CORK OAK AFFORESTATION USING INNOVATIVE TECHNIQUES TO MITIGATE CLIMATE CHANGE

Constança Camilo-Alves

PURPOSE AND SCOPE

Cork oak (*Quercus suber*) woodlands are distributed across the western Mediterranean. Renowned for their cork, their most iconic product is the stopper, essential for the wine industry. Cork is also extensively used in civil construction, aerospace, and sports industries. The renewable nature of cork allows harvesting every 9 to 10 years, with trees living for approximately two centuries and being debarked up to 17 times. However, cork oak woodlands face severe threats. Widespread cork oak mortality events have been occurring since the 1990s. Initially attributed to root disease caused by the oomycete *Phytophthora cinnamomi*, subsequent research suggests that multiple factors acting synergistically contribute to the decline (Camilo-Alves et al. 2013). These factors include drought events, soil constraints on root development, and improper management practices. Though the cork oak distribution area has remained relatively stable, tree loss has resulted in a steady reduction of canopy cover. Furthermore, an alarming decline in tree regeneration has been occurring, compromising the sustainability of these ecosystems. Faced with this situation, particularly the predicted cork shortage in the near future, the cork sector is collaborating with the scientific community to find solutions to promote tree regeneration, survival, vitality, and productivity.

METHODS AND APPROACH

Long-term experimental cork oak fertirrigation plots were tested under specific conditions. Research involved installing ponds to capture winter rains for irrigating new cork oak stands during summer droughts, in response to changing precipitation patterns. The developed protocol involved fertirrigation from planting to cork stripping, aimed to enhance plant survival and reduce the time until the first cork extraction. Subsequently, stands were converted to rainfed mode, or irrigation continued until the second or third cork extraction. The scientific research focused on the structural-functional responses of trees to water availability during periods of high air temperatures. The goal was to promote tree growth through efficient irrigation, using minimal water for a limited period.

Constança Camilo-Alves, Institute for Advanced Studies and Research of the University of Evora, Mediterranean Institute for Agriculture, Environment and Development & CHANGE, Global Change and Sustainability Institute, University of Evora, Pólo da Mitra, Ap. 94, 7006-554 Évora, Portugal

FINDINGS AND IMPLICATIONS

Results obtained in the experimental plots are very promising and highlight cork oaks' remarkable adaptability to varying environmental conditions (Camilo-Alves et al. 2020, 2022). For instance, irrigated cork oaks maintained high transpiration levels during summer droughts, even under extreme meteorological conditions, such as on very hot and dry days. This high transpiration translated into radial growth, indicating sustained photosynthesis and carbon sequestration. Cork stripping on these plots was brought forward to 12 years of age, instead of the 25 years required under rainfed conditions. Water and nutrient availability also influenced shoot development and tree architecture. In particular, root analyses indicated that trees were not solely relying on the irrigation wet bulbs and could be maintained under rainfed conditions. Successful fertirrigation removal on 15-year-old trees demonstrated their independence from the fertirrigation system: trees thrived just like any other cork oak growing under rainfed conditions. Although this approach is feasible only where water can be captured or is available, such as near irrigated agriculture, it represents a paradigm shift in cork oak silviculture. Establishing highly productive cork oak forests within 15 to 20 years from planting may encourage producers to opt for these forests over exotic tree species or agropastoral land use.

LITERATURE CITED

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