Bayleton Applied to Bareroot Nursery Stock Reduces Fusiform Rust in First Year After Outplanting

S. J. Rowan

Principal Research Plant Pathologist, USDA Forest Service, Southeastern Forest Experiment Station, Athens, Ga.

Bayleton applied to bareroot nursery stock at 600 milligrams per liter as a top dip, root dip, or clay slurry prevented fusiform rust infections in loblolly pine seedlings artificially inoculated 3 months later. Clay slurries containing 600, 800, 1,000, and 1,500 milligrams of Bayleton per liter prevented natural infections during the first infection season after outplanting, but top and root dips prevented natural infections only at Bayleton concentrations of 1,500 milligrams per liter.

Fusiform rust caused by *Cronartium quercuum* (Berk.) Miyabe ex Shirai f. sp. *fusiforme* is the most important disease in forest nurseries and young plantations in the Southeastern United States. The systemic fungicide Bayleton (triadimefon; 1- (4-chlorophenoxy)-3, 3-dimethyl -2-(1 H-1,2, 4-triazol-1-yl)-2-butanone) has 24-C registration for use as a foliar spray in forest tree nurseries for control of fusiform rust. The fungicide also controls the disease when applied as a seed treatment or soil drench (6, 7). Because most damaging fusiform rust infections occur during the first 5 years after planting (2), a treatment of nursery stock that provides some control in the young plantation would be most valuable.

This paper reports results of applying Bayleton to 1-0 loblolly pine seedlings for control of fusiform rust after outplanting.

Methods

Loblolly pine seedlings were lifted from a Georgia nursery and groups of 100 seedlings in Wakeley's grade 2 were exposed to various Bayleton treatments (table 1). Five concentrations were applied in water as root and top dips and five concentrations were applied in clay slurry as a root dip. Roots of control seedlings were either dipped in a Bayleton-free clay slurry or received no treatment. Aqueous suspensions of Bayleton were formulated to contain 600, 800, 1,000, and 1,500 milligrams of active ingredient and 2.5 milliliters of the adjuvant Agridex per liter. The clay slurry used as a root dip was formulated to contain Bayleton and 45.35 percent kaolinitic clay (less than 2-

Table 1—*Efficacy of Bayleton[1] for control of fusiform rust in 1-0 loblolly pine nursery stock[2]*

Treatment	Bayleton concentration	Seedlings galled: Greenhouse—artificial inoculations	Seedlings galled: Nursery—natural infections
	Mg/l	%	
Check	0	10.9a[3]	4.0a
Check:clay slurry	0	4.8a	6.3a
Top dip	600	.0b	4.0a
	800	.0b	4.2a
	1,000	.0b	2.1b
	1,500	.0b	.0c
Root dip	600	.0b	2.0b
	800	.0b	4.2a
	1,000	.0b	2.0b
	1,500	.0b	.0c
Clay slurry	600	.0b	.0c
	800	.0b	.0c
	1,000	.0b	.0c
	1,500	.0b	.0c

[1] Bayleton was formulated to contain 2.5 milliliters of the adjuvant Agri-dex per liter. The clay slurry contained 45.35 percent kaolinitic clay.

[2] Seedlings were artificially inoculated 3 months after treatment or exposed to first-year natural-field inoculum.

[3] In each column, means followed by a common letter do not differ ($P = 0.05$) according to Duncan's multiple range test.

micron particle size). This formulation is thicker than that operationally used (36.0 percent) in packing seedlings at nurseries and, consequently, caused more material to adhere to roots (1). Seedling tops or roots were immersed for 30 minutes in each aqueous Bayleton suspension.

Ten seedlings of each treatment were transplanted to each of 10 replicate flats (33 by 13 by 11 cm) containing a sandy loam, sand, and vermiculite soil mixture in a 2:1:1 ratio by volume. Five replicates of each treatment were placed on a greenhouse bench and five were placed on a bed in the Georgia Forestry Commission's Davisboro Nursery on April 15, 1981. Miracle-Gro, a commercially available liquid fertilizer, was applied every other month (5). Seedlings grown in the greenhouse were inoculated 3 months after treatment with the fusiform rust fungus (300,000 basidiospores/ml) (3). Aeciospores collected from loblolly pine galls in Clarke County, Ga. (source 2-74), were used to produce the basidiospore inoculum on northern red oak seedlings. Seedlings in the nursery were in place fort year; thus they were exposed for a full infection season of approximately 3 months (2, 4). One year after the inoculations were made, the percentages of seedlings infected (galled) were determined. Nursery and greenhouse studies were arranged in randomized complete block designs and variances in each study were analyzed independently.

Results and Discussion

Among seedlings grown in the greenhouse, all Bayleton treatments fully controlled fusiform rust (table 1). The low incidence of rust infections in check seedlings (10 percent and 4.8 percent) after artificial inoculation with 300,000 basidiospores per milliliter (a very high inoculum density) reflects the small amount of newly formed tissue on seedlings at the time of inoculation. However, the amount of infection obtained on control seedlings was sufficient to test the effectiveness of the treatments.

Seedlings in the nursery produced considerable amounts of new shoot tissue during the 3month exposure to the rust fungus. On these seedlings, Bayleton concentrations below 1,500 milligrams per liter were effective in only the clay-slurry treatments (table 1). The clay-slurry root dip was fully effective at all concentrations used. Mixing a fungicide with clay and dipping pine seedling roots in the mixture before planting is easily adaptable to nursery operations; a similar clay slurry is applied at some nurseries to improve field survival of seedlings after storage (1). The clay apparently provides a reservoir of Bayleton for systemic translocation after planting and during the time when seedlings are likely to become infected. The lowest concentration of Bayleton applied in this study (600 mg/l in a clay slurry root dip appears promising for reducing fusiform rust in loblolly and slash pine regeneration programs. No phytotoxicity was noted in any treatment concentration tested indicating that the 600-milligram-per-liter rate of application in a clay slurry is well below phytotoxic rates. Because none of the treatments reduced survival or inhibited growth of seedlings in the greenhouse or nursery, it is un likely that they were a serious detriment to mycorrhizal or root development. Plans are underway to test the clay-slurry treatments on operationally planted seedlings to determine effects on field survival, growth, mycorrhizae, and rust control.

Literature Cited

1. Dierauf, T. A.; Marler, R. L. Effect of exposure, clay treatment, and storage on survival and growth of loblolly pine seedlings. Charlottesville, VA: Virginia Division of Forestry;1971; Occas. Rep. 34.10 p.
2. Dinus, R. J.; Schmidt, R. A., eds. Symposium proceedings: Management of fusiform rust in southern pines; 1976 December 7-8; Gainesville, FL. Gainesville, FL: University of Florida; 1977. 163 p.
3. Matthews, F. R.; Rowan, S. J. An improved method for large-scale inoculations of pine and oak with Cronartium fusiforme. Plant Dis. Rep. 56: 931934; 1972.
4. Rowan, S. J. Incidence of fusiform rust in Georgia forest tree nurseries, 19591973. Tree Plant. Notes. 28: 17-18, 29; 1976.
5. Rowan, S. J. Three water soluble fertilizers affect growth and susceptibility of loblolly pine to fusiform rust. Res. Note SE-247. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southeastern Forest Experiment Station; 1977. 3 p.
6. Rowan, S. J. Influence of method and rate of application of Bayleton on fusiform rust on slash pine seedlings. Tree Plant. Notes. 33(1):15-17; 1982.
7. Snow, G. A.; Rowan, S. J.; Jones, J. P.; Kelley, W. D.; Mexal, J. G. Using Bayleton (triadimefon) to control fusiform rust in pine tree nurseries. Res. Note SO-253. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station; 1979. 5 p.