FUNGICIDES IN THE NURSERIES

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Research on forest tree nursery dieseases in the United States has had four peaks of activity, roughly 20 years apart, since the early 1900's. Activity was high about 1915 with the establishment of several forest nurseries in the U. S. Research declined until 1935, when it gained momentum with the establishment of the Prairie States Forestry Project and other planting programs during the Great Depression. Activity again was reduced during World War II and only increased about 1955 with the soil bank and other planting programs, and with the need to control nematodes and serious root rots chiefly in southern nurseries. The pressure for research was reduced following the development of soil fumigation treatments which effectively reduced nematode damage, root rots, and damping-off losses. In contrast, in Canada, where soil fumigants have been used only sparingly there has been continuing investigation of nursery diseases, particularly diseases caused by soil-borne pathogens. Today in the U. S. there is an increase in seedling disease research prompted in part by the need to develop control measures for diseases of seedlings produced in containers.

The fungicides (excluding fumigants) available and used for control of soil-borne diseases have resulted in control for some diseases but have produced highly variable results in others. For example, the pelleting of seeds with fungicides, a practice common in the late 1950's and early 1960's is not widely used now because of highly variable results. Some test results have shown that during years when damping-off losses are moderate, the pelleted fungicides have not improved emergence; the number of seedlings being killed by the fungicide are balanced by the number of seedlings surviving because of protection by the fungicide.

Recent work in Canada and Great Britain may explain the highly variable results obtained when seeds are pelleted. A fungus which infects and kills seeds before they germinate has been found in seedlots of several conifer species. The interesting point is that, even though seeds are infected, they can germinate and produce healthy seedlings if temperatures are moderate (240C); however, when temperatures are in the vicinity of 10°C the fungus can cause germination failure. The fungus apparently does not kill the radicle or other tissues once they have grown through the seed coat distinguishing this pathogen from those fungi causing damping-off. Damping-off refers to killing of germinants either before or after emergence from the soil. British and Canadian investigators have shown that losses in infected seedlots

can be reduced if seeds are pelleted with fungicides such as thiram and captan. If the seedlots used did not contain this fungus, however, the fungicide treatment might have little effect on numbers of seedlings emerging.

The use of fungicide drenches on seed beds for control of damping-off fungi has also produced highly variable results. This is expected since several different fungi can cause damping-off; and these fungi vary in respect to the conditions (moisture, temperature) under which they are most damaging. Furthermore, the soil environment (texture, pH, nutrients, organic matter) in each nursery is different and these fungi can be expected to respond variably in the different soils. While some nurseries have successfully used fungicide drenches, others have found no value in them.

Controls for most of the foliage and stem diseases of seedlings are contained in "Forest Nursery Diseases in the United States" USDA Agriculture Handbook No. 470. Chemicals registered for most conifer seedling diseases as of March 1974 were published in the 1974 Southeastern Nurserymen's Conference Proceedings by W. H. Pawuk and L. P. Abrahamson. Fungicides registered since March 1974 are being compiled and will be provided to Association members and other participants later.

The increased production of containerized tree seedlings has been accompanied by disease problems peculiar to the way in which these seedlings are produced. Damping-off losses have been very low, usually less than one percent in well-run installations in which seedlings are grown in peat and vermiculite. However some damping-off fungi such as water mold (Pythium) species have caused damage after the usual period in which damping-off occurs. The Pythium species, favored by the high greenhouse humidity have been found on and causing damage to the aerial parts of seedlings. Accordingly, some operators routinely apply fungicides such as Dexon to seedling foliage to control water molds.

A blight of conifer seedlings caused by Botrytis cinerea (grey mold) has caused high losses in some facilities in which free moisture remains on foliage for a long time when temperatures are relatively low. Benlate has been used for control in combination with stringent sanitation (keeping all dead plant tissues out of greenhouses) and methods reducing length of time water remains on seedlings.

Benlate has been used to control Botrytis cinerea on a number of plant species other than trees and in some cases has lost effectiveness because of development of resistant forms of Botrytis. When Benlate is used it should be alternated with other fungicides effective against Botrytis (i.e. captan) to reduce the chance of build-up of resistant forms.

Phomopsis juniperovora blight of junipers has been controlled by Benlate which is registered for this use. Whether Benlate will effectively control Phomopsis under epidemic conditions has yet to be determined.

Nematodes and root rot diseases are most effectively controlled by fumigants (methyl bromide, chloropicrin, vortex, mylone). Use of fumigants such as methyl bromide in the absence of root rot and nematode diseases is sometimes justified on the basis of the weed control provided. However, this is very expensive weed control and it is hoped that the study on herbicides in western nurseries will lead to effective results so that fumigants will not have to be used solely for weed control.