ECTOMYCORRHIZAE AND PLANTING DATE AFFECT RUST INCIDENCE IN FOREST TREE NURSERIES

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Abstract.--Pine seedlings planted on or after May 28 of each year in nurseries need not be sprayed with ferbam to control fusiform rust. Number of plantable seedlings is markedly reduced by such late plantings. Unless modifications of cultural conditions increase the number of plantable seedlings produced in late plantings, ferbam sprays are recommended for economical production of pine seedlings. Inoculations with Pisolithus tinctorius did not increase the number of plantable seedlings produced in late plantings.

Fusiform rust (caused by Cronartium fusiforme Hedgc. & Hunt ex Cumm.) is the most serious disease affecting pine seedlings in Southeastern forest nurseries. The disease is controlled in nursery plantings with ferbam sprays, but 2 to 3% is lost annually to rust in sprayed seedbeds in high rust hazard nurseries. Inoculum from infected oaks can cause infections in pines from March through mid-July of each year, but spore trapping data indicate that most infections occur from late April through May. Thus, although ferbam sprays are normally applied from planting date until mid-July, the greatest attention to the ferbam spray program should be given in April and May.

We wondered if the need for spraying with ferbam could be eliminated by planting after the period of highest rust hazard. We knew that losses in late plantings to heat, drou[g]ht, and the short growing season are often too high to economically justify this cultural practice. However, we also knew that pine seedlings mycorrhizal with Pisolithus tinctorius (Pers.) Coker & Couch grow faster and are more tolerant of heat, and possibly drought, than other seedlings. We, therefore, established a study in 1975 to determine if fusiform rust could be controlled by late plantings and inoculation with P. tinctorius (PT).

METHODS

In fumigated microplots at Athens, loblolly pine (Pinus taeda L.) seeds were planted at 2-week intervals beginning April 15, 1975. Five of the 10 microplots planted at each date were inoculated with PT and five left for mother nature to inoculate. All cultural practices used were designed to promote good seedling growth. No ferbam sprays were applied to any of the microplots. Seedling size and percent rust infection were recorded in January 1976.

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RESULTS AND DISCUSSION

Fusiform rust can be controlled by delaying the date of planting (Table 1). Planting on or after May 28 reduced the percentage of infection sufficiently to eliminate the need for ferbam sprays. The number of plantable seedlings produced in late-planted plots, however, was also markedly reduced. The principal cause of the reduced number of plantable seedlings in late plantings was germination failure (Table 2). Increased irrigation frequency to newly planted seedlings may eliminate most of this germination loss. The microplots in this study were irrigated once daily and less frequently as germination began. The latest date seedlings can economically be produced under the cultural conditions used in this study is about the first of May, and ferbam sprays are economically justified in plantings made at that date.

Table 1.--Effects of planting date and inoculation with Pisolithus tinctorius (PT) on incidence of fusiform rust and seedling growth 1/

Treatment		Galled	Plantables No./Sq. Ft.	Culls No./Sq. Ft.	% Mycorrhizae PT	% Mycorrhizae Total
4/15	NI	45.7 c	27.3 de	1.6 ab	0.0 a	52.7 c
	PT	53.8 d	31.4 e	0.9 a	23.8 c	64.9 d
4/29	NI	22.4 b	26.6 de	2.7 abc	0.0 a	52.7 c
	PT	25.2 b	29.6 e	1.3 ab	9.1 b	64.4 c
5/13	NI	22.4 b	23.1 bcd	1.9 abc	0.0 a	49.6 bc
	PT	21.6 b	20.7 cd	4.3 bc	12.0 b	41.2 ab
5/28	NI	4.1 a	18.6 abc	2.5 abc	0.0 a	45.4 abc
	PT	3.5 a	17.0 abc	5.0 bc	14.8 b	41.7 ab
6/10	NI	0.3 a	10.2 ab	6.6 d	0.0 a	38.5 bc
	PT	0.0 a	11.1 ab	8.4 d	24.9 c	50.3 c

1/ Means in each column followed by a common letter are not significantly different at the 95% level (Duncan's Multiple Range Test).

Inoculation with P. tinctorius significantly increased seedling growth and susceptibility to fusiform rust when inoculations were made early. PT inoculations did not affect the number of plantable seedlings produced in plots planted at any date, but PT mycorrhizae were present on seedlings in all inoculated plots at the end of the study. PT inoculations did not affect the number of plantable seedlings produced because of: (1) germination failure and mortality of seedlings before mycorrhizae were formed, (2) lack of time after mycorrhizal formation for significant growth promotion in late plantings, and (3) increased rust incidence in PT plots planted April 15th nullifying the increased number of plantable seedlings. If ferbam sprays are applied to PT inoculated seedlings planted in April, the production costs are considerably

lower than that for seedlings not inoculated with PT because of the increased number of plantable seedlings produced. Seedling production costs may vary from those presented because of any number of factors including the possible high costs of PT inoculations. Seedlings from this study have been outplanted to determine the numbers of latent infected seedlings in each treatment.

Table 2.--Analysis of production losses and costs in terms of date of planting and inoculation with Pisolithus tinctorius (PT)

Treatment		Cause of Losses: Germ. Failure	Inad. Growth	Fusiform Rust	Total Loss	Production Cost/M with Ferbam	Cost/M no Spray
4/15	NI	37.8	2.9	23,4	64,1	$ 9.00	$14.77
	PT	30.4	1.6	37.5	69.5	7.85	17.39
4/29	NI	37.0	5.2	14.2	56.4	9.23	12,16
	PT	33.5	2.5	16.9	52,9	8.34	11.26
5/13	NI	47.2	3.1	12.0	62.3	10.74	14.07
	PT	46.2	8.9	11.6	66.7	11.89	15.93
5/28	NI	55.0	5.2	1.8	62.0	13.41	13.96
	PT	52.7	10.8	1.6	65.1	14.62	15.19
6/10	NI	63.8	14.2	0.1	78.1	24.26	24.19
	PT	58.2	18.0		76.2	22.42	22.48

Assumptions: 1,320,000 Seed Planted/acre; $7,045/acre nursery cost; $45/acre to apply ferbam. PT inoculation costs were negligible. Ferbam sprays eliminated all rust infections.

LITERATURE CITED

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