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, vector of the pathogen that causes zebra chip, as a serious threat to PNW potato production 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 control of this one pest and fitting in control of other insect pests around psyllid management strategies. In the last two seasons, 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 induce 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.

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.

Table 1. Insecticides used in efficacy trial against potato psyllids and other potato pests, Malheur Experiment Station, Oregon State University, Ontario, OR, 2014.

Treatment	active ingredient	IRAC[a] group	Rate	Adjuvant
1 Untreated Control				
2 Movento SC	Spirotetramat	23	5 oz	MSO 0.5% v:v
& Agri-Mek SC (1st application)	Abamectin	6	6 oz	
3 Agri-Mek SC	Abamectin	6	6 oz	MSO 0.5% v:v
4 Exirel EC	Cyazypyr	28	13.5 oz	MSO 0.5% v:v
5 Transform WG	Sulfoxaflor	4C	1.5 oz	-
6 Aza-Direct SL	Azadirachtin	Unknown	1.5 pt	-
7 Beleaf SG	Flonicamid	9C	2.8 oz	Preference 0.25% v/v
8 Brigade EC	Bifenthrin	3A	6.4 oz	-
9 Torac EC	Tolfenpyrad	21A	14 oz	MSO 0.5% v:v
10 Sivanto SL	Flupyradifurone	4D	10.5 oz	MSO 0.5% v:v

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

Insecticides were applied with a CO_2-powered backpack sprayer, delivering 20 gal/acre. Applications were made every 2 weeks from June 25, July 10, July 25, August 8, August 22, and September 5.

Insects were sampled with 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 minutes. 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. 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

During 2014, overall insect pressure at all sites was very low. Air temperatures were well above average at all of the sites during the month of July and the first part of August (Fig. 1). It is likely that these high air temperatures were detrimental to significant development of several pest insects that would typically be increasing during that time period, specifically, potato psyllid. A more typical growing season would likely have resulted in higher pest insect densities.

Tables 2 and 3 denote the seasonal means and analyses for the different pest and beneficial insects by treatment for the trial in Ontario, OR. Six biweekly applications were made in the trial. Few potato psyllid adults were collected in this trial, and no significant differences among numbers of adult potato psyllids were found among the treatments. However, there were significant differences among treatments in the mean numbers of potato psyllid nymphs and eggs. Brigade® (bifenthrin), Sivanto® (flupyradifurone), Beleaf® (flonicamid), Movento (spirotetramat), and Exirel® (cyazypyr) were most effective in controlling immature stages of the potato psyllid (Table 2).

However, numbers of thrips (predominantly western flower thrips) were significantly higher in the Brigade treatment than in any of the other treatments. Brigade and Sivanto tended to be detrimental to most natural enemies (Table 3). Beleaf, Exirel, and Movento were not harmful to beneficials, except for lacewings.

Tubers were inspected for visual symptoms of zebra chip, but no symptomatic tubers were found. No psyllids infected with the zebra chip bacterium were found in 2014.

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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 2. Seasonal means for pest insects sampled by vacuum and leaf collections for all treatments at Ontario, OR, 2014. Means with different letters are significantly different from one another.

Insect	Psyllid adult	Psyllid nymph	Psyllid egg	Aphid	Adult beet leafhopper	Thrips	Lygus adult
Sample type	Vacuum	Leaf	Leaf	Vacuum	Vacuum	Vacuum	Vacuum
Treatment							
1 UTC	0.55 a	8.90 a	30.17 a	1.75 a	0.52 a	8.17 a	5.08 a
2 Abamectin & Movento	0.50 a	2.21 bc	10.39 b	0.25 a	0.43 a	16.92 a	5.71 a
3 Abamectin	0.43 a	5.43 ab	28.35 a	0.25 a	0.27 a	18.67 a	5.60 a
4 Exirel	1.29 a	1.71 bc	7.07 b	0.25 a	0.50 a	17.79 a	8.39 a
5 Transform	0.42 a	7.43 ab	28.36 a	1.75 a	0.76 a	15.76 a	6.57 a
6 Aza-Direct	0.39 a	6.82 ab	32.71 a	0.50 a	0.82 a	13.00 a	6.75 a
7 Beleaf	0.71 a	2.11 bc	8.11 b	1.50 a	0.48 a	19.87 a	3.79 a
8 Brigade	0.36 a	0.93 c	6.36 b	0.25 a	0.18 a	40.32 b	4.11 a
9 Torac	0.43 a	7.25 a	26.53 a	0.50 a	0.39 a	13.86 a	6.29 a
10 Sivanto	0.36 a	1.86 c	12.39 b	0.75 a	0.29 a	17.11 a	4.89 a

Table 3. Seasonal means for adults of beneficial insects sampled by vacuum and leaf for all treatments Ontario, OR, 2014. Means with different letters are significantly different from one another.

Insect	Pirate bug	Big eyed bug	Ladybugs	Lacewings
Sample type	Vacuum	Vacuum	Vacuum	Vacuum
Treatment				
1 UTC	2.30 ab	2.32 a	0.76 ab	4.02 a
2 Abamectin & Movento	2.61 ab	0.82 ab	0.32 ab	1.04 b
3 Abamectin	2.01 ab	1.70 ab	0.68 ab	2.50 ab
4 Exirel	3.25 ab	1.29 ab	0.82 ab	1.11 b
5 Transform	2.57 ab	0.70 ab	1.43 ab	2.13 ab
6 Aza-Direct	3.18 ab	2.39 a	0.93 ab	2.50 ab
7 Beleaf	4.30 a	1.67 ab	0.52 ab	1.05 b
8 Brigade	3.64 ab	0.46 b	0.21 b	0.82 b
9 Torac	3.00 ab	1.89 ab	0.57 ab	2.17 ab
10 Sivanto	1.75 b	1.43 ab	1.71 a	0.89 b

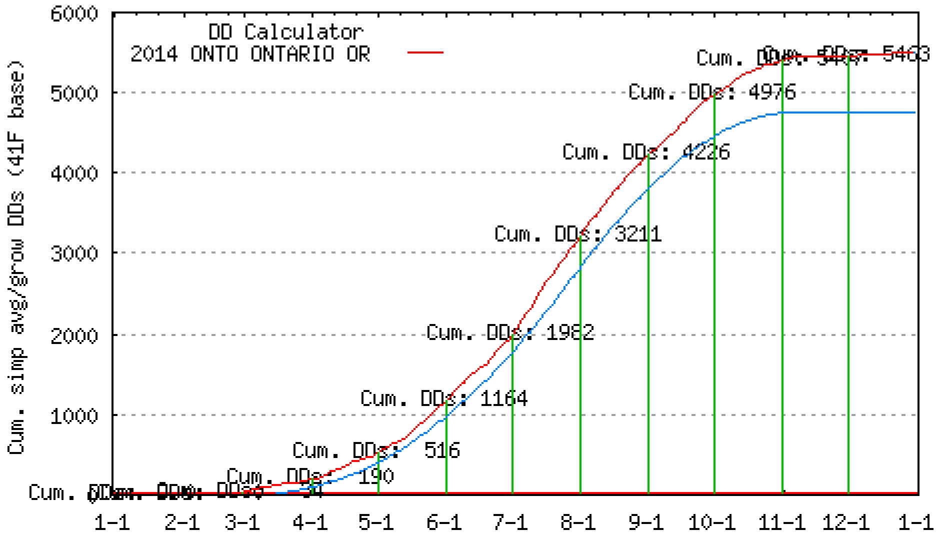

Figure 1. Comparison of accumulated growing-degree days for 2014 (upper [red] line) versus 30 historical averages (lower [blue] line) for Ontario, OR, 2014. Data are from http://uspest.org/.