

(2025) LEAF TURGOR LOSS POINT VARIES SIGNIFICANTLY ACROSS GRAPEVINE CULTIVARS, REVEALING A WIDE RANGE OF DROUGHT VULNERABILITY

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ABSTRACT:

Droughts are expected to become more frequent and intense in many wine-growing regions. Drought affects grapevine physiology, causing severe losses in yield and quality, and even compromises vine survival. So far, most studies have focused on a small number of international varieties, and failed to explore much of the existing cultivar diversity. Among the main physiological traits that characterize plants' response to drought is the leaf turgor loss point (π_{tlp}), which indicates the capacity to maintain cell turgor pressure during dehydration. This parameter is typically strongly related to drought responses in gas exchange and hydraulic function and has been shown to vary across grape cultivars. The variability in π_{tlp} among cultivars indicates a potential for highly diverse responses to drought within the same species. This study was aimed to compare international and historical/native Spanish cultivars to see if the native germplasm could be a source for drought tolerance.

The study was conducted in the first half of September 2024 in a multivarietal experimental vineyard located at IRIAF-IVICAM (Tomelloso, Spain). Twenty-six widespread and native to Spain cultivars were analyzed: Alarije, Albillo Real, Cabernet Sauvignon, Coloraillo, Forcallat Tinta, Garnacha Peluda, Garnacha Tintorera, Gordal, Graciano, Hebén, Jaén Blanco, Malvar, Mazuela, Merseguera, Misión, Monastrell, Moravia Dulce, Moscatel de Grano Menudo, Pardillo, Pedro Ximénez, Pinot Gris, Pinot Noir, Sauvignon Blanc, Tinto de la Pámpana Blanca, Verdejo, and Zinfandel. Leaf turgor loss point (π_{tlp}) was measured with the osmometer method (Bartlett *et al.*, 2012). Five measurements were made in each cultivar (5 shoots x 1 leaf per shoot).

The results revealed that leaf turgor loss point values were highly variable among cultivars. The π_{tlp} values of individual vines ranged from – 1.677 MPa to – 2.540 MPa and the mean π_{tlp} values of cultivars ranged from – 1.760 MPa to – 2.428 MPa. These wide ranges reveal substantial differences in the capacity to maintain cell turgor pressure under drought conditions. π_{tlp} values were significantly different across genotypes (ANOVA, $p < 0.001$). Pinot Noir, Hebén, Sauvignon Blanc, Cabernet Sauvignon, and Pinot Gris exhibited low π_{tlp} values, indicating that they are cultivars with high dehydration tolerance and therefore have the ability to maintain gas exchange and growth during drought. By contrast, Jaén Blanco, Monastrell, Garnacha Tintorera, Verdejo, and Alarije – cultivars traditionally grown in Spain – displayed high π_{tlp} values, meaning that their survival could be at greater risk when grown under drought conditions.