Reducing Botrytis in Container-Grown Western Larch by Vacuuming Dead Needles

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Needles shed during fall from container-grown western larch seedlings can be removed with an ordinary shop vacuum, reducing the potential for Botrytis infection. Nurseries that use this method as part of an integrated pest management system have avoided fungicide treatments for Botrytis. Tree Planters' Notes 43(2):30-32; 1992.

Botrytis cinerea, or grey mold, favors conditions of moderate temperatures, high moisture, and dense foliage, which are frequently found in container nurseries in late summer and fall. Generally, this disease starts on senescent, dead, injured, or lower needles (Sutherland and others 1989). Disease initiation often coincides with the hardening-off phase of western larch *(Larix occidentalis* Nutt.). Falling needles can accumulate to an appreciable depth on top of the blocks. Slow to dry after irrigation, this mat of needles provides excellent conditions for grey mold development. From here, the disease can spread to healthy tissue and degrade stock quality. Packing infected material for cold storage at temperatures above freezing allows the fungus to continue growing, further decreasing stock quality, if not destroying the seedlings (Russell 1990).

Most recommendations for controlling grey mold include lowering relative humidity and increasing aeration to reduce spore germination and further growth of the fungus (Russell 1990; Sutherland and others 1989; Srago and McCain 1989). This can be accomplished by watering less frequently and early in the morning, improving ventilation by spreading the blocks apart, regulating temperature, or some combination of the above. Under-bench, forced-air ventilation also improves aeration and reduces the incidence of disease (Peterson and Sutherland 1990). Some growers also find it helpful to add a spreader to the irrigation water to foster evaporation from the needles and to brush the foliage with a wooden dowel or piece of plastic pipe to gently remove water droplets from the needles. Having shorter target heights and growing seedlings at a slower rate also decreases disease incidence and the need for fungicides (Dumroese and others 1990).

In greenhouses, removing dead material from the growing area to reduce grey mold inoculum is recommended (Sutherland and others 1989; Wenny and Dumroese 1987). Removing the mat of dead larch needles by hand can be a laborious, expensive effort. Workers at North Woods Nursery, Inc., of Elk River, Idaho, and the University of Idaho Forest Research Nursery, Moscow, Idaho, have found an easy way to remove this build-up of dead foliage.

Vacuuming Needles

Workers use a 16-gallon, 2.25-horsepower ordinary wet/dry shop vacuum to remove dead larch needles (figure 1). The vacuum is generally strong enough to remove all the dead needles as well as a grit topdressing (figure 2). This technique also helps keep the greenhouse tidier and reduces the mess of needles that accumulate in the packing shed. Further, it greatly reduces the amount of dead needles packed with the seedlings, reducing the level of *Botrytis* inoculum that could begin to grow during cold storage, causing serious damage.

Vacuuming vs. Fungicides

One worker can clean about 5,700 seedlings per hour. This year, each nursery vacuumed about 100,000 larch seedlings. This procedure was part of an integrated pest management program that included removing dead seedlings, adding a spreader to every irrigation rinse, and brushing off the foliage. The program was so effective that chemical control of *Botrytis* was unnecessary at both nurseries because the fungus was absent or at extremely low levels. Srago and McCain (1989) state the standard preventative spray program for California and the Pacific Northwest uses foliar fungicides applied at 1- to 2-week intervals. If this is done from hardening to late fall, this could result in at least 6 to 12 applications of fungicide. Because *Botrytis* can develop resistance to some fungicides, especially benomyl, it is suggested to use fungicides in rotation to control this disease. The costs of vacuuming were less than

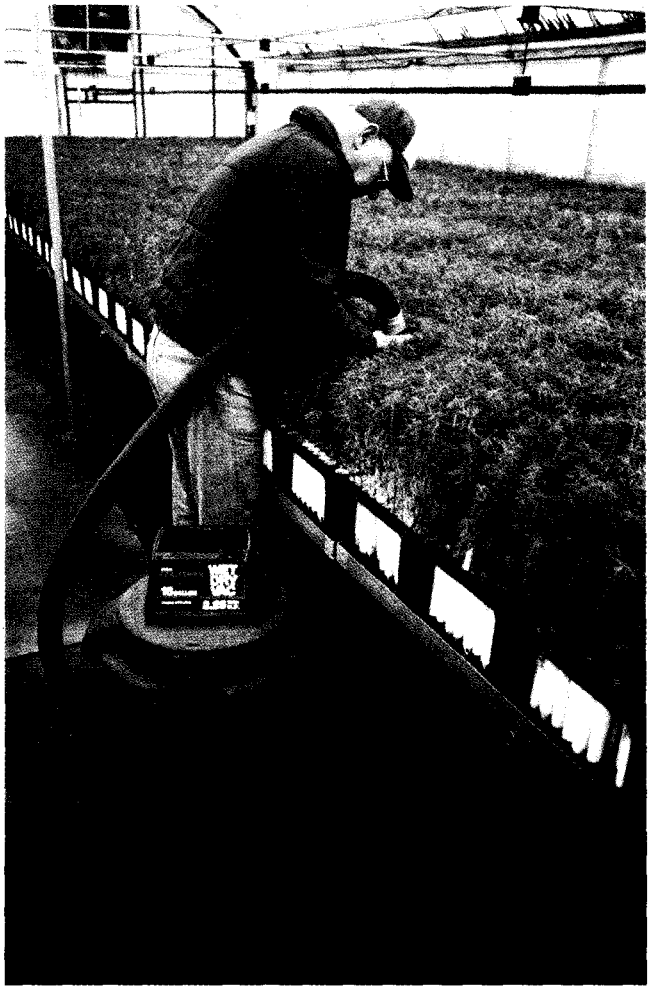

Figure 1—*Worker vacuuming away dead larch needles.*

half those of weekly pesticide spraying (table 1), assuming a Captan 50 WP, Benlate 50 WP (benomyl), Botran 75 W (DCNA) chemical rotation was applied at a rate of 1, 0.5, and 1 pound of fungicide (respectively) per 100 gallons, and 200 gallons were applied each time.

Management Implications

Vacuuming senescent larch needles in early fall, as one component of an integrated pest management plan, can reduce or eliminate the need for chemical fungicide treatments. This treatment seems cost-effective compared to a preventative foliar fungicide spraying program (table 1). Such intensive preventa-

Table 1—*Costs of one-time vacuuming of 100,000 larch seedlings compared to applying foliar fungicides at 1- or 2-week intervals*[1]

	Vacuuming	Fungicides weekly	Fungicides every 2 weeks
Chemical costs[2] ($)	0	144	72
Hours of labor[3]	17.5	6	3
Labor costs[4] ($)	88	48	24
Total costs ($)	88	192	96

[1]Assumes six 2-week interval or twelve 1-week interval fungicide applications for 12 weeks to 100,000 western larch, using 200 gallons of solution applied with a travelling boom irrigation system.

[2]Assumes the following costs: Captan at $2.29 per pound, benomyl at $16.34 per pound, and Botran at $7.47 per pound.

[3]Assumes vacuuming 5700 seedlings per hour and 30 minutes to mix and apply fungicides.

[4]Assumes vacuuming done by seasonal employee paid $5 per hour and fungicides applied by permanent staff at $8 per hour.

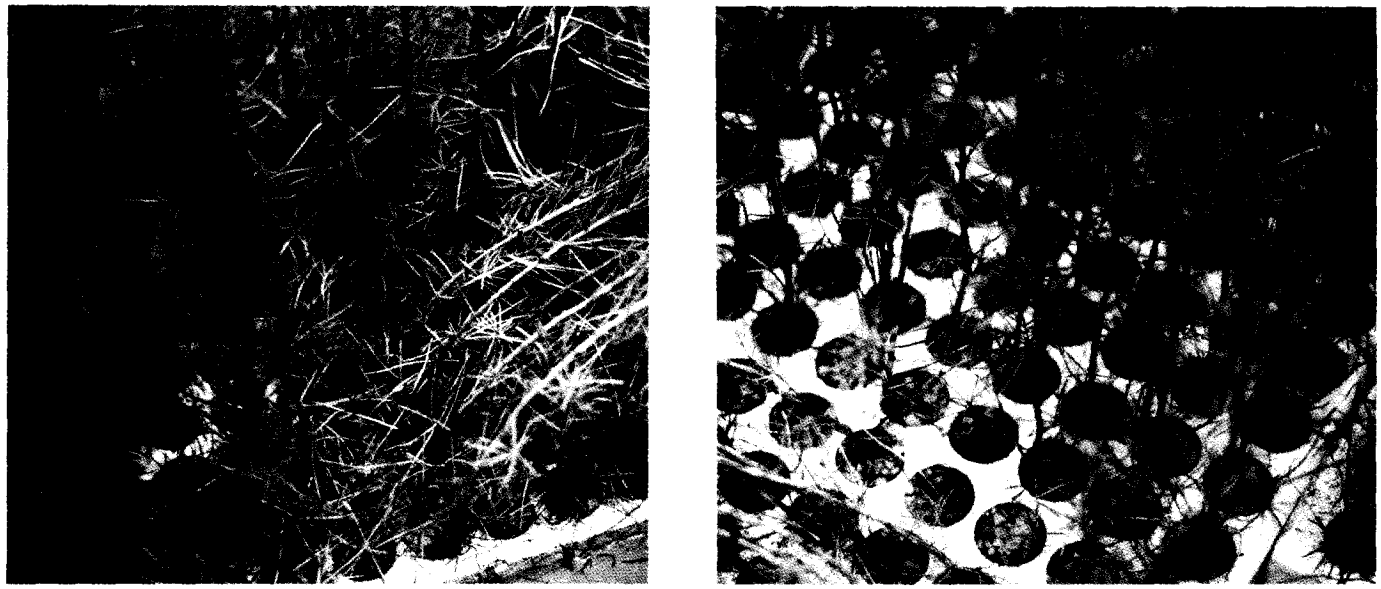

Figure 2—*Seedlings showing mat of dead larch needles before vacuuming (**left**) and afterward (**right**).*

five spray programs are not necessarily needed (Dumroese and others 1990) and will become increasingly hard to maintain as concerns arise over nursery waste water (Dumroese and others 1991). Besides removing needles, vacuuming eliminates problems associated with chemical applications, including waste water, worker exposure, and development of fungal resistance to the chemical.

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