



# Best Practices for Establishing Eastern White Pine

*Based Upon Years of Research*

Forestry Topic 23

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Eastern white pine (*Pinus strobus* L.) is the most common and commercially important tree species planted in the mountains of southwest Virginia. In recent years, survival of eastern white pine (EWP) plantings has been variable and in many cases unacceptable. There are numerous possible reasons for seedling mortality which may act alone or in combination to create plantation failures. Fortunately, a great deal of research has already been reported on this subject; the Virginia Department of Forestry research team has investigated a number of questions regarding how handling and planting practices may affect EWP survival and growth.

A review of data from EWP plots installed in Virginia over the last 40 years suggests that low and / or variable first-year survival of EWP is not a new phenomenon. In a three-year survey of 150-200 plots per year between 1959 and 1962, survival of spring-planted EWP averaged between 65 and 88 percent on old fields and between 74 and 86 percent on cutover sites (Marler 1963). In 1965-1966, survival ranged from 4 to 86 percent with an average of 45 percent, depending on whether the roots were clay dipped and on how long the seedlings were exposed during planting (Dierauf and Marler 1967). A series of root pruning test plots installed from 1980 to 1984 found survival ranging from 15 to 97 percent (Dierauf and Hannah 1989). Depending on lifting date and storage time, between 1982 and 1985 survival ranged between 23 and 95 percent (Dierauf 1989). In a series of five nursery undercutting studies, survival ranged from 51 to 93 percent in 1988, 44 to 86 percent in 1989, 49 to 72 percent in 1990, and 57 to 88 percent in 1991 (Dierauf et al 1995). And in a separate storage study in 1990-1991, survival varied between 52 and 92 percent (Dierauf and Chandler 1995). There is a history of variable survival of EWP in Virginia.

The key question is – what causes the variation? Obviously, some factors beyond our control – like drought, temperature extremes, and insect or disease outbreaks - can and do cause mortality. Controllable variables that have been investigated include:

1. Increasing exposure while planting (i.e. carrying the seedlings in hand, exposed to sun, heat, and / or wind) – even for a few minutes - causes increased mortality (Dierauf and Marler 1967).
2. Root pruning at planting reduces survival, and increasing the severity of pruning multiplies the loss (Dierauf and Hannah 1989).
3. Increasing time in cold storage decreases survival (Dierauf 1989).
4. Later planting dates decrease survival. Depending on location and climate, this effect begins to be expressed anywhere between May and late June (Rexrode and Carvell 1981).
5. Competing vegetation, especially sod in old-field settings, can cause significant first-year mortality (Tigner 2004).
6. Rough handling has been shown to decrease root growth potential and growth initiation in white pine (Yuyitung, et al). Dropping seedlings from a height of just 1-2 meters produces this effect, which could in turn reduce survival (although that has yet to be tested).
7. Clay dipping to protect roots has not been shown to consistently affect survival; it had a positive effect in one year and negative in the next (Dierauf and Marler 1967).
8. Lifting and planting dates in November or December or lifting in late November or December with protected (i.e. boxed) storage until March planting appear to have little effect on survival and might be an option to expand the lifting window (Dierauf 1989).
9. Increasing seedling size (over the range between 2/32 and 5/32 inch root collar diameter) does not affect survival but does significantly accelerate early height growth (Ward et al 2000, Dierauf and Chandler 1995, Bean and Allen).

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10. Planting depth does not affect survival (Mullin 1967, Carvell and Kulow 1964).
11. Root pruning in nursery beds improves survival and height growth (Dierauf et al 1995).

There are also a number of variables which have not been examined in EWP plantings, including:

1. Root protection using gel dip instead of clay dip;
2. Packaging method (traditional open-ended bundles vs kraft bags);
3. Transport effects (refrigerated vs open trucks);
4. Grading exposure effects; and
5. Rough handling effects (i.e. dropping / throwing seedling bundles or bags).

Tigner (2004) summarized observations from a 2003 test of lifting, handling, storage and processing factors. In March 2003, a 12-treatment study using one 20-tree row plot per treatment and replicated six times – once each in Augusta, Carroll, Floyd, Franklin, Rockingham, and Washington counties – was installed. Observations from nursery operations indicated that staffing was inadequate to keep seedlings moving quickly from field to cold storage or from cold storage through the grading and packing process. In addition, field units did not always take appropriate measures to prevent dessication of seedling bundles in transit from the nursery to local storage. The treatments tested in the study compared seedling sizes, grading exposures, planting depths, dipping treatments, lifting exposures, storage times, and root pruning intensities. Survival after one year ranged from 32 to 88 percent. Trees handled with the greatest care survived best. Hand lifting was better than operational lifting. Storage exceeding three months greatly reduced survival. Shallow planting greatly reduced survival. Extremely small seedlings survived poorly. Overall, the test reinforced the concept that numerous factors can contribute to EWP mortality, and most are avoidable.

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