

Uptake, Translocation, and Efficacy of Triadimefon in Control of Turfgrass Pathogens

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ABSTRACT

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Rhizoctonia solani, *Marasmius oreades*, *Corticium fuciforme*, *Fusarium nivale*, and *Sclerotinia homoeocarpa* were sensitive in vitro to triadimefon (Bayleton®, BC 6447), with ED⁵⁰ of ~1 µg active ingredient/ml potato-dextrose agar (PDA). In field tests, triadimefon provided excellent control of *Sclerotinia* dollar spot (*S. homoeocarpa*), *Fusarium* patch (*F. nivale*), stripe smut (*Ustilago striiformis*), *Fusarium* blight (*F. roseum*), and red thread (*Corticium fuciforme*); but it was ineffective against *Helminthosporium* leaf spot/crown rot (*H. vagans*). Residual activity of triadimefon appeared to be quite prolonged. In greenhouse tests employing direct inoculation of the plants with pathogen propagules, the chemical provided complete suppression of *S. homoeocarpa* on mature Kentucky blue-

grass for 15 wk after fungicide treatment. In field tests, there was evidence of suppression of *Sclerotinia* dollar spot and stripe smut 1 yr after treatment with triadimefon. It is evident from greenhouse experiments that triadimefon, applied as a soil drench, is root-absorbed from a variety of soils and translocated acropetally in bentgrass, to provide protection against foliar pathogens. Efficacy of triadimefon on 10 experimental soil mixtures was greatest in sandy mixes and lowest in mixes high in clay content. There was no simple linear relationship between overall efficacy of triadimefon and pH, cation exchange capacity, or percolation rate of the 10 experimental mixes. Phytotoxicity of triadimefon on bluegrass and bentgrass varied with grass genus and cultivar.

Increasing incidence of field tolerance to the benzimidazole fungicides has lent impetus to the search for new systemic fungicides for the long-term control of diseases of turfgrass. *Sclerotinia* dollar spot (*Sclerotinia homoeocarpa* Bennett) and *Fusarium* blight [*Fusarium roseum* (Lk.) emend. Syd. & Hans.] are among the common diseases of fine turf which, in the past, have been well controlled by benzimidazole fungicides. Reports of inadequate control of both diseases first appeared in 1972 (2, 13, 14). In locations where *Sclerotinia* dollar spot is not adequately controlled by benzimidazoles, control emphasis can be shifted to effective contact fungicides. In the case of *Fusarium* blight, no such option in chemical control is available.

In early 1975, our laboratory began evaluation of the experimental systemic fungicide, triadimefon [1-(4-chlorophenoxy)-3,3-dimethyl-1-(1H-1,2,4-triazol-1-yl)-2-butanone]. The experiments reported here were undertaken to determine the initial and residual efficacy of this new systemic fungicide under various conditions, against various pathogens of turfgrass.

MATERIALS AND METHODS

Fungitoxic spectrum.—The fungitoxicity of triadimefon was tested in potato-dextrose agar (PDA)

against 61 fungal isolates representing eight genera of fungi: 15 *Pythium* spp., six isolates of *Corticium fuciforme* (Berke) Wakef., five *Helminthosporium* spp., five isolates of *Rhizoctonia solani* Kühn, two isolates of *Marasmius oreades* Fr., six *Curvularia* spp., seven *Fusarium roseum* (one 'Acuminatum,' three 'Graminearum,' two 'Sambucinum,' and one 'Culmorum'), three *Fusarium nivale* (Fr.) emend. Syd. & Hans., one *Fusarium tricinctum* (Cda.) emend. Syd. & Hans., and 11 isolates of *Sclerotinia homoeocarpa*. Triadimefon (25W) was suspended in sterile distilled water and added in appropriate quantities to partially cooled, sterile PDA. All concentrations were calculated on a w/v active ingredient basis. The supplemented medium was poured into sterile, plastic petri plates, allowed to cool, and used immediately. Rates tested were 0, 0.1, 1, 10, 100, and 1,000 µg active ingredient (a.i.)/ml PDA. Agar plugs of mycelium were taken from the periphery of actively growing colonies of the test isolates and transferred to the center of the fungicide-amended PDA plates. Each treatment was replicated three times. All cultures were incubated at room temperature. Colony diameter in mm was recorded at 1, 2, and/or 7 days, depending on the growth rate of the test organism.

Field Experiments.—*Control of dollar spot caused by Sclerotinia homoeocarpa.*—This trial was conducted on a mixed stand of Seaside creeping bentgrass (*Agrostis palustris* Huds. 'Seaside') and annual bluegrass (*Poa annua* L.), maintained at 0.6 cm cutting height, under standard putting green management. Experimental

design was a completely randomized block with three replications. An untreated control was included in each block. The plot area was inoculated 1 wk prior to fungicide application with a pathogenic isolate of *S. homoeocarpa* grown on autoclaved rye grain. Rye flasks were prepared by placing 50 g of rye grain, 1 g of CaCO_3 , and 75 ml of water in 250-ml Erlenmeyer flasks, plugging with cotton plugs, and autoclaving for 30 min at 1.05 kg-force/cm² (15 lb) pressure. Triadimefon (50W) was applied twice, 2 wk apart, at 28 and 57 g/93 m² in 8 liters of water/93 m². Sprays were applied with a wheel-mounted, CO₂-powered, boom sprayer at 2.8 kg/cm² pressure. The plots were evaluated for disease severity 14 days after the second fungicide application. A 0-10 visual rating scale was employed with 0 = no disease and 10 = 100% of the plot area affected. Data obtained were subjected to analysis of variance (ANOVES) and Duncan's modified (Bayesian) least significant difference tests.

Experimental design, fungicide application method, and collection and treatment of data were similar in all field trials with triadimefon. Methodological exceptions in individual trials are noted in the following sections.

Control of *Fusarium* patch caused by *Fusarium nivale*.—This experiment was conducted on a golf course fairway of creeping bentgrass. Triadimefon (25W) was sprayed once in late fall at 57, 114, and 224 g/93 m². No artificial inoculum was employed. Plots were evaluated in early spring by counting the number of *Fusarium* patch infection centers/plot.

Control of *Helminthosporium* leaf spot/crown rot caused by *Helminthosporium vagans*.—These experiments were conducted on three cultivars of Kentucky bluegrass (*Poa pratensis* L.) cultivars K-109, Delta, and Newport, maintained under fairway/home lawn management conditions. Triadimefon (50W) was applied twice, 2 wk apart, at 114 and 168 g/93 m². No artificial inoculum was employed. Disease incidence in the plots was evaluated approximately 3 wk after the second fungicide application.

Control of *Fusarium* blight caused by *Fusarium roseum*.—These experiments were conducted on two golf course fairways, one a Merion Kentucky bluegrass stand maintained at 1.3 cm cutting height, and the other a mixed stand of Merion Kentucky bluegrass and annual bluegrass maintained at 1.9-cm cutting height. Triadimefon (50W) was applied as three 224 g/93 m² sprays at 14-day intervals. Disease incidence was evaluated 3 and 5 wk after the third fungicide spray. No artificial inoculum was employed.

Control of red thread caused by *Corticium fuciforme*.—This experiment was conducted on a red fescue (*Festuca rubra* L.) turf maintained under home lawn conditions. Natural infection was present and was supplemented by inoculation with *C. fuciforme*-infested rye grain. Triadimefon (50W) was applied as three curative sprays, 1 wk apart, at 28 and 56 g/93 m². Disease was evaluated 4 mo after the last fungicide application.

Control of stripe smut caused by *Ustilago striiformis* (Westend.) Niessl.—This experiment was conducted on a Merion Kentucky bluegrass fairway with a history of stripe smut. Triadimefon was applied in early spring at 14, 28, and 56 g/93 m². Disease was evaluated 2 mo after fungicide treatment by counting the number of smutted

tillers in four 5-cm diameter plugs collected randomly from each treatment plot. Data were converted to number of smutted tillers/.093 m².

Greenhouse experiments.—*Effect of soil composition on initial and residual efficacy of triadimefon.*—This experiment was conducted to determine the effect of soil composition on root absorption and acropetal translocation of triadimefon in bentgrass, as measured by initial and residual efficacy against *Sclerotinia* dollar spot. Ten soil mixes were employed: sand, silty clay loam, peat, sand:peat (1:1), sand:loam (1:1), loam:peat (1:1), and sand:loam:peat (1:1:1, 2:1:1, 1:2:1, and 1:1:2). Components were sterilized separately with aerated steam. Two 30-min steaming periods (80 C) separated by a 24-hr interval were employed. Twenty-eight grams of 14:14:14 Osmocote controlled-release fertilizer (Sierra Chemical Co., Milpetas, CA 95035) were added to each 4 liters of soil mixture as it was being blended in a small soil mixer. The soils were distributed into 10-cm diameter plastic pots, and seeded with 'Penncross' creeping bentgrass. Triadimefon (25W) was applied to the grass as a soil drench 3 wk after seedling emergence. The drench was applied at 114 g/93 m² in water equivalent to a 0.7-cm irrigation. Care was exercised not to wet the grass foliage during the drenching procedure. Individual pots of grass were treated by retracting the seedling grass foliage at one side of the pot rim, and pouring the fungicide solution over the soil surface. Each treatment was replicated three times and nontreated controls were included for each soil mixture. Inoculations were made at 1, 2, and 5 wk postdrench by placing 15-20 kernels of *S. homoeocarpa*-infested rye grain on the grass foliage in each pot. After inoculation, the pots were placed on a shaded greenhouse bench under individual, transparent plastic covers to maintain high humidity. Greenhouse temperature during the experiment was 25 ± 3 C. Plastic covers were removed when the grass in the nontreated control pots was 90-100% diseased, and the amount of disease was evaluated using the previously-described 0-10 visual rating scale. Cation exchange capacity (CEC), pH, and percolation rates were measured on the 10 experimental soils at the termination of the experiment, and an attempt was made to relate these soil parameters individually to overall fungicide efficacy. Cation exchange capacity and pH were determined from a pooled aliquot from the three replications of each treatment by The Pennsylvania State University Soil and Forage Testing Laboratory. Rate of downward water flow through the experimental soils was determined by placing pots of grass from each treatment in wall-mounted, 15.24-cm (6-inch) glass funnels. Water was poured into each pot and the level was maintained at the pot rim by adding water as necessary. The water which passed through the sample was collected and the amount of flow/unit of time was determined. A relative flow rate for a sample (x) was calculated as follows:

$$\text{Relative flow rate} = \frac{\text{flow rate through sample } x}{\text{slowest flow rate}}$$

*Efficacy of triadimefon applied as a curative treatment against *Fusarium* blight.*—Forty-eight 0.3 × 0.6-m strips of mature, field-grown Merion bluegrass sod, which were showing symptoms of *Fusarium* blight, were placed

in shallow trays in the greenhouse. Disease severity of each strip was rated prior to and 6 wk after fungicide treatment, and the amount of disease increase was calculated. The previously described 0-10 visual rating scale was employed. Triadimefon at 224 g/93 m² was applied as a foliar spray to 24 sod strips. The remaining 24 strips were not treated with fungicide.

Phytotoxicity and residual efficacy of triadimefon against Sclerotinia dollar spot.—One-yr-old, pot-grown Kentucky bluegrass, cultivars Merion, Adelphi, and Pennstar, and seedling Penncross bentgrass were used in these experiments. Triadimefon (50W) was applied to the bluegrasses as soil drenches equivalent to 168 and 224 g/93 m² in water equivalent to a 0.7-cm irrigation. The seedling bentgrass was drenched at only the lower rate. Nontreated controls were included for comparison. Each treatment was replicated five times on each cultivar. Grass was evaluated for phytotoxic effects at 2, 4, 6, 8, and 10 wk post-treatment by measuring fresh weight of removed clippings. Percent growth reduction was determined for each grass species by comparing fresh weight of clippings from triadimefon-treated grass with fresh weight of clippings from untreated controls:

$$\text{Percent growth reduction} = 1 - \left(\frac{\text{Fresh wt of clippings from triadimefon-treated grass}}{\text{Fresh wt of clippings from nontreated grass}} \right) \times 100$$

Clippings removed at 2, 4, and 6 wk from nontreated grass and grass treated with 224 g/93 m² triadimefon were frozen, after weighing, for use in a bioassay for the presence of fungitoxic activity against *F. roseum* 'Acuminatum' and *S. homoeocarpa*.

To determine residual efficacy of triadimefon against *S. homoeocarpa*, nontreated bluegrass and bluegrass which had been treated with 224 g/93 m² triadimefon was inoculated with *S. homoeocarpa*-infested rye grain 11 and 13 wk after fungicide treatment. After inoculation, the pots of grass were placed on a shaded greenhouse bench under individual, transparent plastic covers to maintain high humidity. Greenhouse temperature during incubation was ~27 C. Plastic covers were removed 2 wk after inoculation (13 and 15 wk posttreatment), and

disease severity was evaluated. The previously described 0-10 visual rating scale was employed.

In vitro bioassay for fungitoxicity against *Fusarium roseum* 'Acuminatum' and *Sclerotinia homoeocarpa* in extracts of triadimefon-treated bluegrass and bentgrass.—The clippings that had been removed from bluegrass and bentgrass, and frozen, at 2, 4, and 6 wk after drenching with 224 g/93 m² triadimefon, were ground separately in a hand grinder and the liquid was expressed from the resultant homogenate. A plug of agar 8 mm in diameter was removed from the center of PDA plates, and the resultant well was filled with grass extract. Six replicate plates were prepared per treatment, and the plates were refrigerated overnight. Benomyl-sensitive and benomyl-tolerant isolates of both *F. roseum* 'Acuminatum' and *S. homoeocarpa* were used in the bioassay. 'Acuminatum' is a cultivar of *F. roseum* which has been found in association with Fusarium blight by Smiley and Howard (13) and the present authors. Mycelial plugs of the sensitive and tolerant isolates of each fungus were placed on opposite sides of the PDA plates, equidistant from the well. Three replicate plates were prepared for each fungus pair, or a total of six plates per treatment. Extracts from untreated grass of each cultivar and sterile distilled water controls were included for comparison. Plates were examined for inhibition of fungal growth at 48 hr after inoculation.

RESULTS

Fungitoxicity spectrum.—Twenty-five of the 61 fungous isolates tested in vitro were sensitive to triadimefon (ED⁵⁰ 10 µg a.i./ml PDA), including all isolates of *S. homoeocarpa*, *M. oreades*, *C. fuciforme*, four of the five *R. solani* and one of the two *F. nivale*. Thirty-six isolates were tolerant to triadimefon in vitro (ED⁵⁰ 100 µg a.i. or greater per milliliter of PDA). This group included all isolates of *Pythium* sp., *Helminthosporium* sp., *Curvularia* sp., *F. tricinctum*, *F. roseum*, and one isolate each of *R. solani* and *F. nivale*.

Field experiments.—In field trials, triadimefon provided excellent control of *Sclerotinia* dollar spot, Fusarium patch, stripe smut, red thread, and Fusarium blight (Table 1). Triadimefon was completely ineffective in the field against *Helminthosporium* leaf spot/crown

TABLE 1. Efficacy of triadimefon in the field for disease control on creeping bentgrass (CB), annual bluegrass (AB), Kentucky bluegrass (KB), and creeping red fescue (RF)

Triadimefon (g/93 m ²)	Sclerotinia dollar spot		Fusarium blight		Helminthosporium leaf spot/crown rot in KB			Fusarium patch	Red thread	Stripe smut
	CB+AB	Merion KB	Merion KB+AB	K-109	Newport	Delta	Seaside CB	RF	Merion KB	
0	8.0 ^a	2.4 ^a	3.4 ^a	2.8 ^a	3.8 ^a	2.5 ^a	46.3 ^b	4.0 ^a	312 ^c	
14	...	...	...	...	...	...	...	...	83*
28	1.3 ^{*d}	...	...	...	...	...	...	1.0*	46*
57	0.7*	...	...	...	...	...	1.0*	1.4*	18*
114	...	...	...	...	3.5	...	0.0*	...	...
170	...	...	...	3.2	4.0	2.3	...	...	...
227	...	0*	0*	...	...	...	0.6*	...	...

^aDisease severity. Visual rating scale, 0-10, with 0 = no disease and 10 = total infection of turfgrass in plot area.

^bInfection centers per plot.

^cSmuted tillers per 0.093 m².

^dSignificantly different from nontreated control, *P* = 0.05.

rot (Table 1). The field trials of *Helminthosporium* leaf spot/crown rot and *Sclerotinia* dollar spot were re-evaluated 1 yr after fungicide application. In the *Helminthosporium* trial area, those plots which had been sprayed with triadimefon 1 yr before were free of stripe smut, which was present in great abundance over the remainder of the plot area. In the dollar spot trial area, the plots which had been sprayed with triadimefon 1 yr earlier showed an 85% reduction in dollar spot, when compared with the nonsprayed check plots.

Greenhouse experiments.—The effect of soil composition on initial and residual efficacy of triadimefon against *S. homoeocarpa* on creeping bentgrass is shown in Fig. 1. Efficacy of triadimefon at all three inoculation times was greatest in sandy mixes, and least in mixes high in clay content. The fungicide provided at least 85% disease reduction at 5 wk after treatment in all soils except loam:peat and loam. In these two soils, disease reduction was 80% and 73%, respectively. There was no simple linear relationship between mean fungicide efficacy and any single measured soil parameter; i.e., pH, cation exchange capacity, or percolation rate (Table 2).

Triadimefon at 227 g/m² was not effective as a curative spray against *Fusarium* blight on Merion bluegrass sod. Development of *Fusarium* blight continued at the same rate in both nontreated and triadimefon-treated sod strips. A mean disease increase of 1.2 (rating scale = 0-10) occurred on both treated and nontreated grass during the 6-wk test interval.

Percent growth reduction induced by soil drenches of 168 and 224 g triadimefon per 93 m² on pot-grown Penncross creeping bentgrass and Merion, Adelphi, and Pennstar Kentucky bluegrass is shown in Fig. 2. There were cultivar differences in sensitivity to triadimefon among bluegrasses. On Adelphi and Pennstar the 168-g rate was much less phytotoxic than was 224 g. On Merion,

injury generally was less severe, and approximately equal at the two rates tested. This growth reduction was not observed in field tests of triadimefon. The only observed effect on triadimefon-treated grass in the field was a darker green color of the foliage.

The residual efficacy of triadimefon against *Sclerotinia* dollar spot on three cultivars of Kentucky bluegrass is shown in Table 3. The soil drench of triadimefon at 224 g/93 m² provided complete protection of all cultivars

TABLE 2. Overall efficacy of triadimefon at three inoculation times against *Sclerotinia* dollar spot relative to cation exchange capacity (CEC), pH, and relative water flow of 10 soil mixtures

Soil composition ^a	Overall ^b disease mean	CEC	pH	Relative ^c water flow
L	1.4 ^d	11	6.7	2
LP	1.2	17	5.6	9
SLP	1.1	9	5.7	24
2L	1.0	11	5.9	5
2P	0.4	12	5.2	12
P	0.2	36	4.5	227
2S	0.2	8	5.6	8
SL	0.1	7	6.3	1
SP	0.1	10	4.5	67
S	0.1	3	6.1	77

^aAbbreviations: P = peat, S = sand, L = silty clay loam, SP = sand:peat (1:1,v/v), SL = sand:loam (1:1,v/v), LP = loam:peat (1:1, v/v), SLP = sand:loam:peat (1:1:1, v/v), 2S = sand:loam:peat (2:1:1,v/v), 2L = sand:loam:peat (1:2:1,v/v), and 2P = sand:loam:peat (1:1:2,v/v).

^bMean of all replications at all inoculation times (1, 2, and 5 wk posttreatment).

^cSlowest rate is expressed as 1; all other values expressed as multiples of slowest rate.

^dVisual rating scale of 0-10 with 0 = no disease and 10 = complete blighting of grass foliage.

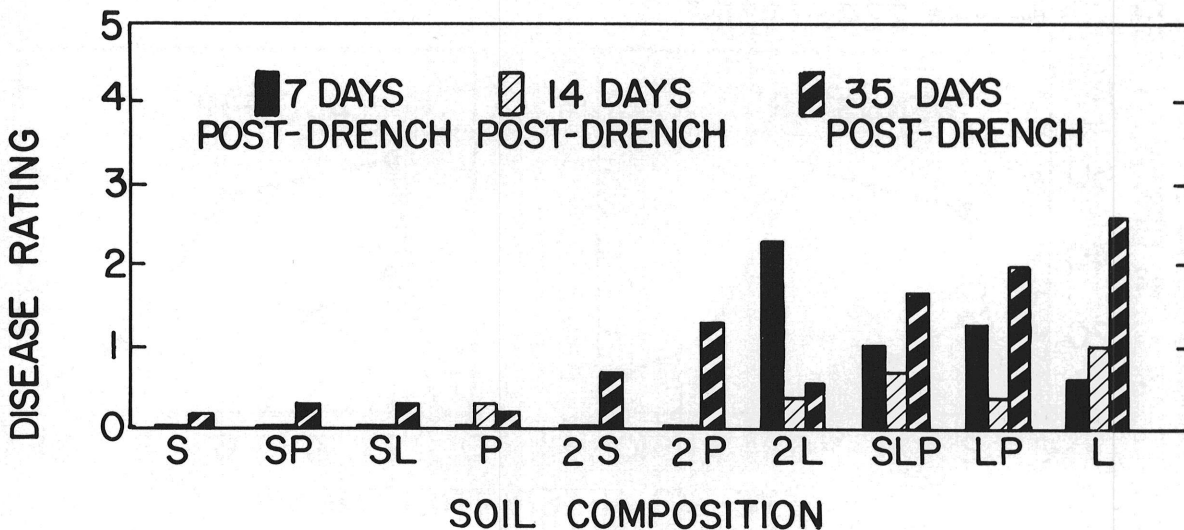


Fig. 1. The effect of soil composition on initial and residual efficacy of triadimefon (114 g/93 m²) against *Sclerotinia* dollar spot on seedling, pot-grown bentgrass inoculated with *S. homoeocarpa*-infested rye grain 7, 14, and 35 days after fungicide treatment. Disease rating was based on a visual rating scale 0-10, with 0 = no disease and 10 = 100% infection of foliage. The abbreviations on the abscissa stand for: P = peat, S = sand, L = silty clay loam, SP = sand:peat (1:1 v/v), SL = sand:loam (1:1, v/v), LP = loam:peat (1:1, v/v), SLP = sand:loam:peat (1:1:1, v/v), 2S = sand:loam:peat (2:1:1, v/v), 2L = sand:loam:peat (1:2:1, v/v), and 2P = sand:loam:peat (1:1:2, v/v).

through 15 wk posttreatment.

In vitro bioassay for fungitoxicity in extracts from triadimefon-treated Kentucky bluegrass and creeping bentgrass.—Extracts from triadimefon-treated Kentucky bluegrass and creeping bentgrass strongly inhibited the

growth of both benomyl-sensitive and benomyl-tolerant isolates of *S. homoeocarpa*. There was no detectable inhibition of either benomyl-sensitive or benomyl-tolerant *F. roseum* 'Acuminatum.'

DISCUSSION

Triadimefon was active against many important pathogens and diseases of turfgrass. Contact efficacy against various fungal genera can be inferred from the results of the in vitro fungitoxicity spectrum study. Laboratory, field, and greenhouse studies have shown that triadimefon was effective against *R. solani*, *M. orades*, *C. fuciforme* (causal agent of red thread), *F. nivale* (causal agent of Fusarium patch), *S. homoeocarpa* (causal agent of dollar spot), stripe smut, and Fusarium blight. Hardison (7) has reported long-term control of stripe smut by triadimefon in greenhouse tests.

Residual efficacy of this new systemic fungicide appeared to be quite prolonged. Results of greenhouse experiments using direct pathogen inoculation, demonstrated activity for up to 15 wk after fungicide treatment. Field observations indicate disease reduction for as long as 1 yr after fungicide application. This effect

TABLE 3. Residual efficacy of triadimefon 11 and 13 wk after application as a soil drench (227 g/93 m²) to control *Sclerotinia* dollar spot on 1-yr-old, pot-grown Kentucky bluegrass

Kentucky bluegrass cultivar	Disease severity ^a observed when interval between treatment and inoculation ^b was:			
	11 wk		13 wk	
	Triadimefon-treated	Non-treated	Triadimefon-treated	Non-treated
Merion	0 ^c	1.7	0	1.0
Adelphi	0	5.7	0	3.0
Pennstar	0	3.7	0	2.0

^aMean of three replications.

^bPlants were evaluated 2 wk after inoculation with *S. homoeocarpa*-infested rye grain.

^cVisual rating scale 0-10, with 0 = no disease and 10 = 100% foliar infection.

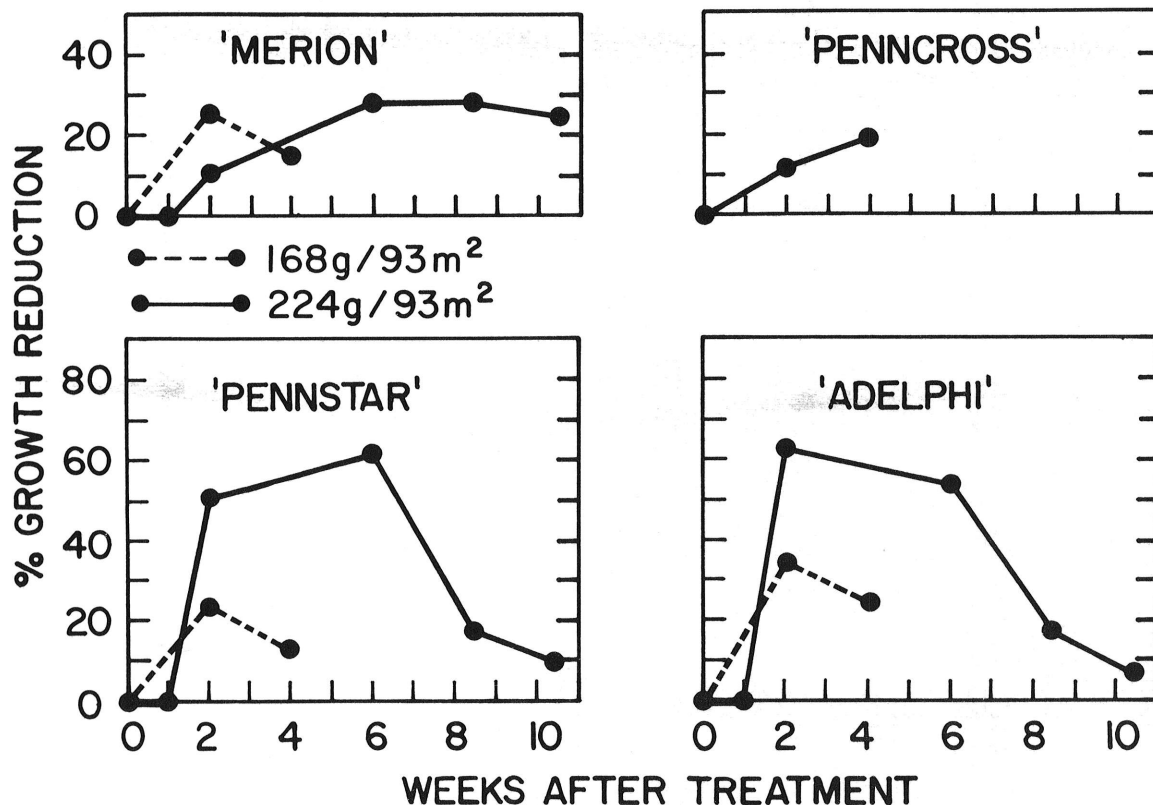


Fig. 2. Percent growth reduction induced by triadimefon drenches (168 and 224 g/93 m²) on pot-grown Merion, Pennstar, and Adelphi Kentucky bluegrass and Pennncross creeping bentgrass.

$$\text{Percent growth reduction} = 1 - \left(\frac{\text{Fresh weight of clippings from triadimefon-treated grass}}{\text{Fresh weight of clippings from untreated grass}} \right) \times 100$$

may be due either to true residual activity or to a reduction of inoculum in treated plots. In either case, however, the effect is a very long-term reduction in disease.

From the greenhouse soil composition experiment, it can be inferred that triadimefon, applied as a soil drench, is root-absorbed from a variety of soils and translocated acropetally in bentgrass, to provide protection against foliar pathogens. There were small but consistent differences in efficacy of triadimefon on the 10 experimental mixes. Efficacy was greatest at all inoculation times in mixes containing 50% or more of sand. Although there was no simple linear relation between overall efficacy of triadimefon and any single measured soil parameter, interactions among pH, cation exchange capacity, and percolation rate are undoubtedly factors in the distribution of triadimefon in the soil profile (1, 8, 9, 10).

With one exception, field data support in vitro results. The apparent inconsistency between laboratory and field results with respect to efficacy of triadimefon against *F. tricinctum* and cultivars of *F. roseum* bears some scrutiny. The fungitoxicity spectrum study revealed no significant activity against *F. tricinctum* or cultivars of *F. roseum*, whereas triadimefon provided complete suppression of the field symptoms of Fusarium blight, which have been attributed to these pathogens (5, 6). The bioassay of extracts from triadimefon-treated grasses was undertaken to investigate the possibility of biotransformation within the grass plant to a substance fungitoxic to fusaria. No such activity could be demonstrated, although activity against *S. homoeocarpa* was marked in this bioassay. The failure of triadimefon as a curative treatment for Fusarium blight supports in vitro studies which show that triadimefon is not active against *F. tricinctum* and *F. roseum*, and suggests that the effectiveness of triadimefon in suppression of Fusarium blight in the field may lie in some effect in the pre-infection stage.

The above results, together with the fact that to date the symptoms of Fusarium blight have not been induced in the field by artificial inoculation with fusaria, raise a question about the etiology of the field symptoms of Fusarium blight. Similar results have been reported and discussed by Smiley and Craven (12) in work with the experimental hydantoin fungicide, RP 26019 [1-isopropyl-carbamoyl-3-(3,5-dichlorophenyl) hydantoin]. Although it exhibited no in vitro activity against spores or mycelium of various *Fusarium* spp. this fungicide provided excellent suppression of Fusarium blight in the field. The number of *Fusarium* propagules recovered from RP 26019-treated field soil was markedly increased over the number recovered from nontreated areas. Smiley and Craven (12) suggest that RP 26019 may control Fusarium blight indirectly by altering host metabolism or the microbial balance in the soil and thatch, rather than acting directly as a fungitoxicant on fusaria.

The findings of the present experiments suggest that other organisms, which are sensitive to triadimefon, may

be involved with fusaria in the development of the field symptoms of Fusarium blight. The proliferation of certain soil fungi may make soils quite hydrophobic (11). This can lead to drought stress with resultant high negative water potentials in grass, a condition which may lead to explosive colonization of grass by fusaria (3, 4). This hypothesis fits the field symptom, a more or less circular pattern of dead grass, with or without the classic "frog-eye" of living grass in the center. The possibility of predisposition of the grass host by unknown soil fungi to attack by fusaria cannot be overlooked. The use of triadimefon may offer a means to elucidate the factors involved in the development of Fusarium blight of turfgrass.

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