Payload/Orthene Trial on Bell Peppers in Ohio, 1995

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Introduction: The objective was to evaluate control of European corn borer on peppers by a granular formulation of acephate (Payload) applied once to the soil as a potential substitute for repeated foliar applications of sprayable acephate (Orthene). Payload is not yet registered for use on peppers.

Methods: 'North Star' pepper plug plants were transplanted by a carousel planter on 24 May 1995 at OSU's Lane Avenue Horticulture Farm in Columbus and on 15 June 1995 at OARDC's Vegetable Crops Branch in Fremont. There were two staggered rows per bed with beds on 5-ft centers. Plots were two beds wide. In Columbus, plants were 15 inches apart within rows, plots were 25 ft long, with 5-ft alleys between plots. In Fremont, plants were 18 inches apart within rows, plots were 30 ft long, with 10-ft alleys between plots. Four replicates of four treatments were set up in a randomized complete block design. Two rates of a granular formulation of acephate (Payload 15G) were applied as a sidedress treatment in mid-summer and compared a standard program of foliar sprays of acephate (Orthene 75SP), and with an untreated check.

Sidedress treatments were applied on 20 July in Columbus and on 22 July in Fremont, when emergence of the second generation of European corn borer adults was first detected in blacklight traps (Table 1). There was one trap per site; traps were checked daily. Payload was sidedressed in the middle of each twin-row bed and subsoil incorporated with a tractor-mounted Gandy spreader in Columbus and with a manual Planter Junior in Fremont. Application rates were 1 lb a.i. per A (= 6.7 lb Payload 15G per A or 8.6 g 15G per 25 ft twin-row bed), and 2 lb a.i. per A (= 13.3 lb Payload 15G per A or 17.1 g 15G per 25 ft twin-row bed). Foliar sprays of acephate were applied at a rate of 1 lb a.i. per acre (= 1.33 lb Orthene 75SP per acre). Orthene was applied in Columbus by a hand operated compressed-air backpack sprayer with a single hollow cone nozzle; pressure was 60 psi and volume was 8 gal/A. Orthene was applied in Fremont by a hydraulic boom sprayer; pressure was 60 psi and volume was 50 gal/A. Orthene sprays were applied in Columbus on 28 July; 4, 11, 18, 25 August; and 1, 8, 15 September. Orthene sprays were applied in Fremont on 27 July; 3, 11, 18, 25 August; and 1, 9, 16 September.

Fully ripe red pepper pods were harvested from the center two rows in each plot at 2-week intervals; at the final harvest, green pods over 2 inches wide also were harvested. Peppers that were too rotten to pick were not harvested. Harvested peppers were counted, weighed, cut open, and rated for damage and presence of European corn borer or other insects. Plots in Columbus were harvested five times between 21 August and 16 October. An unusually early frost on 23 September killed pepper plants in Fremont after only two harvests. Harvest data were subjected to analysis of variance and means were compared by least squares means contrasts using the JMP microcomputer program (SAS Institute 1989). Individual harvests were analyzed separately, and red pod harvests were also summed over the season and analyzed as a cumulative harvest. Percentage data were transformed by arcsine ($x^{0.5}$) before analysis.

Results: The major pest infesting pepper pods at both sites was European corn borer (ECB), but some corn earworm and an unidentified Tortricid were found in the final harvest at Columbus. Damage from second

generation ECB was greater in Fremont than in Columbus. At Columbus, damage by European corn borer was greatest in the fourth harvest when only 35% of peppers were undamaged in untreated check plots. Damage in the first two harvests at Columbus appeared to be by second generation ECB while damage in remaining harvests was due to third generation ECB. Yields were very low in all plots in the third and fourth harvests at Columbus due to lack of fruit set during a long period of hot weather in August.

Yield differences, which include the effect of insect damage so severe that peppers were not harvestable, were apparent in the fifth harvest at Columbus, in the second harvest at Fremont, and in the cumulative red pod harvest at both sites. In these harvests, yield in the Orthene treatment was signficantly greater than either of the Payload treatments and the untreated check (Table 2).

The percentage of harvested peppers undamaged by insects differed significantly among treatments in the third to fifth harvests at Columbus, in both harvests at Fremont, and in the cumulative red pod harvest at both sites. The highest percentage of undamaged peppers was in plots sprayed weekly with Orthene (Table 2). There were no differences in percentage undamaged among the two Payload treatments and the untreated check in either harvest at Fremont. In the third Columbus harvest, the high rate of Payload resulted in significantly fewer undamaged peppers than the untreated control, but this may be an artifact of the small number of harvestable peppers due to weather-related fruit set problems.

Discussion/conclusions: The second harvest at Fremont, as well as the third to fifth harvests at Columbus, reflected damage from third generation ECB as well as lingering second generation ECB. In a year with three generations of ECB, as occurs in Ohio about once every three years, a second application of Payload would be needed at the time the new moths begin emerging.

The best test of a single Payload treatment as an alternative to weekly Orthene treatments was in the first harvest on 7 September at Fremont, where the ECB population had been quite large and damage was due mostly to second generation ECB. Although there was no significant yield effect among treatments in the 7 September harvest, there was a trend of nearly equal yields in the Orthene and the higher rate Payload treatment. The percentage of undamaged peppers, however, was clearly lower in both Payload treatments than in the Orthene treatment. It thus appears that a single application of Payload did not provide adequate protection of peppers from second generation ECB. Although weekly application of Orthene was clearly the best treatment, it should be noted that 5% of pods were infested even in the Orthene treatment. Pepper processors can reject loads if the percentage infested exceeds 5%. Perhaps some combination of a Payload sidedress treatment plus Orthene foliar sprays could reduce the percentage infested.

Table 1. Weekly capture of European corn borer (ECB) in blacklight traps in 1995 at the OSU Lane Avenue Horticulture Farm, Columbus, Ohio, and at the OARDC Vegetable Crops Branch, Fremont, Ohio.

	Number of ECB adults						
	Columbus			Fremont			
Dates	female	male	total	female	male	total	
5/6 to 5/12	0	0	0	-	-	-	
5/13 to 5/19	0	0	0	-	-	-	
5/20 to 5/26	0	1	1	-	-	-	
5/27 to 6/2	0	7	7	21	22	43	
6/3 to 6/9	4	7	11	154	115	269	peak 1st generation
6/10 to 6/16	3	3	6	66	30	96	
6/17 to 6/23	1	1	2	44	50	94	
6/24 to 6/30	0	0	0	3	7	10	
7/1 to 7/7	0	0	0	0	1	1	
7/8 to 7/14	0	0	0	1	0	1	
7/15 to 7/21	12	6	18	34	33	67	
7/22 to 7/28	32	9	41	109	160	269	
7/29 to 8/4	43	29	72	352	194	546	peak 2nd generation
8/5 to 8/11	16	12	28	307	158	465	
8/12 to 8/18	5	7	12	88	53	141	
8/19 to 8/25	11	5	16	64	21	85	
8/26 to 9/1	47	21	68	784	420	1204	
9/2 to 9/8	32	17	49	895	605	1500	peak 3rd generation
9/9 to 9/15	25	20	45	325	137	462	
9/16 to 9/22	5	17	22	114	190	304	
9/23 to 9/29	0	0	0	4	7	11	
9/30 to 10/6	1	1	2	-	-	-	

Table 2. Yield per plot and percentage of pepper pods without insect damage at harvest after weekly applications of Orthene or single sidedress applications of Payload, at Columbus, Ohio, 1995.

Harvest	Treatment	Mean[1] of four replicates Wt.(kg)		% undamaged	
21 August, red pods	Orthene, 1 lb a.i./A	3.4		99	
	Payload, 2 lb a.i./A	2.5		93	
	Payload, 1 lb a.i./A	2.4		97	
	untreated	2.6		94	
	P (ANOVA treatment effect)	0.30		0.47	
5 September, red pods	Orthene, 1 lb a.i./A	7.8		98	
	Payload, 2 lb a.i./A	5.4		94	
	Payload, 1 lb a.i./A	6.2		94	
	untreated	6.9		98	
	P (ANOVA treatment effect)	0.19		0.22	
18 September, red pods	Orthene, 1 lb a.i./A	1.6		100	A
	Payload, 2 lb a.i./A	0.7		45	C
	Payload, 1 lb a.i./A	1.5		77	BC
	untreated	1.3		83	AB
	P (ANOVA treatment effect)	0.47		0.02	*
3 October, red pods	Orthene, 1 lb a.i./A	1.2		96	A
	Payload, 2 lb a.i./A	0.7		47	B
	Payload, 1 lb a.i./A	0.5		30	B
	untreated	0.7		35	B
	P (ANOVA treatment effect)	0.09		0.0008	*
16 October, red pods	Orthene, 1 lb a.i./A	2.1	A	98	
	Payload, 2 lb a.i./A	0.4	B	60	
	Payload, 1 lb a.i./A	0.2	B	50	
	untreated	0.3	B	68	
	P (ANOVA treatment effect)	0.003	*	0.20	
16 October, green pods	Orthene, 1 lb a.i./A	12.1	A	98	A
	Payload, 2 lb a.i./A	6.2	B	70	C
	Payload, 1 lb a.i./A	4.3	B	71	BC
	untreated	4.8	B	80	B
	P (ANOVA treatment effect)	0.01	*	0.0001	*

red pods, cumulative	Orthene, 1 lb a.i./A	16.1 A	98.2 A	
	Payload, 2 lb a.i./A	9.8 B	85.2 B	
	Payload, 1 lb a.i./A	10.8 B	86.6 B	
	untreated	11.9 B	89.3 B	
	P (ANOVA treatment effect)	0.008 *	0.0017 *	

[1] within each column for each harvest, means followed by the same letter are not significantly different by least squares means contrasts, $P > 0.05$.

Table 3. Yield per plot and percentage of pepper pods without insect damage at harvest after weekly applications of Orthene or single sidedress applications of Payload, at Fremont, Ohio, 1995.

Harvest	Treatment	Mean[1] of four replicates Wt.(kg)	% undamaged
7 September, red pods	Orthene, 1 lb a.i./A	4.8	95 A
	Payload, 2 lb a.i./A	4.7	64 B
	Payload, 1 lb a.i./A	3.2	65 B
	untreated	2.9	74 B
	P (ANOVA treatment effect)	0.31	0.01 *
19 September, red pods	Orthene, 1 lb a.i./A	17.8 A	99 A
	Payload, 2 lb a.i./A	7.0 B	16 B
	Payload, 1 lb a.i./A	3.9 B	15 B
	untreated	5.1 B	19 B
	P (ANOVA treatment effect)	0.0007 *	0.0001 *
red pods, cumulative	Orthene, 1 lb a.i./A	22.6 A	98.6 A
	Payload, 2 lb a.i./A	11.8 B	39.6 B
	Payload, 1 lb a.i./A	7.2 B	38.9 B
	untreated	8.1 B	41.9 B
	P (ANOVA treatment effect)	0.004 *	0.0001 *

[1] within each column for each harvest, means followed by the same letter are not significantly different by least squares means contrasts, $P > 0.05$.