate change could affect grape quality, whole plant physiology and grapevine management. The present work provides novel knowledge that could be of major support for future research on climate change in other species with high agricultural value.