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Control of *Hoplolaimus columbus* on Late-planted Soybean with Aldicarb[1]

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Abstract: Efficacy of three rates of aldicarb for control of *Hoplolaimus columbus* was evaluated on highly tolerant ('Foster'), moderately tolerant ('Coker 368'), and highly susceptible ('Braxton') soybean cultivars planted on 28 June 1985. Average yields of the nontreated cultivars were 557 kg/ha for Braxton, 1,309 kg/ha for Coker 368, and 1,682 kg/ha for Foster. Yield differences were significant. Aldicarb increased yields of all three cultivars, with the most tolerant cultivar responding to all aldicarb rates and the most susceptible cultivar responding only to the low rate of aldicarb; there was no significant response to the higher rates. *H. columbus* population densities in the soil 6 weeks after planting were not affected by either aldicarb treatment or cultivar, whereas the populations from roots were reduced in all cultivars by aldicarb. No relationship between tolerant soybean cultivars and population densities of *H. columbus* was observed.
Key words: aldicarb, Columbia lance nematode, *Glycine max*, *Hoplolaimus columbus*, soybean, tolerance.

Columbia lance nematode *Hoplolaimus columbus* Sher is a serious pathogen of soybean *Glycine max* (L.) Merr. in the Coastal Plains of North Carolina (D. P. Schmitt, pers. comm.), Georgia, and South Carolina (7,9). Economic control of *H. columbus* on soybean was obtained before 1984 using the fumigant nematicides D-D (1,3-dichloropropene and 1,2-dichloropropane and related C^3 hydrocarbons), DBCP (1,2-dibromo-3-chloropropane), and EDB (1,2-dibromoethane) (4,5). The suspensions of DBCP and EDB and the voluntary withdrawal of D-D has eliminated the most effective nematicides for use on soybean. Previous research has shown that aldicarb, carbofuran, 1,3-dichloropropene, and fenamiphos can be used to control *H. columbus* on soybean (3,10); however, use of these chemicals is not economically feasible at the current market prices for soybean. Tolerance to *H. columbus* exists in some soybean cultivars, but substantial yield losses can occur even on these cultivars (6,11). Yield losses due to *H. columbus* are greater on late-planted soybean than early-planted soybean (H. L. Musen, pers. comm.), possibly due to the greater activity of the nematode at higher soil temperatures (12). Our objective in this study was to determine if reduced rates of aldicarb would give effective control of *H. columbus* and subsequently increase the yield of late-planted soybean.

Materials and Methods

A field plot was established on 28 June 1985 in a site infested with an average (mean of 48 samples) of 100 (range 8–372) *H. columbus*/100 cm^3 soil at planting. This number exceeds the economic threshold for soybean on this soil type (1). Soil type was a Varina loamy sand (85.4% sand, 7.4% silt, 7.2% clay, 1% organic matter, pH 6.2). Aldicarb treatments consisted of either 5.41, 10.81 or 16.22 g a.i./100 m of row (0.56, 1.12, or 1.68 kg a.i./ha) applied to plots planted with either 'Braxton' (highly susceptible), 'Coker 368' (moderately tolerant), or 'Foster' (highly tolerant) soybean. The 5.41 and 10.81 g a.i./100 m rates were applied in-furrow at planting. The 16.22 g a.i./100 m rate was applied as an 18-cm band in front of the press wheel of the planter. All chemicals were applied using an electric powered Gandy (Gandy Co., Owatonna, Minnesota) applicator. In-furrow applications were made directly into the seed furrow during planting. The band application was applied between the opening disc and the closure arms resulting in some chemical being applied in-furrow.

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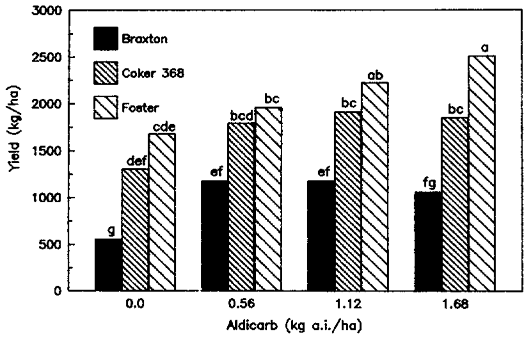

Fig. 1. Seed yield of 'Braxton', 'Coker 368', and 'Foster' soybean treated with soil applications of 0.00, 0.56, 1.12, and 1.68 kg a.i./ha of aldicarb. Bars with a letter in common are not significantly different according to an FLSD test ($P = 0.05$).

TABLE 1. Analysis of variance for recovery of *Hoplolaimus columbus* 6 weeks after planting from 100 cm³ of soil (SWS) and per gram fresh weight of roots (SWR) and yield with rate of aldicarb as main plots and cultivar as subplots.

Source of variation	df	Mean squares SWS	SWR	Yield
Block	3	5,335*	56,720	749,098*
Rate	3	3,465	129,177*	975,609*
Error A	9	1,014	34,444	125,522
Cultivar	2	1,123	14,146	4,876,474*
Rate × cultivar	6	732	14,209*	81,330
Error B	24	1,391	5,555	111,017
C.V. %		92	77	21

The planter press wheel further incorporated some of the chemical. Plots were arranged in a split-plot design with rate of aldicarb as main plots and soybean cultivar as subplots. All treatments were replicated four times. Plots consisted of four 6.4-m rows on 96.5-cm centers. All plots were subsoiled in-furrow 36 cm deep at planting. Weed control consisted of a broadcast application of 841 g/ha trifluralin and 370 g/ha metribuzin, preplant incorporated; a postplant broadcast application of 419 g/ha of paraquat; and postemergence broadcast treatments with 1,120 g/ha bentazon and 560 g/ha acifluorfen. Plots were fertilized with 300 kg/ha of 0-15-30. Insect infestation levels did not exceed threshold levels at any time.

Nematode samples consisting of 12 cores (2.5-cm-d and 20-cm deep) were taken at planting and 6 weeks after planting from the two center rows of each plot. *H. columbus* was extracted from 100 cm³ soil using centrifugation-flotation (8). Six weeks after planting five root systems were taken at random from the first and fourth rows of each plot and *H. columbus* was extracted using a modified mist apparatus (2).

Plots were harvested on 6 November using an Almaco (Almaco, Nevada, Iowa) self-propelled plot combine. Seed were cleaned and dried to 13% moisture before weighing.

Results and Discussion

Application of aldicarb increased the yield of all three cultivars (Fig. 1, Table 1). Application of 0.56 kg a.i./ha aldicarb increased yields of the susceptible cultivar Braxton and the moderately tolerant cultivar Coker 368; however, they did not appear to respond to further increases in the nematicide rate (Fig. 1). Yield of the tolerant cultivar Foster increased with the increasing rates of aldicarb. Yield of Foster was greater than that of Coker 368 at comparable rates of aldicarb application. Similarly, all yields of Coker 368 and Foster were greater than the yield of Braxton at any dosage of aldicarb (Fig. 1).

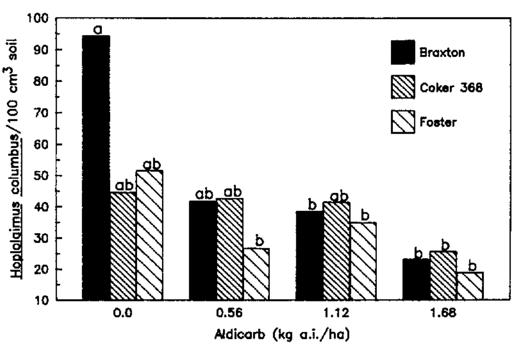

Fig. 2. Numbers of *Hoplolaimus columbus* in soil 6 weeks after planting 'Braxton', 'Coker 368', and 'Foster' soybean treated with soil applications of 0.00, 0.56, 1.12, and 1.68 kg a.i./ha of aldicarb. Bars with a letter in common are not significantly different according to an FLSD test ($P = 0.05$).

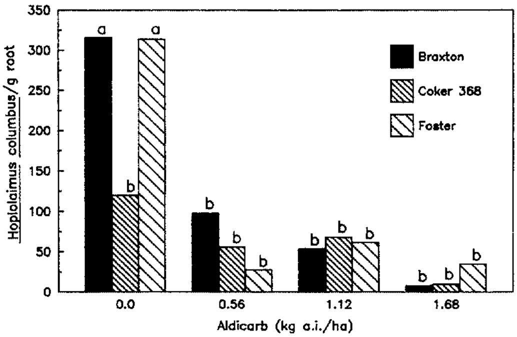

Fig. 3. Numbers of *Hoplolaimus columbus* in roots of 'Braxton', 'Coker 368', and 'Foster' soybeans 6 weeks after planting in soil treated with 0.00, 0.56, 1.12, and 1.68 kg a.i./ha of aldicarb. Bars with a letter in common are not significantly different according to an FLSD test ($P = 0.05$).

Recovery of *H. columbus* from soil 6 weeks after planting was not affected by rate of aldicarb or cultivar (Fig. 2, Table 1), but greater numbers were recovered from soil in which Braxton grew. The 1.68 kg a.i./ha rate of aldicarb suppressed recovery of *H. columbus* from the soil of all three cultivars (Fig. 2), but this trend was not significant (Table 1).

Application of aldicarb reduced recovery of *H. columbus* from soybean roots at 6 weeks after planting for all three cultivars (Fig. 3). Cultivar alone had no effect on the numbers of *H. columbus* recovered from roots (Fig. 3, Table 1); however, the amount of reduction of nematode numbers after aldicarb treatment was greater for Braxton and Foster than Coker 368.

The similarity in numbers of *H. columbus* recovered from roots of Braxton and Foster along with observed yield differences is evidence that Foster is highly tolerant to *H. columbus.* Also, it indicates that levels of infection and reproduction by *H. columbus* on soybean are not always indicative that those cultivars that support relatively high numbers of nematodes produce low yields. The current Clemson University recommendation for aldicarb on soybeans is 1.68 kg a.i./ha. This rate could be lowered to 0.56 kg a.i./ha and still provide adequate control of *H. columbus* on late-planted soybeans. Also, our data suggest that the planting of a tolerant cultivar will increase the yield potential on infested land. There was an increase in yield of all three cultivars where 0.56 kg a.i./ha was applied, and no further large increase in yield occurred, especially on Braxton, when aldicarb was increased. At a market value of $5.00/bu, the selection of Foster instead of Braxton would have netted a grower an $80.00 return/ha on *H. columbus* infested soil. Application of 0.56 kg a.i./ha to Foster would have resulted in a net return of $11.82 after subtracting the $8.18 cost of aldicarb. The application of this particular nematicide, although effective in controlling nematodes and increasing yields, appears to be of marginal economic significance in this situation.

Literature Cited

1. Anonymous. 1984. Nematode guidelines for South Carolina. Plant Disease Note 46, Clemson University, Clemson, South Carolina.

2. Barker, K. R., J. L. Townshend, G. W. Bird, I. J. Thomason, and D. W. Dickson. 1986. Nematode population responses to control agents. Pp. 283–296 *in* K. D. Hickey, ed. Methods for evaluating pesticides for control of plant pathogens. St. Paul, MN: American Phytopathological Society Press.

3. Blackmon, C. W., and H. L. Musen. 1974. Control of the Columbia (lance) nematode *Hoplolaimus columbus* on soybeans. Plant Disease Reporter 58:641–645.

4. Blackmon, C. W., and S. A. Lewis. 1979. Response of soybeans and populations of the lance nematode *Hoplolaimus columbus,* to fumigant nematicides applied at planting. Nematropica 9:3–7.

5. Blackmon, C. W. 1980. Control of Columbia lance nematode for soybeans, 1979. Fungicide and Nematicide Tests 35:229–230.

6. Boerma, H. R., and R. S. Hussey. 1984. Tolerance to *Heterodera glycines* in soybean. Journal of Nematology 16:289–296.

7. Fassuliotis, G., G. J. Rau, and F. H. Smith. 1968. *Hoplolaimus columbus,* a nematode parasite associated with cotton and soybeans in South Carolina. Plant Disease Reporter 52:571–572.

8. Jenkins, W. R. 1964. A rapid centrifugation flotation technique for separating nematodes from soil. Plant Disease Reporter 48:692.

9. Motsinger, R. E., J. L. Crawford, and S. S. Thompson. 1974. Survey of cotton and soybean fields for lance nematodes in east Georgia. Plant Disease Reporter 58:369–372.

10. Mueller, J. D., M. J. Sullivan, and S. G. Turnipseed. 1986. Control of *Hoplolaimus columbus* using granular nematicides and tolerant cultivars. Journal of Nematology 18:622 (Abstr.).

11. Mueller, J. D., E. R. Shipe, and H. L. Musen. 1986. Evaluation of soybean cultivars for tolerance to *Hoplolaimus columbus.* Journal of Nematology 18: 639 (Abstr.).

12. Nyczepir, A. P., and S. A. Lewis. 1979. Relative tolerance of selected soybean cultivars to *Hoplolaimus columbus* and possible effects of soil temperature. Journal of Nematology 11:27–31.