ROOT DISEASE CAUSED BY *FUSARIUM OXYSPORUM* ON CONTAINER-GROWN DOUGLAS-FIR SEEDLINGS WESTERN FOREST SYSTEMS NURSERY, LEWISTON, IDAHO

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Container-grown Douglas-fir (***Pseudotsuga menziesii*** (Mirb.) Franco) seedlings are an important crop grown each year for reforestation at the Western Forest Systems Nursery in Lewiston, Idaho. During visits to the nursery in 1989, several seedlings with needle tip dieback symptoms (figure 1) were found scattered throughout several seedlots. However, overall disease incidence was very low. Growers were interested to know if pathogenic fungi were responsible for disease symptoms since such symptoms have previously been associated with root infection by ***Fusarium*** spp. (James 1984a, 1984b, 1986a, 1986b, 1987b).

Seven seedlings showing various intensities of needle tip dieback were collected and taken to the laboratory for analysis. Seedlings were rated for severity of needle tip dieback symptoms (Table 1). Their roots were washed thoroughly under running tap water to dislodge particles of growing media; tips from 10 randomly selected roots were aseptically severed into pieces about 3-5 mm in length, surface sterilized in a 10% bleach solution (0.525% aqueous sodium hypochlorite), rinsed with sterile distilled water, and placed on a selective agar medium for ***Fusarium*** and related fungi (Komada 1975). Emerging fungi were transferred to potato dextrose and carnation leaf agar and identified using the taxonomic guide of Nelson and others (1983).

All sampled seedlings had roots that were extensively infected with ***Fusarium oxysporum*** Schlecht. (Table 1). In six of the 7 seedlings, all root tips were thoroughly colonized with this fungus (figure 2). No other ***Fusarium*** spp. was isolated from the root tips. On a few of the seedlings, ***Trichoderma*** spp. were colonizing root tips, but at very low levels. No other fungi were isolated. The consistent association of ***F. oxysporum*** with roots of diseased seedlings and the ability of this species to elicit disease in Douglas-fir seedlings (James and others 1986, 1989) strongly implicates this fungus as the primary cause of needle dieback symptoms at the Western Forest Systems Nursery.

Table 1. Colonization of container-grown Douglas-fir seedlings with ***Fusarium oxysporum*** at the Western Forest Systems Nursery, Lewiston, Idaho.

Seedling No.	Needle Tip Dieback Symptom Description	Root Tip Infection with *Fusarium oxysporum*[1]
1	Dieback in top ⅓ of crown	100
2	Dieback in top ½ of crown	100
3	Dieback in top ¼ and bottom ⅓ of crown	100
4	Dieback in top ⅔ of crown	100
5	Dieback in top 1/10 of crown	100
6	Dieback in top ½ of crown	100
7	Dieback in middle ⅓ of crown	70

[1] Percentage of root tips colonized (10 sampled per seedling).

Fusarium oxsyporum colonizes cortical tissues of roots, initiates decay and thereby restricts intake of water and nutrients (Bloomberg 1971). As a result, infected seedlings appear wilted and needles die back from their tips (James 1984a, 1984b, 1987b). Seedlings can be infected for a long period of time before disease symptoms occur (James and others 1987). Important sources of ***Fusarium*** inoculum include infested seed (James 1987a) and styroblock containers that are reused and have not been adequately cleaned (James 1989).

Once disease symptoms become evident, fungicides are usually ineffective in disease control (James and others 1988). The best approach to reducing losses from ***Fusarium*** root disease is prevention of initial infection by cleaning seed and containers prior to sowing, sanitizing interior of greenhouses between crops, careful removal of infected seedlings when found, and reducing amounts of stress placed on seedlings.

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Figure 1. Container-grown Douglas-fir seedling with needle tip dieback symptoms caused by root infection with ***Fusarium oxysporum*** - Western Forest Systems Nursery, Lewiston, Idaho.

Figure 2. Colonization of root tips of container-grown Douglas-fir seedlings with ***Fusarium oxysporum*** when incubated on Komada's medium for one week.