EVALUATION OF FOSTHIAZATE FOR THE SUPPRESSION OF PHYTOPARASITIC NEMATODES IN TURFGRASS[†]

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ABSTRACT

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Two formulations of fosthiazate (10G and 7.5 EC) were compared with fenamiphos 10G for control of phytoparasitic nematodes in fairway managed bermudagrass in two field experiments in southern Florida in 1990 and 1991. Fosthiazate was applied at 1.5 and 2.2 g a.i./m² in the 1990 experiment and 0.7 and 1.5 g a. i./m² in 1991. Fenamiphos was applied at 2.2 g a.i./m² both years. In the 1990 study, both formulations and rates of fosthiazate were as effective as or more effective than fenamiphos 10G in reducing soil populations of *Belonolaimus longicaudatus* and *Meloidogyne* spp. and in improving turfgrass quality ratings for 56 days post-treatment. In the 1991 study, both formulations of fosthiazate at 1.5 g a.i./m² were as effective as fenamiphos 10G in improving turfgrass quality ratings for 56 days post-treatment. In a laboratory pot experiment, fosthiazate 10G at 1.5 g a.i./m² was compared with fenamiphos 10G at 1.1 g a.i./m² for suppression of *B. longicaudatus* on FX-313 St. Augustinegrass. Both nematicides markedly suppressed population expansion of *B. longicaudatus* and prevented root dry weight loss. Fosthiazate was marginally phytotoxic to St. Augustinegrass.

Key words: Belonolaimus longicaudatus, bermudagrass, chemical control, fenamiphos, fosthiazate, *Meloidogyne* spp., root-knot nematode, St. Augustinegrass, sting nematode, turfgrass.

RESUMEN

Giblin-Davis, R. M., J. L. Cisar y F. G. Bilz. 1993. Evaluación de fosthiazato para la supresión de nematodos fitoparásitos de pasto Bermuda. Nematrópica 23:167–175.

Dos formulaciones de fosthiazato (10G y 7.5 EC) se compararon con fenamiphos 10G para el control de nematodos fitoparásitos en pasto Bermuda manejado apropriadamente para uso en la cancha (la parte de expedita) de campos de golf, en dos experimentos de campo en el sur de Florida en 1990 y 1991. El fosthiazato fue aplicado a 1.5 y 2.2 g i.a./m² en el experimento de 1990 y con 0.7 y 1.5 g i.a./m² en 1991. En el estudio de 1990, las dos formulaciones y dosis del fosthiazato fueron tan efectivas o más que el fenamiphos 10G en cuanto a la reducción poblacional de *Belonolaimus longicaudatus* y *Meloidogyne* spp. así como en el mejoramiento de la calidad del pasto por 56 días después de las aplicaciones. En el estudio de 1991, las dos formulaciones de fosthiazato aplicadas a 1.5 g i.a./m² fueron tan efectivas que el fenamiphos 10G en cuanto al mejoramiento de la calidad del pasto por 56 días después de las aplicaciones. En un estudio de laboratorio con macetas, el fosthiazato 10G a 1.5 i.a./m² se comparó con fenamiphos 10G a 1.1 g i.a./m² en el abatimiento de *B. longicaudatus* en pasto San Agustín FX-313. Ambos productos abatieron notoriamente la expansión poblacional de *B. longicaudatus* y evitaron disminuciones del peso seco radical. El fosthiazato fue marginalmente fitotóxico al pasto San Agustín.

Palabras clave: Belonolaimus longicaudatus, césped, control químico, fenamiphos, fosthiazato, *Meloidogyne* spp., nematodo aguja, nematodo agallador, pasto Bermuda, pasto golfero, pasto San Agustín.

INTRODUCTION

The sting nematode, *Belonolaimus longicaudatus* Rau, is the most damaging nematode parasitizing turfgrasses in Florida (2,9). Nematicides are used in more than 80% of the 1 000 golf courses

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in Florida, presumably to manage the sting nematode (9). There are only three nematicides (organophosphates) available for postplant control of phytoparasitic nematodes affecting turfgrasses in Florida (1). Fenamiphos, ethoprop, and isazofos are labeled as restricted use pesticides for turfgrass and can be effective when applied against the sting nematode at labeled rates.

Fenamiphos reduces sting nematode numbers for up to 1 year in bermudagrass golf greens in North Carolina (7). However, recent observations in Florida golf courses suggest that excessive use of fenamiphos in the last decade has led to the selection for microorganisms capable of degrading it, resulting in poorer persistence of the material (5). Even a single soil application of fenamiphos enhances biodegradation of a subsequent application (8). Also, abiotic conditions, such as sandy soils with high organic matter content, large amounts of seasonally excessive rainfall and irrigation, exposure to ultraviolet light, high soil and water pH, and high soil temperature can affect nematicide persistence in southern Florida. In southern Florida, fenamiphos suppresses sting nematode numbers for about 4 weeks and improves performance of fairway bermudagrass for 6–8 weeks (4). Safer, more effective compounds for nematode management in turfgrass are needed. Also needed are strategies for maximizing the persistence and control potential of currently available postplant nematicides.

We evaluated the experimental organophosphate compound ASC-66824, proposed common name fosthiazate (IKI-1145, [R,S,]-S-sec-butyl-O-ethyl-2-oxo-1,3-thiazolidine-3-yl-phosphonothioate), for efficacy against phytoparasitic nematodes in fairway managed bermudagrass in field tests during 2 consecutive years in Broward County, Florida. Fosthiazate was also evaluated for suppression of *B. longicaudatus* on St. Augustinegrass in a laboratory pot experiment.

MATERIALS AND METHODS

1990 field test: Soil samples were collected 20 August 1990 through 23 August 1990 in 1-m^2 plots with a 20-cm margin arranged in a grid on a 2-year-old established field area of 'Tifgreen' (TIF-328) hybrid bermudagrass [*Cynodon dactylon* (L.) Pers. × *C. transvaalensis* (Burt-Davy)]. The soil type was Margate fine sand (siliceous, hyperthermic, Mollic Psammaquent; 96% sand, 3% silt, 1% clay; pH 6.5; 3.8% organic matter). Five 2.5-cm-diam × 10-cm-deep cores taken from each plot were mixed thoroughly, and a 100-cm^3 subsample was extracted using centrifugal sugar flotation (6). Plots with less than 25 sting nematodes/100 cm^3 were not included in the experiment. The experimental design was a randomized complete block. Plots were ranked based on pretreatment counts of *B. longicaudatus* and sequentially ranked plots were assigned to nine blocks. Six treatments were randomly assigned within each block.

All plots were aerated to a depth of 5 cm with a 1.65-cm-diam hollow probe (10 probes per 61 cm^2 spaced on 5-cm centers) with a core aerifier on 6 September 1990.

The six treatments were: fosthiazate 10G at 1.5 and 2.2 g a.i./m^2, fosthiazate 7.5 EC at 1.5 and 2.2 g a.i./m^2, fenamiphos 10G at 2.2 g a.i./m^2, and an untreated control. The nematicides were applied manually to the grass at 0645 to 1030 hours on 7 September 1990. All plots were sprinkler irrigated with 1.3 cm of water immediately afterward. The turfgrass was maintained as low fertility fairway grass and received about 15 g N m^{-2} $year^{-1}$. The turf was mowed every other day at 1.3 cm height and clippings were

removed. Plots were observed for phytotoxicity 7 and 14 days post-treatment. Turfgrass visual ratings, based upon the percentage of ground cover and the density of the bermudagrass on a scale of 1–10 (1 = bare ground, 5 = 50% coverage and medium density, 10 = 100% coverage and high density turfgrass) were taken at the time of treatment and at 28 and 56 days post-treatment. Nematode counts were obtained as previously described at 28 and 56 days post-treatment. Nematode counts were transformed to $\log_{10}$ (n + 1) and a Statistical Analysis System (SAS) general linear models procedure (10) for unbalanced ANOVA was used. Untransformed means are presented. A Waller Duncan *k*-ratio *t*-test ($k = 100$; $P \leq 0.05$) was used for means separation.

1991 field test: Pretreatment soil samples were taken on 22 May 1991 from 1-m² plots as described in the previous section on a 5-year-old field planted with 'Tifgreen II' hybrid bermudagrass (*C. dactylon* × *C. transvaalensis*). The soil type was a Margate fine sand as in the 1990 experiment. The experimental design and the sampling procedures were generally as described for the 1990 study. However, 12–16 rather than five sample cores were taken from each plot and the *B. longicaudatus* count threshold for plot inclusion was 15 rather than 25 sting nematodes/100 cm³ soil. Also, in the 1991 field experiment, plots were not aerated, except as indicated. Treatment rates for the 1991 study were reduced to determine if a lower dose of fosthiazate might be effective for nematode control. A lower rate (0.7 g a.i./m²) was substituted for the highest rate (2.2 g a.i./m²) used in the previous year. The treatments were fosthiazate 10G at 0.7 and 1.5 g a.i./m², fosthiazate 7.5 EC at 0.7 and 1.5 g a.i./m², fosthiazate 7.5 EC at 0.7 g a.i./m² and aerated as described previously on 10 June 1991, fenamiphos 10G at 2.2 g a.i./m², and an untreated control. Materials were applied at 0645 to 1030 hours on 11 June 1991 and were watered in with 1.3 cm of water starting at 1045 hours. The turfgrass was maintained as previously described. Phytotoxicity evaluations, turfgrass visual ratings, nematode counts, and statistical analyses were done as described for the 1990 field study.

Laboratory study: A laboratory pot study was designed to compare the ability of fosthiazate and fenamiphos to suppress the establishment of *B. longicaudatus* on FX-313 St. Augustinegrass [*Stenotaphrum secundatum* (Walt.) Kuntze]. The methods used were as described by Giblin-Davis *et al.* (3). Washed aerial stolons of FX-313 St. Augustinegrass were planted in autoclaved 60-mesh sand in 26 × 52 mm plastic trays kept on a raised bench for rooting. Stolons were 6–8 cm long terminal cuttings with two to three nodes. After 34 days, sprigs were transplanted to square tapered pots (80 mm wide at the top, 60 mm wide at the bottom, 75 mm deep). Sprigs averaged 4.95 g (std dev = 0.29) fresh weight at the time of transplanting and had one strong terminal with two to three nodes and four to six basal roots. Pots were filled with 250 ml (378 g) of moist, autoclaved Margate fine sand. On 16 January 1992, 5 days after transplanting, pots were inoculated with 66 ± 7 *B. longicaudatus* in 0.26 ml of water into a small depression near the base of each plant (population breakdown = 15% J2–J3, 27% J4, 31% adult males, and 27% adult females). The nematodes were obtained by centrifugal flotation (6) from a stock culture maintained on FX-313 St. Augustinegrass.

The treatments were fosthiazate 10G at 1.5 g a.i./m² (90 mg formulated per pot), fenamiphos 10G at 1.1 g a.i./m² (69 mg formulated per pot), and an untreated

control. Nematicides were applied 1 day after nematode inoculation and each pot received 10 ml of water after treatment. Pots were watered twice weekly to bring soil moisture content up to just below saturation. Pots were placed on a laboratory bench under flourescent lights with a 16-hr photoperiod (photosynthetic photon flux: 138 μmole m^{-2} s^{-2}). Soil temperatures ranged between 22 and 23 °C. The experimental design was completely randomized. The blocking variable was time to harvest. Starting at 56 days after inoculation, one or two blocks were harvested daily until all 10 blocks were completed. At harvest, the soil was washed from the root ball and nematodes were extracted from the entire soil volume by centrifugal flotation (6). Nematode counts were obtained from an aliquot of one-half of the sample. Following nematode extraction, roots were separated from stolons and leaves, dried at 60 °C for 72 hr, and weighed. Data were analysed as previously described.

RESULTS AND DISCUSSION

1990 field test: At 28 days post-treatment, *B. longicaudatus* counts were lower in all nematicide treatments than in the untreated control (Table 1). At 56 days, plots treated with fosthiazate 10G at 1.5 g a.i./m^2 and fosthiazate 7.5 EC at 1.5 and 2.2 g a.i./m^2 had lower *B. longicaudatus* counts than both the fenamiphos 10G treated and the untreated control plots (Table 1), suggesting greater persistence for fosthiazate than for fenamiphos.

No symptoms of phytotoxicity were observed in any nematicide treatment. Turfgrass visual ratings were better at 28 days post-treatment for both fosthiazate 10G rates and for fosthiazate EC at 2.2 g a.i./m^2 than for the untreated control (Table 1). Visual ratings for all nematicide treatments were greater than for the untreated control at 56 days post-treatment and the best visual ratings were obtained from the 2.2 g a.i./m^2 rates of fosthiazate EC and 10G. These data support other field observations showing that fenamiphos is suppressive to *B. longicaudatus* at 1.35 g a.i./m^2 in bermudagrass fairways for up to 56 days and can produce significant short term visual rating improvements (4).

Nematode counts for *Meloidogyne* spp. (mostly *M. graminis* Sledge & Golden) were lower in plots treated with fosthiazate 10G at 2.2 g a.i./m^2 and fosthiazate 7.5 EC at 1.5 and 2.2 g a.i./m^2 at 28 days post-treatment than in fenamiphos 10G treated or untreated plots (Table 2). At 56 days post-treatment, fosthiazate 10G at 1.5 and 2.2 g a.i./m^2 and fosthiazate 7.5 EC at 2.2 g a.i./m^2 had reduced *Meloidogyne* spp. counts relative to the fenamiphos 10G commercial standard and the untreated control (Table 2). None of the treatments significantly affected the counts of the other phytoparasitic nematodes present in the plots, namely *Criconemella ornata* (Raski) Luc & Raski, and *Hemicriconemoides annulatus* Pinochet & Raski (data not shown).

1991 field test: Belonolaimus longicaudatus counts were reduced only in the fenamiphos 10G treated plots at 28 days post-treatment (Table 3). None of the treatments had any effect on *B. longicaudatus* counts at 56 days post-treatment (Table 3). There was a decline in the *B. longicaudatus* counts in the controls, which may have been due in part to the timing of the treatments. Treatments for the 1991 field study were done in the summer, which is often a time for natural decline in *B. longicaudatus* densities due to increases in soil temperature. The 1990 field study was conducted in the fall when soil temperatures were lower.

Table 1. Comparison of *Belonolaimus longicaudatus* counts and bermudagrass performance 0, 28, and 56 days after application of fenamiphos and fosthiazate in a 1990 turfgrass study in southern Florida.

Treatment[w]	*B. longicaudatus* per 100 cm³ of soil at three post-treatment intervals[x]			Visual rating at three post-treatment intervals[y]		
	0 days	28 days	56 days	0 days	28 days	56 days
Fosthiazate 10G (1.5 g a.i./m²)	98 ± 63 A[z]	24 ± 28 BC	32 ± 72 C	7.0 ± 0.3 A	7.9 ± 0.6 A	7.4 ± 0.8 B
Fosthiazate 10G (2.2 g a.i./m²)	89 ± 49 A	26 ± 26 BC	38 ± 67 BC	7.1 ± 0.4 A	7.8 ± 0.8 A	8.1 ± 0.8 AB
Fosthiazate 7.5 EC (1.5 g a.i./m²)	90 ± 45 A	27 ± 52 C	16 ± 29 C	6.9 ± 0.3 A	7.1 ± 0.3 C	7.4 ± 1.0 B
Fosthiazate 7.5 EC (2.2 g a.i./m²)	92 ± 48 A	19 ± 19 C	13 ± 14 C	7.1 ± 0.4 A	7.6 ± 0.6 AB	8.4 ± 0.7 A
Fenamiphos 10G (2.2 g a.i./m²)	94 ± 47 A	48 ± 39 B	66 ± 65 AB	7.0 ± 0.3 A	7.2 ± 0.4 BC	7.4 ± 0.9 B
Untreated control	91 ± 46 A	178 ± 169 A	152 ± 158 A	7.0 ± 0.3 A	7.1 ± 0.6 C	6.6 ± 0.9 C

[w]All plots were aerated prior to treatment.
[x]Nematode counts were transformed $\log_{10}(n + 1)$ prior to analysis; non-transformed means ± standard deviations are presented.
[y]Visual rating based upon the percentage of ground cover and the density of the bermudagrass on a scale of 1–10 (1 = bare ground, 5 = 50% coverage and medium density, 10 = 100% coverage and high density turfgrass).
[z]Means in a column followed by different letters indicate significant differences according to a Waller Duncan k-ratio t-test ($k = 100$; $P \leq 0.05$).

Table 2. Comparison of *Meloidogyne* spp. counts 0, 28, and 56 days after application of fenamiphos and fosthiazate in a 1990 turfgrass study.

Treatment[x]	*Meloidogyne* spp. juveniles per 100 cm³ of soil at three post-treatment intervals[y]		
	0 days	28 days	56 days
Fosthiazate 10G (1.5 g a.i./m²)	21 ± 12 A[z]	18 ± 16 AB	29 ± 42 CD
Fosthiazate 10G (2.2 g a.i./m²)	14 ± 18 A	18 ± 27 B	21 ± 30 CD
Fosthiazate 7.5 EC (1.5 g a.i./m²)	14 ± 15 A	22 ± 32 B	48 ± 42 BC
Fosthiazate 7.5 EC (2.2 g a.i./m²)	17 ± 18 A	6 ± 6 B	11 ± 10 D
Fenamiphos 10G (2.2 g a.i./m²)	19 ± 16 A	39 ± 21 A	168 ± 112 A
Untreated control	23 ± 20 A	48 ± 43 A	128 ± 153 AB

[x]All plots were aerated prior to treatment.
[y]Nematode counts were transformed $\log_{10}(n + 1)$ prior to analysis; non-transformed means ± standard deviations are presented.
[z]Means in a column followed by different letters indicate significant differences according to a Waller Duncan *k*-ratio *t*-test ($k = 100$; $P \leq 0.05$).

No phytotoxicity symptoms were observed in any treatment. Turfgrass visual ratings of fosthiazate 7.5 EC and 10G at 1.5 g a.i./m² and fenamiphos 10G were equal at 28 days post-treatment and better than the untreated control (Table 3). Fosthiazate 7.5 EC and 10G at 1.5 g a.i./m² continued to have higher visual ratings than the untreated control at 56 days post-treatment while the fenamiphos 10G treated plots did not (Table 3). There was no significant effect of aeration on visual ratings or *B. longicaudatus* counts in plots treated with 0.7 g a.i./m² of fosthiazate 7.5 EC (Table 3).

The only significant reduction in *Meloidogyne* spp. counts occurred in the fenamiphos 10G treated plots at 28 days post-treatment (Table 4). None of the treatments significantly affected densities of the other phytoparasitic nematodes present in the plots, namely *Hoplolaimus galeatus* (Cobb) Thorne, *C. ornata*, and *H. annulatus* (data not shown).

Laboratory study: When applied to FX-313 St. Augustinegrass, fosthiazate 10G at 1.5 g a.i./m² and fenamiphos 10G at 1.1 g a.i./m² markedly suppressed the counts of *B. longicaudatus* recovered from soil compared with the inoculated control (Table 5). The numbers of *B. longicaudatus* recovered from inoculated control pots 56 days after inoculation were similar to the population densities observed in a previous population dynamics study with *B. longicaudatus* on FX-313 (3). The very low numbers of *B. longicaudatus* recovered from the nematicide treated pots suggest that the nematicidal or nematastatic action of these materials prevented nematode population growth. Giblin-Davis *et al.* (5) obtained a marked suppression in population growth of *B. longicaudatus* on FX-313 St. Augustinegrass (84 days after inoculation) after being exposed for 14 days *in vitro* to >1 ppm fenamiphos or >10 ppm fenamiphos sulfone (fenamiphos metabolite). Their study assessed

Table 3. Comparison of *Belonolaimus longicaudatus* counts and bermudagrass performance 0, 28, and 56 days after application of fenamiphos and fosthiazate in a 1991 turfgrass study in southern Florida.

Treatment	*B. longicaudatus* per 100 cm³ of soil at three post-treatment intervals[w]			Visual rating at three post-treatment intervals[x]		
	0 days	28 days	56 days	0 days	28 days	56 days
Fosthiazate 10G (0.7 g a.i./m²)	67 ± 42 A[y]	25 ± 24 A	35 ± 24 A	3.8 ± 1.5 A	4.3 ± 1.3 BCD	3.4 ± 1.3 BC
Fosthiazate 10G (1.5 g a.i./m²)	68 ± 44 A	25 ± 25 AB	44 ± 33 A	5.1 ± 1.4 A	6.0 ± 1.2 A	4.7 ± 1.9 A
Fosthiazate 7.5 EC (0.7 g a.i./m²)	65 ± 39 A	30 ± 26 A	34 ± 23 A	3.3 ± 0.6 A	4.2 ± 1.0 CD	3.1 ± 0.8 C
Fosthiazate 7.5 EC[z] (0.7 g a.i./m²)	64 ± 38 A	31 ± 23 A	35 ± 19 A	3.8 ± 1.8 A	4.7 ± 1.0 BC	3.5 ± 0.9 ABC
Fosthiazate 7.5 EC (1.5 g a.i./m²)	67 ± 46 A	18 ± 21 A	36 ± 37 A	3.7 ± 1.8 A	5.4 ± 1.4 AB	4.6 ± 1.2 A
Fenamiphos 10G (2.2 g a.i./m²)	64 ± 37 A	8 ± 7 B	18 ± 15 A	4.2 ± 1.0 A	6.2 ± 1.5 A	3.6 ± 1.2 ABC
Untreated control	69 ± 55 A	21 ± 15 A	22 ± 9 A	3.3 ± 1.7 A	3.3 ± 1.2 D	2.4 ± 1.1 C

[w]Nematode counts were transformed $\log_{10}(n + 1)$ prior to analysis; non-transformed means ± standard deviations are presented.
[x]Visual rating based upon the percentage of ground cover and the density of the bermudagrass on a scale of 1–10 (1 = bare ground, 5 = 50% coverage and medium density, 10 = 100% coverage and high density turfgrass).
[y]Means in a column followed by different letters indicate significant differences according to a Waller Duncan k-ratio t-test ($k = 100$; $P \leq 0.05$).
[z]Plots of this treatment were aerated prior to treatment.

Table 4. Comparison of *Meloidogyne* spp. counts 0, 28, and 56 days after application of fenamiphos and fosthiazate in a 1991 turfgrass study.

Treatment	*Meloidogyne* spp. juveniles per 100 cm³ of soil at three post-treatment intervals[x]		
	0 days	28 days	56 days
Fosthiazate 10G (0.7 g a.i./m²)	63 ± 86 A[y]	41 ± 31 AB	34 ± 25 A
Fosthiazate 10G (1.5 g a.i./m²)	72 ± 62 A	66 ± 39 A	38 ± 31 A
Fosthiazate 7.5 EC (0.7 g a.i./m²)	67 ± 72 A	70 ± 50 A	46 ± 40 A
Fosthiazate 7.5 EC[z] (0.7 g a.i./m²)	50 ± 32 A	57 ± 56 AB	43 ± 26 A
Fosthiazate 7.5 EC (1.5 g a.i./m²)	57 ± 48 A	34 ± 22 AB	38 ± 25 A
Fenamiphos 10G (2.2 g a.i./m²)	42 ± 47 A	22 ± 19 B	40 ± 35 A
Untreated control	46 ± 35 A	59 ± 31 A	34 ± 18 A

[x]Nematode counts were transformed $\log_{10}(n + 1)$ prior to analysis; non-transformed means ± standard deviations are presented.
[y]Means in a column followed by different letters indicate significant differences according to a Waller Duncan *k*-ratio *t*-test ($k = 100$; $P \leq 0.05$).
[z]Plots of this treatment were aerated prior to treatment.

contact activity of fenamiphos and its metabolite against *B. longicaudatus*, whereas the exposures in our study involved contact and systemic activity of the formulated nematicide in a perched water table environment (pots).

Phytotoxicity was expressed as a severe leaf tip burn on most of the leaves within

Table 5. Comparison of *Belonolaimus longicaudatus* counts and FX-313 St. Augustinegrass shoot and root dry weights 56 days after treatment with fenamiphos and fosthiazate in a laboratory pot experiment.

Treatment[y]	*B. longicaudatus* per pot	Shoot dry weight (g)	Root dry weight (g)
Fosthiazate 10G (1.5 g a.i./m²)	2 ± 1 C[z]	2.0 ± 0.4 A	0.32 ± 0.08 A
Fenamiphos 10G (1.1 g a.i./m²)	5 ± 2 B	2.2 ± 0.4 A	0.30 ± 0.06 A
Inoculated control	750 ± 219 A	2.3 ± 0.5 A	0.19 ± 0.07 B
Uninoculated control	0 ± 0 D	2.3 ± 0.4 A	0.31 ± 0.08 A

[y]Pots (250-cm³ volume of soil) receiving nematodes were inoculated with 66 ± 7 *B. longicaudatus* in 0.26 ml of water 5 days after transplant rooting of FX-313 sprigs. Nematicides were applied 24 hr after nematode inoculation.
[z]Means ± standard deviations in a column followed by different letters indicate significant differences with a Waller Duncan *k*-ratio *t*-test ($k = 100$; $P \leq 0.05$). Nematode count data were transformed to $\log_{10}(n + 1)$ prior to analysis; non-transformed means are presented.

7 days post-treatment with fosthiazate 10G. However, there were no significant differences in shoot dry weight for any of the treatments after 56 days (Table 5). A small amount of chlorosis was observed in the inoculated controls 56 days after inoculation relative to the other treatments. Plants in the inoculated control also had 35% lower dry root weights than those in the uninoculated control and those in both nematicide treatments. These laboratory data confirm efficacy of both fosthiazate 10G at 1.5 g a.i./m^2 and fenamiphos 10G at the lower labelled rate (1.1 g a.i./m^2) for *B. longicaudatus* suppression. In the field, unfortunately, uneven application, enhanced biodegradation, excessive irrigation, and high soil pH can limit the efficacy of fenamiphos at 1.1 g a.i./m^2 for managing *B. longicaudatus* by reducing the dosage and length of exposure below effective levels (5).

Fosthiazate appears to be a promising organophosphate for postplant management of *B. longicaudatus* and possibly *Meloidogyne* spp. in turf. Further evaluations of fosthiazate phytotoxicity should be made on a variety of turfgrass species and cultivars in the field.

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