Fungicide Control of Algae in Containers

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The fungicides maneb and dichlone controlled algae in styroblock containers in the greenhouse. Treatments were nontoxic to shortleaf pine seedlings.

Many blue-green and green alga species form on soil in containers used for growing containerized southern pine seedlings (*1*). When algae dry, a crust develops, creating a barrier that interferes with irrigation, fertilization, and pesticide applications (*2*).

Chemicals that control algae in water are not labeled for soil treatments, so the greenhouse manager has no guidelines for selecting appropriate chemicals for soil treatments. During greenhouse disease control studies, suppression of algae development was noted by certain fungicidal treatments. A screening study was then established, and 11 materials were evaluated for controlling algae on soil in styroblock containers used to grow shortleaf pine (*Pinus echinata* Mill.). After the screening test was completed, a second study was installed to refine application rates for the most effective chemicals.

[1]Research was conducted while the author was assigned to the USDA Forest Service, Southern Forest Experiment Station, Pineville, La.

Methods

Study I. Individual cavities in styroblock containers are circular, 2.5 centimeters in diameter, and 10.2 centimeters deep. Cavities were filled with a peat-lite medium (Jiffy Mix), watered, and planted with shortleaf pine seed germinants. From 2 weeks after planting, each time the seedlings were irrigated, they were also fertilized with Peters Peat-Lite 20N-19 P-18 K water soluble fertilizer at the rate of 150 parts per million nitrogen (N). Chemical treatments were applied immediately after the first fertilization and 4 weeks later. All chemicals were applied in water at 1 milliliter per cavity, but not as a foliar spray.

The following substances were tested: Simazine (2-chloro-4, 6-bis (ethylamino)-5-triazine), dichlone (2,3-dichloro-1, 4-napthoguinone), maneb (manganese ethylene bis dithiocarbamate), Bordeaux mixture (equal parts copper sulfate and calcium hydroxide), cutrine (copper citrate and copper glucinate chelates), captan (N-trichloromethylthio-4-cyclohexene-1-2 dicarboximide), Clorox (5.25 percent sodium hypochlorite), sulfur (wettable dusting sulfur, 95-percent pure), zineb (zinc ethylenebisdithiocarbamate) copper sulfate, and Kocide 101 (cupric hydroxide) (table 1).

The screening study was established as a split-plot design with four randomized complete blocks

Table 1.—*Algae development after 10 weeks, under varying fungicide treatments*

Treatment	Algae development'			
Concentration 2	0.02	0.03	0.04	0.05
Simazine	.8	.0	.0	.0
Concentration	.1	.2	.3	.4
Dichlone	1.8	1.2	.8	.5
Maneb	2.8	1.2	.8	.2
Bordeaux mixture	4.0	3.0	2.0	.8
Captan	2.5	3.2	3.2	2.8
Sulfur	3.0	3.2	3.5	3.8
Zineb	3.5	4.0	3.8	3.8
Copper sulfate	4.0	4.0	3.8	3.8
Kocide 101	4.0	4.0	4.0	4.0
Concentration	.5	1.0	1.5	2.0
Cutrine	2.5	3.5	2.0	1.8
Clorox	3.2	3.0	2.5	3.2
Check	3.9			

[1]Algae development based on the following rating: 0 = no algae present, 1 = algae present but barely detectable, 2 = algae forming a pale thin film, 3 = algae forming a thin mat less than 0.5 millimeter thick, 4 = algae forming a thick mat greater than 0.5 millimeter thick.
[2]Concentrations in milligrams per square centimeter

Each treatment was applied to one cavity in each replication. At 10 weeks, algae control was estimated on a scale of 0 to 4, with 0= no algae present, 1 = algae present but barely detectable, 2 = algae forming a pale green film, 3 = algae forming a thin mat less than 0.5-millimeter thick, and 4 = algae abundant forming a thick mat greater than 0.5 millimeter.

Study II. Maneb and dichlone were selected from the screening tests for further evaluation. Culture was identical to that in the screening study, except that seedlings were established by sowing,

and treatments and controls were evaluated after 13 weeks. Dichlone and maneb were applied as a single drench at 0.4, 0.6, 0.8, and 1.Ormilligram of active ingredient per square centimeter at either 3 or 5 weeks after sowing. They were also applied at half concentration (0.2, 0.3, 0.4, and 0.5) at 3 and 8weeks (table 2). The total amount applied was the same for the single drench. A check (untreated) treatment was included.

This study was established in a randomized complete block design with four replications. Each treatment replicate comprised 10 seedlings. Average height and dry weight of the seedlings in each treatment replicate were determined after 13 weeks.

Table 2.—*Algae development and shortleaf pine seedling growth in containers at 13 weeks drenched with maneb and dichlone*

Variables	Algae development	Seedling height	Seedling dry weight
	Rating[1]	*Cm*	*Mg*
Material[2]			
Control	2.7	14.5c[3]	412c
Maneb	1.5	16.7a	528a
Dichlone	1.9	16.0b	474b
Time applied[4]			
Week 3 and 8	1.6b	16.4a	505a
Week 3 only	1.8a	16.4a	512a
Week 5 only	1.7b	16.2a	486a
Drench rate (mg/cm 2)[2]			
0.4	2.0	15.8b	489a
.6	1.7	16.4ab	502a
.8	1.6	16.7a	508a
1.0	1.5	16.6a	505a

[1] Algae rating: 0= no algae present, 1 =algae present but barely detectable, 2=algae forming a pale green film, 3 = algae forming a thin mat less than 0.5 millimeter thick, and 4 = algae forming a thick mat greater than 0.5 millimeter thick.

[2] An interaction among drench rates and materials occurred in the algae development data. Maneb was better than dichlone at the 0.8- or 1.0-milligram rates, but not at the others.

[3] Mean separation in columns for treatment variable groupings by Duncan's multiple range test (P=0.05).

[4] Maneb and dichlone applied as a single drench.

Results

Study I. Algae formed a thick mat on soil in control plots and many treatment plots. Simazine gave the best control, but was toxic to shortleaf pine seedlings at all levels tested (table 1). Bordeaux mixture, dichlone, and maneb gave good control at one or more concentrations and were not phytotoxic. Dichlone and maneb were more effective than Bordeaux mixture at low concentrations and were selected for further testing.

Study II. Both maneb and dichlone reduced algae development (table 2). Algae control was better when fungicides were applied at 3 and 8 weeks or at 5 rather than at 3 weeks. There was an interaction between amount applied and fungicide. Maneb was better than dichlone at 0.8 or 1.0 milligram, but not at0.4or0.6 milligram. At each drench schedule, algae development decreased as maneb concentration increased. This trend was not present in the dichlone treatments.

Drenching increased height growth over the check treatment. Seedlings drenched with maneb were significantly taller than those drenched with dichlone, but they differed by only 0.7 centimeter. Height growth was unaffected by drench schedule, but was affected

by amount of chemical applied. Seedlings from the 4-milligram treatment were smaller than those from the 0.8- or 1.0-milligram treatment. None of the other treatments differed from each other.

Drench schedule or rate did not affect seedling dry weight, although all treatments resulted in heavier seedlings than the check. Seedlings drenched with maneb were larger than seedlings drenched with dichlone.

Discussion

Several chemicals were evaluated for their effectiveness in controlling algae on media surfaces, and possible toxicity to pine seedlings. Maneb and dichlone were the most effective of those materials tested. Neither maneb nor dichlone inhibited the growth of shortleaf pine seedlings when applied to the soil surface, and growth was greater in many treatments than in checks. The increase in growth may have been from chemical protection of seedlings from pathogenic soil fungi or from more efficient water and nutrient infiltration when algae is controlled. From a practical viewpoint, any treatment giving control at 2.0 or better (algae forming a pale green film to none present) would be operationally satisfactory.

Literature Cited

1. Barnett, J. P. Covering affects container germination of southern pine seeds. Tree Plant. Notes. 29(2):13-15; 1978.
2. Tinus, R. W.; McDonald, S. E. How to grow tree seedlings in containers in greenhouses. Gen. Tech. Rep. RM-60. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station; 1979. 256 p.