EFFECT OF STORAGE TEMPERATURE AND DURATION ON COLD HARDINESS AND DORMANCY OF NORTHERN RED OAK SEEDLINGS: USE OF THE ELECTROLYTE LEAKAGE PROCEDURE

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Electrolyte leakage (EL) has successfully predicted cold hardiness of conifer seedlings in both research and commercial settings. EL has also been performed experimentally on European hardwood species. The objective of our study was to determine if further refinement and adjustment of EL methodology to account for the unique characteristics of hardwood seedlings (e.g., seasonal loss of leaves) would result in a rapid, accurate approach to assessing cold hardiness, dormancy, and performance potential. In November 2002 we initiated a study to evaluate the effect of storage regime on changes in cold hardiness and dormancy of seedlings of several hardwood species. The impact of cold storage and freezer storage on the physiological status of northern red oak (*Quercus rubra* L.) was assessed at durations of 2, 3, 4, and 5 months.

To get an estimation of the depth of dormancy, seedlings were removed from storage and grown in a greenhouse to monitor the number of days to budbreak (DBB). To evaluate changes in freezing tolerance, the EL procedure was employed. Stem samples were collected from seedlings and subjected to controlled freeze tests at 4, -10, -20, and -40° C. Tissue damage at each temperature was expressed as a percentage of the initial EL values to those after autoclaving.

Results indicated that DBB decreased as storage duration increased, ranging from 42 to 45 days after 2 months of storage to 12 to 20 days after 5 months of storage. After 5 months of storage, freezer-stored seedlings required more DBB than cold-stored seedlings. We found significant freeze test and storage duration main effects for EL values. Tissue damage increased with lower freezing temperatures and extended storage durations. In addition, a freeze test x duration interaction was present when EL increased at lower freeze test temperatures after 3, 4, and 5 months, but not after 2 months of storage. Freezer-stored seedlings tended to have the greatest EL, but this was not consistent. Simple linear regression analysis showed EL values at -20° C and -40° C to be good indicators of dormancy status. Though these results are promising, more intensive study is needed to assess the viability of EL in predicting of dormancy and hardiness for hardwood species across a variety of environmental conditions.