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Stink Bug Control by Insecticides on Tomatoes, 2000

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Background:

The one-spotted stink bug (*Euschistus variolarius*) is a sucking pest that feeds on tomato fruit, leaving white corky tissue in the fruit flesh, often with yellow blotches on the fruit surface. Stink bugs usually are first detected in tomato fields in early July but their early infestation can be difficult to detect. Trials have been conducted for the past few years in Ohio to determine 1) whether insecticides are effective in preventing this injury and 2) when is the best time for insecticide to be applied.

Methods:

The tomato variety 'Peto 696' was transplanted from 288 deep plug trays on 10 June 2000. The experimental design was randomized complete block with four replicates of six treatments. Each plot was 25 ft long by three rows wide with 5 ft row spacing. There was an untreated guard row between adjacent plots and on field edges, and there were bare alleys between blocks. Treatments were lambda-cyhalothrin (Warrior 1EC, 3.2 fl oz/A; Zeneca Inc.), which represented a grower standard treatment; cyfluthrin (Baythroid 2EC, 2.4 oz/A; Bayer Corp.); and two experimental materials, thiamethoxam (Actara 25WG, 4 oz product per acre [70 g AI/ha] and 5 oz product per acre [88 g AI/ha]; Novartis Inc.) and indoxacarb (Avaunt 30WDG, 3.5 oz product per acre [0.065 lb AI/acre]; DuPont Co.); and no insecticides in the untreated check treatment. The trial site was the Ohio Agricultural Research and Development Center (OARDC) Vegetable Crops Branch at Fremont, Sandusky County, Ohio.

Plots were scouted weekly for stink bugs and stink bug injury starting 20 June, with 10 samples per plot. The sample unit was one whole plant during the first 3 weeks. Once fruit formed and adjacent plants began to grow together, the sample unit was 10 fruit. During the first 6 weeks, scouting was supplemented by 10 shake samples per plot; for each sample, a whole plant or a 1-foot length of row was gently shaken over a white tray. Shaking was discontinued after the canopy became too heavy to shake. After the tentative threshold (0.75% of fruit injured) was exceeded on 10 August, treatments were applied on 11 August and reapplied on 24 August. Sprays were applied with a tractor-mounted CO_2-pressurized research boom sprayer that delivered 38 gallons per acre using 60 psi pressure, hollow cone nozzles (TeeJet D4-25) spaced 15 inches apart, and speed of 3 mi/hr. For disease control, all plots were sprayed with Quadris and Champ on 1 July, 9 July, 18 July, 11 August, and 24 August, and with Bravo Weatherstick and Champ on 26 July.

All fruit from a 5-foot section of row in the center of each plot were harvested on 11 September and evaluated for yield after sorting by color category (red, breaker [partially red], mature green) and presence or absence of stink bug injury. The red fruit category is of interest to fresh market tomato growers as well as processors of top grade canned tomatoes, while breaker fruit are used in lower grade canning. Mature green fruit are not used by canners but are used by tomato paste processors. Data were subjected to analysis of variance with mean separations by least significant difference tests using SAS's JMP microcomputer program. Proportions were transformed by arcsine square root before analysis, but untransformed values are shown in results.

Results:

First detection of a stink bug adult was on 17 July in a shake sample; first detection of a stink bug nymph was on 10 August on a fruit sample; and stink bug injury on fruit was first found on 25 July (Table 1). The tentative threshold of 0.75% of fruit injured was exceeded on 10 August.

At harvest, there were significant treatment differences in yield of stink bug injured fruit in all three fruit color categories ($P < 0.05$) and in yield of good (undamaged by stink bug) red fruit, but no significant differences in yield of good breaker or good green fruit (Table 2). The percentage of red fruit injured by stink bug (Table 3) was 44% in the untreated check, which was significantly higher ($P < 0.0001$) than where treated with Warrior (1.0% injured), Actara (1.7% injured at low rate; 1.5% injured at high rate), or Baythroid (4.0% injured). Damage to red fruit in plots treated with Avaunt (41% injured) was not significantly different than the untreated check ($P > 0.05$). The percentage of breaker and green fruit injured also differed significantly among treatments with trends similar to those in red fruit (Table 3).

Discussion:

Compared to the previous year when a similar trial was run at the same farm, fewer stink bugs were seen throughout the season, the first bug found was later, yet damage to fruit was much heavier. The canopy was extremely thick, which might mean that the stink bugs could easily hide during the daytime when scouting was done. This year's field was about 1000 feet (300 meters) away from the nearest wheat field, whereas the previous year's trial was adjacent to wheat; this is important because wheat seems to be the source of stink bugs before they infest tomatoes.

Insecticide timing based on scouting and a threshold seems appropriate for managing this pest. Excellent control of stink bug by provided by most insecticides applied on 11 August, just after damage exceeded the tentative threshold of 0.75% of fruit injured and after the first nymph was detected. Although 0.75% fruit injury is a low threshold, careful field scouting by an experienced scout has consistently detected lower damage than is present at harvest (e.g., untreated check plots scouted on 8 September showed 22% of fruit injured; these plots harvested three days later showed 44% of fruit injured.) The difference between scouting and harvest evaluations is likely due to localized concentrations of damage as well as to difficulty in seeing all sides of fruit in the field. Our harvest evaluation was very strict; we included small injuries in the damage category, although some of these would be unlikely to be culled by typical commercial packing crews who scan large amounts of fruit quickly. A suggested scouting procedure is to examine 10 tomato fruit at each of 40 randomly selected locations per field, for a total of 400 fruit; the 0.75% threshold is exceeded if 3 of 400 fruit are damaged.

Conclusions:

These results suggest that treating with insecticide is very effective for preventing stink bug injury to tomato fruit, and timing based on field scouting seems appropriate with a threshold of 0.75% of fruit injured; the 0.75% threshold would be exceeded if at least 3 of 400 fruit are damaged. Any of the registered insecticide products (Baythroid, Warrior, as well as Thiodan) should give about the same level of control. Avaunt does not appear to have activity against the one-spotted stink bug. Once Actara is registered, it should be an excellent option for stink bug control.

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Table 1. Stink bug injury on tomatoes before and after insecticide application as detected by weekly field scouting, at Fremont, Ohio, 2000.

Treatment (applied 8/11 and 8/24)	*Mean percentage of fruit (of 100 fruit per plot) with stink bug injury[1], on last 8 scouting dates*							
	7/17[2]	*7/25*	*8/01*	*8/10*	*8/16*	*8/22*	*8/29*	*9/08*
Warrior 1EC 3.2 oz/A	0	1.0	0.2	0.2	1.2	1.0	1.2 ABC	0.8 B
Actara 25WG 5 oz/A	0	0.5	0.0	0.2	0.2	1.0	0.0 C	0.2 B
Actara 25WG 4 oz/A	0	0.2	0.2	2.5	1.8	2.8	3.0 A	3.2 B
Baythroid 2EC 2.4 oz/A	0	1.2	0.5	1.5	0.5	1.0	0.8 BC	0.8 B
Avaunt 30WDG 3.5 oz/A	0	0.0	0.5	0.0	1.2	1.8	4.8 A	20.2 A
Untreated check	0	0.2	0.8	1.0	0.2	1.2	3.8 AB	22.0 A
P (treatment effect)	-	*0.58*	*0.77*	*0.16*	*0.67*	*0.61*	*0.02*	*<0.0001*
Evidence found (sum of 240 samples per date):								
adult stink bugs	*1*	*1*	*0*	*1*	*0*	*0*	*0*	*0*
nymph stink bugs	*0*	*0*	*0*	*1*	*0*	*1*	*0*	*2*
fruit damage (2400 fruit)	*0*	*13*	*9*	*22*	*21*	*35*	*54*	*189*

[1] Within a column, means followed by the same letter are not significantly different (*P* > 0.05). Note, means shown are actual percentages, but statistical analysis was based on angular transformed data.

[2] Total sample size per plot on 7/17 was 25 fruit rather than 100 fruit due to lack of fruit.

Table 2. Yield (kg) of good and injured tomato fruit per 5-foot length of row, harvested on 11 September 2000, at Fremont, Ohio; mean of four replicates.

Treatment	*Yield undamaged by stink bug*[1]				*Yield damaged by stink bug*[1]			
	red	*breaker*	*green*	*all*	*red*	*Breaker*	*green*	*all*
Warrior 1EC 3.2 oz/A	13.99 A	2.11	0.71	16.81 A	0.13 B	0.19 B	0.04 BC	0.36 B
Actara 25WG 5 oz/A	10.69 C	2.99	1.51	15.19 A	0.16 B	0.05 B	0.01 C	0.22 B
Actara 25WG 4 oz/A	11.16 BC	2.62	1.20	14.99 A	0.19 B	0.08 B	0.01 C	0.28 B
Baythroid 2EC 2.4 oz/A	13.04 AB	3.02	1.35	17.41 A	0.55 B	0.05 B	0.04 BC	0.64 B
Avaunt 30WDG 3.5 oz/A	8.47 D	2.39	1.01	11.88 B	5.86 A	0.57 A	0.19 B	6.62 A
Untreated check	7.29 D	1.92	1.19	10.41 B	5.73 A	0.69 A	0.46 A	6.88 A
P (treatment effect)	*<0.0001*	*0.76*	*0.83*	*0.0009*	*<0.0001*	*0.003*	*0.0004*	*<0.0001*

[1] Within a column, means followed by the same letter are not significantly different (*P* > 0.05).

Table 3. Stink bug injury on tomatoes as percentage of yield at harvest on 11 September 2000, at Fremont, Ohio; mean of four replicates.

Treatment	*Mean percentage of fruit yield with stink bug injury* [1]			
	Red fruit	*Breaker fruit*	*Green fruit*	*All fruit*
Warrior 1EC 3.2 oz/A	1.0 C	6.2 B	2.9 B	2.2 B
Actara 25WG 5 oz/A	1.5 BC	3.8 B	1.9 B	1.6 B
Actara 25WG 4 oz/A	1.7 BC	2.8 B	0.3 B	1.8 B
Baythroid 2EC 2.4 oz/A	4.0 B	1.1 B	3.0 B	3.6 B
Avaunt 30WDG 3.5 oz/A	41.0 A	21.4 A	16.9 A	35.5 A
Untreated check	44.0 A	25.5 A	32.7 A	40.7 A
P value (treatment effect)	*<0.0001*	*0.0006*	*0.0002*	*<0.0001*

[1] Within a column, means followed by the same letter are not significantly different (*P* > 0.05). Note, means shown are actual percentages, but statistical analysis was based on angular transformed data.