

College of Agriculture  
And  
Life Sciences

**Project Report**  
2004



COLLEGE OF  
**AGRICULTURAL**  
**& LIFE SCIENCES**  
UNIVERSITY OF WISCONSIN-MADISON

**Vegetable Crops Entomology Field Research**  
**J.A. Wyman and S.A. Chapman**  
**Department of Entomology**

**University of Wisconsin-Madison**

## **Acknowledgments**

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2004  
Temperature and Rainfall  
Hancock, WI

<b>April</b>	<b>Air temperature</b>		<b>Rainfall</b> (inches)	<b>May</b>	<b>Air temperature</b>		<b>Rainfall</b> (inches)
	<b>Day</b>	<b>Min.</b>			<b>Max.</b>	<b>Day</b>	
1	53.2	19.7	0	1	34.8	57.7	0.0
2	60.8	19.4	0	2	24.3	50.3	0.0
3	48.5	23.6	0	3	18.1	55.7	0.0
4	47.6	17.1	0	4	39.9	71.8	0.0
5	56.2	23.3	T	5	27.9	68.8	0.01
6	71.7	42.7	0	6	50.4	81.7	T
7	63.7	27.7	0	7	36.4	58.7	0.83
8	48.8	30.3	0	8	36.6	59.1	0.23
9	52.6	23.7	0	9	45.7	78.6	0.047
10	39.8	24.5	T	10	48.1	77.1	0.0
11	37.0	23.7	0.03	11	47.5	70.8	0.0
12	39.6	17.9	T	12	61.5	85.7	0.82
13	55.4	14.5	0	13	46.1	68.3	0.65
14	65.3	32.6	0	14	32.2	46.8	0.2
15	72.3	35.6	0	15	27.8	63.0	0.0
16	49.0	79.0	0.18	16	41.6	71.7	0.0
17	74.3	48.0	0.1	17	56.3	74.2	T
18	79.3	45.7	T	18	44.9	69.8	0.0
19	58.3	36.4	0.29	19	37.0	74.3	0.42
20	49.8	32.7	0	20	55.9	82.4	0.23
21	48.5	39.0	0.44	21	42.3	57.4	1.06
22	55.9	30.5	T	22	46.0	56.6	0.59
23	63.6	27.5	0	23	42.8	56.3	0.17
24	51.4	33.1	T	24	43.6	67.2	0.0
25	48.1	36.2	0.18	25	41.1	68.4	0.0
26	47.5	29.1	0.06	26	48.5	72.9	0.02
27	49.6	20.6	0	27	35.5	68.1	0.03
28	84.1	42.2	0	28	43.2	52.8	0.1
29	75.3	44.1	0	29	50.9	62.9	0.4
30	44.3	39.9	0	30	54.5	70.8	0.83
			0.2	31	34.8	57.7	0.12
<b>Total</b>			<b>1.48</b>	<b>Total</b>			<b>7.18</b>

2004  
Temperature and Rainfall  
Hancock, WI

June Day	Air temperature		Rainfall (inches)	July Day	Air temperature		Rainfall (inches)
	Min.	Max.			Min.	Max.	
1	65.6	53.0	0.06	1	61.7	87.2	0.0
2	75.5	52.0	0.0	2	56.8	84.5	0.0
3	74.9	41.2	0.0	3	59.8	81.6	1.12
4	77.4	45.3	0.0	4	60.9	78.6	0.06
5	73.7	49.9	0.15	5	55.7	69.9	0.59
6	82.4	59.9	0.0	6	54.5	63.6	0.13
7	90.2	65.9	0.0	7	50.9	59.5	0.0
8	89.4	72.2	0.48	8	50.2	71.4	0.0
9	77.8	52.2	1.25	9	53.4	68.2	0.20
10	57.8	48.8	3.25	10	56.9	84.5	0.0
11	59.1	52.4	0.32	11	62.2	83.8	0.0
12	87.5	54.4	0.0	12	64.5	84.9	T
13	81.7	61.6	0.74	13	65.0	90.0	0.03
14	79.7	56.1	0.0	14	57.9	83.1	0.0
15	83.2	53.0	0.0	15	52.2	85.8	0.0
16	87.3	58.2	0.9	16	60.5	83.0	0.21
17	76.2	59.9	0.01	17	57.1	80.5	0.0
18	74.1	50.4	0.0	18	51.3	81.4	0.0
19	69.6	39.4	0.0	19	60.9	86.4	0.0
20	74.3	44.0	0.0	20	64.6	91.6	0.02
21	74.6	55.4	0.06	21	73.0	86.6	T
22	71.4	48.2	0.0	22	62.5	83.6	0.0
23	76.2	51.3	0.33	23	53.7	76.5	0.0
24	63.0	42.9	0.02	24	50.4	76.7	0.0
25	70.3	39.9	0.0	25	53.6	81.1	0.0
26	72.1	42.1	0.0	26	48.0	85.3	0.0
27	74.2	42.7	0.12	27	53.0	86.3	0.0
28	76.4	49.4	0.0	28	56.0	84.3	0.0
29	85.1	54.0	0.0	29	64.0	78.4	0.29
30	85.8	57.4	0.0	30	56.5	83.7	0.04
				31	61.0	82.7	1.01
Total			7.69	Total			3.70

2004  
Temperature and Rainfall  
Hancock, WI

<b>August</b>			<b>September</b>				
Day	Air temperature		Rainfall (inches)	Day	Air temperature		Rainfall (inches)
	Min.	Max.			Min.	Max.	
1	62.3	88.3	0.0	1	69.9	85.5	0.0
2	65.9	88.4	0.13	2	66.4	87.1	0.0
3	63.2	82.6	0.18	3	64.4	86.5	0.0
4	57.9	80.3	0.0	4	61.4	84.9	0.0
5	46.0	76.2	0.0	5	66.5	84.9	0.01
6	47.1	81.4	0.0	6	59.0	75.7	0.0
7	50.5	68.5	0.03	7	48.5	71.3	0.0
8	61.1	81.6	0.0	8	48.8	73.3	0.0
9	60.2	81.9	0.07	9	46.0	71.5	0.0
10	52.1	61.5	0.02	10	54.4	82.1	0.0
11	45.6	57.3	0.0	11	61.1	86.1	0.0
12	44.8	70.5	0.0	12	58.6	87.0	0.0
13	43.4	71.4	0.09	13	61.5	84.0	0.0
14	42.6	76.6	0.0	14	65.4	81.7	T
15	43.7	77.2	0.0	15	60.7	77.8	0.35
16	52.2	67.9	0.22	16	46.0	70.1	0.0
17	55.5	76.9	0.0	17	42.6	73.5	0.0
18	50.8	80.6	0.0	18	55.2	78.4	0.0
19	36.6	69.2	0.0	19	56.6	80.8	0.0
20	38.3	71.0	0.0	20	55.9	79.5	0.0
21	32.6	71.0	0.0	21	53.6	84.5	0.0
22	52.2	83.4	0.0	22	53.7	83.0	0.0
23	57.7	67.7	0.0	23	58.9	82.4	0.16
24	57.1	77.6	1.0	24	55.5	61.8	0.0
25	66.7	75.3	T	25	45.7	72.8	0.0
26	66.6	88.3	0.71	26	40.7	76.3	0.0
27	63.2	83.9	0.09	27	47.0	80.9	0.0
28	53.2	63.8	0.0	28	37.4	65.8	0.0
29	49.0	72.0	0.06	29	29.3	71.7	0.0
30	53.4	78.2	0.0	30	36.2	72.3	0.0
31	48.7	77.4	0.33				
Total			2.93	Total			0.52

2004  
Temperature and Rainfall  
Arlington, WI

<b>April</b> Day	Air temperature		Rainfall (inches)	<b>May</b> Max.	Air temperature		Rainfall (inches)
	Min.	Max.			Min.	Max.	
1	18.65	50.69	0.00	1	34.15	54.63	0.00
2	20.25	58.67	0.00	2	24.45	52.01	0.06
3	25.09	51.23	0.00	3	18.81	55.01	0.00
4	20.63	49.51	0.00	4	37.19	73.87	0.00
5	20.77	56.33	0.00	5	29.99	69.43	0.00
6	39.79	73.59	0.02	6	48.71	76.09	0.00
7	27.21	65.35	0.00	7	38.49	58.17	0.28
8	27.87	52.53	0.00	8	39.41	71.63	0.62
9	23.53	55.01	0.00	9	48.45	81.59	0.01
10	19.71	45.17	0.00	10	49.65	71.27	0.49
11	18.67	40.85	0.00	11	46.89	73.21	0.01
12	16.05	38.75	0.00	12	62.49	84.19	0.11
13	14.07	53.33	0.00	13	48.73	75.17	0.46
14	30.63	71.89	0.00	14	38.49	49.39	0.30
15	28.79	74.13	0.01	15	32.09	60.51	0.00
16	47.81	86.13	0.11	16	38.23	69.41	0.00
17	47.81	74.75	0.40	17	57.65	79.35	0.70
18	50.55	79.77	0.40	18	42.69	62.89	0.02
19	37.07	69.83	0.07	19	36.79	71.63	0.00
20	33.77	52.95	0.43	20	55.01	85.75	0.00
21	34.17	55.29	0.10	21	41.07	70.49	2.74
22	27.07	51.87	0.00	22	54.99	67.35	0.85
23	23.81	62.49	0.00	23	50.17	72.57	1.41
24	33.25	51.87	0.18	24	44.53	55.53	0.02
25	36.65	54.25	0.07	25	44.39	66.15	0.10
26	26.13	51.75	0.00	26	42.97	66.67	0.00
27	20.77	49.79	0.00	27	50.83	76.75	0.00
28	42.55	84.71	0.01	28	42.29	67.57	0.00
29	44.23	78.57	0.00	29	42.17	60.53	0.37
30	40.99	45.45	0.05	30	52.27	69.59	0.58
				31	54.99	70.47	0.23
Total			1.78	Total			8.78

2004  
Temperature and Rainfall  
Arlington, WI

June Day	Air temperature		Rainfall (inches)	July Day	Air temperature		Rainfall (inches)
	Min.	Max.			Min.	Max.	
1	53.59	65.65	0.00	1	56.07	87.29	0.15
2	52.51	74.03	0.00	2	56.47	82.75	0.00
3	44.01	72.67	0.00	3	59.09	82.61	1.04
4	42.97	76.99	0.00	4	64.85	82.21	0.31
5	48.09	76.47	0.02	5	57.51	74.49	0.10
6	60.79	84.85	0.01	6	57.51	68.77	0.04
7	64.99	90.73	0.00	7	50.57	63.81	0.02
8	72.29	90.99	0.00	8	48.09	74.37	0.00
9	56.05	87.85	0.54	9	49.91	71.77	0.44
10	53.71	62.37	0.87	10	51.49	85.59	0.00
11	57.11	63.93	0.22	11	57.91	84.87	0.01
12	54.63	87.17	0.17	12	63.15	80.77	0.00
13	62.75	82.09	0.04	13	61.71	89.67	0.00
14	58.17	82.09	0.00	14	58.05	81.29	0.00
15	54.77	83.13	0.00	15	50.57	84.19	0.00
16	54.77	87.45	0.43	16	59.61	81.03	0.46
17	62.11	79.49	0.04	17	55.55	76.73	0.00
18	53.31	75.03	0.00	18	50.05	81.95	0.00
19	44.51	68.63	0.00	19	56.21	82.35	0.00
20	46.91	73.99	0.00	20	63.01	92.51	0.00
21	56.07	69.83	0.22	21	70.59	84.59	0.26
22	49.91	71.91	0.00	22	59.87	83.13	0.00
23	53.61	76.61	0.21	23	52.55	75.69	0.00
24	42.33	62.89	0.18	24	49.93	75.43	0.00
25	39.17	70.35	0.00	25	48.73	77.65	0.00
26	44.67	73.33	0.00	26	45.07	81.83	0.00
27	45.07	77.13	0.29	27	49.51	83.93	0.00
28	47.93	74.63	0.00	28	50.97	81.55	0.00
29	54.13	82.87	0.00	29	60.67	77.81	0.17
30	54.77	83.01	0.00	30	59.61	76.07	0.18
				31	60.39	81.29	0.00
		Total	3.24			Total	3.18

2004  
Temperature and Rainfall  
Arlington, WI

<b>August</b>				<b>September</b>			
Day	Air temperature		Rainfall (inches)	Day	Air temperature		Rainfall (inches)
	Min.	Max.			Min.	Max.	
1	60.15	88.09	0.15	1	55.05	83.27	0.05
2	62.61	85.51	0.13	2	58.95	85.63	0.00
3	63.55	88.35	1.01	3	54.53	84.85	0.00
4	56.59	78.31	0.00	4	53.47	84.85	0.00
5	47.81	72.81	0.00	5	60.67	84.97	0.00
6	43.89	79.71	0.00	6	54.53	75.73	0.08
7	45.99	66.95	0.01	7	45.73	70.47	0.00
8	53.85	80.91	0.00	8	43.09	70.73	0.00
9	62.23	81.95	0.01	9	42.43	70.47	0.00
10	53.59	65.25	0.00	10	42.97	80.93	0.00
11	48.59	57.25	0.01	11	57.51	85.51	0.00
12	46.65	68.27	0.00	12	52.29	86.29	0.00
13	37.85	69.43	0.00	13	52.55	85.51	0.00
14	38.51	74.63	0.00	14	65.39	85.37	0.00
15	39.43	76.61	0.00	15	60.93	77.57	0.49
16	45.73	74.93	0.07	16	43.11	69.03	0.00
17	51.63	78.29	0.00	17	39.83	73.85	0.00
18	48.35	80.37	0.10	18	46.13	77.65	0.00
19	37.99	67.33	0.01	19	48.99	81.07	0.00
20	40.47	73.59	0.00	20	46.91	78.57	0.00
21	33.41	69.95	0.00	21	42.19	82.09	0.00
22	44.97	81.55	0.00	22	38.77	81.31	0.00
23	56.21	69.67	0.00	23	45.87	82.09	0.01
24	56.07	77.29	0.23	24	46.91	70.07	0.00
25	59.75	77.17	0.01	25	40.35	70.59	0.00
26	66.83	85.51	0.51	26	34.71	75.55	0.00
27	65.91	83.53	0.04	27	34.59	78.83	0.00
28	46.75	66.17	0.08	28	32.21	63.55	0.00
29	44.93	69.27	0.00	29	27.89	72.83	0.00
30	51.37	77.27	0.01	30	26.31	72.57	0.00
31	44.27	80.13	0.00				
		Total	2.38			Total	0.63

**SOIL (Arlington, WI)**

Soil Type: Plano silt loam  
Sand 12%  
Silt 70%  
Clay 18%  
Organic matter 30 tons  
PH 6

**SOIL (Hancock, WI)**

Soil Type: Plainfield sand  
Sand 89%  
Silt 6%  
Clay 5%  
Organic matter 0.77%  
PH 5.9-6.3

**STATISTICAL ANALYSIS PROCEDURE**

All data was subjected to two-way analysis of variance and insect count data was transformed using square root ( $X+1$ ) prior to mean separation. Mean separation was by Least Significant Difference test at the 5% level of significance. Means are rounded for clarity, and in all tables, means in a column followed by the same letter are not significantly different.

## **Section 1. Insect Control on Potatoes.**

Insect management programs for Wisconsin potatoes are designed to hold key insect pests below damaging levels. Three key insect species are normally present on potatoes grown in Wisconsin. The Colorado potato beetle, the potato leafhopper, and the green peach aphid typically require control actions to avoid economic loss on potatoes, however, in recent years the green peach aphid has not been a widespread pest in Wisconsin.

Other potato insect pests occasionally occur in Wisconsin and these may also cause economic damage. However, management programs targeting the key pest complexes typically also control sporadic pests in the system. Therefore specific control measures for sporadic pests are only required when populations are unusually high or when pest specific insecticides are used to control the three key pests (Spintor, Rimon, Fulfill, etc.). The most frequently encountered sporadic pests found on potato include potato aphids, potato flea beetles, European corn borers and other occasional lepidopteran pests such as cutworms and loopers, and soil insects such as wireworm and white grub.

Over the past decade Colorado potato beetles have emerged as the most serious insect pest on potatoes in Wisconsin, largely due to its ability to develop insecticide resistance. Colorado potato beetles cause damage as a defoliator in both the adult and larval stages. Non-chemical control options for Colorado potato beetles are often limited in scope. Cultural manipulations such as crop rotation, to avoid over wintered populations, can be effective in delaying infestations and decreasing their severity. Trap crops or physical barriers (trenches) have also been used successfully in other growing regions to delay infestation. Biological regulation by beneficial insects (predators, parasitoids, etc.) is usually ineffective and growers must rely on chemical control to prevent economic damage.

Potato leafhoppers migrate yearly into Wisconsin from southeastern U.S. Both the adult and nymphal stages cause damage by feeding on the plant sap, disrupting the plants ability to translocate photosynthates from the leaves. The resultant hopper burn can cause serious yield loss in potato. Potato leafhopper control options are limited since both cultural and biological controls are not effective and growers must again rely on insecticidal control when populations exceed damage thresholds.

Green peach aphids, like the potato leafhopper, feed by extracting sap from the plant. However, plant conductive tissues are not seriously damaged during feeding and extremely high populations are necessary to remove sufficient sap to cause wilting and plant death. Populations normally reach this level only late in the season and vine damage is seen in relatively small, circular patches of dead vines scattered throughout the fields. Although direct damage rarely results from

aphid feeding earlier in the season, the green peach aphid is an efficient vector of several potato viruses (e.g. potato virus Y and potato leaf roll virus) and indirect damage can occur from low aphid population levels as a result of virus transmission. In processing and fresh market potatoes, viruses rarely cause current season yield reduction and concern is primarily centered on the prevention of potato leaf roll virus spread which can reduce processing quality through expression in tubers (net necrosis). In processing potatoes, control actions are often recommended at levels of 1 aphid per leaf or below. Higher aphid levels can be tolerated in fresh market production but since aphids reproduce very quickly, population explosions can occur rapidly and control actions are normally taken at or below 4-5 aphids per leaf before damaging levels are reached. In seed potato production, virus spread must be held close to zero to achieve certification and consequently control actions are taken at extremely low aphid levels (1 green peach aphid per 10 leaves).

Control options for aphids are also limited and the primary management tool is again insecticide use. Cultural controls are not effective since winged aphids can be carried over long distances by wind. However, broad complexes of beneficial insects (both predators and parasitoids) utilize aphids as hosts and they can limit aphid populations if left undisturbed by insecticides. Beneficial insects represent an important natural aphid mortality factor which should be preserved whenever possible and used in conjunction with insecticidal control.

Although cultural and biological controls can provide some level of population reduction; key insect pests of potato are currently being managed primarily with insecticides. Chemical management programs should be designed to hold key insect pest populations below damaging levels while avoiding the potential problems associated with resistance, non-target toxicity, environmental degradation and worker safety. The following studies describe research conducted in 2004 on the control of key insect pests of potato using registered and experimental insecticides.

### **Part 1. Insect Control with Soil Applied Systemic Insecticides.**

Systemic insecticides are those applied to the soil (or seed piece) at planting or very early in the growing season (planting-emergence). They are taken up by the plant and provide protection for an extended period of time. Since 1995 several nicotinyl, systemic insecticides have been registered on potatoes in Wisconsin and several others will be registered in the coming years. Nicotinyls have been widely used by the Wisconsin potato industry because they are flexible systemic insecticides with low mammalian toxicity, low environmental impact, and excellent efficacy against key potato pests (Colorado potato beetle and aphids).

## **A. Colorado Potato Beetle Control with Soil Insecticides, Hancock.**

The Colorado potato beetle is the foremost potatoe insect pest throughout the Midwestern and Eastern growing regions of the United States. Insecticide resistance is widespread in most areas and effective registered materials are becoming more limited. Since the mid 1990's soil applied, systemic insecticides have been widely used for Colorado potato beetle control because of their effectiveness and reduced labor inputs.

Imidacloprid and thiamethoxam are extremely flexible insecticides that are currently registered on potatoes in Wisconsin. Formulations are now registered for soil application as furrow sprays, fertilizer incorporation, and layby applications (Admire and Platinum), seed treatments (Genesis, Gaucho, Tops MZ Gaucho and Cruiser), and foliar sprays (Provado and Actara).

Russet Burbank variety potatoes were planted on April 21 into plots consisting of 4 x 20' rows, replicated four times in a randomized block experimental design. Rows were planted on 3' centers with 12 inch plant spacing. Treatments were separated by two untreated border rows (Russet Burbank variety) to provide continual infestation while 15' alleys separated replicates.

Imidacloprid was evaluated in furrow and as seed treatments. Admire 2SC was evaluated in furrow at 13, 16, and 19 ounces product per acre (oz./a) over fungicide treated seed (Tops MZ 8.5DS at the rate of 12 oz./cwt.). Genesis 2FL was evaluated as a seed piece spray at 0.6 and 0.8 fl. oz./cwt. in combination with Tops MZ 8.5DS (12 oz./cwt.). TopsMZ-Gaucho was also evaluated as seed piece treatments (12 oz./cwt.).

Thiamethoxam was evaluated as in furrow, seed treatments and as pre emergence and emergence treatments. Platinum 2SC was evaluated in furrow at 6.5 and 8 oz./a over fungicide treated seed (Maxim 5FS at the rate of 0.08 fl. oz./cwt.). Cruiser 5FS was also evaluated as a seed treatment (0.16 and 0.12 fl. oz./cwt.) in combination with Maxim 5FS (0.08 fl. oz./cwt.).

Several experimental systemic insecticides were evaluated as seed piece treatments, in furrow, pre emergence and emergence applications. Poncho 600L (clothianidin) was evaluated at 0.1 and 0.2 oz. a.i./cwt applied as seed treatments. Vydate CLV (oxamyl) was evaluated at 2 qt./a in furrow followed by a emergence application of Vydate CLV at 2 qt./a. Regent 4SC (fipronil) was evaluated at 3.2 fl. oz./a as an in furrow treatment. Venom 75SG (dinotefuran) was evaluated at 120 g. a.i./a as an in furrow treatment. Venom 20SG (dinotefuran) was evaluated at 120 g. a.i./a as an in furrow treatment, pre emergence treatment, and emergence treatment. Belay 16WSP (clothianidan) was evaluated at 12, 18, and 36 oz./a as in furrow applications.

In furrow insecticides were applied in a 4-6" band over suberized seed pieces using a CO<sub>2</sub> pressurized back pack sprayer with a single hollow cone nozzle (TXVS-6) delivering 5 gpa at 30 psi. Seed piece treatments were applied by adding preweighed dry formulation materials to preweighed, cut, and suberized potato seed pieces in plastic bags. Bags were shaken thoroughly and seed pieces were hand placed (12" spacing) into open furrows and covered by hilling. Pre emergence and emergence applications were made with a CO<sub>2</sub> pressurized back pack sprayer with a single hollow cone nozzle (TXVS-6) delivering 5 gpa at 30 psi. Both pre emergence and emergence applications were immediately followed by hilling. Pre emergence applications were made to the top of each potato hill just prior to plant emergence (May 11). Emergence applications were made to the top of each hill post emergence when the plants were 2-4" tall (May 18). Foliar applications of Asana XL at 8 oz./a and BAS 320I 2SC at the rate of 4 fl. oz./a were applied on July 16 to the Vydate CLV and Regent 4SC treatments respectively.

Colorado potato beetle (CPB) populations were surveyed weekly from June 1 through July 26 by counting CPB life stages (adults, egg masses, small and large larvae) on ten plants from the center two rows of each plot. Damage was recorded weekly by estimating percent defoliation of each plot.

Plots were overhead irrigated with 0.5" water every 2-5 days from plant emergence to vine kill for a total of 10.3 inches of water.

Plots were vine killed on August 3 (Reglone 1 pt./a) and a single row from the center two rows (20') were harvested and graded for yield on August 19. Plot maintenance was conducted by Hancock Agriculture Research Station personnel and was per commercial production.

## **Results**

Colorado potato beetle adult and egg mass numbers (first generation) peaked in mid June (Tables 1 and 2). Oviposition from overwintered adult populations peaked in the untreated plots on June 14 with 4.5 egg masses per 10 plants, thereafter numbers declined during late June and few were detected during July. Overwintered adult numbers declined in the untreated plots after June 21 and they were few detected until second-generation adult emergence between July 19 and 26. Adults were evenly distributed among the treatments during peak infestation, reflecting their mobility and movement among the plots. Egg mass numbers, however, were greatly influenced by the systemic insecticide treatments with significantly fewer among many of the treatments.

Small larvae were first detected in the untreated plots on June 14 and numbers peaked 105 to 200.5 larvae per plot on June 21 63 days after planting (dap) (Table 3). Large larval numbers peaked in the untreated plots at 49.8 to 66.3

larvae per plot (June 28, 70 dap) (Table 4). Large larval numbers remained high in the untreated plots through July 12 (84 dap). Second generation adults and large larvae caused defoliation in the untreated plots to increase from 8.8% to 12.5% on June 28 (70 dap) to 88.8% to 95.0% on July 26 (98 dap) (Table 5).

In furrow treatments with both Platinum and Admire provided excellent control (Tables 1-5). In 2004, however, cool, wet conditions with heavy precipitation in May and June may have resulted in leaching of the more water soluble Platinum and in consequence the Platinum treatments began to lose effectiveness more rapidly than Admire. This was particularly evident with the low Platinum rate where small and large larval populations were higher on 7/6 (78 dap). By 7/12 (84 dap) larval populations were increasing more rapidly in both Platinum treatments while all Admire treatments remained effective (Tables 3 and 4). The longer persistence of Admire in 2004 was also reflected in defoliation ratings (Table 5) where the higher rates of Admire held defoliation below 5% through 98 dap.

The experimental neonicotinoid Belay provided excellent control of both larvae and defoliation with efficacy equal to or better than the highest rates of Platinum and Admire (Tables 3 and 4). Venom was less effective with increases in small and large larvae noted at 63 and 70 dap, respectively (Tables 3 and 4) and 25% defoliation at 84 dap compared to 0% in all rates of Admire. Venom is another highly water soluble compound and these treatments were also negatively impacted by the higher than normal amounts of rainfall in 2004.

The Vydate program with both in furrow and emergence treatments and a foliar spray of Asana was not effective. Small and large larvae increases were noted at 63 and 70 dap (Tables 3 and 4) although defoliation was held to 14% prior to emergence of 2<sup>nd</sup> generation adults (Table 5).

Regent, which has demonstrated excellent CPB efficacy in previous years was tested at a lower rate (3.2 oz./A) in 2004 which proved to be less persistent. By 63 and 70 dap respectively, small and large larval populations were reduced but were not significantly different from the controls (Tables 3 and 4). Defoliation (Table 5) reached 38% on 7/12 (84 dap) which was not significantly different from the control (50%). It was evident that Regent at the low rates, which are anticipated for registration, will require additional foliar treatments to achieve season-long CPB control.

The application of systemics as layby treatments to increase persistence by avoiding early season leaching has not been successful in previous trials. In 2004, however, with wet conditions in early season, which were conducive to leaching, the emergence treatments with Platinum did increase persistence. This was seen with both the pre-emergence and early emergence treatments which were similar and out performed equivalent rates in furrow. Layby treatments

provided essentially complete control of both small (Table 3) and large (Table 4) larvae throughout the season and defoliation (Table 5) was held close to 0%. The increased efficacy of layby treatments of Platinum in 2004 compared to an equivalent 8.0 oz. rate applied in furrow probably resulted from the avoidance of leaching by delaying the application by 2-3 weeks and changing its position in the soil profile from below the seed piece to above. A similar improvement in performance with a layby application was also seen with Venom which was ineffective as a furrow treatment but significantly improved as a layby treatment. This was particularly evident on 7/6 (78 dap) with both small and large larvae which were reduced by over 50% (Tables 3 and 4) and defoliation which was reduced from 19% to 0% (Table 5).

Seed treatments with neonicotinoids have generally exhibited 7-10 days less persistence in previous years. In 2004, however, seed treatments provided excellent control with persistence equivalent to furrow treatments. It is possible that the cool, wet conditions in early season which reduced the persistence of furrow treatments (particularly the more soluble Platinum) also aided in improving the persistence of the seed treatments. Gaucho, Genesis and Cruiser provided excellent small and large larval control through 70 dap (Tables 3 and 4) and held defoliation close to 0% through 84 dap which was equivalent persistence to similar rates of active ingredient applied in furrow. The Poncho experimental was slightly more persistent, particularly at the higher rate with excellent larval control (Tables 3 and 4) and 0% defoliation at 91 dap (Table 5).

Yields typically reflect the amount of damage from Colorado potato beetle and total yields from the plots ranged from 77.8 cwt. per acre in one of the untreated treatments to 201.0 cwt. per acre in the high rate of Cruiser (0.16 fl. oz./cwt.) (Table 6). Yields among the treatments were low and variable and no clear trends among application types are seen.

These data demonstrate that the neonicotinoid systemic insecticides provide excellent control of CPB with great flexibility. Furrow treatments remain the standard but in wet years such as 2004, both seed and layby applications were equally effective.

Table 1. Colorado potato beetle adults sampled from Russet Burbank variety potatoes treated with systemic insecticides. Hancock, WI 2004.

Treatment	Place	Rate	Mean adults per 10 plants									
			6-1 (42 dap)	6-8 (50 dap)	6-14 (56 dap)	6-21 (63 dap)	6-28 (70 dap)	7-6 (78 dap)	7-12 (84 dap)	7-19 (91 dap)	7-26 (98 dap)	
Poncho 600L**	S	0.1 oz. a.i./cwt	0.8 cd	1.3 cd	4.5 cd	2.8 b-h	3.5 ab	1.3 a-d	0.8 bcd	17.0 cde	37.8 b-g	
Poncho 600L**	S	0.2 oz. a.i./cwt	0.8 cd	2.3 a-d	4.0 cd	3.0 a-g	3.8 a	1.8 abc	1.5 a-d	12.5 cde	83.8 ab	
Cruiser 5FS**	S	0.16 fl. oz./cwt	0.5 cd	0.5 d	6.5 a-d	4.5 a-d	1.8 a-f	3.0 a	3.3 ab	18.5 cde	69.5 a-d	
Cruiser 5FS**	S	0.12 fl. oz./cwt	1.5 bcd	1.5 cd	4.5 cd	3.8 a-g	3.3 abc	1.0 a-d	0.0 d	23.3 b-e	76.5 abc	
A1415 2FS	S	0.167 fl. oz./a	0.3 d	0.8 d	5.8 a-d	3.8 a-f	1.8 a-f	0.8 bcd	0.5 bcd	9.3 de	32.0 b-g	
Genesis 2FL*	S	0.6 fl. oz./cwt	1.0 bcd	1.8 a-d	3.8 cd	5.3 abc	2.3 a-f	0.3 cd	0.5 bcd	29.8 a-e	63.0 a-e	
Genesis 2FL*	S	0.8 fl. oz./cwt	0.8 cd	0.5 d	5.3 bcd	2.5 a-h	3.0 a-e	1.8 abc	1.5 a-d	24.0 cde	44.3 b-g	
Tops MZ-Gaucho 1.25D	S	12 oz./cwt	1.0 bcd	1.5 bcd	5.8 a-d	3.8 a-f	1.8 a-f	1.0 a-d	0.3 cd	17.3 b-e	109.3 a	
Control**	S	---	1.5 bcd	4.8 a	5.8 bcd	1.3 gh	0.3 ef	0.0 d	1.5 a-d	46.8 abc	12.0 fg	
Vydate CVL** +Asana XL 0.66E	F+E +Foliar	2 qt./a +8 oz./a	1.0 bcd	0.5 d	8.8 abc	1.8 d-h	0.5 def	0.0 d	0.3 cd	40.0 a-d	69.5 a-d	
Regent 4SC** +BAS 320I 2SC	F +Foliar	3.2 fl. oz./a + 4 fl. oz./a	1.5 bcd	2.3 a-d	6.0 a-d	0.8 h	0.8 c-f	0.3 cd	1.0 a-d	35.0 a-e	70.5 a-f	
Regent 4SC**	F	3.2 fl. oz./a	1.5 bcd	2.0 a-d	5.3 bcd	1.5 fgh	0.8 c-f	0.5 bcd	0.3 cd	42.8 abc	23.3 c-g	
Platinum 2SC**	F	6.5 fl. oz./a	1.3 bcd	0.8 d	7.5 a-d	4.0 a-f	2.8 a-d	1.8 abc	1.3 a-d	12.5 cde	44.5 a-g	
Platinum 2SC**	F	8.0 fl. oz./a	1.5 bcd	0.8 d	5.0 cd	3.3 a-h	1.8 a-f	0.3 cd	0.5 bcd	12.3 cde	62.8 a-d	

Means in a column followed by the same letter are not significantly different (Least Significant Difference Test, P = 0.05).

\*Tops MZ 8.5DS added as a seed treatment at 12 oz./cwt. for disease control.

\*\*Maxim 5FS added as a seed treatment at 0.08 fl. oz./cwt. for disease control.

S=seed treatment applications on April 19, F=in furrow applications made on April 21, PE=pre emergence applications on May 11, E=emergence applications on May 18.

Foliar applications made July 16 (87 dap).

Table 1. (Continued). Colorado potato beetle adults sampled from Russet Burbank variety potatoes treated with systemic insecticides. Hancock, WI 2004.

Treatment	Place	Rate	Mean adults per 10 plants									
			6-1 (42 dap)	6-8 (50 dap)	6-14 (56 dap)	6-21 (63 dap)	6-28 (70 dap)	7-6 (78 dap)	7-12 (84 dap)	7-19 (91 dap)	7-26 (98 dap)	
Admire 2F*	F	13 fl. oz./a	1.5 bcd	1.3 cd	5 cd	2.3 b-h	3.3 a-d	1.0 a-d	1.0 bcd	16.8 cde	113.3 a	
Admire 2F*	F	16 fl. oz./a	0.5 cd	1.8 a-d	7.3 a-d	4.0 a-e	2.5 a-f	0.8 bcd	0.3 cd	46.8 a-e	57.3 a-f	
Admire 2F*	F	19 fl. oz./a	2.0 abc	1.0 cd	4.0 cd	1.8 e-h	0.5 def	1.5 abc	1.5 a-d	17.8 b-e	84.0 abc	
Venom 75SG**	F	120 g. a.i./a	0.3 d	4.0 ab	5.8 a-d	2.3 b-h	0.8 b-f	0.0 d	0.0 d	32.8 a-e	30.5 b-g	
Venom 20SG**	F	120 g. a.i./a	2.0 abc	3.5 abc	6.3 a-d	1.3 gh	0.5 def	0.0 d	0.0 d	30.0 a-e	35.5 b-g	
Belay 16WSP**	F	12 oz./a	0.8 cd	1.3 cd	4.0 cd	3.8 a-g	2.8 a-e	1.0 a-d	3.5 a	7.8 de	69.8 a-d	
Belay 16WSP**	F	18 oz./a	0.8 cd	1.0 cd	4.5 cd	3.5 a-g	2.5 a-e	0.3 cd	2.0 a-d	7.5 de	43.8 a-g	
Belay 16WSP**	F	36 oz./a	1.5 bcd	1.0 cd	3.8 d	1.5 e-h	1.0 a-f	0.5 bcd	1.5 a-d	6.3 e	55.5 a-g	
Control**	S	---	3.8 a	4.3 ab	4.3 cd	2.5 b-h	0.5 def	0.3 cd	1.3 a-d	74.5 a	16.8 d-g	
Platinum 2SC**	PE	8.0 fl. oz./a	1.3 bcd	1.3 cd	5.3 cd	2.0 c-h	2.3 a-f	2.0 abc	2.3 a-d	31.8 b-e	58.0 a-e	
Platinum 2SC**	E	8.0 fl. oz./a	0.5 d	1.5 cd	4.3 cd	3.3 a-g	1.3 a-f	2.0 ab	1.5 a-d	7.5 de	90.3 abc	
Venom 20SG**	PE	120 g. a.i./a	2.5 ab	0.8 d	11.0 a	5.0 ab	1.5 a-f	0.3 cd	0.3 cd	31.0 a-e	26.5 b-g	
Venom 20SG**	E	120 g. a.i./a	1.5 bcd	2.8 a-d	10.0 ab	5.5 a	3.5 ab	2.0 abc	3.0 abc	69.8 ab	8.0 g	
Control**	S	---	0.5 d	3.3 abc	5.0 cd	1.8 e-h	0.0 f	0.3 cd	1.5 a-d	47.0 abc	13.0 efg	

Means in a column followed by the same letter are not significantly different (Least Significant Difference Test, P = 0.05).

\*Tops MZ 8.5DS added as a seed treatment at 12 oz./cwt. for disease control.

\*\*Maxim 5FS added as a seed treatment at 0.08 fl. oz./cwt. for disease control.

S=seed treatment applications on April 19, F=in furrow applications made on April 21, PE=pre emergence applications on May 11,

E=emergence applications on May 18.

Foliar applications made July 16 (87 dap).

Table 2. Colorado potato beetle egg masses sampled from Russet Burbank variety potatoes treated with systemic insecticides. Hancock, WI 2004.

Treatment	Place	Rate	Mean egg masses per 10 plants								
			6-1 (42 dap)	6-8 (50 dap)	6-14 (56 dap)	6-21 (63 dap)	6-28 (70 dap)	7-6 (78 dap)	7-12 (84 dap)	7-19 (91 dap)	7-26 (98 dap)
Poncho 600L**	S	0.1 oz. a.i./cwt	0.3 bc	0.0 d	1.0 b-g	1.5 b-g	1.3 abc	0.8 ab	0.3 ab	0 c	0.0 b
Poncho 600L**	S	0.2 oz. a.i./cwt	0.0 c	0.0 d	0.5 efg	0.5 fg	1.3 abc	0.0 b	0.0 b	0.3 bc	0.0 b
Cruiser 5FS**	S	0.16 fl. oz./cwt	0.0 c	0.0 d	1.5 b-g	1.0 c-g	2.0 ab	0.3 ab	0.3 ab	0.3 bc	0.0 b
Cruiser 5FS**	S	0.12 fl. oz./cwt	0.0 c	0.0 d	0.8 c-g	2.5 abc	2.3 a	0.8 a	0.0 b	0.0 c	0.0 b
A1415 2FS	S	0.167 fl. oz./a	0.0 c	0.0 d	0.5 d-g	1.3 b-g	0.3 c	0.3 ab	0.0 b	0.0 c	0.0 b
Genesis 2FL*	S	0.6 fl. oz./cwt	0.0 c	0.0 d	2.3 abc	2.8 a-d	0.8 abc	0.0 b	0.0 b	0.0 c	0.0 b
Genesis 2FL*	S	0.8 fl. oz./cwt	0.0 c	0.8 bcd	0.5 d-g	1.3 b-g	1.5 abc	1.0 a	0.3 ab	0.0 c	0.0 b
Tops MZ-Gaucho 1.25D	S	12 oz./cwt	0.0 c	0.3 cd	0.0 g	2.0 b-f	2.5 ab	0.0 b	0.0 b	0.0 c	0.0 b
Control**	S	---	1.3 a	3.8 a	4.5 a	1.5 b-g	0.0 c	0.0 b	0.0 b	0.0 c	0.0 b
Vydate CVL**	F+E	2 qt./a	0.0 c	1.8 a-d	2.0 a-d	2.3 a-d	0.3 c	0.0 b	0.0 b	0.0 c	0.0 b
+Asana XL 0.66E	+Foliar	+8 oz./a	1.5 a	5.3 a	1.5 b-f	1.0 c-g	0.5 bc	0.0 b	0.0 b	0.0 c	0.0 b
Regent 4SC**	F	3.2 fl. oz./a	0.0 c	2.5 ab	1.3 b-g	1.8 b-g	0.0 c	0.0 b	0.0 b	0.0 c	0.0 b
+BAS 320I 2SC	+Foliar	+ 4 fl. oz./a	0.0 c	0.0 d	0.5 efg	3.0 ab	1.3 abc	0.5 ab	0.0 b	0.0 c	0.0 b
Regent 4SC**	F	3.2 fl. oz./a	0.3 bc	0.0 d	0.3 fg	0.8 d-g	1.8 abc	0.8 a	0.0 b	0.0 c	0.0 b
Platinum 2SC**	F	6.5 fl. oz./a	0.3 bc	0.0 d	0.3 fg	0.8 d-g	1.8 abc	0.8 a	0.0 b	0.0 c	0.0 b
Platinum 2SC**	F	8.0 fl. oz./a	0.3 bc	0.0 d	0.3 fg	0.8 d-g	1.8 abc	0.8 a	0.0 b	0.0 c	0.0 b

Means in a column followed by the same letter are not significantly different (Least Significant Difference Test, P = 0.05).

\*Tops MZ 8.5DS added as a seed treatment at 12 oz./cwt. for disease control.

\*\*Maxim 5FS added as a seed treatment at 0.08 fl. oz./cwt. for disease control.

S=seed treatment applications on April 19, F=in furrow applications made on April 21, PE=pre emergence applications on May 11, E=emergence applications on May 18.

Foliar applications made July 16 (87 dap).

Table 2. (Continued). Colorado potato beetle egg masses sampled from Russet Burbank variety potatoes treated with systemic insecticides. Hancock, WI 2004.

Treatment	Place	Rate	Mean egg masses per 10 plants								
			6-1 (42 dap)	6-8 (50 dap)	6-14 (56 dap)	6-21 (63 dap)	6-28 (70 dap)	7-6 (78 dap)	7-12 (84 dap)	7-19 (91 dap)	7-26 (98 dap)
Admire 2F*	F	13 fl. oz./a	0.0 c	0.5 bcd	0.3 fg	1.3 c-g	0.8 abc	0.0 b	0.0 b	0.3 bc	0.0 b
Admire 2F*	F	16 fl. oz./a	0.0 c	0.3 cd	0.5 efg	0.5 efg	0.0 c	0.3 ab	0.3 ab	0.0 c	0.3 a
Admire 2F*	F	19 fl. oz./a	0.0 c	0.0 d	0.5 efg	1.3 b-g	0.3 c	0.0 b	0.0 b	0.3 bc	0.0 b
Venom 75SG**	F	120 g. a.i./a	0.0 c	2 abc	1.3 b-g	2.3 a-d	0.8 abc	0.0 b	0.0 b	0.0 c	0.0 b
Venom 20SG**	F	120 g. a.i./a	0.0 c	1.0 bcd	1.3 b-g	2.3 b-f	0.5 bc	0.0 b	0.0 b	0.0 c	0.0 b
Belay 16WSP**	F	12 oz./a	0.0 c	0.0 d	0.3 fg	0.8 d-g	0.5 bc	0.8 a	0.8 a	0.5 ab	0.0 b
Belay 16WSP**	F	18 oz./a	0.0 c	0.0 d	0.8 c-g	0.3 g	0.0 c	0.3 ab	0.0 b	0.0 c	0.0 b
Belay 16WSP**	F	36 oz./a	0.3 bc	0.0 d	2.8 abc	0.3 g	0.0 c	0.0 b	0.0 b	0.0 c	0.0 b
Control**	S	---	0.5 b	3.8 a	2.5 ab	0.8 d-g	0.0 c	0.0 b	0.0 b	0.0 c	0.0 b
Platinum 2SC**	PE	8.0 fl. oz./a	0.0 c	0.3 cd	0.5 efg	1.0 c-g	0.0 c	0.3 ab	0.5 a	0.8 a	0.0 b
Platinum 2SC**	E	8.0 fl. oz./a	0.0 c	0.0 d	0.8 c-g	0.5 efg	0.0 c	0.3 ab	0.0 b	0.0 c	0.0 b
Venom 20SG**	PE	120 g. a.i./a	0.3 bc	0.0 d	0.5 d-g	4.5 a	1.0 abc	0.0 b	0.0 b	0.0 c	0.0 b
Venom 20SG**	E	120 g. a.i./a	0.0 c	0.0 d	0.8 c-g	2.5 b-e	0.8 abc	0.5 ab	0.0 b	0.0 c	0.0 b
Control**	S	---	0.0 c	1.0 bcd	1.8 a-e	1.3 c-g	0.0 c	0.0 b	0.0 b	0.0 c	0.0 b

Means in a column followed by the same letter are not significantly different (Least Significant Difference Test, P = 0.05).

\*Tops MZ 8.5DS added as a seed treatment at 12 oz./cwt. for disease control.

\*\*Maxim 5FS added as a seed treatment at 0.08 fl. oz./cwt. for disease control.

S=seed treatment applications on April 19, F=in furrow applications made on April 21, PE=pre emergence applications on May 11,

E=emergence applications on May 18.

Foliar applications made July 16 (87 dap).

Table 3. Colorado potato beetle small larvae sampled from Russet Burbank variety potatoes treated with systemic insecticides. Hancock, WI 2004.

Treatment	Place	Rate	Mean larvae per 10 plants									
			6-1 (42 dap)	6-8 (50 dap)	6-14 (56 dap)	6-21 (63 dap)	6-28 (70 dap)	7-6 (78 dap)	7-12 (84 dap)	7-19 (91 dap)	7-26 (98 dap)	
Poncho 600L**	S	0.1 oz. a.i./cwt	0.0 a	0.0 a	2.5 c	0.0 e	0.8 c	10.3 d-j	36.8 abc	11.3 a	0.0 c	
Poncho 600L**	S	0.2 oz. a.i./cwt	0.0 a	0.0 a	0.0 c	0.0 e	0.5 c	1.3 g-j	11.0 d-i	2.3 b-e	0.0 c	
Cruiser 5FS**	S	0.16 fl. oz./cwt	0.0 a	0.0 a	0.0 c	0.0 e	0.0 c	20.0 a-f	25.5 b-e	3.5 b-e	2.5 abc	
Cruiser 5FS**	S	0.12 fl. oz./cwt	0.0 a	0.0 a	0.0 c	0.0 e	1.5 c	15.8 b-g	30.8 a-d	2.5 b-e	0.0 c	
A1415 2FS	S	0.167 fl. oz./a	0.0 a	0.0 a	0.0 c	0.0 e	0.5 c	12.0 c-i	16.0 b-g	3.5 a-e	2.8 abc	
Genesis 2FL*	S	0.6 fl. oz./cwt	0.0 a	0.0 a	0.0 c	0.0 e	0.0 c	13.8 b-g	18.0 b-f	4.3 a-e	0.0 c	
Genesis 2FL*	S	0.8 fl. oz./cwt	0.0 a	0.0 a	0.0 c	3.5 e	0.8 c	7.5 d-j	35.0 a-d	5.3 a-e	0.0 c	
Tops MZ-Gaucho 1.25D	S	12 oz./cwt	0.0 a	0.0 a	0.0 c	0.0 e	0.0 c	6.5 e-j	19.0 b-g	8.8 ab	0.0 c	
Control**	S	---	0.0 a	0.0 a	54.3 a	105.0 c	84.8 a	40.8 abc	81.5 a	2.5 b-e	0.0 c	
Vydate CVL** +Asana XL 0.66E	F+E +Foliar	2 qt./a +8 oz./a	0.0 a	0.0 a	2.8 c	53.8 d	48.5 ab	50.8 a	18.3 b-f	1.5 cde	0.0 c	
Regent 4SC** +BAS 320I 2SC	F +Foliar	3.2 fl. oz./a + 4 fl. oz./a	0.0 a	0.0 a	26.3 ab	124.0 bc	62.3 ab	16.0 b-h	0.5 hi	0.0 e	0.0 c	
Regent 4SC**	F	3.2 fl. oz./a	0.0 a	0.0 a	19.3 b	107.3 bc	73.3 ab	27.3 a-d	7.0 e-i	4.5 a-e	0.0 c	
Platinum 2SC**	F	6.5 fl. oz./a	0.0 a	0.0 a	14.0 bc	0.3 e	0.3 c	23.3 a-e	27.0 b-e	7.8 a-d	0.8 abc	
Platinum 2SC**	F	8.0 fl. oz./a	0.0 a	0.0 a	0.0 c	0.0 e	0.5 c	5.3 e-j	26.8 b-e	5.5 a-e	0.0 c	

Means in a column followed by the same letter are not significantly different (Least Significant Difference Test, P = 0.05).

\*Tops MZ 8.5DS added as a seed treatment at 12 oz./cwt. for disease control.

\*\*Maxim 5FS added as a seed treatment at 0.08 fl. oz./cwt. for disease control.

S=seed treatment applications on April 19, F=in furrow applications made on April 21, PE=pre emergence applications on May 11, E=emergence applications on May 18.

Foliar applications made July 16 (87 dap).

Table 3. (Continued). Colorado potato beetle small larvae sampled from Russet Burbank variety potatoes treated with systemic insecticides. Hancock, WI 2004.

Treatment	Place	Rate	Mean larvae per 10 plants								
			6-1 (42 dap)	6-8 (50 dap)	6-14 (56 dap)	6-21 (63 dap)	6-28 (70 dap)	7-6 (78 dap)	7-12 (84 dap)	7-19 (91 dap)	7-26 (98 dap)
Admire 2F*	F	13 fl. oz./a	0.0 a	0.0 a	0.0 c	0.0 e	0.0 c	1.8 g-j	5.5 f-i	4.0 b-e	5.0 ab
Admire 2F*	F	16 fl. oz./a	0.0 a	0.0 a	0.0 c	0.0 e	0.5 c	0.5 hij	5.0 f-i	0.8 de	1.3 abc
Admire 2F*	F	19 fl. oz./a	0.0 a	0.0 a	0.0 c	0.0 e	0.0 c	0.0 j	6.5 f-i	1.0 de	6.3 a
Venom 75SG**	F	120 g. a.i./a	0.0 a	0.0 a	4.8 c	48.8 d	39.8 b	31.5 abc	27.5 b-f	1.5 cde	0.5 abc
Venom 20SG**	F	120 g. a.i./a	0.0 a	0.0 a	4.3 c	48.8 d	65.0 ab	43.8 ab	18.5 b-g	3.0 b-e	0.0 c
Belay 16WSP**	F	12 oz./a	0.0 a	0.0 a	0.0 c	0.0 e	0.0 c	0.3 ij	12.3 c-i	0.0 e	0.0 c
Belay 16WSP**	F	18 oz./a	0.0 a	0.0 a	0.0 c	0.0 e	0.0 c	0.0 j	0.3 i	0.0 e	0.0 c
Belay 16WSP**	F	36 oz./a	0.0 a	0.0 a	0.0 c	0.0 e	0.0 c	0.0 j	0.0 i	0.0 e	0.0 c
Control**	S	---	0.0 a	0.0 a	26.5 ab	167.5 ab	63.0 ab	22.3 c-i	18.5 b-h	0.0 e	0.0 c
Platinum 2SC**	PE	8.0 fl. oz./a	0.0 a	0.0 a	0.0 c	0.0 e	0.0 c	0.0 j	1.0 hi	0.0 e	0.3 bc
Platinum 2SC**	E	8.0 fl. oz./a	0.0 a	0.0 a	0.0 c	0.3 e	0.0 c	0.3 ij	3.0 ghi	0.0 e	0.0 c
Venom 20SG**	PE	120 g. a.i./a	0.0 a	0.0 a	0.0 c	2.3 e	7.5 c	21.0 b-f	20.3 b-f	8.8 abc	0.0 c
Venom 20SG**	E	120 g. a.i./a	0.0 a	0.0 a	0.0 c	1.3 e	1.3 c	17.0 c-j	26.0 b-e	10.0 a-d	0.0 c
Control**	S	---	0.0 a	0.0 a	22.0 b	200.5 a	85.5 ab	45.0 abc	43.8 ab	0.0 e	0.0 c

Means in a column followed by the same letter are not significantly different (Least Significant Difference Test, P = 0.05).

\*Tops MZ 8.5DS added as a seed treatment at 12 oz./cwt. for disease control.

\*\*Maxim 5FS added as a seed treatment at 0.08 fl. oz./cwt. for disease control.

S=seed treatment applications on April 19, F=in furrow applications made on April 21, PE=pre emergence applications on May 11,

E=emergence applications on May 18.

Foliar applications made July 16 (87 dap).

Table 4. Colorado potato beetle large larvae sampled from Russet Burbank variety potatoes treated with systemic insecticides. Hancock, WI 2004.

Treatment	Place	Rate	Mean larvae per 10 plants								
			6-1 (42 dap)	6-8 (50 dap)	6-14 (56 dap)	6-21 (63 dap)	6-28 (70 dap)	7-6 (78 dap)	7-12 (84 dap)	7-19 (91 dap)	7-26 (98 dap)
Poncho 600L**	S	0.1 oz. a.i./cwt	0.0 a	0.0 a	0.0 a	0.0 f	0.0 e	3.8 cd	25.8 d-h	25.0 abc	1.0 bcd
Poncho 600L**	S	0.2 oz. a.i./cwt	0.0 a	0.0 a	0.0 a	0.0 f	0.0 e	0.3 cd	6.5 i-l	9.3 c-i	4.5 ab
Cruiser 5FS**	S	0.16 fl. oz./cwt	0.0 a	0.0 a	0.0 a	0.0 f	0.0 e	5.3 cd	16.8 f-i	28.0 ab	1.5 bcd
Cruiser 5FS**	S	0.12 fl. oz./cwt	0.0 a	0.0 a	0.0 a	0.0 f	0.0 e	3.5 cd	25.0 e-h	38.5 a	1.8 a-d
A1415 2FS	S	0.167 fl. oz./a	0.0 a	0.0 a	0.0 a	0.0 f	0.0 e	3.8 cd	13.3 g-k	23.5 a-d	3.0 abc
Genesis 2FL*	S	0.6 fl. oz./cwt	0.0 a	0.0 a	0.0 a	0.0 f	0.0 e	1.5 cd	21.3 f-i	27.0 a-d	2.3 a-d
Genesis 2FL*	S	0.8 fl. oz./cwt	0.0 a	0.0 a	0.0 a	0.0 f	1.3 e	10.0 cd	24.0 e-h	40.3 a	1.8 a-d
Tops MZ-Gaucho 1.25D	S	12 oz./cwt	0.0 a	0.0 a	0.0 a	0.0 f	0.0 e	7.0 cd	14.5 g-k	22.8 a-e	5.3 a
Control**	S	---	0.0 a	0.0 a	0.0 a	10.5 cde	61.3 ab	71.8 a	51.8 a-d	12.5 b-g	0.0 d
Vydate CVL** +Asana XL 0.66E	F+E +Foliar	2 qt./a +8 oz./a	0.0 a	0.0 a	0.0 a	2.0 def	18.3 d	41.3 ab	34.5 c-f	8.3 d-i	0.5 cd
Regent 4SC** +BAS 320I 2SC	F +Foliar	3.2 fl. oz./a + 4 fl. oz./a	0.0 a	0.0 a	0.0 a	19.8 a	37.5 bc	43.5 b	4.5 jkl	23.0 b-h	1.8 bcd
Regent 4SC**	F	3.2 fl. oz./a	0.0 a	0.0 a	0.0 a	7.3 cd	46.8 abc	46.3 ab	24.5 e-h	15.5 b-f	0.0 d
Platinum 2SC**	F	6.5 fl. oz./a	0.0 a	0.0 a	0.0 a	0.5 ef	0.3 e	7.0 cd	30.3 d-g	25.8 abc	1.3 bcd
Platinum 2SC**	F	8.0 fl. oz./a	0.0 a	0.0 a	0.0 a	2.0 def	0.0 e	1.5 cd	16.0 g-j	25.3 abc	1.8 a-d

Means in a column followed by the same letter are not significantly different (Least Significant Difference Test, P = 0.05).

\*Tops MZ 8.5DS added as a seed treatment at 12 oz./cwt. for disease control.

\*\*Maxim 5FS added as a seed treatment at 0.08 fl. oz./cwt. for disease control.

S=seed treatment applications on April 19, F=in furrow applications made on April 21, PE=pre emergence applications on May 11, E=emergence applications on May 18.

Foliar applications made July 16 (87 dap).

Table 4. (Continued). Colorado potato beetle large larvae sampled from Russet Burbank variety potatoes treated with systemic insecticides. Hancock, WI 2004.

Treatment	Place	Rate	Mean larvae per 10 plants								
			6-1 (42 dap)	6-8 (50 dap)	6-14 (56 dap)	6-21 (63 dap)	6-28 (70 dap)	7-6 (78 dap)	7-12 (84 dap)	7-19 (91 dap)	7-26 (98 dap)
Admire 2F*	F	13 fl. oz./a	0.0 a	0.0 a	0.0 a	0.0 f	0.0 e	1.0 cd	5.0 i-l	8.8 e-i	3.3 abc
Admire 2F*	F	16 fl. oz./a	0.0 a	0.0 a	0.0 a	0.0 f	0.0 e	0.0 d	3.5 kl	7.3 f-i	0.8 cd
Admire 2F*	F	19 fl. oz./a	0.0 a	0.0 a	0.0 a	0.0 f	0.0 e	0.0 d	0.0 l	8.8 c-i	2.5 a-d
Venom 75SG**	F	120 g. a.i./a	0.0 a	0.0 a	0.0 a	0.0 f	27.8 cd	49.8 ab	76.3 a	22.3 a-e	0.0 d
Venom 20SG**	F	120 g. a.i./a	0.0 a	0.0 a	0.0 a	1.3 def	30.0 cd	37.0 b	58 abc	18.0 b-f	0.0 d
Belay 16WSP**	F	12 oz./a	0.0 a	0.0 a	0.0 a	0.0 f	0.0 e	0.0 d	3.8 jkl	7.8 e-i	0.0 d
Belay 16WSP**	F	18 oz./a	0.0 a	0.0 a	0.0 a	0.0 f	0.0 e	0.3 cd	0.3 l	0.5 i	0.3 cd
Belay 16WSP**	F	36 oz./a	0.0 a	0.0 a	0.0 a	0.0 f	0.0 e	0.0 d	0.0 l	0.0 i	0.0 d
Control**	S	---	0.0 a	0.0 a	0.0 a	18.5 ab	66.3 a	57.3 ab	42.3 cde	3.3 f-i	0.0 d
Platinum 2SC**	PE	8.0 fl. oz./a	0.0 a	0.0 a	0.0 a	0.0 f	0.0 e	0.0 d	1.0 l	1.3 ghi	0.0 d
Platinum 2SC**	E	8.0 fl. oz./a	0.0 a	0.0 a	0.0 a	0.0 f	0.0 e	0.0 d	0.8 l	0.8 hi	0.5 cd
Venom 20SG**	PE	120 g. a.i./a	0.0 a	0.0 a	0.0 a	0.0 f	3.8 e	11.5 cd	42.0 b-e	46.0 a	0.5 cd
Venom 20SG**	E	120 g. a.i./a	0.0 a	0.0 a	0.0 a	0.8 ef	1.0 e	14.5 c	49.0 b-e	44.5 a	0.8 cd
Control**	S	---	0.0 a	0.0 a	0.0 a	10.8 bc	49.8 ab	42.3 b	70.0 ab	9.0 c-i	0.0 d

Means in a column followed by the same letter are not significantly different (Least Significant Difference Test, P = 0.05).

\*Tops MZ 8.5DS added as a seed treatment at 12 oz./cwt. for disease control.

\*\*Maxim 5FS added as a seed treatment at 0.08 fl. oz./cwt. for disease control.

S=seed treatment applications on April 19, F=in furrow applications made on April 21, PE=pre emergence applications on May 11,

E=emergence applications on May 18.

Foliar applications made July 16 (87 dap).

Table 5. Defoliation ratings from Russet Burbank variety potatoes treated with systemic insecticides. Hancock, WI 2004.

Treatment	Place	Rate	Mean defoliation per plot								
			6-1 (42 dap)	6-8 (50 dap)	6-14 (56 dap)	6-21 (63 dap)	6-28 (70 dap)	7-6 (78 dap)	7-12 (84 dap)	7-19 (91 dap)	7-26 (98 dap)
Poncho 600L**	S	0.1 oz. a.i./cwt	0.0 a	0.0 a	0.0 a	0.0 b	0.0 d	0.0 c	1.3 f	8.8 fgh	32.5 c-g
Poncho 600L**	S	0.2 oz. a.i./cwt	0.0 a	0.0 a	0.0 a	0.0 b	0.0 d	0.0 c	0.0 f	0.0 h	8.8 fg
Cruiser 5FS**	S	0.16 fl. oz./cwt	0.0 a	0.0 a	0.0 a	0.0 b	0.0 d	0.0 c	0.0 f	10.0 fgh	51.3 bcd
Cruiser 5FS**	S	0.12 fl. oz./cwt	0.0 a	0.0 a	0.0 a	0.0 b	0.0 d	0.0 c	2.5 ef	11.3 fgh	47.5 bcd
A1415 2FS	S	0.167 fl. oz./a	0.0 a	0.0 a	0.0 a	0.0 b	0.0 d	0.0 c	0.0 f	7.5 fgh	37.5 c-f
Genesis 2FL*	S	0.6 fl. oz./cwt	0.0 a	0.0 a	0.0 a	0.0 b	0.0 d	0.0 c	0.0 f	7.5 fgh	43.8 b-e
Genesis 2FL*	S	0.8 fl. oz./cwt	0.0 a	0.0 a	0.0 a	0.0 b	0.0 d	0.0 c	1.3 f	6.3 fgh	32.5 c-g
Tops MZ-Gaucho 1.25D	S	12 oz./cwt	0.0 a	0.0 a	0.0 a	0.0 b	0.0 d	0.0 c	0.0 f	1.3 gh	22.5 d-g
Control**	S	---	0.0 a	0.0 a	0.0 a	1.3 a	8.8 b	38.8 a	68.8 a	76.3 ab	93.8 a
Vydate CVL** +Asana XL 0.66E	F+E +Foliar	2 qt./a +8 oz./a	0.0 a	0.0 a	0.0 a	0.0 b	0.0 d	10.0 bc	13.8 def	25.0 ef	77.5 ab
Regent 4SC** +BAS 320I 2SC	F +Foliar	3.2 fl. oz./a + 4 fl. oz./a	0.0 a	0.0 a	0.0 a	0.0 b	1.3 cd	11.3 bc	17.5 de	22.5 efg	63.8 abc
Regent 4SC**	F	3.2 fl. oz./a	0.0 a	0.0 a	0.0 a	0.0 b	7.5 b	25 ab	37.5 bc	52.5 cd	86.3 a
Platinum 2SC**	F	6.5 fl. oz./a	0.0 a	0.0 a	0.0 a	0.0 b	0.0 d	0.0 c	2.5 ef	18.8 e-h	43.8 b-e
Platinum 2SC**	F	8.0 fl. oz./a	0.0 a	0.0 a	0.0 a	0.0 b	0.0 d	0.0 c	1.3 f	7.5 fgh	12.5 efg

Means in a column followed by the same letter are not significantly different (Least Significant Difference Test, P = 0.05).

\*Tops MZ 8.5DS added as a seed treatment at 12 oz./cwt. for disease control.

\*\*Maxim 5FS added as a seed treatment at 0.08 fl. oz./cwt. for disease control.

S=seed treatment applications on April 19, F=in furrow applications made on April 21, PE=pre emergence applications on May 11, E=emergence applications on May 18.

Foliar applications made July 16 (87 dap).

Table 5. (Continued). Defoliation ratings sampled from Russet Burbank variety potatoes treated with systemic insecticides. Hancock, WI 2004.

Treatment	Place	Rate	Mean defoliation per plot								
			6-1 (42 dap)	6-8 (50 dap)	6-14 (56 dap)	6-21 (63 dap)	6-28 (70 dap)	7-6 (78 dap)	7-12 (84 dap)	7-19 (91 dap)	7-26 (98 dap)
Admire 2F*	F	13 fl. oz./a	0.0 a	0.0 a	0.0 a	0.0 b	0.0 d	0.0 c	0.0 f	0.0 h	12.5 efg
Admire 2F*	F	16 fl. oz./a	0.0 a	0.0 a	0.0 a	0.0 b	0.0 d	0.0 c	0.0 f	11.3 fgh	26.3 d-g
Admire 2F*	F	19 fl. oz./a	0.0 a	0.0 a	0.0 a	0.0 b	0.0 d	0.0 c	0.0 f	0.0 h	5.0 fg
Venom 75SG**	F	120 g. a.i./a	0.0 a	0.0 a	0.0 a	0.0 b	1.3 cd	18.8 b	42.5 b	56.3 bcd	87.5 a
Venom 20SG**	F	120 g. a.i./a	0.0 a	0.0 a	0.0 a	0.0 b	3.8 c	18.8 b	25 cd	57.5 bcd	88.8 a
Belay 16WSP**	F	12 oz./a	0.0 a	0.0 a	0.0 a	0.0 b	0.0 d	0.0 c	0.0 f	0.0 h	3.8 fg
Belay 16WSP**	F	18 oz./a	0.0 a	0.0 a	0.0 a	0.0 b	0.0 d	0.0 c	0.0 f	0.0 h	1.3 g
Belay 16WSP**	F	36 oz./a	0.0 a	0.0 a	0.0 a	0.0 b	0.0 d	0.0 c	0.0 f	0.0 h	1.3 g
Control**	S	---	0.0 a	0.0 a	0.0 a	1.3 a	12.5 a	36.3 a	50.0 b	60.0 bcd	88.8 a
Platinum 2SC**	PE	8.0 fl. oz./a	0.0 a	0.0 a	0.0 a	0.0 b	0.0 d	0.0 c	0.0 f	1.3 gh	22.5 d-g
Platinum 2SC**	E	8.0 fl. oz./a	0.0 a	0.0 a	0.0 a	0.0 b	0.0 d	0.0 c	0.0 f	0.0 h	0.0 g
Venom 20SG**	PE	120 g. a.i./a	0.0 a	0.0 a	0.0 a	0.0 b	0.0 d	0.0 c	12.5 def	40.0 de	75.0 ab
Venom 20SG**	E	120 g. a.i./a	0.0 a	0.0 a	0.0 a	0.0 b	0.0 d	0.0 c	12.5 def	62.8 abc	92.5 a
Control**	S	---	0.0 a	0.0 a	0.0 a	0.0 b	8.8 b	38.8 a	72.5 a	82.5 a	95.0 a

Means in a column followed by the same letter are not significantly different (Least Significant Difference Test, P = 0.05).

\*Tops MZ 8.5DS added as a seed treatment at 12 oz./cwt. for disease control.

\*\*Maxim 5FS added as a seed treatment at 0.08 fl. oz./cwt. for disease control.

S=seed treatment applications on April 19, F=in furrow applications made on April 21, PE=pre emergence applications on May 11,

E=emergence applications on May 18.

Foliar applications made July 16 (87 dap).

Table 6. Yield and percent grade of Russet Burbank variety potatoes treated with systemic insecticides. Hancock, WI 2003.

Treatment	Place	Rate	Mean percent grade		Yield (cwt/A)
			A's	B's & Culls	
Poncho 600L**	S	0.1 oz. a.i./cwt	58.6 a-i	41.4 d-l	160.5 a-e
Poncho 600L**	S	0.2 oz. a.i./cwt	59.9 a-h	40.1 e-l	189.3 abc
Cruiser 5FS**	S	0.16 fl. oz./cwt	63.2 a-f	36.8 g-l	201.0 a
Cruiser 5FS**	S	0.12 fl. oz./cwt	60.8 a-g	39.2 f-l	148.6 a-e
A1415 2FS	S	0.167 fl. oz./a	50.5 e-l	49.5 a-h	135.7 a-e
Genesis 2FL*	S	0.6 fl. oz./cwt	56.1 b-k	43.9 b-k	137.1 a-e
Genesis 2FL*	S	0.8 fl. oz./cwt	56.7 a-k	43.3 b-l	200.8 a
Tops MZ-Gaucho 1.25D	S	12 oz./cwt	66.7 abc	33.3 jkl	195 ab
Control**	S	---	43.4 kl	56.6 ab	77.8 ef
Vydate CVL**	F+E	2 qt./a	52.9 d-l	47.1 a-i	180.2 abc
+Asana XL 0.66E	+Foliar	+8 oz./a			
Regent 4SC** +BAS	F	3.2 fl. oz./a	48.6 g-l	51.4 a-f	139.6 a-e
320I 2SC	+Foliar	+ 4 fl. oz./a			
Regent 4SC**	F	3.2 fl. oz./a	42.0 l	58.0 a	81.2 ef
Platinum 2SC**	F	6.5 fl. oz./a	53.8 c-l	46.2 a-j	108.1 b-f
Platinum 2SC**	F	8.0 fl. oz./a	63.0 a-f	37.0 g-l	158.8 a-e
Admire 2F*	F	13 fl. oz./a	63.7 a-e	36.3 h-l	174.7 a-d
Admire 2F*	F	16 fl. oz./a	67.2 ab	32.8 kl	197.5 ab
Admire 2F*	F	19 fl. oz./a	66.5 abc	33.5 jkl	178.0 a-d
Venom 75SG**	F	120 g. a.i./a	70.1 a	29.9 l	205.4 a
Venom 20SG**	F	120 g. a.i./a	50.0 f-l	50.0 a-g	82.1 ef
Belay 16WSP**	F	12 oz./a	44.7 jkl	55.3 abc	84.6 ef
Belay 16WSP**	F	18 oz./a	63.5 a-e	36.5 h-l	152.5 a-e
Belay 16WSP**	F	36 oz./a	66.6 abc	33.4 jkl	193.0 abc
Control**	S	---	64.4 a-d	35.6 i-l	184.3 abc
Platinum 2SC**	PE	8.0 fl. oz./a	47.0 h-l	53.0 a-e	90.5 def
Platinum 2SC**	E	8.0 fl. oz./a	57.5 a-j	42.5 c-l	165.0 a-e
Venom 20SG**	PE	120 g. a.i./a	52.8 d-l	47.2 a-i	142.4 a-e
Venom 20SG**	E	120 g. a.i./a	60.5 a-g	39.5 f-l	129.6 a-e
Control**	S	---	53.0 d-l	47.0 a-i	104.3 c-f

Means in a column followed by the same letter are not significantly different (Least Significant Difference Test, P = 0.05). \*Tops MZ 8.5DS added as a seed treatment at 12 oz./cwt. for disease control. \*\*Maxim 5FS added as a seed treatment at 0.08 fl. oz./cwt. for disease control. S=seed treatment applications on April 19, F=in furrow applications made on April 21, PE=pre emergence applications on May 11, E=emergence applications on May 18. Foliar applications made July 16.

Table 7. Stand counts of Russet Burbank variety potatoes treated with systemic insecticides. Hancock, WI 2003.

Treatment	Place	Rate	Mean plants per 20' of row	
			Row 1	Row 2
Poncho 600L**	S	0.1 oz. a.i./cwt	17.8 abc	18.0 c-f
Poncho 600L**	S	0.2 oz. a.i./cwt	18.0 abc	16.3 ef
Cruiser 5FS**	S	0.16 fl. oz./cwt	18.5 abc	17.8 c-f
Cruiser 5FS**	S	0.12 fl. oz./cwt	19.8 a	21.0 a
A1415 2FS	S	0.167 fl. oz./a	17.5 abc	15.5 f
Genesis 2FL*	S	0.6 fl. oz./cwt	18.0 abc	19.3 abc
Genesis 2FL*	S	0.8 fl. oz./cwt	19.8 a	19.5 abc
Tops MZ-Gaucho 1.25D	S	12 oz./cwt	19.3 ab	19.8 abc
Control**	S	---	18.3 abc	20.3 abc
-----				
Vydate CVL**+Asana XL 0.66E	F+E+Foliar	2 qt./a+8 oz./a	18.5 abc	19.0 a-d
Regent 4SC** +BAS 320I 2SC	F+Foliar	3.2 + 4 fl. oz./a	16.8 bc	18.0 c-f
Regent 4SC**	F	3.2 fl. oz./a	19.0 ab	19.5 abc
Platinum 2SC**	F	6.5 fl. oz./a	18.5 abc	16.3 ef
Platinum 2SC**	F	8.0 fl. oz./a	17.3 abc	18.8 a-e
Admire 2F*	F	13 fl. oz./a	19.0 ab	18.8 a-e
Admire 2F*	F	16 fl. oz./a	19.5 a	20.8 ab
Admire 2F*	F	19 fl. oz./a	19.5 a	18.8 a-e
Venom 75SG**	F	120 g. a.i./a	19.3 ab	19.5 abc
Venom 20SG**	F	120 g. a.i./a	18.3 abc	19.0 a-d
Belay 16WSP**	F	12 oz./a	18.5 abc	18.8 a-e
Belay 16WSP**	F	18 oz./a	16.8 bc	18.3 b-e
Belay 16WSP**	F	36 oz./a	17.8 abc	16.5 def
Control**	S	---	18.5 abc	18.5 a-e
-----				
Platinum 2SC**	PE	8.0 fl. oz./a	17.5 abc	18.5 a-e
Platinum 2SC**	E	8.0 fl. oz./a	18.0 abc	18.5 a-e
Venom 20SG**	PE	120 g. a.i./a	16.0 c	18.3 b-e
Venom 20SG**	E	120 g. a.i./a	19.8 a	20.8 ab
Control**	S	---	18.0 abc	18.8 a-e

Means in a column followed by the same letter are not significantly different (Least Significant Difference Test, P = 0.05). \*Tops MZ 8.5DS added as a seed treatment at 12 oz./cwt. for disease control. \*\*Maxim 5FS added as a seed treatment at 0.08 fl. oz./cwt. for disease control. S=seed treatment applications on April 19, F=in furrow applications made on April 21, PE=pre emergence applications on May 11, E=emergence applications on May 18. Foliar applications made July 16.

## **Section 1. Insect Control on Potatoes**

### **Part 1. Insect Control with Soil Applied Systemic Insecticides**

#### **B. Potato Leafhopper Control with Soil Insecticides, Hancock**

The potato leafhopper migrates into Wisconsin each year from the southeastern U.S. and causes damage in both the adult and nymphal stages while feeding on the plant sap by disrupting the plants ability to translocate photosynthates from the leaves. The resultant hopper burn can cause serious yield loss in potatoes. Control options for this insect are limited since both cultural and biological controls are not effective and growers must rely on insecticidal control when populations exceed damage thresholds.

A trial was conducted at the Hancock Experimental Station on a loamy sand soil, which is characteristic of one type of growing condition that many of Wisconsin's potatoes are grown, to evaluate systemic insecticide control on potato leafhopper.

Potato plots consisting of 4 x 20' rows of Russet Burbank variety potatoes were planted on May 6. Plots were replicated four times in a randomized block experimental design while rows were planted on 3' centers and 12 inch plant spacing. Treatments were separated by two untreated border rows (Russet Burbank variety) and 15' alleys separated replicates.

Imidacloprid was evaluated in furrow and as seed treatments. Admire 2SC was evaluated in furrow at 13, 16, and 19 ounces product per acre (oz./a) over fungicide treated seed (Tops MZ 8.5DS at the rate of 12 oz./cwt.). Genesis 2FL was evaluated as a seed piece spray at 0.8 fl. oz./cwt. Tops MZ-Gaucho was evaluated as a seed piece treatment at 12 oz./cwt.

Thiamethoxam was evaluated in furrow, as seed treatments, as a pre emergence and emergence application. Platinum 2SC was evaluated as an in furrow spray at 8 and 11 oz./a over fungicide treated seed (Maxim 5FS at the rate of 0.08 fl. oz./cwt.) and as pre emergence and emergence applications at 8.0 oz./a. Cruiser 5FS was evaluated as a seed treatment (0.12 and 0.16 oz. a.i./cwt.) in combination with Maxim 5FS at the rate of 0.08 fl. oz./cwt.

Several experimental systemic insecticides were evaluated as seed piece treatments, in furrow, pre emergence and emergence applications. Poncho 600L (clothianidin) was evaluated at 0.2 oz. a.i./cwt applied as seed treatments. Venom 75SG and Venom 20SG were evaluated at 120 g. a.i./a as an in furrow treatment. Belay 16WSP (clothianidan) was evaluated at 12, 18, and 36 oz./a as in furrow applications.

Furrow treatments were applied May 5 to suberized potato seed pieces in open furrows that were then covered by hilling. Insecticides were applied over seed pieces in a 4-6" band using a CO<sub>2</sub> pressurized back pack sprayer with a single hollow cone nozzle (TXVS-6) delivering 5 gpa at 30 psi. Seed piece treatments were applied by adding preweighed dry formulation materials to preweighed, cut, suberized potato seed pieces in plastic bags. Bags were shaken thoroughly and seed pieces were hand placed (12" spacing) into open furrows and covered by hilling.

Potato leafhopper populations were surveyed weekly from June 8 through July 30 by counting potato leafhopper adults (10 sweeps per plot) and nymphs (10 leaves per plot) from the center two rows of each plot.

Plots were overhead irrigated with 0.5" water every 2-5 days from plant emergence to vine kill and received a total of 16.95" of irrigation.

Plots were vine killed on August 3 (Reglone 1.5 pt./a) and a single center row (20') was harvested and graded for yield on August 19. Plot maintenance was per commercial production.

## **Results**

Potato leafhopper adult and nymph numbers were low during June and July and peaked in the untreated plots at 7.0 adults per 10 sweeps and 0.8 nymphs per 10 leaves on July 30 (Tables 8 and 9). During peak adult infestations in the untreated plots (July 30) numbers were below threshold levels of 1 adult per sweep. There were some slight differences among the treatments but since adult numbers were so low it is difficult to draw any conclusions from these results.

The low potato leafhopper adult numbers in the plots is reflected in the nymph numbers which were well below threshold levels of 0.5 per leaf and in fact nymphs were absent from most of the plots during the season (Table 9).

Aphid numbers were very low during the season and they did not become established in the plots (Tables 10 and 11).

Yields among the treatments ranged from 228.1 cwt. per acre to 335.2 cwt. per acre (Table 12). Yields among the treatments did not differ drastically, indicating the low leafhopper pressure in the plots.

Stand counts were also taken at plant emergence and numbers were lower than expected and variable among treatments (Table 13).

Table 8. Potato leafhopper adults sampled from Russet Burbank variety potatoes treated with systemic insecticides. Hancock, WI 2004.

Treatment	Place	Rate	Mean adults per 10 sweeps							
			6-8 (33 dap)	6-14 (39 dap)	6-22 (47 dap)	7-1 (56dap)	7-8 (63 dap)	7-16 (71 dap)	7-22 (77 dap)	7-30 (85 dap)
Poncho 600FL	S	0.2 oz. a.i./cwt	0.5 bc	1.0 ab	2.8 ab	1.0 bc	1.8 c-g	2.0 b-f	5.3 abc	3.3 a-e
Cruiser 5FS**	S	0.16 oz. a.i./cwt	0.3 bc	2.3 ab	1.8 bc	2.0 abc	2.8 cde	2.8 b-e	6.3 abc	5.5 a-d
Cruiser 5FS**	S	0.12 oz. a.i./cwt	0.0 c	1.0 ab	1.0 bc	2.0 abc	3.3 b-e	3.0 b-f	5.0 abc	4.3 a-e
A14152 FS	S	0.167 oz. a.i./cwt	0.3 bc	1.3 ab	0.8 bc	2.0 abc	2.3 c-f	1.5 def	3.8 bc	2.5 de
Genesis 2FL*	S	0.8 oz. a.i./cwt	0.3 bc	1.3 ab	2.0 bc	1.3 abc	2.8 cde	1.0 ef	3.0 bc	5.5 a-d
Tops MZ Gaucho 1.25D	S	12 oz./cwt	0.5 bc	1.3 ab	2.0 bc	1.3 abc	2.0 c-g	4.5 abc	5.3 abc	4.3 a-e
Platinum 2SC**	F	6.5 oz/a	0.3 bc	1.5 ab	1.8 bc	2.8 abc	3.8 bcd	2.3 b-f	4.8 abc	5.0 a-e
Platinum 2SC**	F	8.0 oz/a	0.5 bc	1.3 ab	1.0 bc	1.0 c	1.3 efg	3.8 a-d	4.5 abc	1.0 e
Platinum 2SC**	F	11.0 oz/a	0.3 bc	0.5 b	1.3 bc	2.0 abc	1.8 c-g	1.3 ef	3.5 bc	3.3 a-e

Means in a column followed by the same letter are not significantly different (Least Significant Difference Test, P = 0.05).

\*Tops MZ 8.5DS added as a seed treatment at 12 oz./cwt. for disease control.

\*\*Maxim 5FS added as a seed treatment at 0.08 fl. oz./cwt. for disease control.

S=seed treatment applications on May 5, F=in furrow applications made on May 6, PE=pre emergence applications on May 18, E=emergence applications on May 25.

Table 8. (Continued). Potato leafhopper adults sampled from Russet Burbank variety potatoes treated with systemic insecticides. Hancock, WI 2004.

Treatment	Rate	Mean adults per 10 sweeps								
		6-8 (33 dap)	6-14 (39 dap)	6-22 (47 dap)	7-1 (56dap)	7-8 (63 dap)	7-16 (71 dap)	7-22 (77 dap)	7-30 (85 dap)	
Admire 2SC*	F	13 oz/a	0.0 c	2.0 ab	2.5 ab	3.0 abc	2.5 c-f	1.5 def	3.8 abc	5.0 a-d
Admire 2SC*	F	16 oz/a	0.0 c	1.5 ab	1.8 bc	1.3 abc	3.0 b-e	2.3 c-f	3.8 bc	3.0 a-e
Admire 2SC*	F	19 oz/a	0.5 bc	1.3 ab	2.3 abc	1.5 abc	2.0 c-g	1.5 def	3.5 bc	6.0 a-d
Venom 75SG*	F	120 g. a.i./a	0.3 bc	2.5 ab	1.0 bc	2.8 abc	3.8 bcd	4.8 ab	6.3 ab	6.5 a-d
Venom 20SG*	F	120 g. a.i./a	1.0 ab	2.0 ab	5.0 a	4.8 a	6.0 ab	4.5 abc	7.5 a	8.8 a
Belay 16SG*	F	12 oz/a	0.0 c	1.5 ab	0.3 c	3.5 abc	1.8 c-g	3.0 b-f	3.0 bc	3.5 a-e
Belay 16SG*	F	18 oz/a	0.3 bc	1.3 ab	1.0 bc	4.0 abc	1.8 d-g	0.8 ef	4 abc	4.3 a-e
Belay 16SG*	F	36 oz/a	0.3 bc	1.0 ab	0.5 bc	4.8 abc	0.3 g	1.3 ef	3.5 bc	1.3 e
Untreated	---	---	1.8 a	2.5 ab	1.8 bc	1.5 abc	4.0 bc	4.3 abc	5.0 abc	7.0 ab
Platinum 2SC**	PE	8.0 oz/a	0.5 bc	0.5 b	1.3 bc	2.0 abc	2.3 c-f	0.5 f	3.5 bc	2.3 cde
Platinum 2SC**	E	8.0 oz/a	0.0 c	1.3 ab	0.3 c	1.3 bc	0.5 fg	1.8 c-f	2.5 c	3.0 b-e

Means in a column followed by the same letter are not significantly different (Least Significant Difference Test, P = 0.05).

\*Tops MZ 8.5DS added as a seed treatment at 12 oz./cwt. for disease control.

\*\*Maxim 5FS added as a seed treatment at 0.08 fl. oz./cwt. for disease control.

S=seed treatment applications on May 5, F=in furrow applications made on May 6, PE=pre emergence applications on May 18, E=emergence applications on May 25.

Table 9. Potato leafhopper nymphs sampled from Russet Burbank variety potatoes treated with systemic insecticides. Hancock, WI 2004.

Treatment	Place	Rate	Mean adults per 10 sweeps							
			6-8 (33 dap)	6-14 (39 dap)	6-22 (47 dap)	7-1 (56dap)	7-8 (63 dap)	7-16 (71 dap)	7-22 (77 dap)	7-30 (85 dap)
Poncho 600FL	S	0.2 oz. a.i./cwt	0.0 a	0.0 a	0.0 b	0.0 b	0.0 a	0.0 b	0.0 c	0.0 c
Cruiser 5FS**	S	0.16 oz. a.i./cwt	0.0 a	0.0 a	0.0 b	0.0 b	0.0 a	0.0 b	0.0 c	0.0 c
Cruiser 5FS**	S	0.12 oz. a.i./cwt	0.0 a	0.0 a	0.0 b	0.0 b	0.0 a	0.0 b	0.0 c	0.0 c
A14152 FS	S	0.167 oz. a.i./cwt	0.0 a	0.0 a	0.0 b	0.0 b	0.0 a	0.0 b	0.0 c	0.0 c
Genesis 2FL*	S	0.8 oz. a.i./cwt	0.0 a	0.0 a	0.3 a	0.0 b	0.0 a	0.0 b	0.3 bc	0.0 c
Tops MZ Gaucho 1.25D	S	12 oz./cwt	0.0 a	0.0 a	0.0 b	0.0 b	0.0 a	0.0 b	0.5 abc	0.0 c
Platinum 2SC**	F	6.5 oz/a	0.0 a	0.0 a	0.0 b	0.0 b	0.0 a	0.0 b	0.0 c	0.3 bc
Platinum 2SC**	F	8.0 oz/a	0.0 a	0.0 a	0.0 b	0.0 b	0.0 a	0.3 a	0.0 c	0.0 c
Platinum 2SC**	F	11.0 oz/a	0.0 a	0.0 a	0.0 b	0.0 b	0.0 a	0.0 b	0.0 c	0.0 c

Means in a column followed by the same letter are not significantly different (Least Significant Difference Test, P = 0.05).

\*Tops MZ 8.5DS added as a seed treatment at 12 oz./cwt. for disease control.

\*\*Maxim 5FS added as a seed treatment at 0.08 fl. oz./cwt. for disease control.

S=seed treatment applications on May 5, F=in furrow applications made on May 6, PE=pre emergence applications on May 18, E=emergence applications on May 25.

Table 9. (Continued). Potato leafhopper nymphs sampled from Russet Burbank variety potatoes treated with systemic insecticides. Hancock, WI 2004.

Treatment	Rate	Mean adults per 10 sweeps								
		6-8 (33 dap)	6-14 (39 dap)	6-22 (47 dap)	7-1 (56dap)	7-8 (63 dap)	7-16 (71 dap)	7-22 (77 dap)	7-30 (85 dap)	
Admire 2SC*	F	13 oz/a	0.0 a	0.0 a	0.0 b	0.0 b	0.0 a	0.0 b	0.0 c	0.0 c
Admire 2SC*	F	16 oz/a	0.0 a	0.0 a	0.0 b	0.0 b	0.0 a	0.0 b	0.5 abc	0.0 c
Admire 2SC*	F	19 oz/a	0.0 a	0.0 a	0.0 b	0.0 b	0.0 a	0.0 b	0.0 c	0.0 c
Venom 75SG*	F	120 g. a.i./a	0.0 a	0.0 a	0.0 b	0.0 b	0.0 a	0.0 b	0.3 bc	0.3 bc
Venom 20SG*	F	120 g. a.i./a	0.0 a	0.0 a	0.0 b	0.3 ab	0.0 a	0.0 b	0.8 ab	1.5 a
Belay 16SG*	F	12 oz/a	0.0 a	0.0 a	0.0 b	0.0 b	0.0 a	0.0 b	0.0 c	0.0 c
Belay 16SG*	F	18 oz/a	0.0 a	0.0 a	0.0 b	0.0 b	0.0 a	0.0 b	0.0 c	0.0 c
Belay 16SG*	F	36 oz/a	0.0 a	0.0 a	0.0 b	0.0 b	0.0 a	0.0 b	0.0 c	0.0 c
Untreated	---	---	0.0 a	0.0 a	0.0 b	0.0 b	0.0 a	0.0 b	0.3 bc	0.8 ab
Platinum 2SC**	PE	8.0 oz/a	0.0 a	0.0 a	0.0 b	0.0 b	0.0 a	0.0 b	0.0 c	0.0 c
Platinum 2SC**	E	8.0 oz/a	0.0 a	0.0 a	0.0 b	0.0 b	0.0 a	0.0 b	0.0 c	0.0 c

Means in a column followed by the same letter are not significantly different (Least Significant Difference Test, P = 0.05).

\*Tops MZ 8.5DS added as a seed treatment at 12 oz./cwt. for disease control.

\*\*Maxim 5FS added as a seed treatment at 0.08 fl. oz./cwt. for disease control.

S=seed treatment applications on May 5, F=in furrow applications made on May 6, PE=pre emergence applications on May 18, E=emergence applications on May 25.

Table 10. Potato aphids sampled from Russet Burbank variety potatoes treated with systemic insecticides. Hancock, WI 2004.

Treatment	Place	Rate	Mean adults per 10 sweeps							
			6-8 (33 dap)	6-14 (39 dap)	6-22 (47 dap)	7-1 (56dap)	7-8 (63 dap)	7-16 (71 dap)	7-22 (77 dap)	7-30 (85 dap)
Poncho 600FL	S	0.2 oz. a.i./cwt	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 b	0.0 b	0.0 b
Cruiser 5FS**	S	0.16 oz. a.i./cwt	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 b	0.0 b	0.0 b
Cruiser 5FS**	S	0.12 oz. a.i./cwt	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 b	0.0 b	0.0 b
A14152 FS	S	0.167 oz. a.i./cwt	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 b	0.0 b	0.0 b
Genesis 2FL*	S	0.8 oz. a.i./cwt	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 b	0.0 b	0.0 b
Tops MZ Gaucho 1.25D	S	12 oz./cwt	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 b	0.3 ab	0.0 b
Platinum 2SC**	F	6.5 oz/a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 b	0.0 b	0.0 b
Platinum 2SC**	F	8.0 oz/a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 b	0.0 b	0.3 a
Platinum 2SC**	F	11.0 oz/a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 b	0.0 b	0.0 b

Means in a column followed by the same letter are not significantly different (Least Significant Difference Test, P = 0.05).

\*Tops MZ 8.5DS added as a seed treatment at 12 oz./cwt. for disease control.

\*\*Maxim 5FS added as a seed treatment at 0.08 fl. oz./cwt. for disease control.

S=seed treatment applications on May 5, F=in furrow applications made on May 6, PE=pre emergence applications on May 18, E=emergence applications on May 25.

Table 10. (Continued). Potato aphids sampled from Russet Burbank variety potatoes treated with systemic insecticides. Hancock, WI 2004.

Treatment		Rate	Mean adults per 10 sweeps							
			6-8 (33 dap)	6-14 (39 dap)	6-22 (47 dap)	7-1 (56dap)	7-8 (63 dap)	7-16 (71 dap)	7-22 (77 dap)	7-30 (85 dap)
Admire 2SC*	F	13 oz/a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 b	0.0 b	0.0 b
Admire 2SC*	F	16 oz/a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 b	0.0 b	0.0 b
Admire 2SC*	F	19 oz/a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 b	0.0 b	0.0 b
Venom 75SG*	F	120 g. a.i./a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 b	0.5 a	0.0 b
Venom 20SG*	F	120 g. a.i./a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 b	0.0 b	0.0 b
Belay 16SG*	F	12 oz/a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 b	0.0 b	0.0 b
Belay 16SG*	F	18 oz/a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.3 a	0.0 b	0.0 b
Belay 16SG*	F	36 oz/a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 b	0.0 b	0.0 b
Untreated	---	---	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 b	0.0 b	0.0 b
Platinum 2SC**	PE	8.0 oz/a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 b	0.0 b	0.0 b
Platinum 2SC**	E	8.0 oz/a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 b	0.0 b	0.0 b

Means in a column followed by the same letter are not significantly different (Least Significant Difference Test, P = 0.05).

\*Tops MZ 8.5DS added as a seed treatment at 12 oz./cwt. for disease control.

\*\*Maxim 5FS added as a seed treatment at 0.08 fl. oz./cwt. for disease control.

S=seed treatment applications on May 5, F=in furrow applications made on May 6, PE=pre emergence applications on May 18, E=emergence applications on May 25.

Table 11. Green peach aphids sampled from Russet Burbank variety potatoes treated with systemic insecticides. Hancock, WI 2004.

Treatment	Place	Rate	Mean adults per 10 sweeps							
			6-8 (33 dap)	6-14 (39 dap)	6-22 (47 dap)	7-1 (56dap)	7-8 (63 dap)	7-16 (71 dap)	7-22 (77 dap)	7-30 (85 dap)
Poncho 600FL	S	0.2 oz. a.i./cwt	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 b	2.3 a	2.0 a
Cruiser 5FS**	S	0.16 oz. a.i./cwt	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 b	0.0 b	0.0 b
Cruiser 5FS**	S	0.12 oz. a.i./cwt	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 b	0.0 b	0.0 b
A14152 FS	S	0.167 oz. a.i./cwt	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 b	0.5 ab	0.0 b
Genesis 2FL*	S	0.8 oz. a.i./cwt	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 b	0.0 b	0.0 b
Tops MZ Gaucho 1.25D	S	12 oz./cwt	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 b	0.0 b	0.0 b
Platinum 2SC**	F	6.5 oz/a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 b	0.0 b	0.0 b
Platinum 2SC**	F	8.0 oz/a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.3 a	0.5 ab	0.0 b
Platinum 2SC**	F	11.0 oz/a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 b	0.0 b	0.0 b

Means in a column followed by the same letter are not significantly different (Least Significant Difference Test, P = 0.05).

\*Tops MZ 8.5DS added as a seed treatment at 12 oz./cwt. for disease control.

\*\*Maxim 5FS added as a seed treatment at 0.08 fl. oz./cwt. for disease control.

S=seed treatment applications on May 5, F=in furrow applications made on May 6, PE=pre emergence applications on May 18, E=emergence applications on May 25.

Table 11. (Continued). Green peach aphids sampled from Russet Burbank variety potatoes treated with systemic insecticides. Hancock, WI 2004.

Treatment	Rate	Mean adults per 10 sweeps								
		6-8 (33 dap)	6-14 (39 dap)	6-22 (47 dap)	7-1 (56dap)	7-8 (63 dap)	7-16 (71 dap)	7-22 (77 dap)	7-30 (85 dap)	
Admire 2SC*	F	13 oz/a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 b	0.0 b	0.0 b
Admire 2SC*	F	16 oz/a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 b	0.3 b	0.0 b
Admire 2SC*	F	19 oz/a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 b	0.3 ab	0.0 b
Venom 75SG*	F	120 g. a.i./a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 b	0.5 ab	1.5 a
Venom 20SG*	F	120 g. a.i./a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 b	1.5 ab	0.3 b
Belay 16SG*	F	12 oz/a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 b	0.0 b	0.0 b
Belay 16SG*	F	18 oz/a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 b	0.5 ab	0.0 b
Belay 16SG*	F	36 oz/a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 b	0.0 b	0.3 b
Untreated	---	---	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 b	0.0 b	0.3 b
Platinum 2SC**	PE	8.0 oz/a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 b	0.0 b	0.0 b
Platinum 2SC**	E	8.0 oz/a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 b	0.0 b	0.0 b

Means in a column followed by the same letter are not significantly different (Least Significant Difference Test, P = 0.05).

\*Tops MZ 8.5DS added as a seed treatment at 12 oz./cwt. for disease control.

\*\*Maxim 5FS added as a seed treatment at 0.08 fl. oz./cwt. for disease control.

S=seed treatment applications on May 5, F=in furrow applications made on May 6, PE=pre emergence applications on May 18, E=emergence applications on May 25.

Table 12. Yield and percent grade of Russet Burbank variety potatoes treated with systemic insecticides. Hancock, WI 2004.

Treatment	Place	Rate	Mean percent grade		Yield (cwt/A)
			A's	B's & Culls	
Poncho 600FL	S	0.2 oz. a.i./cwt	70.1 bc	29.9 ab	267.0 b-e
Cruiser 5FS**	S	0.16 oz. a.i./cwt	73.4 abc	26.6 abc	238.2 de
Cruiser 5FS**	S	0.12 oz. a.i./cwt	71.7 bc	28.3 ab	246.7 cde
A14152 FS	S	0.167 oz. a.i./cwt	69.3 bc	30.7 ab	228.1 e
Genesis 2FL*	S	0.8 oz. a.i./cwt	70.2 bc	29.8 ab	250.8 cde
Tops MZ Gaucho 1.25D	S	12 oz./cwt	73.4 abc	26.6 abc	312.3 abc
Platinum 2SC**	F	6.5 oz/a	68.0 c	32.0 a	279.8 a-e
Platinum 2SC**	F	8.0 oz/a	75 abc	25 abc	303.4 a-d
Platinum 2SC**	F	11.0 oz/a	68.9 bc	31.1 ab	342.9 a
Admire 2SC*	F	13 oz/a	80.2 a	19.8 c	285.4 a-e
Admire 2SC*	F	16 oz/a	74.4 abc	25.6 abc	288.0 a-e
Admire 2SC*	F	19 oz/a	73.5 abc	26.5 abc	305.0 a-d
Venom 75SG*	F	120 g. a.i./a	69.8 bc	30.2 ab	269.0 b-e
Venom 20SG*	F	120 g. a.i./a	74.2 abc	25.8 abc	282.6 a-e
Belay 16SG*	F	12 oz/a	76.3 ab	23.7 bc	269.5 b-e
Belay 16SG*	F	18 oz/a	74.0 abc	26.0 abc	332.0 ab
Belay 16SG*	F	36 oz/a	72.5 bc	27.5 ab	335.2 ab
Untreated	---	---	70.4 bc	29.6 ab	255.2 cde
Platinum 2SC**	PE	8.0 oz/a	74.7 abc	25.3 abc	309.8 abc
Platinum 2SC**	E	8.0 oz/a	73.6 abc	26.4 abc	299.7 a-d

Means in a column followed by the same letter are not significantly different (Least Significant Difference Test, P = 0.05).

\*Tops MZ 8.5DS added as a seed treatment at 12 oz./cwt. for disease control.

\*\*Maxim 5FS added as a seed treatment at 0.08 fl. oz./cwt. for disease control.

S=seed treatment applications on May 5, F=in furrow applications made on May 6,

PE=pre emergence applications on

May 18, E=emergence applications on May 25.

Table 13. Stand counts from Russet Burbank variety potatoes treated with systemic insecticides. Hancock, WI 2004.

Treatment	Place	Rate	Stand count/20' of row	
			Row 1	Row 2
Poncho 600FL	S	0.2 oz. a.i./cwt	9.8 c-f	8.8 d
Cruiser 5FS**	S	0.16 oz. a.i./cwt	8.5 f	9.5 cd
Cruiser 5FS**	S	0.12 oz. a.i./cwt	8.5 f	10.0 cd
A14152 FS	S	0.167 oz. a.i./cwt	9.0 ef	9.5 cd
Genesis 2FL*	S	0.8 oz. a.i./cwt	9.5 def	10.3 cd
Tops MZ Gaucho 1.25D	S	12 oz./cwt	14.0 ab	16.0 a
Platinum 2SC**	F	6.5 oz/a	12.5 a-d	14.5 ab
Platinum 2SC**	F	8.0 oz/a	13.3 ab	13.8 ab
Platinum 2SC**	F	11.0 oz/a	12.8 abc	14.0 ab
Admire 2SC*	F	13 oz/a	11.8 b-e	14.8 ab
Admire 2SC*	F	16 oz/a	13.3 ab	14.3 ab
Admire 2SC*	F	19 oz/a	15.0 a	16.5 a
Venom 75SG*	F	120 g. a.i./a	11.3 b-f	14.0 ab
Venom 20SG*	F	120 g. a.i./a	13.0 ab	15.0 ab
Belay 16SG*	F	12 oz/a	14.3 ab	14.3 ab
Belay 16SG*	F	18 oz/a	13.3 ab	14.3 ab
Belay 16SG*	F	36 oz/a	13.8 ab	15.5 a
Untreated	---	---	12.8 abc	12.0 bc
Platinum 2SC**	PE	8.0 oz/a	13.3 ab	15.5 a
Platinum 2SC**	E	8.0 oz/a	12.5 a-d	14.3 ab

Means in a column followed by the same letter are not significantly different (Least Significant Difference Test, P = 0.05).

\*Tops MZ 8.5DS added as a seed treatment at 12 oz./cwt. for disease control.

\*\*Maxim 5FS added as a seed treatment at 0.08 fl. oz./cwt. for disease control.

S=seed treatment applications on May 5, F=in furrow applications made on May 6, PE=pre emergence applications on May 18, E=emergence applications on May 25.

## **Part 2. Insect Control with Foliar Insecticides.**

### **A. General Insect Control with Foliar Insecticides, Arlington.**

Potato leafhoppers are considered a key insect pest on potatoes in Wisconsin from early June through August. Adult leafhoppers migrate into Wisconsin on strong southerly winds during late May and early June. Eggs hatch within 7-9 days after oviposition, depending on climate and leafhopper nymphs undergo five immature stages each lasting approximately 4-6 days. Potato leafhoppers have few natural enemies and can be difficult to manage due to their mobility. Historically, insecticide use has been the best option to reduce leafhopper populations.

Experimental and registered foliar insecticides were evaluated on potatoes for efficacy on potato leafhoppers, tarnished plant bugs, potato flea beetles and aphids.

Superior variety potatoes were planted on April 24 into two 50' row plots, replicated four times in a randomized complete block design. All plots were separated by 15' of cultivated alleyway and replicates were 15' apart. Spartan (sulfentrazone) at 4 ounces product per acre (oz. pr./a) and Dual II Magnum (metolachlor) at 1.5 pints product per acre (pt. pr./a) was applied post hilling on May 17 for weed control. Hand weeding provided additional weed control.

Colorado potato beetle larvae were managed with an application of fipronil (Regent 4SC) at 3.2 ounces product per acre on June 19.

Ten registered and eight experimental insecticides were evaluated and applied at the following rates.

Registered:

Baythroid 2E (0.0125 lb. a.i./a)

Leverage 2.7SC (0.079 lb. a.i./a)

Actara 25WG (0.234 and 0.047 lb. a.i./a)

Dimethoate 4EC (0.5 lb. a.i./a)

Asana 0.66E (0.03 lb. a.i./a)

## Experimental:

Assail 70WP (0.0262 lb. a.i./a)

TD2472 30WG (0.0262 lb. a.i./a)

Venom 75SG (0.132 lb. a.i./a)

Clutch 50WG (0.047 and 0.0625 lb. a.i./a)

Warrior 1CS (0.0148 and 0.020 lb. a.i./a)

F1785 50DF (0.053 lb. a.i./a)

Mustang Max 0.8EW (0.018 and 0.025 lb. a.i./a)

Capture 2E (0.02 and 0.04 lb. a.i./a)

BAS 320I 2SC (0.0625 lb. a.i./a)

All test materials were applied twice with the first applications made on July 9 while the second applications occurred on August 3. Assail, F1785, and BAS 320I were also applied on July 22 (treatments 4, 18, and 19).

Test materials were applied with a tractor mounted, compressed air, boom sprayer operating at 40 psi delivering 30 gpa through five hollow cone nozzles (TXVS26) spaced at 18". Penetrator Plus was added at the rate of 0.5% v/v to the BAS 320I treatment.

Treatments were evaluated at 3, 8, 15, and 22 days after the first application (July 9) and 2 days after the second application on August 3 (treatments 4, 18, and 19 were applied on July 22 also). Insect populations were monitored using sweep net sampling techniques. Sweep net samples comprise 25 sweeps taken from each plot.

The crop was vine killed on August 6 with Reglone (diquat) at 1 pint product per acre tank mixed with Activator 90 at 1 pint per 100 gallons of spray mix. Yields and grade were taken from 20 feet of row in each plot on September 14.

## **Results**

Potato leafhopper adults were left undisturbed in the study during June to permit increased oviposition that resulted in elevated nymph populations during late July. However, when managing potato leafhoppers it is important to limit adult numbers

during early season since nymphs resulting from extended oviposition can be difficult to control.

Potato leafhopper adults were collected in low numbers during the season and peaked at 35.0 adults per sample in the untreated plots on August 3 (Table 14). After peaking on August 3 adult numbers declined throughout the study on the final sampling date of August 5. All of the insecticides evaluated restricted adult infestation after application and provided acceptable levels of leafhopper adult control both initially and for an extended period of time. Typically the pyrethroids (Baythroid, Capture, Mustang Max, Asana, and Warrior) at low rates provide effective control on leafhopper adults and this is evident from the sample data. The neonicotinyls (Clutch, Venom, Assail, TD2472, and Actara) also provided acceptable leafhopper adult control but were slightly less effective overall than the pyrethroids after the final application on August 3. Leverage and Dimethoate also provided effective adult control after application. BAS 320I was slightly less effective than the other insecticides evaluated.

Potato leafhopper nymph numbers peaked in the untreated plots at 47 nymphs per sample on July 22 and numbers gradually declined thereafter until August 5 (Table 15). All of the materials evaluated controlled leafhopper nymph numbers for a minimum of a week after the first application. Leafhopper nymph numbers increased in many of the treatments 2 weeks after application (July 22) however, numbers were slightly higher among the Assail and TD2472 treatments while numbers were highest in the F1785 and BAS 320I treatments. Treating the Assail, F1785 and BAS 320I plots on July 22 reduced leafhopper nymphs by July 29.

Sweep samples taken from the study consisted primarily of green peach and potato aphids (Table 16). Aphid numbers were low throughout the season and numbers peaked in the untreated plots at 4.8 aphids per sample on August 3. This is well below threshold levels and differences among treatments were so small that it is difficult to draw any conclusions from the data.

Tarnished plant bug populations were very small during the study and numbers did not exceed 0.5 adults per 25 sweeps (Table 17). Again differences among treatments is too small to draw any conclusions from this data.

Potato flea beetle adults were present in all of the plots during late July and early August (Table 18). Adult populations peaked at approximately 1 adult per sweep in the untreated plots on July 22. All of the materials provided good to excellent control of flea beetle adults but many of the pyrethroids provided longer residual control.

Growing conditions were cool and wet during 2004 season and resulting yields ranged from 328.43 hundredweight per acre (cwt./a) in the untreated plots to 405.23 cwt./a in the Baythroid treatments (Table 19). These yields are among the highest harvested at the Arlington Station, reflecting the light insect pressure observed during the 2004

growing season. There were no significant differences among grade in any of the treatments and yields were similar among treatments.

Table 14. Potato leafhopper adults sampled from Superior variety potatoes. Entomology Research Farm, Arlington, WI 2004.

Treatment	Rate		Mean adults per 25 sweeps					
	oz. prod./a	lb. a.i./a	*7/12	7/15	7/22	7/29	8/3	*8/5
Clutch 50WG	1.5	0.047	0.8 c-f	5.3 b	1.8 d-g	3.8 efg	8.8 b-e	2.8 def
Clutch 50WG	2.0	0.0625	1.0 c-f	4.0 b	1.0 fgh	1.5 g	4.3 e-i	2.5 c-f
Venom 75WG	2.82	0.132	1.8 bcd	3.5 b	3.8 bcd	5.8 def	11.8 bc	4.3 b-e
Assail 70WP	0.6	0.0262	0.8 c-f	3.3 b	4.8 bc	2.5 fg	8.5 b-f	6.5 bc
TD 2472 30WG	1.4	0.0262	0.0 f	3.8 b	3.3 b-e	9.3 cd	28.0 a	18.0 a
Leverage 2.7E	3.75	0.079	0.3 ef	0.0 d	0.5 gh	1.5 g	3.8 ghi	0.3 f
Actara 25WG	1.5	0.0234	1.8 bc	4.0 b	0.8 fgh	2.5 fg	6.5 d-h	6.0 bcd
Actara 25WG	3.0	0.047	1.3 b-e	3.8 b	1.3 e-h	2.3 fg	4.3 f-i	5.3 b-e
Untreated	---	---	4.8 a	14.3 a	13.3 a	26.5 a	35.0 a	15.8 a
Baythroid 2E	0.8	0.0125	0.0 f	0.0 d	0.0 h	4.5 efg	2.8 i	0.5 f
Capture 2E	1.3	0.02	0.3 ef	0.5 cd	2.5 c-f	4.0 efg	2.8 i	0.5 f
Capture 2E	2.56	0.04	0.3 ef	0.3 d	0.3 gh	2.8 fg	2.5 i	0.0 f
Mustang Max 0.8EW	2.88	0.018	0.0 f	0.0 d	0.3 gh	3.8 efg	3.5 ghi	0.0 f
Mustang Max 0.8EW	4.0	0.025	0.0 f	0.0 d	0.3 gh	4.8 efg	3.0 hi	0.5 f
Asana 0.66EC	5.8	0.030	0.3 ef	0.0 d	4.0 bcd	12.0 bc	7.0 c-h	0.3 f
Warrior 1CS	1.9	0.0148	0.0 f	0.0 d	0.0 h	2.8 fg	2.0 i	0.0 f
Warrior 1CS	2.56	0.020	0.0 f	0.5 d	1.0 fgh	3.3 efg	3.3 hi	0.0 f
F1785 50SG	1.7	0.053	0.5 def	2.5 bc	5.8 b	3.3 efg	10.8 bcd	1.3 ef
**BAS 320 I	4.0	0.0625	2.8 b	5.3 b	5.8 b	17.3 b	13.3 b	9.5 b
Dimethoate 4E	1 pt.	0.500	1.0 c-f	0.3 d	3.5 bcd	7.3 cde	7.5 b-g	2.3 def

Means followed by the same letter do not significantly differ (P = 0.05, LSD).

\*First sample after an insecticide application.

\*\*Penetrator Plus added at 0.5% v/v.

Treatments 4, 18, and 19 were also applied on July 22.

Table 15. Potato leafhopper nymphs sampled from Superior variety potatoes. Entomology Research Farm, Arlington, WI 2004.

Treatment	Rate		Mean nymphs per 25 sweeps					
	oz. prod./a	lb. a.i./a	*7/12	7/15	7/22	7/29	8/3	*8/5
Clutch 50WG	1.5	0.047	0.0 b	0.0 c	0.8 e	0.8 cde	0.8 cd	0.8 ab
Clutch 50WG	2.0	0.0625	0.0 b	0.8 bc	0.5 e	0.8 cde	0.5 bcd	0.0 b
Venom 75WG	2.82	0.132	0.0 b	1.8 b	0.8 e	1.5 cde	0.8 cd	0.0 b
Assail 70WP	0.6	0.0262	0.0 b	0.5 bc	10.8 c	0.8 cde	0.8 bcd	0.0 b
TD 2472 30WG	1.4	0.0262	0.0 b	0.0 c	6.8 cd	14.5 b	0.8 cd	0.8 ab
Leverage 2.7E	3.75	0.079	0.0 b	0.0 c	0.5 e	0.8 de	0.0 d	0.0 b
Actara 25WG	1.5	0.0234	0.0 b	0.8 bc	1.8 e	0.5 cde	0.0 d	0.8 b
Actara 25WG	3.0	0.047	0.0 b	0.0 c	0.8 e	0.0 e	0.0 d	0.0 b
Untreated	---	---	0.0 b	3.0 a	47.0 a	24.8 a	5.8 a	1.5 a
Baythroid 2E	0.8	0.0125	0.0 b	0.0 c	2.0 e	1.8 cde	0.0 d	0.0 b
Capture 2E	1.3	0.02	0.0 b	0.0 c	1.8 e	0.8 cde	0.8 cd	0.8 b
Capture 2E	2.56	0.04	0.0 b	0.0 c	0.0 e	0.5 cde	0.8 cd	0.0 b
Mustang Max 0.8EW	2.88	0.018	0.0 b	0.0 c	0.0 e	0.8 de	0.0 d	0.8 b
Mustang Max 0.0.8EW	4.0	0.025	0.0 b	0.0 c	0.8 e	0.5 cde	0.0 d	0.0 b
Asana 0.66EC	5.8	0.030	0.0 b	0.0 c	0.5 e	1.0 cde	0.8 cd	0.0 b
Warrior 1CS	1.9	0.0148	0.0 b	0.0 c	0.8 e	0.5 cde	0.8 cd	0.0 b
Warrior 1CS	2.56	0.020	0.0 b	0.0 c	0.8 e	0.0 e	0.8 cd	0.0 b
F1785 50SG	1.7	0.053	0.0 b	0.8 bc	26.8 b	3.8 c	1.8 b	0.0 b
**BAS 320 I	4.0	0.0625	0.8 a	0.5 bc	47.8 a	17.8 ab	1.5 bc	0.8 b
Dimethoate 4E	1 pt.	0.500	0.0 b	0.0 c	2.5 de	2.5 cd	0.0 d	0.0 b

Means followed by the same letter do not significantly differ (P = 0.05, LSD).

\*First sample after an insecticide application.

\*\*Penetrator Plus added at 0.5% v/v.

Treatments 4, 18, and 19 were also applied on July 22.

Table 16. Aphids sampled from Superior variety potatoes. Entomology Research Farm, Arlington, WI 2004.

Treatment	Rate		Mean aphids per 25 sweeps					
	oz. prod./a	lb. a.i./a	*7/12	7/15	7/22	7/29	8/3	*8/5
Clutch 50WG	1.5	0.047	0.0 b	0.0 ab	0.5 b	0.3 b	0.0 f	0.0 b
Clutch 50WG	2.0	0.0625	0.0 b	0.0 b	0.0 b	0.3 b	1.0 c-f	0.0 b
Venom 75WG	2.82	0.132	0.5 a	0.0 a	0.8 b	0.3 b	1.3 b-f	0.0 b
Assail 70WP	0.6	0.0262	0.3 ab	0.0 b	0.0 b	0.0 b	0.0 f	0.8 ab
TD 2472 30WG	1.4	0.0262	0.0 b	0.0 b	0.0 b	0.5 b	1.8 a-f	0.8 ab
Leverage 2.7E	3.8	0.079	0.0 b	0.0 b	0.0 b	0.8 b	4.3 a	0.5 b
Actara 25WG	1.5	0.0234	0.0 b	0.0 b	0.0 b	0.0 b	1.5 c-f	0.0 b
Actara 25WG	3.0	0.047	0.0 b	0.0 b	0.0 b	0.0 b	0.3 ef	0.5 b
Untreated	---	---	0.3 ab	0.3 a	0.8 b	0.3 b	2.5 a-e	0.8 ab
Baythroid 2E	0.8	0.0125	0.0 b	0.0 b	0.0 a	2.0 a	4.8 a	0.3 b
Capture 2E	1.3	0.02	0.0 b	0.0 ab	0.3 b	0.8 b	3.5 abc	0.0 b
Capture 2E	2.56	0.04	0.0 b	0.0 ab	0.3 b	0.0 b	2.5 a-d	0.0 b
Mustang Max 0.8EW	2.88	0.018	0.0 b	0.3 b	0.0 b	0.5 b	1.5 a-f	0.0 b
Mustang Max 0.8EW	4.0	0.025	0.0 b	0.0 b	0.0 b	0.8 b	4.0 ab	1.5 a
Asana 0.66EC	5.8	0.030	0.0 b	0.0 ab	0.3 b	1.0 ab	3.8 ab	0.8 ab
Warrior 1CS	1.9	0.0148	0.0 b	0.0 a	0.8 b	0.0 b	1.0 c-f	0.0 b
Warrior 1CS	2.56	0.020	0.0 b	0.0 b	0.0 b	0.0 b	1.0 c-f	0.5 b
F1785 50SG	1.7	0.053	0.0 b	0.0 b	0.0 b	0.3 b	0.5 def	0.0 b
**BAS 320 I	4.0	0.0625	0.5 a	0.0 ab	0.3 b	0.5 b	0.0 f	0.3 b
Dimethoate 4E	1 pt.	0.500	0.0 b	0.0 ab	0.3 b	0.0 b	1.0 c-f	0.5 b

Means followed by the same letter do not significantly differ ( $P = 0.05$ , LSD).

\*First sample after an insecticide application.

\*\*Penetrator Plus added at 0.5% v/v.

Treatments 4, 18, and 19 were also applied on July 22.

Table 17. Tarnished plant bug adults sampled from Superior variety potatoes. Entomology Research Farm, Arlington, WI 2004.

Treatment	Rate		Mean adults per 25 sweeps					
	oz. prod./a	lb. a.i./a	*7/12	7/15	7/22	7/29	8/3	*8/5
Clutch 50WG	1.5	0.047	0.5 ab	0.0 b	0.5 a	0.5 a	0.3 a	0.0 b
Clutch 50WG	2.0	0.0625	0.0 b	0.0 b	0.3 a	0.0 b	0.0 a	0.3 a
Venom 75WG	2.82	0.132	0.0 b	0.0 b	0.3 a	0.3 ab	0.3 a	0.0 b
Assail 70WP	0.6	0.0262	0.0 b	0.0 b	0.0 a	0.0 b	0.0 a	0.0 b
TD 2472 30WG	1.4	0.0262	0.8 a	0.0 b	0.0 a	0.0 b	0.3 a	0.0 b
Leverage 2.7E	3.75	0.079	0.0 b	0.3 ab	0.0 a	0.0 b	0.0 a	0.0 b
Actara 25WG	1.5	0.0234	0.0 b	0.3 ab	0.0 a	0.0 b	0.5 a	0.0 b
Actara 25WG	3.0	0.047	0.0 b	0.3 ab	0.3 a	0.0 b	0.5 a	0.0 b
Untreated	---	---	0.3 ab	1.0 a	0.0 a	0.0 b	0.3 a	0.0 b
Baythroid 2E	0.8	0.0125	0.0 b	0.0 b	0.3 a	0.0 b	0.5 a	0.0 b
Capture 2E	1.3	0.02	0.5 ab	0.5 ab	0.0 a	0.0 b	0.0 a	0.0 b
Capture 2E	2.56	0.04	0.0 b	0.3 ab	0.3 a	0.0 b	0.5 a	0.0 b
Mustang Max 0.8EW	2.88	0.018	0.0 b	0.0 b	0.5 a	0.0 b	0.3 a	0.0 b
Mustang Max 0.8EW	4.0	0.025	0.0 b	0.0 b	0.3 a	0.0 b	0.0 a	0.0 b
Asana 0.66EC	5.8	0.030	0.3 ab	0.5 ab	0.3 a	0.0 b	0.5 a	0.0 b
Warrior 1CS	1.9	0.0148	0.0 b	0.0 b	0.0 a	0.0 b	0.0 a	0.0 b
Warrior 1CS	2.56	0.020	0.0 b	0.0 b	0.5 a	0.0 b	0.0 a	0.0 b
F1785 50SG	1.7	0.053	0.0 b	0.5 ab	0.0 a	0.0 b	0.0 a	0.0 b
**BAS 320 I	4.0	0.0625	0.0 b	0.0 b	0.5 a	0.0 b	0.0 a	0.0 b
Dimethoate 4E	1 pt.	0.500	0.3 ab	0.3 ab	0.0 a	0.0 b	0.0 a	0.3 a

Means followed by the same letter do not significantly differ ( $P = 0.05$ , LSD).

\*First sample after an insecticide application.

\*\*Penetrator Plus added at 0.5% v/v.

Treatments 4, 18, and 19 were also applied on July 22.

Table 18. Potato flea beetle adults sampled from Superior variety potatoes. Entomology Research Farm, Arlington, WI 2004.

Treatment	Rate		Mean adults per 25 sweeps					
	oz. prod./a	lb. a.i./a	*7/12	7/15	7/22	7/29	8/3	*8/5
Clutch 50WG	1.5	0.047	0.3 c	0.3 cd	23.8 ab	27.3 a	33.3 a	1.8 cde
Clutch 50WG	2.0	0.0625	0.0 c	0.0 d	21.3 ab	19.3 ab	30.5 ab	1.0 de
Venom 75WG	2.82	0.132	0.0 c	0.5 bcd	25.3 a	23.3 ab	28.0 abc	0.0 e
Assail 70WP	0.6	0.0262	0.0 c	1.8 bc	20.5 ab	1.8 f	6.8 de	0.3 e
TD 2472 30WG	1.4	0.0262	0.0 c	0.0 d	17.8 ab	20.3 ab	25.3 abc	0.3 e
Leverage 2.7E	3.75	0.079	0.0 c	0.0 d	2.5 de	4.8 def	23.5 abc	0.3 e
Actara 25WG	1.5	0.0234	0.0 c	0.0 d	17.8 ab	22.3 ab	29.3 a	0.5 de
Actara 25WG	3.0	0.047	0.3 c	0.8 bcd	10.8 bc	14.5 abc	25.5 abc	3.0 abc
Untreated	---	---	2.8 a	6.3 a	24.0 a	7.0 c-f	15.3 cd	2.5 bcd
Baythroid 2E	0.8	0.0125	0.0 c	0.0 d	6.8 cd	13.0 bcd	19.3 abc	0.0 e
Capture 2E	1.3	0.02	0.3 c	0.5 bcd	5.8 cde	7.0 c-f	19.5 abc	0.0 e
Capture 2E	2.56	0.04	0.0 c	0.0 d	2.3 de	2.0 f	13.0 cd	0.0 e
Mustang Max 0.8EW	2.88	0.018	0.0 c	0.5 bcd	2.3 de	2.3 f	13.3 cd	0.0 e
Mustang Max 0.8EW	4.0	0.025	0.0 c	0.0 d	3.8 de	4.3 ef	13.8 cd	0.0 e
Asana 0.66EC	5.8	0.030	0.0 c	0.8 bcd	24.8 a	19.5 ab	23.0 abc	0.0 e
Warrior 1CS	1.9	0.0148	0.0 c	0.0 d	2.3 de	3.0 f	15.8 bcd	0.0 e
Warrior 1CS	2.56	0.020	0.3 c	0.8 bcd	1.3 e	2.0 f	20.8 abc	0.0 e
F1785 50SG	1.7	0.053	1.3 b	2.8 b	23.0 ab	12.0 b-e	14.8 cd	5.5 ab
**BAS 320 I	4.0	0.0625	0.0 c	0.8 bcd	4.5 cde	4.3 f	4.3 e	0.8 de
Dimethoate 4E	1 pt.	0.500	0.3 c	1.0 bcd	19.0 ab	19.8 ab	21.3 abc	5.5 a

Means followed by the same letter do not significantly differ (P = 0.05, LSD).

\*First sample after an insecticide application.

\*\*Penetrator Plus added at 0.5% v/v.

Treatments 4, 18, and 19 were also applied on July 22.

Table 19. Yield and grade of Superior variety potatoes treated with various foliar insecticides. Entomology Research Farm, Arlington, WI 2003.

Treatment	Rate		Mean % grade		Yield (cwt./a)
	oz. prod./a	lb. a.i./a	A's	B's and culls	
Clutch 50WG	1.5	0.047	93.65 a	6.35 a	334.79 de
Clutch 50WG	2.0	0.0625	94.29 a	5.71 a	353.49 a-e
Venom 75WG	2.82	0.132	91.32 a	8.68 a	346.22 b-e
Assail 70WP	0.6	0.0262	92.20 a	7.80 a	361.47 a-e
TD 2472 30WG	1.4	0.0262	92.87 a	7.13 a	333.70 de
Leverage 2.7E	3.75	0.079	94.21 a	5.79 a	351.67 a-e
Actara 25WG	1.5	0.0234	89.66 a	10.34 a	361.47 a-e
Actara 25WG	3.0	0.047	93.22 a	6.78 a	383.26 a-e
Untreated	---	---	91.88 a	8.12 a	328.43 e
Baythroid 2E	0.8	0.0125	92.53 a	7.47 a	405.23 a
Capture 2E	1.3	0.02	91.12 a	8.88 a	385.26 a-d
Capture 2E	2.56	0.04	91.49 a	8.51 a	338.96 cde
Mustang Max 0.8EW	2.88	0.018	94.51 a	5.49 a	380.90 a-e
Mustang Max 0.8EW	4.0	0.025	92.82 a	7.18 a	397.79 ab
Asana 0.66EC	5.8	0.030	94.66 a	5.34 a	384.17 a-d
Warrior 1CS	1.9	0.0148	93.77 a	6.23 a	390.16 abc
Warrior 1CS	2.56	0.020	92.15 a	7.85 a	374.18 a-e
F1785 50SG	1.7	0.053	91.78 a	8.22 a	331.15 de
**BAS 320 I	4.0	0.0625	90.85 a	9.15 a	342.41 cde
Dimethoate 4E	1 pt.	0.500	92.12 a	7.88 a	384.17 a-d

Means followed by the same letter do not significantly differ ( $P = 0.05$ , LSD).

## **Part 2. Insect Control with Foliar Insecticides.**

### **B. Colorado Potato Beetle Control with Foliar Insecticides – Arlington 2004.**

Colorado potato beetles are considered a key insect pest of potatoes in Wisconsin. Colorado potato beetles overwinter in and around potato fields, typically emerging during late May early June depending on seasonal temperatures. Colorado potato beetles have a history of rapidly developing resistance to insecticides and they can be difficult to control. Integrated pest management practices for Colorado potato beetles target the larval stages and more specifically the small (1<sup>st</sup> and 2<sup>nd</sup> instar) larvae. First generation larval numbers peak in Wisconsin during mid to late June.

In a study conducted at the Entomology Research Farm, Arlington, Wisconsin, experimental and registered foliar insecticides were evaluated for efficacy on all life stages of Colorado potato beetle.

Superior variety potatoes were planted on April 24 into two 50' row plots, replicated four times in a randomized complete block design. All plots were separated by 15' of cultivated alleyway and replicates were 15' apart. Spartan (sulfentrazone) at 4 ounces product per acre (oz. pr./a) and Dual II Magnum (metolachlor) at 1.5 pints product per acre (pt. pr./a) was applied post hilling on May 17 for weed control. Hand weeding provided additional weed control.

Orthene 97 (acephate) at the rate of 1 pound product per acre (lb. pr./a) was applied on June 14, 19, July 1, 8 and 22 for potato leafhopper adult control.

Nine registered and nine non-registered materials were evaluated at the following rates.

#### Registered:

Agrimek 0.15EC (0.005 and 0.009 lb. a.i./a)

Provado 1.6SC (0.047 lb. a.i./a)

Actara 25WG (0.023 and 0.047 lb. a.i./a)

Leverage 2.7SE (0.079 lb. a.i./a)

Baythroid 2EC (0.044 lb. a.i./a)

Asana 0.66E (0.04 lb. a.i./a)

Avaunt 30DG (0.066 and 0.084 lb. a.i./a)

Spintor 2SC (0.047 and 0.07 lb. a.i./a)

Non-registered:

Rimon 0.83EC (0.039, 0.058, and 0.078 lb. a.i./a)

Clutch 50WG (0.047, 0.063, and 0.125 lb. a.i./a)

Assail 70WP (0.026 and 0.048 lb. a.i./a)

TD 2472 30WG (0.026 and 0.048 lb. a.i./a)

Mustang Max (0.018 and 0.025 lb. a.i./a)

Capture 2EC (0.04, 0.06, and 0.08 lb. a.i./a)

Warrior 1CS (0.015 and 0.025 lb. a.i./a)

Venom 20SG (0.132 lb. a.i./a)

Venom 75SG (0.132 lb. a.i./a)

Trigard 75WP (0.125 and 0.25 lb. a.i./a)

BAS 320I 4SC (0.071 and 0.125 lb. a.i./a)

All materials were applied with a tractor mounted, compressed air, boom sprayer operating at 40 psi, delivering 30 gpa through five hollow cone nozzles (TXVS26) spaced at 18”.

Insecticides were applied on June 18 for first generation Colorado potato beetle (CPB) larval control, on June 25 a second application of Spintor (0.047 lb. a.i./a), Avaunt (0.66 lb. a.i./a), Trigard (0.125 lb. a.i./a) and BAS 320I (0.071 lb. a.i./a) were made. All treatments were applied on July 9 for second-generation CPB larval and adult control and again on August 3 for CPB adult control only. First generation CPB efficacy was evaluated at 3, 7, 10, 14 and 20 days after the first insecticide application (June 18) and at 3, 7, 13 and 20 days after the second application (July 9). CPB populations were monitored with plant counts. All life stages of the CPB were counted on ten randomly chosen plants per plot.

Plant foliage was rated for defoliation on each survey date from July 2 through July 31. Plots were vine killed with Reglone (diquat) at the rate of 2 pints product per acre and were tank mixed with X77 at the rate of 8-oz/100 gallon on August 8. The study was harvested for yield and grade on September 14.

## **Results**

In 2004, conditions were ideal for foliar spray efficacy with cool conditions which slowed larval development, reduced feeding activity and increased insecticide persistence. In the controls, small larvae (Table 22) increased steadily after June 21 to a peak on July 2 (3/plant). Typically, first generation larval population's peak for one to two week periods were in 2004 peak numbers occurred from June 21 through July 16. These sustained peak numbers reflect the cool temperatures of 2004. Large larvae (Table 23) also increased steadily to a peak on July 8 at 9/plant and numbers did not decline in the untreated plots until July 16. Defoliation from 1<sup>st</sup> generation larvae increased steadily to 50% in the control on July 12 (Table 25). Second generation adults were first noted in significant numbers on July 16 with a peak on July 22 of 7 per plant and these summer adults influenced subsequent defoliations ratings on July 16 and July 22 which rapidly increased to 88%.

Registered pyrethroids provided good small and large larval control with good persistence (Tables 22 and 23) and no defoliation was recorded (Table 24). Experimental pyrethroids provided similar levels of control.

Registered neonicotinoids Provado and Actara were less persistent with larval numbers increasing 10 days after application. The Actara treatment at 3.0 oz./A was more persistent than Provado and Actara at 1.5 oz./A and limited defoliation to 0% for 14 days after application (Table 24) and has been recently registered at this use rate in Wisconsin. The experimental neonicotinoids Clutch, Venom and Assail provided excellent larval control with 14 days persistence (Tables 22 and 23) and held defoliation close to 0% (Table 5).

The reduced risk insecticides Spintor, Avaunt and Agrimek were less persistent than either the pyrethroids or neonicotinoids. Small larval numbers increased after 7 days for Avaunt and Agrimek and after 10 days for Spintor (Table 22). Large larvae were reduced significantly through 20 days but large larvae were present in all plots (Table 23) and this was reflected in defoliation levels of 16% on July 8 for Avaunt and Agrimek (Table 25). Spintor was more effective, holding defoliation below 10% until July 16. TD 2472 was the most effective reduced risk experimental with excellent larval control for over 14 days and 0% defoliation through July 22 (Tables 22-24). BAS 320I also provided good CPB control but was less persistent with defoliation reaching 8% after July 8.

The growth regulator Rimon, which was registered in 2004, provided excellent control at both 9 and 12 oz. rates. Small larval control was not seen at 3 days after application, as expected with the growth regulator mode of action, but subsequent control was excellent through 20 days (Table 22). Similar trends were seen with large larvae (Table 4) which were controlled effectively after 3 days and defoliation was held below 3% through July 22. Trigard was less effective in larval control and defoliation exceeded 10% after July 2.

Yields (Table 25) ranged between 170.8 and 372 cwt./a in this trial. Yields reflected the efficacy of treatments with higher yields among the more effective treatments while lower yields were observed among the less effective and less persistent treatments.

Table 20. Colorado potato beetle adults sampled from Superior variety potatoes treated with foliar insecticides. Arlington, WI 2004.

Treatment	Rate		Mean adults per 10 plants									
	prod./a	lb. a.i./a	*6/21	6/25	6/28	7/2	7/8	*7/12	7/16	7/22	7/29	*8/8
Clutch 50WG	1.5 oz.	0.047	0.0 d	0.0 c	0.0 b	0.0 a	0.3 a	0.0 c	0.0 c	0.0 l	0.8 j	1.0 ij
Clutch 50WG	2 oz.	0.063	0.3 cd	0.3 bc	0.0 b	0.0 a	0.0 ab	0.0 c	0.0 c	0.8 jkl	0.8 j	0.3 h-k
Clutch 50WG	4 oz.	0.125	0.0 d	0.0 c	0.0 b	0.0 a	0.0 ab	0.0 c	0.0 c	0.0 l	1.5 hij	0.3 jk
Venom 20SG	10.6 oz.	0.132	0.0 d	0.0 c	0.0 b	0.5 a	0.3 a	0.0 c	0.3 bc	0.0 l	8.3 c-i	0.0 jk
Venom 75SG	2.8 oz.	0.132	1.3 a-d	0.0 c	0.5 ab	0.0 a	0.3 a	0.0 c	0.0 c	1.3 h-l	3.5 e-j	0.8 k
Assail 70WP	0.6 oz.	0.026	1.0 a-d	0.0 c	0.3 ab	0.3 a	0.0 ab	0.3 bc	0.0 c	0.8 i-l	8.8 c-i	3.0 h-k
Assail 70WP	1.1 oz.	0.048	0.0 d	0.3 bc	0.0 b	0.0 a	0.0 ab	0.0 c	0.0 c	1.0 i-l	2.3 f-j	0.8 e-h
TD 2472 30WG	1.4 oz.	0.026	0.0 d	0.0 c	0.0 b	0.5 a	0.0 ab	0.3 bc	0.5 bc	1.0 i-l	2.0 g-j	0.3 h-k
TD 2472 30WG	2.7 oz.	0.048	0.3 cd	0.0 c	0.0 b	0.0 a	0.0 ab	0.0 c	0.0 c	1.0 i-l	0.8 j	0.0 jk
Provado 1.6SC	3.75 fl. oz.	0.047	0.0 d	0.3 bc	0.8 a	0.0 a	0.5 a	0.0 c	0.0 c	5.8 def	4.5 e-j	1.3 k
Actara 25WG	1.5 oz.	0.023	0.5 bcd	0.8 b	0.3 ab	0.3 a	0.0 ab	0.3 bc	0.0 c	5.0 d-g	7.0 c-i	0.8 h-k
Actara 25WG	3 oz.	0.047	0.0 d	0.3 bc	0.3 ab	0.3 a	0.5 a	0.0 c	0.0 c	2.0 g-l	1.5 ij	0.5 h-k
Leverage 2.7SC	3.75 fl. oz.	0.079	0.0 d	0.0 c	0.3 ab	0.5 a	0.0 ab	0.0 c	0.0 c	1.0 i-l	1.8 hij	0.5 jk
Baythroid 2E	2.8 fl. oz.	0.044	0.3 cd	0.0 c	0.0 b	0.0 a	0.3 a	0.0 c	0.8 bc	1.3 h-l	6.3 c-i	0.3 jk
Asana XL 0.66EC	8.0 fl. oz.	0.04	0.5 bcd	0.0 c	0.3 ab	0.5 a	0.3 a	0.0 c	0.0 c	2.8 f-k	8.0 c-f	2.3 jk
Capture 2EC	3.84 fl. oz.	0.06	0.0 d	0.3 bc	0.0 b	0.0 a	0.0 ab	0.0 c	0.8 bc	2.5 g-k	15.8 abc	2.5 e-i
Capture 2EC	5.1 fl. oz.	0.08	0.0 d	0.0 c	0.0 b	0.0 a	0.0 b	0.0 c	0.3 bc	5.0 d-g	6.5 c-i	1.0 e-h
Mustang Max 0.8EW	2.88 fl. oz.	0.018	0.0 d	0.0 c	0.3 ab	0.0 a	0.5 a	0.0 c	0.0 c	2.3 g-k	2.5 f-j	0.3 h-k
Mustang Max 0.8EW	4 fl. oz.	0.025	0.0 d	0.0 c	0.0 b	0.3 a	0.3 a	0.0 c	0.0 c	0.0 l	4.5 e-j	0.0 jk
Warrior 1CS	1.9 fl. oz.	0.015	0.5 bcd	0.0 c	0.3 ab	0.5 a	0.5 a	0.3 bc	0.0 c	3.5 f-i	4.8 d-j	0.5 k
Warrior 1CS	3.2 fl. oz.	0.025	0.0 d	0.3 bc	0.3 ab	0.3 a	0.3 a	0.3 bc	0.0 c	0.0 l	4.0 e-j	1.3 ijk
Untreated	---	---	2.0 a	0.5 bc	0.3 ab	0.0 a	0.0 ab	0.5 b	12.3 a	63.3 a	21.5 a	9.3 h-k

Means in a column followed by the same letter are not significantly different (Least Significant Difference Test, P = 0.05).

\*First sample after insecticide applications.

\*\*Foliar applications made to selected treatments on 6/25.

Table 20. (Continued). Colorado potato beetle adults sampled from Superior variety potatoes treated with foliar insecticides. Arlington, WI 2004.

Treatment	Rate		Mean adults per 10 plants									
	prod./a	lb. a.i./a	*6/21	6/25	6/28	7/2	7/8	*7/12	7/16	7/22	7/29	*8/8
Rimon 0.83EC	6 fl. oz.	0.039	1.5 ab	1.8 a	0.5 ab	0.0 a	0.3 a	0.3 bc	1.0 b	1.5 h-l	5.8 d-j	6.0 b
Rimon 0.83EC	9 fl. oz.	0.058	1.0 a-d	0.3 bc	0.8 a	0.0 a	0.3 a	0.3 bc	0.5 bc	0.5 kl	4.5 e-j	4.3 cd
Rimon 0.83EC	12 fl. oz.	0.078	0.8 a-d	0.0 c	0.0 b	0.0 a	0.3 a	1.3 a	0.0 c	0.8 i-l	0.5 j	1.5 de
Spintor 2SC**	3.0 fl. oz.	0.047	0.8 a-d	0.8 b	0.3 ab	0.3 a	0.3 a	0.3 bc	0.5 bc	5.8 e-h	10.3 cde	3.8 g-k
Spintor 2SC	4.5 fl. oz.	0.07	0.0 d	0.3 bc	0.0 b	0.0 a	0.3 a	0.3 bc	0.5 bc	3.0 f-j	7.5 c-g	0.8 k
Avaunt 30DG + PBO**	3.5 oz. + 4 fl. oz.	0.066 + 4 oz./A	0.8 a-d	0.3 bc	0.3 ab	0.5 a	0.0 ab	0.3 bc	0.3 bc	2.3 g-l	10.3 b-e	8.0 h-k
Avaunt 30DG + PBO	4.5 oz. + 4 fl. oz.	0.084 + 4 oz./A	0.0 d	0.3 bc	0.3 ab	0.0 a	0.3 a	0.0 c	0.5 bc	20.0 b	18.8 ab	8.3 b
Avaunt 30DG + Penetrator Plus**	3.34 oz. + 0.5 %v/v		1.0 a-d	0.3 bc	0.0 b	0.0 a	0.3 a	0.3 bc	1.0 b	23.8 b	18.8 ab	23.3 a
Agrimek 0.15EC	4 fl. oz.	0.005	1.3 abc	0.3 bc	0.0 b	0.0 a	0.3 a	0.0 c	0.3 bc	13.0 c	12.0 a-d	0.0 jk
Agrimek 0.15EC	8 fl. oz.	0.009	0.0 d	0.0 c	0.0 b	0.0 a	0.0 ab	0.5 b	0.8 bc	8.8 cd	3.8 e-j	0.5 k
Trigard 75WP**	2.66 oz.	0.125	0.8 a-d	0.5 bc	0.5 ab	0.0 a	0.0 ab	0.3 bc	0.0 c	3.0 f-j	8.0 c-h	5.0 ijk
Trigard 75WP	5.33 oz.	0.25	1.3 abc	0.0 c	0.3 ab	0.3 a	0.0 ab	0.3 bc	0.8 bc	7.0 de	17.5 abc	4.0 cd
BAS 320 I 4SC + Penetrator Plus**	2.28 fl. oz. + 0.5%	0.071 + 0.5%	0.0 d	0.3 bc	0.0 b	0.3 a	0.0 ab	0.0 c	0.0 c	0.0 l	5.0 d-j	0.0 def
BAS 320 I 4SC + Penetrator Plus	4.0 fl. oz. + 0.5%	0.125 + 0.5%	0.5 bcd	0.0 c	0.3 ab	0.0 a	0.0 ab	0.0 c	0.0 c	4.8 efg	5.5 d-j	1.8

Means followed by the same letter are not significantly different (Least Significant Difference Test, P = 0.05).

\*First sample after insecticide applications.

\*\*Foliar applications made to selected treatments on 6/25.

Table 21. Colorado potato beetle egg masses sampled from Superior variety potatoes treated with foliar insecticides. Arlington, WI 2004.

Treatment	Rate		Mean egg masses per 10 plants									
	prod./a	lb. a.i./a	*6/21	6/25	6/28	7/2	7/8	*7/12	7/16	7/22	7/29	*8/8
Clutch 50WG	1.5 oz.	0.047	0.5 a-d	0.3 ab	0.0 c	0.3 ab	0.0 a	0.0 a	0.0 b	0.0 a	0.0 a	0.0 a
Clutch 50WG	2 oz.	0.063	1.0 a-d	0.0 b	0.0 c	0.0 b	0.0 a	0.0 a	0.0 b	0.0 a	0.0 a	0.0 a
Clutch 50WG	4 oz.	0.125	1.5 a-d	0.3 ab	0.3 bc	0.0 b	0.0 a	0.0 a	0.0 b	0.0 a	0.0 a	0.0 a
Venom 20SG	10.6 oz.	0.132	0.8 a-d	0.0 b	0.5 abc	0.0 b	0.0 a	0.0 a	0.0 b	0.0 a	0.0 a	0.0 a
Venom 75SG	2.8 oz.	0.132	1.0 a-d	0.0 b	0.0 c	0.0 b	0.0 a	0.0 a	0.0 b	0.0 a	0.0 a	0.0 a
Assail 70WP	0.6 oz.	0.026	1.3 a-d	0.3 ab	0.0 c	0.0 b	0.0 a	0.0 a	0.0 b	0.0 a	0.0 a	0.0 a
Assail 70WP	1.1 oz.	0.048	0.5 bcd	0.8 a	0.0 c	0.0 b	0.3 a	0.3 a	0.0 b	0.0 a	0.0 a	0.0 a
TD 2472 30WG	1.4 oz.	0.026	1.0 a-d	0.5 ab	0.3 bc	0.0 b	0.0 a	0.0 a	0.0 b	0.0 a	0.0 a	0.0 a
TD 2472 30WG	2.7 oz.	0.048	0.5 a-d	0.0 b	0.3 bc	0.0 b	0.0 a	0.0 a	0.0 b	0.0 a	0.0 a	0.0 a
Provado 1.6SC	3.75 fl. oz.	0.047	1.8 a-d	0.3 ab	0.3 bc	0.5 a	0.0 a	0.0 a	0.0 b	0.0 a	0.0 a	0.0 a
Actara 25WG	1.5 oz.	0.023	2.8 a	0.5 ab	0.3 bc	0.0 b	0.0 a	0.3 a	0.0 b	0.0 a	0.0 a	0.0 a
Actara 25WG	3 oz.	0.047	1.5 a-d	0.5 ab	0.0 c	0.0 b	0.0 a	0.0 a	0.0 b	0.0 a	0.0 a	0.0 a
Leverage 2.7SC	3.75 fl. oz.	0.079	1.3 a-d	0.0 b	0.0 c	0.0 b	0.0 a	0.0 a	0.0 b	0.0 a	0.0 a	0.0 a
Baythroid 2E	2.8 fl. oz.	0.044	1.8 a-d	0.3 ab	0.3 bc	0.0 b	0.0 a	0.0 a	0.0 b	0.0 a	0.0 a	0.0 a
Asana XL 0.66EC	8.0 fl. oz.	0.04	0.3 cd	0.5 ab	0.3 bc	0.0 b	0.3 a	0.0 a	0.0 b	0.0 a	0.0 a	0.0 a
Capture 2EC	3.84 fl. oz.	0.06	0.5 a-d	0.5 ab	0.3 bc	0.3 ab	0.0 a	0.0 a	0.0 b	0.0 a	0.0 a	0.0 a
Capture 2EC	5.1 fl. oz.	0.08	1.0 a-d	0.0 b	0.0 c	0.0 b	0.0 b	0.0 a	0.0 b	0.0 a	0.0 a	0.0 a
Mustang Max 0.8EW	2.88 fl. oz.	0.018	1.5 a-d	0.3 ab	0.8 abc	0.0 b	0.0 a	0.0 a	0.0 b	0.0 a	0.0 a	0.0 a
Mustang Max 0.8EW	4 fl. oz.	0.025	2.0 ab	0.3 ab	0.0 c	0.0 b	0.0 a	0.0 a	0.0 b	0.0 a	0.0 a	0.0 a
Warrior 1CS	1.9 fl. oz.	0.015	1.0 a-d	0.0 b	0.0 c	0.0 b	0.0 a	0.0 a	0.0 b	0.0 a	0.0 a	0.0 a
Warrior 1CS	3.2 fl. oz.	0.025	1.3 a-d	0.3 ab	0.0 c	0.0 b	0.0 a	0.3 a	0.0 b	0.0 a	0.0 a	0.0 a
Untreated	---	---	0.8 a-d	0.0 b	0.5 abc	0.3 ab	0.0 a	0.0 a	0.0 b	0.0 a	0.0 a	0.0 a

Means in a column followed by the same letter are not significantly different (Least Significant Difference Test, P = 0.05).

First sample after insecticide applications.

\*\*Foliar applications made to selected treatments on 6/25.

Table 21. (Continued). Colorado potato beetle egg masses sampled from Superior variety potatoes treated with foliar insecticides. Arlington, WI 2004.

Treatment	Rate		Mean egg masses per 10 plants									
	prod./a	lb. a.i./a	*6/21	6/25	6/28	7/2	7/8	*7/12	7/16	7/22	7/29	*8/8
Rimon 0.83EC	6 fl. oz.	0.039	1.5 a-d	0.3 ab	0.5 abc	0.0 b	0.0 a	0.3 a	0.3 a	0.0 a	0.0 a	0.0 a
Rimon 0.83EC	9 fl. oz.	0.058	0.3 cd	0.0 b	0.3 bc	0.3 ab	0.0 a	0.0 a	0.3 a	0.0 a	0.0 a	0.0 a
Rimon 0.83EC	12 fl. oz.	0.078	1.8 abc	0.8 a	0.0 c	0.3 ab	0.3 a	0.0 a	0.0 b	0.0 a	0.0 a	0.0 a
Spintor 2SC**	3.0 fl. oz.	0.047	1.0 a-d	0.0 b	0.8 ab	0.3 ab	0.0 a	0.0 a	0.0 b	0.0 a	0.0 a	0.0 a
Spintor 2SC	4.5 fl. oz.	0.07	1.5 a-d	0.5 ab	0.0 c	0.0 b	0.0 a	0.0 a	0.0 b	0.0 a	0.0 a	0.0 a
Avaunt 30DG + PBO**	3.5 oz. + 4 fl. oz.	0.066 + 4 oz./A	1.0 a-d	0.8 ab	0.0 c	0.0 b	0.0 a	0.0 a	0.0 b	0.0 a	0.0 a	0.0 a
Avaunt 30DG + PBO	4.5 oz. + 4 fl. oz.	0.084 + 4 oz./A	1.0 a-d	0.5 ab	0.5 abc	0.0 b	0.0 a	0.0 a	0.0 b	0.0 a	0.0 a	0.0 a
Avaunt 30DG + Penetrator Plus**	4 fl. oz.	0.005	1.5 a-d	0.0 b	0.0 c	0.0 b	0.0 a	0.0 a	0.0 b	0.0 a	0.0 a	0.0 a
Agrimek 0.15EC	3.34 oz. + 0.5 %v/v		1.5 a-d	0.5 ab	0.3 bc	0.0 b	0.0 a	0.0 a	0.0 b	0.0 a	0.0 a	0.0 a
Agrimek 0.15EC	8 fl. oz.	0.009	1.3 a-d	0.0 b	1.5 a	0.0 b	0.0 a	0.0 a	0.0 b	0.0 a	0.0 a	0.0 a
Trigard 75WP**	2.66 oz.	0.125	0.8 a-d	0.0 b	0.8 abc	0.0 b	0.0 a	0.3 a	0.0 b	0.0 a	0.0 a	0.0 a
Trigard 75WP	5.33 oz.	0.25	0.3 cd	0.0 b	0.0 c	0.3 ab	0.0 a	0.0 a	0.0 b	0.0 a	0.0 a	0.0 a
BAS 320 I 4SC + Penetrator Plus**	2.28 fl. oz. + 0.5%	0.071 + 0.5%	0.0 d	0.3 ab	0.0 c	0.0 b	0.0 a	0.0 a	0.0 b	0.0 a	0.0 a	0.0 a
BAS 320 I 4SC + Penetrator Plus	4.0 fl. oz. + 0.5%	0.125 + 0.5%	1.3 a-d	0.3 ab	0.3 bc	0.0 b	0.0 a	0.0 a	0.0 b	0.0 a	0.0 a	0.0 a

Means followed by the same letter are not significantly different (Least Significant Difference Test, P = 0.05).

\*First sample after insecticide applications.

\*\*Foliar applications made to selected treatments on 6/25.

Table 22. Colorado potato beetle small larvae sampled from Superior variety potatoes treated with foliar insecticides. Arlington, WI 2004.

Treatment	Rate		Mean larvae per 10 plants									
	prod./a	lb. a.i./a	*6/21	6/25	6/28	7/2	7/8	*7/12	7/16	7/22	7/29	*8/8
Clutch 50WG	1.5 oz.	0.047	0.0 i	0.0 g	1.5 e	0.0 f	3.5 g-j	0.0 d	0.0 c	0.0 c	0.0 b	0.0 a
Clutch 50WG	2 oz.	0.063	1.8 ghi	0.3 fg	0.0 e	0.0 f	1.3 j	0.0 d	0.0 c	0.0 c	0.0 b	0.0 a
Clutch 50WG	4 oz.	0.125	2.3 e-i	0.0 g	3.5 de	0.0 f	0.8 j	0.0 d	0.0 c	0.0 c	0.0 b	0.0 a
Venom 20SG	10.6 oz.	0.132	1.0 hi	0.0 g	0.0 e	1.0 def	1.0 j	0.0 d	0.0 c	0.3 c	0.0 b	0.0 a
Venom 75SG	2.8 oz.	0.132	3.3 d-i	0.0 g	0.3 e	4.3 cd	10.3 c-f	0.5 cd	0.0 c	1.0 bc	0.0 b	0.0 a
Assail 70WP	0.6 oz.	0.026	0.0 i	0.0 g	0.0 e	0.8 def	6.8 e-i	0.3 cd	0.0 c	0.0 c	0.0 b	0.0 a
Assail 70WP	1.1 oz.	0.048	1.8 f-i	0.0 g	0.8 e	0.0 f	9.8 c-f	0.0 d	0.0 c	0.0 c	0.0 b	0.0 a
TD 2472 30WG	1.4 oz.	0.026	1.0 hi	0.0 g	0.0 e	1.0 c-f	8.0 d-h	0.0 d	0.0 c	0.0.3 c	0.0 b	0.0 a
TD 2472 30WG	2.7 oz.	0.048	0.5 hi	0.5 efg	0.3 e	0.0 f	3.0 hij	0.0 d	0.0 c	0.0 c	0.0 b	0.0 a
Provado 1.6SC	3.75 fl. oz.	0.047	0.5 hi	0.0 g	1.5 e	4.3 cd	16.0 abc	0.0 d	0.0 c	0.5 bc	0.0 b	0.0 a
Actara 25WG	1.5 oz.	0.023	1.3 ghi	0.5 efg	3.5 de	4.3 cd	11.3 cde	0.8 cd	0.0 c	0.3 c	0.0 b	0.0 a
Actara 25WG	3 oz.	0.047	5.8 d-i	0.0 g	0.3 e	0.8 def	12.3 cde	0.0 d	0.0 c	0.0 c	0.0 b	0.0 a
Leverage 2.7SC	3.75 fl. oz.	0.079	2.0 e-i	0.5 efg	0.0 e	0.3 ef	3.8 f-j	0.0 d	0.5 bc	0.0 c	0.0 b	0.0 a
Baythroid 2E	2.8 fl. oz.	0.044	3.0 d-i	0.3 fg	0.8 e	0.0 f	3.5 g-j	0.5 cd	0.0 c	0.3 c	0.0 b	0.0 a
Asana XL 0.66EC	8.0 fl. oz.	0.04	2.5 d-i	0.0 g	0.5 e	2.0 c-f	4.0 f-j	0.0 d	0.5 bc	2.3 a	0.0 b	0.0 a
Capture 2EC	3.84 fl. oz.	0.06	0.5 hi	0.8 efg	0.8 e	2.3 c-f	6.0 e-i	0.3 cd	0.0 c	0.0 c	0.0 b	0.0 a
Capture 2EC	5.1 fl. oz.	0.08	1.3 ghi	0.3 fg	0.8 e	0.8 def	2.8 hij	0.0 d	0.0 c	0.3 c	0.0 b	0.0 a
Mustang Max 0.8EW	2.88 fl. oz.	0.018	1.3 ghi	0.8 efg	0.5 e	0.5 def	3.5 g-j	0.0 d	0.0 c	0.0 c	0.0 b	0.0 a
Mustang Max 0.8EW	4 fl. oz.	0.025	1.0 hi	1.0 efg	1.3 e	2.3 c-f	1.8 j	0.3 cd	0.8 bc	0.3 c	0.0 b	0.0 a
Warrior 1CS	1.9 fl. oz.	0.015	0.8 hi	0.0 g	0.8 e	0.0 f	1.3 j	0.0 d	0.3 bc	0.3 c	0.0 b	0.0 a
Warrior 1CS	3.2 fl. oz.	0.025	1.0 hi	0.5 efg	1.0 e	1.0 c-f	1.5 j	0.0 d	0.0 c	0.0 c	0.0 b	0.0 a
Untreated	---	---	11.0 abc	21.0 a	16.8 a	31.0 a	10.3 c-f	11.3 a	3.5 a	0.3 c	0.0 b	0.0 a

Means in a column followed by the same letter are not significantly different (Least Significant Difference Test, P = 0.05).

First sample after insecticide applications.

\*\*Foliar applications made to selected treatments on 6/25.

Table 22. (Continued). Colorado potato beetle small larvae sampled from Superior variety potatoes treated with foliar insecticides. Arlington, WI 2004.

Treatment	Rate		Mean larvae per 10 plants									
	prod./a	lb. a.i./a	*6/21	6/25	6/28	7/2	7/8	*7/12	7/16	7/22	7/29	*8/8
Rimon 0.83EC	6 fl. oz.	0.039	8.0 b-e	3.3 c-g	3.3 de	1.5 c-f	0.8 j	0.5 cd	0.0 c	0.0 c	0.0 b	0.0 a
Rimon 0.83EC	9 fl. oz.	0.058	18.8 a	0.5 efg	0.5 e	2.8 c-f	1.8 ij	0.0 d	0.0 c	0.0 c	0.0 b	0.0 a
Rimon 0.83EC	12 fl. oz.	0.078	9.0 bcd	2.3 d-g	0.8 e	0.3 ef	1.0 j	0.0 d	0.0 c	0.0 c	0.0 b	0.0 a
Spintor 2SC**	3.0 fl. oz.	0.047	1.3 ghi	0.0 g	0.8 e	2.3 c-f	4.3 f-j	1.3 bcd	0.5 bc	1.3 ab	0.8 ab	0.0 a
Spintor 2SC	4.5 fl. oz.	0.07	2.0 e-i	0.3 fg	1.0 e	3.8 cd	19.0 ab	0.5 cd	0.0 c	0.0 c	1.3 a	0.0 a
Avaunt 30DG + PBO**	3.5 oz. + 4 fl. oz.	0.066 + 4 oz./A	2.8 d-i	5.0 bcd	0.8 e	4.3 cde	13.3 bcd	1.3 bcd	0.0 c	0.0 c	0.0 b	0.0 a
Avaunt 30DG + PBO	4.5 oz. + 4 fl. oz.	0.084 + 4 oz./A	3.0 d-i	4.3 c-f	15.5 ab	21.0 b	8.3 d-g	1.8 bc	1.0 b	0.0 c	0.0 b	0.0 a
Avaunt 30DG + Penetrator Plus**	3.34 oz. + 0.5 %v/v		16.0 ab	9.0 b	9.8 bc	15.5 b	11.5 b-e	3.5 b	0.0 c	0.0 c	0.0 b	0.0 a
Agrimek 0.15EC	4 fl. oz.	0.005	7.3 b-g	3.8 b-e	6.8 cd	24.8 ab	13.8 a-d	1.0 bcd	0.0 c	0.0 c	0.0 b	0.0 a
Agrimek 0.15EC	8 fl. oz.	0.009	5.0 d-i	1.0 d-g	1.0 e	17.8 b	11.8 b-e	1.3 bcd	0.0 c	0.0 c	0.0 b	0.0 a
Trigard 75WP**	2.66 oz.	0.125	8.3 c-h	8.8 bc	10.5 bc	5.5 c	3.3 g-j	1.8 bc	0.0 c	0.0 c	1.5 a	0.0 a
Trigard 75WP	5.33 oz.	0.25	11.3 b-f	8.8 bc	9.0 bc	14.8 b	22.5 a	2.8 b	0.0 c	0.0 c	0.0 b	0.0 a
BAS 320 I 4SC + Penetrator Plus**	2.28 fl. oz. + 0.5%	0.071 + 0.5%	4.3 d-i	1.3 d-g	1.8 e	0.0 f	0.8 j	0.0 d	0.0 c	0.0 c	0.0 b	0.0 a
BAS 320 I 4SC + Penetrator Plus	4.0 fl. oz. + 0.5%	0.125 + 0.5%	4.0 c-h	3.5 c-g	9.3 abc	13.0 b	9.8 c-f	0.0 d	0.0 c	0.0 c	0.0 b	0.0 a

Means followed by the same letter are not significantly different (Least Significant Difference Test, P = 0.05).

\*First sample after insecticide applications.

\*\*Foliar applications made to selected treatments on 6/25.

Table 23. Colorado potato beetle large larvae sampled from Superior variety potatoes treated with foliar insecticides. Arlington, WI 2004.

Treatment	Rate		Mean larvae per 10 plants									
	prod./a	lb. a.i./a	*6/21	6/25	6/28	7/2	7/8	*7/12	7/16	7/22	7/29	*8/8
Clutch 50WG	1.5 oz.	0.047	0.0 f	0.0 f	0.3 gh	0.5 ij	1.0 no	0.0 j	0.3 n	0.0 d	1.3 bcd	0.0 c
Clutch 50WG	2 oz.	0.063	0.0 f	0.0 f	0.0 h	0.0 j	3.3 k-o	0.0 j	0.0 n	0.0 d	0.0 d	0.0 c
Clutch 50WG	4 oz.	0.125	0.5 f	0.0 f	1.0 gh	0.0 j	0.5 o	0.0 j	0.0 n	0.0 d	0.0 d	0.0 c
Venom 20SG	10.6 oz.	0.132	0.0 f	0.3 ef	0.0 h	0.3 j	4.0 k-o	0.3 j	0.3 n	0.3 cd	0.0 d	0.0 c
Venom 75SG	2.8 oz.	0.132	1.3 def	0.0 f	0.3 gh	1.5 f-j	9.8 g-k	0.5 j	1.0 k-n	0.8 a-d	1.5 bcd	0.0 c
Assail 70WP	0.6 oz.	0.026	0.5 f	0.0 f	0.0 h	0.3 j	11.3 ghi	2.3 ij	1.0 k-n	0.8 bcd	1.5 bcd	0.0 c
Assail 70WP	1.1 oz.	0.048	0.8 ef	0.0 f	0.0 h	1.8 f-j	13.5 fgh	0.0 j	0.0 n	0.0 d	1.0 bcd	0.0 c
TD 2472 30WG	1.4 oz.	0.026	1.0 def	0.8 ef	0.5 gh	2.8 e-j	6.3 h-m	2.3 g-j	2.3 g-n	0.8 a-d	0.0 d	0.0 c
TD 2472 30WG	2.7 oz.	0.048	1.0 def	1.0 def	0.3 gh	0.3 j	4.5 j-o	0.3 j	0.3 n	0.3 cd	0.0 d	0.0 c
Provado 1.6SC	3.75 fl. oz.	0.047	0.0 f	0.0 f	1.8 e-h	5.5 e-i	23.3 def	1.5 j	5.3 e-j	2.3 ab	1.8 bcd	0.0 c
Actara 25WG	1.5 oz.	0.023	1.0 def	1.0 def	5.5 c-f	6.5 ef	25.5 de	6.5 fgh	4.0 f-k	1.5 abc	1.0 bcd	0.0 c
Actara 25WG	3 oz.	0.047	0.3 f	0.0 f	0.3 gh	1.3 hij	5.0 i-n	0.0 j	0.3 n	0.3 cd	4.5 b	0.0 c
Leverage 2.7SC	3.75 fl. oz.	0.079	0.8 def	0.3 ef	0.3 gh	1.0 hij	4.3 i-o	0.0 j	1.5 h-n	0.8 a-d	1.8 bcd	0.0 c
Baythroid 2E	2.8 fl. oz.	0.044	1.3 def	0.0 f	2.0 fgh	1.0 hij	7.0 h-m	0.5 j	0.5 lmn	0.5 bcd	2.5 bc	0.0 c
Asana XL 0.66EC	8.0 fl. oz.	0.04	1.0 def	0.3 ef	0.0 h	2.0 e-j	15.0 efg	3.5 g-j	4.8 d-g	1.5 a-d	2.5 bcd	0.3 bc
Capture 2EC	3.84 fl. oz.	0.06	2.0 def	1.0 def	1.8 e-h	3.3 e-j	15.3 efg	5.8 f-i	4.3 e-h	1.0 a-d	0.8 bcd	0.0 c
Capture 2EC	5.1 fl. oz.	0.08	0.0 f	0.3 ef	0.5 gh	4.0 e-i	10.8 g-j	6.8 efg	0.5 mn	0.8 a-d	0.0 d	0.0 c
Mustang Max 0.8EW	2.88 fl. oz.	0.018	0.0 f	0.3 ef	1.8 fgh	2.3 e-j	6.0 i-n	0.8 j	1.3 i-n	0.0 d	0.0 d	0.0 c
Mustang Max 0.8EW	4 fl. oz.	0.025	1.0 def	0.8 ef	0.3 gh	0.0 j	4.0 k-o	1.3 j	0.8 k-n	1.0 a-d	0.3 cd	0.0 c
Warrior 1CS	1.9 fl. oz.	0.015	0.3 f	0.5 ef	2.5 d-g	2.0 e-j	7.3 g-l	2.0 hij	0.3 n	0.5 bcd	2.5 bc	0.0 c
Warrior 1CS	3.2 fl. oz.	0.025	1.0 def	0.3 ef	0.5 gh	1.5 f-j	2.8 l-o	0.3 j	0.5 mn	0.3 cd	0.5 cd	0.0 c
Untreated	---	---	18.8 a	18.0 a	48.5 a	65.3 a	94.8 a	75.5 a	41.5 a	3.0 a	1.8 bcd	0.0 c

Means in a column followed by the same letter are not significantly different (Least Significant Difference Test, P = 0.05).

First sample after insecticide applications.

\*\*Foliar applications made to selected treatments on 6/25.

Table 23. (Continued). Colorado potato beetle large larvae sampled from Superior variety potatoes treated with foliar insecticides. Arlington, WI 2004.

Treatment	Rate		Mean larvae per 10 plants									
	prod./a	lb. a.i./a	*6/21	6/25	6/28	7/2	7/8	*7/12	7/16	7/22	7/29	*8/8
Rimon 0.83EC	6 fl. oz.	0.039	8.3 bc	0.0 f	1.5 gh	2.5 e-j	6.0 h-m	2.3 hij	0.0 n	0.0 d	0.0 d	0.0 c
Rimon 0.83EC	9 fl. oz.	0.058	11.8 ab	1.5 cde	0.3 gh	1.3 hij	3.0 k-o	0.3 j	1.3 j-n	0.0 d	0.0 d	0.0 c
Rimon 0.83EC	12 fl. oz.	0.078	7.0 cd	0.8 ef	0.5 gh	1.8 e-j	3.3 k-o	0.0 j	0.5 lmn	0.0 d	0.0 d	0.0 c
Spintor 2SC**	3.0 fl. oz.	0.047	0.5 f	0.3 ef	0.0 h	0.8 ij	5.3 i-n	13.5 cd	3.0 f-m	1.5 a-d	8.0 a	0.0 c
Spintor 2SC	4.5 fl. oz.	0.07	1.3 def	0.0 f	0.5 gh	4.5 efg	25.8 de	14.3 de	3.0 f-l	0.3 cd	3.0 bc	1.0 a
Avaunt 30DG + PBO**	3.5 oz. + 4 fl. oz.	0.066 + 4 oz./A	1.0 def	1.8 cde	0.3 gh	1.3 g-j	8.8 g-l	9.5 def	6.8 def	0.3 cd	0.3 cd	0.8 ab
Avaunt 30DG + PBO	4.5 oz. + 4 fl. oz.	0.084 + 4 oz./A	1.8 def	2.8 cd	14.8 b	11.3 cd	47.0 b	22.3 c	16.5 c	0.8 a-d	0.3 cd	0.3 bc
Avaunt 30DG + Penetrator Plus**	3.34 oz. + 0.5 %v/v		1.5 def	2.0 cde	5.0 cd	6.5 de	21.5 def	0.5 j	0.0 n	1.0 a-d	0.0 d	0.0 c
Agrimek 0.15EC	4 fl. oz.	0.005	5.3 cde	7.3 b	16.5 b	26.8 b	55.0 b	43.8 b	24.5 b	0.5 bcd	0.3 cd	0.0 c
Agrimek 0.15EC	8 fl. oz.	0.009	1.3 def	0.0 f	6.0 cd	18.0 bc	45.5 b	16.0 cd	7.5 de	1.0 a-d	0.3 cd	0.0 c
Trigard 75WP**	2.66 oz.	0.125	1.3 def	0.8 ef	0.8 gh	10.8 cd	39.0 bc	6.8 fg	3.3 f-k	0.0 d	0.0 d	0.0 c
Trigard 75WP	5.33 oz.	0.25	9.8 bc	7.0 b	5.0 cde	4.3 e-h	6.0 i-m	3.0 g-j	4.3 e-i	0.8 a-d	0.0 d	0.0 c
BAS 320 I 4SC + Penetrator Plus**	2.28 fl. oz. + 0.5%	0.071 + 0.5%	9.0 bc	3.0 c	6.8 c	11.5 cd	28.5 cd	13.0 def	9.5 d	0.8 bcd	1.5 bcd	0.3 bc
BAS 320 I 4SC + Penetrator Plus	4.0 fl. oz. + 0.5%	0.125 + 0.5%	1.0 def	0.0 f	0.0 h	0.0 j	2.0 mno	0.8 j	0.0 n	0.0 d	0.0 d	0.0 c

Means followed by the same letter are not significantly different (Least Significant Difference Test, P = 0.05).

\*First sample after insecticide applications.

\*\*Foliar applications made to selected treatments on 6/25.

Table 24. Defoliation ratings from Superior variety potatoes treated with foliar insecticides. Arlington, WI 2004.

Treatment	Rate		Mean defoliation per plot									
	prod./a	lb. a.i./a	*6/21	6/25	6/28	7/2	7/8	*7/12	7/16	7/22	7/29	*8/8
Clutch 50WG	1.5 oz.	0.047	0.0 b	0.0 b	0.0 c	0.0 f	0.0 g	0.0 h	0.0 j	0.0 i	5.0 j	8.8 jk
Clutch 50WG	2 oz.	0.063	0.0 b	0.0 b	0.0 c	0.0 f	0.0 g	0.0 h	0.0 j	0.0 i	5.0 j	6.3 k
Clutch 50WG	4 oz.	0.125	0.0 b	0.0 b	0.0 c	0.0 f	0.0 g	0.0 h	0.0 j	0.0 i	5.0 j	6.3 k
Venom 20SG	10.6 oz.	0.132	0.0 b	0.0 b	0.0 c	0.0 f	0.0 g	0.0 h	0.0 j	0.0 i	7.5 hij	10.0 jk
Venom 75SG	2.8 oz.	0.132	0.0 b	0.0 b	0.0 c	0.0 f	0.0 g	0.0 h	0.0 j	0.0 i	8.8 hij	11.3 jk
Assail 70WP	0.6 oz.	0.026	0.0 b	0.0 b	0.0 c	0.0 f	0.0 g	0.0 h	0.0 j	0.0 i	13.8 f-j	21.3 f-j
Assail 70WP	1.1 oz.	0.048	0.0 b	0.0 b	0.0 c	0.0 f	0.0 g	0.0 h	1.3 ij	0.0 i	5.0 j	12.5 ijk
TD 2472 30WG	1.4 oz.	0.026	0.0 b	0.0 b	0.0 c	0.0 f	0.0 g	1.3 gh	0.0 j	0.0 i	12.5 g-j	13.8 h-k
TD 2472 30WG	2.7 oz.	0.048	0.0 b	0.0 b	0.0 c	0.0 f	0.0 g	0.0 h	0.0 j	0.0 i	7.5 hij	11.3 jk
Provado 1.6SC	3.75 fl. oz.	0.047	0.0 b	0.0 b	0.0 c	0.0 f	5.0 de	2.5 gh	5.0 f-j	11.3 g	15.0 f-i	26.3 d-h
Actara 25WG	1.5 oz.	0.023	0.0 b	0.0 b	0.0 c	0.0 f	3.8 ef	5.0 fg	6.3 f-j	11.3 g	22.5 def	35 b-e
Actara 25WG	3 oz.	0.047	0.0 b	0.0 b	0.0 c	0.0 f	0.0 g	1.3 gh	0.0 j	0.0 i	5.0 j	7.5 k
Leverage 2.7SC	3.75 fl. oz.	0.079	0.0 b	0.0 b	0.0 c	0.0 f	0.0 g	0.0 h	0.0 j	0.0 i	5.0 j	7.5 k
Baythroid 2E	2.8 fl. oz.	0.044	0.0 b	0.0 b	0.0 c	0.0 f	0.0 g	0.0 h	0.0 j	0.0 i	6.3 ij	17.5 g-k
Asana XL 0.66EC	8.0 fl. oz.	0.04	0.0 b	0.0 b	0.0 c	0.0 f	0.0 g	0.0 h	0.0 j	0.0 i	10.0 g-j	17.5 g-k
Capture 2EC	3.84 fl. oz.	0.06	0.0 b	0.0 b	0.0 c	0.0 f	0.0 g	0.0 h	0.0 j	0.0 i	16.3 e-h	27.5 d-g
Capture 2EC	5.1 fl. oz.	0.08	0.0 b	0.0 b	0.0 c	0.0 f	0.0 g	0.0 h	0.0 j	0.0 i	6.3 ij	15.0 g-k
Mustang Max 0.8EW	2.88 fl. oz.	0.018	0.0 b	0.0 b	0.0 c	0.0 f	0.0 g	1.3 gh	0.0 j	0.0 i	16.3 e-h	17.5 g-k
Mustang Max 0.8EW	4 fl. oz.	0.025	0.0 b	0.0 b	0.0 c	0.0 f	0.0 g	0.0 h	0.0 j	0.0 i	5.0 j	8.8 jk
Warrior 1CS	1.9 fl. oz.	0.015	0.0 b	0.0 b	0.0 c	0.0 f	0.0 g	0.0 h	0.0 j	0.0 i	6.3 ij	13.8 h-k
Warrior 1CS	3.2 fl. oz.	0.025	0.0 b	0.0 b	0.0 c	0.0 f	0.0 g	0.0 h	0.0 j	0.0 i	7.5 hij	11.3 jk
Untreated	---	---	0.0 b	1.3 a	3.8 a	15.0 a	35.0 a	50.0 a	68.8 a	87.5 a	95.0 a	100.0 a

Means in a column followed by the same letter are not significantly different (Least Significant Difference Test, P = 0.05).

First sample after insecticide applications.

\*\*Foliar applications made to selected treatments on 6/25.

Table 24. (Continued). Defoliation ratings from Superior variety potatoes treated with foliar insecticides. Arlington, WI 2004.

Treatment	Rate		Mean defoliation per plot									
	prod./a	lb. a.i./a	*6/21	6/25	6/28	7/2	7/8	*7/12	7/16	7/22	7/29	*8/8
Rimon 0.83EC	6 fl. oz.	0.039	0.0 b	0.0 b	0.0 c	0.0 f	0.0 g	0.0 h	0.0 j	0.0 i	6.3 ij	16.3 g-k
Rimon 0.83EC	9 fl. oz.	0.058	0.0 b	0.0 b	0.0 c	0.0 f	0.0 g	1.3 gh	2.5 hij	0.0 i	10.0 g-j	15.0 g-k
Rimon 0.83EC	12 fl. oz.	0.078	0.0 b	0.0 b	0.0 c	0.0 f	0.0 g	0.0 h	1.3 ij	0.0 i	7.5 hij	12.5 ijk
Spintor 2SC**	3.0 fl. oz.	0.047	0.0 b	0.0 b	0.0 c	0.0 f	0.0 g	0.0 h	3.8 g-j	6.3 h	22.5 def	45.0 bc
Spintor 2SC	4.5 fl. oz.	0.07	0.0 b	0.0 b	0.0 c	0.0 f	5.0 de	7.5 ef	11.3 ef	11.3 g	30.0 d	37.5 b-e
Avaunt 30DG + PBO**	3.5 oz. + 4 fl. oz.	0.066 + 4 oz./A	0.0 b	0.0 b	0.0 c	0.0 f	0.0 g	2.5 gh	3.8 g-j	6.3 h	18.8 efg	25.0 e-i
Avaunt 30DG + PBO	4.5 oz. + 4 fl. oz.	0.084 + 4 oz./A	0.0 b	0.0 b	1.3 b	5.0 bc	16.3 b	25.0 c	32.5 c	40.0 c	71.3 b	87.5 a
Avaunt 30DG + Penetrator Plus**	3.34 oz. + 0.5 %v/v		0.0 b	0.0 b	1.3 b	6.3 b	17.5 b	30.0 b	51.3 b	70.0 b	78.8 b	93.8 a
Agrimek 0.15EC	4 fl. oz.	0.005	0.0 b	0.0 b	0.0 c	2.5 de	16.3 b	21.3 c	23.8 d	35.0 d	47.5 c	46.3 bc
Agrimek 0.15EC	8 fl. oz.	0.009	0.0 b	0.0 b	0.0 c	1.3 ef	10.0 c	12.5 d	7.5 e-i	16.3 f	31.3 d	38.8 bcd
Trigard 75WP**	2.66 oz.	0.125	0.0 b	1.3 a	0.0 c	1.3 ef	3.8 ef	3.8 fgh	10.0 efg	15.0 fg	25.0 de	41.3 bc
Trigard 75WP	5.33 oz.	0.25	1.3 a	1.3 a	0.0 c	3.8 cd	7.5 cd	10.0 de	13.8 e	22.5 e	30.0 d	47.5 b
BAS 320 I 4SC + Penetrator Plus**	2.28 fl. oz. + 0.5%	0.071 + 0.5%	1.3 a	0.0 b	0.0 c	1.3 ef	1.3 fg	1.3 gh	1.3 ij	1.3 i	16.3 e-h	17.5 g-k
BAS 320 I 4SC + Penetrator Plus	4.0 fl. oz. + 0.5%	0.125 + 0.5%	1.3 a	1.3 a	0.0 c	2.5 de	7.5 cd	7.5 ef	8.8 e-h	16.3 f	25.0 de	33.8 c-f

Means followed by the same letter are not significantly different (Least Significant Difference Test, P = 0.05).

\*First sample after insecticide applications.

\*\*Foliar applications made to selected treatments on 6/25.

Table 25. Yield and percent grade of Superior variety potatoes treated with foliar insecticides. Arlington, WI 2003.

Treatment	Rate		Mean percent grade		Yield (cwt/A)
	prod./a	lb. a.i./a	A's	B's & Culls	
Clutch 50WG	1.5 oz.	0.047	90.9 a	9.1 b	351.6 abc
Clutch 50WG	2 oz.	0.063	91.3 a	8.7 b	353.4 abc
Clutch 50WG	4 oz.	0.125	94.5 a	5.5 b	372.3 ab
Venom 20SG	10.6 oz.	0.132	91.8 a	8.2 b	347.2 a-d
Venom 75SG	2.8 oz.	0.132	92.1 a	7.9 b	290.1 c-i
Assail 70WP	0.6 oz.	0.026	89.4 a	10.6 b	316.2 a-h
Assail 70WP	1.1 oz.	0.048	90.0 a	10.0 b	328.7 a-g
TD 2472 30WG	1.4 oz.	0.026	91.1 a	8.9 b	290.6 b-i
TD 2472 30WG	2.7 oz.	0.048	91.7 a	8.3 b	386.0 a
Provado 1.6SC	3.75 fl. oz.	0.047	91.3 a	8.7 b	282.6 c-i
Actara 25WG	1.5 oz.	0.023	93.0 a	7.0 b	276.6 c-i
Actara 25WG	3 oz.	0.047	89.7 a	10.3 b	325.3 a-g
Leverage 2.7SC	3.75 fl. oz.	0.079	92.3 a	7.7 b	337.4 a-g
Baythroid 2E	2.8 fl. oz.	0.044	91.1 a	8.9 b	343.6 a-f
Asana XL 0.66EC	8.0 fl. oz.	0.04	87.2 a	12.8 b	279.5 c-i
Capture 2EC	3.84 fl. oz.	0.06	86.4 a	13.6 b	287.7 c-i
Capture 2EC	5.1 fl. oz.	0.08	92.8 a	7.2 b	287.3 c-i
Mustang Max 0.8EW	2.88 fl. oz.	0.018	88.7 a	11.3 b	281.9 c-i
Mustang Max 0.8EW	4 fl. oz.	0.025	91.8 a	8.2 b	288.2 c-i
Warrior 1CS	1.9 fl. oz.	0.015	88.5 a	11.5 b	314 a-h
Warrior 1CS	3.2 fl. oz.	0.025	91.4 a	8.6 b	345.2 a-e
Untreated	---	---	68.2 b	31.8 a	170.8 j

Means in a column followed by the same letter are not significantly different (Least Significant Difference Test, P = 0.05).

Table 25. (Continued). Yield and percent grade of Superior variety potatoes treated with foliar insecticides. Arlington, WI 2003.

Treatment	Rate		Mean percent grade		Yield (cwt/A)
	prod./a	lb. a.i./a	A's	B's & Culls	
Rimon 0.83EC	6 fl. oz.	0.039	90.5 a	9.5 b	275.7 c-i
Rimon 0.83EC	9 fl. oz.	0.058	92.0 a	8.0 b	332.7 a-g
Rimon 0.83EC	12 fl. oz.	0.078	66.5 b	33.5 a	261.2 ghi
Spintor 2SC	3.0 fl. oz.	0.047	86.4 a	13.6 b	263.5 e-i
Spintor 2SC	4.5 fl. oz.	0.07	91.6 a	8.4 b	299.8 b-i
Avaunt 30DG + PBO	3.5 oz. + 4 fl. oz.	0.066 + 4 oz./A	93.3 a	6.7 b	329.1 a-g
Avaunt 30DG + PBO	4.5 oz. + 4 fl. oz.	0.084 + 4 oz./A	91.2 a	8.8 b	230.7 ij
Avaunt 30DG + Penetrator Plus	3.34 oz. + 0.5 %v/v		91.8 a	8.2 b	241.1 hij
Agrimek 0.15EC	4 fl. oz.	0.005	91.2 a	8.8 b	263.6 e-i
Agrimek 0.15EC	8 fl. oz.	0.009	95.2 a	4.8 b	271.5 c-i
Trigard 75WP	2.66 oz.	0.125	92.8 a	7.2 b	267.9 d-i
Trigard 75WP	5.33 oz.	0.25	87.9 a	12.1 b	261.6 f-i
BAS 320 I 4SC + Penetrator Plus	2.28 fl. oz. + 0.5%	0.071 + 0.5%	93.4 a	6.6 b	319.3 a-h
BAS 320 I 4SC + Penetrator Plus	4.0 fl. oz. + 0.5%	0.125 + 0.5%	94.3 a	5.7 b	297.7 b-i

Means in a column followed by the same letter are not significantly different (Least Significant Difference Test, P = 0.05).

## **Part 2. Insect Control with Foliar Insecticides.**

### **C. Colorado Potato Beetle Control with Foliar Insecticides – Hancock 2004.**

Russet Burbank variety potatoes were planted into a solid block on April 23. The block was divided into four replicates each consisting of two 20' row plots, arranged in a randomized complete block experimental design. Plots were separated by two untreated potato border rows and replicates were 12' apart. Plots were managed according to commercial potato production for disease and weed control. Hand weeding provided additional weed control.

Nine registered and eight non-registered materials were evaluated at the following rates.

#### Registered:

Agrimek 0.15EC (0.0047 lb. a.i./a)

Provado 1.6SC (0.047 lb. a.i./a)

Actara 25WG (0.0234 and 0.047 lb. a.i./a)

Baythroid 2EC (0.044 lb. a.i./a)

Asana 0.66E (0.04 lb. a.i./a)

Avaunt 30DG (0.084 lb. a.i./a)

Spintor 2SC (0.07 lb. a.i./a)

#### Experimental:

Rimon 0.83EC (0.039 and 0.058 lb. a.i./a)

Clutch 50WG (0.047, 0.0625, and 0.125 lb. a.i./a)

TD 2472 30WG (0.0262 and 0.0506 lb. a.i./a)

Mustang Max (0.018 lb. a.i./a)

Capture 2EC (0.08 lb. a.i./a)

Warrior 1CS (0.03 lb. a.i./a)

Venom 20SG (0.132 lb. a.i./a)

Venom 75SG (0.132 lb. a.i./a)

Trigard 75WP (0.125 lb. a.i./a)

BAS 320I 4SC (0.035 and 0.0625 lb. a.i./a)

All materials were applied with a CO<sub>2</sub> backpack sprayer operating at 40 psi delivering 20 gpa through four flat fan nozzles (8003) spaced at 18”.

Insecticides were applied on June 16 and 25 for first generation larval control and plots were evaluated at 2 and 7 days after the first application (June 16) and at 3, 7 and 19 days after the second application (June 25). All life stages of the Colorado potato beetle (CPB) were monitored on ten randomly chosen plants per plot. CPB pressure was extremely high. Plant foliage defoliation ratings were taken on each survey date from June 15 through July 12.

Plots were not harvested for yield and grade since only first generation CPB populations were managed.

## **Results**

As reported for Arlington, conditions at Hancock were ideal in 2004 for achieving good control with foliar sprays. CPB populations were high but cool conditions slowed CPB development, exposing susceptible small larvae for longer periods and slowed feeding, allowing plants to compensate for and out grow feeding damage.

In the controls, small larvae peaked on June 18 shortly after the 1<sup>st</sup> application at 21 per plant (Table 28) and large larvae peaked 5 days later on June 23 at 19 per plant (Table 29). In spite of these high populations defoliation proceeded slowly in response to the cool conditions with 10% by June 23 which slowly increased to 34% on July 12 (Table 30). The slow defoliation resulted from decreased larval feeding rates and rapid plant growth and compensation.

This slow expression of damage in 2004 was ideal for maximizing foliar insecticide performance. The pyrethroids, which generally perform poorly at Hancock due to widespread resistance, had high larval counts at 7 days after the first spray (Tables 28 and 29). However, high larval numbers among the

pyrethroid treatments did not result in severe defoliation. Subsequent larval control was more effective after the 2<sup>nd</sup> application and defoliation did not exceed 3% (Table 30).

This trend was even more evident with the neonicotinoids Provado and Actara (1.5 oz./A rate) which were less persistent and provided poor larval control at 7 days after the first application (Tables 28 and 29). Actara was more persistent than Provado (especially at the 3 oz./A rate) and provided better larval control, particularly after the 2<sup>nd</sup> application. However, again this poor larval control did not result in increased defoliation, which remained below 3%. The experimental neonicotinoids Clutch and Venom were more persistent than Provado and Actara (1.5 oz./A rate) and provided superior larval control with virtually no defoliation.

Of the reduced risk treatments, Spintor and Agrimek were more effective than Avaunt in larval control (Tables 28 and 29) and held defoliation to close to 0% while Avaunt plots exhibited noticeable defoliation (5-16%) after June 23.

Of the experimental reduced risk materials, TD 2472 was most effective with excellent larval control and no defoliation. BAS 320I was less effective in larval control and defoliation reached 4% on June 23.

The growth regulators Rimon and Trigard provided slow larval population reduction, particularly with small larvae (Table 28). Large larval control was more effective with over 87% reductions for all rates of Rimon and Trigard on June 23 (Table 29). Large larval populations remained very low in these plots after the 2<sup>nd</sup> application with the exception of the lowest rate of Rimon (6 oz.) which had significantly more large larvae on June 28 (Table 29). Defoliation was held to under 4% after the first application in all growth regulator treatments and no defoliation was present after June 28 (Table 30).

Table 26. Colorado potato beetle adults sampled from Russet Burbank variety potatoes treated with foliar insecticides. Hancock, WI 2004.

Treatment	Rate		Mean adults per 10 plants					
	prod./a	lb. a.i./a	6-15	*6-18	6-23	*6-28	7-2	7-12
Clutch 50WG	1.5 oz.	0.047	4.8 a	0.3 a	1.8 a	0.0 a	0.0 a	0.8 a
Clutch 50WG	2 oz.	0.0625	3.0 a	0.8 a	1.8 a	0.0 a	0.0 a	2.8 a
Clutch 50WG	4 oz.	0.125	2.8 a	1.0 a	0.3 a	0.0 a	0.5 a	0.0 a
Venom 20SG	10.6 oz.	0.132	4.8 a	0.0 a	1.0 a	0.0 a	0.0 a	0.3 a
Venom 75SG	2.82 oz.	0.132	5.0 a	0.5 a	1.3 a	0.3 a	0.0 a	0.8 a
TD 2472 30WG	1.4 oz.	0.0262	4.5 a	1.3 a	0.8 a	0.3 a	0.0 a	0.3 a
TD 2472 30WG	2.7 oz.	0.0506	5.0 a	0.3 a	1.8 a	0.0 a	0.0 a	0.3 a
Provado 1.6SC	3.8 fl. oz.	0.047	3.8 a	1.3 a	1.0 a	0.5 a	0.0 a	0.0 a
Actara 25WG	1.5 oz.	0.0234	5.8 a	2.0 a	0.5 a	0.0 a	0.5 a	0.3 a
Actara 25WG	3.0 oz.	0.047	4.8 a	0.3 a	0.5 a	0.3 a	0.0 a	0.5 a
Baythroid 2E	2.8 fl. oz.	0.0437	2.5 a	0.3 a	0.8 a	0.5 a	0.8 a	0.8 a
Capture 2E	5.1 fl. oz.	0.08	5.3 a	1.0 a	0.5 a	0.8 a	0.8 a	1.3 a
Mustang Max 0.8EC	2.88 fl. oz.	0.018	4.8 a	0.5 a	1.5 a	0.0 a	0.3 a	1.5 a
Warrior 1CS	3.84 fl. oz.	0.03	6.3 a	1.0 a	1.8 a	0.0 a	0.0 a	0.3 a
Asana XL 0.66EC	8 fl. oz.	0.04	9.5 a	1.5 a	1.5 a	0.8 a	0.8 a	1.5 a
Rimon 0.83EC	9 fl. oz.	0.0584	7.5 a	2.0 a	0.5 a	0.3 a	0.0 a	0.0 a
Rimon 0.83EC	6 fl. oz.	0.039	3.8 a	2.5 a	0.8 a	0.0 a	0.3 a	2.3 a
Untreated	---	---	5.0 a	1.8 a	0.8 a	0.3 a	0.3 a	5.3 a
Rimon 0.83EC	12 fl. oz.	0.078	5.5 a	2.5 a	0.8 a	0.0 a	0.8 a	0.8 a
Spintor 2SC	4.5 fl. oz.	0.07	5.0 a	1.3 a	1.5 a	0.3 a	0.5 a	0.5 a
Avaunt 30DG	4.5 oz.	0.084	5.8 a	1.5 a	1.3 a	0.0 a	1.3 a	2.5 a
Agrimek 0.15EC	4 fl. oz.	0.0047	3.8 a	0.5 a	0.5 a	0.5 a	0.3 a	0.5 a
Trigard 75WP	2.66 oz.	0.125	3.5 a	1.8 a	0.8 a	0.0 a	0.0 a	0.8 a
BAS 320I 2SC	2.28 fl. oz.	0.0356	3.8 a	2.0 a	0.5 a	0.0 a	0.3 a	1.3 a
BAS 320I 2SC	4 fl. oz.	0.0625	5.0 a	0.8 a	0.3 a	0.0 a	0.3 a	0.0 a

Means in a column followed by the same letter are not significantly different (Least Significant Difference Test, P = 0.05).

\*First sample after an insecticide application.

Table 27. Colorado potato beetle egg masses sampled from Russet Burbank variety potatoes treated with foliar insecticides. Hancock, WI 2004.

Treatment	Rate		Mean egg masses per 10 plants					
	prod./a	lb. a.i./a	6-15	*6-18	6-23	*6-28	7-2	7-12
Clutch 50WG	1.5 oz.	0.047	2.0 a	6.0 a	0.3 a	0.5 a	0.0 a	0.0 b
Clutch 50WG	2 oz.	0.0625	5.0 a	5.3 a	0.5 a	0.0 a	0.0 a	0.0 b
Clutch 50WG	4 oz.	0.125	4.0 a	5.3 a	0.8 a	0.0 a	0.0 a	0.0 b
Venom 20SG	10.6 oz.	0.132	3.5 a	5.3 a	1.0 a	0.0 a	0.3 a	0.0 b
Venom 75SG	2.82 oz.	0.132	2.3 a	4.8 a	0.3 a	0.0 a	0.0 a	0.0 b
TD 2472 30WG	1.4 oz.	0.0262	3.0 a	2.8 a	0.8 a	0.5 a	0.3 a	0.0 b
TD 2472 30WG	2.7 oz.	0.0506	5.8 a	4.3 a	1.0 a	0.3 a	0.0 a	0.0 b
Provado 1.6SC	3.8 fl. oz.	0.047	2.8 a	5.8 a	0.5 a	0.3 a	0.0 a	0.0 b
Actara 25WG	1.5 oz.	0.0234	4.8 a	6.5 a	0.8 a	0.0 a	0.0 a	0.0 b
Actara 25WG	3.0 oz.	0.047	3.5 a	4.8 a	0.5 a	0.0 a	0.0 a	0.0 b
Baythroid 2E	2.8 fl. oz.	0.0437	1.8 a	2.8 a	1.0 a	0.3 a	0.0 a	0.0 b
Capture 2E	5.1 fl. oz.	0.08	3.0 a	4.5 a	1.0 a	0.0 a	0.0 a	0.0 b
Mustang Max 0.8EC	2.88 fl. oz.	0.018	5.0 a	7.5 a	0.8 a	0.0 a	0.0 a	0.0 b
Warrior 1CS	3.84 fl. oz.	0.03	4.5 a	7.8 a	1.0 a	0.3 a	0.3 a	0.0 b
Asana XL 0.66EC	8 fl. oz.	0.04	3.3 a	4.0 a	0.3 a	0.5 a	0.0 a	0.5 a
Rimon 0.83EC	9 fl. oz.	0.0584	3.3 a	5.0 a	0.8 a	0.0 a	0.5 a	0.0 b
Rimon 0.83EC	6 fl. oz.	0.039	3.0 a	3.8 a	0.0 a	0.3 a	0.3 a	0.0 b
Untreated	---	---	2.3 a	2.8 a	0.8 a	0.3 a	0.0 a	0.0 b
Rimon 0.83EC	12 fl. oz.	0.078	2.3 a	2.5 a	0.5 a	0.0 a	0.5 a	0.5 a
Spintor 2SC	4.5 fl. oz.	0.07	1.3 a	2.3 a	1.0 a	0.0 a	0.5 a	0.0 b
Avaunt 30DG	4.5 oz.	0.084	1.5 a	3.5 a	1.3 a	0.0 a	0.0 a	0.0 b
Agrimek 0.15EC	4 fl. oz.	0.0047	3.5 a	9.0 a	0.5 a	0.0 a	0.3 a	0.0 b
Trigard 75WP	2.66 oz.	0.125	2.8 a	4.0 a	0.8 a	0.0 a	0.3 a	0.0 b
BAS 320I 2SC	2.28 fl. oz.	0.0356	5.5 a	3.5 a	0.5 a	0.0 a	0.0 a	0.0 b
BAS 320I 2SC	4 fl. oz.	0.0625	3.8 a	3.5 a	0.0 a	0.0 a	0.0 a	0.0 b

Means in a column followed by the same letter are not significantly different (Least Significant Difference Test, P = 0.05).

\*First sample after an insecticide application.

Table 28. Colorado potato beetle small larvae sampled from Russet Burbank variety potatoes treated with foliar insecticides. Hancock, WI 2004.

Treatment	Rate		Mean larvae per 10 plants					
	prod./a	lb. a.i./a	6-15	*6-18	6-23	*6-28	7-2	7-12
Clutch 50WG	1.5 oz.	0.047	107.3 b-f	12.3 fg	13.5 jkl	0.0 h	0.0 i	0.0 f
Clutch 50WG	2 oz.	0.0625	112.5 a-e	12.8 fg	20.8 i-l	0.5 gh	0.0 i	0.0 f
Clutch 50WG	4 oz.	0.125	100.0 b-f	11.5 fg	1.3 l	0.0 h	0.0 i	0.0 f
Venom 20SG	10.6 oz.	0.132	122.3 a-d	9.3 fg	5.8 kl	0.5 gh	0.0 i	0.0 f
Venom 75SG	2.82 oz.	0.132	100.0 b-f	12.5 fg	19.8 h-l	0.5 gh	0.0 i	0.0 f
TD 2472 30WG	1.4 oz.	0.0262	67.5 f	6.3 g	57.0 c-h	0.0 h	0.0 i	0.0 f
TD 2472 30WG	2.7 oz.	0.0506	83.8 c-f	12.3 fg	24.8 g-l	0.5 gh	0.5 hi	0.3 f
Provado 1.6SC	3.8 fl. oz.	0.047	108.5 a-f	30.5 d-g	80.0 b-f	19.5 bcd	18.5 cd	5.3 bcd
Actara 25WG	1.5 oz.	0.0234	78.8 def	31.5 d-g	52.0 e-j	5.3 e-h	0.0 i	0.0 f
Actara 25WG	3.0 oz.	0.047	80.3 def	11.0 fg	76.3 b-g	2.0 fgh	0.0 i	0.0 f
Baythroid 2E	2.8 fl. oz.	0.0437	113.3 a-e	24.5 efg	39.0 e-j	8.0 def	11.3 d-g	3.0 def
Capture 2E	5.1 fl. oz.	0.08	90.5 c-f	34.3 d-g	64.5 b-g	2.0 fgh	3.5 e-i	0.0.8 f
Mustang Max 0.8EC	2.88 fl. oz.	0.018	72.5 ef	40.8 def	53.0 d-i	4.3 e-h	2.8 f-i	4.0 cde
Warrior 1CS	3.84 fl. oz.	0.03	103.0 b-f	31.3 efg	30.3 f-k	4.5 e-h	2.3 ghi	2.0 def
Asana XL 0.66EC	8 fl. oz.	0.04	87.0 b-f	36.3 d-g	60.8 c-g	11.3 de	11.0 def	8.8 bc
Rimon 0.83EC	9 fl. oz.	0.0584	118.8 a-e	88.3 bcd	65.0 c-h	13.5 cde	3.8 e-i	0.0 f
Rimon 0.83EC	6 fl. oz.	0.039	92.0 b-f	102.5 bc	99.0 a-e	27.5 bc	11.5 de	0.3 f
Untreated	---	---	102.5 b-f	212.3 a	129.5 ab	75.3 a	42.0 b	20.3 a
Rimon 0.83EC	12 fl. oz.	0.078	88.8 b-f	127.3 b	86.0 b-f	14.8 de	1.5 hi	0.0 f
Spintor 2SC	4.5 fl. oz.	0.07	88.3 b-f	29.0 d-g	66.8 b-g	7.3 e-h	0.5 hi	0.3 f
Avaunt 30DG	4.5 oz.	0.084	135.5 ab	99.0 bc	122.0 abc	30.0 b	60.0 a	11.8 b
Agrimek 0.15EC	4 fl. oz.	0.0047	105.0 b-f	53.8 cde	84.3 b-f	12.8 cde	5.3 d-i	1.0 ef
Trigard 75WP	2.66 oz.	0.125	109.5 b-f	79.0 bcd	119.3 abc	13.0 cde	7.0 d-h	1.0 ef
BAS 320I 2SC	2.28 fl. oz.	0.0356	129.0 abc	140.5 ab	173.3 a	78.0 a	31.8 bc	1.8 def
BAS 320I 2SC	4 fl. oz.	0.0625	162.3 a	75.8 bcd	118.3 a-d	8.0 efg	8.0 e-i	0.0 f

Means in a column followed by the same letter are not significantly different (Least Significant Difference Test, P = 0.05).

\*First sample after an insecticide application.

Table 29. Colorado potato beetle large larvae sampled from Russet Burbank variety potatoes treated with foliar insecticides. Hancock, WI 2004.

Treatment	Rate		Mean larvae per 10 plants					
	prod./a	lb. a.i./a	6-15	*6-18	6-23	*6-28	7-2	7-12
Clutch 50WG	1.5 oz.	0.047	1.3 abc	0.0 h	5.3 fgh	0.0 e	1 fg	0.0 g
Clutch 50WG	2 oz.	0.0625	3.3 a	0.0 h	4.3 gh	0.0 e	0.0 g	0.0 g
Clutch 50WG	4 oz.	0.125	0.5 c	0.3 h	1.3 h	0.0 e	0.0 g	0.0 g
Venom 20SG	10.6 oz.	0.132	1.0 bc	0.0 h	5.5 e-h	0.0 e	0.0 g	0.3 g
Venom 75SG	2.82 oz.	0.132	0.8 c	0.5 gh	1.3 h	0.0 e	0.0 g	0.5 g
TD 2472 30WG	1.4 oz.	0.0262	1.0 bc	0.3 h	9.0 e-h	0.0 e	0.5 fg	0.8 g
TD 2472 30WG	2.7 oz.	0.0506	0.5 c	0.0 h	1.5 h	0.0 e	0.0 g	0.0 g
Provado 1.6SC	3.8 fl. oz.	0.047	2.5 abc	1.3 fgh	47.3 cd	15.3 bc	19.5 bc	22.5 bc
Actara 25WG	1.5 oz.	0.0234	0.3 c	0.3 h	35.3 cde	0.5 de	0.3 g	1.0 fg
Actara 25WG	3.0 oz.	0.047	0.3 c	0.0 h	13.0 d-h	0.0 e	0.0 g	0.0 g
Baythroid 2E	2.8 fl. oz.	0.0437	1.3 abc	2.0 fgh	19.8 d-h	2.5 de	11.8 cd	5.0 d-g
Capture 2E	5.1 fl. oz.	0.08	0.5 c	5.5 c-h	31.8 c-g	1.3 de	3.8 d-g	1.8 efg
Mustang Max 0.8EC	2.88 fl. oz.	0.018	0.8 c	6.3 c-f	29.3 c-f	1.8 de	6.5 def	6.3 d-g
Warrior 1CS	3.84 fl. oz.	0.03	1.8 abc	2.3 e-h	15.0 d-h	0.5 de	2.8 d-g	0.8 fg
Asana XL 0.66EC	8 fl. oz.	0.04	0.5 c	3.5 d-h	44.8 c	5.8 cd	20.3 bc	8.5 de
Rimon 0.83EC	9 fl. oz.	0.0584	1.5 abc	8.3 b-e	14.3 c-h	1.0 de	3.5 d-g	1.3 efg
Rimon 0.83EC	6 fl. oz.	0.039	0.5 c	9.3 bcd	23.5 c-h	17.3 bc	7.5 cde	1.5 efg
Untreated	---	---	1.5 abc	23.3 a	191.3 a	81.0 a	66.5 a	41.0 a
Rimon 0.83EC	12 fl. oz.	0.078	0.5 c	16.5 ab	22.3 c-h	1.0 de	2.3 efg	0.3 g
Spintor 2SC	4.5 fl. oz.	0.07	3.5 ab	3.8 d-h	16.0 c-h	3.3 de	0.3 g	1.5 efg
Avaunt 30DG	4.5 oz.	0.084	0.5 c	14.3 abc	114.0 b	23.0 b	72.8 a	30.8 ab
Agrimek 0.15EC	4 fl. oz.	0.0047	0.8 c	6.5 c-g	12.0 d-h	1.3 de	1.3 efg	6.3 def
Trigard 75WP	2.66 oz.	0.125	0.0 c	1.5 e-h	13.0 d-h	0.5 de	1.8 efg	2.3 efg
BAS 320I 2SC	2.28 fl. oz.	0.0356	1.8 abc	9.5 bcd	115.5 ab	28.3 b	29.5 b	13.0 cd
BAS 320I 2SC	4 fl. oz.	0.0625	1.8 abc	4.5 d-h	15.3 c-h	0.0 e	0.8 fg	2.0 efg

Means in a column followed by the same letter are not significantly different (Least Significant Difference Test, P = 0.05).

\*First sample after an insecticide application.

Table 30. Defoliation ratings from Russet Burbank variety potatoes treated with foliar insecticides. Hancock, WI 2004.

Treatment	Rate		Mean adults per 10 plants					
	prod./a	lb. a.i./a	6-15	*6-18	6-23	*6-28	7-2	7-12
Clutch 50WG	1.5 oz.	0.047	0.0 a	0.0 a	0.0 e	0.0 d	0.0 d	0.0 c
Clutch 50WG	2 oz.	0.0625	0.0 a	0.0 a	0.0 e	0.0 d	0.0 d	0.0 c
Clutch 50WG	4 oz.	0.125	0.0 a	0.0 a	0.0 e	0.0 d	0.0 d	0.0 c
Venom 20SG	10.6 oz.	0.132	0.0 a	0.0 a	1.3 de	0.0 d	0.0 d	0.0 c
Venom 75SG	2.82 oz.	0.132	0.0 a	0.0 a	0.0 e	0.0 d	0.0 d	0.0 c
TD 2472 30WG	1.4 oz.	0.0262	0.0 a	0.0 a	1.3 de	0.0 d	0.0 d	0.0 c
TD 2472 30WG	2.7 oz.	0.0506	0.0 a	0.0 a	0.0 e	0.0 d	0.0 d	0.0 c
Provado 1.6SC	3.8 fl. oz.	0.047	0.0 a	0.0 a	2.5 de	0.0 d	0.0 d	3.8 c
Actara 25WG	1.5 oz.	0.0234	0.0 a	0.0 a	1.3 de	0.0 d	0.0 d	0.0 c
Actara 25WG	3.0 oz.	0.047	0.0 a	0.0 a	1.3 de	0.0 d	0.0 d	0.0 c
Baythroid 2E	2.8 fl. oz.	0.0437	0.0 a	0.0 a	1.3 de	1.3 cd	0.0 d	0.0 c
Capture 2E	5.1 fl. oz.	0.08	0.0 a	0.0 a	1.3 de	0.0 d	0.0 d	0.0 c
Mustang Max 0.8EC	2.88 fl. oz.	0.018	0.0 a	0.0 a	0.0 e	0.0 d	0.0 d	0.0 c
Warrior 1CS	3.84 fl. oz.	0.03	0.0 a	0.0 a	1.3 de	0.0 d	0.0 d	0.0 c
Asana XL 0.66EC	8 fl. oz.	0.04	0.0 a	0.0 a	2.5 de	0.0 d	0.0 d	0.0 c
Rimon 0.83EC	9 fl. oz.	0.0584	0.0 a	0.0 a	3.8 cd	2.5 cd	0.0 d	0.0 c
Rimon 0.83EC	6 fl. oz.	0.039	0.0 a	0.0 a	2.5 de	0.0 d	0.0 d	0.0 c
Untreated	---	---	0.0 a	0.0 a	10.0 a	11.3 a	16.3 a	33.8 a
Rimon 0.83EC	12 fl. oz.	0.078	0.0 a	0.0 a	2.5 de	0.0 d	0.0 d	0.0 c
Spintor 2SC	4.5 fl. oz.	0.07	0.0 a	0.0 a	1.3 de	0.0 d	0.0 d	0.0 c
Avaunt 30DG	4.5 oz.	0.084	0.0 a	0.0 a	6.3 bc	3.8 c	7.5 c	16.3 b
Agrimek 0.15EC	4 fl. oz.	0.0047	0.0 a	0.0 a	1.3 de	0.0 d	0.0 d	0.0 c
Trigard 75WP	2.66 oz.	0.125	0.0 a	0.0 a	2.5 de	1.3 cd	1.3 d	0.0 c
BAS 320I 2SC	2.28 fl. oz.	0.0356	0.0 a	0.0 a	8.8 ab	7.5 b	10.0 b	1.3 c
BAS 320I 2SC	4 fl. oz.	0.0625	0.0 a	0.0 a	3.8 cd	1.3 cd	0.0 d	0.0 c

Means in a column followed by the same letter are not significantly different (Least Significant Difference Test, P = 0.05).

\*First sample after an insecticide application.

## **Part 2. Insect Control with Foliar Insecticides.**

### **D. Aphid Control with Foliar Insecticides, Arlington, WI 2003.**

Aphid control is frequently necessary in fresh market and processing potato production to avoid direct damage from aphid feeding and to prevent transmission of potato leaf roll virus that can reduce raw product quality due to tuber net necrosis. Both green peach and to a lesser extent potato aphids are important vectors in this regard and although thresholds for treatment vary, treatment is usually applied when populations exceed one per leaf in samples consisting of twenty-five leaves.

Superior variety potatoes were planted on May 5 into 2 x 50' row plots. Rows were planted on 3' centers and plants were 12" apart. Plots were bordered by 4 untreated rows with 12' of bare ground between replications. Spartan (sulfentrazone) at 4 ounces product per acre (oz. pr./a) and Dual II Magnum (metolachlor) at 1.5 pints product per acre (pt. pr./a) was applied post hilling on May 17 for weed control. Hand weeding provided additional weed control. Regent 4SC (fipronil) was applied at the rate of 3.2 oz./a on June 19 for CPB control. All plots were sprayed with Sevin (carbaryl) at 1 qt. pr./a on June 14, 19, July 1, 8, and 20 to reduce potato leafhopper and beneficial arthropod populations. Aphid populations were allowed to increase until green peach and potato aphid numbers were at high levels. Infestation levels were monitored by counting green peach and potato aphids on 25 mid plant leaves removed per replication. Test materials were applied on July 26 followed by a 4, 8, 14, and 18 day post count and a 2 day count after the second application before aphid numbers crashed throughout the study and no further counts were taken.

Four registered and seven non-registered materials were evaluated at the following rates.

#### Registered:

Provado 1.6SC (0.047 lb. a.i./a)

Actara 25WG (0.023 and 0.047 lb. a.i./a)

Monitor 4E (1.0 lb. a.i./a)

Fulfill 50WG (0.086 lb. a.i./a)

#### Experimental:

Clutch 50WG (0.047, 0.0625, and 0.125 lb. a.i./a)

Venom 20SG (0.132 lb. a.i./a)

Venom 75SG (0.132 lb. a.i./a)

Assail 70WP (0.026 lb. a.i./a)

TD 2472 30WG (0.0262 and 0.05 lb. a.i./a)

F1785 50DF (0.053 and 0.071 lb. a.i./a)

F1785 50DF + Spintor 2SC (0.053 + 0.055 lb. a.i./a)

Treatments were applied with a tractor-mounted compressed air, boom sprayer operating at 40 psi delivering 30 gpa through five hollow cone nozzles (TXVS26) spaced at 18".

## **Results**

Weather conditions for aphids in 2004 were less than ideal at Arlington, cool and wet, however green peach aphid numbers managed to reach 144.5 aphids per sample in the controls on August 3 (Tables 31 and 32). Green peach aphid numbers declined slightly but remained high in the untreated plots through 8/16 before the potatoes senesced and sampling was stopped.

Monitor which has been the standard for aphid control on potatoes provided excellent aphid control for 18 days after application (Tables 31 and 32).

The registered neonicotinyls Provado and Actara along with the experimental Clutch (Arvesta) provided excellent aphid control and continued to limit aphid numbers 18 days post application (Tables 31 and 32).

The reduced risk treatments Fulfill and F1785 (flonicamid) cause aphids to immediately cease feeding but aphids were slow to die from these insecticides. This trend was evident among these treatments and by 10 days after application many of the aphids had died in these plots.

Venom (dinotefuran) was least effective allowing aphid numbers to resurge to threshold levels 7 days after application while Assail (acetamiprid) and TD 2472 (acetamiprid) provided an additional week of protection (Tables 1 and 2).

Table 31. Green peach aphids sampled from Superior potatoes treated with various foliar insecticides. Entomology Research Station, Arlington, WI 2004.

Treatment	Rate		Mean aphids per 25 leaves				
	oz. prod./a	lb. a.i./a	*7/30	8/3	8/9	8/13	*8/16
Clutch 50WG	1.5	0.047	0.8 g	3.8 efg	4.5 ef	9.3 cde	22.0 bcd
Clutch 50WG	2.0	0.0625	1.5 fg	4.3 d-g	4.5 ef	9.5 cde	19.0 cd
Clutch 50WG	4.0	0.125	2.5 fg	2.0 fg	2.5 ef	5.0 e	28.3 bcd
Venom 75SG	2.82	0.132	5.5 d-g	67.0 b	27.0 cd	93.0 a	102.0 a
Venom 20SG	10.6	0.132	37.5 a	80.3 b	42.0 ab	80.0 a	89.0 a
Assail 70WP	0.6	0.0262	3.5 efg	15.5 cde	34.3 bc	26.3 bc	19.5 cd
TD 2472 30WG	1.4	0.0262	9.5 c-f	11.8 cde	11.0 de	42.0 b	41.8 bc
TD 2472 30WG	2.7	0.05	3.3 efg	15.3 cd	2.8 ef	17.5 cd	58.3 b
Provado 1.6SC	3.75	0.047	2.0 fg	9.3 c-g	5.3 ef	6.8 de	29.8 bcd
Actara 25WG	1.5	0.0234	3.3 efg	1.8 g	7.0 ef	3.0 e	16.3 d
Actara 25WG	3.0	0.047	1.5 fg	1.5 g	3.3 ef	3.0 e	11.0 d
Untreated	---	---	33.0 a	144.5 a	62.8 a	101.0 a	97.8 a
Monitor 4E	1 qt.	1.0	1.3 fg	4.0 efg	1.8 f	9.5 cde	16.5 d
Fulfill 50WG	2.75	0.086	12.3 bcd	10.3 c-f	2.5 ef	9.3 cde	19.3 cd
F 1785 50DF	1.7	0.053	18.8 b	15.5 c	2.8 ef	5.0 e	13.0 d
F 1785 50DF	2.27	0.071	19.5 bc	7.5 c-g	1.0 f	7.0 de	12.8 d
F 1785 50DF + Spintor 2SC	1.7 + 3.52	0.053 + 0.055	10.5 b-e	8.0 c-g	1.0 f	2.3 e	11.0 d

Means followed by the same letter do not significantly differ (Least Significant Difference Test, P = 0.05).

\*First sample following a insecticide application.

Table 32. Potato aphids sampled from Superior potatoes treated with various foliar insecticides. Entomology Research Station, Arlington, WI 2004.

Treatment	Rate		Mean aphids per 25 leaves				
	oz. prod./a	lb. a.i./a	*7/30	8/3	8/9	8/13	*8/16
Clutch 50WG	1.5	0.047	0.0 b	0.0 c	0.0 b	0.0 b	0.0 c
Clutch 50WG	2.0	0.0625	0.0 b	0.0 c	0.0 b	0.0 b	0.5 bc
Clutch 50WG	4.0	0.125	0.0 b	0.0 c	0.0 b	0.0 b	0.5 bc
Venom 75SG	2.82	0.132	0.0 b	1.5 bc	0.0 b	0.8 ab	0.5 bc
Venom 20SG	10.6	0.132	0.5 b	2.0 b	0.3 ab	0.5 ab	2.5 a
Assail 70WP	0.6	0.0262	0.0 b	0.0 c	0.5 a	0.0 b	0.0 c
TD 2472 30WG	1.4	0.0262	0.0 b	1.3 bc	0.0 b	0.0 b	1.8 ab
TD 2472 30WG	2.7	0.05	1.3 ab	0.5 bc	0.0 b	0.0 b	0.5 bc
Provado 1.6SC	3.75	0.047	0.0 b	1.8 bc	0.3 ab	1.0 a	1.0 abc
Actara 25WG	1.5	0.0234	0.0 b	0.0 c	0.0 b	0.0 b	0.3 bc
Actara 25WG	3.0	0.047	0.0 b	0.0 c	0.0 b	0.0 b	0.0 c
Untreated	---	---	1.0 ab	4.8 a	0.3 ab	0.8 ab	2.5 a
Monitor 4E	1 qt.	1.0	0.0 b	0.0 c	0.0 b	0.0 b	0.0 c
Fulfill 50WG	2.75	0.086	0.3 b	2.0 b	0.0 b	0.0 b	0.8 abc
F 1785 50DF	1.7	0.053	0.0 b	0.3 bc	0.0 b	0.0 b	0.0 c
F 1785 50DF	2.27	0.071	2.8 a	0.0 c	0.0 b	0.0 b	0.0 c
F 1785 50DF + Spintor 2SC	1.7 + 3.52	0.053 + 0.055	1.0 ab	0.0 c	0.0 b	0.0 b	0.0 c

Means followed by the same letter do not significantly differ (Least Significant Difference Test, P = 0.05).

\*First sample following a insecticide application.

## **Section II. Insect Control on Other Crops.**

### **Part 1. Insect Control on Snap Beans**

In the Midwestern United States snap beans are grown primarily for processing with production areas in Wisconsin, Illinois, Minnesota, and Michigan. Wisconsin ranks first nationally with 35% of national production on over 80,000 acres valued at \$36 million annually.

The most damaging insect pests are those that attack the pods which result in either pod damage or contamination of the processed product. The European corn borer (ECB) and to a lesser extent the corn earworm (CEW) are the major pod feeding pests with damage primarily from 2<sup>nd</sup> generation ECB and late flights of CEW in August/September. Damage from both species occurs from flowering to harvest, creating a treatment window of 30-7 days before harvest. Pods are protected during this window with a 2-4 spray program when crop maturity coincides with moth flights. A typical spray program in Wisconsin includes a pyrethroid (Capture, Warrior, or Mustang) frequently used in rotation with an organophosphate (Orthene).

Although much of the insecticides used on snap beans are targeted at bloom/pod pests, there is never the less a complex of insects which frequently attacks snap beans prior to bloom. These insect pests in Wisconsin have traditionally been the seed corn maggot (SCM) and potato leafhopper (PLH). SCM adults lay eggs in the soil over freshly planted bean seeds and larvae (maggots) tunnel in germinating seeds and plants causing seedling distortion and stand loss. Control of SCM has been achieved with a seed treatment using the organophosphate (OP) insecticide Lorsban with most of the snap bean acreage being treated. PLH adults migrate into emerged beans and feed by extracting sap and causing leaf chlorosis, necrosis and yield loss. Control of PLH is achieved with foliar sprays at threshold using low rates of pyrethroids (Capture, Warrior, Asana, and Mustang), organophosphates (Dimethoate) or carbamates (Sevin, Lannate).

**A. European Corn Borer Control on Snap Bean with Foliar Insecticides. Arlington.**

In 2004, an experiment was established at the Entomology research farm, Arlington WI to evaluate efficacy of registered and experimental insecticides on European corn borer (ECB) on snap bean.

Plots of Hystyle variety snap beans were planted on June 3 and consisted of two rows by 50', planted on 30" centers. Plots were separated by two untreated border rows and 12' alleyways separated four replications arranged in a randomized complete block experimental design. Treflan was applied preplant incorporated at 1.5 pt./A on June 3 for weed control. Plots were also mechanically cultivated and hand weeded as necessary to maintain weed control.

All materials were applied using a CO<sub>2</sub> operated back pack sprayer operating at 25 psi while delivering 22.4 gpa through four TeeJet XR8002 flat fan nozzles spaced at 18".

The following insecticides were evaluated for ECB efficacy on snap bean:

Discipline 2EC (0.0328 and 0.04 lb. a.i./A),

Capture 2EC (0.025, 0.033, and 0.040 lb. a.i./A),

Mustang Max 0.8EC (0.018 and 0.025 lb. a.i./A),

Warrior 1CS (0.020 and 0.025 lb. a.i./A),

Asana XL 0.66EC (0.0495 lb. a.i./A),

Orthene 97SP (1.0 lb. a.i./A),

Spinosad 2SC (0.094 lb. a.i./A),

Avaunt 30WG (0.0656 lb. a.i./A),

Rimon 0.83EC (0.078 lb. a.i./A),

BAS 320I 2SC (0.0625 lb. a.i./A),

S1812 35WG (0.15 and 0.2 lb. a.i./A),

S1812 35WG (0.1 lb. a.i./A) and Mustang Max 0.8EC (0.18 lb. a.i./A).

Insecticide applications were made on July 25, which was three days after the first ECB infestation (July 22) and three days prior to the second infestation (July 28).

Five consecutive plants in each plot were infested with wax paper strips each containing 10 blackhead stage ECB egg masses. Egg masses were placed on the plants during optimal environmental conditions (early evening hours) to increase survival of newly emerging larvae.

Plots were harvested and evaluated on August 9 (1<sup>st</sup> pinning) and August 17 (second pinning) and included the inspection of the pods and stems of the five infested plants from each infestation, recording damage and presence of live larvae.

## **Results**

The early artificial infestations in 2004 (July 22) at first pin pod resulted in an average of 2.0 larvae in 3.5 damaged pods from the untreated plots while an average of 1.5 larvae were found in 5.8 damaged stems (Table 33). The pyrethroids (Discipline, Capture, Mustang Max, Warrior and Asana) performed well and all had fewer damaged pods and stems than the untreated plots. Orthene performed very well, limiting pod (0.3 infested pods) and stem (1.5 damaged stems) damage with no larvae found. Spintor and Avaunt provided control similar to the pyrethroids while Rimon, BAS 320I and S1812 were slightly less effective.

The late artificial infestations on July 28 resulted in an average of 1.0 larvae in 5.0 damaged pods from the untreated plots while an average of 1.3 larvae were found in 1.8 damaged stems (Table 34). Again the numbers of damaged pods and stems were typically lowest among the Orthene and pyrethroid treatments. Spintor, Avaunt, Rimon BAS 320I and S1812 also reduced pod and stem damage but numbers were slightly higher than those among the better treatments. Larval numbers were low among all the plots and with the exception of S1812 (0.2 lb. a.i./A) numbers were significantly lower among the treatments than the untreated plots.

Table 33. European corn borer larvae and damage on Hystyle variety snap beans infested on July 22 and treated with foliar insecticides. Arlington, WI 2004.

Treatment	Rate (lb. a.i./A)	Pods		Larvae		Total damaged stems
		Total	Infested	Pod	Stem	
Discipline 2EC	0.0328	59.8 abc	0.5 cd	0.0 d	0.0 c	0.8 d
Discipline 2EC	0.04	52.5 c	0.8 bcd	0.0 d	0.0 c	0.5 d
Capture 2EC	0.025	67.5 abc	1.0 bcd	0.5 cd	0.0 c	1.5 cd
Capture 2EC	0.0328	71.5 ab	0.0 d	0.0 d	0.3 c	1.0 d
Capture 2EC	0.04	70.5 abc	0.3 cd	0.0 d	0.3 c	1.0 d
Mustang Max 0.8EC	0.018	59.3 abc	2.5 abc	1.0 a-d	0.8 abc	2.3 cd
Mustang Max 0.8EC	0.025	66.0 abc	0.5 cd	0.0 d	0.8 abc	2.0 cd
Warrior 1CS	0.0198	58.0 abc	1.3 a-d	0.8 bcd	0.0 c	0.0 d
Warrior 1CS	0.025	65.8 abc	1.3 a-d	0.5 cd	0.5 bc	2.0 cd
Asana XL 0.66EC	0.0495	64.5 abc	1.8 a-d	0.3 cd	0.5 bc	2.5 bcd
Untreated	---	63.5 abc	3.5 a	2.0 a	1.5 a	5.8 a
Orthene 97SP	1.0	58.8 abc	0.3 cd	0.0 d	0.0 c	1.5 cd
Spintor 2SC	0.094	73.3 a	0.8 bcd	0.0 d	0.3 c	2.5 bcd
Avaunt 30WG	0.0656	65.5 abc	0.8 bcd	0.3 cd	0.0 c	1.0 d
Rimon 0.83EC	0.078	60.3 abc	2.3 a-d	0.8 bcd	0.0 c	1.5 cd
BAS 320 I 2SC	0.0625	58.3 abc	1.5 a-d	0.3 cd	1.3 ab	3.8 abc
S1812 35WG	0.15	63.8 abc	2.3 a-d	1.3 abc	0.0 c	2.5 bcd
S1812 35WG	0.2	55.5 abc	3.0 ab	1.8 ab	1.3 ab	2.3 cd
S1812 35WG + Mustang Max 0.8EC	0.1 + 0.18	58.5 abc	3.0 ab	1.3 abc	0.5 bc	2.3 cd
Untreated	---	54.5 bc	3.5 a	0.8 bcd	1.3 ab	5.0 ab

Means in a column followed by the same letter do not significantly differ (Least Significant Difference Test, P=0.05).

Table 34. European corn borer larvae and damage on Hystyle variety snap beans infested on July 25 and treated with foliar insecticides. Arlington, WI 2004.

Treatment	Rate (lb. a.i./A)	Pods		Larvae		Total damaged stems
		Total	Infested	Pod	Stem	
Discipline 2EC	0.0328	58.8 ab	0.0 f	0.0 c	0.0 c	0.0 d
Discipline 2EC	0.04	55.5 b	0.0 f	0.0 c	0.0 c	0.3 cd
Capture 2EC	0.025	58.0 b	0.5 def	0.0 c	0.0 c	0.0 d
Capture 2EC	0.0328	58.8 ab	0.5 def	0.0 c	0.0 c	0.5 bcd
Capture 2EC	0.04	67.8 ab	0.3 ef	0.0 c	0.0 c	0.0 d
Mustang Max 0.8EC	0.018	57.5 b	1.5 c-f	0.3 bc	0.0 c	0.0 d
Mustang Max 0.8EC	0.025	60.5 ab	0.3 ef	0.0 c	0.0 c	0.3 cd
Warrior 1CS	0.0198	64.0 ab	0.3 ef	0.0 c	0.0 c	0.3 cd
Warrior 1CS	0.025	59.3 ab	0.0 f	0.0 c	0.0 c	0.0 d
Asana XL 0.66EC	0.0495	79.0 a	2.5 bcd	0.0 c	0.0 c	0.8 a-d
Untreated	---	65.5 ab	5.0 a	1.0 a	1.3 a	1.8 a
Orthene 97SP	1.0	57.8 b	1.0 c-f	0.0 c	0.0 c	0.8 a-d
Spintor 2SC	0.094	65.3 ab	2.0 b-f	0.3 bc	0.0 c	1.0 a-d
Avaunt 30WG	0.0656	54.5 b	2.8 bc	0.3 bc	0.3 bc	0.5 bcd
Rimon 0.83EC	0.078	59.5 ab	2.3 b-e	0.3 bc	0.0 c	0.3 cd
BAS 320 I 2SC	0.0625	61.3 ab	0.8 c-f	0.0 bc	0.0 c	1.0 a-d
S1812 35WG	0.15	63.5 ab	3.8 ab	0.0 bc	0.5 b	1.5 ab
S1812 35WG	0.2	61.3 ab	2.8 bc	0.5 abc	0.5 b	1.3 abc
S1812 35WG + Mustang Max 0.8EC	0.1 + 0.18	54.3 b	2.0 b-f	0.0 c	0.0 c	0.5 bcd
Untreated	---	54.3 b	4.0 ab	0.8 ab	1.0 a	1.8 a

Means in a column followed by the same letter do not significantly differ (Least Significant Difference Test, P=0.05).

## **Section II. Insect Control on Other Crops**

### **Part 1. Insect Control with Soil Applied Systemic Insecticides**

#### **B. Seed Corn Maggot, Aphid, Leaf Hopper and Bean Leaf Beetle Control on Snap Beans with Soil Treatments. Arlington.**

In 2004, two experiments were established at the Arlington Experimental Station to evaluate efficacy of seed treatments on seed corn maggot, aphids, leafhoppers, and bean leaf beetles on snap bean. An early planted trial (June 4) focused on seed corn maggot control with seed treatments and a second planting (July 8) evaluated seed corn maggot, aphid, leafhopper, and bean leaf beetle control with the same insecticides.

##### **1. Seed corn maggot study (June 4 planting).**

At planting (June 4) 240 pretreated, snap bean seeds were counted out for each row and planted into two row plots that were replicated 4 times in a randomized complete block experimental design. Blood meal was applied directly over the rows after planting to attract adult seed corn maggots. Treflan was applied preplant incorporated at 1.5 pt./a on June 3 for weed control. Mechanical cultivation and hand weeding provided additional weed control.

Potato leafhopper and soybean aphid numbers did not reach threshold levels in this study and no foliar treatments were applied.

Seed corn maggot damage ratings were taken at emergence (June 14 and 18) and potato leafhopper, bean leaf beetle, and soybean aphid counts were taken on July 7, 13, 20, and 28. Potato leafhopper adults were collected during sweep sampling (25 sweeps per plot) and aphids were monitored with leaf samples (20 leaves per plot). Bean leaf beetles did not infest the plots.

The following treatments were evaluated:

1. Maxim 4 FS at 2.5 g.a./100 kg seed, Apron XL 3 LS at 7.5 g.a./100 kg seed, and streptomycin at 2% v/v.
2. Maxim 4 FS at 2.5 g.a./100 kg seed, Apron XL 3 LS at 7.5 g.a./100 kg seed, streptomycin at 2% v/v, and Cruiser 5 FS 30 g.a./100 kg seed.
3. Maxim 4 FS at 2.5 g.a./100 kg seed, Apron XL 3 LS at 7.5 g.a./100 kg seed, streptomycin at 2% v/v, and Cruiser 5 FS 50 g.a./100 kg seed.
4. Maxim 4 FS at 2.5 g.a./100 kg seed, Apron XL 3 LS at 7.5 g.a./100 kg seed, streptomycin at 2% v/v, and Cruiser 5 FS 75 g.a./100 kg seed.
5. Maxim 4FS at 2.5 g.a./100 kg seed, Apron XL 3 LS at 7.5 g.a./100 kg seed, streptomycin at 2% v/v, and Lorsban 50 WP 62 g.a./100 kg seed.

6. Maxim 4FS at 2.5 g.a./100 kg seed, Apron XL 3LS at 7.5 g.a./100 kg seed, streptomycin at 2% v/v, and Dimethoate 4E at 560 g.a. /Ha (foliar).
7. Maxim 4FS at 12.5 g.a./100 kg seed, Apron XL 3LS at 7.5 g.a./100 kg seed, streptomycin at 2% v/v, Cruiser 5FS at 75 g.a./100 kg seed and Dimethoate 4E at 560 g.a. /Ha (foliar).
8. Ipconazole, streptomycin 2% v/v, Poncho 5SC 125 g.a./Ha.
9. Captan 4L at 55 g.a./100 kg seed, Allegiance-fl at 15 g.a./100 kg seed, streptomycin at 2% v/v, Poncho 5 SC 62.5 g.a./Ha.
10. Capture 2EC at 0.04 lb. a.i./A broadcast over the row.
11. Mustang Max 0.8EC at 0.04 lb. a.i./A.

Yields were taken from on entire row from each plot with a commercial bean harvester. Total bean weights were recorded in tons per acre. At the time of harvest 60-70% of the beans were grade 4 and 5.

## **Results**

Seed corn maggot adult populations were closely monitored prior to planting by pan traps and sweep sampling tall grassy areas adjacent to the field. Peak seed corn maggot adult numbers were collected on June 3 (5-6 adults per sweep).

Seed corn maggot populations were high at planting and during plant emergence, stands were significantly impacted (Table 35). Seedling damage was extensive with 47.5% stand reductions in the untreated plots. Plant damage among the treatments was significantly lower than in the untreated plots with the exceptions of the two broadcast treatments Capture and Mustang Max which were not significantly different than the untreated plots. Plant stand reductions ranged from 19.3 to 47.9 among the plots. All the seed treatments provided effective seed corn maggot control with the high rate of Cruiser having slightly less damage (not statistically) than the Lorsban treatments. Poncho also performed well with stand reductions similar to the Cruiser treatments.

Potato leafhopper adults were collected in low numbers from the plots during July (Table 36) and the resulting nymph numbers were also low among the treatments (Table 37). Since both numbers of adults and nymphs were so low among the plots conclusions can not be drawn from the data.

Soybean aphid numbers were very low in the plots during July (Table 38) and there were very few differences among treatments.

Yields among the plots ranged from 2.09 tons/A in the Mustang Max treated plots to 3.36 tons/A in the Cruiser treated plots (50 g.a./100 kg seed) (Table 39).

Yields among the treated plots were similar reflecting the low insect pressure during the trial.

Table 35. Seed corn maggot damage on Hystyle variety snap beans treated with systemic insecticides (June 4 planting). Arlington, WI 2004.

Treatment	Rate (g.a./100 kg seed)	Mean final stand	Damaged plants	Percent damaged
*Control	---	126.0 d	21.8 a	47.5 a
*Cruiser 5FS	30.0	168.9 ab	21.8 a	29.6 cd
*Cruiser 5FS	50.0	169.6 ab	4.5 b	29.3 cd
*Cruiser 5FS	75.0	193.8 a	10.9 b	19.3 d
*Lorsban 50WP	62.0	180.6 ab	8.3 b	24.7 cd
*Dimethoate 4E (foliar)	1 pt./A	181.8 ab	8.3 b	24.3 cd
*Cruiser 5FS + Dimethoate 4E (foliar)	75.0 + 1 pt./A	162.5 bc	19.9 a	32.3 bc
**Poncho 5SC	62.5	187.4 ab	8.6 b	21.9 cd
***Poncho 5SC	62.5	169.5 ab	5.6 b	29.4 cd
Capture 2EC	0.04 lb. a.i./A	133.4 cd	22.1 a	44.4 ab
Mustang Max 0.8EC	0.04 lb. a.i./A	125.1 d	20.3 a	47.9 a

Means in a column followed by the same letter do not significantly differ (Least Significant Difference Test, P=0.05).

\*Seed treated with Maxim 4 FS at 2.5 g.a./100 kg seed, Apron XL 3 LS at 7.5 g.a./100 kg seed, and streptomycin at 2% v/v.

\*\*Seed treated with Ipconazole, streptomycin 2% v/v.

\*\*\*Seed treated with Captan 4L at 55 g.a./100 kg seed and streptomycin at 2% v/v.

Table 36. Potato leafhopper adults sampled from Hystyle variety snap beans treated with systemic insecticides (June 4 planting).  
Arlington, WI 2004.

Treatment	Rate (g.a./100 kg seed)	Mean adults per 20 sweeps			
		7-8	7-13	7-20	7-28
*Control	---	0.5 ab	1.8 a	1.5 b	1.0 ab
*Cruiser 5FS	30.0	1.8 a	0.8 a	6.0 a	1.0 ab
*Cruiser 5FS	50.0	1.3 ab	2.0 a	2.8 ab	0.0 b
*Cruiser 5FS	75.0	0.0 b	1.8 a	3.5 ab	0.3 ab
*Lorsban 50WP	62.0	0.8 ab	2.5 a	2.8 ab	1.8 a
*Dimethoate 4E (foliar)	1 pt./A	1.0 ab	1.3 a	3.5 ab	0.5 ab
*Cruiser 5FS + Dimethoate 4E (foliar)	75.0 + 1 pt./A	0.5 ab	0.8 a	3.5 ab	1.3 ab
**Poncho 5SC	62.5	1.0 ab	1.3 a	1.8 b	0.5 ab
***Poncho 5SC	62.5	2.0 a	2.8 a	2.8 ab	1.5 ab
Capture 2EC	0.04 lb. a.i./A	0.8 ab	1.0 a	5.0 a	0.0 b
Mustang Max 0.8EC	0.04 lb. a.i./A	1.3 a	1.8 a	3.0 ab	0.8 ab

Means in a column followed by the same letter do not significantly differ (Least Significant Difference Test, P=0.05).

\*Seed treated with Maxim 4 FS at 2.5 g.a./100 kg seed, Apron XL 3 LS at 7.5 g.a./100 kg seed, and streptomycin at 2% v/v.

\*\*Seed treated with Ipconazole, streptomycin 2% v/v.

\*\*\*Seed treated with Captan 4L at 55 g.a./100 kg seed and streptomycin at 2% v/v.

Table 37. Potato leafhopper nymphs sampled from Hystyle variety snap beans treated with systemic insecticides (June 4 planting).  
Arlington, WI 2004.

Treatment	Rate (g.a./100 kg seed)	Mean nymphs per 20 sweeps			
		7-8	7-13	7-20	7-28
*Control	---	1.0 ab	0.3 ab	1.0 a	1.8 a
*Cruiser 5FS	30.0	0.8 ab	0.5 ab	0.3 a	0.3 a
*Cruiser 5FS	50.0	0.0 b	0.0 b	0.5 a	1.0 a
*Cruiser 5FS	75.0	0.0 b	0.0 b	0.0 a	0.5 a
*Lorsban 50WP	62.0	0.0 b	0.0 b	0.0 a	0.8 a
*Dimethoate 4E (foliar)	1 pt./A	1.8 a	1.3 a	0.3 a	1.3 a
*Cruiser 5FS + Dimethoate 4E (foliar)	75.0 + 1 pt./A	0.0 b	1.0 ab	0.0 a	0.8 a
**Poncho 5SC	62.5	0.0 b	0.0 b	0.3 a	0.8 a
***Poncho 5SC	62.5	0.0 b	0.0 b	0.5 a	1.8 a
Capture 2EC	0.04 lb. a.i./A	0.0 b	1.0 ab	0.0 a	1.3 a
Mustang Max 0.8EC	0.04 lb. a.i./A	0.3 b	1.3 a	0.3 a	0.3 a

Means in a column followed by the same letter do not significantly differ (Least Significant Difference Test, P=0.05).

\*Seed treated with Maxim 4 FS at 2.5 g.a./100 kg seed, Apron XL 3 LS at 7.5 g.a./100 kg seed, and streptomycin at 2% v/v.

\*\*Seed treated with Ipconazole, streptomycin 2% v/v.

\*\*\*Seed treated with Captan 4L at 55 g.a./100 kg seed and streptomycin at 2% v/v.

Table 38. Soybean aphids sampled from Hystyle variety snap beans treated with systemic insecticides (June 4 planting). Arlington, WI 2004.

Treatment	Rate (g.a./100 kg seed)	Mean aphids per 20 leaves			
		7-8	7-13	7-20	7-28
*Control	---	0.0 b	0.0 b	0.3 a	0.3 a
*Cruiser 5FS	30.0	0.0 b	0.8 a	0.3 a	0.3 a
*Cruiser 5FS	50.0	0.0 b	0.0 b	0.0 a	0.0 a
*Cruiser 5FS	75.0	0.0 b	0.0 b	0.0 a	0.0 a
*Lorsban 50WP	62.0	0.0 b	0.0 b	0.0 a	0.0 a
*Dimethoate 4E (foliar)	1 pt./A	0.0 b	0.5 ab	0.3 a	0.3 a
*Cruiser 5FS + Dimethoate 4E (foliar)	75.0 + 1 pt./A	0.0 b	0.3 ab	0.0 a	0.0 a
**Poncho 5SC	62.5	0.0 b	0.0 b	0.3 a	0.3 a
***Poncho 5SC	62.5	0.3 a	0.3 ab	0.0 a	0.0 a
Capture 2EC	0.04 lb. a.i./A	0.0 b	0.3 ab	0.0 a	0.0 a
Mustang Max 0.8EC	0.04 lb. a.i./A	0.0 b	0.0 b	0.0 a	0.0 a

Means in a column followed by the same letter do not significantly differ (Least Significant Difference Test, P=0.05).

\*Seed treated with Maxim 4 FS at 2.5 g.a./100 kg seed, Apron XL 3 LS at 7.5 g.a./100 kg seed, and streptomycin at 2% v/v.

\*\*Seed treated with Ipconazole, streptomycin 2% v/v.

\*\*\*Seed treated with Captan 4L at 55 g.a./100 kg seed and streptomycin at 2% v/v.

Table 39. Yields of Hystyle variety snap beans treated with systemic insecticides (June 4 planting). Arlington, WI 2004.

Treatment	Rate (g.a./100 kg seed)	Yield (tons/A)
*Control	---	2.34 bc
*Cruiser 5FS	30.0	2.92 abc
*Cruiser 5FS	50.0	3.36 a
*Cruiser 5FS	75.0	3.21 ab
*Lorsban 50WP	62.0	3.07 ab
*Dimethoate 4E (foliar)	1 pt./A	3.21 ab
*Cruiser 5FS + Dimethoate 4E (foliar)	75.0 + 1 pt./A	2.51 abc
**Poncho 5SC	62.5	3.07 ab
***Poncho 5SC	62.5	2.68 abc
Capture 2EC	0.04 lb. a.i./A	2.45 bc
Mustang Max 0.8EC	0.04 lb. a.i./A	2.09 c

Means in a column followed by the same letter do not significantly differ (Least Significant Difference Test, P=0.05).

\*Seed treated with Maxim 4 FS at 2.5 g.a./100 kg seed, Apron XL 3 LS at 7.5 g.a./100 kg seed, and streptomycin at 2% v/v.

\*\*Seed treated with Ipconazole, streptomycin 2% v/v.

\*\*\*Seed treated with Captan 4L at 55 g.a./100 kg seed and streptomycin at 2% v/v.

## **2. Seed Corn Maggot, Aphid, Leaf Hopper and Bean Leaf Beetle (July 8 planting).**

A second seed treated snap bean trial was planted on July 8 at the Entomology Research Farm, Arlington, WI. Plots consisted of 2 x 30' rows planted on 3' centers with 240 seeds per row. Seeds were counted prior to planting with a planet junior hand planter. Blood meal was applied directly over the rows after planting to attract adult seed corn maggots. Treflan was applied and incorporated at 1.5 pt./a on June 3. Mechanical cultivation and hand weeding provided additional weed control.

The same treatments were evaluated in this study as the earlier planted study (June 4).

Seed corn maggot damage ratings were taken at emergence (July 16 and 20) and potato leafhopper, bean leaf beetle, and soybean aphid counts were taken on July 28, August 3, 10, 16, and 24. Potato leafhopper adults were collected during sweep sampling (25 sweeps per plot) and aphids were monitored with leaf samples (20 leaves per plot). Bean leaf beetles did not infest the plots.

Foliar applications of Dimethoate 4E at 1 pint/A were made on August 14 (treatments 6 and 7) for PLH and soybean aphid control. Foliar materials were applied with a CO<sub>2</sub> backpack sprayer with a 6-foot boom equipped with four Tee Jet XR8003, hollow cone nozzles delivering 30 gpa while operating at 40 psi.

Yields were taken with a commercial bean harvester from a single 30' row from each plot on September 14. At the time of harvest 60-70% of the beans were grade 4 and 5.

### **Results**

Conditions were favorable for seed corn maggot infestation during the second snap bean planting on July 8. Seedling damage was less severe than the June planting, however stands in the untreated plots were significantly reduced (Table 40). Seedling damage was extensive in the untreated plots with 42% stand reductions. Plant damage among the treatments was significantly lower than in the untreated plots with the exceptions of the two broadcast treatments Capture and Mustang Max which were not significantly different than the untreated plots. Plant stand reductions ranged from 1.9 to 42 among the plots. All the seed treatments provided effective seed corn maggot control with the Poncho treatments being most efficacious. The Cruiser treatments performed similarly to the Lorsban treatment with a rate response between Cruiser at 30 g.a./100 Kg seed and Cruiser at 50 g.a./100 Kg seed.

Potato leafhopper adults were collected in low numbers from the plots during late July and August (Table 41) and the resulting nymph numbers were also low among the treatments (Table 42). Since both numbers of adults and nymphs were so low among the plots conclusions can not be drawn from the data.

Soybean aphid numbers were slightly higher during late July and August than were found in early July (Table 43). However, numbers did not exceed 0.5 aphids per leaf in any of the treatments and since numbers were so low conclusions can not be drawn from the data.

Yields among the plots ranged from 3.31 tons/A in the Mustang Max treated plots to 4.7 tons/A in the Poncho treated plots (62.5 g.a./100 kg seed) (Table 44). Yields among the treated plots were similar reflecting the low insect pressure during the trial.

Table 40. Seed corn maggot damage on late planted (July 8) Hystyle variety snap beans treated with systemic insecticides. Arlington, WI 2004.

Treatment	Rate (g.a./100 kg seed)	Final stand	Damaged plants	Percent damaged
*Control	---	139.1 d	8.1 a	42 a
*Cruiser 5FS	30.0	181.1 c	5.0 abc	24.5 b
*Cruiser 5FS	50.0	206.1 bc	7.5 ab	14.6 bc
*Cruiser 5FS	75.0	203.4 bc	4.9 abc	15.3 bc
*Lorsban 50WP	62.0	207.5 bc	5.0 abc	14.1 bcd
*Dimethoate 4E (foliar)	1 pt./A	214.4 ab	3.9 c	12.4 bcd
*Cruiser 5FS + Dimethoate 4E (foliar)	75.0 + 1 pt./A	201.5 bc	6.3 abc	16 bc
**Poncho 5SC	62.5	242.3 a	4.6 bc	1.9 d
***Poncho 5SC	62.5	231.0 ab	6.3 abc	3.9 cd
Capture 2EC	0.04 lb. a.i./A	148.1 d	7.9 ab	38.3 a
Mustang Max 0.8EC	0.04 lb. a.i./A	150.0 d	7.5 ab	37.5 a

Means in a column followed by the same letter do not significantly differ (Least Significant Difference Test, P=0.05).

\*Seed treated with Maxim 4 FS at 2.5 g.a./100 kg seed, Apron XL 3 LS at 7.5 g.a./100 kg seed, and streptomycin at 2% v/v.

\*\*Seed treated with Ipconazole, streptomycin 2% v/v.

\*\*\*Seed treated with Captan 4L at 55 g.a./100 kg seed and streptomycin at 2% v/v.

Table 41. Potato leafhopper adults sampled from Hystyle variety snap beans treated with systemic insecticides (July 8 planting). Arlington, WI 2004.

Treatment	Rate (g.a./100 kg seed)	Mean adults per 20 sweeps				
		7-28	8-3	8-10	8-16	8-24
*Control	---	0.8 ab	0.0 b	0.8 ab	0.8 ab	1.5 a
*Cruiser 5FS	30.0	0.8 a	0.5 ab	0.5 ab	2.3 a	1.0 a
*Cruiser 5FS	50.0	0.0 b	1.5 a	0.8 a	0.8 ab	1.0 a
*Cruiser 5FS	75.0	0.3 ab	0.3 b	0.0 b	1.3 ab	1.0 a
*Lorsban 50WP	62.0	0.3 ab	0.3 b	0.0 b	1.8 ab	0.5 a
*Dimethoate 4E (foliar)	1 pt./A	0.3 ab	0.8 ab	0.3 ab	0.3 b	0.5 a
*Cruiser 5FS + Dimethoate 4E (foliar)	75.0 + 1 pt./A	0.8 a	0.3 b	0.5 ab	0.3 b	0.8 a
**Poncho 5SC	62.5	0.0 b	0.5 ab	0.3 ab	1.3 ab	0.5 a
***Poncho 5SC	62.5	0.3 ab	1.0 ab	0.3 ab	1.3 ab	1.3 a
Capture 2EC	0.04 lb. a.i./A	0.3 ab	1.0 ab	0.0 b	0.8 ab	1.3 a
Mustang Max 0.8EC	0.04 lb. a.i./A	0.8 a	0.3 b	0.0 b	0.5 ab	1.5 a

Means in a column followed by the same letter do not significantly differ (Least Significant Difference Test, P=0.05).

\*Seed treated with Maxim 4 FS at 2.5 g.a./100 kg seed, Apron XL 3 LS at 7.5 g.a./100 kg seed, and streptomycin at 2% v/v.

\*\*Seed treated with Ipconazole, streptomycin 2% v/v.

\*\*\*Seed treated with Captan 4L at 55 g.a./100 kg seed and streptomycin at 2% v/v.

Table 42. Potato leafhopper nymphs sampled from Hystyle variety snap beans treated with systemic insecticides (July 8 planting).  
Arlington, WI 2004.

Treatment	Rate (g.a./100 kg seed)	Mean nymphs per 20 leaves				
		7-28	8-3	8-10	8-16	8-24
*Control	---	0.0 b	0.0 b	1.0 a	0.0 b	0.3 a
*Cruiser 5FS	30.0	0.0 b	0.0 b	0.3 b	0.5 a	0.0 a
*Cruiser 5FS	50.0	0.5 a	0.0 b	0.0 b	0.0 b	0.0 a
*Cruiser 5FS	75.0	0.0 b	0.0 b	0.0 b	0.0 b	0.0 a
*Lorsban 50WP	62.0	0.0 b	0.0 b	0.0 b	0.0 b	0.0 a
*Dimethoate 4E (foliar)	1 pt./A	0.0 b	0.0 b	0.5 ab	0.0 b	0.0 a
*Cruiser 5FS + Dimethoate 4E (foliar)	75.0 + 1 pt./A	0.0 b	0.3 a	0.0 b	0.0 b	0.0 a
**Poncho 5SC	62.5	0.0 b	0.0 b	0.0 b	0.0 b	0.0 a
***Poncho 5SC	62.5	0.0 b	0.0 b	0.0 b	0.0 b	0.3 a
Capture 2EC	0.04 lb. a.i./A	0.0 b	0.0 b	0.0 b	0.5 a	0.0 a
Mustang Max 0.8EC	0.04 lb. a.i./A	0.0 b	0.0 b	0.0 b	0.3 ab	0.0 a

Means in a column followed by the same letter do not significantly differ (Least Significant Difference Test, P=0.05).

\*Seed treated with Maxim 4 FS at 2.5 g.a./100 kg seed, Apron XL 3 LS at 7.5 g.a./100 kg seed, and streptomycin at 2% v/v.

\*\*Seed treated with Ipconazole, streptomycin 2% v/v.

\*\*\*Seed treated with Captan 4L at 55 g.a./100 kg seed and streptomycin at 2% v/v.

Table 43. Aphids sampled from Hystyle variety snap beans treated with systemic insecticides (July 8 planting). Arlington, WI 2004.

Treatment	Rate (g.a./100 kg seed)	Mean aphids per 20 leaves				
		7-28	8-3	8-10	8-16	8-24
*Control	---	4.5 a	10.0 ab	1.3 ab	3.3 de	5.0 a
*Cruiser 5FS	30.0	6.8 a	5.8 bc	2.5 a	7.3 ab	4.0 ab
*Cruiser 5FS	50.0	7.3 a	9.5 ab	0.0 b	5.0 a-d	1.3 ab
*Cruiser 5FS	75.0	8.8 a	9.0 ab	0.5 ab	3.3 cde	2.3 ab
*Lorsban 50WP	62.0	7.3 a	3.0 c	1.5 ab	3.8 b-e	3.3 ab
*Dimethoate 4E (foliar)	1 pt./A	5.5 a	6.5 abc	0.8 ab	2.0 e	2.3 ab
*Cruiser 5FS + Dimethoate 4E (foliar)	75.0 + 1 pt./A	3.3 a	8.3 ab	0.8 ab	1.8 e	1.5 ab
**Poncho 5SC	62.5	7.8 a	12.8 a	0.5 ab	3.3 de	0.8 b
***Poncho 5SC	62.5	4.0 a	6.3 abc	1.5 ab	8.5 a	2.8 ab
Capture 2EC	0.04 lb. a.i./A	6.8 a	10.5 ab	1.8 ab	6.8 abc	3.8 ab
Mustang Max 0.8EC	0.04 lb. a.i./A	5.5 a	10.5 ab	0.0 b	5.8 a-d	3.8 ab

Means in a column followed by the same letter do not significantly differ (Least Significant Difference Test, P=0.05).

\*Seed treated with Maxim 4 FS at 2.5 g.a./100 kg seed, Apron XL 3 LS at 7.5 g.a./100 kg seed, and streptomycin at 2% v/v.

\*\*Seed treated with Ipconazole, streptomycin 2% v/v.

\*\*\*Seed treated with Captan 4L at 55 g.a./100 kg seed and streptomycin at 2% v/v.

Table 44. Yields of Hystyle variety snap beans treated with systemic insecticides (July 8 planting). Arlington, WI 2004.

Treatment	Rate (g.a./100 kg seed)	Yield (tons/A)
*Control	---	3.53 de
*Cruiser 5FS	30.0	3.98 b-e
*Cruiser 5FS	50.0	4.33 ab
*Cruiser 5FS	75.0	4.35 ab
*Lorsban 50WP	62.0	4.27 abc
*Dimethoate 4E (foliar)	1 pt./A	4.22 a-d
*Cruiser 5FS + Dimethoate 4E (foliar)	75.0 + 1 pt./A	4.58 ab
**Poncho 5SC	62.5	4.65 ab
***Poncho 5SC	62.5	4.7 a
Capture 2EC	0.04 lb. a.i./A	3.56 cde
Mustang Max 0.8EC	0.04 lb. a.i./A	3.31 e

Means in a column followed by the same letter do not significantly differ (Least Significant Difference Test, P=0.05).

\*Seed treated with Maxim 4 FS at 2.5 g.a./100 kg seed, Apron XL 3 LS at 7.5 g.a./100 kg seed, and streptomycin at 2% v/v.

\*\*Seed treated with Ipconazole, streptomycin 2% v/v.

\*\*\*Seed treated with Captan 4L at 55 g.a./100 kg seed and streptomycin at 2% v/v.

## **Section II. Insect Control on other Crops.**

### **Part 2. Insect Control on Bell Pepper.**

#### **A. European corn borer control on bell peppers with foliar insecticides. Arlington, WI.**

In 2004, an experiment was established at the Entomology Research Farm to evaluate efficacy of registered and experimental insecticides in the management of European corn borer (ECB) on bell pepper.

Midway variety bell peppers were planted on June 4 into plots consisting of one 25' row. Plots were separated by 18' of alleyway between replicates. The study was replicated four times and arranged in a randomized complete block experimental design. Treflan was applied preplant incorporated at 1.5 pt./a on June 3 for weed control. Hand weeding and mechanical cultivation provided additional weed control. Tarnished plant bugs were controlled with a single application of Sevin (carbaryl) at the rate of one qt./a on July 12.

All test materials were applied using a CO<sub>2</sub> backpack sprayer operating at 25 psi while delivering 14 gpa through two TeeJet XR8003 flat fan nozzles spaced at 18".

The following insecticides were evaluated for ECB control on pepper: Baythroid 2E (0.044 lb. a.i./a), Asana XL 0.66E (0.05 lb. a.i./a), Capture 2E (0.04 lb. a.i./A), Mustang Max 0.8EC (0.026 lb. a.i./a), Warrior 1CS (0.020 and 0.025 lb. a.i./a), Spintor 2SC (0.094 lb. a.i./a), BAS 320I 2SC (0.0625 lb. a.i./A), Diamond 0.83EC (0.075), S 1812 35WP (0.15 and 0.20 lb. a.i./A), Orthene 97SP (0.5 and 1.0 lb. a.i./a) and Discipline 2E (0.04 lb. a.i./A).

Insecticide applications made on August 11, one day prior to egg mass pinning (August 12).

At the time of infestation, five consecutive plants in each plot were infested with wax paper strips each containing 10 blackhead stage ECB egg masses. Egg masses were placed on the plants during optimal environmental conditions to enhance larval survival (late evening).

Plots were harvested and evaluated on August 24 (13 days post application) and included inspection of the infested plants fruit, recording damage and presence of live larvae.

## **Results**

Total fruit from the plots was similar among treatments and numbers ranged from 21.0 to 32.8 fruit per treatment (5 plants) (Table 45). Fruit damage was similar among treatments, which were all significantly fewer than those found in the untreated plots. All of the treatments significantly reduced fruit damage in comparison to the untreated plots. Larval numbers were also significantly reduced in all the treatments with the highest numbers being found in the untreated plots.

Table 45. European corn borer larvae and damage on Midway variety bell peppers treated with various foliar insecticides. Arlington Research Farm, Arlington, WI 2004.

Treatment	Rate (lb. a.i./a)	Mean fruit			Mean larvae
		Total	Damaged	% Damaged	
Baythroid 2E	0.04	23.8 a	3.8 b	13.1 b	4.5 b
Asana XL 0.66EC	0.05	26.0 a	2.3 bcd	7.8 bc	0.3 cd
Capture 2E	0.04	32.8 a	0.0 d	0.0 c	0.0 d
Mustang Max	0.026	24.0 a	1.0 bcd	3.6 bc	1.0 bcd
Warrior	0.020	25.0 a	0.8 bcd	2.2 bc	0.8 bcd
Warrior	0.025	20.8 a	0.8 bcd	2.6 bc	0.3 cd
Spintor 2SC	0.094	27.3 a	0.3 cd	0.9 bc	0.0 d
*BAS 320 I 2SC	0.0625	23.5 a	1.5 bcd	6.0 bc	0.5 cd
Diamond 0.8EC	0.078	21.0 a	3.3 bc	11.5 bc	3.8 bcd
S 1812 35WP	0.15	28.8 a	3.5 b	12.5 bc	4.0 bc
S 1812 35WP	0.20	28.8 a	1.0 bcd	3.8 bc	0.0 d
Untreated	---	21.0 a	14.3 a	68.8 a	13.8 a
Orthene 97SP	0.485	24.3 a	1.0 bcd	3.4 bc	0.0 d
Orthene 97SP	1.0	27.0 a	0.8 bcd	2.8 bc	0.0 d
Discipline 2E	0.04	27.0 a	1.5 bcd	5.3 bc	0.8 bcd

Means in a column followed by the same letter do not significantly differ (Least Significant Difference Test, P=0.05).

## **Section II. Insect Control on other Crops.**

### **Part 2. Insect Control on Bell Pepper.**

#### **B. Aphid control on bell peppers with foliar insecticides. Arlington, WI.**

In 2004, an experiment was established at the Arlington Experimental Farm to evaluate efficacy of registered and experimental insecticides in the management of aphids on bell pepper.

Midway variety bell peppers were planted on June 4 into plots consisting of one 25' row. Plots were separated by 18' of alleyway between replicates. The study was replicated four times and arranged in a randomized complete block experimental design. Treflan was applied preplant incorporated at 1.5 pt./a on June 3 for weed control. Hand weeding and mechanical cultivation provided additional weed control. Tarnished plant bugs were controlled with a single application of Sevin (carbaryl) at the rate of one qt./a on July 12.

All test materials were applied using a CO<sub>2</sub> backpack sprayer operating at 25 psi while delivering 14 gpa through two TeeJet XR8003 flat fan nozzles spaced at 18".

The following insecticides were evaluated for aphid control on pepper: Baythroid 2E (0.04 lb. a.i./a), Asana XL 0.66E (0.05 lb. a.i./a), Capture 2E (0.04 lb. a.i./A), Mustang Max 0.8EC (0.026 lb. a.i./a), Warrior 1CS (0.020 and 0.025 lb. a.i./a), Fulfill 50WG (0.074 lb. a.i./a), BAS 320I 2SC (0.0625 lb. a.i./A), Assail 70WP (0.086 lb. a.i./A), F1785 50SG (0.54 and 0.71 lb. a.i./A), Dimethoate 4E (0.25 lb. a.i./A), TD 2472 30WDG (0.0262 and 0.0525 lb. a.i./A), Orthene 97SP (0.5 and 1.0 lb. a.i./a) and Actara 25WG (0.0312 lb. a.i./A).

Insecticide applications made on August 12 were followed by aphid surveys at 4 days post application (August 16), 12 days post application (August 24) and 19 days post application (August 31). Aphid surveys consisted of randomly selecting 15 pepper leaves from each plot and counting green peach and "other" aphids on the leaves.

#### **Results**

Aphid numbers peaked in the untreated plots at 50.8 green peach aphids per 15 leaves and 2.0 other on August 16 (Table 46). Green peach and "other" aphid numbers declined in the untreated plots on August 24 and August 31. All of the materials evaluated significantly reduced green peach aphid numbers by 4 days after application. However, green peach aphid numbers were highest in the Fulfill treatment. This is not surprising since Fulfills mode of action causes aphids to cease feeding and eventually die (7-10 days). This trend was seen in this study; by August 24 (12 days post application) aphid numbers had

significantly declined in the Fulfill treated plots. Interestingly, aphid numbers among the pyrethroid treatments had increased by August 24 and numbers became quite high by August 31. In contrast, aphid numbers among many of the remaining treatments had continued to decline on August 24 and August 31. There were no resurge in aphid numbers as seen with the pyrethroid treatments.

Table 46. Aphids sampled from Midway variety bell peppers treated with various foliar insecticides. Arlington Research Farm, Arlington, WI 2004.

Treatment	Rate (lb. a.i./a)	Mean aphids per 15 leaves					
		8-16		8-24		8-31	
		GPA	Other	GPA	Other	GPA	Other
Baythroid 2E	0.04	25.8 b	0.5 bc	21.5 abc	1.3 a	46.0 b	0.5 bc
Asana XL 0.66EC	0.05	15.5 bcd	0.3 bc	11.5 cde	0.3 a	13.3 d	0.3 bc
Capture 2E	0.04	5.8 def	1.0 abc	19.0 abc	1.3 a	23.3 c	0.0 c
Mustang Max	0.026	19.3 bcd	0.5 bc	37.3 a	1.8 a	59.5 ab	1.8 a
Warrior	0.020	9.3 cde	0.3 bc	34.8 ab	0.0 a	52.5 ab	0.3 bc
Warrior	0.025	6.8 def	1.0 abc	16.3 bcd	1.0 a	62.3 a	0.3 bc
Fulfill 50WG	0.74	27.0 b	0.8 abc	7.8 def	1.3 a	5.8 de	1.0 ab
*BAS 320 I 2SC	0.0625	16.5 bc	1.3 ab	18.0 cd	1.5 a	1.5 ef	0.3 bc
Assail 70WP	0.0262	3.3 ef	0.3 bc	2.0 efg	0.3 a	1.0 ef	0.8 abc
F1785 50SG	0.054	2.3 ef	0.8 abc	0.3 fg	1.0 a	1.5 ef	0.3 bc
F1785 50SG	0.071	4.5 ef	0.3 bc	0.0 g	0.3 a	1.3 ef	0.8 abc
Dimethoate 4E	0.25	8.5 cde	0.5 bc	36.3 a	0.8 a	7.3 d	0.5 bc
TD 2472 30WDG	0.0262	2.8 ef	0.3 bc	1.3 fg	0.0 a	1.3 ef	0.0 c
TD 2472 30WDG	0.0525	1.3 f	0.0 c	1.3 fg	0.3 a	0.8 f	0.3 bc
Orthene 97SP	0.5	4.0 ef	0.3 bc	0.0 g	0.3 a	0.0 f	0.3 bc
Orthene 97SP	1.0	3.5 ef	0.5 bc	0.0 g	0.0 a	0.5 f	0.0 c
Actara 25WG	0.0312	0.3 f	0.0 c	0.8 fg	0.3 a	0.5 f	0.3 bc
Untreated	---	50.8 a	2.0 a	11.3 cd	0.5 a	1.0 ef	0.5 bc

Means in a column followed by the same letter do not significantly differ (Least Significant Difference Test, P=0.05).