Composted Bark, Chrysanthemums, and Christmas Trees

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For the past 10 years, H. A. Hoitink and colleagues at the Ohio Agricultural Research and Development Center, Wooster, have been studying the effects of **composted bark media** on root diseases of ornamental plants grown in containers. Traditionally, soilborne diseases of container-produced ornamentals have been controlled by media sterilization, sanitation practices, and fungicide drenches. The Ohio group, however, reports that organic components containing high percentages of composted tree barks suppressed many soilborne diseases, whereas those containing peat were conducive to disease. Diseases suppressed by composted hardwood bark included those associated with *Rhizoctonia, Pythium, Phytophthora, Fusarium, Thielaviopsis, Verticillium,* and some nematodes. Raw and composted pine bark suppressed *Phytophthora* and *Pythium* root rots but had little effect on *Rhizoctonia* diseases; many of the commercially available media containing pine bark also did not suppress *Rhizoctonia.*

Several Ohio growers report they have used composted bark media successfully to reduce soilborne diseases in their production cycles since the mid-1970s. Apparently, part of the suppressive effect of young (3-month-old) hardwood bark compost is due to antifungal compounds in the bark. The effect of mature (1-year-old) hardwood bark compost, however, is due to microorganisms that colonize bark after composting. These beneficial organisms can be found in soil, decaying organic matter, and bark composted for less than 3 months but are most abundant in composts older than 1 year. A future possibility is converting media that do not normally suppress plant pathogens into media with consistent disease-suppressive properties by adding these microorganisms.

Salinity stress intensified Phytophthora root rot severity in hydroponically grown chrysanthemums. Using the chrysanthemum model as a test system, J. D. MacDonald of the University of California at Davis found significantly more zoospores of *P. cryptogea* encysted on stressed roots than on nonstressed roots. More recent experiments showed that salt-stressed host tissues were also more susceptible to *P. cryptogea.* When inoculum dosage was adjusted so roots had equal numbers of encysted zoospores, salt-stressed roots were still more severely diseased. MacDonald hypothesized that salt interfered with normal host-plant defense mechanisms. Histopathological studies of stressed and nonstressed roots at intervals after inoculation showed that mycelium of *P. cryptogea* ramified through stressed roots much faster and to a greater extent than through nonstressed roots.

Apparently, saline-induced predisposition to Phytophthora root rot involves: 1) a significant increase in the number of zoospores that encyst on roots, resulting in numerous points of infection, and 2) a physiologic change in stressed root tissues that allows a rapid, spreading invasion by the pathogen. These two factors combined could result in severe disease problems when ornamental plants are cultivated in the presence of excess salinity owing to heavy use of fertilizers or other soil amendments, poor-quality irrigation water, or inadequate leaching of soils.

G. A. Chastagner, R. S. Byther, and E. Michaels of the Western Washington Research and Extension Center, Washington State University, Puyallup, have updated an earlier report on **Swiss needle cast disease of Christmas trees** in the Pacific Northwest. During 1981, they found that 84% of 2,650 Douglas-fir Christmas trees examined in western Washington and Oregon were infected with *Phaeocryptopus gaeumannii,* the causal agent of Swiss needle cast. At harvest, the infected trees generally retained only 2–3 years of needles. Older, symptomless needles often were infected, and their postharvest retention time on the tree was significantly reduced.

Controlling Swiss needle cast during the three years before harvest increases retention of needles at harvest and improves postharvest quality of Douglas-fir Christmas trees. Chlorothalonil, benomyl, and mancozeb effectively control the disease when applied during shoot extension in the spring. The effectiveness of helicopter applications of chlorothalonil was compared with that of backpack mist-blower applications of the fungicide in four plantations in western Washington during 1981 and 1982. Swiss needle cast was effectively controlled by a single application on 4 or 5 June of chlorothalonil at 8 pt/A by helicopter or two applications at 4 or 8 pt/A by mist blower. Control was less with 4 pt/A than with 8 pt/A applied by helicopter, particularly on needles in the middle or lower portions of the tree. Thus, application by helicopter required higher rates of chlorothalonil for uniform control than applications by backpack mist blower. Nevertheless, helicopter applications provide a rapid and convenient means of controlling Swiss needle cast.

The effects of **emissions from large coal-burning power plants** were nil on natural vegetation and Christmas tree plantings in western Pennsylvania, according to F. A. Wood (now dean of agriculture at the University of Florida, Gainesville) and a team of co-workers from Pennsylvania. The demand for electricity rose rapidly during the 1950s and 1960s, and large power plants were constructed in rural areas, often at the site of a coal mine, to meet this demand at the lowest cost. Preconstruction data were collected around the sites of several plants for three years (1964–1967) to provide a baseline for comparison after the plants were built and emissions began. Natural vegetation is mostly mixed oak with some northern hardwoods, and the only common native conifer species are eastern white pine and eastern hemlock. Christmas trees are a major crop, however; Scotch pine is the dominant species grown, and production is increasing rapidly.

From 1964 to 1981, sulfur levels were monitored and growth patterns of trees were analyzed. Sulfur dioxide (SO_2) injury was observed in the vicinity of existing sources of the pollutant (other than power plants), such as culm piles and coke ovens. SO_2 symptoms were observed at two of the three large power plants after they began operation, but injury was insignificant and was far exceeded by wind damage. In contrast, ozone (O_3) injury was common, widespread, and often severe, even before power plants began operation. The combination of O_3 and SO_2 caused chlorotic dwarf of eastern white pine and possibly some damage to Austrian and Scotch pines. The most significant problems confronting Christmas tree producers were not from air pollutants, however, but from needle cast diseases caused by *Lophodermium* and *Naemacyclus.* Ambient air monitoring indicated that SO_2 standards were rarely exceeded but that those for O_3 were exceeded much more often. The widespread O_3 symptoms observed during both the preoperation and postoperation phases of the study were not associated with distance and direction from the power plants. Such O_3 injury is now common throughout the Northeast; the ozone or preozone compounds apparently originate in metropolitan centers and are transported to remote rural areas.