MISSISSIPPI SOYBEAN PROMOTION BOARD

Management of Soybean Insect Pests
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Rationale/Justification for Research:

Up to date non-biased information is critical for making any agricultural management decision, including insect management decisions. As production practices change, so can the impact of pests change. An example of this is greater risk from early season/soil insects as a result of reduced tillage and increased plant residue from the previous crop, native winter vegetation, and/or cover crops. Also, uncommon and unexpected insect pest issues can occur. For example, redbanded stink bug infestations were much more widespread during 2017. As a result, many studies were conducted with regard to management, damage potential, and treatment thresholds. Also, many current management tools are under reregistration review. It is possible that some of the older insecticides, which growers rely on, may have uses either restricted or revoked in the near future. With a limited number of insecticides already, this would make insect management in soybeans, and all crops more challenging. Insecticide resistance can be a major issue for insect management, and new insecticides are not being brought to market regularly anymore. "Routine" studies to evaluate current insecticides, along with reports from growers and consultants provide the first indications of pending insecticide resistance issues. Current market conditions have reduced profit margins considerably. The most informed and economical insect management decision is always important, but may be even more important when profit margins are small. To keep information current, studies must be regularly conducted to evaluate management strategies and tools and to provide information on unexpected insect issues.

RESULTS AND DISCUSSION

During 2019 ten experiments were conducted to evaluate the performance of selected insecticides against a range of soybean insect pests including, seedling/soil insects (corn rootworm, wireworm, pea leaf weevil), bollworm, soybean looper, and stink bugs (including redbanded stink bug). These experiments were conducted at the Delta Research and Extension Center and on commercial farms.

Two experiments were conducted at DREC to evaluate the performance of at-planting insecticides against seedling/soil pests. In the first experiment, all of the insecticide seed treatments resulted in higher plant populations than the non-treated control (received only fungicide seed treatment) at 34 days after emergence (DAE) (Table 1). Brigade (bifenthrin)

applied in-furrow resulted lower plant populations compared to all of the other insecticide treatments, except Dermacor. For soybean yield, all of the insecticide treatments, except Brigade in-furrow, resulted in higher yields compared to the non-treated control. In the second experiment, selected insecticide seed treatments and seed treatment packages were evaluated. At 23 DAE only CruiserMaxx Vibrance, CruiserMaxx Vibrance plus Avicta, Intego Suite, Trilex Allegiance plus Gaucho, and Trilex Allegiance plus Fortenza resulted in greater plant population than Trilex Allegiance (Fungicide Only) (Table 2). Only CruiserMaxx Vibrance and CruiserMaxx Vibrance plus Avicta resulted in greater yields compared to Trilex Allegiance (Fungicide Only).

An experiment was conducted on a commercial farm in Washington County to evaluate the performance of selected insecticides against bollworm infesting soybeans (Table 3). At 4 DAT all of the insecticide treatments, except Sniper plus Diamond, reduced bollworm numbers compared to the non-treated control. At 6 DAT, all of the insecticide treatments reduced bollworm numbers compared to the non-treated control. By 8 DAT populations had declined in all plots and no differences among treatments were observed. Three other experiments were initiated on a different commercial farm. However, these were inadvertently over sprayed by a commercial applicator before the first sample date.

Three experiments were conducted at DREC to evaluate the performance of selected insecticides against soybean looper. Moderate populations were present when experiments were initiated, but a cold front passed through at ca. 7 DAT which triggered a disease outbreak. This resulted in a rapid decline in populations. In the first experiment, all of the insecticides reduced soybean looper densities compared to the non-treated control at 2 and 6 DAT (Table 4). By 13 DAT soybean looper densities had declined substantially in all plots. However, at this rating date all of the insecticides, except Besiege, reduced looper densities compared to the non-treated control. In the second experiment, all of the insecticides, except Besiege and Intrepid, reduced soybean looper densities compared to the non-treated control at 3 DAT (Table 5). In general populations had declined by 7 DAT. By 7 DAT all of the insecticides had reduced looper densities compared to the non-treated control. Also, plots treated with Prevathon at 20 oz, Denim at 8 oz, or Intrepid Edge had fewer soybean looper larvae than plots treated with Besiege at 7 oz. In the third experiment, generally soybean looper infestations were moderate at 3 DAT and had declined by 7 DAT (Table 6). At 3 DAT only Intrepid Edge and Steward reduced soybean looper densities compared to the non-treated control. By 7 DAT all of the insecticides, except Besiege, Diamond, and Intrepid, had reduced soybean looper densities compared to the non-treated control.

Four experiments were conducted at DREC to evaluate the performance of selected insecticides against stink bugs. Two stink bug experiments were initiated on a commercial farm in Leflore County. However, the trials were compromised by harvest aid drift from adjacent soybeans prior to the first sample date. In the experiments at DREC, stink bugs occurred late in the growing season during the R5.8 to R6.5 growth stages. Mixed populations of green, southern green, brown, and redbanded stink bugs were observed. In the first experiment, no differences among treatments were observed at 2 DAT (Table 7). In the non-treated plots southern green stink bug was the primary species observed at 2 DAT (Table 8). While in the insecticide treated plots, brown stink bug accounted for ≥50% of the stink bugs observed. Overall stink bug

densities increased by 6 DAT, and all of the insecticides reduced stink bug numbers compared to the non-treated control. Also, Acephate plus Sniper and Acephate alone reduced stink bug densities compared to Belay. In the non-treated plots brown stink bug was the predominate species observed (Table 9). While redbanded stink bug was the predominate species observed in several of the insecticide treated plots. All of the insecticides reduced stink bug densities compared to the non-treated control at 8 DAT. At 8 DAT redbanded stink bug was the predominate stink bug species observed in all plots, except those treated with Belay (Table 10). In the second experiment, all of the insecticides reduced stink bug densities compared to the non-treated control at 2 DAT (Table 11). Brown stink bug was the predominate species in all plots at 2 DAT (Table 12). All of the insecticides reduced stink bug densities compared to the non-treated control at 6 DAT. Also, Acephate plus Sniper, Endigo ZCX, and Sniper plus Belay resulted in fewer stink bugs than Belay or Karate. Generally, the incidence of brown and redbanded stink bugs increased by 6 DAT, with one of these two species being predominate in most of the plots (Table 13). At 8 DAT all of the insecticides, except Sniper and Sniper plus Wrangler, reduced stink bug densities compared to the non-treated control. Brown or redbanded stink bug was the predominate species observed at 8 DAT (Table 14). In the third experiment, all of the insecticides, except Acephate and Karate, reduced stink bug densities at 3 DAT compared to the non-treated control (Table 15). Southern green stink bug was the predominate species in the non-treated plots, while brown or redbanded stink bug was the predominate species in the insecticide treated plots at 3 DAT (Table 16). At 7 DAT, all of the insecticides, except Acephate and Wrangler, reduced stink bug densities compared to the non-treated control. Green stink bug was the predominate species in the non-treated plots, while brown or redbanded stink bug was the predominate species in the insecticide treated plots at 7 DAT (Table 17). In the fourth experiment, all of the insecticides reduced stink bug densities compared to the non-treated control at 2, 5, and 7 DAT (Table 18). At 2 DAT brown or redbanded stink bug was the predominate species observed (Table 19). Species composition varied among plots at 5 DAT (Table 19) and 7 DAT (Table 20). At 9 DAT, all of the insecticides, except Brigade plus Prevathon, reduced stink bug densities compared to the non-treated control. There were no differences among treatments for numbers of stink bugs at 12 DAT. At 9 DAT southern green stink bug was the predominate species in the non-treated plots, while brown or redbanded stink bug was the predominate species in the insecticide treated plots (Table 20). Brown or redbanded stink bug was the predominate species observed at 12 DAT (Table 21).

In summary, the use of an insecticide seed treatment improved soybean yield in several cases. In the second experiment the response was variable. However, this experiment flooded (completely submerged) at ca. 5 DAE which may have influenced the results. The insecticide that are recommended for bollworm control performed well. In this study the pyrethroid (bifenthrin) in combination with Acephate or Diamond performed adequately. However, these products/combinations have performed very inconsistently in the past. Most of the insecticides evaluated against soybean looper performed adequately. Looper infestations did not persist for an extended period of time, therefore it was not possible to evaluate the extended residual activity of some products exhibit. Over the last several years observations of the diamide insecticides “working slower” than in previous years have been observed. This was also observed in some of the current studies as well. Generally, mixed populations of stink bugs were present in experiments. In this situation most of the insecticides performed satisfactorily, even against redbanded stink bug. However, infestations occurred later in soybean development.

Most of the soybean plots reached the R7 growth stage at 7 to 12 DAT, therefore re-infestation by stink bugs did not occur. It is likely that several of the treatments evaluated would not have been adequate if infestations, especially redbanded stink bug, had occurred earlier. As earlier infestations would have likely resulted in multiple or constant movement of adult stink bugs into the soybeans.

Table 1. Impact of selected at-planting insecticide treatments on soybean stand establishment and yield.

Treatment	Rate	Plants per acre 34 DAE[i]	Yield bu/acre
Non-Treated	-	27,729d	35.3c
Gaucho 5FS[a]	2.5[f]	55,294ab	51.0a
Poncho 5FS[b]	0.11[g]	54,396ab	51.7a
Fortenza 5FS[c]	0.25[g]	61,134a	54.3a
Dermacor 5.21FS[d]	0.25[g]	44,921bc	48.7ab
Brigade 2EC[e]	5.12[h]	34,671cd	42.2bc
P>F		<0.01	<0.01

Means within columns followed by a common letter are not significantly different (FPLSD, *P*=0.05).

All seed received a fungicide seed treatment (Apron XL 3FS 0.105 fl oz/cwt and Maxim 4FS 0.115 fl oz / cwt).

[a]Active ingredient – Imidacloprid, Class - Neonicotinoid.

[b]Active ingredient – Clothianidin, Class - Neonicotinoid.

[c]Active ingredient – Cyantraniliprole, Class - Diamide.

[d]Active ingredient – Chlorantraniliprole, Class - Diamide.

[e]Brigade applied as an in-furrow spray at-planting. Active ingredient – Bifenthrin, Class - Pyrethroid.

[f]fl oz per cwt.

[g]mg A.I. per seed.

[h]fl oz per acre.

[i]DAE=Days after emergence.

Table 2. Impact of selected soybean seed treatment packages on stand establishment and yield.

Treatment	Rate fl oz/cwt	Insecticide component	Plants per acre 23 DAE[e]	Yield bu/acre
Trilex Allegiance	1.0	-	27,361c	42.2c
Trilex Allegiance + Poncho/Votivo	1.0 + 3.28	Poncho[a]	25,850c	42.3c
CruiserMaxx Vibrance	3.2	Cruiser[b]	38,183a	52.4ab
CruiserMaxx Vibrance + Avicta	3.2 2.5	Cruiser[b]	42,267a	56.5a
Intego Suite	3.37	Nipsit[a]	38,306a	50.1abc
Trilex Allegiance + Gaucho	1.0 + 2.5	Gaucho[c]	36,917ab	47.4bc
Trilex Allegiance + Poncho/Votivo + Gaucho	1.0 3.28 2.5	Poncho[a] + Gaucho[c]	26,912c	47.3bc
Trilex Allegiance + Fortenza	1.0 1.084	Fortenza[d]	39,163a	49.7abc
CruiserMaxx Vibrance + Fortenza	3.2 1.084	Cruiser[b] + Fortenza[d]	30,424bc	45.5bc
P>F			<0.01	0.03

Means within columns followed by a common letter are not significantly different (FPLSD, *P*=0.05).

[a]Active ingredient – Clothianidin, Class - Neonicotinoid.

[b]Active ingredient – Thiamethoxam, Class - Neonicotinoid.

[c]Active ingredient – Imidacloprid, Class - Neonicotinoid.

[d]Active ingredient – Cyantraniliprole, Class - Diamide.

[e]DAE=Days after emergence.

Table 3. Performance of selected insecticides against bollworm infesting soybeans.

Treatment	Rate/acre (fl oz product)	Bollworm / 25 Sweeps 4 DAT[g]	6 DAT	8 DAT
Intrepid Edge 3SC[a]	4.0	0.9bc	0.5bc	0.1
Intrepid Edge 3SC[a]	5.0	0.7bc	0.8bc	0.1
Intrepid Edge 3SC[a]	6.0	0.5c	0.5bc	0.4
Prevathon 0.43SC[b]	20.0	0.3c	1.3b	0.2
Besiege 1.252CS[c]	7.0	0.7bc	0.0c	0.4
Acephate 90S[d] + Sniper 2EC[e]	1.11 + 6.4	1.0bc	1.3b	0.4
Sniper 2EC[e] + Diamond 0.43EC[f]	6.4 + 6.0	2.9ab	1.0bc	0.1
Non-Treated	-	5.9a	5.3a	2.0
P>F		<0.01	<0.01	0.49

Means within columns followed by a common letter are not significantly different (FPLSD, *P*=0.05).
[a]Active ingredients – Spinetoram plus Methoxyfenozide, Class – Spinosyn and IGR.
[b]Active ingredient – Chlorantraniliprole, Class - Diamide.
[c]Active ingredients – Lambda Cyhalothrin plus Chlorantraniliprole, Class – Pyrethroid and Diamide.
[d]Active ingredients – Acephate, Class – Organophosphate.
[e]Active ingredient – Bifenthrin, Class – Pyrethroid.
[f]Active ingredient – Novaluron, Class – IGR.
[g]DAE=Days after emergence.

Table 4. Evaluation of selected insecticides against soybean looper, Experiment 1.

Treatment	Rate/acre (fl oz product)	Soybean Looper / 25 Sweeps 2 DAT[e]	6 DAT	13 DAT
Brigade 2EC[a] + Prevathon 0.43SC[b]	6.4 + 20.0	7.1bc	3.6bc	0.1b
Prevathon 0.43SC[b]	20.0	8.4b	4.7bc	0.3b
Besiege 1.252CS[c]	10.0	9.1bc	5.4b	1.5ab
Intrepid Edge 3SC[d]	5.0	3.1c	5.2b	0.5b
Intrepid Edge 3SC[d]	6.4	4.4bc	1.1c	0.3b
Non-Treated	-	21.7a	16.2a	4.0a
P>F		<0.01	<0.01	0.04

Means within columns followed by a common letter are not significantly different (FPLSD, *P*=0.05).
[a]Active ingredient – Bifenthrin, Class – Pyrethroid.
[b]Active ingredient – Chlorantraniliprole, Class - Diamide.
[c]Active ingredients – Lambda Cyhalothrin plus Chlorantraniliprole, Class – Pyrethroid and Diamide.
[d]Active ingredients – Spinetoram plus Methoxyfenozide, Class – Spinosyn and IGR.
[e]DAE=Days after emergence.

Table 5. Evaluation of selected insecticides against soybean looper, Experiment 2.

Treatment	Rate/acre (fl oz product)	Soybean Looper / 25 Sweeps 3 DAT[f]	7 DAT
Prevathon 0.43SC[a]	14.0	6.5bcd	1.9bcd
Prevathon 0.43SC[a]	20.0	6.9bcd	1.4cd
Besiege 1.252CS[b]	7.0	15.2a	4.4b
Besiege 1.252CS[b]	10.0	10.7abc	2.1bcd
Denim 0.16EC[c]	6.0	7.0bcd	1.5bcd
Denim 0.16EC[c]	8.0	4.3cd	1.3cd
Intrepid Edge 3SC[d]	5.0	2.0d	0.2d
Intrepid 2F[e]	6.0	12.4ab	3.5bc
Non-Treated	-	18.8a	8.9a
P>F		<0.01	<0.01

Means within columns followed by a common letter are not significantly different (FPLSD, *P*=0.05).

[a]Active ingredient – Chlorantraniliprole, Class - Diamide.

[b]Active ingredients – Lambda Cyhalothrin plus Chlorantraniliprole, Class – Pyrethroid and Diamide.

[c]Active ingredient – Emamectin Benzoate, Class - Avermectin.

[d]Active ingredients – Spinetoram plus Methoxyfenozide, Class – Spinosyn and IGR.

[e]Active ingredient – Methoxyfenozide, Class – IGR.

[f]DAE=Days after emergence.

Table 6. Evaluation of selected insecticides against soybean looper, Experiment 3.

Treatment	Rate/acre (fl oz product)	Soybean Looper / 25 Sweeps 3 DAT[a]	7 DAT
Prevathon 0.43SC[a]	14.0	6.7ab	0.7de
Prevathon 0.43SC[a]	20.0	6.1ab	0.9cde
Besiege 1.252CS[b]	7.0	3.4abc	3.5ac
Besiege 1.252CS[b]	10.0	7.0ab	1.8a-d
Diamond 0.43EC[c]	6.0	7.4ab	4.2a
Diamond 0.43EC[c]	9.0	4.8ab	1.4a-e
Intrepid Edge 3SC[d]	6.0	0.4d	0.7de
Intrepid 2F[e]	6.0	4.0ab	2.3a-d
Steward 1.25EC[f]	6.0	1.0cd	0.4de
Steward 1.25EC[f]	9.0	0.4d	0.0e
Diamond 0.43EC[c] + Intrepid 2F[e]	6.0 + 4.0	2.6bc	1.0b-e
Non-Treated	-	9.4a	3.8ab
P>F		<0.01	0.01

Means within columns followed by a common letter are not significantly different (FPLSD, *P*=0.05).

[a]Active ingredient – Chlorantraniliprole, Class - Diamide.

[b]Active ingredients – Lambda Cyhalothrin plus Chlorantraniliprole, Class – Pyrethroid and Diamide.

[c]Active ingredient – Novaluron, Class - Avermectin.

[d]Active ingredients – Spinetoram plus Methoxyfenozide, Class – Spinosyn and IGR.
[e]Active ingredient – Methoxyfenozide, Class – IGR.
[f]Active ingredient – Indoxacarb, Class – Oxydiazine.
[g]DAE=Days after emergence.

Table 7. Evaluation of selected insecticides against stink bugs, Experiment 1.

	Rate/acre	Total Stink Bugs / 25 Sweeps		
Treatment	(fl oz product)	2 DAT[g]	6 DAT	8 DAT
Acephate 90S[a] + Sniper 2EC[b]	0.56[f] + 5.12	0.0	0.6c	3.0b
Acephate 90S[a]	0.83[f]	0.1	0.7c	1.7b
Sniper 2EC[b]	5.12	0.1	1.6bc	2.8b
Belay 2.13EC[c]	4.0	1.5	3.4b	1.3b
Endigo ZCX 2.7CS[d]	4.0	0.3	1.6bc	2.4b
Sniper 2EC[b] + Wrangler 4F[e]	5.12 + 1.5	0.0	2.0bc	2.4b
Sniper 2EC [b]+ Belay 2.13EC[c]	5.12 + 4.0	0.4	2.1bc	2.3b
Non-Treated	-	1.5	10.5a	7.7a
P>F		0.14	<0.01	0.03

Means within columns followed by a common letter are not significantly different (FPLSD, *P*=0.05).
[a]Active ingredient – Acephate, Class – Organophosphate.
[b]Active ingredient – Bifenthrin, Class – Pyrethroid.
[c]Active ingredient – Clothianidin, Class – Neonicotinoid.
[d]Active ingredients – Lambda Cyhalothrin plus Thiamethoxam, Class – Pyrethroid and Neonicotinoid.
[e]Active ingredients – Imidacloprid, Class – Neonicotinoid.
[f]lb (wt) product per acre.
[g]DAT=Days after treatment.

Table 8. Stink bug species composition at 2 DAT, Experiment 1.

	Rate/acre	Percent of total stink bugs			
Treatment	(fl oz product)	GSB[g]	SGSB[h]	BSB[i]	RBSB[j]
Acephate 90S[a] + Sniper 2EC[b]	0.56[f] + 5.12	0.0	0.0	0.0	0.0
Acephate 90S[a]	0.83[f]	0.0	0.0	100.0	0.0
Sniper 2EC[b]	5.12	50.0	0.0	50.0	0.0
Belay 2.13EC[c]	4.0	16.7	0.0	83.3	0.0
Endigo ZCX 2.7CS[d]	4.0	0.0	0.0	100.0	0.0
Sniper 2EC[b] + Wrangler 4F[e]	5.12 + 1.5	0.0	0.0	0.0	0.0
Sniper 2EC [b]+ Belay 2.13EC[c]	5.12 + 4.0	0.0	0.0	66.7	33.3
Non-Treated	-	7.7	61.5	23.1	7.7

[a]Active ingredient – Acephate, Class – Organophosphate.
[b]Active ingredient – Bifenthrin, Class – Pyrethroid.
[c]Active ingredient – Clothianidin, Class – Neonicotinoid.
[d]Active ingredients – Lambda Cyhalothrin plus Thiamethoxam, Class – Pyrethroid and Neonicotinoid.

[e]Active ingredients – Imidacloprid, Class – Neonicotinoid.
[f]lb (wt) product per acre.
[g]GSB = green stink bug.
[h]SGSB = southern green stink bug.
[i]BSB = brown stink bug.
[j]RBSB = redbanded stink bug.

Table 9. Stink bug species composition at 6 DAT, Experiment 1

Treatment	Rate/acre (fl oz product)	Percent of total stink bugs			
		GSB[g]	SGSB[h]	BSB[i]	RBSB[j]
Acephate 90S[a] + Sniper 2EC[b]	0.56[f] + 5.12	0.0	0.0	0.0	100.0
Acephate 90S[a]	0.83[f]	50.0	0.0	0.0	50.0
Sniper 2EC[b]	5.12	50.0	0.0	12.5	37.5
Belay 2.13EC[c]	4.0	35.7	0.0	25.6	35.7
Endigo ZCX 2.7CS[d]	4.0	0.0	0.0	22.2	77.7
Sniper 2EC[b] + Wrangler 4F[e]	5.12 + 1.5	0.0	0.0	20.0	80.0
Sniper 2EC [b]+ Belay 2.13EC[c]	5.12 + 4.0	33.3	0.0	44.4	22.2
Non-Treated	-	15.2	23.9	47.8	13.0

[a]Active ingredient – Acephate, Class – Organophosphate.
[b]Active ingredient – Bifenthrin, Class – Pyrethroid.
[c]Active ingredient – Clothianidin, Class – Neonicotinoid.
[d]Active ingredients – Lambda Cyhalothrin plus Thiamethoxam, Class – Pyrethroid and Neonicotinoid.
[e]Active ingredients – Imidacloprid, Class – Neonicotinoid.
[f]lb (wt) product per acre.
[g]GSB = green stink bug.
[h]SGSB = southern green stink bug.
[i]BSB = brown stink bug.
[j]RBSB = redbanded stink bug.

Table 10. Stink bug species composition at 8 DAT, Experiment 1.

Treatment	Rate/acre (fl oz product)	Percent of total stink bugs			
		GSB[g]	SGSB[h]	BSB[i]	RBSB[j]
Acephate 90S[a] + Sniper 2EC[b]	0.56[f] + 5.12	0.0	16.7	25.0	58.3
Acephate 90S[a]	0.83[f]	0.0	0.0	0.0	100.0
Sniper 2EC[b]	5.12	16.7	16.7	8.3	58.3
Belay 2.13EC[c]	4.0	0.0	16.7	50.0	33.3
Endigo ZCX 2.7CS[d]	4.0	18.2	0.0	27.3	54.5
Sniper 2EC[b] + Wrangler 4F[e]	5.12 + 1.5	0.0	9.1	18.2	72.7
Sniper 2EC [b]+ Belay 2.13EC[c]	5.12 + 4.0	10.0	0.0	10.0	80.0
Non-Treated	-	18.8	15.6	28.1	37.5

[a]Active ingredient – Acephate, Class – Organophosphate.
[b]Active ingredient – Bifenthrin, Class – Pyrethroid.
[c]Active ingredient – Clothianidin, Class – Neonicotinoid.

[d]Active ingredients – Lambda Cyhalothrin plus Thiamethoxam, Class – Pyrethroid and Neonicotinoid.
[e]Active ingredients – Imidacloprid, Class – Neonicotinoid.
[f]lb (wt) product per acre.
[g]GSB = green stink bug.
[h]SGSB = southern green stink bug.
[i]BSB = brown stink bug.
[j]RBSB = redbanded stink bug.

Table 11. Evaluation of selected insecticides against stink bugs, Experiment 2.

Treatment	Rate/acre (fl oz product)	Total Stink Bugs / 25 Sweeps 2 DAT[b]	6 DAT	8 DAT
Acephate 90S[a] + Sniper 2EC[b]	0.83[g] + 6.4	0.0b	0.2d	0.8d
Acephate 90S[a]	1.11[g]	0.1b	1.9bc	1.1cd
Sniper 2EC[b]	6.4	0.1b	1.8bc	5.1ab
Belay 2.13EC[c]	5.0	0.0b	2.9b	1.6bcd
Endigo ZCX 2.7CS[d]	4.5	0.1b	0.6cd	0.8d
Sniper 2EC[b] + Wrangler 4F[e]	6.4 + 5.0	0.0b	0.6cd	1.2cd
Sniper 2EC [b]+ Belay 2.13EC[c]	6.4 + 1.5	0.0b	2.0bc	4.2abc
Karate Z 2.08CS[f]	1.92	0.0b	3.7b	1.5bcd
Non-Treated	-	3.5a	14.9a	7.4a
P>F		<0.01	<0.01	0.01

Means within columns followed by a common letter are not significantly different (FPLSD, *P*=0.05).
[a]Active ingredient – Acephate, Class – Organophosphate.
[b]Active ingredient – Bifenthrin, Class – Pyrethroid.
[c]Active ingredient – Clothianidin, Class – Neonicotinoid.
[d]Active ingredients – Lambda Cyhalothrin plus Thiamethoxam, Class – Pyrethroid and Neonicotinoid.
[e]Active ingredients – Imidacloprid, Class – Neonicotinoid.
[f]Active ingredients – Lambda Cyhalothrin, Class – Pyrethroid.
[g]lb (wt) product per acre.
[h]DAT=Days after treatment.

Table 12. Stink bug species composition at 2 DAT, Experiment 2.

Treatment	Rate/acre (fl oz product)	Percent of total stink bugs GSB[h]	SGSB[i]	BSB[j]	RBSB[k]
Acephate 90S[a] + Sniper 2EC[b]	0.83[g] + 5.12	0.0	0.0	0.0	0.0
Acephate 90S[a]	1.11[g]	0.0	0.0	100.0	0.0
Sniper 2EC[b]	6.4	0.0	0.0	100.0	0.0
Belay 2.13EC[c]	5.0	0.0	0.0	0.0	0.0
Endigo ZCX 2.7CS[d]	4.5	0.0	0.0	100.0	0.0
Sniper 2EC[b] + Wrangler 4F[e]	6.4 + 5.0	0.0	0.0	0.0	0.0
Sniper 2EC [b]+ Belay 2.13EC[c]	6.4 + 1.5	0.0	0.0	0.0	0.0
Karate Z 2.08CS[f]	1.92	0.0	0.0	0.0	0.0
Non-Treated	-	26.7	0.0	53.3	20.0

[a]Active ingredient – Acephate, Class – Organophosphate.
[b]Active ingredient – Bifenthrin, Class – Pyrethroid.
[c]Active ingredient – Clothianidin, Class – Neonicotinoid.
[d]Active ingredients – Lambda Cyhalothrin plus Thiamethoxam, Class – Pyrethroid and Neonicotinoid.
[e]Active ingredients – Imidacloprid, Class – Neonicotinoid.
[f]Active ingredients – Lambda Cyhalothrin, Class – Pyrethroid.
[g]lb (wt) product per acre.
[h]GSB = green stink bug.
[i]SGSB = southern green stink bug.
[j]BSB = brown stink bug.
[k]RBSB = redbanded stink bug.

Table 13. Stink bug species composition at 6 DAT, Experiment 2.

Treatment	Rate/acre (fl oz product)	Percent of total stink bugs GSB[h]	SGSB[i]	BSB[j]	RBSB[k]
Acephate 90S[a] + Sniper 2EC[b]	0.83[g] + 5.12	0.0	0.0	0.0	100.0
Acephate 90S[a]	1.11[g]	50.0	0.0	37.5	12.5
Sniper 2EC[b]	6.4	12.5	12.5	25.0	50.0
Belay 2.13EC[c]	5.0	16.7	8.3	66.7	8.3
Endigo ZCX 2.7CS[d]	4.5	0.0	0.0	33.3	66.7
Sniper 2EC[b] + Wrangler 4F[e]	6.4 + 5.0	0.0	33.3	33.3	33.3
Sniper 2EC [b]+ Belay 2.13EC[c]	6.4 + 1.5	30.0	0.0	20.0	50.0
Karate Z 2.08CS[f]	1.92	21.1	5.3	15.8	57.9
Non-Treated	-	21.2	21.2	28.8	28.8

[a]Active ingredient – Acephate, Class – Organophosphate.
[b]Active ingredient – Bifenthrin, Class – Pyrethroid.
[c]Active ingredient – Clothianidin, Class – Neonicotinoid.
[d]Active ingredients – Lambda Cyhalothrin plus Thiamethoxam, Class – Pyrethroid and Neonicotinoid.
[e]Active ingredients – Imidacloprid, Class – Neonicotinoid.
[f]Active ingredients – Lambda Cyhalothrin, Class – Pyrethroid.
[g]lb (wt) product per acre.

[h]GSB = green stink bug.
[i]SGSB = southern green stink bug.
[j]BSB = brown stink bug.
[k]RBSB = redbanded stink bug.

Table 14. Stink bug species composition at 8 DAT, Experiment 2.

	Rate/acre	Percent of total stink bugs			
Treatment	(fl oz product)	GSB[h]	SGSB[i]	BSB[j]	RBSB[k]
Acephate 90S[a] + Sniper 2EC[b]	0.83[g] + 5.12	0.0	20.0	20.0	60.0
Acephate 90S[a]	1.11[g]	0.0	0.0	80.0	20.0
Sniper 2EC[b]	6.4	34.6	7.7	15.8	42.3
Belay 2.13EC[c]	5.0	8.3	16.8	25.0	50.0
Endigo ZCX 2.7CS[d]	4.5	0.0	0.0	80.0	20.0
Sniper 2EC[b] + Wrangler 4F[e]	6.4 + 5.0	0.0	0.0	40.0	60.0
Sniper 2EC [b]+ Belay 2.13EC[c]	6.4 + 1.5	11.8	17.6	5.9	64.7
Karate Z 2.08CS[f]	1.92	0.0	14.3	28.6	57.1
Non-Treated	-	33.3	9.1	36.4	21.2

[a]Active ingredient – Acephate, Class – Organophosphate.
[b]Active ingredient – Bifenthrin, Class – Pyrethroid.
[c]Active ingredient – Clothianidin, Class – Neonicotinoid.
[d]Active ingredients – Lambda Cyhalothrin plus Thiamethoxam, Class – Pyrethroid and Neonicotinoid.
[e]Active ingredients – Imidacloprid, Class – Neonicotinoid.
[f]Active ingredients – Lambda Cyhalothrin, Class – Pyrethroid.
[g]lb (wt) product per acre.
[h]GSB = green stink bug.
[i]SGSB = southern green stink bug.
[j]BSB = brown stink bug.
[k]RBSB = redbanded stink bug.

Table 15. Evaluation of selected insecticides against stink bugs, Experiment 3.

	Rate/acre	Total Stink Bugs / 25 Sweeps	
Treatment	(fl oz product)	3 DAT[i]	7 DAT
Acephate 90S[a]	0.56[h]	10.2ab	8.0a
Sniper 2EC[b]	5.12	1.9d	3.5b
Belay 2.13EC[c]	4.0	4.0bcd	4.8bc
Endigo ZCX 2.7CS[d]	4.0	3.2cd	4.3bc
Wrangler 4F[e]	1.4	3.6cd	5.8ab
Karate 2.08CS[f]	1.6	6.1abc	2.5c
Leverage 360 3SC[g]	2.85	1.8d	3.0c
Non-Treated	-	12.6a	8.0a
P>F		<0.01	<0.01

Means within columns followed by a common letter are not significantly different (FPLSD, *P*=0.05).

[a]Active ingredient – Acephate, Class – Organophosphate.
[b]Active ingredient – Bifenthrin, Class – Pyrethroid.
[c]Active ingredient – Clothianidin, Class – Neonicotinoid.
[d]Active ingredients – Lambda Cyhalothrin plus Thiamethoxam, Class – Pyrethroid and Neonicotinoid.
[e]Active ingredients – Imidacloprid, Class – Neonicotinoid.
[f]Active ingredients – Lambda Cyhalothrin, Class – Pyrethroid.
[g]Active ingredients – Beta Cyfluthrin plus Imidacloprid, Class – Pyrethroid and Neonicotinoid.
[h]lb (wt) product per acre.
[i]DAT=Days after treatment.

Table 16. Stink bug species composition at 3 DAT, Experiment 3.

	Rate/acre	Percent of total stink bugs			
Treatment	(fl oz product)	GSB[i]	SGSB[j]	BSB[k]	RBSB[l]
Acephate 90S[a]	0.56[h]	6.7	26.7	46.6	0.0
Sniper 2EC[b]	5.12	0.0	0.0	30.0	70.0
Belay 2.13EC[c]	4.0	11.1	22.2	66.7	0.0
Endigo ZCX 2.7CS[d]	4.0	6.7	13.3	66.7	13.3
Wrangler 4F[e]	1.4	6.7	20.0	46.7	26.7
Karate 2.08CS[f]	1.6	3.7	3.7	51.9	40.7
Leverage 360 3SC[g]	2.85	22.2	0.0	66.7	11.1
Non-Treated	-	12.1	39.7	31.0	17.2

[a]Active ingredient – Acephate, Class – Organophosphate.
[b]Active ingredient – Bifenthrin, Class – Pyrethroid.
[c]Active ingredient – Clothianidin, Class – Neonicotinoid.
[d]Active ingredients – Lambda Cyhalothrin plus Thiamethoxam, Class – Pyrethroid and Neonicotinoid.
[e]Active ingredients – Imidacloprid, Class – Neonicotinoid.
[f]Active ingredients – Lambda Cyhalothrin, Class – Pyrethroid.
[g]Active ingredients – Beta Cyfluthrin plus Imidacloprid, Class – Pyrethroid and Neonicotinoid.
[h]lb (wt) product per acre.
[i]GSB = green stink bug.
[j]SGSB = southern green stink bug.
[k]BSB = brown stink bug.
[l]RBSB = redbanded stink bug.

Table 17. Stink bug species composition at 7 DAT, Experiment 3.

Treatment	Rate/acre (fl oz product)	Percent of total stink bugs			
		GSB[i]	SGSB[j]	BSB[k]	RBSB[l]
Acephate 90S[a]	0.56[h]	15.6	18.8	46.9	18.8
Sniper 2EC[b]	5.12	7.1	14.3	42.9	35.7
Belay 2.13EC[c]	4.0	10.5	10.5	63.2	15.8
Endigo ZCX 2.7CS[d]	4.0	0.0	11.8	52.9	35.3
Wrangler 4F[e]	1.4	17.4	13.0	30.4	39.1
Karate 2.08CS[f]	1.6	10.0	0.0	10.0	80.0
Leverage 360 3SC[g]	2.85	8.3	16.7	41.7	33.3
Non-Treated	-	34.4	21.9	15.6	28.1

[a]Active ingredient – Acephate, Class – Organophosphate.
[b]Active ingredient – Bifenthrin, Class – Pyrethroid.
[c]Active ingredient – Clothianidin, Class – Neonicotinoid.
[d]Active ingredients – Lambda Cyhalothrin plus Thiamethoxam, Class – Pyrethroid and Neonicotinoid.
[e]Active ingredients – Imidacloprid, Class – Neonicotinoid.
[f]Active ingredients – Lambda Cyhalothrin, Class – Pyrethroid.
[g]Active ingredients – Beta Cyfluthrin plus Imidacloprid, Class – Pyrethroid and Neonicotinoid.
[h]lb (wt) product per acre.
[i]GSB = green stink bug.
[j]SGSB = southern green stink bug.
[k]BSB = brown stink bug.
[l]RBSB = redbanded stink bug.

Table 18. Evaluation of selected insecticides against stink bugs, Experiment 4.

Treatment	Rate/acre (fl oz product)	Total Stink Bugs / 25 Sweeps 2 DAT[d]	5 DAT	7 DAT	9 DAT	12 DAT
Brigade 2EC[a] + Prevathon 0.43SC[b]	6.4 + 20.0	0.0c	2.0b	1.0b	6.4ab	6.3
Brigade 2EC[a]	6.4	0.3bc	1.2b	0.7b	4.0b	8.3
Besiege 1.252CS[c]	8.0	0.7b	1.4b	1.4b	4.0b	6.3
Non-Treated	-	4.4a	9.0a	5.5a	7.0a	7.8
P>F		<0.01	0.01	<0.01	0.03	0.71

Means within columns followed by a common letter are not significantly different (FPLSD, *P*=0.05).
[a]Active ingredient – Bifenthrin, Class – Pyrethroid.
[b]Active ingredient – Chlorantraniliprole, Class – Diamide.
[c]Active ingredients – Lambda Cyhalothrin plus Chlorantraniliprole, Class – Pyrethroid and Diamide.
[d]DAT=Days after treatment.

Table 19. Stink bug species composition at 2 and 5 DAT, Experiment 4.

Treatment	Rate/acre (fl oz product)	2 DAT Percent of total stink bugs GSB[d]	SGSB[e]	BSB[f]	RBSB[g]	5 DAT Percent of total stink bugs GSB[d]	SGSB[e]	BSB[f]	RBSB[g]
Brigade 2EC[a] + Prevathon 0.43SC[b]	6.4 + 20.0	0.0	0.0	0.0	0.0	20.0	0.0	30.0	50.0
Brigade 2EC[a]	6.4	0.0	0.0	100.0	0.0	33.3	16.7	33.3	16.7
Besiege 1.252CS[c]	8.0	25.0	0.0	0.0	75.0	16.7	16.7	16.7	50.0
Non-Treated	-	22.2	22.2	27.8	27.8	40.0	10.0	30.0	20.0

[a]Active ingredient – Bifenthrin, Class – Pyrethroid.
[b]Active ingredient – Chlorantraniliprole, Class – Diamide.
[c]Active ingredients – Lambda Cyhalothrin plus Chlorantraniliprole, Class – Pyrethroid and Diamide.
[d]GSB = green stink bug.
[e]SGSB = southern green stink bug.
[f]BSB = brown stink bug.
[g]RBSB = redbanded stink bug.

Table 20. Stink bug species composition at 7 and 9 DAT, Experiment 4.

Treatment	Rate/acre (fl oz product)	7 DAT Percent of total stink bugs				9 DAT Percent	
		GSB[d]	SGSB[e]	BSB[f]	RBSB[g]	GSB[d]	SGSB
Brigade 2EC[a] + Prevathon 0.43SC[b]	6.4 + 20.0	40.0	20.0	20.0	20.0	8.0	20.0
Brigade 2EC[a]	6.4	33.3	0.0	33.3	33.3	0.0	25.0
Besiege 1.252CS[c]	8.0	33.3	16.7	33.3	16.7	12.5	0.0
Non-Treated	-	26.1	8.7	39.1	26.1	10.7	35.7

[a]Active ingredient – Bifenthrin, Class – Pyrethroid.
[b]Active ingredient – Chlorantraniliprole, Class – Diamide.
[c]Active ingredients – Lambda Cyhalothrin plus Chlorantraniliprole, Class – Pyrethroid and Diamide.
[d]GSB = green stink bug.
[e]SGSB = southern green stink bug.
[f]BSB = brown stink bug.
[g]RBSB = redbanded stink bug.

Table 21. Stink bug species composition at 12 DAT, Experiment 4.

Treatment	Rate/acre (fl oz product)	12 DAT Percent of total stink bugs			
		GSB[d]	SGSB[e]	BSB[f]	RBSB[g]
Brigade 2EC[a] + Prevathon 0.43SC[b]	6.4 + 20.0	6.5	12.9	32.3	48.4
Brigade 2EC[a]	6.4	2.5	10.0	25.0	62.5
Besiege 1.252CS[c]	8.0	0.0	6.9	27.6	65.5
Non-Treated	-	12.1	18.2	36.4	33.3

[a]Active ingredient – Bifenthrin, Class – Pyrethroid.
[b]Active ingredient – Chlorantraniliprole, Class – Diamide.
[c]Active ingredients – Lambda Cyhalothrin plus Chlorantraniliprole, Class – Pyrethroid and Diamide.
[d]GSB = green stink bug.
[e]SGSB = southern green stink bug.
[f]BSB = brown stink bug.
[g]RBSB = redbanded stink bug.