

Management Options

The best practices for minimizing losses to little-leaf disease vary with stand conditions and management objectives. By following the flowchart in figure 1, the land manager can obtain options (represented by letters) to consider while making stand prescriptions. A short statement and explanation of each option follows.

A. Use symptom-free pines as seed sources. Many littleleaf disease sites are marginally productive and cannot support large investments in timber growing. Natural, even-aged regeneration utilizes potential genetic resistance in disease-free trees for the next stand and is less expensive than artificial regeneration. This option applies to resistant species (e.g., loblolly and Virginia pines) already present in the stand, as well as to disease-free individuals of the more susceptible shortleaf pine.

B. Favor resistant conifer species. This option may be applied in uneven-aged or even-aged systems with natural or artificial regeneration. Loblolly and Virginia pines should be favored over shortleaf pine in damaged, mixed stands. Although loblolly may be damaged under some conditions, it is less susceptible than shortleaf pine, and individuals will be larger when symptoms appear. Consider plantings of custom-grown seedlings inoculated with the ectomycorrhizal fungus *Pisolithus tinctorius*. In comparison with uninoculated seedlings, they have been shown to be more resistant to infection by *Phytophthora cinnamomi*. Further, survival and early growth are better on harsh regeneration sites such as mine spoils and borrow pits, which share many common characteristics with littleleaf sites.

C. Manage hardwoods. Hardwoods are immune to littleleaf disease and are a long-term solution to site amelioration. They can be favored in low cost natural regeneration systems or planted when wood products are not an overriding management objective. Black locust, sweetgum, and wildlife food species are potentially useful.

D. Decrease planting density. Widening of initial spacing reduces root competition and competitive stress. It therefore delays the onset of littleleaf disease symptoms, lengthens the possible rotation, promotes species diversity beneficial to wildlife and esthetic values, and carries lower regeneration costs.

E. Ameliorate the site and plant. Wood product values alone may not justify this very intensive, high-cost option. However, watershed protection, recreation, and historic values may. Deep plowing, called "sub-soiling," breaks up impervious clays and promotes deeper, more extensive rooting; deep gullies can be filled; and, where values permit, topsoil or organic amendments, such as municipal sewage sludge, can be applied to improve the site.

F. Conduct regular surveillance. Early detection aids in management planning. Stands over 30 years old on high-risk sites are the most vulnerable to damage. If symptoms appear early in stand history, long