

THE EFFECTS OF TREE SHELTERS ON SEEDLING SURVIVAL AND GROWTH OF TWO BOTTOMLAND HARDWOOD SPECIES: THIRD-YEAR RESULTS

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Abstract—Tree shelters can aid hardwood seedling establishment by increasing early survival and growth. Tree shelters are translucent plastic tubes that act as mini-greenhouses by maintaining higher humidity environments around the seedlings (Minter and others 1992). Shelters can also protect seedlings from herbivory (Schweitzer and others 1999). Lower cost shelters may provide the same benefits as more expensive shelters.

This study was established in February 2004 at two 2.5-acre University of Arkansas research station sites in southwest and east central AR (Hope in Hempstead County and Pine Tree in St. Francis County). The purpose was to compare three types of tree shelters installed on green ash (*Fraxinus pennsylvanica* Marsh.) and cherrybark oak (*Quercus pagoda* Raf.) seedlings. The Hope site is a former hay field on a silty clay loam, and was disked twice before planting. The Pine Tree site is a former crop field on silt loam soils, and was ripped (subsoiled) before planting. The study is a replicated randomized complete block design.

Tree seedlings enclosed in 4-foot tall BLUE-X[®], Protex[®] or Tubex[®] tree shelters (12 by 12 foot spacing) were observed monthly during the growing season and compared to unsheltered controls with respect to survival and height growth. Total height and groundline diameter of each seedling were measured at the end of each growing season. The BLUE-X[®] shelter (blue) consists of a flat Poly film and sleeve which must be assembled. The Protex[®] shelter (blue) is shipped flat, and must be rolled into a cylinder and secured with eight tabs. The Tubex[®] shelter (green) is shipped as a tube ready to install. Each shelter was held upright with a 4-foot bamboo stake. Netting was installed on the top of each tube to prevent birds from falling in.

The total establishment cost (per shelter) for each tree shelter type includes all materials and labor for assembly and installation. The BLUE-X[®] cost in 2004 was \$1.26 per shelter, the Protex[®] cost was \$2.36 per shelter, and the Tubex[®] cost was \$2.64 per shelter.

After three growing seasons, tree shelters did not significantly affect seedling survival. Survival at Pine Tree was 99 to 100 percent for all four treatments for ash, and 93 to 98 percent for oak. At Hope, green ash survival was 96 to 99 percent, but cherrybark oak survival was only 74 to 84 percent. Oak survival at Hope was less than at Pine Tree, probably due to heavier soils at Hope. Deer browsed more of the unsheltered green ash than cherrybark oak control seedlings, which caused stunted growth, but not mortality. About 63 to 75 percent of the green ash control seedlings were browsed by deer at both sites. Fewer cherrybark oak controls (15 to 25 percent) were browsed.

Third-year groundline diameters at Hope were slightly greater for seedlings growing in shelters compared to controls, except oaks in BLUE-X[®] shelters had a slightly smaller diameter than controls. Diameters for both species at Hope ranged from 0.4 to 0.6 inches. At Pine Tree, control seedlings generally had greater diameters than sheltered seedlings. Diameters at Pine Tree ranged from 0.7 to 0.9 inches for green ash, and from 0.8 to 1.0 inches for oak. At both sites, tree shelters significantly increased height growth over the unsheltered seedlings for both species, but the differences among shelter types were negligible. At Hope, sheltered green ash heights averaged about 4 feet, and about 2.5 feet for control seedlings. Cherrybark oak heights averaged about 5 feet in shelters, and about 3 feet for controls. At Pine Tree, sheltered green ash heights were about 5.5 feet, compared to 4.5 feet for control seedlings. Cherrybark oak heights ranged from 5.5 to 6 feet in shelters, and were about 5 feet for control seedlings. Height growth of sheltered seedlings, especially at Pine Tree, was rapid the first year until the seedlings reached the tops of their shelters, after which height growth slowed down and diameter growth resumed.

Emergence was recorded when the terminal bud of each seedling reached the top of its shelter (3.9 feet, because tubes are in the ground 1 to 2 inches) or the equivalent height for controls. At Pine Tree, 96 percent of all the sheltered seedlings had emerged by the end of the third growing season, compared to 73 percent of the controls. At Hope, only 62 percent of the sheltered seedlings had emerged, compared to only 11 percent of the controls. Percentage of seedlings emerged varied the most by shelter type for green ash at Hope (50 to 68 percent), but otherwise shelter type made little difference on percentage emerged. Emergence rates (feet per month growth to reach top of shelter) at both sites were significantly greater (usually more than double) for sheltered seedlings of both species over controls. BLUE-X[®] and Tubex[®] shelters at Pine Tree produced mean growth rates of about 0.5 foot per month. Protex[®] growth rates were slightly less. Most (60 to 80 percent) of the sheltered seedlings at Pine Tree emerged during the first growing season (2004), whereas most emergence at Hope occurred during the second and third growing seasons.

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In general, tree shelters did not affect overall survival compared to unsheltered seedlings, and survival by shelter type varied very little. Many unsheltered controls were browsed by deer, resulting in reduced height growth. Tree shelters increased growth rates of green ash and cherrybark oak seedlings. Cherrybark oak seedlings grew slightly faster than green ash seedlings. Height growth was more pronounced than diameter growth until emergence. BLUE-X® shelters cost half as much as Tubex® shelters, but improve growth rates similarly. This study will be monitored through five growing seasons.

LITERATURE CITED

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