WEED HOSTS FOR *ROTYLENCHULUS RENIFORMIS* IN COTTON FIELDS ROTATED WITH CORN IN THE SOUTHEAST OF THE UNITED STATES

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ABSTRACT

Lawrence, K. S., A. J. Price, G. W. Lawrence, J. R. Jones, and J. R. Akridge. 2008. Weed hosts for *Rotylenchulus reniformis* in cotton fields rotated with corn in the southeast United States. Nematropica 38:13-22.

The reniform nematode (*Rotylenchulus reniformis*) is the primary economical nematode pest of cotton (*Gossypium hirsutum*) in the southern states of Alabama, Louisiana, and Mississippi. Corn (*Zea mays*), a non-host to *R. reniformis*, is the principal crop rotated with cotton to reduce *R. reniformis* populations. In recent years, failure to manage the nematode populations have been attributed to non-controlled common weed species growing in fields farmed under the cotton-corn rotation system. The important role played by 43 weed species in sustaining reniform nematode populations in these fields was confirmed in greenhouse, microplot and field experiments. In the greenhouse, the majority of dicotyledonous weed species tested served as hosts for *R. reniformis*, while the monocots did not. In field microplot studies, individual weed species (*Ipomoea hederacea*, *I. lacunosa*, *I. purpurea*, and *Senna obtusifolia)* growing in association with corn increased *R. reniformis* nematode populations. In field trials where corn plots were treated with only a preemergence herbicide, non-controlled weed species sustained *R. reniformis* populations as compared to the weed-free treatments. Season long weed management during the corn rotation system is an essential agronomic practice to obtain the full benefit of the rotation, and to effectively suppress *R. reniformis* populations.

Key words: Alabama cropping systems, *Gossypium hirsutum*, reniform nematode, *Rotylenchulus reniformis*, weed hosts, *Zea mays*.

RESUMEN

Lawrence, K. S., A. J. Price, G. W. Lawrence, J. R. Jones, and J. R. Akridge. 2008. Malezas hospedantes de *Rotylenchulus reniformis* en campos de algodón rotados con maíz en el sureste de Estados Unidos. Nematropica 38:13-22.

El nematodo reniforme (*Rotylenchulus reniformis*) es el prinicpal nematode de importancia económica en algodón (*Gossypium hirsutum*) en los estados de Alabama, Louisiana, y Mississippi. El cultivo más usado en rotación con algodón para reducir poblaciones de nematodo reniforme es el maíz (*Zea mays*), pues no es hospedante de *R. reniformis*. Recientemente, la ineficacia en el control de poblaciones con esta rotación algodón-maíz ha sido atribuída a la presencia de malezas comúnmente asociadas con el cultivo. En experimentos de invernadero, microparcelas y campo, se confirmó el papel de 43 especies de malezas en el sostenimiento de los niveles de población de nematode reniforme. En el invernadero, la mayoría de las malezas dicotiledóneas fueron hospedantes de *R. reniformis*, mientras que las monocotiledóneas no lo fueron. En los estudios de microparcelas, algunas malezas asociadas con el cultivo de maíz (*Ipomoea hederacea*, *I. lacunosa*, *I. purpurea* y *Senna obtusifolia)* aumentaron las poblaciones de *R. reniformis*. En los ensayos de campo en donde se trataron los lotes de maíz sólo con herbicida preemergente, las malezas no controladas sostuvieron las poblaciones de *R. Reniformis*, en contraste con los lotes libres de malezas. El control de malezas durante todas las fases del cultivo es esencial para obtener todos los benficios de la rotación y para reducir efectivamente las poblaciones de *R. reniformis*.

Palabras clave: Gossypium hirsutum, nematodo reniforme, malezas hospedantes, *Rotylenchulus reniformis*, sistemas de cultivo de Alabama, *Zea mays*.

INTRODUCTION

In the United States (USA), the reniform nematode (*Rotylenchulus reniformis*) Linford & Oliveira) is the primary nematode pest of cotton (*Gossypium hirsutum*) in the southern states of Alabama, Louisiana, and Mississippi. This nematode is estimated to reduce cotton production in these states by an average of 8% or 146,000 bales valued at $36 million (Blasingame *et al.*, 2007). Crop rotation is a viable nematode management strategy due to the lack of cotton varieties with resistance to *R. reniformis* (Cook and Robinson, 2005; Weaver *et al.,* 2007). The primary crop recommended to be rotated with cotton for managing *R. reniformis* in the southeast region is corn (*Zea mays*). Corn hybrids do not serve as hosts for *R. reniformis* making this crop an ideal alternate rotation sequence. One growing season in corn can reduce *R. reniformis* populations by 90% (Gazaway *et al.*, 2007). Recently, however, populations of *R. reniformis* have not declined in cotton fields after the corn season of the annual rotation (Lawrence, unpublished). Non-controlled weed species may account for this problem. The non-controlled weed species associated with corn production may be serving as hosts for *R. reniformis,* and sustaining nematode numbers during the non-host crop season. The purpose of this research was to determine if non-controlled weed plants associated with the corn phase of the cotton-corn rotation system were the cause of sustained *R. reniformis* populations. The objectives of this research were to determine if: 1) selected weed species common to the southeastern United States serve as hosts and allow reproduction of *R. reniformis*; 2) corn growing in a mixture with individual weed species increases *R. reniformis* numbers; and 3) corn with increasing densities of weeds growing in a mixture will sustain *R. reniformis* populations in the field. The outcome of this research will determine which weed species associated with corn in a cotton-corn rotation system favor the increase of *R. reniformis* numbers under field conditions.

MATERIALS AND METHODS

Tests were established in the greenhouse, microplot and in a cotton field to determine the host status of selected weed species to *R. reniformis* and their effect in increasing nematode soil densities when corn is rotated with cotton.

Rotylenchulus reniformis

The nematode inoculum used for all greenhouse tests consisted of *R. reniformis* populations collected from numerous cotton fields in Alabama, Louisiana, Mississippi and Tennessee. The *R. reniformis* populations were cultured and maintained in the greenhouse on 'Delta and Pineland 555 BG/RR' (DPL 555) cotton in 10-cm diameter polystyrene pots containing 500 cm^3 of a loamy sand soil (72.5% sand, 25% silt, 2.5% clay, OM 1%, pH 6.4). The soil was autoclaved at 121°C and 103.4 kPa for two hours on two successive days for sterilization. Nematode inoculum consisted of *R. reniformis* eggs and vermiform life stages extracted from the soil and root systems of cotton plants using combined gravity screening and sucrose centrifugal flotation. Eggs were extracted by agitating the root system for 4 minutes in a 0.6% sodium hypochlorite (NaOCl) solution (Hussey

and Barker, 1973). The *R. reniformis* life stages were enumerated using a Nikon Eclipse TS100 inverted microscope and adjusted to 2,000 eggs and vermiform life stages per 2 ml of water.

Greenhouse Evaluations

Greenhouse trials were conducted at the Plant Science Research Center on the campus of Auburn University in Auburn, Alabama. Forty-three species of noxious weeds were compared to cotton for suitability as hosts for *R. reniformis* (Table 1). All weed species tested were grown from seed with the exception of *Cyperus rotundus* and *Imperata cylindrica*, which were increased from root tubers and rhizomes, respectively. Seeds from each of the individual weed species were sown into 500 cm^3 of autoclaved loamy sand soil placed in 10 cm diam. polystyrene containers. DPL 555 cotton was included as a positive control. Each experiment was arranged in a randomized complete block design with five replications and each test was repeated twice. Fourteen to 21 days after sowing, the weed seeds had germinated and were inoculated by pipetting 2 ml of an aqueous suspension containing 2,000 *R. reniformis* eggs and vermiform life stages into a depression in each pot. Temperatures in the greenhouse throughout the experiments ranged from 24 to 35°C. All tests were harvested sixty days after *R. reniformis* inoculation. *Rotylenchulus reniformis* nematode eggs and vermiform life stages were extracted from the soil and roots as previously described. Populations were enumerated and reproduction factors were determined (Rf = final population/initial population). Weed species with populations above the original inoculum level of 2,000 were considered hosts (H) of *R. reniformis*. Weed species allowing nematode reproduction and Rf < 1 were considered poor hosts (PH). Those weeds without egg masses in their roots were considered non-host (NH). Total reproduction of *R. reniformis* on the weed species was also standardized as a percentage of the reproduction on cotton to provide an estimate of the relative susceptibility of each weed species to the nematode compared to that of cotton [(weed population/cotton population)*100].

Microplot Trials

Microplot field trials were conducted at the R. R. Foil North Plant Science Research Farm on the campus of Mississippi State University in 2005 and 2006. Corn and selected individual weed species populations were grown in mixtures to monitor *R. reniformis* population dynamics over time. Treatments consisted of cotton alone (a positive control), corn alone (negative control) and corn grown singularly with the weed species listed in Table 2. The microplots were infested with *R. reniformis* and were cropped with cotton the previous year. Each microplot consisted of 76 cm diam. fiberglass cylinders, placed 45 cm deep into the soil. The soil within the microplots was as a sandy loam (61.25% sand, 31.25% silt, 7.5% clay, 1% OM, pH 6.4). 'Dyna-Grow 58K22 RR corn' and DPL 555 cotton were planted in the appropriate plots. Weed seeds (40 cm^3 of seed) were hand-broadcasted into the respective treatment plots and lightly covered by hand hoeing. Each microplot test was arranged in a randomized complete block design with four replications and the test was performed twice over two years. Soil samples containing root fragments were collected at corn planting, and continued monthly through the growing season. Six soil cores, 2.5-cm in diam. and 15-cm deep, were collected per microplot and mixed in a composite sample. Soil samples with root fragments were stored in plastic bags for no more than 7

Table 1. Evaluations of common weed species for host status to *Rotylenchulus reniformis* as measured by the number of eggs, vermiform, and total nematodes per 500 cm^3 of soil, reproductive factors, and percentage to the cotton standard.

Common name	Scientific name	*Rotylenchulus reniformis**			Rf value**	% to Cotton	Dunnett's P-value
		Eggs	Vermiforms	Total			
Cotton	*Gossypium hirsutum* L.	3,084	7,005	10,089	5.0	100	
Common ragweed	*Ambrosia artemisiifolia* L.	4,620	7,607	12,227	6.1	121	0.869
Coffee senna	*Senna occidentalis* (L.) Link.	7,934	4,025	11,959	6.0	119	0.831
Common waterhemp	*Amaranthus rudis* Sauer.	6,141	5,531	11,672	5.8	116	0.721
Prickly sida	*Sida spinosa* L.	5,016	6,311	11,327	5.7	112	0.575
Wild buckwheat	*Polygonum convolvulus* L.	845	6,610	7,455	3.7	74	0.286
Carolina geranium	*Geranium carolinianum* L.	1,638	4,992	6,630	3.3	66	0.283
Pale smartweed	*Polygonum lapathifolium* L.	1,653	4,388	6,041	3.0	60	0.282
Sicklepod	*Senna obtusifolia* (L.) Irwin & Barneby	2,068	3,445	5,513	2.8	55	0.211
Black medick	*Medicago lupulina* L.	3,106	2,078	5,184	2.6	51	0.162
Red sesbania	*Sesbania punicea* (Cav.) Benth.	613	4,164	4,777	2.4	47	0.156
Entireleaf morningglory	*Ipomoea hederacea* Jacq.	2,106	2,590	4,696	2.3	47	0.151
Pitted morningglory	*Ipomoea lacunosa* L.	420	3,453	3,873	1.9	38	0.085
Carpetweed	*Mollugo verticillata* L.	570	2,794	3,364	1.7	33	0.065
Velvetleaf	*Abutilon theophrasti* Medik.	453	2,884	3,337	1.7	33	0.054
Benghal dayflower	*Commelina benghalensis* L.	464	1,864	2,328	1.2	23	0.028
Redroot pigweed	*Amaranthus retroflexus* L.	232	1,885	2,117	1.1	21	0.017
Hemp sesbania	*Sesbania herbacea* (P. Mill.) McVaugh	409	1,679	2,088	1.0	21	0.006
Wild onion	*Allium canadense* L.	796	780	1,576	0.8	16	0.004
Wild mustard	*Sinapis arvensis* L.	340	989	1,329	0.7	13	0.001
Henbit	*Lamium amplexicaule* L.	303	962	1,265	0.6	13	<0.001
Buckhorn plantain	*Plantago lanceolata* L.	245	760	1,005	0.5	10	<0.001
Field bindweed	*Convolvulus arvensis* L.	178	502	680	0.3	7	<0.001
Kochia	*Kochia scoparia* (L.) Schrad.	62	494	556	0.3	6	<0.001

*Population determined per 500 cm^3 of soil.

**Rf (Reproductive factor) = final population/initial population.

Significantly differences in egg, vermiform and total populations are indicated by Fischer's Protected Least Significant Difference test ($P \leq 0.05$).

Dunnett's test P values less than 0.05 indicate significant differences between each weed species and cotton.

Table 1. (Continued) Evaluations of common weed species for host status to *Rotylenchulus reniformis* as measured by the number of eggs, vermiform, and total nematodes per 500 cm^3 of soil, reproductive factors, and percentage to the cotton standard.

Common name	Scientific name	*Rotylenchulus reniformis**			Rf value**	% to Cotton	Dunnett's P-value
		Eggs	Vermiforms	Total			
Broadleaf signalgrass	*Urochloa platyphylla* (Nash) R. D. Webster	23	518	541	0.3	5	<0.001
Green foxtail	*Setaria viridis* (L.) Beauv.	8	523	531	0.3	5	<0.001
Common lambsquarters	*Chenopodium album* L.	8	489	497	0.2	5	<0.001
Red sorrel	*Rumex acetosella* L.	68	293	361	0.2	4	<0.001
Texas millet	*Urochloa texana* (Buckl.) R. Webster.	98	216	314	0.2	3	<0.001
Yellow foxtail	*Setaria pumila* (Poir) Roemer & S.A. Schultes	55	212	267	0.1	3	<0.001
Jimsonweed	*Datura stramonium* L.	31	216	247	0.1	2	<0.001
Curly dock	*Rumex crispus* L.	31	201	232	0.1	2	<0.001
Corn spurry	*Spergula arvensis* L.	57	147	204	0.1	2	<0.001
Purple nutsedge	*Cyperus rotundus* L.	10	106	116	0.1	1	<0.001
Fall panicum	*Panicum dichotomiflorum* Michx.	26	85	111	0.1	1	<0.001
Johnsongrass	*Sorghum halepense* (L.) Pers.	3	100	103	0.1	1	<0.001
Cogongrass	*Imperata cylindrica* (L.) Beauv.	0	77	77	0.0	1	<0.001
Large crabgrass	*Digitaria sanguinalis* (L.) Scop.	6	61	67	0.0	1	<0.001
Shattercane	*Sorghum bicolor* (L.) Moench ssp. *arundinaceum* (Desv.) de Wet & Harlan.	8	23	31	0.0	0	<0.001
Yellow nutsedge	*Cyperus esculentus* L	0	23	23	0.0	0	<0.001
Wild oat	*Avena fatua* L.	0	13	13	0.0	0	<0.001
Barnyardgrass	*Echinochloa crus-galli* (L.) Beauv.	3	0	3	0.0	0	<0.001
Dandelion	*Taraxacum officinale* G.H.Weber ex Wiggers	0	0	0	0.0	0	<0.001
LSD ($P \leq 0.05$)		1,830	4,290	5,104			

*Population determined per 500 cm^3 of soil.

**Rf (Reproductive factor) = final population/initial population.

Significantly differences in egg, vermiform and total populations are indicated by Fischer's Protected Least Significant Difference test ($P \leq 0.05$).

Dunnett's test P values less than 0.05 indicate significant differences between each weed species and cotton.

Table 2. Evaluations of weed species growing in combination with corn to determine population development of *Rotylenchulus reniformis* over time.

Treatment	Planting* May	30 DAP June	60 DAP July	90 DAP August	120 DAP Sept
Senna occidentalis + corn	8,375	1,651 b	3,863 bc	1,757 c	985 cd
Ambrosia artemisiifolia + corn	6,692	3,428 b	2,520 c	1,632 c	1,123 cd
Sida spinosa + corn	8,237	2,816 b	2,559 c	1,082 c	821 cd
Abutilon theophrasti + corn	10,715	4,007 b	3,611 bc	1,729 c	1,873 bc
Ipomoea spp. + corn	8,111	4,481 b	5,259 bc	3,486 b	1,342 bcd
Senna obtusifolia + corn	8,127	3,486 b	8,951 b	4,452 b	2,491 b
Sorghum halepense + corn	6,032	4,928 b	3,776 bc	956 c	579 d
Urochloa platyphylla + corn	5,887	3,148 b	3,187 c	1,304 c	830 cd
Z. mays (corn)	10,232	3,708 b	3,527 bc	1,275 c	850 cd
G. hirsutum (cotton)	8,842	20,713 a	16,165 a	10,229 a	4,210 a
LSD ($P \leq 0.05$)	ns	4,660	5,463	1,583	1,164

*Populations per 150 cm^3 of soil.
**Combination of *Ipomoea hederacea*, *I. lacunosa* and *I. purpurea* (L.) Roth.
Nematode population reported as means from two tests with four replications each.
The means within each column succeeded by different letters differ significantly according to Fisher's Protected Least Significant Difference test ($P \leq 0.05$).

days in a temperature controlled refrigeration unit at 4°C and processed for *R. reniformis* extraction and enumeration as previously described. Cotton and corn yields were determined at harvest.

Field Trials

Field experiments were conducted in 2005 and 2006 in a cotton field naturally infested with *R. reniformis*, located near Huxford, Alabama. Dyna-Gro 58K22 RR corn was grown utilizing four differential herbicide regimes designed to produce increasing weed densities. The four herbicide regimes included: 1) S-metolachlor plus atrazine applied at preemergence (PRE), followed by monthly applications of glyphosate; 2) a PRE application of S-metolachlor plus atrazine, followed by a single application of glyphosate before corn plants were 76 cm in height; 3) a PRE application of S-metolachlor plus atrazine; and 4) S-metolachlor applied PRE alone. S-metolachlor, atrazine, and glyphosate were applied at recommended rates of 0.23 L, 0.75 L, and 0.68 L per hectare, respectively. The field plots consisted of four rows, 7.62 m long with 102 cm row spacing arranged in a randomized complete block design with six replications. The soil within the plot area was classified as a Grady loam to a Poarch fine sandy loam (56.25% sand, 28.75% silt, 15% clay, pH 6.4). Nematode samples were collected at planting and monthly through the growing season. Samples containing root fragments were composed of ten soil cores, 2.5 cm in diameter and 20 cm deep collected from the center two rows per plot, using a systematic sampling pattern. Samples were transported, stored and processed as previously described. Weed biomass samples were col-

lected at 60 days after corn planting, and monthly until the end of the growing season. Biomass samples were collected from two 0.25 m^2 areas selected randomly between the two center rows of each plot. All weed growth within the areas was clipped at the soil line, bagged, and oven-dried at 55°C for 48 hours.

Generalized linear mixed models (GLMM) methodology with the lognormal distribution function was employed to analyze the data utilizing the Statistical Analysis System (SAS Institute, Cary, NC). The weed treatments were considered to be fixed effects, whereas block and year (block) were random effects. Means were separated either with Fisher's Protected Least Significant Difference test ($P \leq 0.05$) and comparisons to cotton were estimated using Dunnett's test. All levels of significance reported herein are at the $P \leq 0.05$ level unless otherwise stated.

RESULTS

Greenhouse Evaluations

Of the 43 weed species tested, 79% of dicotyledonous weed species served as hosts for *R. reniformis*, while, with the exception of *C. benghalensis*, the monocotyledonous species tested were not hosts (Table 1). Seventeen of the 43 weed species were hosts to *R. reniformis* producing a Rf value equal to one or above (Table 1). The remaining weed species had Rf < 1.0 allowing poor or no nematode reproduction (Table 1). Total reproduction on weeds ranged from 0 to 121% of reproduction on cotton with Rf values ranging from 0 to 6.1 (Table 1). Of the 43 weed species, 13 supported *R. reniformis* numbers that were not different from cotton based on Dunnett's test. The nematode numbers on the remaining weeds were lower ($P \geq 0.05$) than that on cotton. *Ambosia artemisiifolia*, *S. occidentalis*, *A. rudis*, and *S. spinosa* were excellent hosts for *R. reniformis,* allowing Rf values greater than those recorded on cotton. Other weed hosts (*P. convolvulus*, *G. carolinianum*, *P. lapathifolium*, *S. obtusifolia, M. lupulina*, *S. punicea*, *I. hederacea*, *I. lacunosa*, *M. verticillata*, *A. theophrasti*, *C. benghalensis*, *A. retroflexus*, and *S. herbacea)* supported less nematode reproduction than cotton. The remaining weed species had Rf < 1.0 and did not maintain the nematode populations, indicating they are poor hosts of *R. reniformis*.

Microplot Trials

In the microplot trials, *R. reniformis* populations remained higher throughout the growing season in the cotton alone treatment compared to corn, and any treatment containing corn and weeds (Table 2). *Rotylenchulus reniformis* numbers decreased in all of the weed species and corn at all the sampling dates compared to the initial nematode densities. However, the population decline was less drastic in the plots planted with *Ipomea* spp. and *Senna obtusifolia* associated with corn. At 90 DAP the nematode populations levels in these plots were higher than with corn only (Table 2). This trend persisted also at 120 DAP sample date when the nematode numbers decreased at the end of the crop and weed cycles.

Field Trials

Rotylenchulus reniformis populations increased in the treatments with minimal herbicide applications that had the highest weed density as compared to the weed-free treatment (Table 3). At 60 DAP, plots receiving only PRE herbicide treatments contained higher *R. reniformis* numbers than the weed-free treatment. *Rotylenchulus reniformis* populations had declined by 88% in the weed-free treatment and only 33% in the highest weed density S-metolachlor PRE treatment. At harvest, *R. reniformis*

Table 3. *Rotylenchulus reniformis* populations, corn yield, and weed biomass produced under four herbicide regimes in a corn production rotation.

Herbicide application	*Rotylenchulus reniformis*/150 cm³ soil			Corn* kg/ha	Weed biomass g/m
	May	July	Sept		
S-metolachlor @ pre emergence Atrazine @ pre emergence Glysophate monthly	1,128	133 c	815 b	6,065 a	67 b
S-metolachlor @ pre emergence Atrazine @ pre emergence Glysophate prior to 30" in height	1,536	193 bc	940 b	6,065 a	103 b
S-metolachlor @ pre emergence Atrazine @ pre emergence	1,306	425 ab	1,172 ab	5,363 bc	462 a
S-metolachlor @ pre emergence	1,023	682 a	1,455 a	4,660 c	541 a
LSD ($P \leq 0.05$)	ns	272	414	817	236

*Yield based on 15% moisture.
The means within each column succeeded by different letters differ significantly according to Fisher's Protected Least Significant Difference test ($P \leq 0.05$)

population levels had increased above the initial at-plant populations only in the S-metolachlor PRE treatment. All lower weed density treatments had fewer *R. reniformis*. Weed biomass weights collected before harvests were greater in the S-metolachlor alone and S-metolachlor plus atrazine PRE treatments as compared to the S-metolachlor plus atrazine followed by one or multiple glyphosate applications.

DISCUSSION

Overall, the findings of this research validate field observations indicating that non-controlled weed species associated with the cotton-corn rotation system, have the ability to serve as hosts for *R. reniformis*, and allow for increases of this nematode's population levels. Previous findings by Windham and Lawrence (1992) indicated corn was not a host to this nematode. Many of the weed species tested in this study are hosts to *R. reniformis*. The efficiency of the cotton-corn rotation to reduce *R. reniformis* numbers will not be adequate if season long weed control is not appropriately maintained. The high rate of reproduction of *R. reniformis* on *A. artemisiifolia*, *S. occidentalis*, *A. rudis*, and *S. spinosa* is a significant concern since these are common weeds in corn fields and can increase *R. reniformis* populations as efficiently as cotton during the non-host rotation cycle. In a literature review, Robinson *et al.* (1997) reported plant species in 77 families as hosts for *R. reniformis*. The majority of the crop and ornamental plant species reported are of major economic importance in the tropical regions of the world. Any plant species which allows for the increase in numbers of *R. reniformis* is considered a host. However, it is more difficult to determine if a plant species is a poor host or a non-host. When the Rf value of the

nematode on a given host is less than 1, it indicates the nematode population persists at low density levels on that specific host, which maintains a nematode reservoir in the field. This would reduce the potential decline of the nematode numbers during the non-host corn rotation. The effect of a weed reservoir is not unique to the cotton - corn rotation system. Numerous weed species common to fruits, vegetables and ornamentals in Brazil (Ferraz, 1985), Martinique (Quénehérvé *et al.*, 1995), USA (Inserra *et al.*, 1999; Starr, 1991) and Trinidad (Edmunds *et al.*, 1971) have been reported to act as hosts for *R. reniformis* and promote its reproduction. Some of the weed species in these cropping systems are in the same families and genera, but are different species than the ones reported here.

A recent report by Davis and Webster (2005) evaluated 11 weed species and three crops for relative host status for *R. reniformis* and *Meloidogyne incognita* (Kofoid & White) Chitwood. The numbers of *R. reniformis* did not increase above the initial inoculum level on any of the weeds or crops tested in Davis and Webster's first greenhouse tests but some did in the second test. In our tests, *I. hederacea*, *S. obtusifolia*, and *S. spinosa* were good hosts for *R. reniformis* increasing nematode numbers above the initial inoculum, while in Davis and Webster's test only *S. obtusifolia* and *S. spinosa* consistently increased nematode numbers. They also indicated *C. rotundus* as a good host from the findings in one test; however, this monocot weed did not increase *R. reniformis* numbers in any of our studies. Our *R. reniformis* population consisted of mixed isolates of nematode populations from across the southeast and mid-south allowing for a broad spectrum of genetic variability and pathogenicity which may explain the differences between these reports.

The microplot and field trials also demonstrated that specific weed species have the ability to serve as hosts and allow for the reproduction of *R. reniformis* under natural field conditions. Davis and Webster (2005) stated that most of the weeds they examined would not maintain high population levels of *R. reniformis* when non-host or nematode-resistant crops were grown in Georgia. Our microplot evaluations indicated that of the eight noxious weed plants tested, *S. occidentalis*, *A. artemisiifolia*, *S. spinosa*, *A. theophrasti*, *Ipomoea* spp., and *S. obtusifolia* all allowed *R. reniformis* numbers to increase to levels higher than those that persisted in the soil where the non-host corn was growing alone. However, these populations were lower than those on cotton.

Our results indicate that lack of season-long weed control can adversely affect the benefits of a non-host crop in a rotation system. Gaur and Haque (1986) suggested that un-weeded fallowing in *R. reniformis* nematode infested fields could do more harm than good by allowing for the increase of the nematode numbers on the weed species. This is in agreement with our field studies where minimal herbicide applications (S-metolachlor plus atrazine or S-metolachlor PRE alone) resulted in higher *R. reniformis* populations and greater weed biomass when growing with corn when compared to the standard S-metolachlor plus atrazine followed by one or multiple glyphosate applications. In selection of a herbicide regime in a non-host rotation, the *R. reniformis* reproduction potential should also be considered as a deciding factor in the type and timing of herbicide applications to control weed growth and subsequent nematode population increases.

Heald and Thames (1982) found the optimum soil temperature for *R. reniformis* life stage development was 25 to 36°C. Life cycle completion could occur at 21.5° and 15°C (Bird, 1983; Heald and Inserra, 1988), but required twice the amount of time to complete (Bird, 1983). Thus, winter weeds

such as *G. carolinianum* and *M. lupulina* could potentially serve to increase *R. reniformis* populations in the early spring before cotton planting if soil temperatures are sufficiently warm.

This study provided insight into why *R. reniformis* population densities remain above threshold levels after a production season growing a non-host corn rotation crop. Season-long weed management during the corn rotation is essential to obtain the full benefit of the rotation. These findings stress the importance of weed management decisions in a rotation crop option of a nematode management system.

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