

(E48)

**PEPPER (BELL):** *Capsicum annuum* L., 'Socrates'

## EUROPEAN CORN BORER CONTROL IN BELL PEPPERS WITH FOLIAR INSECTICIDES, 2005

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European corn borer (ECB): *Ostrinia nubilalis* (Hübner)  
Fall armyworm (FAW): *Spodoptera frugiperda* (J.E. Smith)  
Corn earworm (CEW): *Helicoverpa zea* (Boddie)

Chemical management of ECB is the preferred control tactic used by pepper growers to reduce the damage by this key insect pest of Ohio bell peppers. Orthene is the most effective insecticide against ECB, and because it is limited to a maximum of two applications per season, it is usually applied at peak egg hatch of second-generation ECB. This field trial was designed to investigate which are the most effective chemicals to be used before or after this period when Orthene is used. Chemicals with potentially good ovicidal activity were applied at pre-peak egg-laying (treatments 2-5), whereas those known as larvicides were selected for post-peak application (treatments 6-10). Orthene was used during peak egg-laying for two consecutive weeks. Insecticides were combined into a total of 11 application schedules plus an untreated control. This study was conducted in 2005, at the North Central Agricultural Research Station of the Ohio State University, Fremont, Ohio. Insecticide efficacy against ECB was evaluated in a RCB design containing 12 treatments and four replications. Bell peppers var. 'Socrates' were seeded in 200-cell trays in a greenhouse on 29 Mar and transplanted to the field on 27 May. Plots consisted of 25 ft-long single row of pepper plants, and an untreated guard row on each side. Planting distances were 15 inches within row and five ft between rows. A tractor-drawn boom sprayer pressurized by CO<sub>2</sub> with 2.5 gal stainless steel canister tanks was used for insecticide applications at approximately 7-day intervals. The first insecticide application was made when the second flight of ECB moths was detected by blacklight and pheromone traps. Dates of insecticide applications were: 29 Jul, 8, 15, 22, and 29 Aug. Insecticides were applied at 3 mph, 55 psi, with TJ-60 11003 VS nozzles, and a spray volume of 40.1 gpa. Chemicals for aphid and disease control were applied uniformly on all plots, including the untreated checks. For disease management, Manex (1.6 qt product/acre) and Champ II (2 pt product/acre) were applied on 26 Jul; Ridomil Gold (2.5 lb product/acre) and Copper (3.75 lb product/acre) on 5, 16, and 25 Aug. For aphid control, Dimethoate 4EC (0.67 pt product/acre) was used on 12 Aug, and Provado (3.8 fl oz product/acre) on 25 Aug. Dry weather prevailed in Jun thus the crop was irrigated on 3, 24, and 27 Jun. High precipitation on 21 to 27 Jul flooded the field and provided favorable conditions for attack by *Phytophthora capsici*, which produced severe symptoms characteristic of the foliar phase. The study was terminated after the second harvest due to the destruction of the crop from this disease. Fruit were harvested from a row length of 20 ft in the center of each plot. Only fully red fruit were collected during the first harvest on 25 Aug. During the second and final harvest on 9 Sep, all fruit with a minimum diameter of two inches were collected. Green and red fruit from this harvest were evaluated separately. Fruit too rotten to pick were not collected. Fruit were first inspected for external damage and then cut open to determine presence of larvae or damage. To stabilize the variance, the angular transformation (arcsine square root) was used on percentages of undamaged fruit before statistical analysis. Data were analyzed using ANOVA and means were separated using LSD ( $P \leq 0.05$ ).

In the first harvest, all 143 lepidopteran larvae found were ECB. In the second harvest, the 91 larvae found in red fruit were: 53% ECB and 47% FAW. The 97 larvae found in the green fruit in the second harvest were: 46% ECB, 51 % FAW, and 3% CEW. There were no significant differences among treatments in yield, number of worm-

damaged fruit, percentage of undamaged fruit, and estimated clean yield in any of the harvests. Green fruit in the second harvest showed the lowest clean yield in the untreated check, but with few differences among the chemical treatments. This suggests that an extremely short field season, due to the impact of *Phytophthora capsici*, may have obscured treatment effects that would have been present in later harvests.

Table 1.

Treatment/ formulation	Rate amt product/acre	Application dates	Red fruit harvested / 20 ft row on 25 Aug			Estimated clean yield (kg) <sup>a</sup>
			Total (kg)	No. worm- damaged	% clean	
Orthene 97S	16 oz	29 Jul, 8, 15, 20, 29 Aug	6.28a	6.0a	77a	4.73a
Calypso 4F	4 fl oz	29 Jul	5.63a	3.0a	88a	4.94a
Orthene 97S	16 oz	8, 15 Aug				
Mustang Max 0.8EC	4 fl oz	22, 29 Aug				
Dimilin 25W	8 oz	29 Jul	6.25a	2.8a	88a	5.59a
Orthene 97S	16 oz	8, 15 Aug				
Mustang Max 0.8EC	4 fl oz	22, 29 Aug				
Rimon 0.83EC	15 fl oz	29 Jul	6.93a	5.5a	79a	5.46a
Orthene 97S	16 oz	8, 15 Aug				
Mustang Max 0.8EC	4 fl oz	22, 29 Aug				
Assail 30SG	4 oz	29 Jul	7.20a	3.5a	90a	6.31a
Orthene 97S	16 oz	8, 15 Aug				
Mustang Max 0.8EC	4 fl oz	22, 29 Aug				
Mustang Max 0.8EC	4 fl oz	29 Jul	6.61a	6.5a	74a	4.96a
Orthene 97S	16 oz	8, 15 Aug				
Mustang Max 0.8EC	4 fl oz	22, 29 Aug				
Mustang Max 0.8EC	4 fl oz	29 Jul	7.11a	6.5a	78a	5.39a
Orthene 97S	16 oz	8, 15 Aug				
Avaunt 30WG	3.5 oz	22, 29 Aug				
Mustang Max 0.8EC	4 fl oz	29 Jul	5.95	2.5a	86a	5.29a
Orthene 97S	16 oz	8, 15 Aug				
Intrepid 2F	6 fl oz	22, 29 Aug				
Mustang Max 0.8EC	4 fl oz	29 Jul	5.30a	4.3a	84a	4.39a
Orthene 97S	16 oz	8, 15 Aug				
Proclaim 5WDG	3.6 oz	22, 29 Aug				
Mustang Max 0.8EC	4 fl oz	29 Jul	4.99a	2.8a	83a	4.28a
Orthene 97S	16 oz	8, 15 Aug				
SpinTor 2SC	4 fl oz	22, 29 Aug				
Mustang Max 0.8EC	4 fl oz	29 Jul	6.93a	3.0a	90a	6.11a
Orthene 97S	16 oz	8, 15 Aug				
Untreated		22, 29 Aug				
Untreated check	--	--	6.54a	3.5a	87a	5.65a
<i>P</i> > <i>F</i>			0.91	0.35	0.49	0.89
LSD			3.03	4.1	16	2.55

Means within a column followed by the same letter are not significantly different (LSD, *P* > 0.05).

Percentages were transformed (arcsine square root (x)) before statistical analysis. Actual percentages are shown in table.

<sup>a</sup>Estimated clean yield = (Total kg of fruit) × (% of clean fruit).

Table 2.

Treatment/ formulation	Rate amt product/acre	Application dates	Red fruit harvested / 20 ft row on 25 Aug			Estimated clean yield (kg) <sup>a</sup>
			Total (kg)	No. worm- damaged	% clean	
Orthene 97S	16 oz	29 Jul, 8, 15, 20, 29 Aug	3.06a	2.3a	81a	2.52a
Calypso 4F	4 fl oz	29 Jul	3.99a	2.8a	87a	3.34a
Orthene 97S	16 oz	8, 15 Aug				
Mustang Max 0.8EC	4 fl oz	22, 29 Aug				
Dimilin 25W	8 oz	29 Jul	3.64a	1.5a	90a	3.79a
Orthene 97S	16 oz	8, 15 Aug				
Mustang Max 0.8EC	4 fl oz	22, 29 Aug				
Rimon 0.83EC	15 fl oz	29 Jul	4.21a	3.5a	79a	3.35a
Orthene 97S	16 oz	8, 15 Aug				
Mustang Max 0.8EC	4 fl oz	22, 29 Aug				
Assail 30SG	4 oz	29 Jul	3.52a	3.5a	77a	2.73a
Orthene 97S	16 oz	8, 15 Aug				
Mustang Max 0.8EC	4 fl oz	22, 29 Aug				
Mustang Max 0.8EC	4 fl oz	29 Jul	2.56a	1.3a	86a	2.28a
Orthene 97S	16 oz	8, 15 Aug				
Mustang Max 0.8EC	4 fl oz	22, 29 Aug				
Mustang Max 0.8EC	4 fl oz	29 Jul	4.30a	2.0a	88a	3.79a
Orthene 97S	16 oz	8, 15 Aug				
Avaunt 30WG	3.5 oz	22, 29 Aug				
Mustang Max 0.8EC	4 fl oz	29 Jul	4.57a	3.0a	84a	3.80a
Orthene 97S	16 oz	8, 15 Aug				
Intrepid 2F	6 fl oz	22, 29 Aug				
Mustang Max 0.8EC	4 fl oz	29 Jul	4.59a	2.5a	87a	4.04a
Orthene 97S	16 oz	8, 15 Aug				
Proclaim 5WDG	3.6 oz	22, 29 Aug				
Mustang Max 0.8EC	4 fl oz	29 Jul	3.63a	2.5 a	84a	3.01a
Orthene 97S	16 oz	8, 15 Aug				
SpinTor 2SC	4 fl oz	22, 29 Aug				
Mustang Max 0.8EC	4 fl oz	29 Jul	3.97a	2.5 a	85a	3.30a
Orthene 97S	16 oz	8, 15 Aug				
Untreated		22, 29 Aug				
Untreated check	--	--	4.48a	2.3 a	88a	3.97a
<i>P</i> > <i>F</i>			0.54	0.91	0.98	0.57
LSD			1.88	2.9	18	1.75

Means within a column followed by the same letter are not significantly different (LSD,  $P > 0.05$ ).

Percentages were transformed (arcsine square root (x)) before statistical analysis. Actual percentages are shown in table.

<sup>a</sup>Estimated clean yield = (Total kg of fruit) × (% of clean fruit).

Table 3.

Treatment/ formulation	Rate amt product/acre	Application dates	Red fruit harvested / 20 ft row on 25 Aug			Estimated clean yield (kg) <sup>a</sup>
			Total (kg)	No. worm- damaged	% clean	
Orthene 97S	16 oz	29 Jul, 8, 15, 20, 29 Aug	4.83a	5.8a	88a	4.13a
Calypso 4F	4 fl oz	29 Jul	4.43a	4.0a	88a	3.94a
Orthene 97S	16 oz	8, 15 Aug				
Mustang Max 0.8EC	4 fl oz	22, 29 Aug				
Dimilin 25W	8 oz	29 Jul	4.46a	1.5a	95a	4.25a
Orthene 97S	16 oz	8, 15 Aug				
Mustang Max 0.8EC	4 fl oz	22, 29 Aug				
Rimon 0.83EC	15 fl oz	29 Jul	4.15a	1.5a	95a	3.97a
Orthene 97S	16 oz	8, 15 Aug				
Mustang Max 0.8EC	4 fl oz	22, 29 Aug				
Assail 30SG	4 oz	29 Jul	5.17a	0.8a	98a	5.06a
Orthene 97S	16 oz	8, 15 Aug				
Mustang Max 0.8EC	4 fl oz	22, 29 Aug				
Mustang Max 0.8EC	4 fl oz	29 Jul	4.17a	5.8a	86a	3.52a
Orthene 97S	16 oz	8, 15 Aug				
Mustang Max 0.8EC	4 fl oz	22, 29 Aug				
Mustang Max 0.8EC	4 fl oz	29 Jul	5.27a	2.5a	94a	4.93a
Orthene 97S	16 oz	8, 15 Aug				
Avaunt 30WG	3.5 oz	22, 29 Aug				
Mustang Max 0.8EC	4 fl oz	29 Jul	4.08a	1.0a	98a	3.98a
Orthene 97S	16 oz	8, 15 Aug				
Intrepid 2F	6 fl oz	22, 29 Aug				
Mustang Max 0.8EC	4 fl oz	29 Jul	4.09a	2.8a	90 a	3.74a
Orthene 97S	16 oz	8, 15 Aug				
Proclaim 5WDG	3.6 oz	22, 29 Aug				
Mustang Max 0.8EC	4 fl oz	29 Jul	3.93a	2.5a	93a	3.57a
Orthene 97S	16 oz	8, 15 Aug				
SpinTor 2SC	4 fl oz	22, 29 Aug				
Mustang Max 0.8EC	4 fl oz	29 Jul	6.16a	2.5a	94a	5.83a
Orthene 97S	16 oz	8, 15 Aug				
Untreated		22, 29 Aug				
Untreated check	--	--	3.24a	3.0a	83a	2.82a
<i>P</i> > <i>F</i>			0.87	0.55	0.55	0.74
LSD			3.00	5.0	13	2.78

Means within a column followed by the same letter are not significantly different (LSD,  $P > 0.05$ ).

Percentages were transformed (arcsine square root (x)) before statistical analysis. Actual percentages are shown in table.

<sup>a</sup>Estimated clean yield = (Total kg of fruit) × (% of clean fruit).