



Drought Resilience in Pistachio: Linking Growth, Redox Homeostasis, and Antioxidant Defense

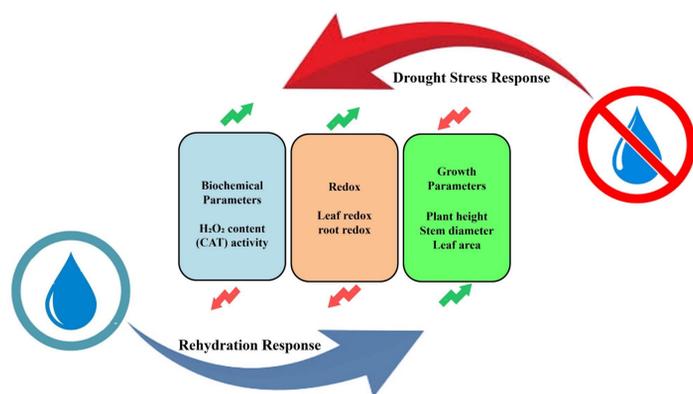
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Abstract

Drought reduced growth and increased oxidative stress in pistachio hybrids. Tolerant clones maintained higher growth, enhanced catalase activity, and showed strong recovery after rewatering, highlighting key traits for selecting drought-resilient genotypes.



Introduction

Drought severely limits pistachio growth by disrupting redox balance and increasing H₂O₂ accumulation. Redox signaling and antioxidant defense, especially catalase activity, play key roles in drought tolerance and recovery. This study evaluates seven clonal hybrids to identify genotypes with superior redox regulation and resilience under water deficit.

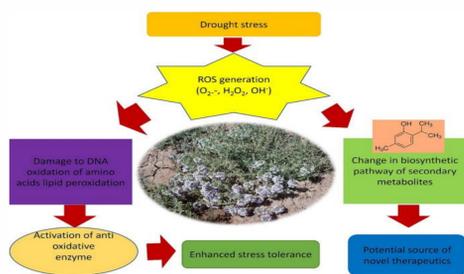


Fig 1. Effects of drought stress on plant

Materials and Methods

Greenhouse experiment (2023) evaluated six clonal pistachio hybrids and UCB1 under well-watered and 30-day drought followed by 30-day recovery. Growth traits (height, stem diameter, leaf area) and physiological indicators (leaf and root redox potential, H₂O₂ content, and catalase activity) were measured to assess drought response and resilience. The study was conducted using a randomized complete block design (RCBD) with two factors: irrigation treatments (well-watered and drought) and the cloned hybrids. Data were analyzed using R software (version 4.3.2). Trait means were compared with Duncan's Multiple Range Test at a significance level of $P < 0.05$.

Results and Discussion

✓ Drought stopped height growth in all hybrids, with recovery varying by genotype. Clones 'C1' and 'C4-2' showed the best recovery, while 'C8-3' and 'C16-1' were most sensitive. Stem diameter responses differed under stress but became similar after rewatering.

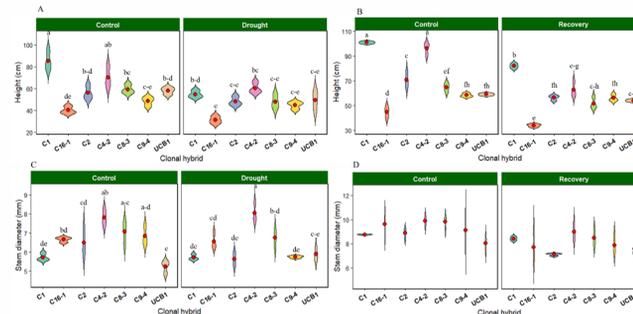


Fig 2. Effects of drought and recovery on plant height and stem diameter.

✓ Drought increased leaf and root redox in all hybrids, with the highest levels in sensitive clone 'C8-3'. After rewatering, redox returned to near-control levels in most clones, except 'C8-3', which remained elevated.

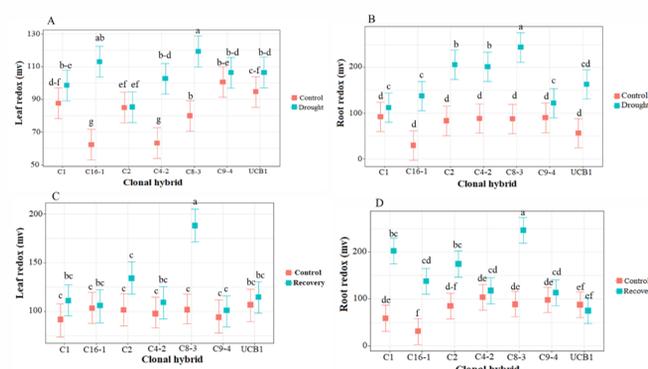


Fig 3. Effects of drought stress and recovery on leaf and root redox

✓ Drought significantly increased catalase activity, especially in 'C9-4' and 'C1', with higher levels in leaves than roots. After rewatering, CAT activity remained elevated, indicating sustained antioxidant response.

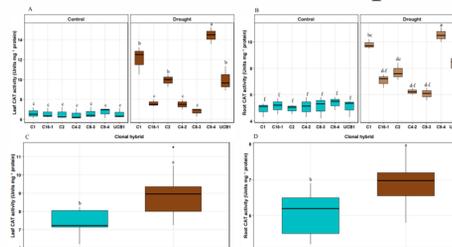


Fig 4. Effects of drought stress and recovery on leaf and root Catalase

References

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- Davies, W.J., Metcalfe, J., Lodge, T.A., Da Costa, A.R., 1986. Plant growth substances and regulation of growth under drought. *Aust. J. Plant Physiol.* 13, 105–125. <https://doi.org/10.1071/pp9860105>