*environmental sciences proceedings*

MDPI

*Abstract*

# Effect of Water Stress on Physiology and Carbon Balance in Seedlings of Different Eucalyptus Genotypes †

**Luz Garcia [1,*], Rafael Rubilar [1,2,*], Verónica Emhart [3], Luisa Bascuñan [4], Daniel Bozo [1] and Juan Carlos Valverde [1]**

[1] Cooperativa de Productividad Forestal, Departamento de Silvicultura, Facultad de Ciencias Forestales, Universidad de Concepción, Concepción 4030555, Chile
[2] Centro Nacional de Excelencia para la Industria de la Madera (CENAMAD), Pontificia Universidad Católica de Chile, Santiago 8331150, Chile
[3] Bioforest S.A., Km 15 S/N Camino a Coronel, Concepción 4030555, Chile
[4] Facultad de Ciencias Naturales y Oceanográficas, Universidad de Concepción, Concepción 4030555, Chile
* Correspondence: luzyeidy@gmail.com (L.G.); rafaelrubilar@udec.cl (R.R.)
† Presented at the 3rd International Electronic Conference on Forests—Exploring New Discoveries and New Directions in Forests, 15–31 October 2022; Available online: https://iecf2022.sciforum.net/.

**Abstract:** Eucalyptus is a fast-growing genus widely used in the forestry industry; however, in the plant's early stages, plantations are susceptible to drought conditions and it is common to find high mortality rates and loss of productivity. Therefore, this study analyzed the physiological response photosynthesis (An) and predawn leaf water potential ($\Psi_{PLWP}$) and the change in carbon balance (C) in ten Eucalyptus genotypes exposed to different water deficits, with the hypothesis that it is possible to identify and differentiate genotypes with a tolerance to drought. Therefore, ten one-year-old genotypes were placed in greenhouse conditions and soil matric power ($\Psi_s$) was regulated in four levels: −0.03 MPa (control), −0.7 Mpa (slight stress), −1.5 Mpa (moderate stress) and −2.5 Mpa (chronic stress); each level was determined from the automated monitoring of soil conditions. The example considered in the experiment was tree stress per genotype × $\Psi_s$. The measurements of An and $\Psi_{PLWP}$ considered tree measurement per individual ($n$ = 9 per genotype × $\Psi_s$); in contrast, the Gross primary productivity (GPP) was estimated with destructive sampling ($n$ = 3 genotype × $\Psi_s$). We found a significant relationship between water deficit and physiological response (a major deficit produced a reduction of An and $\Psi_{PLWP}$). *E. nitens* clones had a minor physiological variation and GPP maintained the same trend and proportionality between aerial and underground production. In contrast, two hybrids of *E. nitens* × *E. globulus* showed an immediate physiological change and variation in GPP, with increased underground production and stagnant aerial production. These results suggest that it is possible to differentiate genotypes with a tolerance to water deficit early. This will allow genotype selection according to the climatic conditions of each site, minimizing mortality and optimizing the available water resources.

**Keywords:** genotype; forest production; carbon allocation; climate change

check for updates

**Citation:** Garcia, L.; Rubilar, R.; Emhart, V.; Bascuñan, L.; Bozo, D.; Valverde, J.C. Effect of Water Stress on Physiology and Carbon Balance in Seedlings of Different Eucalyptus Genotypes. *Environ. Sci. Proc.* **2022**, *22*, 55. https://doi.org/10.3390/IECF2022-13123

Academic Editor: Rodolfo Picchio

Published: 31 October 2022

**Publisher's Note:** MDPI stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.

**Copyright:** © 2022 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (https://creativecommons.org/licenses/by/4.0/).

**Supplementary Materials:** The presentation material of this work is available online at https://www.mdpi.com/article/10.3390/IECF2022-13123/s1.

**Author Contributions:** Conceptualization, L.G. and R.R.; methodology, L.G. and R.R.; resources, L.G., V.E., R.R. and D.B.; data curation, L.G.; writing—original draft preparation, L.G., R.R. and J.C.V.; writing—review and editing, L.G., R.R. L.B. and J.C.V.; funding acquisition, R.R. and V.E. All authors have read and agreed to the published version of the manuscript.

**Funding:** This work was funded by the government of Chile via CONICYT Fondecyt Regular Project 1190835, CONICYT FONDEF Project IT16I10087 and ANID BASAL FB210015, also funding for

maintenance of these trials was provided by CMPC Forestal Mininco S.A., the Forest Productivity Cooperative at Universidad de Concepción Chile and support of Smurfit Kappa Colombia.

**Institutional Review Board Statement:** Not applicable.

**Informed Consent Statement:** Not applicable.

**Data Availability Statement:** Not applicable.

**Acknowledgments:** We gratefully acknowledge the support of many professionals from CMPC S.A. and Smurfit Kappa Colombia.

**Conflicts of Interest:** The authors declare no conflict of interest.