

TRANSPLANT SHOCK OF NORTHERN RED OAK SEEDLINGS FOLLOWING SIMULATED DROUGHT AS INFLUENCED BY ROOT MORPHOLOGY

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Transplant shock, implicated by depressed seedling physiological response associated with moisture or nutrient stress immediately following planting, limits early plantation establishment. We investigated the impacts of simulated drought and transplant root volume on predawn leaf xylem water potential, photosynthetic assimilation rates, stomatal conductance, and growth of northern red oak (*Quercus rubra* L.) seedlings to explain susceptibility of these plants to transplant shock.

Bareroot oak seedlings were graded into four root volume categories, planted, and then kept well watered or subjected to moisture stress. To simulate drought, irrigation was discontinued for 22 days (low moisture stress), 44 days, 66 days, and 88 days (high moisture stress) after which all seedlings were re-watered to examine drought recovery.

Transplant shock was implicated by restricted shoot growth, lower predawn leaf xylem water potentials, and depressed photosynthetic assimilation rates. These changes increased with increasing transplant root volume. Simulated drought lowered the predawn xylem water potentials to -2.5 MPa in high moisture stress plants while xylem water potentials never fell below -0.7 MPa in well watered seedlings. Transpiration rate, photosynthetic assimilation rate, stomatal conductance, and seedling growth decreased with increasing moisture stress. Unlike seedlings exposed to 22 and 44 days of simulated drought, seedlings exposed to 66 or 88 days of simulated drought never fully recovered when re-watered. The most effective drought avoidance mechanisms were root growth, stomatal regulation, reduced leaf area, and higher growth allocation to roots relative to shoots.