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Tree Shelters For Seedling Protection And Increased Growth

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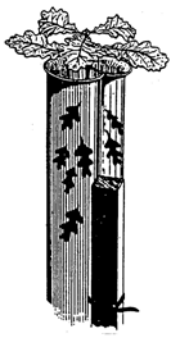
Tree shelters are a relatively new tool available to forest managers and landowners to increase seedling survival and growth rates and aid in the establishment of desired species on difficult sites. Developed in England and first used in 1979, the shelters protect trees from animal browse and can dramatically improve growth rates by creating a 'greenhouse effect' around each tree. Ongoing research is seeking to determine economic feasibility of using shelters on large-scale applications; optimal shapes, sizes, colors and types of shelters to use for each species and site condition; and a solution to the problem of plastic waste. Over 80 percent of foresters currently using tree shelters have been using them for less than two years, so much is yet to be learned about the shelters' field performance. There are four brands of tree shelters currently available in the U.S. This report examines results of existing studies and personal experiences with tree shelters as reported in 14 papers collected and summarized by Keith Windell in the USDA Forest Service publication Tree Shelters For Seedling Protection. No bias for or against any brand is implied by this publication.

SEEDLING PROTECTION

The reason most often given by foresters for using tree shelters is to protect against animal browse. The physical protection offered by shelters is more effective than that of mesh guards or fencing. In Wisconsin, where the major browse animal is the white-tailed deer, a five-foot high shelter is recommended so the foliage will be out of the deer's reach when it emerges from the top of the tube.



The physical protection offered by plastic tree shelters has benefits even in areas with low browse danger. A properly installed tree shelter protects seedlings from sprayed herbicide applications; alerts forest workers to the presence of the seedling to prevent accidental trampling; and protects the seedling from damaging windblown sand and debris.

THE GREENHOUSE EFFECT

The other primary benefit of tree shelters is the greenhouse effect they create around seedlings, greatly improving growth rates and establishment success for many species.

Tree shelters trap carbon dioxide (CO_2) and moisture, while still allowing enough light for photosynthesis to pass through the shelter walls. The greenhouse effect is created by driving the shelter into the ground, thereby sealing off the bottom end from outside air. The shelters prevent CO_2 given off by the soil and respired by the plant, and moisture transpired by the plant, from immediately blowing away. Some of the moisture transpired by the plant condenses on the shelter walls and drips back into the soil; the high humidity helps prevent water stress; and increased CO_2 levels can aid growth. In addition, the greenhouse condition moderates temperature extremes.

University of Wisconsin, United States Department of Agriculture, and Wisconsin counties cooperating. UW-Extension provides equal opportunities and programming, including Title IX requirements.

INCREASED GROWTH

Tree shelters have increased growth in some oak trials in England by as much as 500 percent; 350 percent growth improvement is not unusual (Figure 1). While results in U.S. trials have not been quite so dramatic, most trials report 100 to 200 percent growth improvement over unsheltered seedlings.

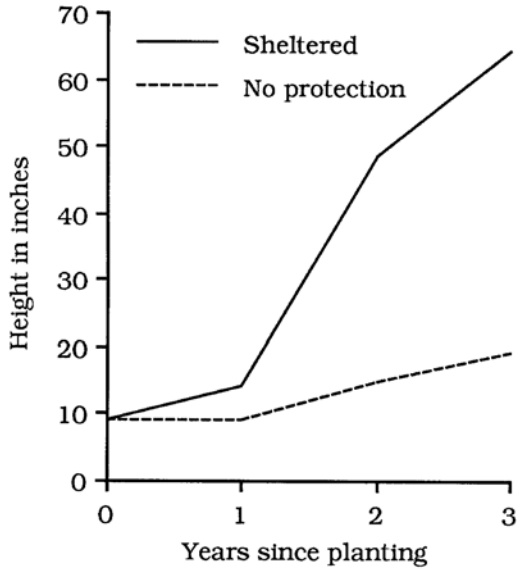


Figure 1. Height of sessile oak seedlings over time with and without tree shelter protection (Alice Holt Forest, England).

In a recently completed study by Trenten Marty, Wisconsin Department of Natural Resources, sheltered oak seedlings were 90 percent taller than unsheltered seedlings after three growing seasons; sheltered ash were 100 percent taller than unsheltered ash.

A similar study, by Douglas Lantagne of Michigan State University, found annual height growth of sheltered oak seedlings double that of unsheltered seedlings for the first two growing seasons, and one and one half times greater in the third growing season (Table 1).

INCREASED SURVIVAL

The primary importance of increased early growth rates is not in reduced rotations--in fact, most studies to date suggest that trees in shelters will have no long-term growth advantage over unsheltered trees. On difficult sites, however, rapid growth during the establishment phase can be a matter of survival for seedlings. Where soils are poor, climate is extreme or vegetative competition is fierce, tree shelters have proven extremely effective in improving seedling survival.

Table 1. Mean annual height growth of planted northern red oak seedlings on a southern Michigan clearcut (Lantagne, 1990).

	Initial Height (cm)	Growth per season (cm) 1	2	3
Sheltered	18	36	43	33
Unsheltered	18	15	23	21

Marty's Wisconsin study, on an open field site, showed 98 percent survival of sheltered oak after three years, while only 64 percent survived without shelters.

The Lantagne study in Michigan employed brush control in addition to shelters. Ninety-eight percent of oak seedlings with shelters and competitive brush control survived through the third growing season, while only 90 percent of seedlings with only brush control survived.

The increase in seedling survival means fewer seedlings need to be purchased, planted and cared for. On some sites, particularily difficult sites, the savings in seedling costs and replanting efforts may offset the cost of the tree shelters.

COMPETITION CONTROL

In Wisconsin, where competing vegetation is likely to be one of the biggest factors in seedling survival, several years in a tree shelter should give seedlings enough of an edge to overtop and outcompete other vegetation. It is important to note, however, that using tree shelters does not eliminate the need for control of competing vegetation.

Vegetation around tree shelters (and inside if possible) should be removed or killed. If vegetation remains near the shelter, the seedling's roots have to compete for limited nutrients and moisture. Often the competing vegetation is more adapted to the site and thus is more vigorous and aggressive than the desired seedling. This is often the case for cleared or open field sites.

PRECAUTIONS

As tree shelters and our knowledge of their long-term benefits are really still in the developmental stage, some concerns should be addressed before investing in tree shelters:

Cost of shelters may be prohibitive for general field use, although, under certain circumstances, cost sharing funds are available from the Stewardship Incentive Program. Each site should be evaluated based on site quality, species planted and extent of competition.

Dieback of shoot tips can occur in sheltered seedlings on some sites. Some dieback also occurs in seedlings that fail to harden off inside the shelters before winter. The amount of dieback is usually less inside shelters than outside, however. Raising shelters off the ground a few inches or propping them open in fall, allows for proper hardening off.

Shelterwood cuts may not allow enough light to penetrate to seedlings in shelters. Best results have come in open field tests or in shelterwood cuts where white or light-colored shelters were used.

An effectively sealed bottom can double growth over unsealed tubes. The beneficial greenhouse effect is lost when air can flow freely under or through the tubes.

Choose the correct site for planting. Although shelters have shown to accelerate plant growth through the establishment stage, they do not alter the site quality or correct an inappropriate choice of species for the site.

Conifer growth increases with shelters have not yet proven sufficient to justify large-scale use. Physical protection from browse may, however, be the only way to establish trees on some sites.

Shelter durability is improving but still needs to be watched. A shelter should last from 5 to 7 years before degrading. More durable shelters can be reused, reducing the cost per tree.

Stake durability should at least equal that of the shelter. White oak is the standard stake material. Aluminum stakes may be used, but require retrieval from the field. Avoid wood treated with a surface or "painted on" chemical preservative. Chemical leaching from stakes can kill seedlings.

No shelter design or color has produced significantly better growth than others. Compare products and buy the most economical shelter for your situation. An exposed site may need a more durable shelter than a sheltered site.

Plastic waste from shelters often needs to be cleaned up. All shelters sold in the U.S. are photodegradable, but the plastic must remain in sunlight. If plastic pieces get under leaves or other shade, they will remain on the site. In reality, there will probably be some plastic that has to be removed from the site.

Birds have been trapped and killed, and seedlings damaged, in shelters on some sites. The problem can be alleviated by stretching netting over the opening until the seedling grows up and out the top.

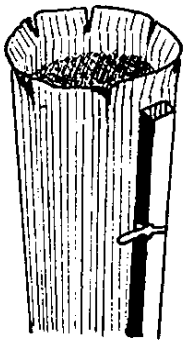
For further reading on tree shelters:
Windell, Keith. Tree shelters for seedling protection, Missoula Technology and Development Center. USDA Forest Service, 2400-Timber, 9124-2834-MTDC. September, 1991.

TREE SHELTERS AVAILABLE IN THE U.S.

Four brands of tree shelters are currently available in the United States. * The main U.S. distributor of each shelter is listed, although some companies have local distributors. Please call the distributors for prices; **UW-Extension has no more information than is provided here**.

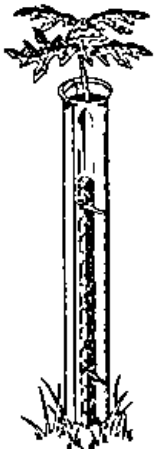
Tree Pro™

This shelter is manufactured in the U.S. and is made of a single faced polyethylene sheet rolled into a tube and attached to the stake with lock-ties. A large quantity can be carried in their flat, unassembled form. Several slits are cut into the top of the Tree Pro shelter, creating 2-inch tabs which are flared back to reduce stem abrasion. Tree Pro shelters are ivory in color.



Manufacturer and chief distributor: Tree-Pro-Tree Protectors, 445 Lourdes LN, Lafayette, IN 47905, (800) 875-8071, (317) 463-1011.

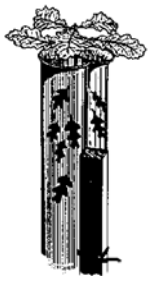
Distributor: American Forestry Technology, 1001 North 500 West, West Lafayette, IN 47906, (317) 583-3311. (AFT only sells shelters as a package with black walnut seedlings.)



Tree Sentry™

This shelter is manufactured in the U.S. of recycled milk jugs. Tree Sentry's coiled design allows for easy removal and access for trunk inspection at any height. The top rim is flared to reduce stem abrasion and the stake recess prevents shelter rotation around a flat-sided stake. Shelters are available in any length and come nested five-in-one.

Lake States distributor: TREEGARD, Inc., 3825 Highridge Road, Madison, WI 53704, (608) 837-9093.



Tubex™

This shelter is manufactured in England of polypropylene extruded into a twin-walled tube. Shelters are pre-assembled but nest together in bundles of four for easier storage and transport. Tubex shelters also have a groove to prevent the shelter from spinning around the stake. The top of the shelter is flared to decrease stem abrasion, and netting is included to keep birds out. Tubex shelters come in brown or white.

Rigid mesh with plastic sleeve

This tree shelter is being widely used on conifer seedlings in the Pacific Northwest. The rigid mesh tube can be fitted with a plastic sleeve and used a as traditional tree shelter, or can be used without the sleeve as a physical barrier against browsing animals. Both mesh and sleeve can be ordered with varying degrees of ultraviolet protection; the manufacturer guarantees photodegradation within six months of your choosing. Manufacturer/Distributor: International Reforestation Suppliers, 2100 West Broadway, P.O. Box 5547, Eugene, OR 97405, (800) 321-1037, (503) 345-0597.

*Several hundred Quandra™ shelters remain available from TREEGARD, Inc. Treehouse™ shelters are sometimes available in quantities of 5,000 or greater from American Forestry Technology.