BLEACH TREATMENTS OF LEACH® PINE CELL CONTAINERS - USDA FOREST SERVICE NURSERY, COEUR D'ALENE, IDAHO

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Root diseases caused by ***Fusarium*** spp. are important problems affecting production of container-grown seedlings at the USDA Forest Service Nursery in Coeur d'Alene, Idaho (James 1985b). Recent investigations (James 1989; James and Gilligan 1988) have shown that contaminated Leach® pine cell containers are important sources of inoculum of ***Fusarium*** and other potential pathogens of container seedlings. These investigations have shown that fungal inoculum is usually not sufficiently reduced to innocuous levels by the standard high-pressure steam cleaning procedures employed at the nursery. Since much of the potentially pathogenic inoculum is concentrated near the bottom of containers (James 1989), steam treatment through the top of containers does not adequately kill this inoculum.

In order to improve cleanliness of containers at the nursery, tests were conducted to evaluate efficacy of standard household bleach (sodium hypochlorite) to reduce inoculum viability of potentially pathogenic fungi on pine cell containers. Four concentrations of bleach in an aqueous solution were tested: 0.5%, 1.0%, 1.5%, and 2% (corresponding to 0.0262%, 0.0525%, 0.0787%, and 0.105% aqueous sodium hypochlorite solutions, respectively). Containers were initially cleaned using the standard high pressure steam system of the nursery, i. e., residual growing media were first dislodged from cells and then trays of seedlings were placed on a conveyor and steam delivered via high pressure nozzles through their tops. Selected trays were then sprayed with the appropriate bleach solution, allowed to air dry, and sampled. Six pine cells, randomly selected from each tray of containers treated with one of the four bleach concentrations, were sampled for presence of fungi.

Because previous investigations have shown that potentially pathogenic fungi are usually concentrated near the bottom of pine cell containers (James 1989; James and Gilligan 1988), sampling was limited to this area. Four small pieces (2mm x 3mm) were aseptically cut from the bottom of each sampled cell. One piece was extracted from each of the four cardinal directions. Pieces were aseptically placed, inside surface down, on an agar medium selective for ***Fusarium*** and related disease fungi (Komada 1975). Plates were incubated for 7-10 days at about 26°C under diurnal cycles of cool, fluorescent light. Emerging fungi were identified to genus using a standard taxonomic guide (Barnett and Hunter 1972). Selected isolates were transferred to potato dextrose and carnation leaf agars for identification of species (Booth 1971; Gerlach and Nirenberg 1983; Nelson and others 1983).

Isolation results are summarized in Table 1. ***Fusarium*** spp. were commonly isolated from pine cells undergoing all treatments. However, levels of colonization were less in cells treated with a 2% bleach solution, although statistical differences could not be determined due to small sample sizes. Two-thirds of the sampled cells treated with 2% bleach were still colonized with ***Fusarium*** spp. This is probably sufficient inoculum to result in root infection of seedlings. Two species of ***Fusarium*** were consistently isolated from pine cell containers: ***F. oxysporum*** Schlecht. and ***F. sambucinum*** Fuckel .***Fusarium oxysporum*** is generally much more pathogenic than ***F. sambucinum*** (James and others 1988a), although pathogenic potential of the isolates obtained from containers in this investigation is not known.

Other fungi isolated from bleach treated pine cells included ***Cylindrocarpon***, ***Phoma***, ***Trichoderma*** and ***Penicillium*** (Table 1). Although ***Cylindrocarpon*** and ***Phoma*** spp. are potential pathogens of conifer seedlings (James 1988; James and Hamm 1985), they are not nearly as serious as ***Fusarium*** spp. at the Coeur d'Alene Nursery. ***Cylindrocarpon*** spp. were detected at relatively low levels on pine cell containers. However, ***Phoma*** spp. were quite common. These organisms are usually weakly parasitic, attacking the roots and growing tips of seedlings (James 1985a; James and Hamm 1985). Although ***Phoma*** spp. are persistent colonizers of the bottoms of pine cell containers (James and others 1988b), relationships between amount of inoculum carried over on containers and extent of disease resulting in the new seedling crop have not been investigated. ***Trichoderma*** and ***Penicil-***

lium spp. are common saprophytic fungi colonizing a wide range of substrates, including the residual organic matter on pine cell containers (James 1989: James and Gilligan 1988).

In conclusion, treatments of pine cell containers with bleach solutions following cleaning with high pressure steam did not sufficiently reduce amounts of residual ***Fusarium*** remaining on containers. Growers are currently developing procedures to expose containers to hot water for sufficient time periods to kill potentially pathogenic organisms.

Table 1. Colonization of pine cell containers with selected fungi following bleach treatment at the USDA Forest Service Nursery, Coeur d'Alene, Idaho.

Percent Colonization[1]
Treatments[2]

	0.5%		1.0%		1.5%		2.0%	
Fungi	cells	pieces	cells	pieces	cells	pieces	cells	pieces
Fusarium oxysporum	50.3	25.0	83.3	66.7	83.3	54.2	33.3	25.0
Fusarium sambucinum	83.3	58.3	50.0	25.0	50.0	16.7	33.3	8.3
All *Fusarium*	100.0	75.0	100.0	83.3	100.0	66.7	66.7	33.3
Cylindrocarpon	0	0	16.7	8.3	16.7	4.2	16.7	8.3
Phoma	50.0	16.7	16.7	4.2	66.7	54.2	83.3	62.5
Trichoderma	100.0	62.5	50.0	29.2	66.7	45.8	66.7	37.5
Penicillium	0	0	33.3	8.3	33.3	8.3	0	0
Bacteria	16.7	4.2	16.7	4.2	0	0	0	0

[1] Six pine cells sampled per treatment; 4 pieces sampled from the bottom of each cell.

[2] Percent bleach treatment sprayed on containers after they were treated with high pressure steam cleaning.

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