Effects of Triadimefon and Triadimenol as Seed Dressings on Incidence of Fusiform Rust on Loblolly Pine Seedlings

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ABSTRACT

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Triadimefon or triadimenol applied as seed dressings at rates of 0.31, 0.62, and 1.25 g a.i./kg of seed protected emerging seedlings of *Pinus taeda* from rust caused by *Cronartium quercuum* f. sp. *fusiforme*. Triadimefon was superior to triadimenol. The degree of protection for each compound decreased as seedling age increased. Both compounds were compatible with the animal repellent and fungicide thiram. Triadimefon applied as a seed dressing at a rate of 1.25 g a.i./kg of seed provided protection equal to that of the triadimefon seed soak (800 mg of triadimefon per liter, 24-hr seed soak) currently being used by forest tree nursery personnel; both methods provided adequate protection to emerging seedlings for at least 36 days after sowing.

In 1978, Mexal and Snow (4) reported that loblolly pine seedlings from seed soaked for 24 hr in an aqueous solution containing 800 mg/L of the systemic fungicide triadimefon were protected from fusiform rust (caused by *Cronartium quercuum* (Berk.) Miyabe ex Shirai f. sp. *fusiforme* Burdsall & Snow) for about 14 days after emergence. Other papers corroborating the effectiveness of treating pine seeds with triadimefon have been published (2,5). Because foliar sprays for control of fusiform rust usually are not initiated until after more than 50% of the seedlings have emerged, the seed treatment reduces disease losses by protecting early-emerging seedlings from rust. Although effective, the seed-soak method is time-consuming and creates logistical problems during the rather short seed-sowing period; consequently, many nurseries currently do not employ the method. Because of the importance of protecting early-emerging seedlings, the research reported herein was initiated to evaluate alternative seed-treatment procedures.

Objectives were to compare triadimefon and triadimenol as seed soaks and seed dressings for control of fusiform rust, to determine effective rates for the compounds, to determine the number of days each compound provides protection, and to evaluate each compound for its compatibility with the animal repellent and fungicide thiram.

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MATERIALS AND METHODS

The USDA Forest Service Rust Resistance Screening Center, Asheville, NC, supplied loblolly pine (*Pinus taeda* L.) seed from a family (10-8(3)) known to be highly susceptible to fusiform rust and provided the standard pasteurized soil mix used at the center to grow seedlings for rust-resistance tests. Triadimefon (Bayleton 50WP) and triadimenol (Baytan 150FS) were supplied by Mobay Chemical Corporation.

Tests. Before receiving seed treatments, loblolly pine seeds were soaked for 2 days in tap water, stored moist at 5 C for 6 wk, and soaked for 10 min in 20% (v/v) hydrogen peroxide. Fungicide treatments were 1) control, 2) triadimefon seed soak (800 mg/L for 24 hr), 3) triadimenol seed soak (800 mg/L for 24 hr), 4) triadimefon seed dressing (0.31 g a.i./kg of seed), 5) triadimefon seed dressing (0.62 g a.i./kg of seed), 6) triadimefon seed dressing (1.25 g a.i./kg of seed), 7) triadimenol seed dressing (0.31 g a.i./kg of seed), 8) triadimenol seed dressing (0.62 g a.i./kg seed), and 9) triadimenol seed dressing (1.25 g a.i./kg seed). Each fungicide treatment or the control was applied with and without thiram (Arasan) (at 5 g/kg of seed) to seeds that were sown on four dates so that seedlings could be inoculated 26, 31, 36, and 41 days after sowing to total 72 treatments.

All treatments except seed soaks were applied with a Gustafson Batch Laboratory Treater (Gustafson Co., Dallas, TX) modified to handle small (10–50 g) quantities of seeds. Treatments were applied immediately before sowing the seed on autoclaved vermiculite in greenhouse flats. As seedlings emerged, they were transplanted into plastic trays (34 × 13 × 10 cm; No. 135 Planter, Ball Seed Co., West Chicago, IL), each containing about 4 kg of soil mix. Twenty seedlings (two rows of 10 each) were transplanted into each tray with a multiprobe template. Each treatment was represented by five replicate trays, which were placed on greenhouse benches in a completely random manner.

Trays of seedlings were transported to the Resistance Screening Center and seedlings were inoculated with basidiospores of a virulent isolate (L-6) of *C. quercuum* f. sp. *fusiforme* following established procedures (1). Seedlings were maintained at the screening center during the test.

Evaluations. Each seedling was examined for fusiform rust galls 30 wk after inoculation; only definite swellings were counted as galls. Seedlings in each tray were cut off at the soil line, placed together in a plastic bag, oven-dried, weighed, and the average weight per seedling was calculated. Data were subjected to analyses of variance, which included components for linear and quadratic effects of fungicidal rates and for differences among seed-soak and seed-dressing treatments.

RESULTS

Thiram had no significant effect on the incidence of rust among either the treatments or the controls. Therefore, data from treatments with and without thiram were combined.

All seed treatments with triadimefon and triademenol reduced the incidence of rust on seedlings inoculated 26 days after seeds were sown (Fig. 1A). Significantly greater incidences of rust were recorded for the triadimenol seed soak (800 mg/L for 24 hr) and the triadimenol seed dressing (0.31 g/kg) than for other fungicidal treatments.

Similar results were obtained on seedlings inoculated 31 days after seeds were sown (Fig. 1B). Seedlings from seed soaked in triadimenol had significantly more rust than seedlings from other treatments. Although differences between corresponding rates were not always significant, the data indicate that triadimefon was superior to triadimenol as a seed dressing.

Although rust percentages for treated seedlings at 36 days were significantly less than for the control (Fig. 1C), the magnitude of protection was less than

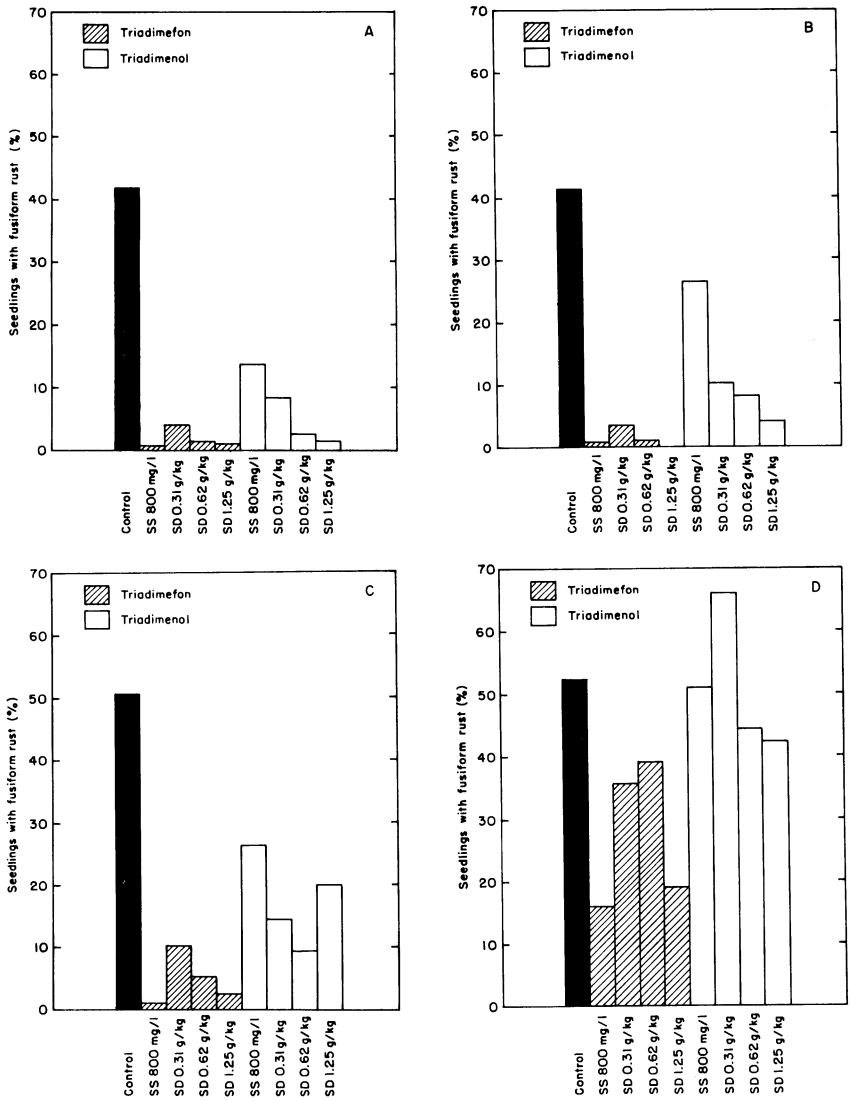

Fig. 1. Effects of triadimefon and triadimenol applied as seed soaks (SS) (800 mg a.i./L of water, 24-hr soak) and seed dressings (SD) (0.31, 0.62, and 1.25 g a.i./kg of seed applied immediately before sowing) on incidence of fusiform rust on emerging loblolly pine seedlings. Seedlings inoculated with *Cronartium quercuum* f. sp. *fusiforme* **(A)** 26, **(B)** 31, **(C)** 36, and **(D)** 41 days after sowing.

that recorded at 31 days. Triadimenol seed soak again resulted in poor protection, whereas the best protection was with triadimefon seed soak. Among the seed dressings, best protection was provided by triadimefon at 1.25 g/kg of seed; again, triadimenol appeared inferior to triadimefon.

By 41 days after sowing, only two treatments, triadimefon seed soak (800 mg/L for 24 hr) and triadimefon seed dressing (1.25 g/kg of seed), were still providing significant protection; all other treatments had lost effectiveness.

None of the treatments significantly affected seedling growth as determined by dry weights of shoots. Average weights of seedlings ranged from 2.1 g per seedling for those inoculated at 26 days to 2.3 g per seedling for those inoculated at 41 days.

DISCUSSION

This study answers several important questions concerning use of triadimefon as a treatment for pine seed. Furthermore, it complements the findings of Mexal and Snow (4) and identifies an alternative, simpler method of treating the seed.

The failure of triadimenol to perform as effectively as triadimefon as a seed dressing at the rates tested may be due to one or several factors. Triadimenol may not be as fungitoxic as triadimefon and/or triadimenol may be less efficient in entering the seed. Two observations support the possible explanations. First, protection afforded by triadimenol at all inoculation ages was inferior to that of triadimefon at identical rates. Second, in the seed-soak test where each of the compounds was at a concentration of 800 mg/L, triadimefon consistently was one of the best treatments, whereas triadimenol consistently provided the poorest protection. This suggests that triadimenol is less efficient in entering the seed.

Triadimefon applied as a seed dressing at 1.25 g a.i./kg of seed provided protection from fusiform rust equal to that of the standard triadimefon seed soak. Furthermore, the triadimefon seed dressing can be applied along with thiram, thus eliminating the need for separate procedures for the two compounds. It should be pointed out, however, that care must be taken to ensure that all seed are coated with triadimefon. Nonuniform treatment will reduce the benefits gained by seed treatment.

Seed treatment provided adequate protection to emerging seedlings for at least 36 days (but less than 41) after sowing. Assuming triadimefon can be labeled as a seed dressing, it may be possible to decrease the number of foliar applications of triadimefon currently used to control fusiform rust in nurseries (3,6). This hypothesis will be tested in the field during 1984.

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