

LOCAL ACCLIMATION OF HOLM OAKS IS DRIVEN BY EARLY-LIFE PLASTIC TRAIT ADJUSTMENTS

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Functional traits shape plant performance. However, understanding within-species functional trait variability is challenging due to diverse responses to environmental heterogeneity. Moreover, acclimation to local conditions during early development is vital for securing tree growth. The holm oak (*Quercus ilex*) is an ideal candidate for studying intraspecific early performance, given its wide leaf economic spectrum. This study aimed to unravel the tradeoffs among aboveground biomass, water-use efficiency (leaf $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$), and nutrients (leaf nitrogen-phosphorus-potassium [N-P-K] concentrations) in young holm oaks in Mediterranean semiarid conditions. By using a randomized block design in a common garden experiment, trait data from 240 holm oaks from diverse populations and mother trees were analyzed. Origin population and mother tree had low contributions to trait variation, whereas the block factor was more influential, reflecting trait variations at fine spatial scale. Aboveground biomass correlated positively with P concentrations but negatively with N:P ratio, indicating that P is key for holm oak growth on calcareous soils. $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ were positively correlated, and both showed positive links with P and K concentrations, reflecting that an anisohydric behavior and plastic tradeoffs shape resource-acquisition strategies at early-life stages. These findings call for a need to focus on abiotic and biotic limitations at individual plant scale to promote functional holm oak reforestations.

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