Potato Insecticide Evaluation

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Introduction

The Colorado potato beetle (CPB) and the potato leafhopper (PLH) are two important insect pests that need to be controlled to achieve profitable potato production. The CPB, in particular, is troublesome because it has developed resistance to insecticides in the carbamate, organophosphate, and pyrethroid chemical groups. Currently, insecticides in the neonicotinoid group provide effective control of CPB, but there are concerns that with continued use of neonicotinoids this resilient pest will also develop resistance against this group of insecticides. The goal of this project was to evaluate potato insecticides with different modes of action for use in a CPB resistance management program.

Materials and Methods

Planting and Plot Design. Insecticide evaluations were done at two locations: Field G of the Muscatine Island Research Farm (Research Farm) and in a commercial potato field located at Halane Farms approximately 5 miles south of the Research Farm. Trial design was the same at both locations: a randomized complete block with four replications. A plot consisted of four rows 25 ft long. The cultivar, Atlantic, was planted at the Halane Farms site during first week of April and the cultivar, Snowden, was planted on April 12 at the Research Farm. Normal cultural practices for fertilization, irrigation, and weed control were followed at both locations. Insecticide treatments are listed in Table 1. Admire Pro treatments (No. 2 and 3) were sprayed in the planting furrow over the seed pieces before covering. Foliar insecticide treatments were applied to plots with a backpack CO_2 pressurized sprayer with four nozzle boom set at 25 psi and delivering material at a rate of 20 gallon/acre. Foliar treatments were applied to plots at the Research Farm on June 6, and foliar treatments were applied to Halane Farms site on June 2 and again on June 22. Only the center rows of each plot were used for data collection. Once a week during the growing season 10 8-in.-long shoots were collected from the center plot rows and examined for number of CPB adult, egg masses, and larvae and 10 randomly collected leaves were examined for number of PLH nymphs.

Results and Discussion

The Halane Farms site differed from the Research Farm by providing heavier CPB pressure and developing a significant PLH population by the end of June. Potato plots at the Research Farm were surrounded by soybeans and were not affected by PLH. Otherwise, results at the two locations were similar. Potato sprouts emerged by late April and CPB adults were observed in the plantings shortly afterwards. Freshly laid egg masses were found on the underside of potato leaves by late May and insecticide treatments were applied to coincide with egg hatching into larvae. Looking at CPB larvae counts at both sites after foliar insecticide treatments were applied (Tables 2 and 3), it can be seen that all treatments significantly lowered CPB larvae counts over untreated control plots. Treatments 2, 3, 9, and 10 utilized Group 4A neonicotinoid insecticides and were extremely effective at reducing CPB numbers in plots. Treatments 5, 6, 7, and 8 also reduced CPB numbers and were of particular interest in this study because they represented different chemistries from the neonicotinoid group. Treatment 4 (Mustang Max, group 3 pyrethroid) reduced the number of CPB larvae compared with untreated control plots but a small and persistent number of CPB larvae remained indicating some resistance in the population to this product. By the end of June, large CPB larvae started dropping to the ground and burrowing into the soil to pupate into adults and start the cycle over again. By this time the untreated control plots were 25–75 percent defoliated due to CPB larvae feeding. The June 6 insecticide treatments at the Research Farm reduced the CPB population so that the second generation of CPB wasn't large enough to trigger a second insecticide application. However, a second foliar insecticide application was made at the Halane Farms site due to increasing numbers of CPB and the presence of PLH. Toward the end of July, tuber yield data were harvested from plots and illustrate how destructive the CPB can be, even at low populations. At the Research Farm tuber yield from untreated control plots was half of most of the insecticide treated plots. There were no significant differences for plot yield or specific gravity between the nine insecticide treatments. However, yield results at the Halane Farms site were influenced by larger numbers of CPB and presence of PLH. Potato plants in Treatments 5, 6, 7, and 8 showed 'hopper burn' and poor control of PLH, which probably hurt yield.

Conclusion

The 2010 potato insecticide trial found that applying the neonicotinoid, Admire Pro, at planting, provided good CPB and PLH control lasting into July. Insecticide application at planting isn't currently used by commercial potato growers in this area and needs to be further investigated for consistency. This evaluation also found that foliar sprays of Radiant, Coragen, Rimon, and Agri-Mek (Treatments 5, 6, 7, and 8, respectively) were effective at controlling CPB and provide alternative modes of action for resistance management. However, these treatments did not adequately control PLH at the Halane Farms site. Only foliar sprays of Actara and Voliam Flexi (Treatments 9 and 10) controlled both CPB and PLH.

Table 1. Insecticide treatment descriptions and application rates.

	Insecticide treatment (active ingredient)	Group Code	Application method and rate
1.	Control, no insecticide		Untreated
2.	Admire Pro (imidacloprid)	4A	Banded in furrow at planting, 8 fl oz/acre
3.	Admire Pro (imidacloprid)	4A	Banded in furrow at planting, 8 fl oz/acre
	Radiant (spinetoram)	5	Foliar spray, 8 fl oz/acre
4.	Mustang Max (zeta cypermethrin)	3	Foliar spray, 4 fl oz/acre
5.	Radiant (spinetoram)	5	Foliar spray, 8 fl oz/acre
6.	Coragen (chlorantraniliprole) + MSO 1% V/V	28	Foliar spray, 5 fl oz/acre
7.	Rimon (novaluron)	15	Foliar spray, 12 fl oz/acre
8.	Agri Mek (abamectin)	6	Foliar spray, 16 fl oz/acre
9.	Actara (thiamethoxam)	4A	Foliar spray, 3 oz/acre
10.	Voliam Flexi (thiamethoxam + chlorantraniliprole)	4A & 28	Foliar spray, 4 oz/acre

Table 2. Halane Farms site average number of CPB larvae per shoot, PLH nymphs per leaf and plot yield by insecticide treatment. Foliar insecticides applied on June 2 and June 22, 2010.

Treatment	CPB larvae/shoot[a]			PLH nymph/leaf[b]		Plot yield[c] (lb)
	June 9	June 15	July 3	June 21	July 3	
10. Voliam Flexi	0.3	0.0	0.0	0.0	0.0	32.9
9. Actara	0.1	0.3	0.0	0.0	0.0	29.1
3. Admire Pro + Radiant	0.0	0.0	0.0	0.0	0.0	28.3
2. Admire Pro	0.0	0.2	0.0	0.0	0.0	26.6
8. Agri Mek	0.4	0.3	0.0	4.3	4.2	25.5
6. Coragen	0.3	0.1	0.1	2.4	2.0	24.3
4. Mustang Max	3.3	1.2	3.5	0.3	0.1	23.1
5. Radiant	0.0	0.7	0.1	3.1	2.4	20.1
7. Rimon	1.7	1.3	0.1	2.6	2.6	14.0
1. Control, untreated	13.7	3.1	2.8	3.6	4.1	10.9
LSD 5%	1.5	0.6	0.9	1.6	1.4	7.6

[a]Average number of CPB larvae on 8 in. shoot taken from middle of canopy.
[b]Average number of PLH nymphs on compound leaf taken from middle of canopy.
[c]Lb of tubers from 25 ft of row.

Table 3. Muscatine Island Research Farm site average number of CPB larvae per shoot, PLH nymphs per leaf, plot yield, and tuber specific gravity by insecticide treatment. Foliar insecticides applied on June 6.

Treatment	CPB larvae/shoot[a]			PLH nymphs[b]	Plot yield[c] (lb)	Tuber specific gravity
	June 11	June 18	July 2	July 3		
9. Actara	0.0	0.0	0.0	0.0	33.7	1.072
2. Admire Pro	0.0	0.1	0.0	0.0	32.6	1.074
3. Admire Pro + Radiant	0.0	0.0	0.0	0.0	31.1	1.074
10. Voliam Flexi	0.4	0.0	0.0	0.0	29.7	1.072
5. Radiant	0.0	0.1	0.2	0.0	27.4	1.072
4. Mustang Max	1.0	1.6	0.1	0.0	27.3	1.070
7. Rimon	2.0	0.3	0.1	0.0	27.3	1.070
6. Coragen	0.2	0.0	0.0	0.0	26.7	1.071
8. Agri Mek	0.0	0.1	0.1	0.1	25.4	1.070
1. Control, untreated	4.9	4.1	0.2	0.1	15.5	1.065
LSD 5%	0.6	0.5	n.s.	n.s.	8.1	0.005

[a]Average number of CPB larvae on 8 in. shoot taken from middle of canopy.
[b]Average number of PLH nymphs on compound leaf taken from middle of canopy.
[c]Lb of tubers from 25 ft of row.