CHLOROSIS OF ENGELMANN SPRUCE TRANSPLANT SEEDLINGS - USDA FOREST SERVICE NURSERY, COEUR D'ALENE, IDAHO

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Most bareroot seedling stock produced at the USDA Forest Service Nursery, Coeur d'Alene, Idaho, is grown for 2 years in production beds. Normally this stock is not transplanted to provide an extra year's growth at the nursery. However, in the spring of 1987, 2-0 Engelmann spruce (*Picea engelmanni* Parry) stock was transplanted in a portion of Field 10 adjacent to an area that had been fumigated the previous summer with Basamid®. Toward the end of summer, some of the stock became chlorotic (fig. 1). Chlorotic transplants were grouped and most occurred on the side of beds closest to irrigation lines. No mortality was evident in transplant beds.

Figure 1.--Engelmann spruce transplant seedlings with chlorotic foliage at the USDA Forest Service Nursery, Coeur d'Alene, Idaho. Affected transplants were usually grouped and concentrated within beds adjacent to the irrigation line.

Growers were concerned about possible causes of this chlorosis. Therefore, 10 transplants, each with chlorotic foliage collected from throughout affected beds, were collected for analysis of pathogenic fungi on their roots. Seedlings were carefully excavated so as to obtain most of their roots. Root systems were

rinsed thoroughly under running tap water for several minutes to remove adhering soil particles. They were then surface sterilized in 10 percent aqueous sodium hypochlorite for 2 minutes and rinsed with distilled water. Ten randomly selected root tips per seedling were aseptically cut and placed on a selective medium for *Pythium* spp. (V-8 juice agar amended with rose bengal, pimaricin, rifamycin, ampicillin, and pentachloronitrobenzene). Plates were incubated at about 22 degrees C in the dark for 3-5 days, after which number of root tips colonized by *Pythium* spp. was determined. From the same root systems five to seven randomly selected lateral roots were aseptically cut at their point of junction with other roots. Five mm pieces of root were cut from each selected lateral root and placed on a selective medium for *Fusarium* (Komada 1975). Plates were incubated at about 22 degrees C under cool fluorescent light for 7-10 days, after which number of root pieces colonized with *Fusarium* was determined. Simple linear regressions were conducted to compare possible relationships between extent of root infection by *Pythium* and *Fusarium*.

Roots of all sampled seedlings were infected with both *Pythium* and *Fusarium* (table 1). Coefficients of determination comparing amounts of root infection by both groups of fungi were very low ($R^2 = 0.06$). This would indicate poor correlation in amounts of infection between *Pythium* and *Fusarium*.

Table 1.--Colonization of roots of chlorotic Engelmann spruce transplants with *Fusarium* and *Pythium* at the USDA Forest Service Nursery, Coeur d'Alene, Idaho.

Seedling number	Percent root infection	
	Fusarium	*Pythium*
1	83.3	40
2	60.0	30
3	66.7	20
4	85.7	20
5	60.0	10
6	42.9	20
7	16.7	30
8	33.3	50
9	16.7	30
10	50.0	40
Averages	51.7	29

Previous investigations at the nursery have implicated *Pythium* as a cause of seedling mortality, especially in soils where water tends to accumulate (James 1982; James and Gilligan 1986a). Also, soil populations of *Pythium* have been detected at levels that were probably high enough to elicit some disease response on the part of seedlings. (James and Gilligan 1985; James and Gilligan 1986b; James et al. 1987). Transplanted western white pine seedlings have developed root disease associated with *Pythium* spp. in other parts of the nursery (James 1985; James and Gilligan 1986a). Therefore, it is likely that infection of transplanted Engelmann spruce stock by *Pythium* was at least partially responsible for the chlorotic condition of the stock.

Fusarium may also have been partially responsible for the chlorotic condition of the transplant stock. A relatively large percentage of sampled roots were infected with *Fusarium*. The major species isolated was *F. oxysporum* Schlect. Low populations of soil-borne *Fusarium* have been detected in the field where transplanting occurred (James and Gilligan 1986b; James et al. 1987). However, it is possible that roots

[illegible] previously reported at the nursery (James 1983).

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