

## ALABAMA COTTON COMMISSION 2005

**TITLE: Reniform nematode management investigations – project report.**

### INVESTIGATORS:

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### OBJECTIVE:

Our objectives are to: 1) examine the utility of poultry litter as an alternative means of reniform nematode management by encouraging growth of microbial populations that are parasitic and/or toxic to plant-parasitic nematodes; 2) conduct cotton variety screening for tolerance and resistance to the reniform nematode; 3) examine summer and winter weeds for host suitability of the reniform nematode 4) examine various winter cover crop rotations for management of the reniform nematode; 5) determine the efficacy and economics of recommended and experimental nematicides and biologicals for management of the reniform nematode.

1) **Poultry litter as an alternative means of reniform nematode management.** Evaluations were conducted in the greenhouse and in field plots to determine the effect of poultry litter on *R. reniformis* populations, bacterial and fungal populations, and seed cotton yields. Two types of poultry litter, house litter, and compost litter were evaluated at three rates. Results obtained from greenhouse evaluations indicate that poultry litter may have an antagonistic effect on *R. reniformis* populations. House litter produced 42% fewer *R. reniformis* vermiform nematode compared to its inorganic fertilizer equivalent.

The application of house litter reduced ( $P \leq 0.05$ ) *R. reniformis* eggs per gram of root by 279.5%, while compost litter applications had 107.4% fewer eggs ( $P \leq 0.05$ ) compared to the inorganic fertilizer equivalents. Increases in bacterial populations were observed in the compost litter treatments in the greenhouse evaluations. Compared to the inorganic fertilizer equivalents, a 210.5% and 231.3% increase in bacterial populations ( $P \leq 0.05$ ) was observed at 60 days after planting in the 1.0% and 2.0% house litter treatments, respectively. Fungal populations were not influenced by litter applications. Poultry litter applications in field trials did not effect ( $P \leq 0.05$ ) *R. reniformis* populations at mid-season and harvest or seed cotton yields over two years of testing. Greenhouse evaluations confirm that poultry litter has the potential to reduce *R. reniformis* numbers in cotton; however, field trials indicate that future long-term evaluations with poultry litter should be conducted before recommendations are made.

2. **Cotton variety screening for tolerance to the reniform nematode.** Variety trials will be established in north and south Alabama cotton fields naturally infested with the reniform nematode. This data has been published in the Alabama Agricultural Experiment Station Bulletin 657, July 2005.

3. **Determine the host suitability of various summer and winter weeds for the reniform nematode.** Selected summer and winter weed species common to Alabama crop production fields were grown in the greenhouse in autoclaved soil under controlled conditions. Corn and individual weed species populations growing together were evaluated in a microplot field study in order to quantify reniform population development under a mix host status. A field trial was also conducted in a naturally infested reniform cotton field in Huxford, Alabama, where corn was grown under different herbicide regimes to simulate various weed conditions in order to determine if the noxious weed plants associated with the cotton-corn rotation system may serve as hosts to the reniform nematode.

Greenhouse trials indicate that of the 28 weed species tested, the majority of dicotyledonous noxious weed species serve as host to the reniform nematode while the monocotyledonous species tested did not. The following weeds are hosts of the reniform nematode: Black Medic, Blue Fescue, Coffee Senna, Coffee Weed, Common Ragweed, Common Waterhemp, Hemp Sesbania, Ivy Leaf Morningglory, Lambsquarter, Morningglory (*I. nil*), Mornigglory (*I. tricolor*), Musk Thistle, Pale Smartweed, Pitted Morningglory, Redrood Pigweed, Tall Mornigglory, Teaweed, Velvetleaf, and Wild Buckwheat (Table 1). Sicklepod, Velvetleaf, and the Morningglory species tested, all serve as excellent hosts for the reniform nematode.

Thus, these weeds which are common to cotton corn rotation systems, could potentially increase reniform nematode populations if weed populations are high. Noxious weeds that did not increase reniform nematode numbers include: Cogongrass, Corn Spurry, Curly Dock, Field Bindweed, Jimson Weed, Kochia, Purple Nutsedge, and Wild Mustard. In the microplot studies, reniform nematode populations were higher ( $P \leq 0.05$ ) throughout the season in the cotton treatments compared to corn and any of the corn plus noxious weed combinations. Corn growing in combination with

Sicklepod or mixed Morningglory species had reniform nematode populations greater ( $P \leq 0.05$ ) than corn growing alone at 60 and 120 days after planting, although the populations were not as high as cotton. Microplot treatments containing corn with the monocotyledonous weeds, Johnsongrass or Broadleaf Signalgrass, had decreasing reniform populations throughout the growing season. Therefore, the dicotyledonous weed plants, Sicklepod or mixed Morningglory, served as good hosts to the reniform nematode allowing the nematode population to increase in the corn cycle of the cotton corn rotation system. Noxious weed species in field plots with minimal herbicide applications increase ( $P \leq 0.05$ ) reniform nematode populations as compared to the weed-free treatments. At harvest, the minimal pre-emergence and no post-emergence herbicide plots, had higher reniform nematode numbers than the routine pre-emergence herbicide application with one roundup application. This population response would be expected, due to the time required for population growth of the nematode

Table 1. List of noxious weed species and reniform nematode reproductive factor (Rf) values determining weed host status to the nematode in the greenhouse.

Scientific Name	Common Name	High rf	Low rf	rf mean
<i>Medicago lupulina</i>	Black Medic	12.128	0.000	2.592
<i>Festuca glauca</i>	Blue Fescue	3.798	0.000	1.550
<i>Senna occidentalis</i>	Coffee Senna	40.556	0.116	15.932
<i>Sesbania punicea</i>	Coffee Weed	18.077	0.309	5.902
<i>Imperata cylindrica</i>	Cogon grass	0.193	0.000	0.039
<i>Ambrosia artemisifolia</i>	Common Ragweed	17.613	0.167	8.100
<i>Amaranthus rudis</i>	Common Waterhemp	16.223	0.464	5.836
<i>Spergula arvensis</i>	Corn Spurry	2.781	0.000	0.539
<i>Rumex crispus</i>	Curly Dock	1.854	0.000	0.353
<i>Convolvulus arvensis</i>	Field Bindweed	2.575	0.116	0.632
<i>Sesbania herbacea</i>	Hemp Sesbania	11.819	0.039	3.454
<i>Ipomea hederacea</i>	Ivy Leaf Morningglory	16.686	0.464	5.615
<i>Datura stramonium</i>	Jimsonweed	2.318	0.039	0.460
<i>Kochia scoparia</i>	Kochia	2.742	0.039	0.599
<i>Chenopodium album</i>	Lambsquarter	4.867	0.013	1.432
<i>Carduus nutans</i>	Musk Thistle	3.592	0.927	2.610
<i>Ipomea tricolor</i>	Morningglory	257.243	144.612	180.150
<i>Ipomea lacunosa</i>	Pitted Morningglory	19.004	0.129	5.129
<i>Cyperus rotundus</i>	Purple Nutsedge	0.270	0.000	0.155
<i>Amaranthus retroflexus</i>	Redroot Pigweed	4.172	0.142	1.681
<i>Ipomea nil</i>	Morningglory	174.727	57.706	120.070
<i>Senna obtusifolia</i>	Sicklepod	90.614	1.120	15.867
<i>Polygonum lapathifolium</i>	Pale Smartweed	35.458	0.193	10.143
<i>Ipomea purpurea</i>	Tall Morningglory	163.487	22.016	95.420
<i>Sida spinosa</i>	Teaweed	35.226	2.318	11.840
<i>Abutilon theophrasti</i>	Velvetleaf	55.620	0.476	17.683
<i>Polygonum convolvulus</i>	Wild Buckwheat	30.359	0.129	7.213
<i>Sinapis arvensis</i>	Wild Mustard	3.013	0.000	0.838

\*Population determined per 500 cc of soil.

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

**4) Examine various winter cover crop rotations for management of the reniform nematode.** The impact of winter cover crops crimson clover (*Trifolium incarnatum*), subterranean clover (*Trifolium subterraneum*), ryegrass (*Lolium multiflorum*), rye (*Secale cereale*), vetch (*Vicia sativa*), black oat (*Avena strigosa*), lupin (*Lupinus albus*), and wheat (*Triticum aestivum*) on

*Rotylenchulus reniformis* population densities in cotton (*Gossypium hirsutum*) was examined in greenhouse, microplot, and field environments. Greenhouse trials indicated that crimson clover, subterranean clover, and hairy vetch serve as hosts for *R. reniformis*. Reproduction factors (Rf) for those crops were 7.2, 2.2, and 3.7, respectively. The remaining cover crops produced Rf values less than 1 indicating these crops are poor hosts for *R. reniformis*. In microplot and field trials, *R. reniformis* population densities did not increase on crimson clover, subterranean clover, and hairy vetch over the winter months under natural conditions. Aldicarb applied in the seed furrow at cotton planting subsequent to cover crop termination, decreased *R. reniformis* population densities throughout the cotton season compared to the untreated control. Seed cotton yields were not affected by the cover crop but increased an average of 20% in all plots treated with aldicarb. Although crimson clover, subterranean clover and hairy vetch are hosts for *R. reniformis* as indicated in greenhouse tests, the *R. reniformis* populations did not increase on these cover crops under natural environmental conditions.

**5. Determine the efficacy and economics of recommended and experimental nematicides for the management of the reniform nematode.** Sixteen trials were conducted in 2005 to determine the efficacy of recommended and experimental nematicides. Tests were established in naturally infested fields located either adjacent to the Auburn University, Tennessee Valley Research and Extension Center, in Belle Mina; at the E. V. Smith Research Station in Tallassee; or in a producer's field near Huxford, AL. Avicta, Temik 15 G, and Vydate and various experimental compounds were examined at various rates and application timings. All treatments were planted in 2 - 4 row plots, 25 feet long with a 36 - 40 inch row spacing, and replicated 4 - 6 times. Avicta and experimental compounds were applied to the seed by the manufacturer. Temik 15 G (5.0 lb/A) was applied at planting in the seed furrow with chemical granular applicators attached to the planter. Vydate C-LV was applied as a foliar spray at the 4 - 6 true leaf plant growth stage with a two row CO<sub>2</sub> charged back pack sprayer. Nematode population development was determined at monthly intervals. Plots were rated at 4 weeks to determine seedling emergence and uniformity. Cotton was harvested utilizing a two-row cotton picker to determine the effects of each treatment on cotton yield.

Reniform nematode and seedling disease pressure was high to moderate in 2005. However, weather conditions were extreme in the Huxford area which endured rains and winds from two tropical storms, as well as three hurricanes. Belle Mina suffered a drought during the boll filling period in August and September. Avicta, Temik 15 G and Cruiser treatments were present in six tests in the two locations. For a general summary of 2005, seed cotton yields were averaged across tests and Temik 15 G and Avicta seed treatments produced 0.3 and 1.3 percent more seed cotton than the Cruiser control treatment.

In Belle Mina, reniform nematode numbers increased throughout the season from the initial 2277 vermiform per 150 cc of soil. The total of the monthly reniform populations were 22% lower in the Dynasty CST 125 + Cruiser 5 FS + Avicta treatment as compared to the Dynasty CST 125 + Cruiser 5 FS control (Table 2). The Dynasty CST 125 + Cruiser 5 FS + Avicta seed application increased seed cotton yields 198 lb over the Dynasty CST 125 + Cruiser 5 FS treatment. The addition of Temik 15 G at planting to the Dynasty CST 125 + Cruiser 5 FS + Avicta B seed application further increased seed cotton yields by an additional 285 lbs. Similarly, the foliar application of Vydate at the 4-6 leaf stage increased the Dynasty CST 125 + Cruiser 5 FS + Avicta B seed cotton yields by 341 lb.

Table 2. Effect of Avicta, Temik 15G, and Vydate CLV on stand, reniform nematode numbers, and seed cotton yields.

Treatment/Product	Product/AI Rate	Product/AI Rate Unit	Applied	Timing	Stand/ 25 ft row	Reniform/ 150 cc soil	Seed cotton lb/a
Dynasty CST 125 + Cruiser 5 FS	32 + 0.34	Ga/100KgSeed + MgA/Seed	seed	plant	47.2 ab	20543 ab	3426.7 abc
Dynasty CST 125 + Cruiser 5 FS + Avicta	32 + 0.34 + 0.15	Ga/100KgSeed + MgA/Seed + MgA/Seed	seed	plant	55.4 a	15991 b	3624.8 ab
Dynasty CST 125 FS + Temik 15G	32 + 5.6	Ga/100KgSeed + KgPr/Ha	seed + infurrow	plant	47.6 ab	22119 a	3009.1 bc
Dynasty CST 125 + Crusiser 5 FS + Avicta + Temik 15 G	32 + 0.34 + 0.15 + 5.6	Ga/100KgSeed + MgA/Seed + MgA/Seed + KgPr/Ha	seed + infurrow	plant + Side dress	49.2 ab	21177 ab	3909.4 a
Dynasty CST 125 FS + Temik 15G + Temik 15 G	32 + 5.6	Ga/100KgSeed + KgPr/Ha	seed + infurrow	plant + Side dress	36.6 c	20420 ab	3454.0 abc
Dynasty CST 125 + Cruiser 5 FS + Avicta + Vydate	32 + 0.34 + 0.15 + 561	Ga/100KgSeed + MgA/Seed + MgA/Seed + gal/Ha	seed	plant + foliar 4- 6L	49.8 ab	17273 ab	3965.7 a

Dynasty CST 125 FS + Temik 15G + Vydate	32 + 5.6 +561	Ga/100KgSeed + KgPr/Ha + gal/Ha	seed	plant	39.4 bc	16068 b	2853.5 c
Dynasty CST 125 + Cruiser 5 FS + Vydate	32 + 0.34 + 561	Ga/100KgSeed + MgA/Seed + gal/Ha	seed	plant + foliar 4-6L	45 abc	21476 ab	4011.0 a
LSD (P ≤0.05)					10.5	5783	675.7

In the beltwide standardized Avicta versus Temik nematicide test, Huxford and Belle Mina locations did not respond similarly. In Huxford, the Dynasty CST 125 + Cruiser 5 FS seed application with and without Avicta increased cotton stand ( $P \leq 0.05$ ) as compared to the Allegiance FL + RTU Baytan-Thiram 1.76 FS + Temik 15 G combination treatment (Table 3). Reniform nematode numbers increased slowly throughout the season with the highest numbers observed in Aug at 90 dap which corresponds with the maximum plant growth stage. Neither Avicta nor Temik 15 G consistently reduced nematode numbers across the season. Avicta in combination with Dynasty CST 125 + Cruiser 5 FS produced the greatest yield. The addition of Avicta to the Dynasty CST 125 + Cruiser 5 FS treatment increased seed cotton yields 55 lb. The addition of Temik 15 G to the Dynasty CST 125 seed treatment or the Allegiance FL + RTU Baytan-Thiram 1.76 FS seed treatment did not increase seed cotton yields as compared to the Dynasty CST 125 + Cruiser 5 FS treatment.

Table 3. Effect of Avicta and Temik 15G, on stand, reniform nematode numbers, and seed cotton yields in Huxford, AL.

Treatment/Product	Product/AI Rate	Product/AI Rate Unit	Applic.	Applic. Timing	Stand 25 ft row	Reniform/ 150 cc soil	Seed cotton lb/a
Dynasty CST 125 + Cruiser 5 FS	32 + 0.34	Ga/100KgSeed + MgA/Seed	seed	plant	65.7 a	6120	1852.8 ab
Dynasty CST 125 + Cruiser 5 FS + Avicta	32 + 0.34 + 0.15	Ga/100KgSeed + MgA/Seed + MgA/Seed	seed	plant	60.3 a	5433	1907.9 a
Dynasty CST 125 + Temik 15 G	32 + 5.6	Ga/100KgSeed + KgPr/Ha	seed + infurrow	plant	48.8 b	6219	1740.5 abc
Dynasty CST 125 + Temik 15 G	32 + 7.0	Ga/100KgSeed + KgPr/Ha	seed + infurrow	plant + Side dress	35.3 c	4197	1514.0 c
Allegiance FL + RTU Baytan-Thiram 1.76 FS + Temik 15 G	15 + 41 + 5.6	Ga/100KgSeed + KgPr/Ha	seed + infurrow	plant + Side dress	41.5 bc	4867	1658.7 bc
LSD P=0.05					8.9	2075 (NS)	234.9

In Belle Mina, the Dynasty CST 125 + Cruiser 5 FS + Avicta seed application increased cotton stand ( $P \leq 0.05$ ) as compared to the Allegiance FL + RTU Baytan-Thiram 1.76 FS + Temik 15 G combination treatment, although the uniformity of the stand was not affected by any treatment (Table 4). Plant vigor ratings were not affected by seed treatment. Reniform nematode numbers increased slowly throughout the season with the highest numbers observed in Aug at 120 dap which corresponds with the maximum plant growth stage. Both nematicides increased seed cotton yields numerically as compared to the Dynasty CST 125 + Cruiser 5 FS control. The addition of Avicta to the Dynasty CST 125 + Cruiser 5 FS treatment increased seed cotton yields 163 lb. The addition of Temik 15 G to the Dynasty CST 125 seed treatment increased seed cotton yields by an average of 172.5 lbs as compared to the Dynasty CST 125 + Cruiser 5 FS treatment. The addition of the nematicides Avicta or Temik 15 G increased seed cotton yields by 140 lb/a.

Table 4. Effect of Avicta and Temik 15G, on stand, reniform nematode numbers, and seed cotton yields in Belle Mina, AL.

Treatment/Product	Product/AI Rate	Product/AI Rate Unit	Applic.	Applic. Timing	Stand 25 ft row	Vigor	Reniform/ 150 cc soil	Seed cotton lb/a
Dynasty CST 125 + Cruiser 5 FS	32 + 0.34	Ga/100KgSeed + MgA/Seed	seed	plant	36.4 ab	3.6	11629	3315
Dynasty CST 125 + Cruiser 5 FS + Avicta	32 + 0.34 + 0.15	Ga/100KgSeed + MgA/Seed + MgA/Seed	seed	plant	41 a	3.6	9718	3478
Dynasty CST 125 + Temik 15 G	32 + 5.6	Ga/100KgSeed + KgPr/Ha	seed + infurrow	plant	39.4 ab	3.3	10413	3428
Dynasty CST 125 + Temik 15 G	32 + 7.0	Ga/100KgSeed + KgPr/Ha	seed + infurrow	plant + Side dress	39.4 ab	3.6	10511	3547

Allegiance FL + RTU Baytan-Thiram 1.76 FS + Temik 15 G	15 + 41+ 5.6	Ga/100KgSeed + KgPr/Ha	seed + infurrow	plant + Side dress	31.4 b	3.5	8508	3368
LSD P=0.05					9.1	0.5 (NS)	3843(NS)	458(NS)

Bayer also has two experimental nematicide seed treatments. In Huxford, cotton stand was not affected by any of the seed treatments or Temik 15 G (Table 5). Reniform nematode numbers increased slowly throughout the season with the highest numbers observed in Aug which corresponds with the maximum plant growth stage. At 60 day after planting the Gaucho experimental 600003BFS SC at the low rate reduced reniform numbers as compared to the control (data not shown). No treatment reduced nematode numbers consistently at all sample dates as compared to the untreated control. Seed cotton yields varied by 437 lb/A; however, differences were not significant ( $P \leq 0.05$ ). The Gaucho L1489A FS EC and 600003BFS SC experimental seed treatments averaged over both rates increased seed cotton yields by 225 and 390 lb/A, respectively as compared to the untreated control.

Table 5. Effect of Bayer experimental nematicide seed treatments on stand, reniform nematode numbers, and seed cotton yields in Huxford, AL.

Treatment	Rate	Applied	Stand 25 ft row	Season total reniform/ 150 cc soils	Seed cotton lb/A
Untreated			86.67	4995.5	1741.4
Gaucho FS	500ga/100 kg	seed	70.83	5642.4	2118.5
Gaucho L1489A FS EC	500 + 100/100 kg	seed	54.5	4656.5	1934.1
Gaucho L1489A FS EC	500 + 0.15 mg/seed	seed	58.67	6051.3	1998.0
Gaucho Exp600003BFS SC	500+500ga/100 kg	seed	71.17	4248.7	2084.6
Gaucho Exp600003BFS SC	500+750ga/100 kg	seed	68.33	6386.1	2179.0
Temik 15G	840 ga/ha (5lb/a)	In furrow	56	4815.3	1826.6
LSD P<0.05			32.8 (NS)	2898 (NS)	301.9 (NS)

In Belle Mina, the Gaucho Exp600003BFS SC seed application increased cotton stand ( $P \leq 0.05$ ) as compared to the Gaucho FS. At 60 days after planting, the Gaucho experimental seed treatments, L1489A FS EC at both rates and 600003BFS SC at the low rate reduced reniform numbers as compared to the control (data not shown). No treatment reduced nematode numbers consistently producing a lower season total number as compared to the untreated control. Seed cotton yields varied by 688 lb/A; however, differences were not significant ( $P \leq 0.05$ ). The Gaucho L1489A FS EC and 600003BFS SC experimentals increased seed cotton yields by an average of 191 and 430 lb/A, respectively as compared to the untreated control.

Table 6. Effect of Bayer experimental nematicide seed treatments on stand, reniform nematode numbers, and seed cotton yields in Belle Mina, AL.

Treatment	Rate	Applied	Stand 25 ft row <sup>Z</sup>	Season total reniform/ 150 cc soils	Seed cotton lb/A	
Untreated			44.6	ab	12982.5	2504.2
Gaucho FS	500ga/100 kg	seed	33.8	b	14116.5	3192.2
Gaucho L1489A FS EC	500 + 100/100 kg	seed	42.0	ab	13719.8	2753.1
Gaucho L1489A FS EC	500 + 0.15 mg/seed	seed	48.4	ab	11364.5	2446.7
Gaucho Exp600003BFS SC	500+500ga/100 kg	seed	40.4	ab	10599.5	2701.8
Gaucho Exp600003BFS SC	500+750ga/100 kg	seed	51.8	a	9610.3	3166.1
Temik 15G	840 ga/ha	In furrow	42.2	ab	10898	2815.3
LSD P<0.05			15.2		10041(NS)	785.5 (NS)