

## EVALUATION OF SOYBEAN VARIETIES WITH AVICTA FOR CONTROL OF *ROTYLENCHULUS RENIFORMIS*

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### Abstract

The reniform nematode, *Rotylenchulus reniformis*, is an economically significant plant parasitic nematode that causes yield loss on soybean and cotton in the Southeastern United States. The objectives of this research was to determine the performance of reniform-nematode resistant, moderately resistant, and susceptible soybean varieties when planted in a reniform infested field, and to determine if the addition of the nematicide seed treatment Avicta (Abamectin 0.15mg ai/seed) will significantly reduce reniform populations across varieties and prevent yield loss. Varieties planted with and without the Avicta treatment were compared to the same varieties planted in an adjacent, non-reniform infested field. Yield was 35% lower on varieties without Avicta in the reniform-infested field compared to the same varieties in the non-infested field. The Avicta seed treatment reduced reniform eggs per gram of root by 49% on average; however the reduction was only statistically significant for the nematode susceptible variety. The root-knot and soybean cyst nematode resistant variety: Mycogen 5N522R2 outperformed moderate and susceptible varieties with higher yield and lower reniform eggs per gram of root. The Avicta seed treatment increased yield by 7% on average. A soybean variety resistant to root-knot, soybean cyst, and reniform nematodes and the Avicta nematicide are recommended for growers with *R. reniformis* infested fields.

### Introduction

*Rotylenchulus reniformis*, also known as reniform nematode, is a plant parasitic nematode which can cause severe yield losses on cotton and soybean. It was estimated that reniform nematodes caused soybean yield losses of approximately 5 million bushels in the United States in 2014 (Koenning and Wrather, 2014). In addition to causing yield loss on soybean, the reniform nematode causes an average yield loss of 5% annually on cotton in Louisiana, Alabama, and Mississippi (Lawrence *et al.*, 2014). Because reniform nematode is a significant pathogen of soybean and cotton, incorporating a resistant variety in a cotton-soybean rotation in reniform infested fields will reduce nematode populations and increase yields. The objective of this study was to screen nematode resistant, moderate, and susceptible soybean varieties with and without the nematicide Avicta to determine variety performance in a reniform infested field. Soybean varieties with and without Avicta planted in the reniform infested field will be compared to the same varieties planted in a non-infested field.

### Materials and Methods

Five soybean varieties (two root-knot (RK) and soybean cyst nematode (SCN) resistant, two RK moderately resistant, and one susceptible to RK, SCN, and reniform nematode) were evaluated with and without the nematicide Avicta (0.15mg Abamectin/ seed, Syngenta, Greensboro, NC) in nematode infested and uninfested fields. The varieties were planted at Tennessee Valley Research and Extension Center (TVREC) near Belle Mina, Alabama on May 5th and harvested Oct 7<sup>th</sup>, 2016. The soil type at TVREC is a Decatur silt loam (24% sand; 49% silt; 28% clay). Field trials were arranged in a RCBD design in four and two row plots with five replications per treatment. Treatments consisted of varieties with and without Avicta planted in the infested field and untreated varieties planted in a field not infested with reniform nematode (see table 1 for list of varieties). Four row plots planted in the *R. reniformis* infested field were comprised of untreated varieties on the left two rows and Avicta treated varieties on the right two rows. Two row control plots of the varieties were planted in an adjacent field without *R. reniformis* populations. After 34 days two plants per row were harvested (four plants per treatment) and fresh shoot and root weights were used to calculate plant biomass. *Rotylenchulus reniformis* eggs were extracted from the root systems by shaking for four minutes in a 6% NaOCl solution. Eggs per root replicate were enumerated under an inverted Nikon

light microscope. All treatments were compared together to determine differences in plant biomass, reniform eggs per gram of root, and yield. Data were analyzed using SAS 9.4 with Proc Glimmix and the LS-means compared by Tukey's ( $P \leq 0.10$ ) for significant differences.

### **Results and Discussion**

The performance of the soybean varieties with and without Avicta demonstrated that a nematicide-treated resistant variety outperformed the nematicide treated moderate and susceptible varieties in terms of yield and reniform population density. Plant biomass at 34 DAP was similar between soybean varieties with and without Avicta in the reniform nematode infested field. Varieties in the non-infested field had 34% greater biomass on average than the varieties in the reniform field without Avicta. Asgrow 5935 control plots (no reniform present) had significantly greater biomass than Asgrow 5935 with and without Avicta in the reniform field (Table 1). Avicta significantly reduced the number of *R. reniformis* eggs per gram of root when applied to the susceptible variety: UA 5414RR (Table 1). The RK and SCN resistant variety Mycogen 5N522R2 treated with Avicta had significantly less reniform eggs per gram of root than Asgrow 5935, Progeny 5333RY, and UA 5414RR varieties without Avicta (Table 1). The average yield over all varieties in the reniform-free field was 40 bu/a while the yields of the varieties without Avicta in the reniform-infested field was 25 bu/a. Thus the reniform reduced yield over all varieties by 37 %. Varieties treated with Avicta yielded 28 bu/a, which was an 11% when reniform is present. Yields between soybean varieties in the infested field were not significantly different when compared with and without Avicta (Table 2). Mycogen 5N522R2 with Avicta produced significantly more yield than UA, Progeny, and Asgrow varieties with and without Avicta (Table 2). The UA and Progeny varieties produced significantly greater yield in the non-infested field than in the reniform infested field with or without Avicta (Table 2).

Table 1. Soybean variety plant biomass and *R. reniformis* eggs per gram of root when planted in a Reniform infested field with and without Avicta and in a field without Reniform.

Variety	Plant Biomass (g)			<i>R. reniformis</i> eggs per gram of root	
	<i>R. reniformis</i> No Avicta	<i>R. reniformis</i> Avicta	Without <i>R. reniformis</i>	<i>R. reniformis</i> No Avicta	<i>R. reniformis</i> Avicta
Mycogen 5N522R2*	19.8 abcd	20.2 abcd	27.7 ab	212 bcd	87 cd
USG 75T40*	15.3 cd	18.0 bcd	24.3 abcd	193 bcd	106 cd
Asgrow 5935	20.0 abcd	20.0 abcd	32.0 a	1021 ab	493 bcd
Progeny 5333RY	17.5 bcd	15.0 b	27.4 ab	993 ab	650 abcd
UA 5414RR**	17.0 bcd	15.8 bcd	24.3 abcd	1536 a	529 bcd

<sup>a</sup>Observations followed by same letter across columns are not significantly different according to Tukey's test at an alpha of  $P \leq 0.10$ . \* Indicates RK and SCN nematode resistant varieties. \*\* Indicates RK, SCN, and reniform susceptible varieties.

Table 2. Soybean variety yield in bushels in *R. reniformis* infested field with and without Avicta compared to field without *R. reniformis*.

Variety	Yield Bu./a		
	<i>R. reniformis</i> <sup>a</sup> No Avicta	<i>R. reniformis</i> Avicta	Without <i>R. reniformis</i>
Mycogen 5N522R2*	35 bcde	38 abc	49 a
USG 75T40*	26 efgh	32 cde	39 abc
Asgrow 5935	27 efgh	26 efgh	29 cdef
Progeny 5333RY	19 fgh	27 defg	44 ab
UA 5414RR**	18 gh	16 h	38 abc

<sup>a</sup>Observations followed by the same letter across columns are not significantly different according to Tukey's test at an alpha of  $P \leq 0.10$ . \* Indicates RK and SCN nematode resistant varieties. \*\* Indicates RK, SCN, and reniform susceptible varieties.

### **Summary**

This trial has demonstrated that the reniform nematode does reduce soybean yields in Alabama. The use of the Avicta nematicide seed treatment significantly decreased reniform eggs per gram of root when applied to the RK , SCN, and reniform susceptible variety UA 5414RR, though this was not observed with other varieties included in the study. The Avicta treatment reduced reniform eggs 49 % and increased yield 7% over all varieties tested. On average, yields were 35% lower for soybean varieties not treated with Avicta compared to the same varieties planted in the non-infested field. The Avicta seed treatment increased yield 3 Bu/a on average or \$28.50 at a price of \$9.50/Bu; after factoring the approximate cost of the nematicide this results in a profit of \$11.50 an acre. The nematode resistant Mycogen variety demonstrated significantly better performance in terms of yield and less reniform eggs per gram of root than the moderate and susceptible varieties in the infested field (Asgrow, Progeny, and UA with and without Avicta). This trial has demonstrated that a reniform-resistant soybean variety treated with Avicta is economically feasible for growers with fields heavily infested with *R. reniformis*.

### **References**

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