Diseases in Forest Nurseries: Implications for Forest Managers

BY ROBERT L. JAMES

Continued sources of high-quality seedlings are needed for proper management of forestland in western North America. Diseases may often be important factors limiting production of seedlings in forest nurseries. Fortunately, organisms that cause important diseases within nurseries are usually not of concern once seedlings are outplanted on forest sites. Rather, they are similar to or the same organisms that elicit diseases on agricultural crops. This would be expected because forest nurseries are really agricultural enterprises, producing large numbers of plants using intensive cropping systems.

An example of one of the most important groups of pathogens in forest nurseries is *Fusarium*. These pathogens induce damping-off and root diseases on both container-grown and bareroot crops. In some cases, disease levels can be very high, with a large proportion of the crop being damaged. These organisms may also elicit diseases of many agricultural crops including a wide range of vegetable, fruit and cereal crops.

In some cases, the same *Fusarium* species that causes root disease of vegetable and fruit crops, such as tomatoes and melons, also elicit disease on young conifer seedlings in forest nurseries. Fortunately, these pathogens are mostly restricted in their activity while seedlings are in nurseries. Seriously infected seedlings displaying disease symptoms are usually culled before being sent to the field for planting. However, if seedlings are infected with nursery root or foliar pathogens and are outplanted on standard forest sites, the resident pathogens usually either die out or are replaced by other mycoflora once seedlings are planted. This is primarily because typical forest environments are usually not conducive to these pathogens, that is, the pathogens are not capable of competing with natural organisms residing within forests, whereas they seem to thrive in many forest nursery settings.

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Bare root conifer seedlings are grown for one to several years and then shipped for outplanting on forest sites.

Beware of molding

One exception to the general lack of problems elicited by pathogens once seedlings leave nurseries is molding of seedlings held in cold storage. When seedlings are stored for prolonged periods, fungi residing on foliage or roots may become metabolically active and damage seedling tissues. This is especially true when seedlings are stored at above-freezing temperatures and at high humidity. These conditions are ideal for growth, sporulation and spread of many microorganisms, including certain fungi that can cause disease.

A good example is *Botrytis cinerea*, a pathogen with an extremely wide host range that can grow and cause seedling damage at very low temperatures. Seedlings can readily become infected with this pathogen in nurseries, especially on seedlings grown in containers within greenhouses. Infection by *Botrytis* may not always be evident, resulting in some infected seedlings being shipped for outplanting. Under storage conditions, especially at above-freezing temperatures, this pathogen may become active and cause substantial damage.

Storage problems are usually alleviated by reducing the time of storage as much as possible, keeping seedlings frozen during storage, and rapidly thawing seedlings and outplanting them as soon as possible after thawing.

Many conifer seedlings leaving nurseries are mycorrhizal. This is due either to natural infection, particularly on bareroot seedlings grown for two or more years, or to artificial inoculation with commercially available sym-

bionts, commonly applied to container-grown seedlings. Whether or not seedlings are mycorrhizal prior to outplanting, they will normally develop this symbiosis during the first growing season on typical forest sites. Exceptions may be if seedlings are planted on sites where local mycorrhizal inoculum is limited or not present, such as certain reclamation sites, pasture land or other locations where natural trees are lacking. When seedling stock is destined for such sites, it is important to introduce mycorrhizal inoculum while seedlings are being produced in nurseries; otherwise their chances for survival are reduced. On forest sites, planted seedlings with mycorrhizae obtained from the nursery usually become infected with alternative fungal symbionts after awhile. These alternative symbionts may be better adapted to the specific forest sites than those obtained at the nursery.

In summary, foresters generally need not be overly concerned with diseases of seedlings in forest nurseries. Most nursery growers take steps to make sure diseases are minimized during seedling production, cull seedlings with any evidence of disease that might adversely affect outplanting performance, keep molding of seedlings during storage to a minimum and provide mycorrhizal inoculation when required.

Most growers of forest nursery seedlings utilize the latest technological improvements to enhance seedling quality. As a result, most seedlings coming from nurseries are of high quality, with the best potential for successful establishment and growth once outplanted. Very rarely are diseases obtained in nurseries major contributors to problems following outplanting. Site and environmental factors, such as vegetation competition, animal damage or drought are much more important contributors to outplanting problems. ◆

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