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ABSTRACT. Root diseases, which are caused by Macrophomina phaseolina (charcoal root rot fungus), Fusaria spp., Cylindrocladium spp., and Phytophthora spp., periodically continue to cause widespread and significant seedling damage in southern nurseries. The most effective and efficient control continues to be soil fumigation with methyl bromide-67%; chloropicrin-33% fumigant formulations before seed sowing.

The Conservation Reserve Program (CRP) has stimulated conversion of large acreages of cropland to pine plantations in the South. Excessive tree damage and poor survival are showing up in CRP plantings in several Southern States.

Field tests over a 3-year period demonstrate the importance of the seed treatment in a fusiform rust control program in southern nurseries. In greenhouse tests, seedling emergence was greater after seed dressing with Bayleton 50WP.

Tip-blight of southern pine nursery seedlings, caused by Phoma sp., has been observed for the last 10 years. Mulching with hardwood bark chips has proved significantly more beneficial than mulching with Geotech, spraying with 1 and 2 pounds active ingredient Kocide and Benlate per acre, and no treatment.

Additional Keywords: Nursery seedling root diseases, Conservation Reserve Program (CRP) pest problem, Bayleton seed treatment, fusiform rust nursery seedling control, nursery seedling tip-blight, hardwood bark/chip mulch treatment.

Nursery root diseases and pest problems in the Conservation Reserve Program (CRP) tree plantings - Charles E. Cordell.

Root diseases, which are caused primarily by Macrophomina phaseolina (charcoal root rot fungus), Fusaria spp., Cylindrocladium spp., and Phytophthora spp., periodically continue to cause widespread and significant seedling damage in southern nurseries (Peterson and Smith 1975, Cordell and others 1988). Charcoal root rot (M. phaseolina and Fusaria spp.) is causing significant damage to loblolly, slash, and longleaf pines; and dogwood and

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sweetgum seedlings in several southern nurseries. Cylindrocladium root rot (Cylindrocladium spp.) continues to cause widespread damage to eastern white pine and black walnut, yellow-poplar, and sweetgum seedlings. Phytophthora root rot (Phytophthora spp.) is a periodic pest problem on Fraser fir and sand pine.

The majority of these soil-borne pathogenic fungi have very widespread geographic and host ranges; caused a variety of disease types on roots, stems, and foliage; and are capable of surviving under adverse environmental conditions for extended time periods. These diseases also damage recent field plantings, as well as older-aged conifer and hardwood plantations and natural stands. Root disease symptoms include blackening, longitudinal cracking, decortication, and necrosis of feeder, lateral, and primary taproots. Top symptoms include basal stem cankers; foliage discoloration, blight, and wilt; and tree mortality. Significant seedling losses have occurred periodically in southern nurseries during the past decade. One nursery in northern Florida realized a saleable seedling loss of 15 million pine seedlings, caused by charcoal root rot (M. phaseolina), in 1976. This is the largest single nursery seedling loss to date in the Southern U.S.

The most effective and efficient control for these soil-borne nursery pest problems with their highly resistant fungus spore stages is soil fumigation using a strong methyl bromide formulation such as methyl bromide-67%; chloropicrin-33% (Cordell and Filer 1985). At present, there are no effective alternative chemical treatments to soil fumigation with methyl bromide.

The Conservation Reserve Program (CRP) is a federally-funded, forest incentives program and is administered by the USDA Agricultural Stabilization and Conservation Service (ASCS), the USDA Forest Service, and the state forestry agencies in the U.S. The CRP, established in 1985, is a voluntary land retirement program designed to reduce soil erosion and provide agricultural crop replacement alternatives to nonindustrial private landowners throughout the U.S. The landowners make bids for rental payments (the minimum they will accept to retire the land) during a sign-up period. Land is declared eligible on the basis of criteria established for the program, and contracts for eligible land include annual payments to the landowner for 10 years. Program eligibility is determined by ASCS and is based on such factors as erosion hazard, prior cultivation, and present availability for crop production. Land accepted in the CRP must be protected from erosion by planting trees or some other form of permanent vegetation cover, such as grass. Congress has targeted 12.5 percent (1/8) of the total CRP acreage for tree plantings. The CRP has resulted in pine planting on large acreages of agricultural cropland in the Southern U.S. during the 1986-87 and 1987-88 tree planting seasons. Approximately 1.46 million acres have been planted to trees during the first six CRP sign-up periods (1985-87) in our 13 Southern States from Virginia to Texas. This represents about 92 percent of the total CRP tree-planted acreage (1.58 million acres) in the U.S. Three Southern States (Georgia, Mississippi, and Alabama) contain approximately 63 percent (994,500 acres) of the total CRP tree-planted acreage. All 13 Southern States are participating in the CRP. Acreage planted to trees in Southern States ranges from a high of 470,392 acres in Georgia to a low of only 528 acres in Oklahoma. Seven of the 13 States have over 50,000 acres planted to trees.

As might be expected, excessive tree damage and poor survival are occurring in widely separated locations in several southern states. Tree damage and mortality varies greatly both within and between field planting sites. Numerous field observations and limited surveys in several states have revealed a wide variety of probable causal agents, including diseases, insects, nematodes, residual herbicides, poor seedling quality, poor planting techniques, adverse sites, and drought. However, no single causal agent, or even groups of causal agents, have been either consistently or definitively associated. At least in localized areas, definite tree damage and survival problems exist. Field reports from several states relate possible tree damage to certain agricultural crops, such as soybeans. These observations are based on limited nonstandardized field surveys; however, a more intensive, widespread, standardized field survey would help to determine the effects of such factors on tree survival. Consequently, during the summer and fall of 1988, a cooperative, southwide CRP planting pest survey is planned by Forest Pest Management, Region 8, USDA Forest Service, and the respective State Forestry and Agricultural Stabilization and Conservation Service (ASCS) agencies in the affected states. The primary objectives of this survey are to collect CRP planting site background information, seedling mortality incidence, and causal agent(s), along with possible correlations of observed mortality with former agricultural crops. The survey will be completed during the fall of 1988, and a report will be distributed to all cooperators.

The effects of Bayleton seed treatments on fusiform rust control and pine seed viability in southern forest tree nurseries - Walter D. Kelley and G.B. Runion.

During the last 6 years, the systemic fungicide Bayleton (Triadimefon) has become established as the fungicide of choice for control of fusiform rust in forest tree nurseries in the Southern U.S. Recommendations for rust control with Bayleton have been refined (Kelley 1985) since the original paper (Snow and others 1979) was published.

Research efforts at Auburn University during the past few years have concentrated on achieving maximum rust control with minimum use of Bayleton.

Greenhouse tests were established to determine effects of four seed treatments on viability and rate of emergence of loblolly and slash pine seeds: 1) Nontreated seeds; 2) Gustafson 42S at 15 g a.i./kg of seeds; 3) Bayleton 50WP at 1.25 *g* a.i./kg of seeds; and 4) a combination of treatments 1 and 2 above. All seed treatments were applied with and without a latex sticker. Loblolly seeds were stratified; slash were not. Emergence counts were made daily for 35 days after sowing.

Results are presented in Tables 1 and 2 for slash and loblolly pines, respectively. For slash, significant differences among the treatments did not occur until the 20th day after sowing. At 35 days, the greatest decrease in emergence was recorded in the Gustafson 42S plus latex treatment; highest percentage emergence was recorded in the Bayleton plus latex treatment. For loblolly, differences among treatments were recorded as early as day 10, but were not evident again until after day 25. As with slash seeds, greatest decrease in emergence was recorded in the Gustafson 42S treatments, both with and without latex.

Table 1.--Percent emergence[1] of loblolly pine seeds[2] at various times after sowing for the various fungicide seed treatments.

Fungicide[3]	Latex	Days after Sowing					
		10	15	20	25	30	35
Neither	-	42.0 a[4]	66.7 a	73.0 a	75.2 a	76.7 a	78.0 a
Neither	+	38.2 ab	60.8 a	66.8 a	69.8 a	70.7 ab	71.5 abc
Gustafson	-	33.2 ab	59.0 a	65.3 a	67.7 a	68.0 b	68.3 c
Gustafson	+	33.7 ab	58.3 a	65.8 a	68.5 a	69.0 ab	69.2 be
Bayleton	-	29.2 b	60.2 a	65.5 a	68.8 a	71.8 ab	73.8 abc
Bayleton	+	41.0 a	65.5 a	71.8 a	73.2 a	75.3 ab	76.8 ab
Both	-	29.8 b	66.2 a	74.2 a	75.8 a	76.6 a	77.5 a
Both	+	31.5 b	65.5 a	73.2 a	75.3 a	76.0 a	76.8 ab

[1] Data are the percentage of all sown seeds that emerged by the various days after sowing and are based on 200 seeds per treatment in each of three runs of the experiment.

[2] Loblolly pine seeds were stratified by soaking in water for 24 hours and holding at 5°C for 6 weeks prior to sowing.

[3] Gustafson 42S was applied at 15 g a.i./kg seeds; Bayleton 50WP was applied at 1.25 g a.i./kg seeds; and latex was applied at 5 ml product/kg seeds.

[4] Percentages followed by the same letter are not significantly different ($P < 0.05$) according to Duncan's multiple range test.

Table 2.--Percent emergence[1] of slash pine seeds[2] at various times after sowing for the various fungicide seed treatments.

Fungicide[3]	Latex	Days after Sowing					
		10	15	20	25	30	35
Neither	-	30.5 a[4]	55.8 a	64.5 a	68.8 a	73.2 ab	76.0 abc
Neither	+	31.8 a	55.0 ab	63.7 a	67.8 a	74.5 ab	77.8 ab
Gustafson	-	32.3 a	55.2 ab	63.7 a	67.2 a	70.0 ab	72.7 bc
Gustafson	+	28.3 a	48.3 b	56.8 b	60.7 b	63.2 c	65.7 d
Bayleton	-	32.3 a	57.8 a	66.2 a	68.5 a	72.5 ab	75.7 abc
Bayleton	+	29.7 a	57.3 a	65.3 a	69.5 a	75.8 a	79.0 a
Both		26.0 a	52.8 ab	62.2 ab	66.0 a	70.0 ab	73.2 bc
Both	+	24.2 a	50.8 ab	60.2 ab	64.5 ab	66.7 bc	68.2 c

[1] Data are the percentage of all sown seeds that emerged by the various days after sowing and are based on 200 seeds per treatment in each of three runs of the experiment.

[2] Slash pine seeds were not stratified, but were soaked in water for 24 hours prior to sowing.

[3] Gustafson 42S was applied at 15 g a.i./kg seeds; Bayleton 50WP was applied at 1.25 g a.i./kg seeds; and latex was applied at 5 ml product/kg seeds.

[4] Percentages followed by the same letter are not significantly different ($P < 0.05$) according to Duncan's multiple range test.

Plots were established at three nurseries to determine the most effective program for control of fusiform rust using Bayleton. Bayleton sprays at a rate of 4 oz. a.i./acre/application were applied both to plots sown with Bayleton-treated seeds and to plots sown with untreated seeds; all seeds were treated with Gustafson 42S as a bird repellent. Bayleton spray treatments were: 1) all sprays missed, 2) first spray missed, and 3) no sprays missed. Study plots were assessed for fusiform rust incidence at lifting time.

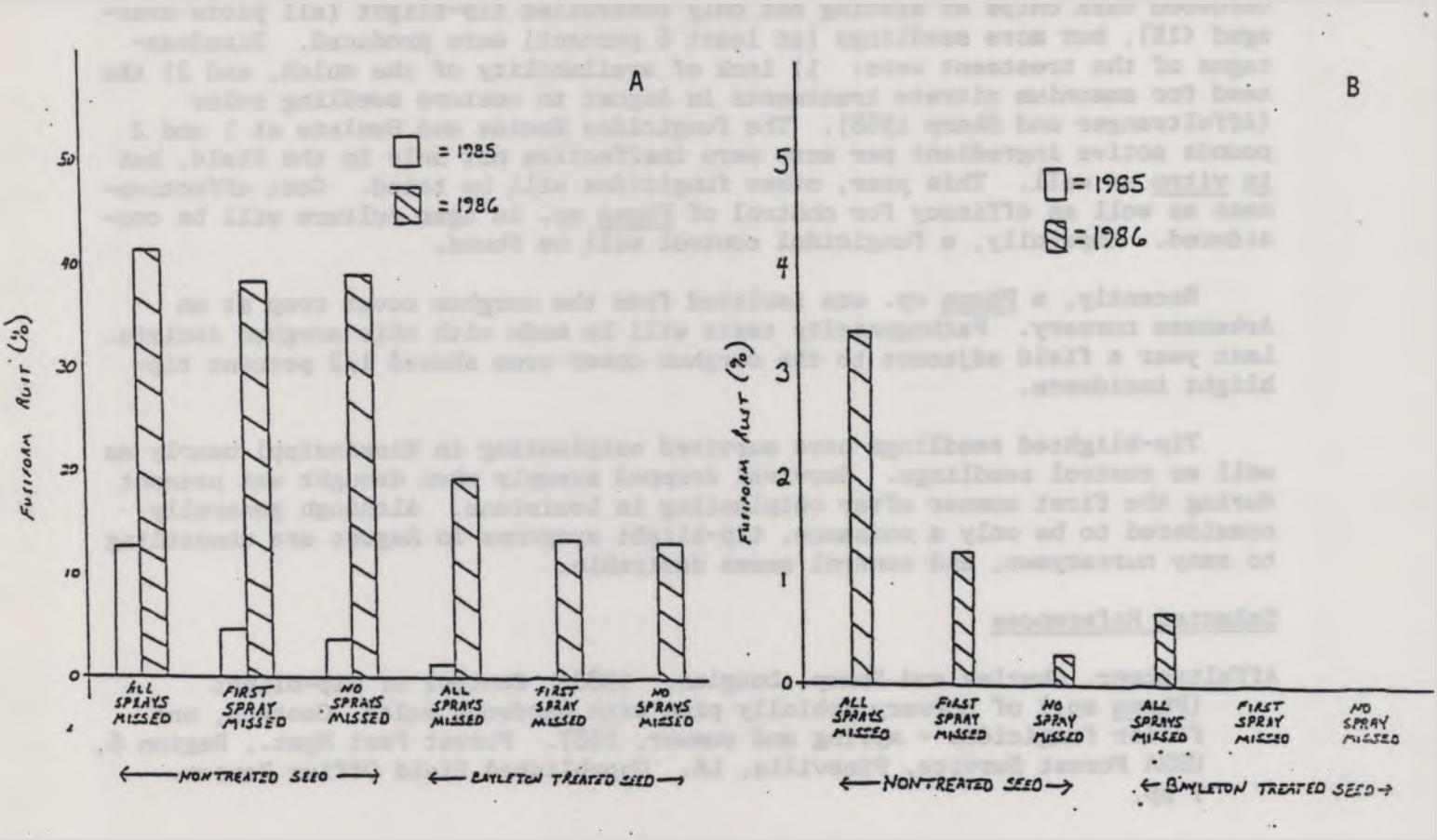
Results are shown in Figure 1. In all cases, the single most important step in the rust control program was the seed treatment with Bayleton. In all cases where Bayleton seed treatment was used, the first scheduled foliar spray with Bayleton could have been missed with no adverse consequences. Losses were considerable when seeds were not treated with Bayleton and the first foliar spray was missed in two of the three nurseries.

Results of these tests demonstrate that Bayleton dressing on loblolly and slash pine seeds has little effect on seed viability and seedling emergence. The slight decrease in seedling emergence resulting from seed treatment with Gustafson 42S probably is insignificant compared to the value of this compound as a bird repellent. The lack of an effect by Gustafson 42S on seedling emergence when combined with Bayleton on loblolly seeds is important, but cannot be explained by this study. For slash seeds, the decrease in emergence due to Gustafson 42S was not offset by the use of Bayleton; this result suggests that perhaps slash pine seeds are more sensitive to seed treatments than are loblolly seeds. Data from the field tests indicate that fusiform rust control treatments can be refined. However, we are lacking proper environmental and epidemiological data to predict infection periods precisely enough to recommend alterations in the existing program.

Control of tip blight (Phoma sp.) with hardwood mulch on loblolly pine seedlings in a southern nursery - Charles E. Affeltranger.

Tip-blight, caused by Phoma sp., kills back the terminals of slash and loblolly pine nursery seedlings. It often kills 2-3 inches of the terminal, but it can cause mortality in defined centers. When only the top 2-3 inches are killed, the disease can be top-pruned out. A frequent early symptom is a purpled, crooked terminal with reddening of older side needles.

In western nurseries, a similar disease caused by P. eupyrena on true fir and Douglas-fir was found to readily reinvade fumigated soils and to survive in soil cones for 3 months in the Pacific Northwest winter (Kliejunas et al. 1985). In this study, the disease was restrained by redwood mulch applied at seeding and by the fungicide Daconil. In southern nurseries, undercutting tip-blighted seedlings usually kills them when symptoms appear in late July. Symptom expression usually terminates in late September, but June symptoms have also been reported. The disease is favored by hot, moist, and rainy weather (Peterson 1977). At an Arkansas nursery, inoculation was followed by symptoms in 9-12 days and began in a wet area adjacent to a riser line. During this interval, seedlings were irrigated for 3 hours after inoculation, and a sudden thunderstorm dropped rain on the seedlings 3 days after inoculation. The 9- to 12-day incubation (infection to symptom expression) period was confirmed by greenhouse work.



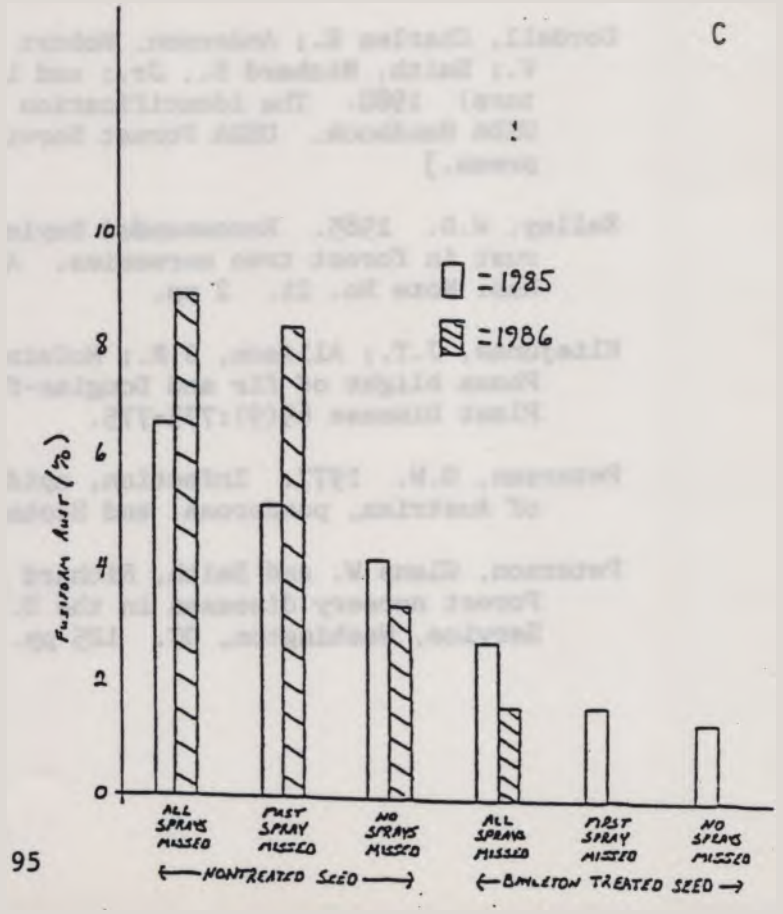


Figure 1. Effects of various Bayleton treatments on incidence of fusiform rust at three different nurseries during 1985 and 1986 seasons.

An early September evaluation indicated that applying 1/2 to 1 inch of hardwood bark chips at seeding not only controlled tip-blight (all plots averaged <1%), but more seedlings (at least 8 percent) were produced. Disadvantages of the treatment were: 1) lack of availability of the mulch, and 2) the need for ammonium nitrate treatments in August to restore seedling color (Affeltranger and Sharp 1988). The fungicides Kocide and Benlate at 1 and 2 pounds active ingredient per acre were ineffective not only in the field, but in vitro as well. This year, other fungicides will be tried. Cost effectiveness as well as efficacy for control of Phoma sp. in agar culture will be considered. Hopefully, a fungicidal control will be found.

Recently, a Phoma sp. was isolated from the sorghum cover crop at an Arkansas nursery. Pathogenicity tests will be made with this sorghum isolate. Last year a field adjacent to the sorghum cover crop showed 1/2 percent tip-blight incidence.

Tip-blighted seedlings have survived outplanting in Mississippi nearly as well as control seedlings. Survival dropped steeply when drought was present during the first summer after outplanting in Louisiana. Although generally considered to be only a nuisance, tip-blight symptoms in August are unsettling to many nurserymen, and control seems desirable.

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