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REGULAR ARTICLE

Root desiccation and drought stress responses of bareroot *Quercus rubra* seedlings treated with a hydrophilic polymer root dip

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Abstract Root hydrogel, a hydrophilic polymer, has been used to improve transplanting success of bareroot conifer seedlings through effects on water holding capacity. We examined mechanisms by which Terra-sorb® Fine Hydrogel reduces damage that occurs when roots of 1-year old, dormant northern red oak (*Quercus rubra* L.) were subjected to short-term (1, 3, and 5 h) pre-transplanting desiccation and long-term (45 days) drought stress following transplanting in a controlled environment chamber or greenhouse conditions. Hydrogel-treated seedlings had 80% greater root moisture content than non-root dipped control seedlings following the pre-transplanting desiccation period. Hydrogel reduced root membrane leakiness by 31% 5 h after the desiccation exposure. Hydrogel-treated seedlings did not show greater differences in shoot length, plant dry mass, root volume, net photosynthesis, and stomatal conductance compared with control seedlings following the 45-day drought stress exposure. A reduction in mean number of days to bud break in hydrogel-treated seedlings, combined with delayed tissue moisture loss (linked to higher stem water potential), suggests that hydrogel may have provided stress protection to aid survival under short-term desiccation, which may be beneficial toward alleviating initial transplanting stress.

Keywords Desiccation · Electrolyte leakage · Gas exchange · Hydrogel · Moisture content · Northern red oak · Stem water potential

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Introduction

Water deficit serves as a primary cause of transplant stress in forest tree seedlings (Burdett 1990; Haase and Rose 1993). Continuous water stress conditions inhibit plant growth, stomatal conductance, and CO_2 assimilation (Brakke and Allen 1995; Gómez-Cadenas et al. 1996). This desiccation-induced injury may delay root regeneration, which is essential for the establishment of newly-planted seedlings. Desiccation of the root system was associated with increased