EVALUATION OF POTATO INSECT PEST MANAGEMENT PROGRAMS

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Introduction

A number of insect pests negatively affect yield and quality of potatoes throughout the Pacific Northwest (PNW), although the distribution and intensity of infestations vary by location and year. The number of insect pests is increasing. In the early nineties, recognized insect pests of potatoes included wireworms, Colorado potato beetles, aphids, and two-spotted spider mites. Since the mid-nineties, other problematic species have been recognized, including thrips, cutworms, loopers and armyworms, potato tuberworm (2004), beet leafhopper (2005), potato psyllid (2011), and stink bug (2013). With the increase in pest species, loss of products such as Monitor® and Temik®, and the rapid introduction of several new insecticidal products, control of potato insect pests has become increasingly complicated.

Historically, the primary drivers of product choice have been price and efficacy, but factors such as spectrum of control and mode of action increasingly influence growers' decisions as well. Complicating grower choice is the lack of efficacy and use pattern information on most new products for several pest species. One example of this is that although the label allows chemigation of Movento® (spirotetramat), one of the most widely used potato insecticides, neither the registrant nor entomologist-based control guidelines support this use pattern due to lack of knowledge of whether chemigation is effective.

The recent emergence of potato psyllid, a serious threat to PNW potato production and vector of the pathogen that causes zebra chip, has fundamentally changed insect control programs and has effectively ended traditional integrated pest management programs. Growers have no tolerance for potato psyllid with an action threshold of detection at any level triggering a season-long control program. Many growers at risk of potato psyllid are designing their insect management programs around psyllid management strategies and fitting in control of other insect pests. Since 2012, psyllids have become the cornerstone insect pest of potatoes throughout the PNW.

We evaluated potato pest management programs as part of a regional trial conducted across the PNW. Data from these trials will help to inform growers about what products will best control potato psyllid, how and when to best deploy psyllid control products, and what effects psyllid control strategies will have on other insect pests and beneficials.

Hypothesis and Objectives

1) Generate efficacy data on products/programs for control of potato psyllids.

2) Examine the effects of insecticides that target potato psyllid on chemical control strategies for other insect pests.

3) Determine if potato psyllid control induces outbreaks of other insect pests.

4) Determine the effect of potato psyllid control on natural enemies.

Materials and Methods

'Ranger Russet' potatoes were planted in two rows per bed. The flat-topped beds were on 72-inch centers. Rows of potatoes within the bed were 36 inches apart. Seed was planted at a 6-inch depth. Plants were irrigated by drip irrigation (Shock et al. 2005). A drip line was placed approximately 6 inches from each row of potatoes and shanked in the soil to about a 3-inch depth. Soil moisture was monitored with Watermark sensors and irrigation was initiated when the soil water tension (SWT) reached 30 cb. Other cultural practices followed those typical for Malheur County.

We evaluated nine different insecticides, each with a different mode of action (Table 1). The experiment was arranged as a randomized complete block with four replications of each treatment. Plots were 25 ft long and 12 ft wide, with a 5-ft buffer between the ends of adjoining plots.

Insecticides were applied with a CO_2-powered backpack sprayer, delivering 20 gal/acre. Applications were made every 2 weeks on June 16, June 29, July 13, July 27, and August 10.

Insects were sampled weekly by two methods. Adult insects were sampled by taking vacuum samples: an inverted leaf blower was slowly run through the canopy of plants in outer rows of each plot for 2 min. Psyllid nymphs and eggs were sampled by collecting 10 potato leaves from the mid-canopy of plants in the interior two rows of each plot. Leaf samples were also used to assess thrips and spider mites populations. Vacuum and leaf samples were analyzed under dissecting microscopes to identify and count specimens. Data were analyzed by ANOVA. Seasonal means are presented in the tables.

Results and Discussion

Five biweekly insecticide applications were made in the trial (Table 1). Tables 2 and 3 show the seasonal means and analyses for the different pest and beneficial insects by treatment for the trial.

Despite high temperatures through the season (Fig. 1), overall pest pressure remained low throughout the 2015 season. Few potato psyllid adults were collected in this trial, and no significant differences in numbers of adult potato psyllids were found among the treatments. We did not observe any statistical differences among treatments in other pest populations.

Relatively high numbers of big-eyed bugs and pirate bugs were observed throughout the season across all treatments. We did not observe any statistical differences in populations of beneficial species by treatment.

Tubers were inspected for visual symptoms of zebra chip (100 per plot), but no symptomatic tubers were found.

Acknowledgments

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References

Shock, C.C., E.P. Eldredge, and A.B. Pereira. 2005. Irrigation system comparison for the production of Ranger Russet and Umatilla Russet potato. Oregon State University Agricultural Experiment Station, Special Report 1062:173-176. http://www.cropinfo.net/AnnualReports/2004/25-UmatillaRangerComparison.php.

Table 1. Insecticides used in the efficacy trial against potato psyllids and other potato pests, Malheur Experiment Station, Oregon State University, Ontario, OR, 2015.

Treatment	Active ingredient	IRAC[a] group	Rate	Adjuvant
Untreated check			-	
Movento (+Agri-Mek SC at 1st Application)	spirotetramat	23	5 fl oz	MSO 0.5% v:v
	abamectin	6	6 fl oz	
Agri-Mek SC	abamectin	6	6 fl oz	MSO 0.5% v:v
Exirel	cyazypyr	28	13.5 fl oz	MSO 0.5% v:v
Aza-Direct	azadirachtin	4C	1.5 fl oz	-
Beleaf	flonicamid	Unknown	2.8 oz	-
Brigade	bifenthrin	9C	6.4 fl oz	Preference 0.25% v/v
Torac	tolfenpyrad	3A	14 fl oz	-
Sivanto	flupyradifuone	21A	10.5 fl oz	MSO 0.5% v:v
Blackhawk	spinosad	5	3.5 oz	Dyne-amic 0.7 pt
Radiant	spinetoram	5	6 fl oz	Dyne-amic 0.7 pt
Admire Pro (at plant treatment)	imidacloprid	4A	8.7 fl oz	

[a] Insecticide Resistance Action Committee mode of action classification.

Table 2. Season means for pest species sampled by vacuum and leaf for all treatments, Malheur Experiment Station, Ontario, OR, 2015. No statistically significant differences were observed in seasonal means among treatments for pests.

Treatment	Psyllid adult	Psyllid eggs (leaf samples)	Psyllid nymphs (leaf samples)	Beet leafhopper	Aphids	Lygus	Thrips (leaf samples)	Spider mites (leaf samples)
Untreated check	0.03	5.15	2.15	1.98	0.70	3.53	13.38	49.63
Movento (+Agri-Mek SC at 1st Application)	0.03	1.42	0.56	1.38	0.58	2.88	14.70	11.20
Agri-Mek SC	0.00	2.26	0.70	1.28	1.33	3.80	14.03	0.93
Transform	0.03	2.74	0.94	1.18	0.75	2.58	12.83	42.10
Aza-Direct	0.08	1.57	0.64	1.43	1.00	2.30	13.55	15.95
Beleaf	0.08	1.60	0.47	1.48	0.85	2.33	13.58	29.25
Brigade	0.03	0.90	0.07	1.03	2.43	3.38	11.75	0.68
Torac	0.00	2.63	0.63	1.50	0.85	3.63	16.03	4.20
Sivanto	0.10	2.18	0.53	1.23	0.73	2.78	13.60	22.03
Blackhawk	0.10	3.10	1.25	1.38	0.85	3.30	12.28	44.50
Radiant	0.03	2.18	0.69	1.83	0.78	3.60	14.20	17.75
Admire Pro (at plant treatment)	0.13	2.78	1.44	1.35	0.55	3.65	19.43	26.55

Table 3. Seasonal means for adults of beneficial insects sampled by vacuum for all treatments Malheur Experiment Station, Ontario, OR, 2015. No statistically significant differences were observed in seasonal means among treatments for beneficial organisms.

Treatment	Ladybird beetles	Lacewings	Big-eyed bugs	Pirate bugs	Spiders
Untreated Check	0.02	0.90	10.03	2.48	2.08
Movento (+Agri-Mek SC at 1st application)	0.02	0.46	5.68	2.34	1.65
Agri-Mek SC	0.03	0.48	8.73	2.65	1.90
Transform	0.03	0.73	6.20	2.03	2.13
Aza-Direct	0.02	0.33	6.95	2.23	2.10
Beleaf	0.03	0.78	8.18	2.10	1.93
Brigade	0.03	0.53	4.05	2.65	0.45
Torac	0.03	0.75	7.30	2.75	2.30
Sivanto	0.01	0.83	6.85	2.33	2.13
Blackhawk	0.02	1.10	7.60	2.50	1.88
Radiant	0.03	0.88	9.53	3.28	2.05
Admire Pro (at plant treatment)	0.03	0.50	8.85	2.88	2.50

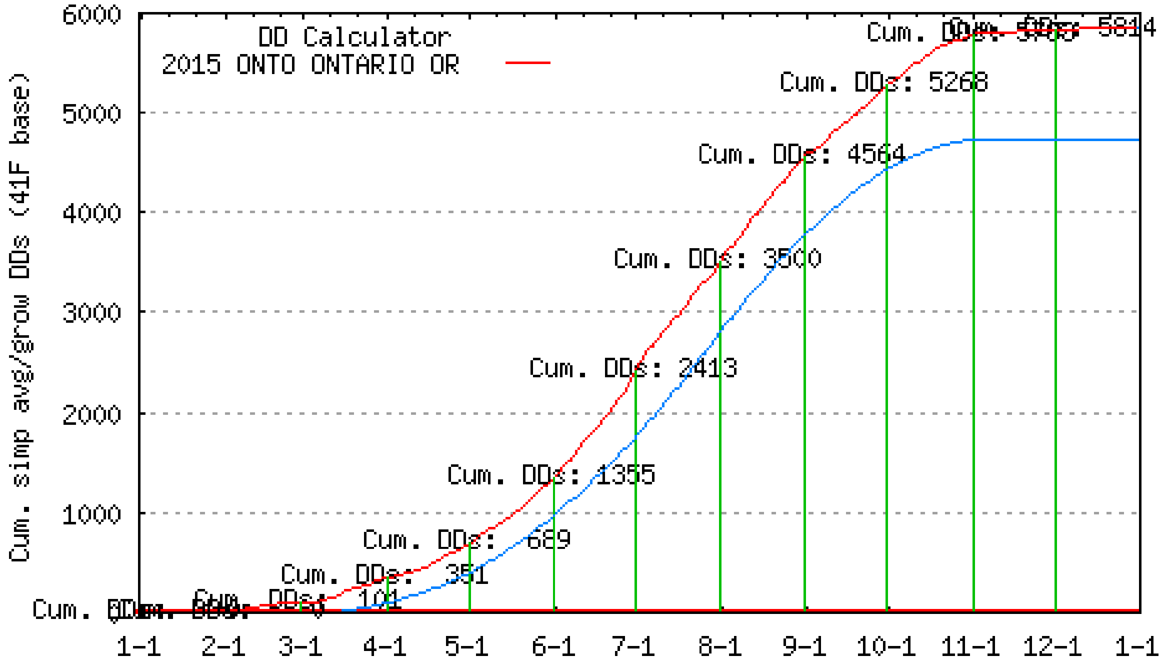

Figure 1. Comparison of accumulated growing degree-days for 2015 (upper line) versus 30 historical averages (lower line) for Ontario, OR, 2015. Data are from http://uspest.org/.