 doi: 10.4182/amt.2014.E12

(E12)

POTATO: *Solanum tuberosum* L., 'Russet Burbank'

FULL SEASON INSECTICIDE MANAGEMENT PROGRAMS FOR THE CONTROL OF COLORADO POTATO BEETLE IN WISCONSIN POTATO, 2013

Russell L. Groves
University of Wisconsin-Madison
Entomology Department
1630 Linden Drive
Madison, WI 53706
Phone: 608-262-3229
Fax: 608-262-3322
Email: groves@entomology.wisc.edu

Scott Chapman
Email: chapman@entomology.wisc.edu

Anders S. Huseth
Email: ashuseth@wisc.edu

Linda K. Crubaugh
Email: crubaugh@wisc.edu

Kenneth E. Frost
Email: kfrost@wisc.edu

Colorado potato beetle (CPB): *Leptinotarsa decemlineata* (Say)
Potato leafhopper (PLH): *Empoasca fabae* (Harris)
Green peach aphid (GPA): *Myzus persicae* (Sulzer)

The purpose of this experiment was to evaluate various full-season, reduced-risk, insecticide programs designed to manage Colorado potato beetle (CPB) on potatoes in Wisconsin. With developing neoicotinoid insecticide resistance among CPB populations in the potato production areas in Wisconsin, several systemic based and foliar based programs were designed to evaluate their effectiveness on managing the CPB on potato. This experiment was conducted in 2013 on a loamy sand soil at Hancock Agricultural Research station (HAES) located 1.1 mile (1.8 km) southwest of Hancock, Wisconsin. Potato, *Solanum tuberosum* cv. 'Russet Burbank', seed pieces were planted on 2 May. Plants were spaced 12 inches apart within rows and rows were spaced 3 ft apart. The 8-row plots were 24 feet wide by 40 ft long, for a total of 0.025 acres/plot. Replicates were separated by a 5 ft border of bare ground. Three replicates of 15 full-season insecticide programs were arranged in a RCB design. Systemic insecticides were applied in-furrow at planting (2 May for treatments 1-6). The first application of Rimon (treatment 7) was made on 14 Jun. The first foliar insecticide applications were applied after peak egg hatch and prior to large larval population development (21 Jun, for treatments 7-15). Subsequent applications were made on 28 Jun (for treatments 7-15) and 25 Jul (for all treatments, including at plant treatments). Treatment information is available in Table 1. All in-furrow treatments were applied at 11.0 gpa on 2 May using a two nozzle boom equipped with Tee Jet XR8001 flat fan spray nozzles powered by a CO_2 backpack sprayer at 30psi. Furrows were cut using a commercial potato planter without closing discs attached. Immediately after the in-furrow treatments were applied and all seed piece treatments were placed in open furrows, all seed was covered by hilling. Foliar insecticides were applied using a CO_2 pressurized sprayer with a 24 ft boom operating at 30 psi delivering 20 gpa through 16 Tee Jet XR8002XR flat fan nozzles spaced 18 inches apart while travelling at 4.0 ft/s. The efficacy of treatments was assessed by counting the number of egg masses (EM), small larvae (SL), and large larvae (LL) per plant on 10 randomly selected plants in each plot. Percent defoliation (% DF) ratings were taken by visual observation of the entire plot. Potato leafhopper (PLH), *Empoasca fabae*, efficacy was assessed by counting the number of adults collected from 15 sweep net samples in each plot and replicate. Specifically, 15 pendulum sweeps were made over a single row in each of the 4 experimental replicate plots per treatment using a 15" diameter sweep net. Green peach aphid (GPA), *Myzus persicae*, and potato leafhopper nymph populations were surveyed by visual assessment of 25 leaves per plot. Insect counts occurred on several dates throughout the summer and reported means were averaged across those dates (Tables 2 & 3). Insect count averages reflect time periods during the summer when specific life stages peaked in the plots. Yield and quality data were collected after harvest (11 Sep) (Table 4).

 doi: 10.4182/amt.2014.E12

Data sets were analyzed using ANOVA and means were compared using a Fisher's Protected Least Significant Difference (LSD) mean separation test (P=0.05).

No signs of phytotoxicity were observed among treatments. Treatment programs outlined in this experiment were assembled to be consistent with a 'Best Management Practices' approach and based on insecticide resistance management guidelines (http://www.irac-online.org/). No single treatment in this experiment was designed as an untreated control so as to limit the extent of inter-plot interfere that might result from uncontrolled populations of insects randomized within the experiment. Taken together, all plots performed similarly in terms of controlling populations of CPB and producing commercially acceptable yields. Although we did observe some significant differences among treatments with some lifestages of the CPB, and with defoliation estimates, these means are well below economic thresholds that would warrant another approach. In only a few treatment programs did we observe significant differences in populations of PLH, and here again, these populations are well within the limits of allowable population numbers when averaging over the season. This research was partially supported by industry gifts including products and research funding.

Table 1.

	1st generation CPB				2nd generation CPB			
Trt	Appl. Date	Insecticide/formulation	Rate amt/acre	[†]Type	Appl. Date	Insecticide/formulation	Rate amt/acre	[†]Type
1	2-May	Platinum 75 SC	2.67 fl oz	IF	28-Jun	[a]Besiege 1.25ZC	9 fl oz	F
					25 Jul	[a]Besiege 1.25 ZC	7.5 fl oz	F
2	2-May	Belay 2.13 SC	12 fl oz	IF	28-Jun	[a]Agri-Mek 0.7 SC	3.5 fl oz	F
					25 Jul	[a]Agri-Mek 0.7 SC	3.0 fl oz	F
3	26-Apr	[a]Verimark 20 SC	10 fl oz	IF	28-Jun	Assail 30 SG	4 oz wt	F
	21 Jun	Blackhawk 36 WG	3.3 oz wt	F	25-Jul	Assail 30 SG	3 oz wt	F
4	26-Apr	Verimark	13.5 fl oz	IF	28-Jun	[a]Actara 25 WDG	3 oz wt	F
	21-Jun	[b]Agri-Mek 0.7 SC	3.5 fl oz	F	25-Jul	[a]Actara 25 WDG	2.5 oz wt	F
5	2-May	Admire Pro 4.6SC	8.7 fl oz	IF	28-Jun	[b]Radiant 1 SC	8 fl oz	F
	21-Jun	Agri-Mek 0.7 SC	3.5 fl oz	F	25-Jul	[b]Radiant 1 SC	6 fl oz	F
6	2-May	Scorpion 3.24 SC	13.25 fl oz	IF	28-Jun	[b]Athena 0.87 SC	17 fl oz	F
	21 Jun	Blackhawk 36 WG	3.3 oz wt	F	25-Jul	[b]Athena 0.87 SC	17 fl oz	F
7	14-Jun	[c]Rimon 0.83 EC	10 fl oz	F	25-Jul	[d]Exirel 10 SE	6.75 fl oz	F
	21-Jun	[c]Rimon 0.83 EC	7 fl oz	F				
	28-Jun	[c]Rimon 0.83 EC	7 fl oz	F				
8	21-Jun	[d]Coragen 1.67 SC	5 fl oz	F	25-Jul	[c]Admire Pro 4.6SC	8.7 fl oz	F
	28-Jun	[d]Coragen 1.67 SC	3.5 fl oz	F				
9	21-Jun	[b]Agri-Flex 1.55 EC	8.5 fl oz	F	25 Jul	[d]Besiege 1.25 ZC	9 fl oz	F
	28-Jun	[b]Agri-Flex 1.55 EC	6 fl oz	F				
10	21-Jun	[b]Blackhawk 36 WG	3.3 oz wt	F	25-Jul	[d]Exirel 10 SE	5 fl oz	F
	28-Jun	[b]Blackhawk 36 WG	2.5 oz wt	F				
11	21-Jun	[b]Radiant 1 SC	8 fl oz	F	25-Jul	[d]Actara 25WDG	3 oz wt	F
	28-Jun	[b]Radiant 1 SC	6 fl oz	F				
12	21-Jun	[a]Athena 0.87 EC	17 fl oz	F	25-Jul	[b]Admire Pro 550 SC 1.3	fl oz	F
	28-Jun	[a]Athena 0.87 EC	14 fl oz	F				
13	21-Jun	[d]Actara 25 WDG	3 oz wt	F	25-Jul	[d]Besiege 1.25 ZC	9 fl oz	F
	28-Jun	[d]Actara 25 WDG	1.5 oz wt	F				
14	21-Jun	[b]Belay 2.13 SC	3 fl oz	F	25-Jul	[d]Coragen 1.67 SC	5 fl oz	F
	28-Jun	[b]Belay 2.13 SC	2.5 fl oz	F				
15	21-Jun	[a]Exirel 10 SE	5 fl oz	F	25-Jul	[a]Belay 2.13 SC	3 fl oz	F
	28-Jun	[a]Exirel 10 SE	3 fl oz	F				

[†]F=foliar, IF=In furrow,
[a]MSO 100 L added at 0.25% vol/vol
[b]NIS 100 L added at 0.25% vol/vol
[c]Silwet 100 L added at 0.25% vol/vol
[d]MSO 100L added at 0.5% vol/vol

 doi: 10.4182/amt.2014.E12

Table 2.

	CPB/10 plants			CPB damage	
Trt	Adults	Egg Masses	Small Larvae	Large Larvae	% DF/plot
1	9.5a	2.1a	3.3e	3.5cde	0.1d
2	7.6a	1.4a	3.8cde	5.6bcd	0.1d
3	4.9bc	1.3a	7.9abc	4.0bcd	0.3bcd
4	2.5de	0.9a	2.7de	0.5f	0.1d
5	3.5de	2.2a	6.2abc	1.8de	0.1d
6	7.9ab	1.5a	18.0abc	7.9ab	1.3a
7	4.7ab	1.3a	13.9ab	5.2bcd	0.4bcd
8	6.7ab	1.6a	13.5ab	4.8bcd	1.1ab
9	2.2de	1.5a	12.5abc	1.2ef	0.3cd
10	6.5ab	1.3a	10.3abc	5.9bcd	0.4bcd
11	7.7ab	1.5a	12.1abc	5.2bcd	0.3cd
12	6.8ab	1.0a	11.4abc	6.2a	0.9abc
13	4.2bc	1.1a	5.1bcd	4.3bcd	0.2d
14	3.9bc	1.5a	7.2abc	3.7bcd	0.4bcd
15	1.6e	1.3a	3.5cde	1.8ef	0.2d
P	0.0001	0.7618	0.0024	0.0001	0.0305
LSD	0.147	0.146	0.185	0.157	0.157

Means in columns followed by the same letter are not significantly different (Fisher's Protected Least Significant Difference Test, $P>0.05$).

Table 3.

	PLH		
Trt	adults/15 sweeps	nymphs/15 sweeps	GPA/15 sweeps
1	0.5de	0.1cd	0.1a
2	0.6de	0.0d	0.3a
3	3.5a	0.5bc	0.5a
4	3.5a	1.4a	0.4a
5	0.3e	0.1cd	0.0a
6	0.5de	0.6ab	0.5a
7	2.8ab	0.2bcd	0.9a
8	1.4a-d	0.2bcd	0.2a
9	0.7de	0.1cd	0.2a
10	1.5b-e	0.2bcd	1.0a
11	2.0abc	0.1cd	0.6a
12	0.4e	0.0d	1.7a
13	0.8de	0.0d	0.5a
14	0.9cde	0.3bcd	0.2a
15	2.4abc	0.2bcd	0.3a
P	0.0004	0.0023	0.141
LSD	0.158	0.0800	0.1012

doi: 10.4182/amt.2014.E12

Table 4.

Trt	Total US #1 (lbs)	Proportion US #1-A	CWT/acre
1	98.8a	85.1a	386a
2	110.1a	90.4a	410a
3	92.6a	86.3a	392a
4	81.1a	78.3a	355a
5	94.0a	85.9a	390a
6	82.8a	83.3a	378a
7	96.6a	86.9a	394a
8	93.6a	87.4a	394a
9	102.2a	88.6a	402a
10	91.4a	88.0a	399a
11	92.6a	88.4a	401a
12	97.3a	88.7a	402a
13	99.4a	86.5a	393a
14	96.0a	85.6a	389a
15	90.3a	85.7a	390a
P	0.0959	0.0759	0.0759
LSD	15.4933	5.9718	271

Means in columns followed by the same letter are not significantly different (Fisher's Protected Least Significant Difference Test, *P*>0.05).