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Effect of Foliar Applications of Oxamyl with Aldicarb for the Management of *Rotylenchulus reniformis* on Cotton

G. W. Lawrence[1] and K. S. McLean[2]

Abstract: The efficacy of foliar applications of oxamyl were evaluated for the management of *Rotylenchulus reniformis* on cotton in Mississippi. Two tests were established in Tallahatchie County on a fine sandy loam soil (56.8% sand, 37.8% silt, 5.3% clay, pH 5.4, and 0.3% OM) naturally infested with *R. reniformis.* Oxamyl was applied as a foliar spray at 0.14, 0.27, or 0.53 kg a.i./ha to cotton plants that had reached the sixth true leaf growth stage. A second oxamyl application was applied 14 days after the first treatment at the same rates. All oxamyl treatments also received aldicarb at 0.59 kg a.i./ha at planting. Controls consisted of aldicarb alone, disulfoton (which is not a nematicide), and an untreated control. Oxamyl reduced *R. reniformis* numbers at 79 and 107 days after planting in Test 1 and at 62 and 82 days after planting in Test 2 compared to aldicarb at 0.59 kg a.i./ha alone and the controls that received neither material. Average reniform population densities in oxamyl-treated plots were 24.5% and 30% lower than with aldicarb alone and the controls. Cotton plant height was greater in plots that received oxamyl at all rates than in the controls. Cotton in oxamyl plus aldicarb and aldicarb alone treatments produced more bolls per plant and had a greater total boll weight than disulfoton and the untreated control. Seed cotton yields were greater in oxamyl-treated plots than for disulfoton-treated and the untreated control.

Key words: aldicarb, cotton, *Gossypium hirsutum,* management, nematicide, nematode, oxamyl, reniform nematode, *Rotylenchulus reniformis.*

Cotton, *Gossypium hirsutum,* is a major agricultural crop of Mississippi, where it is produced annually on more than 2.5 million ha in 70 of the 82 counties in the state. A majority of this cotton production (70%) occurs in 16 counties, which comprise the Mississippi Delta (Southern Mississippi Valley Alluvium) (Pettry, 1977).

Plant-parasitic nematodes are economically important pests in Mississippi cotton production. The reniform nematode, *Rotylenchulus reniformis* Linford and Oliveira, is the most prevalent species of plant-parasitic nematodes in cotton fields in the state and has been found to infest more than 20% of the cotton hectarage (Hankins et al., 1997). Cotton yield suppression due to *R. reniformis* has averaged 25.7% in disease-loss study plots over the past 8 years (Lawrence, unpubl.). Statewide, yield losses attributed to this nematode are estimated to be greater than 5.0%, valued at $13.7 million dollars (Mueller, 2000).

Nematode management tactics available to Mississippi cotton growers are limited. Some cotton growers have established rotation practices with corn or *R. reniformis*-resistant soybean to help manage *R. reniformis* in cotton. Cotton yields following these rotation crops are higher the year following the rotation crop due to lower initial nematode population densities. However, nematodes increase rapidly during that first year of cotton production and the subsequent cotton crop requires additional management strategies. In addition, the higher value of cotton relative to most rotation crops often encourages monoculture cotton production. *Rotylenchulus reniformis*-resistant varieties are not available in the mid-south cotton region (Robinson and Percival, 1997; Sciumbato and Lawrence, 1994); therefore, cotton growers depend primarily on nematicides to reduce nematode populations at planting.

Aldicarb is the most widely used insecti-

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[1] Associate Professor of Nematology, Department of Entomology and Plant Pathology, Mississippi State University, Mississippi State, MS 39762.
[2] Assistant Professor of Plant Pathology, Department of Entomology and Plant Pathology, Auburn University, Auburn, AL 36849.
E-mail: glawrence@entomology.msstate.edu
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cide/nematicide in cotton production in Mississippi. It is applied at-planting in or near the seed furrow at rates varying from 0.59 to 1.19 kg a.i./ha to lower the numbers of plant-parasitic nematodes in the soil, thus allowing a time period of reduced stress for plant establishment. Aldicarb degrades and (or) leaches rapidly, allowing nematode populations to increase to high levels during the growing season (Lawrence and McLean 1996, 1997; Lawrence et al., 1990, 1995). In Mississippi, *R. reniformis* often reaches a maximum density at the time cotton is in its peak reproductive state (Lawrence and McLean, 1995, 1996, 1997). The additional plant stress from nematode parasitism results in suppressed yield as well as the need for additional nematode management tactics for the subsequent cotton crop. Nematicide applications after plant establishment might suppress the rate of population increase of *R. reniformis* and reduce plant stress at the critical growth stages of cotton development.

Oxamyl is a systemic insecticide/nematicide that is registered for use as a foliar treatment for the control of plant-parasitic nematodes on many field crops. When applied to the leaf surface, oxamyl penetrates the cuticle and is translocated to the root system through the phloem, where it should provide a degree of nematode management after plant establishment (Hsu and Kleier, 1996). Foliar application on cotton is recommended following a preplant or at-planting soil nematicide treatment. The objective of this study was to examine the efficacy of foliar applications of oxamyl in combination with soil application of aldicarb for the management of *R. reniformis* and to determine the effects of this application on subsequent cotton growth and yield.

Materials and Methods

Tests were conducted in 1996 and 1997 in a field that was naturally infested with *R. reniformis* and in continuous cotton production. The tests were located in Tallahatchie County in a Dubbs very fine sandy loam soil (56.8% sand, 37.8% silt, 5.3% clay, pH 5.4, and 0.3% OM).

Oxamyl (Vydate C-LV, DuPont, Wilmington, DE) was applied as a foliar spray at 0.14, 0.27, or 0.53 kg a.i./ha on cotton at the sixth true leaf growth stage. All oxamyl treatments followed an at-planting application of aldicarb (Temik 15G, Aventis, Research Triangle Park, NC), which was applied in the seed furrow at 0.59 kg a.i./ha and is recommended in Mississippi for early-season insect control (Layton, 1998). Aldicarb, at this rate, has demonstrated some nematicidal activity (Lawrence and McLean 1996, 1997; Lawrence et al., 1995). Consequently, three treatments—aldicarb (0.59 a.i./ha) alone applied at planting; disulfoton (Di-Syston 8E, Kansas City, MO) (0.85 kg a.i./ha), an insecticide with no nematicidal activity, applied at planting; and an untreated control—were included as controls for comparison. Aldicarb was applied in the seed furrow using a tractor-mounted granular chemical applicator. Disulfoton was applied in the seed furrow using a single 8003 flat fan nozzle positioned behind the seed furrow opening disk with a CO_2-charged system calibrated to apply a total volume of 95 liters/ha. Oxamyl was applied as a foliar spray 37 days after planting (DAP) in a total volume of 95 liters/ha when the cotton plants had reached the sixth true leaf physiological growth stage. A second oxamyl treatment was applied at the same rates 14 days after the first application. Oxamyl was applied with a CO_2-charged backpack field plot spray system. All treatments that did not receive oxamyl were treated with acephate (Orthene 90S, Valent USA, Walnut Creek, CA) (0.28 kg/ha) to reduce any variation between treatments due to possible insect control effects from oxamyl.

The experimental design was a randomized complete block with five replications. Plots consisted of four 12.7-m-long rows spaced 0.97 m apart. Replications were separated by a 4.6-m alley. Each row was planted with 'Sure Grow 125' cotton seeds that were commercially treated with captan, carboxin (Vitavax) plus metalaxyl (Apron), and acephate.

Cotton seedling stand (number of live plants/12.7 m of row) was measured 35 DAP. Cotton plant height was measured at

7, 21, and 49 days after the second oxamyl application (65, 85, and 141 DAP). Plots were irrigated as needed.

Population densities of *R. reniformis* (juveniles and vermiform adult stages) in the soil were determined at the time of planting and at monthly intervals for the duration of the test. Ten soil cores, 2-cm-diam. × 20-cm-deep, were collected from each plot and thoroughly mixed, and a 250-cm^3 subsample was removed. Nematodes were extracted using gravity screening, and the fraction collected on a 38-um-pore sieve was further processed by centrifugal flotation (sucrose sp. gr. = 1.13) (Jenkins, 1964).

Cotton plants were collected from 1 m of row at harvest, and the number of bolls produced on a plant, the respective fruiting position of the bolls, and boll weights were recorded. Plots were hand-harvested 148 and 140 DAP in Test 1 and Test 2, respectively. All nematode population levels and harvest data were subjected to analysis of variance, and means were compared using Fisher's protected least significant difference (FLSD) test ($P \leq 0.05$).

Results

Test 1: Rotylenchulus reniformis population densities ranged from 3,310 to 6,762 juveniles and vermiform adult stages/250 cm^3 soil at planting (Table 1). In June (35 DAP) nematode densities decreased an average of 64% from at-planting densities in all plots. In July (65 DAP) nematode numbers had increased in all plots. This July sample represented the first nematode sample after the plots received the two foliar applications of oxamyl (21 and 7 days after treatment for the first and second applications, respectively). Although not significantly different ($P \leq 0.05$) from aldicarb alone, nematode population densities were 13 to 22% lower in all treatments that included oxamyl in combination with aldicarb. A second sample, collected in July at 79 DAP, showed fewer *R. reniformis* ($P \leq 0.05$) in the oxamyl applied at 0.53 kg/ha plus aldicarb combination than with aldicarb alone, disulfoton, or the untreated control plots. In August, 107 DAP, *R. reniformis* populations were lower ($P \leq 0.05$) in plots that received the two foliar applications of oxamyl at 0.27 kg a.i./ha plus aldicarb than in the untreated control.

Rotylenchulus reniformis population levels ranged from 8,626 to 21,888 nematodes/250 cm^3 soil at harvest (Table 2). Fewer *R. reniformis* ($P \leq 0.05$) were recovered in the oxamyl 0.14 and 0.27 kg a.i./ha plus aldicarb treatment than with aldicarb alone and in the disulfoton control plots. Nematode populations were 41.9% lower where oxamyl was applied than in plots that received aldicarb alone. Nematode population densities averaged across all sampling dates were lower after treatment with oxamyl applied at both 0.27 and 0.53 kg/ha in combination with aldicarb than for either the aldicarb alone or disulfoton controls (Table 3). Oxamyl applied at the lowest rate resulted in

TABLE 1. Effect of foliar application of oxamyl on population development of *Rotylenchulus reniformis* on Sure Grow 125 cotton, Year 1.

Treatment[a]	Rate (kg a.i./ha)	*R. reniformis*/250 cm^3 soil (Days after planting)					
		0	35	65	79	107	148
Oxamyl + Aldicarb	0.14 + 0.59	3,310	1,546	7,715	11,330	9,656	8,626
Oxamyl + Aldicarb	0.27 + 0.59	5,461	2,795	7,380	8,755	3,605	9,013
Oxamyl + Aldicarb	0.53 + 0.59	4,778	1,674	6,453	5,665	4,635	9,914
Aldicarb	0.59	4,611	1,198	8,939	16,609	12,746	21,888
Disulfoton	0.85	6,762	1,842	7,548	20,858	11,330	21,630
Control	—	4,714	1,224	7,110	15,193	14,034	19,055
FLSD ($P \leq 0.05$)		2,728	1,063	4,848	9,977	10,058	12,850

Data are means of five replications. Means compared using Fisher's protected least significant difference (FLSD) test. All oxamyl treatments received aldicarb at 0.59 kg a.i./ha in the seed furrow at planting.

[a] Oxamyl was applied at the sixth true leaf stage (37 days after planting) and 14 days later.

TABLE 2. Effect of foliar application of oxamyl on population development of *Rotylenchulus reniformis* on Sure Grow 125 cotton, Year 2.

		R. reniformis / 250 cm^3 soil (Days after planting)					
Treatment[a]	Rate (kg a.i./ha)	0	32	62	82	104	118
Oxamyl + Aldicarb	0.14 + 0.59	8,446	5,086	13,776	15,708	12,746	6,438
Oxamyl + Aldicarb	0.27 + 0.59	6,901	4,236	20,471	11,845	12,618	6,051
Oxamyl + Aldicarb	0.53 + 0.59	8,588	4,944	14,034	10,558	13,648	3,991
Aldicarb	0.59	5,279	4,674	16,609	25,879	21,630	5,150
Disulfoton	0.85	6,605	5,086	21,888	19,956	15,321	6,566
Control	—	7,403	5,255	28,969	20,214	19,441	6,695
FLSD (P ≤ 0.05)		3,546	2,874	9,315	7,906	11,162	4,800

Data are means of five replications. Means compared using Fisher's protected least significant difference (FLSD) test. All oxamyl plots received aldicarb at 0.59 kg a.i./ha in the seed furrow at planting.
[a] Oxamyl was applied at the sixth true leaf stage (41 days after planting) and 14 days later.

average population densities that were lower than in the disulfoton control.

At 65 DAP planting, cotton plants were taller ($P \leq 0.05$) in all plots that received the oxamyl plus aldicarb combinations and the aldicarb alone control compared with disulfoton and the untreated control (Table 4). Although plants treated with two foliar sprays of oxamyl in addition to aldicarb were taller than plants treated with aldicarb alone, differences were not significant. At 79 days, cotton plants that received oxamyl at 0.53 kg/ha plus aldicarb were taller ($P \leq 0.05$) than those that received aldicarb alone, disulfoton, or in the untreated control ($P \leq 0.05$). Plants were 13.2, 15.3, and 19.6 cm taller where oxamyl was applied at 0.14, 0.27, and 0.53 kg/ha, respectively, in combination with aldicarb than where aldicarb was applied alone. By 107 DAP, cotton plants treated with oxamyl at 0.27 and 0.53 kg/ha plus aldicarb were the only plants that were significantly taller than with application of disulfoton and in the untreated control. Plant height was increased 1.6, 11.0, and 7.6 cm, respectively, over aldicarb alone when two applications of oxamyl were applied at 0.14, 0.27, and 0.53 kg/ha in combination with aldicarb (Table 4).

A trend toward a greater number of bolls retained was apparent on the plants that received oxamyl at 0.27 and 0.53 kg/ha in combination with aldicarb compared with the disulfoton or the untreated controls (Table 5). The first open bolls were produced and retained on a lower main stem node in all treatments that included an at-planting application of either aldicarb or disulfoton than in the untreated control. The first fruiting position occurred at a lower (*P*

TABLE 3. Effect of foliar applications of oxamyl on mean *Rotylenchulus reniformis* population development on Sure Grow 125 cotton.

		Mean *R. reniformis* population/250 cm^3 soil[b]		
Treatment[a]	Rate (kg a.i./ha)	Year 1	Year 2	Mean
Oxamyl + Aldicarb	0.14 + 0.59	7,031	10,367	8,699
Oxamyl + Aldicarb	0.27 + 0.59	6,168	10,354	8,261
Oxamyl + Aldicarb	0.53 + 0.59 kg	5,520	9,294	7,407
Aldicarb	0.59	10,998	13,203	12,100
Disulfoton	0.85	11,662	12,570	12,116
Control	—	10,221	14,665	12,443
FLSD (P ≤ 0.05)		4,401	3,482	2,451

Data are the means of five replications. Means compared using Fisher's protected least significant difference (FLSD) test. All oxamyl treatments received aldicarb at 0.59 kg a.i./ha in the seed furrow at planting.
[a] Oxamyl was applied at the sixth true leaf stage (37 and 41 days after planting, Test 1 and Test 2, respectively) and 14 days later.
[b] Mean *R. reniformis* populations across 2 years' data, with five replications in each year.

TABLE 4. Effect of foliar applications of oxamyl on the height of Sure Grow 125 cotton in soil naturally infested with *Rotylenchulus reniformis*.

		Days after planting							
		Year 1				Year 2			
Treatment[a]	Rate (kg a.i./ha)	65	79	107	Mean[b]	62	79	140	Mean[b]
		Plant height (cm)							
Oxamyl + Aldicarb	0.14 + 0.59	58.9	78.2	96.0	79.8	56.6	80.0	90.2	75.7
Oxamyl + Aldicarb	0.27 + 0.59	57.7	80.3	105.4	81.0	56.1	76.2	90.2	72.9
Oxamyl + Aldicarb	0.53 + 0.59	57.2	84.6	102.0	79.8	56.6	80.0	93.7	76.7
Aldicarb	0.59	55.1	65.0	94.4	73.9	54.3	74.1	89.6	72.6
Disulfoton	0.85	44.5	61.7	86.6	64.2	45.9	67.8	80.7	65.0
Control	—	40.4	58.4	83.5	60.7	49.5	72.1	83.5	68.3
FLSD ($P \leq 0.05$)		9.3	10.1	14.2	8.6	4.0	3.8	5.5	3.0

Data are the means of five replications. Means compared using Fisher's protected least significant difference (FLSD) test. All oxamyl treatments received aldicarb at 0.59 kg a.i./ha in the seed furrow at planting.

[a] Oxamyl was applied at the sixth true leaf stage (37 and 41 days after planting, Test 1 and Test 2, respectively) and 14 days later.

[b] Mean plant height across each sample date.

≤ 0.05) main stem node, where oxamyl (0.27 kg/ha) plus aldicarb was applied than with either aldicarb alone or in the disulfoton and untreated control treatments. All treatments resulted in a lower first fruiting nodal position than was found in the untreated control. Open boll weights were greater ($P \leq 0.05$) in all oxamyl plus aldicarb combination treatments than in the untreated control (Table 5).

All three treatments that included oxamyl resulted in higher ($P \leq 0.05$) cotton yields than treatments with aldicarb alone, and all treatments that included aldicarb resulted in yields that were higher than the control or disulfoton (Table 6). Plots that received a foliar application of oxamyl (0.53 kg/ha) at the sixth true leaf stage and 14 days later produced the highest yield of 3,023.52 kg/ha.

Test 2: Population development trends for *R. reniformis* in Test 2 were similar to those in Test 1. Population densities did not differ among treatments until 62 DAP (7 days after the last oxamyl application) (Table 2). At 62 DAP, fewer ($P \leq 0.05$) *R. reniformis* were found after the 0.14 and 0.53-kg/ha oxamyl plus aldicarb combinations and aldicarb alone than after the other treatments. At 82 DAP, fewer ($P \leq 0.05$) *R. reniformis* were recovered from all oxamyl plus aldicarb combinations compared with aldicarb alone. Population densities of *R. reniformis* decreased in all treatments at harvest.

The numerically lowest nematode population densities in Test 2, averaged across all

TABLE 5. Effect of foliar applications of oxamyl on the number of open bolls, open boll weight per plant, and node of first fruiting branch on Sure Grow 125 cotton in soil naturally infested with *Rotylenchulus reniformis*.

		Year 1			Year 2		
Treatment[a]	Rate (kg a.i/ha)	Open bolls	Boll weight	Node of first boll	Open bolls	Boll weight	Node of first boll
Oxamyl + Aldicarb	0.14 + 0.59	34.3	147.2	6.1	35.8	150.3	6.3
Oxamyl + Aldicarb	0.27 + 0.59	39.3	172.4	5.6	38.8	172.5	6.3
Oxamyl + Aldicarb	0.53 + 0.59	39.0	164.8	5.9	43.4	184.9	5.5
Aldicarb	0.59	31.0	133.9	5.5	36.4	138.5	6.0
Disulfoton	0.85	28.0	109.0	7.5	14.8	59.3	7.9
Control	—	21.0	81.3	9.6	18.8	74.9	7.6
FLSD ($P \leq 0.05$)		16.0	59.7	1.9	6.5	29.6	0.8

Data are the means of five replications. Means compared using Fisher's protected least significant difference (FLSD) test. All oxamyl treatments received aldicarb at 0.59 kg a.i./ha in the seed furrow at planting.

[a] Oxamyl was applied at the sixth true leaf stage (37 and 41 days after planting, Test 1 and Test 2, respectively) and 14 days later.

TABLE 6. Effect of foliar applications of oxamyl on seed cotton yield of Sure Grow 125 cotton in soil naturally infested with *Rotylenchulus reniformis*.

Treatment[a]	Rate (kg a.i./ha)	Seed cotton yield (kg/ha)		
		Year 1	Year 2	Mean[b]
Oxamyl + Aldicarb	0.14 + 0.59	2,895.34	3,061.59	2,978.5
Oxamyl + Aldicarb	0.27 + 0.59	3,006.93	3,111.14	3,059.0
Oxamyl + Aldicarb	0.53 + 0.59	3,023.52	3,200.68	3,112.1
Aldicarb	0.59	2,410.79	2,917.96	2,664.4
Disulfoton	0.85	1,814.31	1,966.59	1,890.5
Control	—	1,406.36	1,989.32	1,697.8
FLSD ($P \leq 0.05$)		202.8	634.5	372

Data are the means of five replications. Means compared using Fisher's protected least significant difference (FLSD) test. All oxamyl treatments received aldicarb at planting at 0.59 kg a.i./ha in the seed furrow at planting.

[a] Oxamyl was applied at the sixth true leaf stage (37 and 41 days after planting, Test 1 and Test 2, respectively) and 14 days later.

[b] Mean seed cotton yield across 2 years.

sampling dates, were following the oxamyl 0.53 kg/ha plus aldicarb treatment (Table 3). Fewer nematodes ($P \leq 0.05$) were found in this treatment than with aldicarb alone, disulfoton, or the untreated control.

Plants in Test 2 were taller ($P \leq 0.05$) in all oxamyl- and aldicarb-treated plots at 62 DAP and at harvest than in the untreated control or where disulfoton was used (Table 4). At 79 days, plants in the oxamyl 0.14 and 0.53 kg/ha plus aldicarb combinations were taller than with aldicarb alone, disulfoton, and the untreated control, and plants receiving oxamyl at 0.53 kg/ha plus aldicarb were taller at harvest than those receiving aldicarb alone.

There were more ($P \leq 0.05$) open bolls per cotton plant in the oxamyl 0.53-kg/ha plus aldicarb treatment compared with aldicarb alone, disulfoton, and the untreated control (Table 5). Higher open boll weights were recorded from the plants treated with oxamyl at 0.27 and 0.53 kg/ha plus aldicarb than with aldicarb alone, disulfoton, and the untreated control.

In year 2, all oxamyl and aldicarb treatments and aldicab alone resulted in higher yields than disulfoton and the controls (Table 6).

Combined analyses over the 2 years for seed cotton yield (Steel and Torrie, 1980) indicated that seed cotton yields were improved ($P \leq 0.05$) with the addition of oxamyl at 0.27 and 0.53 kg/ha in combination with aldicarb in comparison with aldicarb alone, disulfoton, and the untreated control (Table 6).

DISCUSSION

Oxamyl applied as a foliar spray at the sixth true leaf stage followed by a second application 14 days later, in combination with an at-planting application of aldicarb, reduced the population density of *R. reniformis* at specific sample dates in each test. In many cases, this was accompanied by an improvement in cotton plant development and seed cotton yield. The temporal population development trends for *R. reniformis* in our study were similar to nematode development observed previously (Lawrence and McLean 1996, 1997; Lawrence et al. 1990, 1995). High population densities at planting are a characteristic of the reniform nematode due to its ability to withstand unfavorable environmental conditions (Birchfield and Martin, 1967). At the first sample after planting, nematode population densities decreased an average of 48% for both tests, which is also consistent with previous studies on *R. reniformis* population development (Lawrence and McLean, 1996, 1997; Lawrence et al., 1990, 1995). This reduction is due in part to the primary inoculum (infective females) penetrating the cotton roots so that they are not recoverable by routine soil sampling. Lower *R. reniformis* numbers also may be attributed to actual mortality due to soil disturbance during seed bed preparation and planting (Lawrence et al., 1990).

Because oxamyl was applied as a foliar spray at the sixth true leaf stage and 14 days later, few differences in nematode population levels were observed among treatments at our 62 and 65 day samples, although there was a trend toward numerically fewer nematodes recovered from the oxamyl-treated plots. Fewer nematodes were recovered in all plots that received the two foliar applications of oxamyl starting at 79 and 82 DAP and throughout the remainder of the season. Population densities of *R. reniformis* in the oxamyl treatments were also lower when averaged across the season for both tests, indicating that the cotton plants may have been subjected to less stress from nematode parasitism in these treatments during the growing season. In Mississippi, less plant stress, as expressed by *R. reniformis* population densities, relates well to seed cotton yields.

The foliar applications of oxamyl in combination with aldicarb at planting produced a positive effect on cotton plant development and boll production. During the growing season, the three rates of oxamyl varied as to increasing plant height ($P \leq 0.05$). However, at each sample date, plants in all oxamyl plus aldicarb plots were numerically taller than plants in the three controls. Larger and more vigorously growing plants generally support a larger boll load and subsequently produce higher yields at harvest (Jenkins et al., 1990).

In mid-south cotton production, the primary position for harvestable cotton bolls occurs at the first three flowering positions along the sympodial branches (Mauney, 1986). Tests conducted by Jenkins et al. (1990) in Mississippi have determined that 77% of the total lint is produced from the first fruiting position. The second fruiting position produces an average of 20%, with the third position producing the remainder of the total yield. The largest number of open bolls in these two tests were produced on the first fruiting position, which subsequently produced a higher percentage of the total yield. In addition, 16.1 percent of the yield resulted from bolls on the third fruiting position, from plants that received oxamyl plus aldicarb. This additional boll weight in each fruiting position may be, in part, the reason higher total yields were recovered from oxamyl and aldicarb combination plots compared with the other treatments.

One symptom of *R. reniformis* not previously associated with cotton development is the effect on the height of the first fruiting node, the lowest main stem node above the cotyledonary node from which a sympodial branch develops (Oosterhuis et al., 1996). In mid-south cotton, the first fruiting node generally occurs at main-stem nodes 5 to 7 but is influenced by environmental conditions and cultural practices (Oosterhuis et al., 1996). A lower first fruiting position is a desirable character in cotton production, while a higher position indicates delayed plant development. In this study, the first fruiting node was produced lower on the main stem on plants that received aldicarb at planting. Foliar applications of oxamyl did not have an effect on the first fruiting node position because applications were made after first-square initiation.

In summary, the inclusion of oxamyl as a foliar spray in combination with an at-planting application of aldicarb may provide mid-south cotton growers an additional means for management of *R. reniformis* after plant establishment. Many Mississippi cotton growers routinely use aldicarb (0.59 kg/ha) for early-season insect control. A knowledge that oxamyl may provide a degree of *R. reniformis* management in addition to insect control would allow the grower to judiciously choose a pest management program that would optimize the use of multiple-activity pesticides. Foliar applications of oxamyl might also serve as a limited treatment in a situation where nematode population levels were not known until after the crop was established.

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