2016 Delaware Soybean Board Report

Title: Area Wide Evaluation of Multiple Insecticide Applications to Control Dectes Stem Borer in Soybeans—Another Try!

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Objectives:

1. Evaluate the effectiveness of multiple foliar insecticide applications to control Dectes stem borer

2. Determine if the timing for making a foliar application based on Dectes stem borer adult beetle emergence can apply to an area wide-basis

Methods

To evaluate the effectiveness of various insecticide timing regimes, fifteen fields were monitored on a weekly basis from late-June to mid-August using sweep net sampling methods to determine Dectes adult beetle emergence and to monitor adult beetle activity pre- and post-treatment. Among the fifteen fields sampled on a weekly basis, thirteen fields were treated with foliar insecticides based on the treatment timings being evaluated and seven of the fields included an untreated check. The untreated checks were sampled independently from the treated portions of the fields starting after the first insecticide application. The insecticide programs evaluated include:

1. One Spray versus Two: First spray applied one week after beetle emergence (entire field) followed by a second spray 14 days later (a portion of field did not receive 2nd spray) (1 field)
2. Two Spray: First spray applied one week after beetle emergence followed by a second spray 14 days later (5 fields)
3. Two Spray: First spray applied when densities reached one beetle per 10 sweeps followed by a second spray 7-10 days later (4 fields)
4. One Spray: applied 7-14 days after first beetle emergence (3 fields)
5. Untreated (2 fields)

Prior to harvest, the percentage of soybean stems infested with Dectes stem borer larvae was determined by randomly collecting 100 plants from each field and splitting the stems with a knife. At the same time, 100 randomly chosen plants were pushed to determine lodging potential. After harvest, lodging losses were estimated in six fields by either tossing a hula hoop in ten random locations and collecting lodged plants or using a tape measure to collect lodged plants in 1/1000th of an acre. Stand counts were taken when sampling with a tape measure to document the percent of lodged plants. Seven of the fields included an untreated check that was sampled separately from the treated portion of the field beginning after the first insecticide application. Sampling results were averaged among fields with similar treatment scenarios when appropriate. Individual field level results are shown in Appendices A & B.

Results

One Spray versus Two: First spray applied one week after beetle emergence followed by a second spray 14 days later

This treatment scenario was demonstrated in one field. The entire field was treated with an insecticide on July 14, seven days after the first beetle was detected. Approximately two weeks later on July 30, a second application was made to a portion of the field. Adult sweep net sampling results suggest the first and second sprays were successful in reducing adult beetles (**Table 1**) but did not necessarily reduce the percent infested stems with 73% of stems infested with larvae in the two spray zone versus 45% in the one spray area. When pushing stems by hand prior to harvest, 16% lodged in the one spray versus 10% in the two spray program (**Table 2**). The two spray treatment yielded 2 bushels per acre higher than the one spray treatment (**Table 3**).

Table 1. *One Spray versus Two: Sweep Net Sampling Results (1 field)*

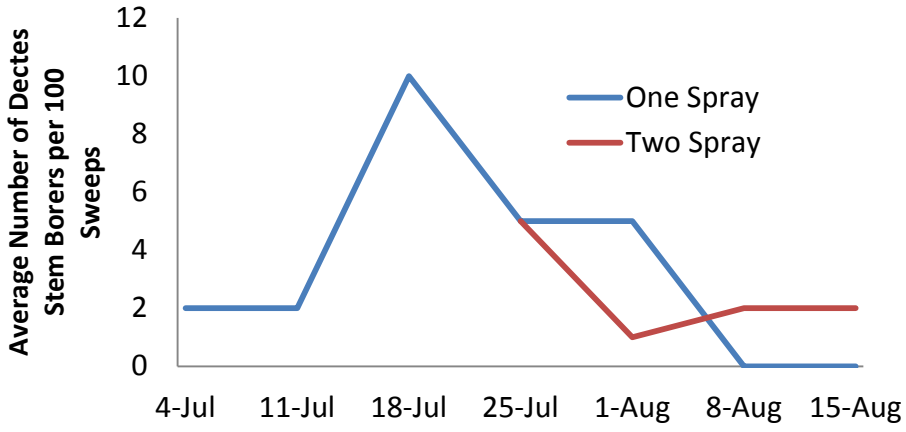


Table 2. *One Spray versus Two Pre-harvest: Percent of infested stems with Dectes stem borer larvae and percent lodged stems*

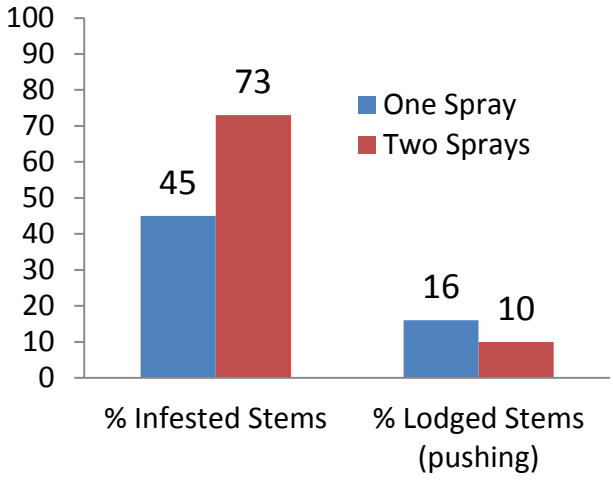
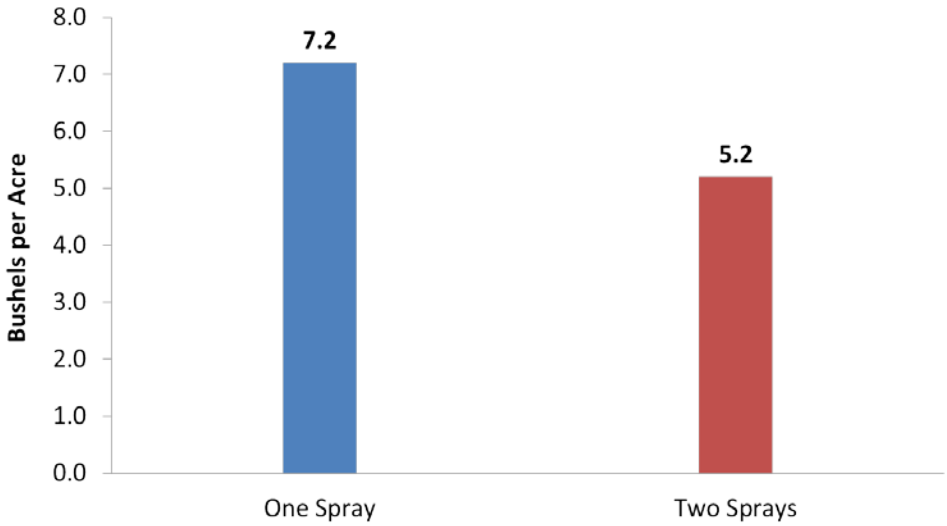


Table 3. *Lodging Yield Loss Post-harvest: One Spray versus Two*

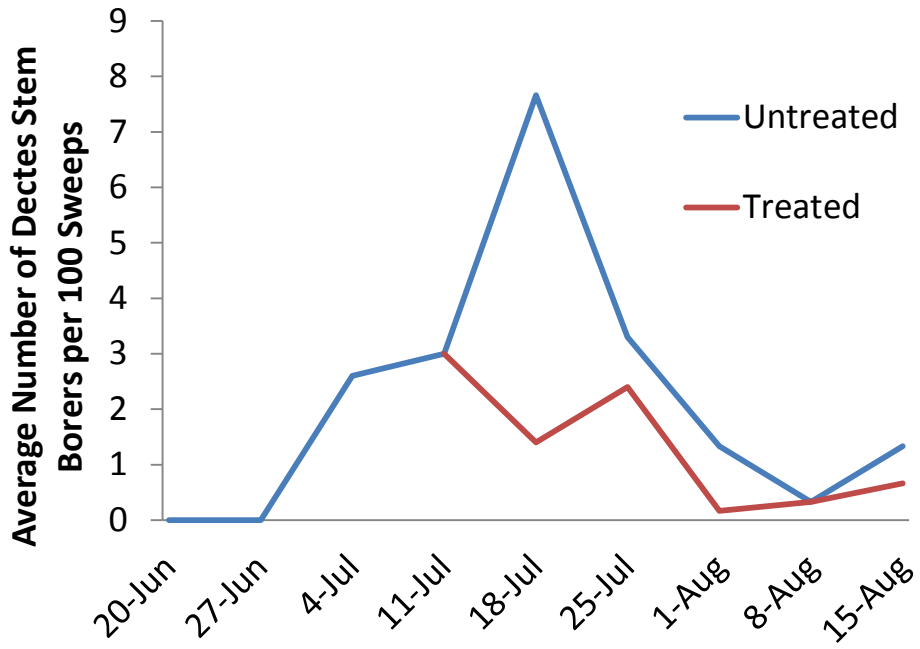


Two Spray: First spray applied one week after beetle emergence followed by second spray 14 days later

Five fields were treated with an insecticide one week after the first beetle was detected and again 14 days later. Fields were sprayed on July 14th and July 27th with an insecticide application targeting Dectes stem borer beetles. All fields were sprayed with an insecticide tank-mixed with herbicide on June 27th, which is prior to the Dectes targeted sprays. Averaged across all fields, adult beetle counts were lower in the treated zones compared to the untreated for each sample date following the first insecticide application (**Table 4**). While this did result in fewer infested

stems and pre-harvest lodging (**Table 5)**, it did not result in a reduction of post-harvest lodging or yield loss (**Table 6**).

Table 4. *Two Spray: First spray applied one week after beetle emergence and second 14 days later- Adult Dectes Stem Borer Sweep Net Counts (5 fields)*



Fields treated on July 14th and July 27th with an insecticide application targeting Dectes stem borer beetles. All fields treated with insecticide tank-mixed with herbicide on June 27th, which is prior to the Dectes targeted sprays.

Table 5. *Two Spray Pre-harvest: First spray applied one week after beetle emergence and second 14 days later- percent infested stems and percent Lodged Stems (5 fields)*

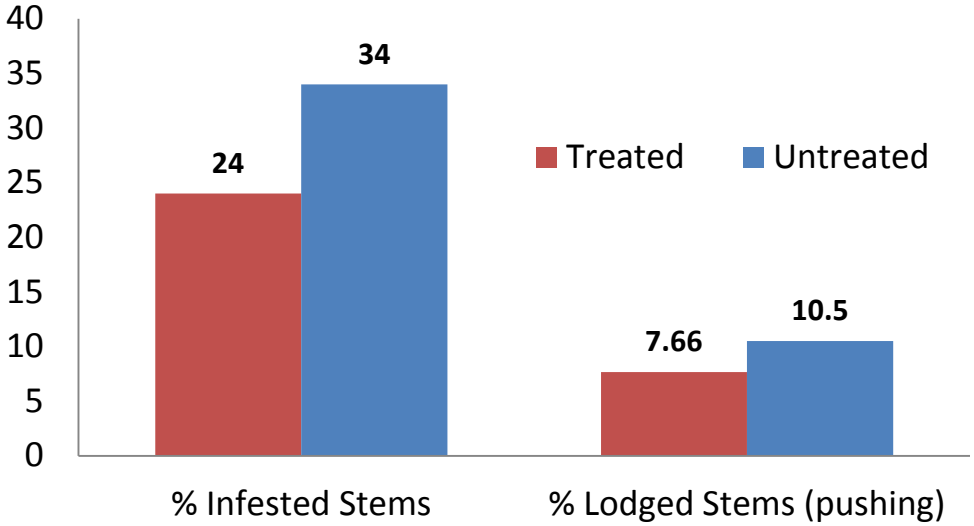
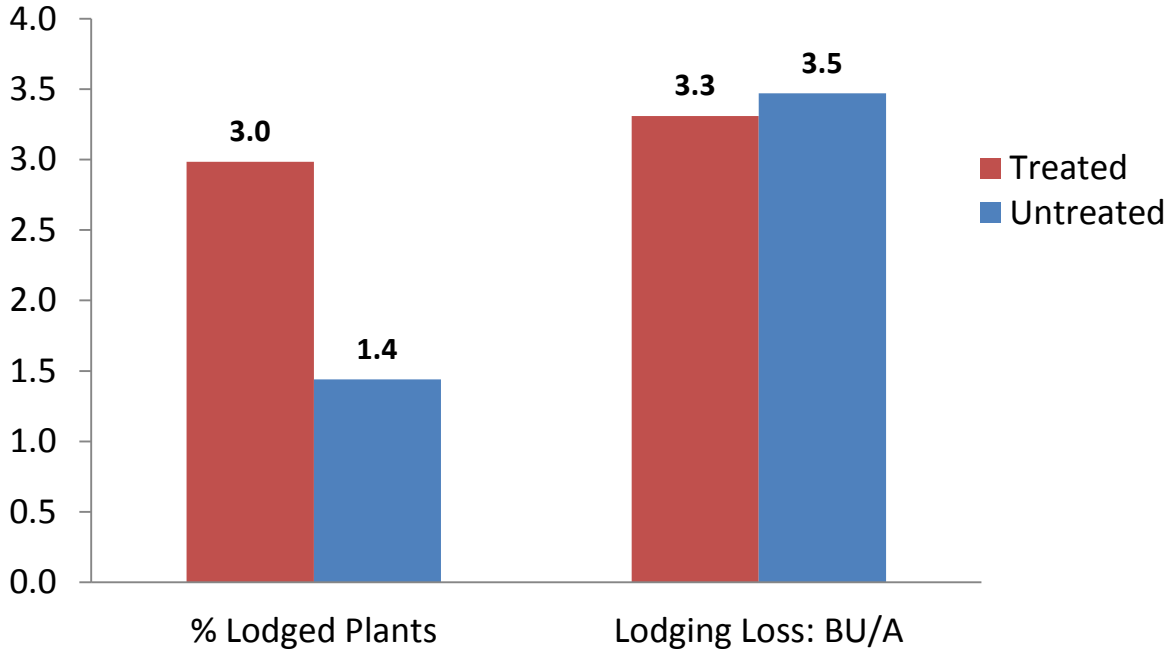


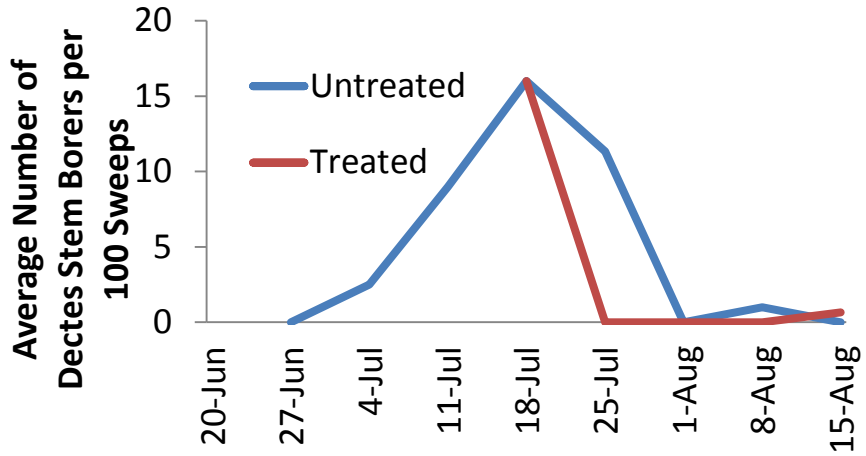
Table 6. *Two Spray Post-harvest: First spray applied one week after beetle emergence and second 14 days later- Percent Lodged Plants and Lodging Loss (Bushels per Acre)*



Two Spray: First spray applied when densities reach one beetle per 10 sweeps and second spray applied 7-10 days later

We considered this a "threshold" spray, basing the decision and timing to spray on when densities reach one Dectes stem borer adult per ten sweeps. It should be noted that there is no threshold for Dectes stem borer. This number was only treated in an attempt to once again see if the "threshold" reported in industry literature was effective as it is not supported by any validated research in Delaware or Kansas. Three fields used this approach to time the first insecticide application and a second application was made 7-10 days later. It should be noted that a fourth field was treated in a similar manner but no untreated strip was included so the results were not included. Similar to the other strategies evaluated, the insecticide applications were successful in reducing adult beetle populations (**Table 7**). However, there was no reduction in the percent infested stems and pre-harvest lodged plants (**Table 8**). There was a slight reduction in post-harvest lodging loss but no reduction in yield losses (**Table 9**).

Table 7. *Two Spray: First spray applied when densities reach one beetle per 10 sweeps and second spray applied 7-10 days later- Sweep Net Sampling Results (3 fields)*



First spray applied ~July 23 and Second spray applied ~August 1

Table 8. *Two Spray Pre-harvest: First spray applied when densities reach one beetle per 10 sweeps and second spray applied 7-10 days later-Percent infested stems and percent lodged plants (post-harvest)(3 fields)*

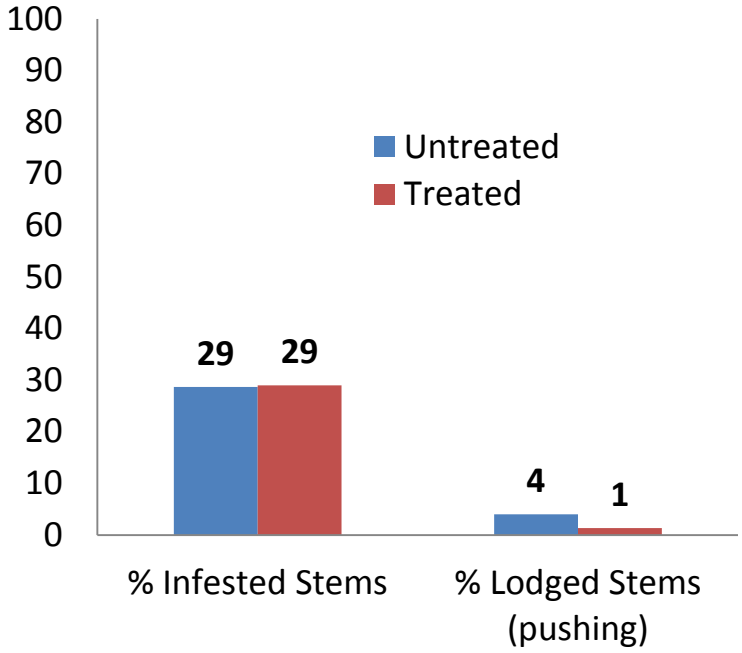
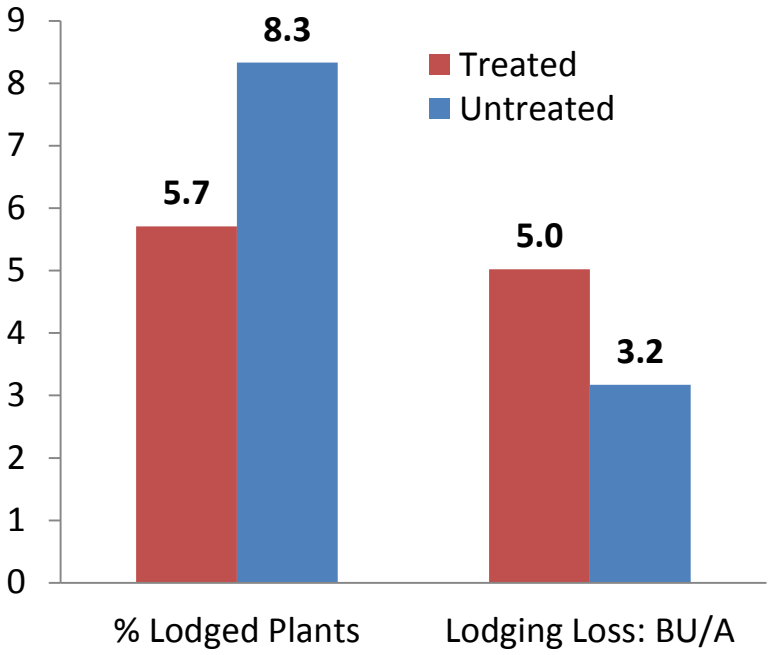


Table 9. *Two Spray Post-harvest: First spray applied when densities reach one beetle per 10 sweeps and second spray applied 7-10 days later-percent lodged plants and lodging loss (3 fields)*



One Spray: Applied 7-14 days after first beetle emergence

Three fields received a single insecticide application applied 7-14 days after the first beetle was detected. An insecticide application was applied on July 26 and none of the fields included an untreated check. Adult beetle sweep net counts decreased after the insecticide application (**Table 10**). The single application program resulted in 20 percent infested stems and 39 percent of the plants lodged (pre-harvest) (**Table 11**).

Table 10. *One Spray 7-14 days after first beetle emergence – Sweep Net Sampling Results (3 fields)*

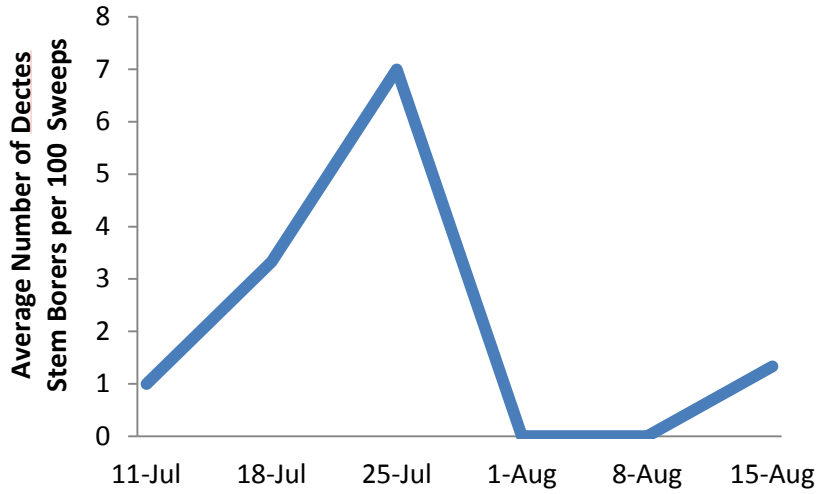
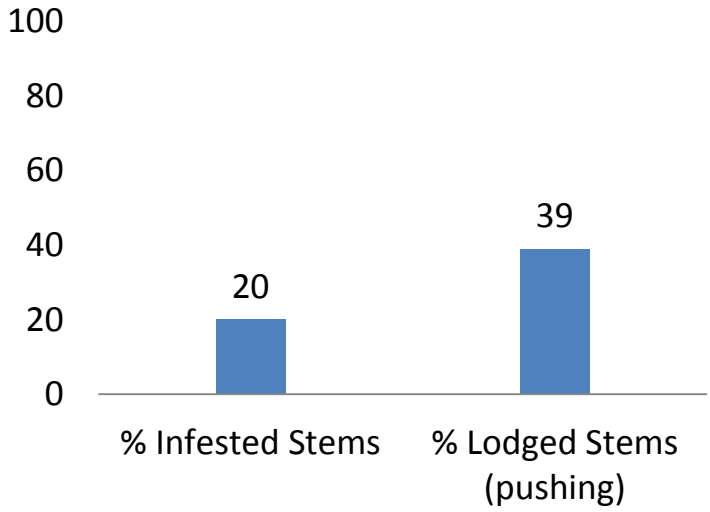


Table 11. *Pre-harvest: One Spray 7-14 days after first beetle emergence – % Infested stems and % Lodged Plants (3 fields)*



Untreated

Two fields unsprayed and monitored for adult beetles, percent infested stems, and lodging loss. Adult Dectes beetle counts were high, peaking on July 25 (**Table 12**). The percent of infested stems was also very high, averaging 55% (**Table 13**). However, lodging loss were very low after harvest (<1 bushel/acre) due to a timely harvest. This is a good example of how lodging losses can be kept to a minimum when harvest is timely.

Table 12. *Untreated: Sweep Net Sampling Results (2 fields)*

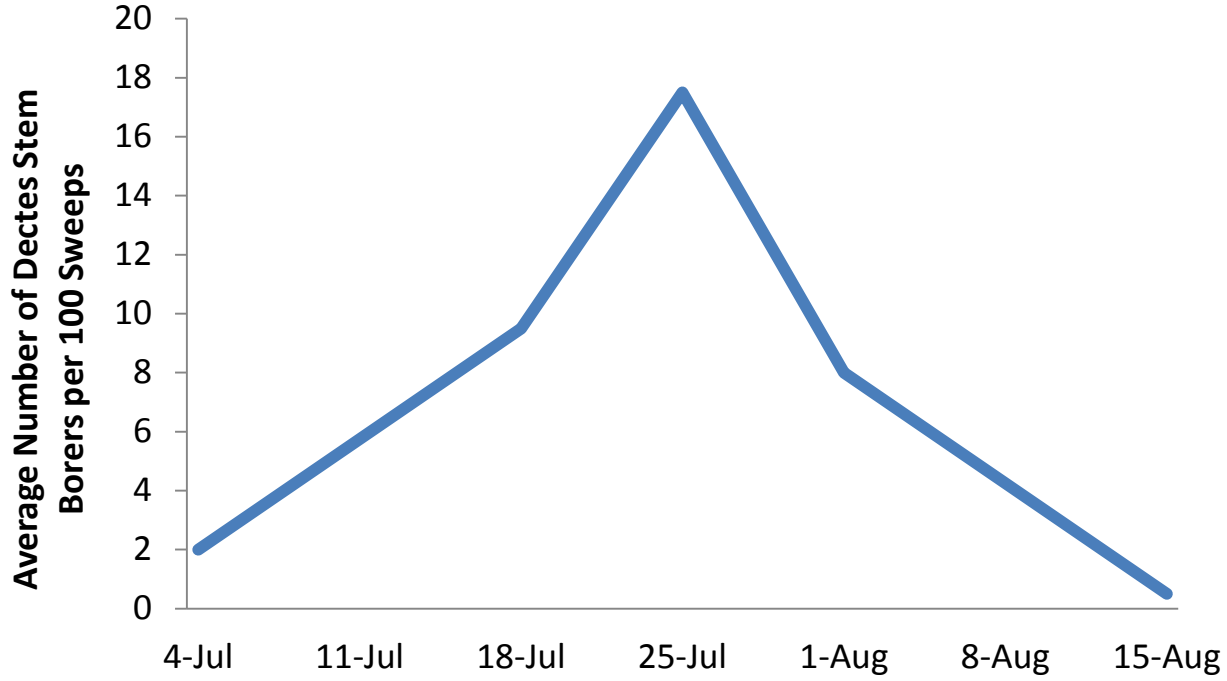
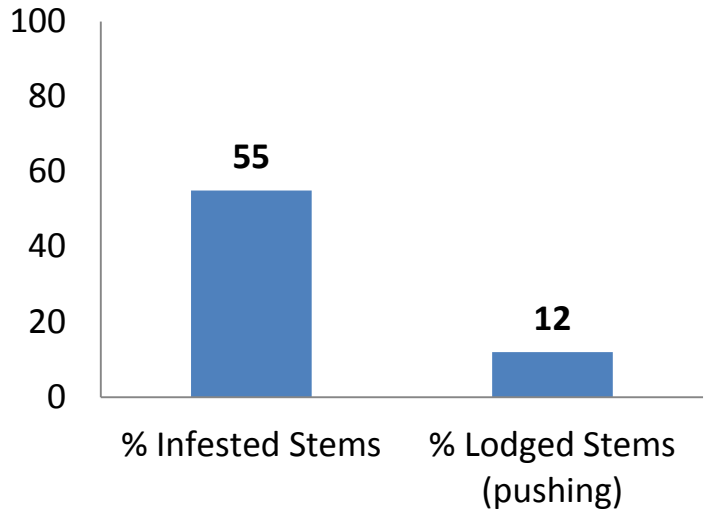


Table 13. *Pre-harvest: Untreated: % Infested stems and % Lodged Plants (pre-harvest) (2 fields)*



Discussion:

Sweep net sampling results in each of the treatment strategies demonstrated that the adult Dectes stem borers can be controlled using foliar insecticides. As seen in past work in Delaware and

Kansas, this did not always result in a reduction of infested stems or lodging loss. One of the reasons the Dectes stem borer is so difficult to manage with insecticides is that the adult beetle has a large emergence window, from late June to mid-August. The larvae, which are responsible for causing lodging losses in soybeans, hatch from eggs laid directly into the pith of the soybean plant and don't leave the plant until the following year when they emerge as adults. As a result, insecticide applications are not effective at controlling the larvae. Multiple cultural practices will be necessary for Dectes stem borer management since relying on multiple insecticide applications did not consistently reduce yield loss from lodging. The single best strategy to date is harvesting soybeans as soon as the grain reaches an acceptable harvest moisture. Further investigation into other management strategies is warranted.

Appendix A: Detailed adult Dectes stem borer sweep net sampling results from individual fields.

One Spray versus Two: First spray applied one week after beetle emergence and second spray applied 14 days later

Field Demonstration 1

Sample Date	Growth Stage		# per 100 sweeps
7-Jul	V1		2
13-Jul	V1		2
19-Jul	V3		10
27-Jul	R1		5
4-Aug	R3	Two Spray	1
		One Spray	5
10-Aug	R3	Two Spray	2
		One Spray	0
16-Aug	R4	Two Spray	2
		One Spray	0

Entire field sprayed 7/14. Field sprayed on 7/30 with an untreated area.

Two Spray: First spray applied one week after beetle emergence and second 14 days later

Field Demonstration 2

Sample Date	Growth Stage		# per 100 sweeps
21-Jun	V1		0
30-Jun	V1		0
6-Jul	V2		0
12-Jul	V2		2
19-Jul	V9	Treated	0
		Untreated	7
25-Jul	R1	Treated	1
		Untreated	14
2-Aug	R2	Treated	0
		Untreated	0
10-Aug	R4	Treated	0
		Untreated	1
16-Aug	R5-R6	Treated	1
		Untreated	3

Treated area sprayed 7/14 and 7/27 with an insecticide
Entire field was sprayed on 6/27 with an insecticide tank mixed with herbicide.

Field Demonstration 3

Sample Date	Growth Stage	# per 100 sweeps
21-Jun	V2	0
30-Jun	V2	0
6-Jul	V2	1
12-Jul	V7	1
19-Jul	V8	0
25-Jul	R1	4
2-Aug	R2	0
10-Aug	R4	0
16-Aug	R5	0

Field sprayed 7/14 and 7/27 with an insecticide
Entire field was sprayed on 6/27 with an insecticide tank mixed with herbicide.

Field Demonstration 4

Sample Date	Growth Stage	# per 100 sweeps
21-Jun	V2	0
30-Jun	V2	0
6-Jul	V2	0
12-Jul	V2	4
19-Jul	V9	4
25-Jul	R1	1
2-Aug	R2	0
10-Aug	R3	0
16-Aug	R5	0

Field sprayed 7/14 and 7/27 with an insecticide
Entire field was sprayed on 6/27 with an insecticide tank mixed with herbicide.

Field Demonstration 5

Sample Date	Growth Stage		# per 100 sweeps
21-Jun	V2		0
30-Jun	V2		0
6-Jul	V2		1
12-Jul	V2		3
19-Jul	V9	Treated	3
		Untreated	1
25-Jul	R1	Treated	4
		Untreated	2
2-Aug	R2	Treated	0
		Untreated	0
10-Aug	R3	Treated	0
		Untreated	0
16-Aug	R5	Treated	0
		Untreated	1

Field sprayed 7/14 and 7/27 with an insecticide
Entire field was sprayed on 6/27 with an insecticide tank mixed with herbicide.

Field Demonstration 6

Sample Date	Growth Stage		# per 100 sweeps
21-Jun	V2		0
30-Jun	V2		0
7-Jul	V2		11
12-Jul	V2		5
19-Jul	V9	Treated	0
		Untreated	15
25-Jul	V9	Treated	2
		Untreated	8
2-Aug	R2	Treated	0
		Untreated	4
10-Aug	R3	Treated	0
		Untreated	0
16-Aug	R5	Treated	1
		Untreated	0

Field sprayed 7/14 and 7/27 with an insecticide
Entire field was sprayed on 6/27 with an insecticide tank mixed with herbicide.

Two Spray: First spray applied when densities reach one beetle per 10 sweeps and second spray applied 7-10 days later

Field Demonstration 7

Sample Date	Growth Stage		# per 100 sweeps
7-Jul	V1		0
22-Jul	V3		16
28-Jul	V5-R1	Treated	0
		Untreated	20
8-Aug	R5	Treated	0
		Untreated	1
17-Aug	R5	Treated	2
		Untreated	0

Treated area sprayed on 7/23 and 8/1 with an insecticide.

Field Demonstration 8

Sample Date	Growth Stage		# per 100 sweeps
29-Jun	V2		0
7-Jul	R1		2
21-Jul	R1		13
27-Jul	R3-R4	Treated	0
		Untreated	7
8-Aug	R4	Treated	0
		Untreated	2
17-Aug	R5-R6	Treated	0
		Untreated	0

Treated area sprayed on 7/22 and 7/30 with an insecticide.

Field Demonstration 9

Sample Date	Growth Stage		# per 100 sweeps
29-Jun	V2		0
7-Jul	R1		3
21-Jul	R1		11
27-Jul	R3-R4	Treated	0
		Untreated	7
8-Aug	R4	Treated	0
		Untreated	0
17-Aug	R5-R6	Treated	0
		Untreated	0

Treated area sprayed on 7/22 and 7/30 with an insecticide.

One Spray: Applied 7-14 days after first beetle emergence

Field Demonstration 10

Sample Date	Growth Stage	# per 100 sweeps
12-Jul	V1	3
19-Jul	V5	3
26-Jul	V5	10
2-Aug	R2	0
10-Aug	R2	1
16-Aug	R3	0

Field treated with an insecticide on 7/26.

Field Demonstration 11

Sample Date	Growth Stage	# per 100 sweeps
12-Jul	V1	0
19-Jul	V5	4
26-Jul	V5	6
2-Aug	R2	0
10-Aug	R2	0
16-Aug	R5	2

Field treated with an insecticide on 7/26.

Field Demonstration 12

Sample Date	Growth Stage	# per 100 sweeps
13-Jul	V4	0
19-Jul	V5	3
26-Jul	V5	5
2-Aug	R2	0
10-Aug	R2	0
16-Aug	R2	0

Field treated with an insecticide on 7/26.

Two Spray: First spray applied when densities reach one beetle per 10 sweeps and second spray applied 7-10 days later

Field Demonstration 13:

Sample Date	Growth Stage	# per 100 sweeps
29-Jun	V3	0
7-Jul	V5	5
12-Jul	V4-V5	9
19-Jul	V8	1
28-Jul	R2	6
2-Aug	R3	0
12-Aug	R5	2

Field treated with an insecticide on 7/12 and 7/19.

Untreated

Field Demonstration 14

Sample Date	Growth Stage	# per 100 sweeps
7-Jul	V2	2
19-Jul	R1	6
26-Jul	R1	18
2-Aug	R3-R4	8
16-Aug	R4	1

Field Demonstration 15

Sample Date	Growth Stage	# per 100 sweeps
7-Jul	V2	2
19-Jul	R1	13
26-Jul	R1	17
2-Aug	R3-R4	8
16-Aug	R4	0

Field treated on 8/9 with an insecticide for spider mites.

Appendix B. Percent Infested Stems and Percent Lodged Stems (Pre-Harvest)

Field ID	Treatment	Sample Date	% Infested Stems	% Lodged Stems (pushing)
1	Untreated	3-Oct	45	16
	Treated	3-Oct	59	0
	Treated*	10-Oct	73	10
2	Untreated	7-Oct	27	4
	Treated	7-Oct	8	7
3	Treated	7-Oct	20	6
4	Treated	7-Oct	17	4
5	Untreated	7-Oct	30	10
	Treated	7-Oct	17	5
6	Untreated	12-Oct	33	12
	Treated	12-Oct	18	19
7	Untreated	12-Oct	29	10
	Treated	12-Oct	20	3
8	Untreated	23-Sep	23	2
	Treated	23-Sep	20	1
9	Untreated	23-Sep	34	0
	Treated	23-Sep	47	0
10	Treated	19-Oct	19	23
11	Treated	19-Oct	30	45
12	Treated	19-Oct	11	49
13	Treated	10-Oct	33	2
14	Untreated	3-Oct	66	14
15	Untreated	3-Oct	43	10
16	Untreated	3-Oct	48	5
17	Treated	26-Sep	47	0
18	Treated	4-Oct	14	2
19	Untreated	10/11 and 10/18	15	6
20	Untreated	10/13 and 10/18	32	12
* area sampled was in a hot spot in the field				