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ARMILLARIA ROOT DISEASE AT THE YAAK-KILBRENNAN TREE IMPROVEMENT PLANTATION - THREE RIVERS RANGER DISTRICT, KOOTENAI NATIONAL FOREST, MONTANA

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A tree improvement progeny test of Douglas-fir (*Pseudotsuga menziesii* Franco) was established in 1982 on the Three Rivers Ranger District, Kootenai National Forest. This plantation, designated the Yaak-Kilbrennan Tree Improvement Site, was composed on container-grown stock obtained from the Potlatch Nursery in Lewiston, Idaho. During 1990, groups of dead and dying trees were evident throughout much of the plantation. Stumps from the previous stand of trees often delineated the center or mortality groups. Mortality progressed from these centers, with trees on the periphery exhibiting chlorotic foliage (figure 1).

This pattern of mortality in young stands is indicative of root disease (Morrison 1981, Redfern 1978). Lateral spread of mortality is due to movement of root pathogens from tree to tree via root contacts, grafts, and fungal rhizomorphs (Morrison 1981). Trees with chlorotic foliage often have roots extensively colonized with root pathogens (Wargo and Shaw 1985). Many green, healthy trees may be infected, especially if they are adjacent to disease centers (Filip and Goheen 1978). Examination of lateral roots and root collars of dead and dying trees within the Yaak-Kilbrennan plantation revealed presence of mycelial fans in the cambial region between the bark and wood. Such fans indicate presence of *Armillaria* spp. (Morrison 1981). Recent investigations of the genus *Armillaria* (Morrison and others 1985a, 1985b) have shown that the major pathogenic species associated with tree mortality in northwestern North America is *A. ostoyae* (Romagn.)Herink.

It is expected that mortality due to root infection by *A. ostoyae* will continue within this Douglas-fir stand. Greatest mortality often occurs 6-8 years after seedlings are planted (Redfern 1978). Experience indicates that Douglas-fir continues to be susceptible to infection and mortality throughout the rotation (Redfern 1978). However, some decrease in rates of mortality may occur in stands greater than 30 years of age (Filip and Goheen 1978, Johnson and others 1972). Therefore, non-uniform mortality is expected to continue in the stand (Filip 1979).

Genetic resistance to *Armillaria* has not been adequately evaluated, especially in Douglas-fir. It is possible that some genetically-controlled mechanisms might exist in host trees. However, factors such as host vigor (Buckland 1953, Johnson 1976), pathogen virulence (Morrison and others 1985a), and amount of inoculum (Filip and Goheen 1978) are probably more important in determining level of damage from *Armillaria*.

Figure 1. Chlorosis of Douglas-fir tree within an *Armillaria* root disease center at the Yaak-Kilbrennan Tree Improvement Plantation.

Tree improvement test plantations are periodically monitored for growth increments and general condition. Armillaria root disease may adversely affect tree growth in the plantation as well as causing mortality (Bloomberg and Morrison 1989). Therefore, it is recommended that information on root disease incidence and severity be monitored when other data are taken. Disease severity ratings based on extent of foliar symptoms (chlorotic - necrotic foliage, mortality) and probabilities of root infection based on proximity to probable infection sources (nearby stumps or trees with diagnosed pathogens) should be collected. Also, root collar examinations for basal resinosis and mycelial fans may be necessary (Foster and Johnson 1963). Because all individual trees are not exposed to equal levels of subterranean inoculum, trees without apparent injury may not reflect resistance, but may have escaped infection.

This tree improvement stand will soon be ready for pre-commercial thinning. However, the disease will most likely continue to non-randomly remove trees (Filip 1979). Therefore, many trees intended for the final "crop", i.e., those to be kept for cone production or further propagation, will likely be killed by the fungus. As such, it may be unwise to thin the stand around existing disease centers.

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