

INSECT AND DISEASE IN NURSERIES

STUDY OF SOIL FUNGI

by

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Seedling mortality at the National Forest Nursery in Coeur d'Alene, Idaho, occurs in both 1-0 and 2-0 stock. Mortality generally occurs in small groups or centers within a row and most often does not extend across to an adjacent row. In the centers, old dead seedlings are found in the central portions; more recent mortality and possibly yellowing and wilting seedlings are found on the edges. Occasionally a group or center will consist of even age mortality. Size of the disease center depends upon many factors and may involve from several to eight or ten seedlings in a given group.

Roots of yellow or wilting seedlings are normally necrotic and cortical tissues are easily sloughed off, indicative of root rot.

Impact studies show that losses vary by species, seed source, section in which planted, and by year.

Flats installed in 1974 in newly seeded areas show that first year (1-0) losses were highest in grand fir (25-40%), western larch (25%), and Douglas-fir (15-30%) and lowest in 2- and 3-needle pines (10%) and Engelmann spruce (3%).

In a separate study losses in the 2-0 year for Englemann spruce amounted to approximately 6%. No figures are available for 2-0 stock of other species. Mortality increased significantly as the summer progressed and then declined in the fall, suggesting a temperature-related effect on the host and/or the pathogen. This is supported by similar findings by Bloomberg (1973).

Isolations made from dead and from apparently healthy seedlings frequently yielded *Fusarium* spp., the suspect pathogen(s). Dead seedlings yielded *Fusarium* spp. 70 to 90 percent of the time, while "healthy" seedlings yielded *Fusarium* spp. 30 to 60 percent of the time, being variable by species.

Fusarium spp. are sometimes observed sporulating on the stem near ground line, and appear as small, salmon pink pustules.

At least two species of *Fusarium* appear to be involved--*Fusarium oxysporum*, a wilt-causing organism, and *Fusarium roseum*, a decaying organism. It is suggested that perhaps *F. oxysporum* is the early invader causing the wilt symptoms with *F. roseum* invading and decaying cortical tissues shortly before or after seedling death. Inoculation studies must be conducted to determine whether either or both are the primary pathogens.

Currently, fumigation with a methyl bromide-chloropicrin mixture is being used at the Coeur d'Alene nursery partially to reduce seedling losses. Studies designed to provide some insight into the need for and effectiveness of fumigation in terms of disease control have been initiated. Involved are seedling mortality counts and determination of active and total populations of potentially pathogenic and highly competitive saprophytic fungi within the soil.

Preliminary results of these studies show that in some cases fumigation was ineffective in reducing Fusarium populations, in some it was very effective, and in others because of very low numbers of Fusarium propagules, fumigation may have been unnecessary. However, the relationship between seedling mortality and fungal populations is unknown. In most cases an increase in competitive saprophytes was found following fumigation.

The systematic fungicide benomyl has been found to be ineffective in reducing seedling mortality when applied at rates of 7 pounds or 14 pounds active material per acre to 1-year-old Engelmann spruce (Williams 1975). Bioassays indicate that lack of sufficient active material reaching the absorptive surfaces of the roots was the reason for lack of control. Disease cycle must be determined in order to better utilize benomyl and other chemicals for root disease control.

Large-scale color infrared photography of the Coeur d'Alene nursery was obtained in 1974 to evaluate its utility in identifying problem areas. Photos show different reflectance patterns of bare soils, and also differences in seedling densities, perhaps a function of soil properties. What these differences mean in terms of (1) seedling mortality and vigor, (2) soil microflora, (3) soil chemical and physical properties, and (4) correlations between 1, 2, and 3 is unknown. Evaluations are currently being undertaken to study these factors with the long-term goal of reducing losses and improving seedling quality via integrated management systems.

REFERENCES

- Bloomberg, H. J. 1973. Fusarium root rot of Douglas-fir seedlings. *Phytopathology* 63: 337-341.
- Williams, R. E. 1975. Nursery conifer diseases: evaluation of benomyl to control root disease of Engelmann spruce seedlings. USDA Forest Service, Northern Region, Forest Environmental Protection, report 75-15.