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Natural and Synthetic Hydrophilic Polymers Enhance Salt and Drought Tolerance of *Metasequoia glyptostroboides* Hu and W.C.Cheng Seedlings

Jing Li [1,2], Xujun Ma [1], Gang Sa [1], Dazhai Zhou [3], Xiaojiang Zheng [3], Xiaoyang Zhou [1], Cunfu Lu [1], Shanzhi Lin [1], Rui Zhao [1] and Shaoliang Chen [1,*]

1 Beijing Advanced Innovation Center for Tree Breeding by Molecular Design, College of Biological Sciences and Technology, Beijing Forestry University, Qinghua East Road 35, Beijing 100083, China; kaka19832008@163.com (J.L.); maxujun@lzb.ac.cn (X.M.); sg_1214@126.com (G.S.); zhouxiaoyang@bjfu.edu.cn (X.Z.); lucunfu@bjfu.edu.cn (C.L.); szlin@bjfu.edu.cn (S.L.); ruizhao926@126.com (R.Z.)

2 School of Architectural and Artistic Design, Henan Polytechnic University, Jiaozuo 454000, China

3 Key Laboratory of Biological Resources Protection and Utilization in Hubei Province, Hubei University for Nationalities, Enshi 445000, China; sws0048@163.com (D.Z.); hbzxj123@126.com (X.Z.)

* Correspondence: Lschen@bjfu.edu.cn; Tel.: +86-(0)10-6233-8129

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Abstract: We compared the effects of hydrophilic polymer amendments on drought and salt tolerance of *Metasequoia glyptostroboides* Hu and W.C.Cheng seedlings using commercially available Stockosorb and Luquasorb synthetic hydrogels and a biopolymer, Konjac glucomannan (KGM). Drought, salinity, or the combined stress of both drought and salinity caused growth retardation and leaf injury in *M. glyptostroboides*. Under a range of simulated stress conditions, biopolymers and synthetic hydrogels alleviated growth inhibition and leaf injury, improved photosynthesis, and enhanced whole-plant and unit transpiration. For plants subjected to drought conditions, Stockosorb hydrogel amendment specifically caused a remarkable increase in water supply to roots due to the water retention capacity of the granular polymer. Under saline stress, hydrophilic polymers restricted Na^+ and Cl^- concentrations in roots and leaves. Moreover, root K^+ uptake resulted from K^+ enrichment in Stockosorb and Luquasorb granules. Synthetic polymers and biopolymers increased the ability of *M. glyptostroboides* to tolerate combined impacts of drought and salt stress due to their water- and salt-bearing capacities. Similar to the synthetic polymers, the biopolymer also enhanced *M. glyptostroboides* drought and salt stress tolerance.

Keywords: hydrophilic polymers; Stockosorb; Luquasorb; Konjac glucomannan; photosynthesis; ion relation

1. Introduction

Soil salinity and drought pose major problems in agriculture and forestry [1–4]. Soil salinization often accompanies drought due to evaporative salt accumulation in upper soil layers. Together, these cause soil degradation and erosion [3]. Molecular physiology indicates that multiple stress signaling networks are involved in the plant response to dehydration and saline conditions. These networks specifically include the abscisic acid-activated signaling pathway, mitogen-activated protein kinase (MAPK) cascades, extracellular adenosine triphosphate (ATP) signaling, and hydrogen peroxide catabolic process [3,5–8]. Gene transformation, mycorrhization, and polymer amendments to soil can enhance drought and salt tolerance at the tissue and cellular level [1–3,9]. These interventions can