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Corn Nematode Control Update - 2011

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Among major row crops grown, corn was always thought to suffer the least damage from plant parasitic nematodes. Severe root-knot related yield losses have been seen in Southwest Georgia in irrigated cotton cropped behind corn. Greenhouse trials previously showed that the cotton (southern) root knot nematode (*Meloidogyne incognita* race 3) had a relatively high rate of reproduction on nearly all inbred lines and commercial varieties. In a recent Alabama study, yield losses ranging from 4 to 11% based on the preceding year juvenile (J2) counts for every 100 juvenile root knot nematodes in 100 cc of soil. In a corn rotation study at PBU, season-end root knot juvenile numbers ranging from 300 to 900 on corn cropped behind cotton or corn were seen. While the sandy and sandy loam soils of the Coastal Plain are the favored haunt for this damaging nematode, high root knot populations are present in the red clay soils in the Tennessee Valley in fields in a cotton monoculture. So, sizable yield losses in corn cropped behind cotton in nematode infested fields in the Tennessee Valley may also occur.

Options for managing cotton root knot nematode in corn and avoiding associated yield loss are limited. Rotation studies have shown sizable reductions in cotton root knot juvenile populations and noticeable yield gains for corn cropped behind one year of peanut. However, peanut is not a viable cropping option for many Alabama farmers. The soil insecticide/nematicides Counter 15G and Mocap 15G are registered for the control of nematodes and soil insect pests of corn. In recent years, yield gains ranging from 10 to 18 bu/A have been obtained with Counter 15G on corn planted on cotton root knot-infested fields. While Counter 15G and new Counter 20G formulations are readily available, this product, which is highly toxic, is a restricted use pesticide, as is Mocap 15G. Both Counter 20G and Mocap 15G are marketed in a Lock 'n Load capable container to minimize human exposure.

Avicta (a.i. abamectin + thiamethoxam) Duo Corn seed treatment insecticide/nematicide from Syngenta Crop Protection is registered for early season-protection from plant parasitic nematodes on corn. While availability of Avicta-treated corn seed is very limited for 2011, treated seed of some Northrup King corn varieties, most notably 785 3111, is available from some farm supply outlets. In a recent Alabama study, corn yield gains with Counter 15G and Avicta Duo nematicide seed dressing were similar.

VOTiVO/Poncho is a new nematicide/insecticide seed dressing that has recently been labeled for the control of plant parasitic nematode on corn. VOTiVO is unique in that the nematicide component is not a toxic chemical but the spore forming soil bacterium *Bacillus firmus* I-1582. According to Bayer CropScience literature, this biological control agent quickly reproduces to form a protective barrier that 'blocks' nematode feeding activity around the seedling roots. Comparisons of the performance of VOTiVO/Poncho with Avicta or Counter 15G against the cotton root knot nematode or protecting corn yields has not yet been reported. Field trials comparing the efficacy of VOTiVO/Poncho with Counter 15G against cotton root knot nematode and subsequent yield response will be conducted in 2011. Like Avicta Duo, limited quantities of VOTiVO/Poncho treated corn seed, most notably from Pioneer, are available from selected farm supply outlets, primarily in Central and North Alabama.

A 2ee label for the use of Telone II when applied as a row treatment at 3 to 6 gallons per acre for the control of nematodes on corn has also been issued. To be effective, Telone II must be injected with suitable equipment to deliver the product to a depth of 14 inches with a single chisel per planted row. Rows much be immediately sealed by bedding over the treated row or with strip till equipment that seals the soil surface. Wait a minimum of one week before planting corn. Information concerning the efficacy of Telone II on corn is very limited.

This report summarizes the results of several recent field trials to assess the effectiveness of selected nematicides to control cotton root knot nematode and increase corn yield.

Influence of Counter 15G on cotton root knot nematode and yield of selected corn varieties at the Brewton Agricultural Research Unit in 2009

On 3 March 2009, 400 pounds per acre (lb/A) of 5-10-15 analysis fertilizer with sulfur (20 lb/A) was broadcast and incorporated into the Benndale sandy loam soil (<1% organic matter) at the Brewton Agricultural Research Unit. Rows were laid off on 11 March with a ripper bedder. Prior to planting, beds were knocked down and the corn was sown with a cone planter on 8 April. The study area was not irrigated. Weed control was provided by an at-plant, broadcast application of Dual Magnum II at 1.0 pt/A on 8 April was followed by a broadcast application of 0.5 gallons per acre of Atrazine + 1 pint per acre of Dual Magnum on 19 May. A broadcast application of 176 pounds per acre of ammonium nitrate (34-0-0) on 29 April was followed by a second application of the same rate on 19 May. The experimental design was a split plot design with corn variety as the whole plot and nematicide treatment as the split plot treatment. Individual subplots consisted of two 25 foot rows on 3 feet centers arranged in six replications. For each corn hybrid, the split plot treatments were a non-treated control or an in-furrow, at plant application of Counter 15G at 6.5 lb/A. Plots were combined on 3 September. Soil samples for a nematode assay were collected from each subplot on 4 September and nematodes were extracted using the sugar flotation method. Significance of treatment effects were tested by analysis of variance and Fisher's protected least significant difference (LSD) test ($P \leq 0.05$).

With the exception of June 2009, monthly rainfall totals equaled and often exceeded the 30 year l average and were adequate for rainfed corn production. The nematicide treatment x corn variety interaction for cotton root-knot juvenile numbers, test weight, and yield were not significant, so pooled data are presented in Table 1. Counter 15G significantly increased yield by 16.3 bu/A, but did not reduce juvenile counts or increase test weight when compared with the non-treated control. Corn variety selection had a significant impact on cotton root-knot juvenile numbers, test weights, and yield. Equally high cotton root-knot nematode juvenile counts were recorded on DKC 68-06, Pioneer 31D59, Pioneer 33V16, Pioneer 31D57, and Southern States 804. Juvenile counts on Pioneer 33V14 were lower compared with four of the nine remaining corn varieties. While Southern States 804 had the highest test weight, lowest test weights were recorded for DKC 69-71 and DKC 69-72. Similarly high yields were reported for DKC 68-08, Pioneer 31P42, Pioneer 33V16, Southern States 777, Southern States 804, DKC 69-71, and Pioneer 31D59. Pioneer 33V14 had lower yields than all of the above corn varieties except for Southern States 804, DKC 69-71, and Pioneer 31D59.

Table 1. Impact of Counter 15G nematicide/insecticide and corn variety selection on the test weight and yield as well as on cotton root knot nematode juvenile numbers – PBU 2009

Split-plot analysis *P*(F)	Root-knot juvenile counts[z]	Test Weight[y]	Yield bu/A
Corn variety	0.0076**[x]	<0.0001***	0.0424*
Soil insecticide/nematicide	0.9302	0.5400	<0.0001***
Treatment x variety	0.1462	0.2873	0.9094
Soil insecticide/nematicide mean			
Counter 15G 6.5 lb/A	49.8 a[w]	56.4 a	118.1 a
Non-treated control	44.4 a	56.4 a	101.8 b
Corn variety mean			
Pioneer 31P40	74 bcd	56.5 bc	101.6 bc
Pioneer 31P42	65 cd	56.6 b	123.3 a
Pioneer 33V14	58 d	56.6 b	99.4 c
Pioneer 33V16	87 abc	56.6 b	117.1 ab
Pioneer 33M53	67 cd	56.5 bc	106.7 bc
Pioneer 33M57	65 cd	56.4 bcd	103.8 bc
Pioneer 31D57	86 abc	56.5 bc	101.1 bc
Pioneer 31D59	98 ab	56.4 bcd	110.7 abc
DKC 69-71	61 cd	55.9 f	111.1 abc
DKC 69-72	70 cd	56.1 e	104.4 bc
Southern States 775	71 bcd	56.3 de	106.7 bc
Southern States 777	73 bcd	56.4 bcd	115.8 ab
Southern States 804	83 abcd	56.8 a	111.8 abc
DKC 68-06	107 a	56.4 bcd	123.6 a

[z] Number of cotton root-knot nematode juveniles (J2)/100 cc soil.

[y] Corn test weight is expressed as pounds per bushel (lb/bu).

[x] Significance at the 0.05, 0.01, and 0.001 levels is indicated by *, **, or ***, respectively.

[w] Means in each column that are followed by the same letter are not significantly different according to Fisher's protected least significance (LSD) test ($P \leq 0.05$).

Nematode control and yield response of selected corn varieties to Counter 15G at the Plant Breeding Unit in 2010

The study site, which has a history of cotton and corn production along with a resident population of the cotton root knot nematode, was prepared for planting with a para-till and disk harrow. A 4 April 2010 broadcast application of 181 pounds per acre (lb/A) of a 33-0-0 fertilizer supplemented with zinc and sulfur was followed by a 13 May application of 286 pounds per acre of a 28-0-0 analysis fertilizer. Corn varieties were planted on 6 April in an Independence (Cahaba) loamy fine sand (OM<1%). Weed control was obtained with an early post broadcast application of Intro at 2 quarts per acre on 8 April followed by a broadcast application of Roundup Weathermax at 22 fluid ounces per acre on May 5. Plots received 1.0 acre inches of water on 22 June, 23 June, and 10 July. The experimental design was a split plot with corn variety as the whole plot and nematicide treatment as the split plot. Individual subplots, which consisted of two 25 foot rows on 3 foot centers, were replicated six times. For each corn variety, the split plot treatment included a non-treated control or an in-furrow application of the Counter 15G at 6.5 lb/A. Soil samples for a nematode assay, which were taken on 8 September, were processed using the sugar flotation method. Plots were harvested on 11 August. Significance of treatment effects were tested by analysis of variance and Fisher's protected least significant difference (LSD) test ($P \leq 0.05$). Yields are presented at 15.5% moisture.

The Counter 15G nematicide treatment x corn variety interaction for cotton root knot juvenile counts and yield were not significant, so pooled data is presented. When compared with the non-treated control, Counter 15G significantly increased yield by 21.5 bu/A but did not reduce nematode juvenile counts. Corn variety had a significant impact on juvenile counts and yield. Equally high juvenile counts were noted on DKC 69-72, DKC 67-88, DKC 67-21, DKC 67-22, and DKC 69-71, while similarly low counts were recorded for Pioneer 31P40, Pioneer 33V14, Pioneer 33M52, Pioneer 33M57, Southern States 749, Pioneer 33V16, Pioneer 31P42, Pioneer 31D59, DKC 67-86, Pioneer 33M53, and Southern States 775. Yield for Southern States 775 was higher than all other varieties except DKC 69-72. Yields similar to the latter variety were noted for DKC 67-88, DKC 67-21, Pioneer 33V16, Pioneer 33V14, and DKC 67-22. Pioneer 33M52, Pioneer 33M53, and Pioneer 33M57, Pioneer 31D57 had equally low yield.

Table 2. Impact of Counter 15G nematicide treatment on root knot juvenile counts and corn yield.

Split-plot analysis *P*(F)	Root-knot juvenile count[z]	Yield bu/A
Corn variety	0.0002***[y]	<0.0001***
Soil insecticide/nematicide	0.5898	<0.0001***
Treatment x variety	0.6111	0.8387
Soil insecticide/nematicide mean		
Counter 15G 6.5 lb/A	252 a[x]	119.9 a
Non-treated control	269 a	98.4 b
Corn variety mean		
Pioneer 31P40	118 e	102.3 def
Pioneer 31P42	219 cde	103.6 def
Pioneer 33V14	164 e	112.8 bcde
Pioneer 33V16	214 de	115.8 bcd
Pioneer 33M52	130 e	82.6 g
Pioneer 33M53	299 bcde	94.3 fg
Pioneer 33M57	151 e	99.0 efg
Pioneer 31D57	145 e	103.2 def
Pioneer 31D59	264 bcde	109.4 cdef
DKC 69-71	385 abcd	100.9 def
DKC 69-72	517 a	127.7 ab
Southern States 775	282 bcde	141.8 a
Southern States 749	161 e	102.4 def
DKC 67-21	407 abc	120.9 bc
DKC 67-22	393 abcd	112.6 bcde
DKC 67-86	255 bcde	100.5 def
DKC 67-88	428 ab	122.0 bc

[z]Numbers of cotton root-knot nematode juveniles (J2)/100 cc soil.

[y]Significance at the 0.05, 0.01, and 0.001 levels is indicated by *, **, or ***, respectively.

[x]Means in each column that are followed by the same letter are not significantly different according to Fisher's protected least significance (LSD) test ($P \leq 0.05$).

Effect of Counter 15G for root-knot nematode management on corn in Mississippi

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Counter 15G was evaluated with Avicta Complete Corn for the management of the root-knot nematode on corn in a naturally infested field at the MSU R. R. Foil Plant Science Research Center. The field had a history of root-knot nematode infestation and the soil type was Loamy Sand 3.75% clay, 13.0% silt and 83.25% sand. Counter 15G was applied at-planting in the seed furrow at 6.5 lb/A with a Case 900 Early Riser planter equipped with granular applicators. Avicta Complete Corn and Cruiser were applied to the seed by the manufacturer. Plots consisted of 2 rows, 40 feet long, with 3 foot wide row spacing and were arranged in a randomized complete block design with five replications; blocks were separated by a 12 foot alley. All plots were maintained throughout the season with standard production practices. Root-knot nematode numbers were determined at-planting, 29 and 65 days after planting (DAP). Nematodes were extracted using the gravity sieving and sucrose centrifugation technique. Plots were established on 18 April and entire plots harvested on 10 September. Data were statistically analyzed by ANOVA and means compared using Fisher's protected least significant difference test (P<0.10).

Root-knot nematode numbers averaged 275 juveniles/500 cm^3soil at planting and did not increase to high level during the growing season due to drought conditions. There were no differences in root-knot juvenile counts among nematicide treatments. Root-knot nematode counts were similar in all treatments at each sample date. Corn grain yields ranged from 48 to 124 bu/A in the control and Avicta Complete Corn, respectively. Seed corn yields were improved in all treated plots despite the dry conditions. Corn yields with Avicta Complete Corn were improved by nearly 70 bu/A when compared with the control.

Table 3. Avicta nematicide seed dressing compared with Counter 15G for root knot nematode management on corn.

		No. *Meloidogyne incognita*/500cm^3 soil			Yield
Treatment	Rate	0 DAP	29 DAP	65 DAP	bu/A
Cruiser	0.25 mg ai / seed ……	323	323	323	66 bc[z]
Cruiser + Counter 15G	0.25 mg ai / seed + 6.5 lb/A ……	323	323	322	101 ab
Avicta Complete Corn	0.25 mg ai/seed ……..	258	258	323	124 a
Avicta + Cruiser	0.25 mg ai+0.25 mg/seed…….	323	322	323	109 a
Counter 15G	6.5 lb/A ……	258	258	258	68 bc
Control	--- ……..	258	322	323	48 c

[z]Means in the column that are followed by the same letter are not significantly different according to Fisher's protected least significance (LSD) test (P≤0.05).

http://www.plantmanagementnetwork.org/pub/trial/PDMR/reports/2010/N016.pdf

Effect of Telone II for root-knot nematode management on corn in Mississippi.

In 2008, Telone II was evaluated with Counter 15G and Avicta Complete Corn for the management of the root-knot nematode on corn in a naturally infested field at the MSU R. R. Foil Plant Science Research Center. The field had a history of root-knot nematode infestation and the soil type was loamy sand 3.75% clay, 13.0% silt and 83.25% sand. Telone II was applied on 4 April as a pre-plant application of 3 and 6 gallons per acre with a modified John Deere ripper hipper. A CO_2-charged system was used to propel the fumigant through flow regulators mounted on stainless steel delivery tubes

attached to the trailing edge of forward-swept chisels. Telone II was injected 15 inches deep 14 days prior to planting with one chisel per row. Rows were immediately hipped with disc hillers to seal and prevent the rapid loss of the fumigant. All remaining rows were chiseled at the same depth and hipped without the fumigant. Counter 15G was applied at-planting in the seed furrow at 6.5 pounds per acre with a Case 900 Early Riser planter equipped with granular chemical applicators. Avicta Complete Corn was applied to the seed by the manufacturer. Plots consisted of 2 rows, 40 feet long, with 3 feet wide row spacing and were arranged in a randomized complete block design with five replications; blocks were separated by a 12 foot alley. All plots were maintained throughout the season with standard production practices. Root-knot nematode numbers were determined at-planting, 57 and 100 days after planting (DAP). Ten soil cores were collected from the two rows of each plot in a systematic sampling pattern. Nematodes were extracted using the gravity sieving and sucrose centrifugation technique. Plots were established on 18 April and entire plots harvested on 10 September. Data were statistically analyzed by ANOVA and means compared using Fisher's protected least significant difference test (P<0.10).

Root-knot nematode numbers averaged 86 juveniles/500 cm^3 soil at planting and did not increase to high level during the growing season due to drought conditions at the field location. There were no differences in root-knot nematode numbers among treatments (Table 4). Root-knot nematode numbers were similar in all treatments at each sample date. Corn yield ranged from 44 to 86 bu/A in the control and Counter 15G, respectively. Corn yields were improved with Avicta Complete Corn and Counter 15G. The highest seed corn yields were in the plots which received Counter 15G with 86 bu/A.

Table 4. Telone II compared with other nematicides for the control of root knot on corn

		Meloidogyne incognita/500cm^3 soil			Yield
Treatment	Rate	0 DAP	29 DAP	65 DAP	bu/A
Telone II	3 gal/A ……..	86	86	120	50 bc
Telone II	6 gal/A ……..	86	120	120	47 c
Counter 15G	6.5 lb/A ……	86	86	86	86 a
Avicta Complete Corn	0.25 mg ai/seed ……..	86	120	120	68 ab
Control ……..		86	86	86	44 c

[z]Means in the column that are followed by the same letter are not significantly different according to Fisher's protected least significance (LSD) test ($P \leq 0.05$).

http://www.plantmanagementnetwork.org/pub/trial/PDMR/reports/2010/N015.pdf

Summary: As was noted in this study, solid yield gains of up to 20 bu/A can be expected with nematicide treatments such as Counter 15G (now 20G) and Avicta Duo Corn in corn planted to fields with sizable resident populations of the cotton root knot nematode. Since Counter and Avicta Complete/Duo Corn have often preformed equally well, it's difficult to recommend one product over the other. Further work needs to be done to determine whether or not Telone II is a viable treatment for managing the cotton root nematode on corn. Information on VOTiVO efficacy against the cotton root knot nematode on corn will be available in 2012.