Insect Management Reports

2011 Season

University of Delaware
Cooperative Extension -- IPM Program

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Root Knot Nematode Management Demonstration in Pickling Cucumbers, 2011

Investigators: R. Mulrooney, Extension Plant Pathologist, University of Delaware
J. Whalen, Extension IPM Specialist, University of Delaware

Objective: To evaluate the effectiveness of Avicta as a seed treatment for the control of southern root-knot nematode (*Meloidogyne incognita*) in processing cucumbers

Procedures: Demonstrations were established on two farms with a history of economically damaging levels of southern root knot nematode (*Meloidogyne incognita*) to evaluate the effectiveness of an Avicta 400 FS seed treatment for root knot nematode management. Seed was commercially treated with Avicta by the Syngenta Seed Care Group in Minnesota with Avicta 400 FS at a rate of 0.6 mg ai/seed, plus the following fungicides Apron XL(7.5 g ai/100 kg seed), Maxim 4FS (2.5 g ai/100 kg seed) and Dynasty 100FS (2.5 g ai/100 kg seed). At the Hurlock, MD location, large treated (2.5 acre) and untreated (2.5 acre) non-replicated blocks were planted. At the Lincoln, DE location, a four acre treated block and a one acre non treated block were planted. Roots were rated twice for galling from root knot nematodes, approximately 3 weeks after planting and within a week of harvest. At Location # 1 , ten 3 ft sections of row were randomly selected in the treated and untreated blocks (approximately a total of 90 plants observed in each treatment), At Location #2, each large treatment block was sampled by randomly sampling four 3 ft. sections of row (approximately 36 plants were observed in each treatment). No yield data was obtained.

Results:

(I) Location # 1 - near Lincoln, DE
Planting Date: May 20, 2011
Variety: 'Expedition'

Treatment	Stand Counts Plants per 3 ft. of row		Plant Height (inches)*		Nematode Damage Rating	
	June 1	June 6	June 15	June 28	June 15**	June 28***
Avicta ST	9.32	9.39	3.15	21.76	3.92	4.35
Untreated	8.50	9.23	2.99	16.10	4.05	4.86

*Plant height was measured from the cotyledonary node to the node of the last fully expanded leaf.

** Modified root damage rating system: 1-5: 1=0 galls present, 2=few galls present, 3= 10% of roots with galls, 4= 25% of the roots with galls, 5= >50% or more of the roots with galls.

*** The Bridge and Page root knot rating chart was used: 0 = no knots on roots; 1 = few small knots, difficult to find; 2= small knots only, but clearly visible and main roots clean; 3= some larger knots visible, main roots clean; 4 = larger knots predominate but main roots clean; 5 = 50% root infested, knotting on parts of the main roots; 6= knotting on main roots; 7= majority of main roots knotted; 8 = all main roots knotted, few clean roots; 9= all roots severely knotted, plant starting to die; 10= all roots severely knotted, no root system, plant usually dead

(II) Location # 2 - near Hurlock, MD
Planting Date: May 26, 2011
Variety: 'Expedition'

Treatment	Stand Count per 3 ft of row	June 17	
	June 6	Plant Height* (inches)	Nematode Damage Rating**
Avicta ST	10.2	4.45	3.68
Main Field (Vydate – foliar treatment 2 weeks after planting)	9.5	4.06	4.34
Untreated	9.7	4.06	1.40

Treatment	July 1	
	Plant Height* (inches)	Nematode Damage Rating***
Avicta ST	29.22	3.09
Avicta ST plus Vydate – foliar treatment late	29.86	3.00

*Plant height was measured from the cotyledonary node to the node of the last fully expanded leaf.
** Modified root damage rating system: 1-5: 1=0 galls present, 2=few galls present, 3= 10% of roots with galls, 4= 25% of the roots with galls, 5= >50% or more of the roots with galls.
*** The Bridge and Page root knot rating chart was used: 0 = no knots on roots; 1 = few small knots, difficult to find; 2= small knots only, but clearly visible and main roots clean; 3= some larger knots visible, main roots clean; 4 = larger knots predominate but main roots clean; 5 = 50% root infested, knotting on parts of the main roots; 6= knotting on main roots; 7= majority of main roots knotted; 8 = all main roots knotted, few clean roots; 9= all roots severely knotted, plant starting to die; 10= all roots severely knotted, no root system, plant usually dead

Comments: Overall, there was no observable difference between the Avicta treatment and the untreated control. In reviewing past data, trials on other crops have demonstrated that an Avicta seed treatment can provide early season suppression of root knot nematode. Seed treatments for root knot nematode management would only be considered as part of a solution for nematode management and would not provide season long control. Since the crop is mature in approximately 6 weeks or less depending on temperatures, root knot damage was not severe on these cucumbers at the first sampling but at the second sampling there were large galls and many of the roots were galled. There was enough galling to see visible reductions in plant growth at both sampling dates. Additional studies with Avicta as a seed treatment for root knot nematode management are needed in the Mid-Atlantic.

Late Planted Field Corn Variety Trial, 2011

University of Delaware
J. Whalen and B. Cissel

Objective: Producers continue to have questions about the effect of fall armyworm feeding in whorl stage corn and ear damage from corn earworm in later plantings of field corn. Foliar insecticides have not provided effective control of these two insects. Research results from trials with newer BT technologies (i.e. Herculex, SmartStax and Viptera) indicate that these technologies can provide control of these two insect problems. This is the second year of a trial established to determine the effectiveness of “newer” Bt technologies in controlling worm pests in “double crop “field corn under Delaware conditions.

Procedures: Seven field corn hybrids were planted on June 22 at the University of Delaware’s Research and Education Center located near Georgetown, DE. Research plots 20 ft wide (8 rows on 30-inch centers) by 30 ft long were replicated four times in a randomized complete block design. Stand counts were taken from the center two rows of each plot (60 linear foot of row) on July 11. Observations on July 11 and 20 indicated that no fall armyworm were present in the trial. Corn earworm damage was evaluated on Aug 30 before physiological maturity. All the ears were collected from a single row (30 linear feet) and evaluated for corn earworm damage. The following data was collected: total number of infested ears (1 or more larvae per ear) and total number of damaged ears (included ears with and without larvae present). Damage was rated as no damage, tip damage (1" or less), and damage >1" below tip. Plots were harvested at physiological maturity on November 2 and yields adjusted to 15.5 % moisture. Data were analyzed using Proc GLM and means were separated by Tukey’s mean separation test (P=0.05).

Results:

Variety	Traits	Intended Use	Stand Count July 11	% Clean Ears Aug 30	% Ears CEW Tip Damage Aug 30	% Ears CEW Damage > 1 cm Aug 30	Yield BU/A Nov 2
DKC55-08	RR-2	Grain	85.25a	2.06c	5.42ab	92.52a	90.47ab
DKC55-09	GENSS SmartStax	Grain	84.25a	61.77b	12.53ab	25.70b	102.82ab
TMF2Q717	SmartStax	Silage	84.50a	73.11ab	19.82a	7.07b	90.59ab
TMF2Q716	Herculex	Silage	82.75a	9.10c	13.47ab	77.43a	87.16b
TMF2Q715	RR2	Silage	88.00a	0.58c	2.40ab	91.25a	85.60b
P1184YHR	YGCB,HX1,LL,RR2	Dual Purpose (grain/silage)	84.75a	16.25c	16.68ab	67.07a	120.15ab
NK N68B-3111 Brand	Viptera	Grain	86.50a	99.39a	0.00b	0.61b	130.94a

Means in the same columns followed by the same letter are not significantly different (Tukey's; P=0.05).

Comments: NK N68B3111 brand and the TMF 2Q717 provided the highest percentage of clean ears. Overall, the NK N68B3111 brand provided the best corn earworm control .

Evaluate Insecticide Applications to Control Dectes Stem Borer in Soybeans

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Objectives:

1. Evaluate foliar insecticides to control the Dectes stem borer

2. Determine the ideal timing for making a foliar application based on adult Dectes adult beetle emergence

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

Background and Review of Activities :

Over the past few years, Dectes stem borer populations have been increasing statewide, causing as much as a 10 -30% yield loss due to lodging. A single foliar insecticide application had not been effective in reducing lodging losses caused by the Dectes stem borer larvae because of such a long (6 week) emergence window for the adults. In 2008, Hero insecticide (FMC Corporation) was labeled on soybeans and it is the only pyrethroid labeled on soybeans that has Dectes stem borer control on the label. It was also indicated that it might have extended residual control.

In 2009, research and demonstration plots were established at the University of Delaware's research farm near Georgetown and on cooperators farms (Milford, Bridgeville, Redden and Middletown) to evaluate Hero. Results indicated that applications did reduce the adult Dectes populations and the percent of infested stems. However, there were no differences between lodging loss and yield in the plots. This could have been related to the timing of the insecticide application and/or the need to make a second application to achieve satisfactory control.

In 2010, replicated research plots were established at the University of Delaware's research farm in Georgetown and on University of Delaware's Demonstration and Research Farm located near Middletown, DE to evaluate insecticide application timing and the need to make a second application to control the Dectes stem

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borer. Implementing the application protocol developed by Kansas States Entomologists and reported in industry literature, three insecticide timing treatments were evaluated. Treatments consisted of (1) an application of Hero @ 10.3 oz/acre one week after the first adult was detected, (2) an application of Hero @ 10.3 oz/acre one week after the first adult was detected and an application of Tombstone Helios @ 2.8 oz/acre one week after the first application, and (3) an untreated check. Results indicate that there were no significant differences in adult beetle sweep net counts, percent infested stems, lodging loss or yield between treatments at either location.

In 2011, as a continuation of this project, demonstration plots were established in three grower fields to evaluate the effectiveness of timely insecticide applications to control the Dectes stem borer in soybeans. Due to drought conditions and Dectes field population levels, only one application was evaluated. Starting the end of June or beginning of July, two fields were sampled on a weekly basis by performing one hundred sweep net counts to monitor adult beetle emergence and to determine field populations. Approximately one week after adult beetle emergence, an insecticide application was made using commercial equipment on each of the grower demonstration plots. Hero EC was applied at a rate of 10.3 fl oz/acre in field #1 and at a rate of 5 oz/A in fields # 2 and 3. Grower Field 1 was split in half in a treated and untreated plot applied on July 19. Grower Field 2 and Grower Field 3 received a whole field insecticide application applied on July 20. Prior to harvest, one hundred stems were collected from each field and split to determine the percent of infested stems and the total number of larvae per one hundred stems. After harvest, fields were evaluated for lodging losses by collecting lodged plants in each of the demonstration plots. None of the demonstration plots experienced significant lodging losses in 2011 due to the ability to harvest on a timely manner.

<u>Results:</u>

Grower Field 1: Adult Sweep Net Counts and Stem Infestation Data

Trt	**# of Adult Dectes per 100 Sweeps**					**% Infested Stems**	**# of Larvae per 100 Stems**
	7/14 Pre-trt	7/21	7/29	8/4	8/16	10/18	
Treated	17	0	0	0	0	5	0
Untreated	14	5	0	0	1	6	2

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Grower Field 2: Adult Sweep Net Counts and Stem Infestation Data

# of Adult Dectes per 100 Sweeps							% of Infested Stems	# of Larvae per 100 Stems
7/1	7/8	7/12	7/22	7/29	8/5	8/17		
0	0	26	0	0	2	3	6	2

Grower Field 3: Stem Infestation Data (no adult counts)

% Infested Stems: 27

 # Larvae per 100 stems: 1

Discussion: The control of Dectes stem borer with insecticide applications continues to be variable. Early harvest continues to be the most viable and available management option. Although two applications appear to be necessary, we have not been able to document that two applications will result in an increase in yields as a result of reductions in lodging losses. It appears that the only true way to manage Dectes will be through host plant resistance. Although one variety has been identified in the national seed bank that exhibits true resistance to the Dectes stem borer, soybean breeders will need to incorporate this trait into commercially acceptable varieties.

Project funded by the Delaware Soybean Board

Management of Southern Root-Knot Nematodes in Lima Beans – 2011

Investigators: R. Mulrooney, Extension Plant Pathologist, University of Delaware
J. Whalen, Extension IPM Specialist, University of Delaware
A. Taylor, Professor, Horticulture, NYSAES,Cornell University

Objectives: (1) To evaluate the effectiveness of Avicta as a seed treatment for the control of southern root-knot nematode (*Meloidogyne incognita*) in processing baby lima beans.
(2) To determine if the Avicta rate used on soybeans will provide effective control of southern root-knot nematodes in a lima bean system.

Procedures: 'C-elite' lima beans were planted on June 15 in a section of a commercial lima bean field (sandy-loam soil) with a history of high root-knot nematodes near Houston, DE . At planting each plot averaged approximately 85 J2 larvae of root-knot/ 250 cc soil. Randomized paired strip plots, four rows wide by 1000 foot long were planted on 30-inch centers and replicated seven times. The lima bean seed was treated with Avicta by Alan Taylor's seed treatment laboratory at Cornell University. Root ratings were taken at monthly intervals from early July through mid-September by examining the roots for damage in 3 ft of row sections (8-12 plants) in 3 random locations per strip for a total of 24-36 plants rated per treatment. The root damage rating system used on July 7 was a modified system: 0 = no galls; 1= <5% of roots with galls; 2 = 5-10% of roots with galls; 3 = 11-20% of roots with galls; 4 = 21-30% of roots with galls and 5 = > 30% of roots with galls. On Aug 4 and Sept 12, the Bridge and Page root knot rating chart was used: 0 = no knots on roots; 1 = few small knots, difficult to find; 2= small knots only, but clearly visible and main roots clean; 3= some larger knots visible, main roots clean; 4 = larger knots predominate but main roots clean; 5 = 50% root infested, knotting on parts of the main roots; 6= knotting on main roots; 7= majority of main roots knotted; 8 = all main roots knotted, few clean roots; 9= all roots severely knotted, plant starting to die; 10= all roots severely knotted, no root system, plant usually dead.

Results:

Due to the severe nematode damage to the roots, very few plants in the treated or untreated plots had pods with harvestable seed so no yield data was collected. Data was analyzed using an unpaired t-test (P=0.05).

Treatment	Rate	Average Root Damage Rating		
		July 7	Aug 4	Sept 12
Avicta ST	0.15 mg ai per seed	0.91	5.54	8.61
Untreated	----	1.13	6.68	8.92
P-value		0.49	0.24	0.22
Significance		NS	NS	NS

Comments: In reviewing past data, trials on other crops have demonstrated that an Avicta seed treatment can provide early season suppression of root knot nematode. Seed treatments for root knot nematode management would only be considered as part of a solution for nematode management and would not provide season long control. At the rate evaluated, the Avicta seed treatment did not provide control of the root knot population levels present in this field. Additional work is needed to determine if increased rates of seed-applied Avicta can control root-knot nematode on baby lima bean.

***Late Season Evaluation of Foliar Insecticides for Control of Lepidopterans on Sweet Corn, 2011*:** 'Xtra Tender 372A' sweet corn was planted on July 1 at the University of Delaware Research and Education Center located near Georgetown, Delaware. Plots were 25 ft long and two rows wide, planted on 30 inch centers. Each treatment was replicated 4 times and arranged in a RCB design. Silk sprays began at ear shank emergence. All applications were made using a CO^2 pressurized back pack sprayer and a two nozzle boom equipped with D2 hollow cone nozzles delivering 66 gpa at 40 psi. At harvest (Aug 29), all the ears from each plot were husked and evaluated for damage as percent clean ears (fresh market) and percent clean plus tip damaged ears (less than 1.0 inches from the tip- processing ears). The total number of live larvae of each species were identified and counted. Data were analyzed using Proc GLM and means were separated by Tukey's mean separation test (P=0.05).

Corn earworm was high. Fall armyworm pressure was low-moderate.

Trt #	Treatment - Rate/A	Application Date
1	A,C,E - Voliam Xpress - 9.0 oz B,D,F – Warrior II - 1.92 oz	A - 8/8, C– 8/15, E—8/22 B – 8/11, D – 8/18, F – 8/25
2	A,B,C - Voliam Xpress - 9.0 oz D,E, F – Warrior II - 1.92 oz	A - 8/8, B – 8/11, C- 8/15 D – 8/18, E– 8/22, F – 8/25
3	A,C,E – Coragen 1.67 SC - 5 oz B,D,F – Lannate LV – 24.0 oz + Asana XL – 9.6 oz	A - 8/8, C– 8/15, E—8/22 B – 8/11, D – 8/18, F – 8/25
4	A,B,C - Coragen 1.67 SC - 5 oz D,E,F - Lannate LV – 24.0 oz + Asana XL – 9.6 oz	A - 8/8, B – 8/11, C- 8/15 D – 8/18, E– 8/22, F – 8/25
5	A,C,E-Belt 480 SC - 3 oz + Li-700 0.25% v/v B,D,F- Baythroid XL - 2.8 oz	A - 8/8, C– 8/15, E—8/22 B – 8/11, D – 8/18, F – 8/25
6	A,B,D,E -Belt 480 SC -3.0 oz + Li-700 0.25% v/v + Baythroid XL - 2.8 oz C,F-Lannate LV - 24.0 oz + Baythroid XL - 2.8 oz	A - 8/8, B – 8/11, D – 8/18, E– 8/22 C- 8/15, F – 8/25
7	Lannate LV - 24.0 oz + Warrior II - 1.92 oz	A - 8/8, B – 8/11, C- 8/15 D – 8/18, E– 8/22, F – 8/25
8	Radiant - 6 oz	A - 8/8, B – 8/11, C- 8/15 D – 8/18, E– 8/22, F – 8/25
9	Warrior II - 1.92 oz	A - 8/8, B – 8/11, C- 8/15 D – 8/18, E– 8/22, F – 8/25
10	Untreated	-------

Trt #	% Clean Ears (Fresh Market)	% Clean + Tip Damaged Ears (Processing)	Percent Damaged Ears	
			CEW	FAW
1	75.63ab	88.75ab	20.00d	1.88a

2	77.50a	91.25a	19.38d	1.25a
3	60.63bc	76.25bcd	39.38c	0.00a
4	59.38c	68.75cd	40.00c	0.00a
5	58.13c	75.63bcd	39.38c	1.25a
6	72.50abc	87.50ab	24.38cd	3.13a
7	65.63abc	80.63abc	30.63cd	0.63a
8	21.25d	31.88e	76.88b	0.00a
9	35.00d	63.13d	59.38b	4.38a
10	1.25e	1.25f	98.75a	5.63a

Means in the same columns followed by the same letter are not significantly different (Tukey's; P=0.05).

Mid- Season Evaluation of Foliar Insecticides for Control of Lepidopterans on Sweet Corn, 2011**:** 'Xtra Tender 372A' sweet corn was planted on June15 at the University of Delaware Research and Education Center located near Georgetown, Delaware. Plots were 25 ft long and two rows wide, planted on 30 inch centers. Each treatment was replicated 4 times and arranged in a RCB design. Silk sprays began at ear shank emergence. All applications were made using a CO2 pressurized back pack sprayer and a two nozzle boom equipped with D2 hollow cone nozzles delivering 66 gpa at 40 psi. At harvest (Aug 12), all the ears from each plot were husked and evaluated for damage as percent clean ears (fresh market) and percent clean plus tip damaged ears (less than 1.0 inches from the tip- processing ears). The total number of live larvae of each species were identified and counted. Data were analyzed using Proc GLM and means were separated by Tukey's mean separation test (P=0.05).

Corn earworm and sap beetle pressure was high. .

Trt #	Treatment - Rate/A	Application Date
1	A,C,E - Voliam Xpress - 9 oz B,D,F – Warrior II - 1.92 oz	A - 7/22, C– 7/29, E—8/5 B – 7/26, D – 8/2, F – 8/9
2	A,B,C - Voliam Xpress - 9 oz D,E, F – Warrior II - 1.92 oz	A - 7/22, B – 7/26, C– 7/29 D – 8/2, E– 8/5, F – 8/9
3	A,C,E – Coragen 1.67 SC - 5 oz B,D,F – Lannate LV – 24 oz + Asana XL – 9.6 oz	A - 7/22, C– 7/29, E—8/5 B – 7/26, D – 8/2, F – 8/9
4	A,B,C - Coragen 1.67 SC - 5 oz D,E,F - Lannate LV – 24 oz + Asana XL – 9.6 oz	A - 7/22, B – 7/26, C– 7/29 D – 8/2, E– 8/5, F – 8/9
5	A,C,E-Belt 480 SC - 3 oz + Li-700 0.25% B,D,F-Baythroid XL- 2.8 oz	A - 7/22, C– 7/29, E—8/5 B – 7/26, D – 8/2, F – 8/9
6	A,B,D,E -Belt 480 SC + NIS + Baythroid XL C,F-Lannate LV - 24 oz/A + Baythroid XL -2.8 oz	A - 7/22, B – 7/26, D – 8/2, E– 8/5 C– 7/29, F – 8/9
7	Larvin 3.2F - 30 oz	A - 7/22, B – 7/26, C– 7/29 D – 8/2, E– 8/5, F – 8/9
8	Radiant - 6 oz	A - 7/22, B – 7/26, C– 7/29 D – 8/2, E– 8/5, F – 8/9
9	A,C,E -Gemstar - 5 oz + Li-700 0.25% v/v B,D,F Radiant - 6 oz	A - 7/22, C– 7/29, E—8/5 B – 7/26, D – 8/2, F – 8/9
10	Untreated	-------

Trt #	% Clean Ears (Fresh Market)	% Clean + Tip Damaged Ears (Processing)	Percent Damaged Ears	
			CEW	Sap Beetles

1	70.97a	96.64a	6.06d	23.46c
2	53.04ab	93.87a	7.43d	39.10bc
3	33.72bc	83.05abcd	20.84cd	51.49bc
4	22.88cd	78.44bcd	15.60cd	60.22b
5	32.75bc	71.50de	21.70cd	38.46bc
6	57.58a	88.87abc	8.14d	33.82bc
7	25.56c	59.38e	46.88b	28.67c
8	33.14bc	74.23cde	20.16cd	46.24bc
9	21.14cd	59.75e	35.14bc	42.39bc
10	0.45d	1.27f	98.32a	98.32a

Means in the same columns followed by the same letter are not significantly different (Tukey's; P=0.05).

Evaluating the Effectiveness of Vertical Tillage in Managing Slug Populations in No-till Corn Systems—First Year, 2011

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This study was conducted to identify and document the conditions associated with vertical tillage that help reduce slug populations and/or the damage caused by slugs in no-till corn systems. In addition, we wanted to document the impact of vertical tillage on overall soil health and identify potential water quality benefits of using vertical tillage in no-till corn systems. This is a start toward developing a process to document the impact of vertical tillage.

Management of slugs in no-till corn systems continues to present major challenges to producers and threatens the viability of no-till production systems. Since no-till has been identified as important for maintaining the quality of the watersheds in the region, the identification of strategies that maintain a viable agriculture as well as healthy environment are needed. Vertical tillage was identified by producers and NRCS at the local level as one way to potentially address both of these needs. This demonstration has begun the collection of information to document the effectiveness of vertical tillage as a slug management tool and assess its impact on soil health.

***Summary of Procedures*:**

Demonstration plots were established by three growers in a total of four fields comparing no-till and vertical till. Each of the demonstration plots were arranged in paired plots of vertical-tilled and no-tilled strips. Six paired strips were established at location one and three paired strips at locations 2, 3 and 4. An AerWay strip was also established at location 2. Prior to performing the tillage treatments, each demonstration plot was sampled using shingle traps to establish a baseline for slug densities. Once the tillage treatments were established, treatment effects on soil health were observed including soil compaction, percent cover, bulk density and infiltration rate. Immediately after planting, shingle traps were placed in each of the demonstration plots to monitor slug densities. Once the plants emerged, stand counts were taken and the plants were evaluated for slug feeding damage. Harvest data was collected in two of the four locations.

Pre-Tillage Slug Densities

In mid-March, five shingle traps of 1ft^2 size were randomly placed in each field to establish a baseline for slug population densities. The traps were checked on a weekly basis for adult and juvenile slugs until mid-April. The total number of eggs observed under the shingle traps was also recorded (Table 1).

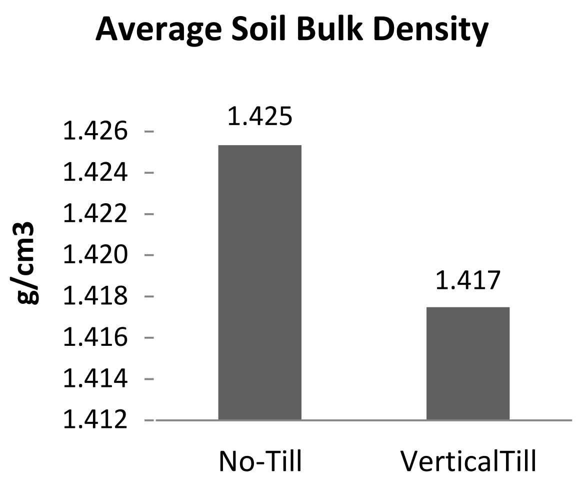
Shingle Trap Survey Results

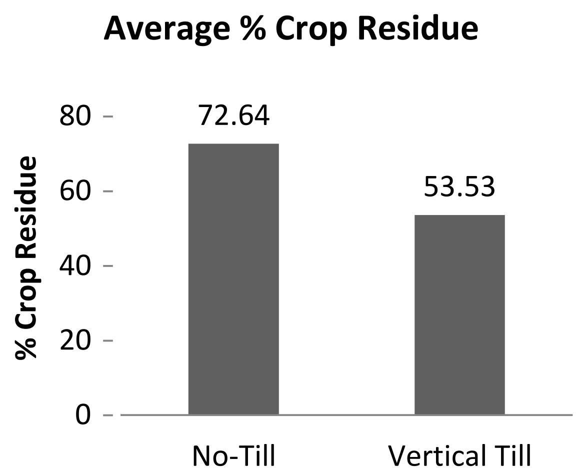
Table 1. Total number of slugs/eggs per 5 shingle traps.

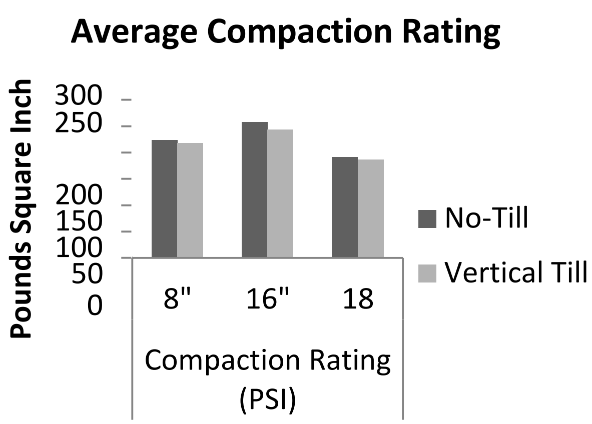
Sample Date	Marsh		Grey Garden		
	Adult	Juvenile	Adult	Juvenile	Eggs
Location 1					
21-Mar	0	0	1	0	3
29-Mar	1	0	2	0	3
4-Apr	1	0	2	0	3
11-Apr	0	0	2	0	0
20-Apr	0	0	0	0	14
Location 2					
21-Mar	1	0	3	0	6
29-Mar	0	0	2	0	2
4-Apr	2	0	0	0	5
Location 3					
21-Mar	0	1	0	0	12
29-Mar	2	0	2	0	2
4-Apr	1	0	2	0	28
11-Apr	0	0	7	7	11
20-Apr	0	2	0	6	7
Location 4					
21-Mar	0	0	0	0	0
29-Mar	1	0	0	0	5
4-Apr	1	0	2	0	11
11-Apr	0	0	0	7	11
20-Apr	0	2	0	6	7

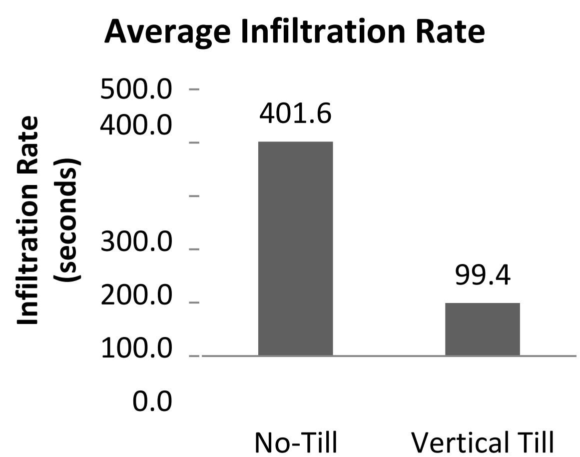
Pre-Planting Soil Health Measurements

Soil compaction was measured using a penetrometer. Readings were taken in three random locations in each paired strip. Readings were recorded at 6”, 12” and 18” in pounds per square inch (psi). The percent of crop residue was estimated in three random locations in each paired strip using the line transect methods. Water infiltration rates were estimated in two random locations in each strip by removing vegetation and crop residue from the soil surface and driving a cylinder 6” in diameter into the soil approximately 4” deep. The soil surface within the cylinder was gently firmed and 1000 ml of distilled water was poured into the ring. The amount of time required for the water to infiltrate into the soil was recorded in seconds. Soil bulk density was also measured in each of the demonstration plots using the cylindrical core method and reported as grams/centimeter^3.









Discussion of Soil Health Measurements

The average compaction rating represented in pounds square inch (psi) at each of the three depths, 6”, 12”, and 18” indicates that the no-tilled plots were slightly more compacted compared to the vertical tilled plots. However, subsoil compaction was found to be severe in each of the demonstration plots regardless of the tillage treatment.

Vertical tillage reduced the percent of crop residue on average by 19 percent. However, the range of reduction was from six percent to twenty nine percent and the average cover even on the vertical tillage plots was greater than 50 percent.

Vertical tillage also had a significant impact on infiltration rates compared to no-tilling. The average rate of infiltration for the no-till demonstration plots was 402 seconds and the average rate of infiltration for the turbo-tilled plots was 99 seconds. Bulk density is a factor of the mineral composition of the soil and the degree of compaction. A compacted soil has fewer pores and therefore, a higher bulk density. On average, the vertical tilled plots had a slightly lower bulk density at 1.417g/cm^3 compared to the no-tilled plots at 1.425 g/cm^3.

The agronomic and soil health benefits observed in the vertical till treatments compared to the no-till treatments including an increase in water infiltration rate and a slight reduction in bulk density are based on one year's worth of data. These practices need to be evaluated over multiple years and multiple locations to determine the long term effects of these treatments on soil health and to identify any draw backs that may develop from continued use of vertical tillage.

Table 2. Comparison of slug numbers per shingle, injury ratings, and percent damaged plants for multiple sampling dates at four locations in Delaware in 2011.

Sample Date	Tillage	Stand 1/1000/Acre	Injury Rating	% Damaged Plants	#Slugs/Shingle
Location 1					
May 6	NT	28.33	--	0.93	0.23
	VT	28.00	--	0.80	0.03
May 16	NT	--	0.70	1.57	0.20
	VT	--	0.57	1.77	0.03
May 24	NT	--	0.33	0.70	1.80
	VT	--	0.27	0.60	1.23
Location 2					
May 18	NT	25.53	0.53	1.07	0.89
	VT	25.00	0.33	0.47	0.89
	Aerway	24.8	0.8	0.8	--
June 3	NT	--	0.77	1.8	0.56
	VT	--	0.3	0.53	0
	Aerway	--	0.40	0.60	--
Location 3					
May 9	NT	26.20	1.50	6.73	1.78
	VT	24.65	1.43	4.47	0.22
May 16	NT	27.53	1.33	4.07	1.22
	VT	28.27	0.67	1.73	0.22
May 24	NT	--	0.73	3.40	0.00
	VT	--	1.10	4.67	0.00
June 3	NT	--	0.07	0.07	0.00
	VT	--	0.07	0.27	0.00
Location 4					
May 9	NT	--	--	--	1.33
	VT	--	--	--	0.44
May 16	NT	26.53	1.93	7.60	0.78
	VT	26.93	1.67	6.33	0.00
May 24	NT	--	1.54	7.17	0.39
	VT	--	1.37	6.07	0.22
June 3	NT	--	0.67	2.42	0.39
	VT	--	0.47	1.13	0.00

Post-Planting Data

Once the demonstration plots had been planted, three shingle traps were placed in each paired strip to determine slug population densities and tillage treatment effects (Table 2). Stand counts were taken by counting the total number of corn plants in 17’5” of linear row in five random locations per plot. The percent of damage plants was determined by counting the number of plants out of ten consecutive plants exhibiting leaf feeding damage in five random locations per plot. A corn plant injury rating was assigned for each plant based on a scale from 0-4 and averaged for each location. *Corn Plant Injury Rating Scale*: 0 = no damage, 1 = only 1 leaf showing damage (less than 25% defoliation), 2 = all leaves showing moderate damage (25-30% defoliation), 3 = all leaves consumed except one remaining intact (greater than 75% defoliation), 4 = seedling completely cut off at the ground level.

Discussion of Post Planting Data

The tillage treatments did not appear to have any significant affect on stand counts in any of the demonstration plots (Table 2). There does appear to be a trend suggesting that there is a slight increase in the percentage of damaged plants and the severity of damage in the no-tilled plots compared to the vertical tilled plots. A slight increase in the number of slugs per shingle trap in the no-tilled plots compared to the vertical tilled plots was also noted. This suggests that vertical tillage may be an effective cultural control strategy when managing slugs in corn. More information is needed to document when benefits are likely to occur.

The agronomic and soil health benefits seen in the vertical till treatments compared to the no-tilling treatments including an increase in water infiltration rate and a slight reduction in bulk density are based only on one year’s worth of data. These practices need to be evaluated over multiple years to determine the long term effects of these treatments on soil health and to identify any draw backs that may develop from continued use such as a compaction layer just beneath the soil surface.

Beneficial Insect Sampling

Beneficial arthropods can play an important role in preventing crop pest populations from reaching levels high enough to cause significant economic damage. However, little is known about the beneficial arthropod complex found within crop fields that prey on slugs. In an attempt to identifying the abundance of these beneficial arthropods within crop fields and to determine the effects minimum tillage practices may have on them, a pitfall trapping survey was conducted in locations 2, 3, and 4.

Of the demonstration plots surveyed, three trapping locations were established in each treatment. Traps were constructed of 18 oz plastic beverage cups buried within the soil profile so that the lip of the cup was even with the soil surface. A roof, approximately 1 ft^2, was placed over the traps at an elevation of 1-2 inches above the soil surface to prevent contamination from rain water. Pitfall traps were placed in the survey fields in mid-April and checked weekly until early-June. The arthropods collected were then combined for each treatment, identified, and tallied for each sampling date (Table 3).

Table 3. The average number of arthropods per tillage treatment.				
Date	**Tillage ID**	**Aranae**	**Carabidae**	**Opilione**
Location 2				
24-May	NT	5.00	1.67	3.00
	VT	1.67	2.67	3.67
3-Jun	NT	9.67	10.33	4.00
	VT	7.33	5.00	3.33
Location 3				
3-June	NT	5.67	22.00	0.00
	VT	4.67	25.33	0.00
Location 4				
3-June	NT	3.67	2.00	0.00
	VT	12.33	3.00	0.00

Based on the limited number of sample dates, it does not appear that the tillage treatments had any significant effect on the beneficial arthropod populations in any of the demonstration plots (Table 3). Additional research, including a more extensive sampling period is needed to determine the potential long term effects of tillage on beneficial arthropods.

Table 4. Yield data for no-till and vertical till treatments at two locations averaged over treatment strips.		
Location #	**No-Till**	**Vertical Till**
1	102.77	104.05
3	97.13	94.32

Yield data were very limited and were not analyzed statistically (Table 4). Observed differences were very minor.

Current plans call for fewer locations in 2012 but with more intensive soil health evaluations.

2011 Western Bean Cutworm Trap Summary New Castle and Northern Kent Counties					
	Newark Farm	*Middletown-*	*Townsend*	*Smyrna*	*St. George's*
15-Jun	0	0	0	0	0
22-Jun	0	0	0	0	0
28-Jun	0	*	0	0	0
6-Jul	0	0	0	0	0
12-Jul	0	0	0	0	0
19-Jul	0	0	0	0	0
26-Jul	0	0	0	0	0
3-Aug	0	*	0	0	0
9-Aug	0	0	0	0	0
17-Aug	0	0	0	0	0
24-Aug	0	0	0	0	0

* Suspect Specimens – sent to USDA for identification

2011 Western Bean Cutworm Trap Summary Southern Kent and Sussex Counties					
	Harrington	*Greenwood*	*Laurel*	*Georgetown*	*Frankford*
14-Jun	0	0	0	0	0
18-July	0	0	0	0	0
28-Jun	0	0	0	0	0
28-July	0	0	0	0	0

Brown Marmorated Stink Bug Management in Bell Peppers, 2011 : ‘ Paladin ‘ bell peppers were transplanted on June 2 at the University of Delaware’s Research farm located in Newark, DE. One row plots 20 ft long on 6 foot center were replicated 4 times in a RCB design. All foliar materials were applied with a CO_2 backpack sprayer with a one-row boom, having 3 hollow cone nozzles per row (one over the top and one drop nozzle on each side) delivering 55 gpa at 35psi on July 8, 15, 27; Aug 4 and 17. Plots were sampled on a weekly basis from June 5 through Sept 14 by counting the number of adults and nymphs on 5 plants per plot using direct visual and beat counts. All commercial size peppers were harvested on July 18; and Aug 1, 8, 15 and 22 and evaluated for the percent BMSB damaged fruit. Data were analyzed using Proc GLM and means were separated by Tukey’s mean separation test (P=0.05).

Table 1. Adult BMSB Counts

Treatment	Rate/Acre	Number BMSB Adults /5 plants (direct counts)				
		July 18	July 25	August 1	August 8	August 15
Baythroid XL	2.8 oz	0.25a	0.00a	0.75a	0.00a	0.00a
Leverage 360	4.1 oz	1.25a	0.00a	0.25a	0.25a	1.25a
Lannate LV	1.0pt	0.25a	0.00a	0.00a	0.50a	0.50a
Lannate LV	1.5 pt	0.50a	0.00a	0.25a	0.50a	0.25a
Belay 2.13SC	4 oz	0.50a	0.00a	1.00a	0.50a	0.50a
Endigo ZC	4.5 oz	0.50a	0.00a	0.00a	0.00a	1.00a
Sniper 2EC	4 oz	0.00a	0.00a	0.00a	0.25a	0.25a
Venom 70 SG	2 oz	0.25a	0.00a	1.00a	0.50a	0.75a
Warrior II	1.92 oz	0.00a	0.25a	1.00a	0.25a	0.75a
Untreated	---	0.00a	0.00a	1.25a	0.75a	0.50a

[1] Means within a column followed by the same letter are not significantly different (Tukey’s, P=0.05).

Table 2. Nymphal BMSB Counts

Treatment	Rate/Acre	Number BMSB Nymphs /5 plants (direct count)				
		Aug 8	Aug 15	Sept 1	Sept 8	Sept 14
Baythroid XL	2.8 oz	0.00a	0.00a	0.25a	0.00a	0.50a
Leverage 360	4.1 oz	0.00a	0.00a	5.00a	2.00a	0.50a
Lannate LV	1.0pt	0.00a	0.00a	1.00a	0.00a	0.00a
Lannate LV	1.5 pt	0.00a	0.00a	0.00a	0.50a	0.00a
Belay 2.13SC	4 oz	0.00a	0.00a	0.25a	0.75a	1.00a
Endigo ZC	4.5 oz	0.00a	0.00a	0.00a	0.00a	0.50a
Sniper 2EC	4 oz	0.25a	0.50a	0.75a	0.50a	1.00a
Venom 70 SG	2 oz	0.00a	0.00a	1.25a	0.25a	0.25a
Warrior II	1.92 oz	0.00a	0.00a	5.75a	0.75a	0.50a
Untreated	---	0.00a	0.00a	1.00a	0.25a	0.25a

[1] Means within a column followed by the same letter are not significantly different (Tukey's, P=0.05).

Table 3. Harvest Data

Treatment	Rate/Acre	Percent BMSB Damaged Fruit				
		July 18	August 1	August 8	August 15	August 22
Baythroid XL	2.8 oz	2.27a	0.62b	2.39a	0.48a	3.67b
Leverage 360	4.1 oz	3.75a	0.68ab	1.49a	4.17a	3.35b
Lannate LV	1.0pt	0.00a	1.42ab	0.73a	4.56a	1.64b
Lannate LV	1.5 pt	1.39a	1.22ab	0.45a	4.03a	2.09b
Belay 2.13SC	4 oz	2.75a	1.58ab	0.83a	0.78a	0.51b
Endigo ZC	4.5 oz	2.14a	1.99ab	3.06a	0.74a	0.43b
Sniper 2EC	4 oz	0.00a	1.90ab	2.48a	2.25a	5.42ab
Venom 70 SG	2 oz	0.00a	1.13ab	1.79a	1.39a	1.29b
Warrior II	1.92 oz	2.52a	2.02ab	1.86a	2.62a	1.36b
Untreated	---	0.00a	5.17a	4.37a	7.16a	9.98a

[1] Means within a column followed by the same letter are not significantly different (Tukey's, P=0.05).

Final 2011 Delaware Soybean Board Report

Title: Evaluation of Perimeter Treatments as a Control Strategy to Manage the Stink Bug Complex and Evaluation of Insecticides to Control the Brown Marmorated Stink Bug

Personnel: Bill Cissel, Extension IPM Associate, Joanne Whalen, Extension IPM Specialist,

Objectives:

(1) Evaluate the effectiveness of perimeter treatments to control stink bugs in soybeans.

(2) Determine yield loss, seed quality, and the possibility of delayed plant growth, "stay green effect", caused by stink bug feeding.

(3) Evaluate the effectiveness of insecticides to control the brown marmorated stink bug on soybeans.

Methods:

(1) Evaluate the effectiveness of perimeter treatments to control stink bugs in soybeans.

Stink bug populations were monitored in fifty-two soybean fields throughout the state by taking one hundred weekly sweep net samples from late June to early September. The intent of the survey was to (1) identify fields to evaluate perimeter treatments, (2) determine the distribution of stink bugs within soybean fields including the brown (BSB), green (GSB), and brown marmorated stink bug (BMSB), and (3) to determine how widely distributed the BMSB is across the state.

Three fields were selected for evaluating the effectiveness of perimeter treatments, two fields located in New Castle County and one field located in Sussex County. The BMSB was the predominant stink bug species in both of the New Castle County fields, and BSB and GSB were the only stink bug species found in the Sussex County field. In the New Castle County fields, pre and post treatment sampling consisted of performing 100 sweeps in the field perimeters (0-100 ft) and in the field interiors (>100 ft). Once stink bug populations had reached a threshold of five stink bugs per twenty-five sweeps on the field perimeters, perimeter treatments were applied using commercial application equipment. Both of the New Castle County locations received a pyrethroid application around the entire perimeter of the field. In the Sussex County location, the perimeter treatment was arranged in paired treated and untreated plots along a wooded field edge in 90 ft wide x 200 ft long swaths. For the perimeter treatment, twenty sweeps per paired treatment were taken post-treatment at 0, 20, 45 and 90 ft from the field perimeter. The interior of the field was sampled by taking 10 sweep samples in 10 locations randomly throughout the field interior.

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Prior to harvest, subsamples were collected from the field perimeters and the field interiors to determine pod feeding damage and to evaluate seed quality. The fields were also monitored for symptoms of delayed plant growth or “stay green effect”. A final evaluation was also performed to determine the stink bug infestation levels by examining three linear foot of row in five locations on the field perimeter and field interior.

(2) Determine yield loss, seed quality, and the possibility of delayed plant growth, “stay green effect”, caused by stink bug feeding.

Prior to harvest, a sub-sample of nineteen fields (out of the 52 total fields sampled) were selected based on the level of stink bug infestation during pod formation and grain fill stages to be monitored for symptoms of delayed plant growth, evidence of pod feeding, and for reductions in seed quality. A final determination of stink bug populations in each field were also determined by randomly counting the number of stink bugs within three linear foot of row in five locations in the field perimeter and field interior that exhibited delayed plant growth. Five locations within the field interior that did not appear to exhibit delayed plant growth were also examined for comparison. Plant subsamples were taken from each of the fields to examine pods and seed for stink bug feeding damage and to evaluate reductions in seed quality.

(3) Evaluate the effectiveness of insecticides to control the brown marmorated stink bug on soybeans.

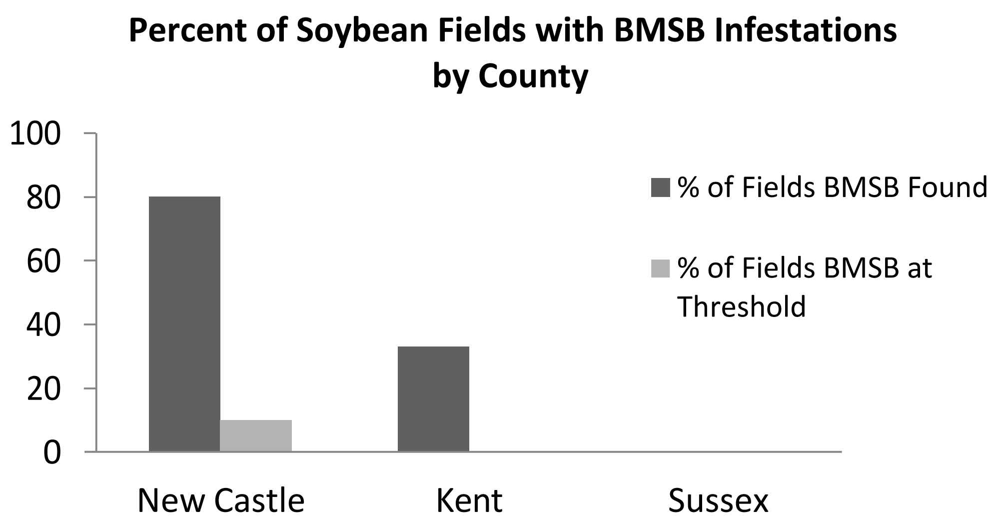
Replicated research plots were established at two locations: University of Delaware’s Research Farm in Newark, DE planted on June 17 and at University of Delaware’s Demonstration Farm located near Middletown, DE planted on June 2. In Newark, plots were 10 ft wide (4 rows planted on 30 inches) and 25 ft long, arranged in a randomized complete block design with four replications. In Middletown, plots were 6.25 ft wide (5 rows planted on 15 inches) and 18 ft long arranged in a randomized complete block design with six replications. BMSB populations were monitored on a weekly basis from late June to the end of September using a sweep net and counting the total number of BMSB adults and nymphs found in ten sweep net samples/plot. Ten leaves per plot were also examined and the total number of egg masses was recorded. Since BMSB populations in the Newark plot were extremely low, no insecticide treatments were applied.

At the Middletown location, treatments were applied on August 16th using a CO^2 pressurized back pack sprayer equipped with a five nozzle broadcast boom delivering 17.8 gallons per acre. All plots were monitored on a weekly basis following treatment to determine the effectiveness of each treatment. Treatments consisted of (1) Baythroid XL, (2) Leverage 360, (3) Lannate LV, (4) Warrior II, (5) Endigo ZC, (6) Cobalt Advanced, (7) Acephate 97 UP, and (8) an untreated check. Yield data was collected on November 3 and subsamples were taken from each plot to evaluate seed quality.

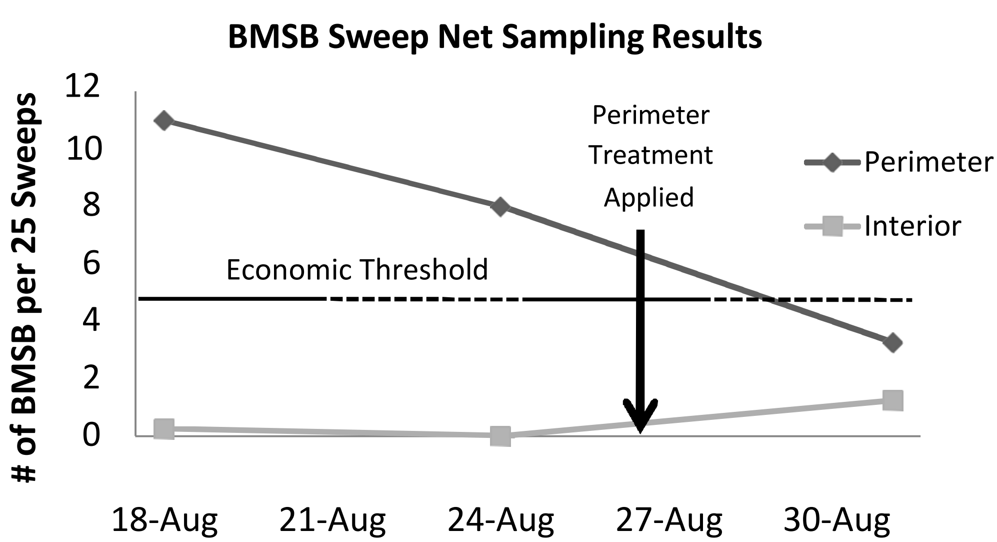
Results:

(1) Evaluation of Perimeter Treatments

(A) Survey Result for BMSB Distribution in Delaware Soybean Fields



(B) Grower 1: Survey Results for BMSB Distribution within Soybean Fields



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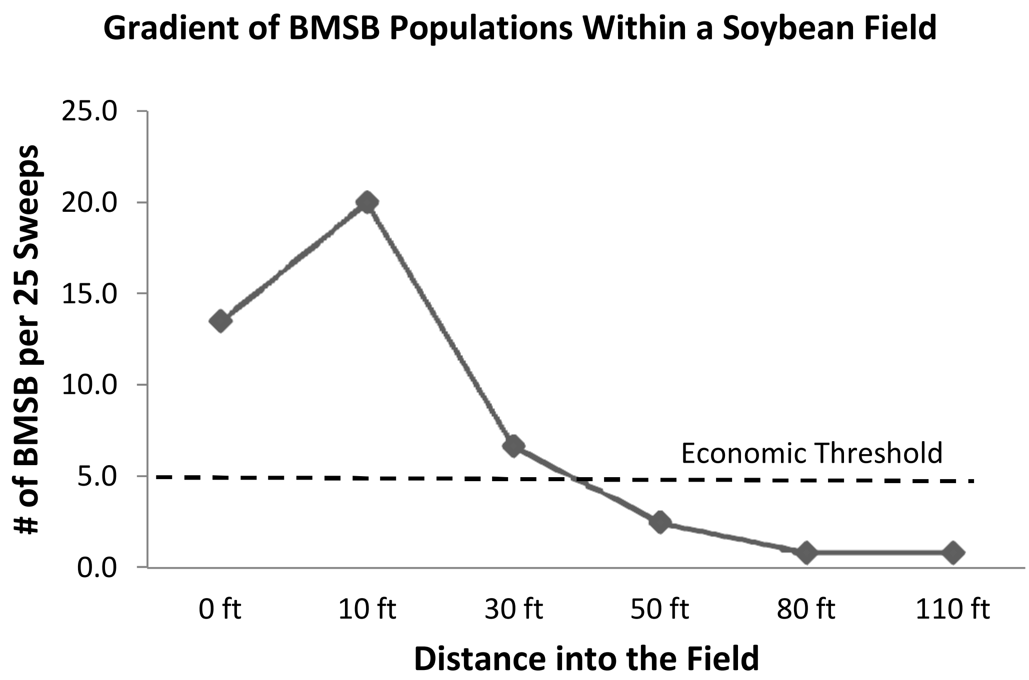
(C) Grower 2: Survey Results for BMSB Distribution within Soybean Fields



(D) Grower 1 & Grower 2: Pod Evaluation

Sampled 9/27	Perimeter (0-100 Ft)			Interiror (>100 Ft)		
	Avg # of Pods/Plant	% Flat Pods	% Pods with Aborted Seed	Avg # of Pods/Plant	% Flat Pods	% Pods with Aborted Seed
Grower 1	24	9.8	16.0	38.5	3.5	13.3
Grower 2	34	22.3	20.3	35.9	7.4	15.8

(E) Grower 1: Seed Quality Evaluation

Field Position	BMSB/25 sweeps 8/18	BMSB/25 Sweeps 8/24	Seed Quality Evaluation			
			% Clean	%Purple Stain	% Moldy	% Shriveled
Edge	15.5	26.5	2.02	0.00	92.22	5.76
Interior	2	6.5	98.48	0.23	1.23	0.06

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(F) Grower 2: Seed Quality Evaluation

Field Position	BMSB/25 sweeps 8/18	BMSB/25 Sweeps 8/24	Seed Quality Evaluation			
			% Clean	%Purple Stain	% Moldy	% Shriveled
Edge	20.75	13.3	8.95	0.28	89.63	1.14
Interior	0.25	0.83	97.41	1.17	1.17	0.26

(G) Grower 3: Pre-Treatment Sampling Results

Average # of Green and Brown Stink Bugs per 10 Sweeps						
Treatment	11-Aug		16-Aug		22-Aug	
	GSB	BSB	GSB	BSB	GSB	BSB
Treated Field Perimeter	0.25	0	0.75	0	2.25	0
Untreated Perimeter	0	0	1	0.5	1.5	0
Untreated Interior (>100 ft)	0	0	0	0	0	0

(H) Grower 3: Post-Treatment Sampling Results

Average # of GSB and BSB per 10 Sweeps											
Sample Date	Treatment	Distance From Field Edge									
		0 ft		20 ft		45 ft		90 ft		**Interior (>100 ft)**	
		GSB	BSB	GSB	BSB	GSB	BSB	GSB	BSB	GSB	BSB
1-Sep	Treated	0.13	0.13	0	0	0	0	0	0	0	0
	Untreated	0.25	0.38	0	0.13	0	0	0	0		
7-Sep	Treated	0	0.13	0	0	0.25	0	0.13	0	0.15	0.15
	Untreated	0.13	0.25	0.25	0	0.38	0	0.13	0.13		
27-Sep	Treated	0	0.13	--	--	0.75	0.13	--	--	1.4	0.6
	Untreated	0.38	0.13	--	--	0.88	0.63	--	--		
4-Oct	Treated	1.38	0	--	--	1.0	0	1.88	0	0.3	0.4
	Untreated	2	0.13	--	--	2.5	0.25	1.38	0.13		

(I) Grower 3: Seed Quality Evaluation

Sample Location	Treatment	% Clean	% Purple Stain	% Moldly	% Shriveled
Field Edge (0 ft)	Treated	98.25	0.75	0	1
	Untreated	98.0	1.5	0	0.5
Field Edge (45 ft)	Treated	99.5	0	0	0.5
	Untreated	98.5	1.25	0	0.25
Field Interior (>100 ft)	Untreated	98.33	0.67	0	1

Determine yield loss, seed quality, and the possibility of delayed plant growth, "stay green effect", caused by stink bug feeding

(J) Pre-Harvest Stink Bug Sampling

Field ID #	Sample Date	Areas of Delayed Maturity						Senesced Areas		
		Field Perimeter (<100 ft)			Field Interior (>100 ft)			Field Interior (>100 ft)		
		GSB	BSB	BMSB	GSB	BSB	BMSB	GSB	BSB	BMSB
1	11-Oct	1	0	0				0	0	0
2	12-Oct	0	0	0	0	0	0	0	0	0
4	13-Oct	2	0	0				13	0	0
5	14-Oct	0	0	0	0	0	0	0	0	0
6	17-Oct	0	0	0				0	0	0
7	18-Oct	0	0	0				0	0	0
8	19-Oct	1	0	0				0	0	0
9	18-Oct	0	0	0	0	0	0	0	0	0
10	19-Oct	0	0	0	0	0	0	0	0	0
11	20-Oct	0	0	0				0	0	0
12	21-Oct	1	0	0	0	0	0	0	0	0
13	5-Oct	0	0	0	0	0	0	0	0	0
	11-Oct	0	0	0	0	0	0	2	0	0
	18-Oct	1	0	0	0	0	0	0	0	0
14	5-Oct	0	0	0	0	0	0	0	0	0
	11-Oct	0	0	0	0	0	0	0	0	0
	18-Oct	3	0	0	0	0	0	0	0	0
15	11-Oct	0	0	0	0	0	0	0	0	0
16	11-Oct	3	0	0	0	0	0	0	0	0
	20-Oct	47	0	0	0	0	0	0	0	0
17	11-Oct	0	0	0	0	0	0	0	0	0
	18-Oct	0	0	0	0	0	0	0	0	0
18	18-Oct	0	0	0	0	0	0	0	0	0
	11-Oct	0	0	0	0	0	0	0	0	0
19	20-Oct	0	0	0	0	0	0	0	0	0

NOTE: The areas of delayed maturity that were sampled in (Table J) were not determined to have been a result of stink bug infestations.

(K) Pod Evaluation

Field ID #	Sample Location	total # pods/ 20 plants	% pods with aborted seed	% flat
1	Exterior	480	16.04	9.79
	Interior	769	13.26	3.51
2	Exterior	691	20.26	22.29
	Interior	717	15.76	7.39
6	Exterior	895	12.96	10.73
	Interior	733	10.64	3.27
11	Exterior	836	23.33	1.2
	Interior	853	15.83	13.6
20	Exterior	742	14.15	1.08
	Interior	675	10.07	1.63

(L) Seed Quality Evaluation

Field ID #	Location	% clean	% purple	% moldy	% shriveled
1	perimeter	8.95	0.28	89.63	1.14
	interior	97.41	1.17	1.17	0.26
2	perimeter	2.02	0.00	92.22	5.76
	interior	98.48	0.23	1.23	0.06
4	perimeter	99.58	0.42	0.00	0.00
	interior	99.12	0.38	0.25	0.25
5	perimeter	99.35	0.38	0.27	0.00
	interior	99.88	0.06	0.06	0.00
6	perimeter	99.83	0.00	0.00	0.17
	interior	99.69	0.21	0.00	0.10
7	perimeter	99.87	0.09	0.00	0.04
	interior	99.92	0.04	0.00	0.04
8	perimeter	99.95	0.00	0.00	0.05
	interior	99.85	0.05	0.00	0.10

The samples in Field ID 1 and Field ID 2 indicate a high percentage of moldy seed on the field perimeters. At the time of sampling, the seed from both of these fields were not fully mature on the field perimeters and a large percentage of the mold occurred after the samples were collected. Therefore, it cannot be determined if stink bug feeding is responsible for the high percentage of moldy seed.

Evaluate the effectiveness of insecticides to control the brown marmorated stink bug on soybeans

(M)Brown Marmorated Stink Bug Insecticide Trial Sample Results - Newark

Newark Insecticide Efficacy Trial												
Treatment	Average # of BMSB Adults and Nymphs per 10 Sweeps											
	7/5	7/11	7/20	7/25	8/4	8/11	8/19	8/31	9/8	9/16	9/21	9/30
Baythroid XL	0	0	0	0	0.25	0	0	0.25	0.50	1.0	0.75	0
Leverage 360	0	0	0	0	0.25	0.5	0.25	0.25	0	0	0	0
Lannate LV	0	0	0	0	0	0.25	0.25	1.25	0.25	0.25	1.0	0
Warrior II	0	0	0	0	0	0	0	1.0	0.25	0.25	0	0
Endigo ZC	0	0	0	0	0	0	0	0	0.75	0	0	0
Cobalt Advanced	0	0	0	0	0.25	0	0	0.25	0	0.50	0	0
Acephate 97 UP	0	0	0	0.25	0	0.25	0	0	0.75	0.50	0.25	0
Untreated	0	0	0	0	0	0	0	0.5	0	0	0	0

(N) Brown Marmorated Stink Bug Insecticide Trial Sampling Results - Middletown

Middletown Insecticide Efficacy Trial												
Treatment	Average # of BMSB Adults and Nymphs per 10 Sweeps											
	6/22	6/28	7/6	7/12	7/19	7/27	8/3	8/10	8/23	8/31	9/13	9/27
Baythroid XL	0	0	0	0	0.33	0	0.17	0	0.17	0.33	0.33	0.17
Leverage 360	0	0	0.33	0.17	0.83	0.17	0.17	0.17	0.50	0.17	0.00	0
Lannate LV	0	0	0	0	0.33	0	0.17	0.33	0.17	0.17	1.17	0
Warrior II	0	0	0	0	0.50	0.17	0	0.33	0	0	0.33	0
Endigo ZC	0	0	0	0	0	0	0	0	0	0	0.33	0
Cobalt Advanced	0	0	0	0	0.33	0	0.33	0	0.50	0.67	0.17	0
Acephate 97 UP	0	0	0	0	0.67	0.17	0	0	0	0	0.17	0
Untreated	0	0	0	0.33	0.33	0.17	0	0	0	0.17	0.17	0.17

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(O) Brown Marmorated Stink Bug Insecticide Trial Yield and Seed Evaluation- Middletown

Middletown Insecticide Efficacy Trial					
Treatment	Rate/Acre	Yield Bushels per Acre	Seed Quality Evaluation		
			% Purple Stain	% Moldy	% Shriveled
Baythroid XL	2.8 oz	68.7a	1.83a	1.0a	1.0a
Leverage 360	2.8 oz	65.3a	2.33a	0.33a	0.5a
Lannate LV	1.5 pt	68.4a	1.33a	1.16a	2.0a
Warrior II	1.92 oz	68.1a	0.83a	0.83a	1.0a
Endigo ZC	4.0 oz	71.3a	2.33a	0.83a	1.17a
Cobalt Advanced	22 oz	69.4a	0.58a	1.54a	1.89a
Acephate 97 UP	1 lb	69.4a	1.98a	1.13a	1.49a
Untreated	--	66.3a	1.83a	0.67a	0.67a

Means within a column followed by the same letter are not significantly different (Tukey's mean separation test; P=0.05)

Discussion

Evaluate the effectiveness of perimeter treatments to control stink bugs in soybeans

Based on the 2011 survey results, soybean fields in New Castle County and western Kent County were at greatest risk for BMSB infestations. In New Castle County, BMSBs were found in eighty percent of the fields surveyed and ten percent of the fields were at or above a threshold of five stink bugs per twenty-five sweeps. In Kent County, BMSBs were found in thirty-three percent of the fields surveyed and none of the fields reached or exceeded the threshold. When factoring in the complex of stink bug species within a field including GSB, BSB, and BMSB, twenty percent of the New Castle County fields and nineteen percent of the Kent County fields were at threshold. In Sussex County, BMSBs were not found in any of the soybean fields included in the survey and none of the fields reached threshold for GSB or BSB.

The survey results also suggest that stink bugs are not evenly distributed throughout a soybean field and that stink bugs, especially the BMSB, tend to be concentrated on field perimeters. This finding agrees with prior research and suggests that perimeter treatments may be an effective control strategy to manage stink bugs in soybeans. The two fields in New Castle County that were selected for perimeter treatments provide a good example of the concentration of BMSB on the field perimeters compared to the interior of the field. On Aug 26, a perimeter treatment was applied on Grower Field 1 and was successful in reducing BMSB populations below the economic threshold. The perimeter treatment applied on Grower Field 2 was not successful in significantly reducing stink bug populations because a heavy rain event occurred immediately following the application. Once it was determined that the application was not successful, a second application was not warranted because the soybeans had progressed in their lifecycle and reached a point in which the stink bug infestations no longer posed a serious threat. The seed quality results indicate that there was an increase in the percentage of moldy seeds in the field perimeters compared to the subsamples collected from the interior of field in both Grower field 1 and Grower field 2. However, when the subsamples were collected, the soybean plants on the field perimeters were slightly delayed in maturity compared to the rest of the field and the seed was not physiologically mature. As a result, mold quickly developed on the seed in storage. At this point, although it appears that stink bug infestations may have contributed to the slight delay in maturity, more data is needed to draw a definite conclusion. Researchers in Virginia and Maryland also evaluated perimeter treatments for managing stink bugs and initial findings suggest that this may be an effective control strategy. However, additional research is needed to further evaluate the use of perimeter treatments to manage stink bugs in soybeans.

Determine yield loss, seed quality, and the possibility of delayed plant growth, "stay green effect", caused by stink bug feeding

Stink bug populations were greatest on the field perimeters in all of the fields surveyed. Typically, field edges also have the most variability in plant health and yield. This created a challenge in determining the effects of stink bug feeding injury from the normal variability found on field edges. None of the fields surveyed exhibited any symptoms of delayed plant growth compared to what would be expected under typical growing conditions. There also was not a significant difference in purple stain, shriveled seed or moldy seed when comparing the sample results in the field perimeters to the field interiors except for what was discussed in Field ID # 1 and Field ID # 2. There was an increase in flat pods and pods with aborted seed in the field perimeters compared to the interior portions of the field. Although flat pods and pods with aborted seeds can result from stink bug feeding, it can also occur when plants are stressed. Prior research conducted in Virginia and Maryland suggests that the most damage from stink bug feeding occurs during the R4 (full pod) growth stage and that infestations are of greatest concern from R3 (flowering) to R6 (full bean). Additional research is needed to fully understand the impacts stink bug infestation have on soybeans.

Brown Marmorated Stink Bug Insecticide Efficacy Trial

Overall, BMSB populations were low in the Newark and Middletown plots. In Newark, populations never reached levels high enough to evaluate. In Middletown, treatments were applied on August 16, as soon as BMSB started to move into the plots. However, populations never increased to levels high enough to evaluate efficacy and there were no significant difference in BMSB populations on any of the post application sampling dates. There were also no significant differences between yield or seed quality between each of the treatments. Research conducted in Virginia, indicates that initial control of BMSB in soybeans can be achieved with labeled products but additional research needs to be conducted to determine residual activity.

Management of Snap Bean Insects with Soil Applied and Foliar Insecticides, 2011- 'Slenderette' snap beans were planted on July 13 at the University of Delaware's Research and Education Center located near Georgetown, DE. Plots consisted of four 25 ft long plots planted on 30-inch centers replicated four times in a RCB design. Soil treatments were applied in furrow at planting using a CO^2 pressurized backpack sprayer with a two-nozzle boom delivering 20 gpa at 40 psi. Foliar treatments were applied on August 19 (bud stage), August 25 (pin stage) and Sept 1 (6 days from harvest) with a CO^2 pressurized backpack boom sprayer delivering 18 gpa @ 30 psi. Snap beans were harvested on Sept 7 from a 6 ft row section and all the beans were evaluated for corn borer and corn earworm injury. Data were analyzed using Proc GLM and means were separated by Tukey's means separation test (P=0.05).

No corn borer damage was detected in the plots and corn earworm pressure was light. No phytotoxicity was observed.

Table 1. Damaged Beans

Trt #	Treatment	Rate/Acre	Treatment Placement	Percent CEW Damaged Beans Sept 7
1	Coragen 1.67 SC	3.5 oz	at planting	0.69a
2	Coragen 1.67 SC	5.0 oz	at planting	0.36a
3	Coragen 1.67 SC	7.0 oz	at planting	0.00a
4	HGW86 20SC	10.2 oz	at planting	2.41a
5	Coragen 1.67 SC	5.0 oz	foliar	0.00a
6	Radiant 1 SC	6.0 oz	foliar	0.00a
7	Belt	3.0 oz	foliar	0.17a
8	Blackhawk	3.3 oz	foliar	0.25a
9	Orthene (2ppl) Warrior II (1 appl)	1 lb switch to 1.92 oz	foliar	0.00a
10	Untreated	------	------	1.07a

1 Means within a column followed by the same letter are not significantly different (Tukey's; P=0.05).

Table 2. Thrips and Leafhopper Infestations

Treatment	Rate/A	Placement	Thrips per 10 leaflets	Thrips per 20 leaflets		Potato Leafhopper per 10 leaflets	Potato Leafhopper per 10 leaflets	
			Aug 3 [1]	Aug 11[1]	Aug 22[1]	Aug 3[1]	Aug 11[1]	Aug 22[1]
Coragen 1.67 SC	3.5 oz	at planting	12.25a	7.00a	0.25a	0.25a	0.00a	0.50a
Coragen 1.67 SC	5.0 oz	at planting	11.00a	5.50a	0.75a	0.25a	0.00a	0.50a
Coragen 1.67 SC	7.0 oz	at planting	5.50a	6.50a	0.25a	0.25a	0.75a	0.50a
HGW86 20SC	10.2 oz	at planting	20.75a	4.25a	0.50a	0.00a	0.25a	0.50a
Coragen 1.67 SC	5.0 oz	foliar	20.50a	7.25a	0.25a	1.25a	1.50a	0.00a
Radiant 1 SC	6 oz	foliar	17.50a	2.75a	0.50a	1.50a	1.50a	0.50a
Belt	3 oz/A	foliar	18.25a	5.25a	0.25a	1.75a	0.00a	0.00a
Blackhawk	3.3 oz	foliar	19.00a	4.50a	0.50a	1.25a	0.50a	0.00a
Orthene switch to Warrior II	1 lb switch to 1.92 oz	foliar	14.75a	7.50a	0.50a	0.25a	2.00a	0.00a
Untreated	------	------	18.75a	6.50a	0.00a	0.00a	0.00a	0.25a

[1] At Planting treatments on July 13; Foliar Treatments – Aug 19, 25 and Sept 1; Means within a column followed by the same letter are not significantly different (Tukey's; P=0.05).

Evaluation of Pepper Cultivars for Brown Marmorated Stink Bug (BMSB) Susceptibility, 2011: The varieties 'Paladin' (bell pepper), 'Bounty' (Banana Pepper) and 'Sparky' (Jalapeno Pepper) were transplanted on June 2 at the University of Delaware's Research farm located in Newark, DE. Four row plots 15 ft. long on 6 foot center were replicated 3 times in a RCB design. Five plants from each of the middle two rows (10 total plants) were examined for BMSB adults, nymphs, and egg masses twice a week by direct count and beat samples from June 9 through Sept 14. The first adult BMSB adults were detected at low levels on July 5. Five leaves were pulled from each of these ten total plants looking for ECB Egg masses and aphids. We also searched for CEW and BAW larvae during this process. Marketable fruit were harvested on 5 dates. The number of harvested fruit varied at each harvest date: (a) July 18 – 50 to 90 fruit per plot; (b) Aug 3 and 11- 100 marketable fruit ; (c) Aug 16 – 200 marketable fruit; and on (d) Aug 23 - 200 marketable fruit from the Paladin plots and 500 marketable fruit from the Bounty and Sparky plots. The total number of damaged fruits was recorded and the number of feeding sites on each damaged fruit was also noted.

Table 1. BMSB Adults – Direct Visual Counts

	Average # BMSB Adults per 10 Plants		
Date	Paladin	Bounty	Sparky
July 7	1.0	4.7	2.0
July 11	0.0	1.5	0.3
July 14	3.0	1.0	7.0
July 18	2.3	3.3	3.7
July 22	0.3	2.3	0.3
July 25	0.0	0.0	0.0
Aug 1	5.0	3.3	2.7
Aug 8	0.8	1.7	2.3
Aug 15	1.7	2.7	1.3
Aug 19	4.7	3.7	7.7
Aug 22	2.7	5.7	8.7
Aug 25	2.7	0.3	1.3
Sept 1	0.0	0.0	0.3
Sept 8	0.3	0.3	0.0
Sept 14	0.0	0.7	0.7

Table 2. Harvest Data – BMSB Damage

Treatment	Percent BMSB Damaged Fruit [1]				
	July 18	Aug 3	Aug 11	Aug 16	Aug 23
Paladin	1.33a	1.00b	1.50a	19.33a	13.85a
Bounty	15.36a	17.00a	10.67a	9.17b	23.67a
Sparky	15.34a	11.33ab	10.00a	8.50b	8.40a

[1] Means followed by the same letter are not significantly different (Tukey's; P=0.05).

Comments: BMSB populations in each variety were generally low throughout the season. At the first evaluation date in Aug, damaged fruit was significantly higher in the 'Bounty' plots compared to the 'Paladin' plots. Two weeks later, damaged fruit was significantly higher in the 'Paladin' plots. In general, no overall difference was observed in varietal susceptibility in 2011. Although differences were observed in demonstrations in 2010, further research is needed in 2012 to determine if differences consistently occur.

Brown Marmorated Stink Bug Management in Sweet Corn, 2011: ' WSS 0987' Bt sweet corn was planted on May 27 at the University of Delaware's Research farm located in Newark, DE. Two row plots 25 foot long planted on 5 foot centers were replicated 4 times in a RCB design. All applications were applied with a CO2 pressurized back pack sprayer using a two nozzle boom equipped with D2 hollow cone nozzles delivering 66 gpa at 40 psi. The number of BMSB adults and nymphs per 10 plants was recorded pre-treatment on July 11. The number of BMSB adults and nymphs per plant was also recorded on 3 post treatment dates (July 12 – tassel emergence, July 19 – green silk, and July 27 – brown silk). At harvest (Aug 1), all the ears from each plot were husked and evaluated for damage from BMSB (blemished kernels). Data were analyzed using Proc GLM and means were separated by Tukey's mean separation test (P=0.05).

Although BMSB could be readily found on tassels and plants, damage was low and no significant different was observed between the treatments and the untreated control.

Trt #	Treatment	Rate/Acre	No. BMSB Adults & Nymphs per 10 plants [1]	No. BMSB Adults & Nymphs per plant[1]			Mean % Clean Ears Aug 1[1]	Mean % Damaged Ears Aug 1 [1]
			July 11 Pre-trt	July 15 3 DAT #1	July 18 6DAT #1	July 25 6DAT #2		
1	Baythroid XL	2.8 oz	0.00a	0.21a	0.13a	0.01a	97.46a	1.07a
2	Leverage 360	2.8 oz	0.50a	0.20a	0.11a	0.01a	99.04a	1.39a
3	Venom 70 SG	116 grams	0.75a	0.06a	0.08a	0.03a	96.75a	2.86a
4	Lannate LV	1.5 pt	0.50a	0.11a	0.16a	0.02a	83.73a	15.91a
5	Venom 70 SG + Exponent Insecticide Synergist	116 grams + 5 oz	1.50a	0.13a	0.14a	0.02a	96.86a	1.99a
6	Trebon 30 EC	236.6 ml	1.00a	0.13a	0.23a	0.01a	98.33a	0.57a
7	Trebon + Exponent Insecticide Synergist	236.6 ml + 8 oz	0.25a	0.17a	0.10a	0.003a	95.87a	3.66a
8	Untreated	----	0.25	0.12a	0.10a	0.09a	88.64a	9.81a

[1] Means in the same columns followed by the same letter are not significantly different (Tukey's; P=0.05).

Watermelon Aphid Management Insecticide Trial, 2011 – 'Sangria' watermelons were transplanted on May 26 at the University of Delaware's Research and Education Center located near Georgetown, DE. Plots consisted of two 20 ft long rows planted on 7ft centers. Each treatment was replicated four times and arranged in a RCB design. Foliar treatments were applied with a CO_2 pressurized back pack sprayer on June 7 using a single nozzle broadcast application delivering 38 gpa at 40 psi. Aphid populations were evaluated by counting the number of aphids per 25 leaves and the number of infested plants pre-treatment and 6 days after treatment. Beneficial activity was very high at time treatments were applied resulting in total population crash post treatment. Data were analyzed using Proc GLM and means were separated by Tukey's mean separation test (P=0.05).

Treatment	Rate/Acre	Percent Aphid Infested Plants[1]		Number Melon Aphids per leaf [1]	
		June 6 Prt – Trt	June 13 6 DAT	June 6 Prt – Trt	June 13 6 DAT
Assail 30 SG	4 oz	25a	0	0.93a	0
Belay 2.13 SC	4oz	55a	0	0.41a	0
Movento 240 SC + NI	5 oz + 0.25% NIS V/V	30a	0	0.14a	0
Beleaf 50 SG	2.8 oz	25a	0	0.11a	0
Lannate LV	3 pt	45a	0	0.64a	0
Actara	3 oz	35a	0	0.53a	0
Vydate L	2 pt	25a	0	0.17a	0
Endigo ZC	4.5 oz	40a	0	0.27a	0
Fulfill	2.75 oz	30a	0	0.14a	0
Untreated Check	--	30a	0	0.37a	0

[1] Means within a column followed by the same letter are not significantly different (Tukey's; P=0.05).