Carrot weevil management on parsley with soil-applied and foliar-applied insecticides, 2009

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Background: Carrot weevil is the key pest of parsley. This pest has been causing significant stand losses in Ohio parsley due to petiole and root injury by weevil larvae. To prevent damage, growers use a combination of crop rotation and insecticides. Parsley growers have reported losses due to carrot weevil at up to 100% in certain fields even after insecticide treatment. Insecticides have been most effective if applied as soon as weevil egg-laying scars are found on 1% of plants, which is typically in early June. Azinphosmethyl (Guthion) is the standard product for carrot weevil control but it is being phased out by the year 2012. With the phase-out of Guthion, there is a need to find effective alternative management tools as soon as possible. Laboratory bioassays conducted in 2007 and 2008 showed that indoxacarb (Avaunt) and cyfluthrin (Baythroid) showed promise as alternatives for adult control and thus need to be tested under field conditions. Another option might be larval control via systemic insecticides. Systemic products that are registered for soil application to parsley are dinotefuran (Venom), imidacloprid (Admire), and thiamethoxam (Platinum). Although labeled primarily for control of sucking pests such as aphids, these products are known to control some beetle and weevil pests in other crops. Although unregistered on parsley, oxamyl (Vydate) is used on carrots and celery for systemic control of carrot weevil larvae, via soil application. We conducted preliminary laboratory bioassays in June 2008 with Admire, Platinum, and Vydate, which showed good potential for control of carrot weevil larvae from a seedling soil drench application. Admire is commonly used on vegetable crops as an in-furrow treatment at planting, but this provides protection to a crop for the first four weeks, which is a time when parsley does not need protection from carrot weevil. A sidedress application could be done about 6 weeks after seeding, which would deliver the liquid insecticide to the target zone in the roots at the optimal time for control of young carrot weevil larvae. This application would be needed about the same time that nitrogen is commonly applied as a sidedress.

Objective: Evaluate control of carrot weevil on parsley by several insecticides that are potential replacements for Guthion, including foliar-applied products for control of adult weevils, and soil-applied sidedress treatments with systemic insecticides for control of weevil larvae.

Methods:

A large-plot field trial was conducted along one edge of a 14-acre commercial parsley field at Buurma Farms near Celeryville using a randomized complete block design with two treatments and six replicates. The field was adjacent to a field that had been heavily damaged by carrot weevil the previous year. The two treatments were the grower standard foliar spray program (Baythroid, 3 oz/A, on 15 May and 21 May), and Admire as a sidedress treatment in addition to the grower standard foliar spray program. The field was seeded on 24 March, Plots were one double-row bed wide by 100 ft long in five blocks and 80 ft long in the sixth block, with 10 inches between rows, and 36-inch bed centers. Admire was applied on 22 May. Admire was sidedressed by one shank down the middle of the bed, using 49.5 GPA and 40 PSI. On 5 May, when plants were at the first true-leaf stage,150 plants across the field were scouted for ovipunctures. Plots were scouted for ovipunctures on 20 May on 10 plants per plot, on 8 June (17 days after treatment) on 20 plants per plot, and on 15 June (24 days after treatment) on 60 plants per plot. The first cutting of parsley was on 15 June.

A small-plot field trial was conducted at OARDC's Muck Crops Ag. Research Station at Celeryville using a randomized complete block design with nine treatments and four replicates. Treatments were four foliar insecticides (Guthion, Malathion, Avaunt, Baythroid), four sidedressed insecticides (Admire, Platinum, Venom, Vydate), and an untreated control. Plots were 25 feet long by one three-row bed wide, with rows 18 inches apart. The field was seeded on 2 April. After fresh egg-laying scars were found by scouting on 20 May, all insecticides were applied on 22 May. Foliar sprays were applied in a 36" spray swath to all 3 rows per plot, using a hydraulic boom sprayer operated at 44 GPA, 45 PSI, and traveling at 2 MPH. Sidedress application was made to 2 rows per plot with 2 shanks, operated at 48 GPA, 20 PSI, and traveling at 3 MPH. On 5 May, when plants were at the first true-leaf stage, 148 plants across the field were scouted for ovipunctures. Ten plants per plot were scouted for ovipunctures on 20 May, 8 June, and 25 June. Plants sampled on 20 May and 8 June were evaluated in the field but plants sampled on 25 June were taken to the lab for evaluation, and data included whether eggs were brown (older) or white (younger), hatched or unhatched. The first cutting of parsley was on 26 June. Weevil damage to roots was rated on 20 plants per plot on 24 July (63 days after treatment and 28 days after the first cutting); root damage was rated as none, light, or heavy. The number of dead and live plants per 3-foot length of row was also assessed on 24 July.

Products and rates tested were Guthion 50WP, 1 lb/A; Malathion 57EC, 2 pt/A; Avaunt 30WG, 6 oz/A; Baythroid XL 1EC, 3.2 fl oz/A; Admire Pro 4.6F, 10.5 fl oz/A; Platinum 2SC, 11 fl oz/A; Venom 70SG, 6 oz/A; and Vydate 2WSL, 4 pt/A. Data were subjected to analysis of variance (ANOVA) and mean comparisons by least significant difference (LSD) tests in the SAS 9.1 microcomputer statistics program.

Results:

In the large-plot trial, no ovipunctures were found on 5 May or 20 May in this field, but the decision was made to proceed with Admire application because ovipunctures were found by more intensive sampling in the small-plot trial that was in the same vicinity. In the first post-treatment evaluation on 8 June, 17 days after treatment, the number of ovipunctures per plant was 0.01 to 0.03 and there was no significant difference between the two treatments ($P = 0.42$; Table 1). In the more intensive evaluation on 15 June, 24 days after treatment, the number of ovipunctures per plant was 0.10 to 0.16 and there was again no significant difference between the two treatments ($P = 0.22$) although there was a trend of fewer ovipunctures in Admire plots than in standard no-Admire plots. The percentage of plants with ovipuncture damage showed similar trends: 0.8 to 3.3% of plants were damaged on 8 June, and 9.4 to 13.9% were damaged on 15 June, but there were no significant treatment effects on either date ($P = 0.49$ and $P = 0.18$ respectively; Table 1).

In the small-plot trial, the average number of ovipunctures per plant on 20 May, before treatment, ranged 0.00 to 0.05. In the first post-treatment evaluation on 8 June, 17 days after treatment, the number of ovipunctures per plant was 0.0 to 0.6 and there was no significant difference among treatments ($P = 0.27$; Table 2). In the evaluation on 25 June, 34 days after treatment, the number of ovipunctures per plant was 2.6 to 3.8 and again there was no significant difference among treatments ($P = 0.85$). The percentage of plants with no root damage on 24 July showed no significant treatment differences ($P = 0.61$; Table 3). The percentage of plants that were dead due to weevil feeding on roots ranged from 27 to 48% and also showed no significant treatment effect ($P = 0.08$; Table 3).

Discussion: The lack of significant treatment differences showed that prevention of root damage and plant death was not achieved by one application of a standard foliar insecticide or alternative foliar or soil treatments, under conditions of heavy pest pressure. Eggs were found over a long period of time, from late May through late June, and it is likely that a single foliar application was inadequate for control of egg-laying adult weevils over this extended period. Although the sidedress treatments were not effective, it is possible that placement of these insecticides in the root zone was not optimal for uptake into the plants. Additional variables that need to be evaluated for sidedress treatment are volume of water per acre, distance of shank from row, and number of shanks per row.

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Table 1. Damage by carrot weevil in large plot trial to evaluate the addition of soil sidedress treatment to a standard foliar spray program for carrot weevil control, Celeryville, Ohio, 2009.

Treatment (applied 5/22/2009)	Number of ovipunctures per plant				% of plants damaged	
	5/5/09, pre-treat, plants with 1-2 leaves	5/20/09, pre-treat, N=10/plot, plants with 3-4 leaves	6/8/09, 17 DAT, N=20/plot, plants 8" tall, 6-7 leaves	6/15/09, 24 DAT, N=60/plot, plants 8" tall, 7 leaves	6/8/09	6/15/09
Admire Pro 4.6F, 10.5 fl oz/A, sidedressed, plus standard spray program	0	0	0.01	0.10	0.8	9.4
Standard spray program without Admire	0	0	0.03	0.16	3.3	13.9
Treatment effect	-	-	*P=0.42*	*P=0.22*	*P=0.49*	*P=0.18*

Table 2. Damage by carrot weevil on parsley petioles in small-plot insecticide trial, Celeryville, Ohio, 2009.

Treatment (applied 5/22/2009)	Number of ovipunctures per plant			
	5/5/09, pre-treat, plants with 1 true leaf	5/20/09, pre-treat, plants 3 leaves	6/8/09, 17 DAT, plants 5-6 leaves	6/25/09 34 DAT, plants 9-12" tall, 6-9 leaves
foliar Guthion 50WP, 1 lb/A	0	0	0.4	2.7
foliar Baythroid XL, 3.2 fl oz/A	0	0	0.3	2.8
foliar Malathion 57EC, 2 pt/A	0	0.05	0.0	3.7
foliar Avaunt 30WG, 6 oz/A	0	0.02	0.6	3.8
sidedress Vydate 2WSL, 4 pt/A	0	0	0.4	2.8
sidedress Admire Pro, 10.5 fl oz/A	0	0.05	0.3	3.0
sidedress Platinum 2SC, 11 fl oz/A	0	0.02	0.3	3.4
sidedress Venom 70SG, 6 oz/A	0	0	0.2	3.8
untreated control	0	0	0.3	2.6
Treatment effect	-	*P=0.28*	*P=0.27*	*P=0.85*

Table 3. Damage by carrot weevil on parsley roots on 24 July (63 days after treatment) in small-plot insecticide trial, Celeryville, Ohio, 2009.

Treatment (applied 5/22/2009)	%[a] of plants in each category of damage to roots by carrot weevil larvae			%[a] of plants dead in 3' length of row
	No damage	Light damage	Heavy damage	
foliar Guthion 50WP, 1 lb/A	25	22	52	35
foliar Baythroid XL, 3.2 fl oz/A	20	34	40	37
foliar Malathion 57EC, 2 pt/A	19	38	44	27
foliar Avaunt 30WG, 6 oz/A	15	31	54	27
sidedress Vydate 2WSL, 4 pt/A	11	25	64	38
sidedress Admire Pro, 10.5 fl oz/A	20	20	60	48
sidedress Platinum 2SC, 11 fl oz/A	26	32	41	39
sidedress Venom 70SG, 6 oz/A	19	19	62	30
untreated control	28	25	48	42
Treatment effect	*P=0.61*	*P=0.14*	*P=0.33*	*P=0.08*

[a] Actual percentages are shown but statistics based on transformed values.

Parsley insecticide trial, 2009,
Celeryville, Ohio