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Control of Fusiform Rust in Slash Pine with Bayleton (Triadimefon) Seed Treatment

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SUMMARY

The Bayleton® seed treatment protects pine seedlings against fusiform rust for at least 4 weeks after sowing. If nurserymen use treated seed, no more than three foliar sprays are needed during the season. These can be timed to give maximum protection during the most hazardous period and adequate protection for the remainder of the infection season.

Additional keywords: Systemic fungicide, *Cronartium quercuum* f. sp. *fusiforme*

INTRODUCTION

Bayleton[1] is a systemic fungicide used in many southern pine tree nurseries for protective and curative control of fusiform rust caused by *Cronartium quercuum* (Berk.) Miyabe ex Shirai f. sp. *fusiforme* (Kelley 1980, Mexal, et al. 1979, Snow, et al. 1979). It is registered as a foliar spray for pines in the southeastern states and has given excellent results with as few as three or four applications.

The effectiveness of Bayleton against the fusiform rust fungus was first observed in seed treatment tests with loblolly pine (*Pinus taeda* L.) (Mexal and Snow 1978). Seedlings grown from seed soaked in 800 mg. triadimefon/liter water were protected until seed coat shed. Subsequent field trials showed that seed treatment reduced galling from natural infection, and tended toward better rust control when it was used along with spraying (Snow, et al. 1979). In the same field tests, however, four or five foliar sprays of Bayleton provided good rust control with or without the seed treatment. Foliar sprays were then recommended to nurserymen and the chemical was registered for foliar application.

Nontheless, there are still advantages of seed treatment with Bayleton that deserve consideration by nurserymen. The most important is the additional protection provided during the period between seed germination and the first foliar spray. Rust hazard is very high at this time because the trees are very susceptible, inoculum levels are high, and weather is most often favorable for infection. Another potential advantage of seed treatment would be a reduction in number of sprays resulting in use of less pesticide. Also, timing of sprays when pine seed are germinating would be less critical.

Use of Bayleton as a seed treatment on an operational basis in nurseries depends largely on the length of time that seedlings are protected after seed germination. Mexal and Snow (1978), obtained protection up to 18 days after the seeds were sown. Longer periods were not tested. Rowan (1982) has more recently observed rust control with seed treated 64 days before inoculation. The maximum time, however, that the Bayleton seed treatment is effective has not been determined.

[1]Bayleton is registered trademark of Farbenfabriken Bayer Gmbh, Leverkusen, West Germany.

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This publication reports research involving fungicides. All uses of fungicides must be registered by appropriate State and Federal agencies before they can be recommended. Use fungicides only when needed and handle them with care. If fungicides are handled, applied, or disposed of improperly, they may injure humans, domestic animals, desirable plants, pollinating insects, fish, or other wildlife, and may contaminate water supplies. Follow the directions and heed all precautions on the container label.

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The experiments described herein were carried out in 1979, 1980, and 1981 to determine the number of weeks after seed treatment that Bayleton would protect slash pine (*P. elliottii* Engelm. var. *elliottii*) seedlings against galling.

MATERIALS AND METHODS

Bulk slash pine seed from south Mississippi were treated by soaking in water alone or in water containing 800 mg a.i. Bayleton per liter. After 24 hours, the water was decanted through a screen and the seeds were germinated without drying on moist vermiculite in closed dishes under lights at 25° C. Germinated seeds were planted in a 1:1 (v/v) peat-vermiculite mixture in plastic Leach® containers. In the 1979 and 1980 experiments, the inoculated seedlings were grown in the greenhouse for the duration of the experiment. The 1981 seedlings were grown outside in full sun because such plants were expected to be physiologically more similar to nursery seedlings than seedlings grown indoors. Typically, about 60 percent of the seeds germinated within a week after sowing and shed their coats a week later.

To determine the duration of fungicide effectiveness, seedlings were inoculated weekly from 2 to 9 weeks after sowing. The 1980 inoculations were carried out at the USDA Forest Service Resistance Screening Center near Asheville, North Carolina (Anonymous 1980) with the concentrated basidiospore spray (CBS) system. The 1979 and 1981 inoculations were done at Gulfport, Mississippi, using the forced air method of Snow and Kais (1972).

Plots consisted of 30 seedlings in 1979 and 20 seedlings each in 1980 and 1981; each plot was replicated four times in a randomized complete block design. Seedlings were tallied for the presence of galls at 6–8 months, and analyses of variance were carried out on the basis of percentage of seedlings galled per plot to determine whether treatment effects were significant at the 0.05 level. If so, Duncan's multiple range test was used to determine significant differences between individual treatments.

RESULTS AND DISCUSSION

Bayleton seed treatment at 800 mg/liter provided significant rust control in all 3 years (table 1). In 1979, when inoculated 6 weeks after sowing, 23 percent of the seedlings from treated seed were galled compared with 80 percent from untreated seed. In 1980, however, Bayleton gave significant control for only 2 weeks after sowing. Control seedlings for the first two inoculations had very few galls in 1980, whereas in 1981 the first two inoculations gave high infection of controls and Bayleton significantly controlled rust at 3 and 4 weeks. Failure to obtain high control infection at 2 and 3 weeks in 1980 may be a weakness in the CBS system related to the small target area of very small plants. Infection of germinants at all ages has been very consistent with the forced air system.

Age was a significant factor in fusiform rust resistance of control seedlings grown in full sun in 1981. Gall frequency dropped from 96 percent at 3 weeks to only 26 percent at 9 weeks (table 1). This age effect was not apparent in the greenhouse-grown experiment of 1980, where there was no change over time. We suspect the difference between the control seedlings in 1980 and 1981 was due to the relative succulence of the tissue. Greenhouse conditions promote succulent, susceptible tissue growth, whereas plants grown in pots in full sun harden rapidly and become resistant. Nursery-grown seedlings would likely behave similarly and develop some natural resistance after a few weeks. This result supports the opinions of many nurserymen who have long recognized that fungicidal protection is needed most when the pine seeds are germinating and in the weeks immediately following. But our finding should not be interpreted to mean that sprays are not needed later. Other factors can promote succulence and susceptibility of nursery seedlings such as fertilization (Rowan 1977), irrigation, and cool, rainy weather.

CONCLUSIONS

The results of these experiments and those reported previously (Mexal and Snow 1978, Rowan 1982, Snow, et al. 1979) indicate that Bayleton seed treatment effectively controls fusiform rust for at least 4 weeks after the seeds the sown. Therefore, no more than three foliar sprays should be needed to protect seedlings in nursery beds sown with treated seed (fig. 1). Without seed treatment, the first Bayleton spray in the nursery must be relied on to arrest incipient infections. The eradicative effect of Bayleton spray has been tested and the maximum time after inoculation that it has been shown to prevent gall development is 14 days (Rowan 1982). Therefore, if germination occurs over a period longer than 14 days, additional sprays may be neces-

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sary during this period. Without Bayleton seed treatment, timing of these first sprays is critical and the decision to spray or not to spray may be difficult to make. With Bayleton seed treatment protection through the period during germination is assured and timing of the first spray is less critical. The proposed spray schedule we present is for a nursery in south Mississippi. The critical infection period could be earlier or later at other locations and this could require an adjustment in the spray schedule. Nurserymen are therefore advised to seek assistance from a forest pathologist who is familiar with their area in planning their rust control program.

Pesticide Use Policy.—The authors believe the present label for Bayleton as a foliar spray for pines permits its use as a seed treatment. Environmental Protection Agency policy states that it is not a misuse to employ any method of application that is not prohibited by the labeling, provided the concentration used is at or below that recommended on the label. This policy is subject to different interpretations and nurserymen are advised to consult their appropriate state agencies before they treat pine seed with Bayleton.

Table 1.—*Percent of slash pine seedlings with fusiform rust galls. Seedlings were grown from seed soaked in water or 800 mg/L Bayleton and inoculated at different times after sowing*

Year	Treatment	Inoculation schedule—weeks after sowing seed							
		2	3	4	5	6	7	8	9
		percent galled							
1979	Control	....	....	....	....	80	....	....	....
	Bayleton	....	....	....	....	23*	....	....	....
1980	Control	25	22	62	48	57	63	....	....
	Bayleton	5*	21	51	39	45	66	....	....
1981	Control	....	96a[1]	80ab	75b	75b	41c	28c	26c
	Bayleton	....	61*	51*	84	55	30	42	31

[1] Means followed by a common letter are not significantly different (P=0.05).
* Significantly different from control (P=0.05).

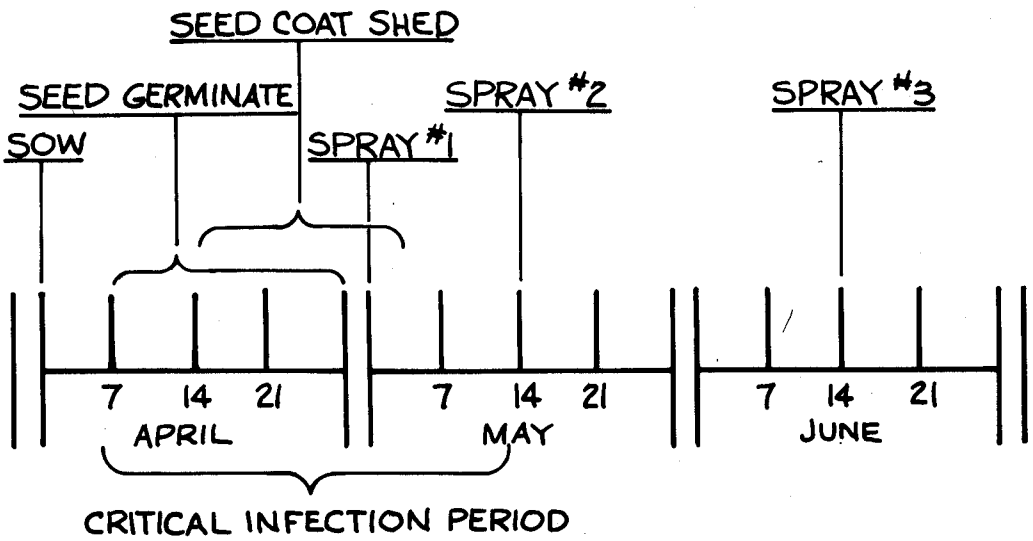

Figure 1.—*A proposed spray schedule based on April 1 sowing. The seed treatment provides protection during the critical infection period up to at least a week after the first seed coats have been shed, and the first foliar spray has been applied, about May 1. The second spray is applied 2 weeks later to cover the last of the critical period, and the last spray is delayed until the middle of June. The critical infection period is the approximate time that seedlings are most susceptible, inoculum is most prevalent on oaks, and weather is most often favorable for pine infection in south Mississippi. The dates for this period could be earlier or later at other locations.*

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