EVALUATION OF POTATO PEST MANAGEMENT PROGRAMS

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Introduction

A number of insect pests reduce yield and quality of potatoes throughout the Pacific Northwest (PNW), although their distribution and intensity of infestations vary by location and year. Unfortunately, the number of insect pests has been increasing in recent years. In the early 1990s, the major insect pests of potatoes in the PNW were limited to wireworms, Colorado potato beetles, aphids, and two-spotted spider mites. Other species that have emerged as pests more recently (since the mid-1990s) include thrips, cutworms, loopers and armyworms, potato tuberworm (2004), beet leafhopper (2005), potato psyllid (2011), and stink bug (2013), and potentially *Lygus* bug. This increase in pest species coupled with rapid changes in registered insecticides have severely complicated management of potato insects in the PNW.

Most importantly, the potato psyllid has emerged as a serious threat to PNW potato production because of its ability to be a vector of the bacterium that causes zebra chip disease. The pest and disease have fundamentally changed insect management strategies and have effectively ended traditional integrated pest management programs. Although the urgency regarding potato psyllid and zebra chip have receded slightly, they remain the cornerstone for pest management in potatoes because processors have virtually zero tolerance for zebra chip defects. Detection of potato psyllids at any level can trigger a season-long insecticide treatment program, especially for long-season potato cultivars. Consequently, many growers at risk of potato psyllid are designing their insect management programs around this one pest and fitting management of other insect pests around psyllid management strategies.

Given this situation, there is a critical need to develop and refine psyllid management within the context of overall insect pest management programs to ensure that potato production in the PNW remains viable and economically sustainable. Most insecticides with psyllid efficacy also have activity, and are currently used, against other pests, including aphids, thrips, and Colorado potato beetles. Therefore, it is critical to determine what insecticides would be most suitable for psyllid management and which would be suitable for other pests. This information will enable growers to make better informed choices regarding their insecticide selections and will help develop appropriate insecticide resistance management programs for potatoes in the PNW.

Our regional research team conducted a series of experiments to evaluate insecticides for psyllid management and their effect on other pest and beneficial insects and to assess different plot designs and sampling strategies to help improve the efficiency of psyllid research trials.

Open field insecticide trials with small versus large plots and different sampling schemes were conducted at Eltopia and Pasco, Washington and Ontario, Oregon. Sleeve cage trials to evaluate insecticides were conducted in Kimberly, Idaho and Hermiston, Oregon. Results of the Ontario trial are reported below.

Materials and Methods

A trial for determining the efficacy of the insecticides Agri-Mek® (abamectin), Brigade® (bifenthrin), Exirel® (cyazapyr), and Movento® (spirotetramat) was conducted at the OSU Malheur Experiment Station. The trial was arranged on a randomized complete block design with four replications of each treatment and plot size. Small plots were 4 rows or 12 ft by 25 ft. Large plots were 8 rows or 24 ft by 25 ft. 'Ranger Russet' potatoes were planted on April 24, 2017. Treatments were made on a 14-day interval: August 4, and 18, and September 1, 2017. Treatments were applied with a CO_2 powered backpack sprayer applying insecticides at 20 gal water/acre and 30 psi.

Table 1. Insecticides used in potato field trial at the Oregon State University, Malheur Experiment Station, Ontario, OR, 2017.

Treatment products	Active ingredient	Rate (fl oz/acre)	Timing
Check	-	-	-
Movento	Spirotetramat	5	ABC
Agri-Mek SC	Abamectin	3.5	ABC
Brigade	Bifenthrin	4	ABC
Exirel	Cyazypyr	13.5	ABC

Evaluations were made using two different sampling methods, as follows:

- Leaf samples were randomly selected from the middle canopy of plants in the interior rows of each plot, and placed in a 1-gal Ziploc bag. Samples were brought back to the lab for evaluation under magnification. Intense samples consisted of 20 leaves per plot and standard samples consisted of 10 leaves per plot.
- An inverted leaf blower with an organza fabric bag was used on the outside rows, and the contents of each sample were place into 1-gal Ziploc bags, and evaluated with the use of dissecting microscopes. Intense samples were collected over a 3-min interval and standard samples were collected over a 90-sec interval.

Sample collection began 3 days after the first insecticide application and every 7 days thereafter.

Results

Overall insect populations were relatively low. Few potato psyllids were detected in this trial. Results were comparable between small and large plot samples (see figures below). The more intensive sampling regimens detected more insects and mites and tended to have less variation than the standard sampling regimens.

There were no significant differences in numbers of adult potato psyllids among the treatments (Fig. 1). However, there were significant differences in potato psyllid eggs among treatments (Fig. 2). Agri-Mek did not have an effect on potato psyllid eggs as there was no difference between the Agri-Mek treatment and the untreated check. Egg numbers were significantly lower in the Brigade, Exirel and Movento treatments compared with the untreated check. The same pattern was observed with the potato psyllid nymphs (Fig. 3).

In large-plot samples, two-spotted spider mite populations were significantly lower in the Agri-Mek, Brigade, and Movento treatments than in either the Exirel treatment or the untreated check. In the small plots, Agri-Mek and Movento performed the best. Exirel and Brigade had significantly lower populations than the untreated check, but higher than either Agri-Mek or Movento.

Thrips populations also differed among treatments. In both the small and large plots, there were significantly more thrips in the Brigade treatment than in any of the other treatments, including the untreated check. Agri-Mek, Exirel, and Movento performed equally well; all treatments had significantly fewer thrips than the untreated check.

Although we observed some statistical differences among treatments for psyllid eggs and psyllid nymphs, their biological importance is uncertain. The differences were consistent between the large and small plots but the averages ranged from only 0 to 2.3 per sample. Many leaves had no psyllid eggs or nymphs. The trial results support other trial results showing that pyrethroids (e.g., Brigade) flare thrips populations.

Conclusions

Psyllid pressure was again surprisingly low in 2017. In open field trials, we observed minor, but statistically different treatment effects on psyllid eggs and nymphs, with Brigade, Exirel, and Movento tending to have lower numbers than the untreated check. However, Brigade, a synthetic pyrethroid, led to significantly higher numbers of thrips.

Brigade also significantly reduced populations of beneficial insects.

Sleeve cage trials conducted at other locations with *Liberibacter*-infected psyllids did not demonstrate that insecticides significantly reduced the transmission of *Liberibacter*. However, there was a trend for lower levels of zebra chip disease symptoms with Agri-Mek and Brigade. Additional replication of these tests would be needed to confirm these results.

Acknowledgments

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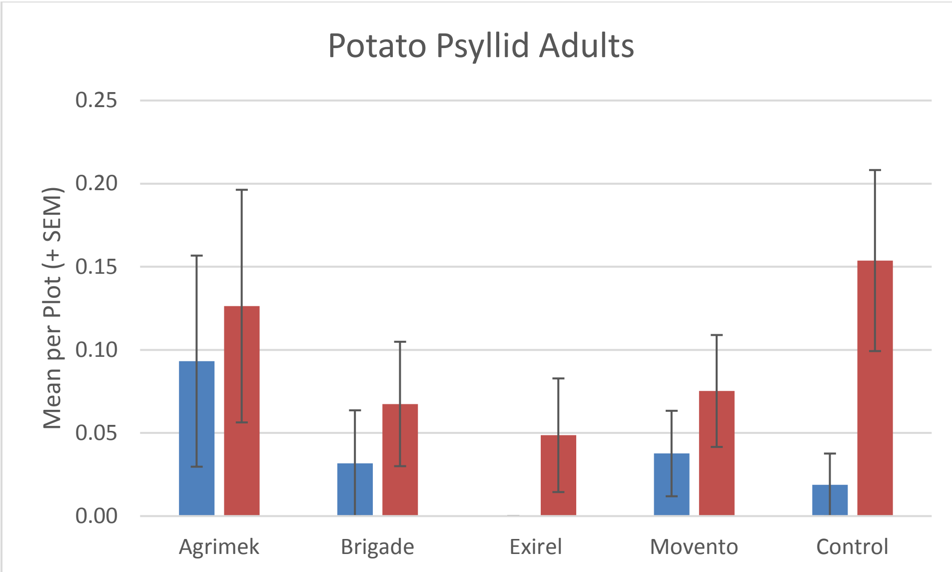

Figure 1. Mean number of adult potato psyllids by insecticide treatment in small plots (left) and large plots (right) in an efficacy trial at Ontario, OR, 2017. There were no statistical differences among the treatments.

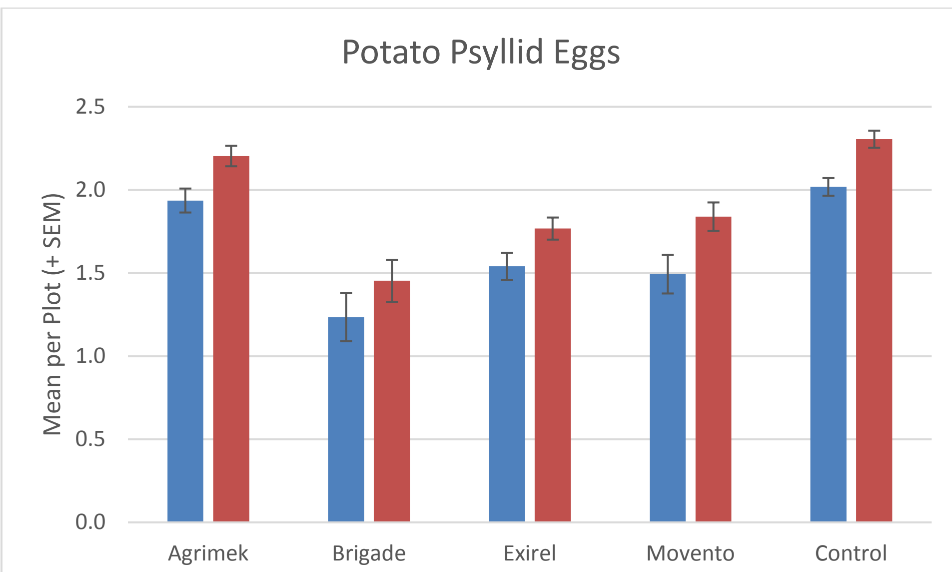

Figure 2. Mean number of potato psyllid eggs by insecticide treatment in small plots (left) and large plots (right) in an efficacy trial at Ontario, OR, 2017, Brigade, Exirel, and Movento had significantly fewer eggs than the untreated check or the Agri-Mek treatment.

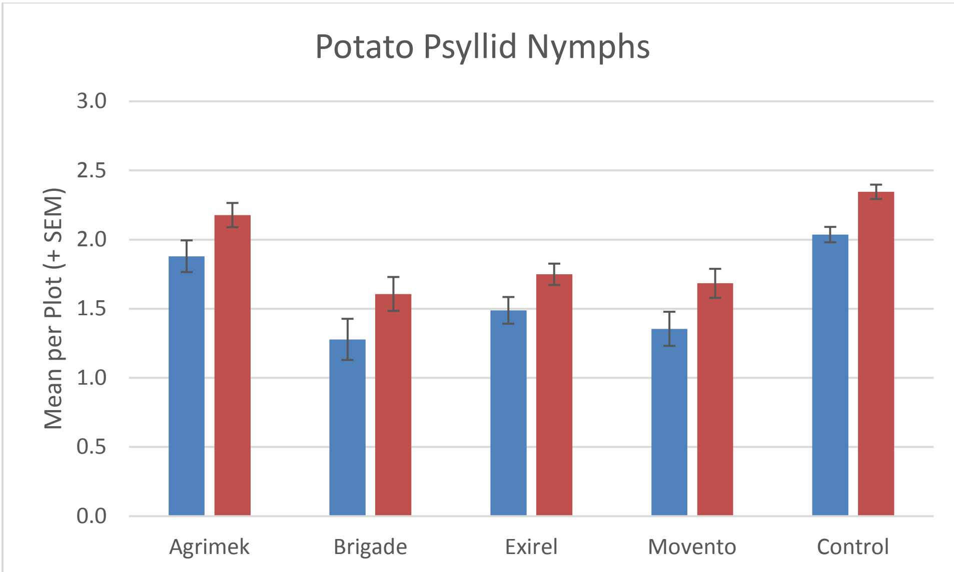

Figure 3. Mean number of potato psyllid nymphs by insecticide treatment in small plots (left) and large plots (right) in an efficacy trial at Ontario, OR, 2017. Brigade, Exirel, and Movento had significantly fewer nymphs than the untreated check or the Agri-Mek treatment.