REPRODUCTION OF *HOPLOLAIMUS GALEATUS* AND GROWTH OF SEVEN ST. AUGUSTINEGRASS (*STENOTAPHRUM SECUNDATUM*) CULTIVARS[1]

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ABSTRACT

R. A. Henn and R. A. Dunn. 1989. Reproduction of *Hoplolaimus galeatus* and growth of seven St. Augustinegrass (*Stenotaphrum secundatum*) cultivars. Nematrópica 19:81–87.

Seven commonly available cultivars of St. Augustinegrass (*Stenotaphrum secundatum*) were grown in soil infested with lance nematodes (*Hoplolaimus galeatus*) to determine their ability to support nematode reproduction and sustain leaf growth. The Pf/Pi ranged from 5.7 to 8.6 for the seven cultivars, indicating similar host suitabilities. Differences in leaf weights increased with time so that the weights at the final cutting time and summed weights of the three cuttings differed among cultivars. The 'Roselawn-Floratam' group produced more clippings than did the 'Bitterblue' group whereas no differences between diploid and triploid cultivars were found.

Key words: Hoplolaimus galeatus, host suitability, lance nematodes, St. Augustinegrass, *Stenotaphrum secundatum.*

RESUMEN

Henn, R. A., y R. A. Dunn. 1989. Reproducción de *Hoplolaimus galeatus* y crecimiento de siete cultivares de césped San Agustín. Nematrópica 19:81–87.

Siete cultivares comunes de césped San Agustín (*Stenotaphrum secundatum*) se desarrollaron en suelo infestado con nematodos lanzas (*Hoplolaimus galeatus*) para determinar sus habilidades en mantener la reproducción del nematodo y sostener crecimiento foliar. Los Pf/Pi variaron de 5.7 a 8.6 en los siete cultivares, indicando preferencias similares hacia los hospederos. Diferencias en los pesos de las hojas aumentaron con el tiempo de manera que los pesos de la última poda y los pesos sumados de las tres podas variaron entre cultivares. El grupo 'Roselawn-Floratam' produjo más podas que el grupo 'Bitterblue' aunque no se encontraron diferencias entre cultivares diploides y triploides.

Palabras claves: césped San Agustín, *Hoplolaimus galeatus*, nematodo lanza, preferencia hacia el hospedero, *Stenotaphrum secundatum.*

INTRODUCTION

An association between lance nematodes (*Hoplolaimus* spp.) and unthrifty St. Augustinegrass (*Stenotaphrum secundatum* (Walt.) Kuntze)

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lawns was first reported in 1953 (8). Subsequent surveys (5,12,14,20) have frequently associated *Hoplolaimus galeatus* (Cobb) Thorne with problem lawns in Florida.

Lance nematodes often feed endoparasitically on St. Augustinegrass (5,12,19) and cotton, alfalfa, and bermudagrass (9,10,16). In their 1956 study of *H. galeatus* on cotton, Krusberg and Sasser (9) concluded that host symptoms were accentuated by dry conditions, but greenhouse-grown plants supplied with adequate moisture and nutrients could tolerate rather high populations. Those observations probably apply to the relationship of this *H. galeatus* to St. Augustinegrass, on which the nematode has been classified as moderately pathogenic (13).

Hoplolaimus galeatus poses a frequent and seemingly unmanageable problem in many St. Augustinegrass lawns because of its widespread distribution, the generally sandy soils of the southern coastal plain of the United States, and the frequent failure of nematicides to reduce their numbers while controlling competing phyotoparasites (13,14). Sensitivity of Florida's groundwater to contamination by pesticides also makes future availability of nematicides questionable.

Since resistance to other pests of St. Augustinegrass is available (15), tolerance and/or resistance to *H. galeatus* might be found. The objective of this study was to determine the ability of seven commercially available St. Augustinegrass cultivars to support reproduction of *H. galeatus* and to sustain leaf growth.

MATERIALS AND METHODS

Three different trials were conducted. In each trial, eight individual nodes of each of seven St. Augustinegrass cultivars were planted separately in uniform 15.2-cm-diam clay pots containing steam-pasteurized Arredondo fine sand (ca. 93% sand, 5% silt, 2% clay, 0.1% organic matter, pH 7.5). Turf nodes were added or subtracted from the pots to keep the density constant while covering the soil surface. The pots were fertilized once a week with 200 ml of a 1% 20-20-20 (N-P-K) solution and were watered as needed to keep the soil moist.

Of the three different trials, two were kept in the greenhouse and the third was transferred from the greenhouse to microplots 1 week after the pots were infested. Each microplot consisted of a 20-cm-diam $\times$ 76-cm-deep polyvinyl chloride cylinder containing methyl bromide-treated Arredondo fine sand. The three trials were staggered over 10 months (February–May, July–October, and August–November 1986). The design for all trials was a randomized complete block with seven commonly available cultivars of St. Augustinegrass (Table 1) and five replications, except in the second greenhouse trial in which there were four replications. Each experimental unit was a 15.2-cm-diam clay pot, which in the case of the third trial became a microplot.

Table 1. St. Augustinegrass cultivars tested, their chromosome numbers, and groups to which they belong.

Cultivar	Chromosome number	Group
Bitterblue	30	Bitterblue
Common	unknown	unknown
Floralawn	32	Roselawn-Floratam
Floratam	32	Roselawn-Floratam
Floratine	30	Bitterblue
Roselawn	18	Roselawn-Floratam
Seville	18	Dwarf

The *H. galeatus* population used was isolated from a Levy County, FL 'Tifgreen' bermudagrass (*Cynadon dactylon* (L.) Pers × *C. transvaalensis* J. B. Davy) golf green and increased on 'Dekalb hybrid forage' sorghum (*Sorghum bicolor* (L.) Moench. Pots were infested by pipetting *H. galeatus* into five 2.5-cm-deep holes to obtain a density of 30 nematodes per 100 cm^3 of soil. Previous greenhouse work had indicated that a rapid population increase could be expected at this initial population (Pi).

Plants were cut to a uniform height prior to commencing the trials and cut similarly as needed during each trial. The clippings were placed in paper bags and dried at 60 C for 2 days before cooling in a desiccator and weighing.

Harvest at 3.5 months after infestation included final clipping weights, estimates of final population density (Pf) of four nematode lifestages (second-stage juveniles (J2), third- + fourth-stage juveniles (J3 + J4), males and females) per 100 cm^3 of soil extracted using modified sieving-centrifugation (2), and number of nematodes per gram of dry root. Nematodes were extracted from the roots using the pie pan method with Scotties® tissue for 24 hours at room temperature (19). After extraction, dry root weights were determined by drying at 60 C, cooling in a desiccator, and weighing. Appropriate data analyses were performed and means separated by the Waller-Duncan k-ratio t-test with $k = 100$ ($P \leq 0.05$) (17).

RESULTS

Combined analysis of variance (Table 2) indicated that the three trials varied significantly ($P \leq 0.005$). The similarity of cultivar rankings between tests and the absence of cultivar effects within trials (Table 2), which would have indicated seasonal effects and necessitated separate analyses for the three trials, allowed the summary analyeses presented here, except where specifically noted.

There were no differences among cultivars in either the numbers of nematodes in each lifestage or in the total population (Table 2). The

Table 2. Summary analysis of variance table on three trials of seven St. Augustinegrass cultivars for dried clipping weights at three cutting times and for final *Hoplolaimus galeatus* numbers.

		Cutting time and clipping weight (g)								*H. galeatus* life-stages (soil)									
		1		2		3		Final		J2		J3 + 4		Male		Female		Total	
Source	df	*F*	*P* > *F*	*F*	*P* > *F*	*F*	*P* > *F*	*F*	*P* > *F*	*F*	*P* > *F*	*F*	*P* > *F*	*F*	*P* > *F*	*F*	*P* > *F*	*F*	*P* > *F*
Trial[z]	2	14.8	***	154.9	***	168.4	***	6.0	***	5.86	***	10.35	***	55.43	***	37.30	***	26.71	***
Rep (Trial)	11	5.1	***	0.7		.8		3.8	***	0.90		3.94	***	1.19		0.87		1.92	
Cultivars	6	2.1		1.7		8.9	***	2.9	*	0.54		1.23		1.87		1.61		1.63	
Trial (Cultivars)	12	0.9		1.3		3.8		0.8		0.49		0.70		0.96		1.61		0.87	
Error (MSE)	65	7.2		2.5		0.1		9.9		415.1		1 262.0		399.4		1 331.0		8 236.1	
Total	96																		

*, **, *** denote *F* values significant at the probability levels *P* > *F* of 0.05, 0.01, and 0.001, respectively.
[z]Five replications in trials 1 and 3, four replications in trial 2.

Table 3. Pf/Pi values for soil-inhabiting, root-dwelling, and combined *Hoplolaimus galeatus* populations on seven cultivars of St. Augustinegrass over three trials.

	Pf/Pi		
Cultivar	Soil	Root	Combined
Bitterblue	7.3	1.0	8.3
Common	6.2	1.2	7.3
Floralawn	7.3	1.3	8.5
Floratam	6.0	1.0	7.0
Floratine	7.7	0.9	8.6
Roselawn	5.1	0.6	5.7
Seville	6.1	0.8	6.9

No significant differences were detected.

Pf/Pi ratios averaged over the three trials are presented in Table 3. No differences were found among cultivars in the Pf/Pi for soil-inhabiting, root dwelling, or total lance nematode populations.

There were three clipping times in each trial. Slight and variable differences were detected in the clipping weights of the first and second cuttings of the three trials, but these stabilized into distinct and constant differences by the third cutting (Table 4). Total clipping weight summed over the three times also differed ($P \leq 0.05$) (Table 4).

While significant correlations were observed between the number of soil-dwelling adults and root-inhabiting J3 + J4 and adults, the level of correlation was low. Juveniles were three times (17/g dry root) as prevalent inside the root as females, the next most frequent lifestage (5/g dry root).

Linear contrasts comparing diploid cvs. Roselawn and Seville versus triploid cvs. (3) Biterblue, Floralawn, Floratam, and Floratine showed no differences in final clipping weights whereas the 'Bitterblue' group cvs. Bitterblue and Floratine and the 'Roselawn-Floratam' group (5) cvs. Roselawn, Floratam, and Floralawn differed significantly at the final clipping time ($P \leq 0.005$) (Table 5).

Table 4. Dried clipping weights summed over three cuttings and for each cutting, for seven St. Augustinegrass cultivars infected with *Hoplolaimus galeatus*. Data combined over three trials.

Cultivar	Summed weight (g)[z]	Cutting 1	Cutting 2	Cutting 3
Roselawn	12.3 a	8.7 a	2.6 ab	1.0 b
Floratam	11.3 ab	6.6 ab	3.4 a	1.3 a
Seville	9.8 abc	6.2 b	2.6 ab	0.9 b
Floratine	8.6 bc	5.6 b	2.6 ab	0.6 c
Floralawn	8.6 bc	5.6 b	2.1 ab	1.0 b
Bitterblue	8.3 c	5.2 b	2.1 ab	0.9 b
Common	8.2 c	5.9 b	1.7 b	0.6 c

[z]Means (14 observations over three trials) in columns followed by the same letter do not differ according to the Waller-Duncan k ratio t-test with $k = 100$ ($P \geq 0.05$).

Table 5. Final clipping weights produced by the members of the 'Roselawn-Floratam' groups and the 'Bitterblue' group infected with *Hoplolaimus galeatus*.

Weight (g)			
Roselawn-Floratam Group		Bitterblue Group	
Roselawn	12.3	Bitterblue	8.3
Floratam	11.3	Floratine	8.9
Floralawn	8.6		

Linear contrast of Roselawn-Foratam group vs. Bitterblue group significant at $P \leq 0.005$.

Low numbers (8–25/100 cm^3 soil) of *Paratrichodorus* sp. were recovered from the outdoor microplot test. Differences in population densities occurred among the seven cultivars, with 'Common' supporting significantly higher numbers of *Paratrichodorus* sp. than did the other cultivars.

DISCUSSION

Hoplolaimus galeatus increased equally on the seven St. Augustinegrass cultivars tested, indicating similar host suitabilities. These data should be interpreted with caution since St. Augustinegrass is a perennial, and a given cultivar might have a long-term influence on *H. galeatus* population dynamics that would not be apparent in a short-term test.

The amount of leaf tissue produced by these cultivars changed within each trial. At the final cutting, the 'Roselawn-Floratam' group produced more than the 'Bitterblue' group. These differences may reflect better adaptations of the 'Roselawn-Floratam' group to conditions of the trials, or to some other factor such as lance nematodes. These speculations cannot be addressed by this study. It is informative to note, however, that there is a negative correlation between first year yields of the pasture grasses, *Lolium* spp., and their persistence (18).

Dr. Phillip Busey (pers. comm.) has observed that plantings of triploid cultivars often maintain better coverage than diploid plantings. Genetic variation in grasses (e.g. polyploidy) has been related to success under herbivory (1,6,7). The varying gene expressions made possible by polyploidy (6) may produce a mosaic of minority genotypes which could escape pathogen pressure (1). However, the diploid vs. triploid contrast analyzed in this study did not support the hypothesis of multiple-genome superiority under *H. galeatus* pressure.

The contamination of fumigated soil with low numbers of *Paratrichodorus* sp. is not uncommon in Florida (11). Significant differences in their numbers on the seven cultivars of the microplot trial should provide stimulus for further investigation.

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