Insects and Diseases of Oak Seedlings Grown in Tree Shelters

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Tree shelters are a new technology used in regenerating oak. Oak seedlings typically have insect and disease associates that may become pests on seedlings grown in shelters. In this study, insects and diseases found on sheltered seedlings were listed over a 1-year period, and their effects on sheltered and unsheltered seedlings were compared. Despite sustaining greater damage from insects and disease, sheltered seedlings showed more height growth than unsheltered seedlings. But potential problems were indicated that warrant further study. Tree Planters' Notes 45(3):88-90; 1994.

Regeneration of oak seedlings is one of the most challenging tasks facing land managers in the Northeast. Oak seedlings are often crowded out by faster-growing vegetation or browsed by deer. Land managers have searched for ways to protect this valuable forest tree in order to preserve its place in forest ecosystems.

Tree shelters are a new technique being tried on some national forests and elsewhere (figure 1). Tree shelters are plastic tubes that can be placed over seedlings, whether naturally regenerated or grown from planted seed or nursery stock (Windell 1992).

Figure 1—*Tree shelters are plastic tubes placed over seedlings to enhance their growth and to protect them from deer browsing and competing vegetation.*

Tree shelters protect seedlings from browsing and provide a microenvironment that enhances height growth, helping oak seedlings to outgrow competing vegetation (Minter and others 1992, Lantagne and others 1990).

One drawback of shelters is cost. Because the technology is new, purchasing and installing shelters can cost up to $3 per seedling. Sheltered seedlings thus represent a much higher investment than unsheltered plants, making damage from insects and disease a major concern (Lamson 1991). But very little is known about how insects and diseases interact with seedlings in shelters.

This paper presents results from the first year of a study of insects and diseases on sheltered and unsheltered (control) seedlings.

Methods

Following the initial cut of a shelterwood harvest, the Green Mountain and Finger Lakes National Forests installed 1.5-m (5-ft) Tubex tree shelters over planted acorns and naturally regenerated oak seedlings on 5 sites. At each of 3 sites on the Green Mountain National Forest, 25 sheltered seedlings on a transect were marked; and on each of 2 sites on the Finger Lakes National Forest, 30 sheltered seedlings on a transect were marked. For each sheltered seedling, a nearby open-grown seedling (if present) was chosen as a control. The seedlings were first examined during the week of May 17, 1993, then reexamined monthly, with the last visit occurring during the week of September 6, 1993.

The kind and number of insects and diseases found were noted and scored on a monthly basis. Amount of missing foliage (in 10% intervals) was estimated monthly, and stem damage caused by insects or disease was recorded. Because damage data were not cumulative across months, total defoliation on a seedling could decrease as new growth occurred. Seedling height was measured at the beginning and end of the growing season to determine the impact of insects and diseases on vertical growth.

Results and Discussion

Insects and diseases. Most insects and diseases found on both sheltered and unsheltered seedlings were common associates of oak, including:

- Leaf rollers and tiers, such as oak leaftier *(Croesia semipurpurana)* (Kearfott) and oak leafroller *(Archips semiferanus)* (Walker)
- Gypsy moth *(Lymantria dispar)* (L.)
- Leaf galls *(Acraspis erinacei* Beutenmueller and *Cecidomyia niveipila* Osten Sacken)
- Sawflies *(Acordulecera* spp.*)* and oak slug sawfly *(Caliroa fasciata)* (Norton)
- Assorted unidentified loopers (family *Geometridae)*
- Oak anthracnose *(Apiognomonia quercina)* (Kleb) v.Hoehne
- An unidentified leaf-eating weevil
- Twig galls *(Callirhytis quercuspunctata* (Bassett) and *Callirhytis cornigera* (Osten Sacken))

Insects and diseases found changed during the season, with early-season and late-season defoliators appearing both inside and outside the shelters at the same time. In May and June, seedlings were frequently attacked by rollers and tiers, rarely found later in the season. Loopers, by contrast, were rare early on, but increased in July and peaked in August. Early in the season, more insects were found on sheltered than on unsheltered seedlings, and defoliation in May was higher on sheltered seedlings on both national forests (table 1). Shelters may provide a good environment for insect survival and growth early in the season, when temperatures outside may still be too cold for insects to flourish. Early-season defoliation can be a major stress when seedlings are just leafing out. Leaf diseases showed up late in the season, possibly adding a second period of defoliation for the season.

Impact. Most seedlings suffered less than 20% defoliation over the period of study (table 1), a level of damage not usually considered to cause mortality or growth loss in mature hardwood trees. It is not known how this level of damage will affect the seedlings, although no pest-related mortality was found. There were no outbreak populations of insects or diseases in the forest during the year of study, so damage was done by endemic populations and can be expected to recur every year. Some seedlings were heavily defoliated when 1 or 2 gypsy moths got into the shelters, although many of the defoliating insects found could produce the same level of damage.

Twig galls caused several instances of main-stem dieback, but in each case seedlings were already resprouting. Overall, height growth was greater in sheltered than unsheltered seedlings (figure 2), indicating that increased damage by defoliators (table 1) was more than offset by the benefits of shelters. Damage

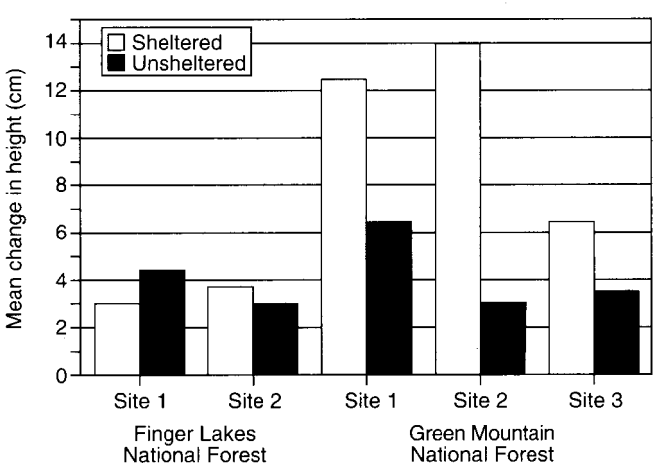

Figure 2—*Mean height growth of sheltered and unsheltered oak seedlings, Finger Lakes and Green Mountain National Forests, 1993.*

Table 1 -*Mean percentage defoliation of attacked oak seedlings on the Finger Lakes and Green Mountain National Forests by month (1993)*

	Finger Lakes NF		Green Mountain NF		Total	
Month	Sheltered	Control	Sheltered	Control	Sheltered	Control
May	15	11	18	15	17	13
June	14	14	19	13	17	13
July	13	12	21	17	17	15
August	16	13	17	27	17	20
September	20	13	16	22	18	18
Average	16	13	18	19	—	—

was limited to loss in leaf area rather than height growth, although it is unknown how this reduction in leaf area affected potential growth. A major benefit of shelters (and a reason for greater height growth) was reduced deer browsing on sheltered seedlings. Most unsheltered seedlings were browsed back, and some even suffered negative height growth.

Despite low damage levels shown in the study, possible future problems are indicated. The seedlings that were infected with leaf diseases are likely to be infested and defoliated every year. When leaves drop in fall, they are trapped in the shelters, leaving inoculum in close contact with seedlings. Leaf and stem tissue of seedlings grown in shelters is more succulent than that of open-grown seedlings, which could attract insects and diseases. Moreover, shelters provide an excellent growing environment for insects and diseases, although it is hard to say whether this environment will actually attract them. Finally, shelters may provide pests with protection from natural enemies.

Conclusions

Tree shelters appear to be a very good way of regenerating oak seedlings in forests. Although more insects and diseases attacked sheltered seedlings than unsheltered ones, the sheltered seedlings still produced more height growth. The ultimate impact of higher levels of insect and disease infestation found in sheltered seedlings is unknown; economic damage thresholds will be crossed sooner because of the higher value of sheltered seedlings. It is also unknown how other factors (such as site and competing vegetation) play into the picture. These could be major factors in seedling performance. Further monitoring is called for as a step toward developing an integrated pest management that minimizes insect and disease losses.

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Literature Cited

Lamson N. 1991. Results of tree shelter survey. In: Forest management update. No. 12. Morgantown, WV: USDA, Forest Service, State and Private Forestry. p. 7-9.

Lantagne DO, Ramm CW, Dickmann DI. 1990. Tree shelters increase heights of planted oaks in a Michigan clearcut. Northern Journal of Applied Forestry 7:2426.

Minter WF, Myers RK, Fischer BC. 1992. Effects of tree shelters on northern red oak seedlings planted in harvested forest openings. Northern Journal of Applied Forestry 9:58-63.

Windell K. 1992. Tree shelters for seedling protection. 2400-Timber 9224-2834-MTDC. Missoula, MT: USDA Forest Service, Missoula Technological Development Center. 142 p.