FUNGICIDE COVERINGS AFFECT THE GERMINATION OF SOUTHERN PINE SEEDS

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Germination of longleaf, shortleaf, and loblolly pine seed was less affected by a wide range of fungicide coatings than slash pine seed. Captan and Arasan had no effect on germination. Busan 72, although registered for treating pine seed, reduced slash pine germination at recommended concentrations.

Damping-off is often a major problem when growing containerized pine seedlings, especially in closed environments where conditions are favorable for rapid spread of disease organisms (*2*)(*3*). *Fusarium* spp. have been identified as the pathogens mainly responsible for heavy seedling mortality in central Louisiana greenhouses where containerized seedling production is being tested. The fungi are often introduced on infested seedcoats. Seedcoats can be sterilized by soaking them in hydrogen peroxide (*1*) but such treatments do not protect against reinfestation during germination. Coating seeds with a fungicide should provide more lasting protection, but fungicides might also reduce viability.

Materials and Methods

Each fungicide (table 1) was tested on slash, loblolly, shortleaf, and longleaf seeds at *1, 2, 4, 8,* and 16 ounces active ingredient per 100 pounds of seed. The fungicides and seed were mixed in a beaker until seeds were uniformly coated. Treated seed was dried overnight and then germinated in a seed-testing laboratory in closed plastic trays on a moist, sand-vermiculite (1 :1) medium at 72° F with 120 footcandles of light and a 16-hour photoperiod. Seeds were watered once at the start of the study. Germination was recorded at 7 days and at *2* to 3 day intervals thereafter, up to *28* days.

Fungicide treatments consisted of three replications of 100 treated seeds. Germination boxes were placed on shelves in a completely randomized design. Untreated seeds served as controls. One seed source was used for each species. Separate analyses were made for each species-fungicide combination, using Dunnett's two-tailed T test (at the 0.05 level) to compare treatment means to the control.

Table 1.—Maximum *fungicide dosages* that did not inhibit germination *of four southern pine seeds*

Fungicide[1]	Slash	Loblolly	Shortleaf	Longleaf
	(Oz. ai/100 lb. of seed)			
Captan 50 WP	16[2]	16	16	16
Arasan 42-S	16	16	16	16
Bunema 40 S	8	8	8	16
Terraclor 75 WP	4	16	16[3]	8
Demosan 65 WP	4	16	16	8[3]
HMI 90 percent Tech	2	2[3]	4	16
Truban 30 WP	2	8	16	16
Banrot 40 WP	2[3]	4	2	4[3]
Dexon 35 WP	2	4	2	8
Terra-Coat SD-205, 25 WP	2	8	4	16
Mertect 42 F	1	8	4	4
Benlate 50 WP	1	4	2	2
Busan 72 60 EC	0	4	28	4
Terra-Coat L-205, 30 L	0	4	2	4
Nurelle 7.2 EC	0	0	0	0
Control germination percent[2]	90	86	78	58

[1] Common names and chemical names for the fungicides can be found in Fungicide and Nematicide Tests. 1977. American Phytopathological Society 32: 240-251.

[2] Seed germination was analyzed separately for each fungicide-species combination, using Dunnett's T test. Differences were significant when germination deviated from the control by 8 percent for slash and shortleaf and 9 percent for loblolly and longleaf pine.

[3] In these cases deviation had to exceed 8 percent for slash and shortleaf and 9 percent for loblolly and longleaf pine to be significant.

Results

Slash seed was the most sensitive to fungicides. All but 5 chemicals reduced slash germination below that of untreated seed when applied at 4 ounces or more (table 1). Loblolly and longleaf were the most tolerant species, with only two fungicides reducing germination at concentrations of 4 ounces or more. Shortleaf response was intermediate.

Applied at the highest rate (16 ounces), only Captan and Arasan did not reduce slash seed germination. These two fungicides were also satisfactory with the other three species, and they significantly boosted germination of longleaf by about 8 percentage points. High concentrations of Terraclor and Demosan had no adverse effect on loblolly and shortleaf pine, and Truban was not phytotoxic to shortleaf or longleaf pine. Longleaf was also unaffected by Bunema and Terra-Coat SD-205 WP.

All other fungicides reduced germination of all four species. Nurelle was particularly harmful even at the 1-ounce rate. Many of the others became phytotoxic at 8 ounces or less.

HMI did not reduce germination of any species at the 1- and 2-ounce rates and stimulated longleaf germination at rates from 1 to 8 ounces. But, as HMI concentration increased, radical elongation was ;.ihibited. Although less noticeable on longleaf, high concentrations on the other species so greatly reduced radical elongation that the seedlings fell over shortly after they germinated.

Discussion

In this study, fungicides were applied without a sticker. Consequently, some erosion of chemicals from seeds into the growing medium probably occurred when the containers were watered. It is not known if phytotoxicity resulted from injury to the seed or to the emerging radicles.

Busan is registered for seed treatment of pine at 0.53 fluid ounces per bushel of seed, which is approximately equal to 1 ounce active ingredient per 100 pounds of seed. This level significantly reduced slash germination from 90 to 73 percent, but was innocuous to the other species. Busan should not be used on slash pine seed at this level, and should only be used on other species after determining it is harmless.

Captan and Arasan were the least toxic of the chemicals tested. They gave no indication of toxicity even at the 16-ounce level. This does not suggest that all other fungicides should be discarded from consideration. Some may be quite effective
against disease organisms at levels nontoxic to seed.

Results from this study may help nurserymen to avoid fungicides that are harmful when applied to containers as drenches between sowing and germination. Chemicals that proved detrimental in this study are suspect.

Once fungicides that do not harm seed viability are identified the most promising can be tested for effectiveness against damping-off fungi.

Literature Cited

1. Barnett, J.P
1976. Sterilizing southern pine seed with hydrogen peroxide. U.S. Dep. Agric. For. Serv. Tree Planters' Notes 27(3): 17-19, 24.

2. Pawuk, W. H. and J. P. Barnett.
1974. Root rot and damping-off of container grown southern pine seedlings. In Proc. North Am. Containerized For. Tree Seedling Symp. Great Plains Agric. Counc. Pub. 68, p. 173-176.

3. Peterson, G. W.
1974. Disease problems in the production of containerized forest tree seedlings in North America. In Proc. North Am. Containerized For. Tree Seedling Symp. Great Plains Agric. Counc. Pub. 68, p. 170-172.