PLANT PROTECTION

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(Panel Moderator)

CONTROLLING INFECTIOUS DISEASES IN NURSERIES

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At least 300 publications have been written about non-infectious and infectious diseases of tree seedlings. I will outline some of the progress that is being made in finding ways to control infectious diseases, those caused by pathogens. I will touch upon pre- and post-emergence damping-off, root rots, leaf spots, and fusiform rust, which are the most serious diseases in southern nurseries.

Damping-off and root rots are the most damaging both to hardwoods and conifers. Chemical treatments have been and are being developed, but they are effective only in conjunction with sound cultural practices. An environment which is conductive to rapid seedling, but not fungal, growth is required in nursery beds. Damping-off and root rots are caused by a large number of fungi, many of which are virulent only in extremely moist soil. Good drainage, therefore, is essential. Beds should probably not be established in heavy or excessively wet soil.

Nurserymen have long fumigated beds with methyl bromide to reduce or eliminate fungi and thereby control damping-off and root rots. This treatment requires a lot of labor and is effective only if the soil is moist and above 50°F. at the time of application. Studies are, therefore, under way to find a better treatment than fumigation for weed and fungus control.

The performance of Vorlex, a formulation made by the Morton Chemical Company, was recently compared with that of methyl bromide at the state nursery in Winona, Mississippi. The study was sponsored by the Southern Forest Experiment Station and the Mississippi Forestry Commission.

Plots 14 x 60 feet were laid out in a randomized block design, and methyl bromide fumigation was compared with six Vorlex treatments plus a control. Each treatment was replicated four times. Methyl bromide was spread under polyethylene at a rate of 430 pounds per acre. Vorlex was applied at rates of 20 and 40 gallons per acre in February, when the soil temperature *was* less than 40°F. Then, one of three post-application treatments was assigned:

1/ Panel presentation. Papers of panel participants are included.

1. Immediately sprinkling 1/2-inch of water over the soil surface, and applying another 1/2-inch the next day to seal the soil surface and keep it wet. These plots were not again disturbed until April when all plots were disked, plowed, and planted.

2. Plowing to a depth of 6 inches 30 days after treatment. The objective of plowing was to bury the weed seeds and to redistribute the remaining chemical.

3. Disking to a depth of 4 inches 30 days after treatment. The purpose was the same as in Number 2.

Ash and sycamore seeds were planted on all plots at equal spacings in 1968. In June 1968, the numbers of seedlings, their heights, and the number of competing plants were tallied for each plot.

In terms of seedling survival, 40 gallons per acre of Vorlex followed by a water soak to seal the soil was more effective than methyl bromide fumigation (table 1). The two treatments were equally good for weed control. Seedlings in methyl bromide-treated soil were tallest. The Vorlex treatment plus water seal must be considered as very promising. Other Vorlex treatments were inferior to fumigation.

Assistant Forester T. M. Markham of the Tennessee Forestry Commission applied Vorlex to approximately 7 acres of pine nursery at Jackson, Tennessee. Seedlings in treated beds were clearly superior to those in untreated beds. In 1968, Mr. Markham applied Vorlex to hardwood beds as well.

A preliminary test of two fungicides for control of two common damping-off fungi, Pythium sylvaticum Campbell & F. F. Hendrix and Fusarium solani (Mart.) Appel & Wr., *was* made in a greenhouse near Stoneville, Mississippi, in July 1965. Five hundred sweetgum seeds were planted in each of fourteen 3-foot x 2-foot x 4-inch pans. Two pans were assigned to each of seven treatments. The effects of the two chemicals, thiram and methyl mercury dicyandiamide, were observed by adding a fungus into treated and untreated pans. The thiram was applied to the seeds. The soil was drenched with methyl mercury dicyandiamide. A control with neither fungus nor chemical was included.

Temperatures during the tests were between 80° and 90°F. Pythium sylvaticum is considered less sirulent than Fusarium solani at these temperatures.

Thiram applied to seeds was not effective. Drenching the soil with methyl mercury dicyandiamide, on the other hand, appears to be very promising.

Table 1.--Heights of hardwood seedlings and numbers per acre of seedlings and weeds, by treatment

Treatment	Ash		Sycamore		Weeds	
	Height	Seedlings	Height	Seedlings	Grasses	Broadleaved plants
	Inches	No. / acre	Inches	No. / acre		
Vorlex plus water seal (40 gallons per acre)	3.3	745,000	6.5	571,000	4,000	4,000
Methyl bromide (430 pounds per acre)	4.3	335,000	7.6	409,000	4,000	4,000
No chemical	1.7	484,000	2.0	357,000	196,000	39,000

Fungus	Chemical	Emergence (%)
Pythium	None	81
Pythium	Thiram	72
Pythium	Methyl mercury dicyandiamide	94
Fusarium	None	72
Fusarium	Thiram	57
Fusarium	Methyl mercury dicyandiamide	96
None	None	96

Leaf diseases seldom cause serious damage to hardwood seedlings, and then they are likely to, they can usually be controlled by spraying chemicals, such as copper-zinc chromate and maneb (manganese ethylene bisdithiocarbamate). Leaf diseases in hardwoods usually appear either during periods of high humidity or when sprinklers are used at night or in late afternoon. The fungus Cylindrocladium scoparium Morg., for example, occasionally causes leaf spots on yellow-poplar, sweetgum, and oak seedlings. It usually inhabits the soil exclusively, but during wet periods it sporulates on the surface of the soil. The spores can then be carried by the wind to leaves, which are penetrated directly.

Cedar blight and brown spot are serious problems in conifer nurseries. Cedar blight, which is caused by Phomopsis juniperovora Hahn, attacks members of the cypress-cedar family. Dr. G. W. Peterson of the U. S. Forest Service reports that phenylmercuric tri-ethanol ammonium lactate controls the disease caused by this fungus. Although the symptoms are the same, the blight that attacks eastern redcedar and Arizona cypress in southern nurseries is probably not caused by the same fungus. I have been unable to isolate P. juniperovora from diseased tissue of these species. Dr. Wesley Witcher of Clemson University is now seeking the cause and cure for the disease.

Brown spot, caused by Scirrhia acicola (Dearn.) Siggers, is very damaging to longleaf pine seedlings in the grass stage. It also attacks loblolly and white pines of all ages, but with far less harmful results. The treatment now recommended for control of brown spot in nurseries is four to six applications of ferbam between June and October.

In southern nurseries, the only rust of major significance is southern fusiform rust, which is caused by Cronartium fusiforme Hedgc. & Hunt ex Cumm. Infected seedling stems are easily overlooked during

grading. Thus, diseased seedlings are sometimes sent to planters. Nurseries in areas where the disease is common should prevent infection by spraying ferbam every 3 days from April through June.

Fungicides are necessary in the modern nursery. They increase production and can help prevent the spread of diseases to the field. As in the past, however, the best protection against disease is a vigorous seedling. There is still no substitute for skillful seedling culture.