

**AGRICULTURAL RESEARCH FOUNDATION
FINAL REPORT
FUNDING CYCLE 2013 – 2015**

TITLE: A New Threat to northeastern Oregon Certified Seed & Commercial Potato Production – Zebra Chip and the Potato Psyllid.

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COOPERATOR (S) (if any): Silvia Rondon, Extension Entomologist Specialist, OSU-Hermiston Agricultural Research and Extension Center. Erik Echegaray, OSU-HAREC, Entomologist, Postdoctoral Scholar. Arnie Grammon, Baker County Vegetation Management Program Manager, Baker City, OR. Union County Board of Commissioners – Steve McLure. Baker County Weed Board. Union County Weed Board.

Objectives:

1. Develop and implement an area-wide potato psyllid monitoring program in order to determine adult potato psyllid dynamics within northeastern Oregon (Union-Baker Co. area) commercial potato fields.
2. Survey and identify potential bittersweet nightshade (*S. dulcamara*) overwintering sites for potato psyllids in Union and Baker Co.; collect potato psyllid and *S. dulcamara* leaf/stem samples and determine occurrence of *Candidatus Liberibacter bacterium* (Lso) overwinter.
3. Provide outreach & engagement opportunities for the stakeholders (e.g. local growers, field men, ag-service providers, potato processors, University faculty) for timely dissemination of results.

Procedures:

Objective 1 - Area-wide potato psyllid monitoring program: The area-wide aphid insect pest monitoring program was adapted in 2013 and 2014 to include weekly monitoring of potato psyllid populations in 6 commercial processing potato production fields in Baker County and 4 commercial Oregon certified seed potato production fields in Union County. The 10 sites were selected to provide representative sampling within each production area and were monitored weekly for a period of 14 to 16-weeks (early June through vine-kill in September). Psyllid samples were collected from potato plant foliage by operating a DVAC vacuum device (inverted leaf blower) for 3 to 5 minutes near the field edge. DVAC samples were then processed to identify

and determine the number of potato psyllids and other psyllid species collected at each site. Adult potato psyllid samples were shipped to the OSU-Hermiston Agricultural Research Center for species identification confirmation and PCR analysis to determine presence of *Liberibacter* bacterium, the causal agent of ZC.

Objective 2 - Survey of Potential Over-Wintering Sites: The overwintering component of the study was designed to investigate potato psyllid population dynamics between two consecutive potato growing seasons (2013 and 2014). In September 2013, a bittersweet nightshade (*Solanum dulcamara*) survey was developed and implemented in conjunction with the Baker Co. Weed Management Department and growers in both counties. Due to the extensive nature of both irrigation canal and stream/river systems in the area, priorities were to survey areas in close proximity to potato production fields and survey a few sentinel sites distant to production fields. Each infestation site was evaluated and the following data collected to characterize each site: GPS coordinates, *S. dulcamara* infestation level, proximity to potato production fields and environmental conditions (e.g. dry, seasonally wet, permanently wet, etc.).

Given the widespread distribution of *S. dulcamara* in both counties, 10 sites in close proximity to potato production fields were selected for the 2013-14 over-winter monitoring study. Five monitoring sites were located in Union county (Figure 1) and 5 sites were located in Baker Co. (Figure 2). DVAC samples were collected from the *S. dulcamara* sites on a 4-week interval which was initiated on 25 October 2013. Overwinter sample collection continued through 27 May 2014, at which point, the growing season aphid insect monitoring program was initiated (June 2014).

In order to determine *Liberibacter* bacterium (Lso) presence in overwintering *S. dulcamara* host plant tissue, leaf and stem samples (5 each) were collected from host plants at each monitoring site for future PCR analysis. Adult potato psyllid samples collected from each monitoring site were also subjected to PCR analysis. All samples were shipped to the OSU-Hermiston Agricultural Research Center for testing and species identification confirmation (adult psyllids). The number of sites and type of samples collected during the overwintering season are summarized in Table 1.

Objective 3 – Outreach:

Weekly monitoring results were disseminated in a timely manner to the potato industry via electronic distribution (email and internet) and hard-copy delivery (U.S. Postal Service). Growers, field representatives and agricultural service providers utilized the weekly results to track potato psyllid population dynamics and as a baseline comparison for evaluating the efficacy of potato psyllid control programs in commercial fields. Weekly results were posted online at the OSU Extension Service – Union Co. web site (<http://extension.oregonstate.edu/union/potato-aphid-reports-current>) which also enabled timely, in-field data access (via smart phone technology).

Significant Accomplishments

Objective 1 - Area-wide potato psyllid monitoring program:

Potato psyllid populations were very high during the 2013 growing season (June – September) where a total of 2772 potato psyllids were captured from 10 monitoring sites (Figure 3). Potato psyllids were first detected 8 July 2013 and populations increased significantly late season. A

total of 89 potato psyllid samples were collected during the growing season and subjected to PCR analysis. Fortunately, only one Lso-positive sample (26 August – Baker Co.) was discovered which indicates very low Lso incidence levels within potato psyllid populations.

In 2014, potato psyllids appeared in fields two weeks earlier than in 2013 with initial potato psyllid detection made 23 June 2014 (Figure 4). Early discovery required growers to initiate and maintain expensive insect management programs over a much longer period of time. A total of 72 potato psyllid samples were collected during the growing season and subjected to PCR analysis. Results for all samples were Lso-negative which indicates, for the second year in a row, Lso incidence levels were very low in potato psyllid populations in northeastern Oregon. 2014 potato psyllid populations were significantly lower compared to 2013 (Figure 5) but late season populations were still considered to be high compared to other potato production areas in Oregon (S. Rondon, personal communication).

Objective 2: Survey of Potential Over-wintering Sites:

The *S. dulcamara* survey was conducted between 8 August 2013 and 27 August 2013. *S. dulcamara* infestations were located at 165 sites in both counties combined. Survey results and observations indicate that *S. dulcamara* is wide-spread throughout the region. *S. dulcamara* was primarily found in continuously-wet and seasonally-wet areas but also found in areas considered to be dry. Infestation levels across all the sites varied from individual plants to sizeable areas or patches consisting of numerous individual plants. One site, in particular, measured in excess of 500 yards in length by 25 yards in width (approx.) with thousands of individual plants! *S. dulcamara* leaves were checked during the survey to determine presence of potato psyllid nymphs and adults. It was determined that the presence of potato psyllid populations (present or not present) were variable across all *S. dulcamara* sites found in the survey (observational data).

S. dulcamara plants were found predominantly in areas with access to moisture and structure (e.g. willow trees, cattail, fences, bushes, etc.) upon which the vines can climb (Figure 6). Such areas included roadside ditches, stream/river banks, irrigation ditches and marsh/bog/slough areas. Example *S. dulcamara* sites in Union County include areas along the Grande Ronde River, Catherine Creek and the Ladd Marsh. Baker County examples include areas along the Powder River, North Powder River, Wolf Creek, Rock Creek and around North Powder Pond #1. Interestingly, *S. dulcamara* was found upstream towards the headwaters of Wolf Creek in an area distant to the nearest potato production field. This particular infestation was small, located on the creek bank and in close proximity to a homestead.

Overall, potato psyllid adults were collected (DVAC sampling technique) from *S. dulcamara* monitoring sites in both Union and Baker Co. during early winter but were not collected mid- to late-winter. These results are in contrast to the Columbia Basin where potato psyllid adults have been collected from *S. dulcamara* throughout the winter season (Rondon). A total of 19 adult potato psyllid, 25 *S. dulcamara* leaf and 70 *S. dulcamara* stem samples were collected over winter in Union and Baker Co. (Table 1).

Results for the number of potato psyllid adults collected at each site per sampling date are summarized in Table 2. A total of 282 potato psyllid adults were collected from 5 Union Co. monitoring sites during October, November and December 2013 sampling efforts. No potato psyllid adults were collected from January through May 2014. Results were similar for Baker Co. except the total number of potato psyllid adults collected (21 total) during October, November and December 2013 was significantly less than were collected in Union Co.

Potato psyllid adults were subjected PCR testing for presence of Lso by Dr. Robert Cating, OSU-Plant Pathologist, and all samples tested negative for the Lso bacterium. Lso testing *S. dulcamara* leaf and/or stem samples are not available at this time.

Objective 3 – Outreach:

Presentations with focus on the potential threat of zebra chip disease to the local commercial and certified seed potato industry in Union and Baker counties were given to the weed boards in each county in 2013. Survey results from the *S. dulcamara* survey supported both Union and Baker County Weed Management Boards to classify the plant as an Agricultural Class B noxious weed since it is of economic importance to agriculture due to being known over-wintering host for potato psyllid.

Potato psyllid population data and Lso test results were disseminated via 170 email newsletters and pest alert contacts (79 in 2014, 91 in 2013) and 1024 direct mail contacts (480 in 2014, 544 in 2013). Final study results will be presented to local growers and industry reps at grower meetings/workshops and disseminated via email/web site tools. Preliminary results from this study and work conducted in the Columbia Basin were presented at the 62nd Annual Meeting of the Entomological Society of America held in Portland, OR in November 2014.

Benefits / Impact:

- Techniques for monitoring potato psyllid populations were refined and successfully integrated into the current area-wide aphid monitoring program in Union-Baker Co.
- Monitoring efforts over the last two growing seasons have been instrumental in quantifying potato psyllid populations and Lso occurrence within these populations.
- Outreach efforts have been helpful to growers and field consultants in their pest management efforts and to gauge potential for Zebra Chip disease introduction and spread.
- Bittersweet nightshade (*S. dulcamara*) was found to be widespread throughout the region and awareness of its potential to host potato psyllid has increased.
- Potato psyllids were not found on all *S. dulcamara* surveyed in this study which indicates that the pest is not widespread across the region for reasons unknown.
- Potato psyllids were not collected throughout the winter in Union – Baker Co. which may suggest the possibility that potato psyllids in this region either: 1) do not survive over winter on *S. dulcamara*; or 2) survive on alternate over wintering *hosts* or other *sites* that are unknown at this time.

- Given the widespread distribution of *S. dulcamara*, it is not feasible to manage the plant host on a regional-basis. However, localized control efforts to manage *S. dulcamara* infestations within close proximity to potato production fields would be feasible with the development of effective management techniques.
- The results of this study suggest Lso bacterium in this region may not over winter within its' vector, the potato psyllid, based upon negative test results from potato psyllids collected from October through December 2013 and the inability to find the vector during mid- to late-winter.
- As a valuable addition to the study, potato psyllid samples collected from this study were subjected to high resolution melting/PCR analysis (R. Cating, OSU-HAREC) to determine the haplotype(s) of potato psyllids found in Union – Baker Co. (data not shown). The results from this effort will support regional efforts (USDA-ARS, Washington) to better understand the genetic differentiation of populations that occur in the region. Research is currently underway to determine the interaction between potato psyllid haplotype and vector-potential of Lso.

Additional Funding Received

No additional funds were received, however, the project created additional opportunity to generate new information beyond the original scope of the project through additional research support provided by OSU-HAREC (Cating) to conduct genetic/haplotype testing (valued at approx. \$18,000) of psyllid samples collected in Union-Baker Co.

Future Funding

Due to additional costs associated with psyllid monitoring and Lso testing, funding will be sought from other sources to continue monitoring this pest complex as a permanent component of the area-wide aphid monitoring program deployed each growing season.

Acknowledgments

Dr. Robert Cating - Plant Pathology Diagnostician and Laboratory Manager, Oregon State University – Hermiston Agricultural Research and Extension Center.

Bryon Quebbeman – Crop Consultant



Figure 1. 2013-14 Over-wintering potato psyllid monitoring sites in Union County, OR.



Figure 2. 2013-14 Over-wintering potato psyllid monitoring sites in Baker County.

Table 1. Number of samples* collected from monitoring sites during 2013-14 overwintering study in Union-Baker Co.

Collection Date	Potato Psyllid Adults		Bittersweet Nightshade (<i>S. dulcamara</i>)		
	DVAC	Lso (Pos/Neg)	Leaf	Lso (Pos/Neg)	Lso (Pos/Neg)
26-Oct-13	9	Neg	10		0
21-Nov-13	6	Neg	0		10
17-Dec-13	4	Neg	0		10
16-Jan-14	0	0	0		10
26-Feb-14	0	0	0		10
18-March-14	0	0	0		10
29-April-14	0	0	5		10
27-May-14	0	0	10		10
Total	19	All Neg	25		70

*10 sites were sampled on a 4-week schedule. One sample per site on each collection date.

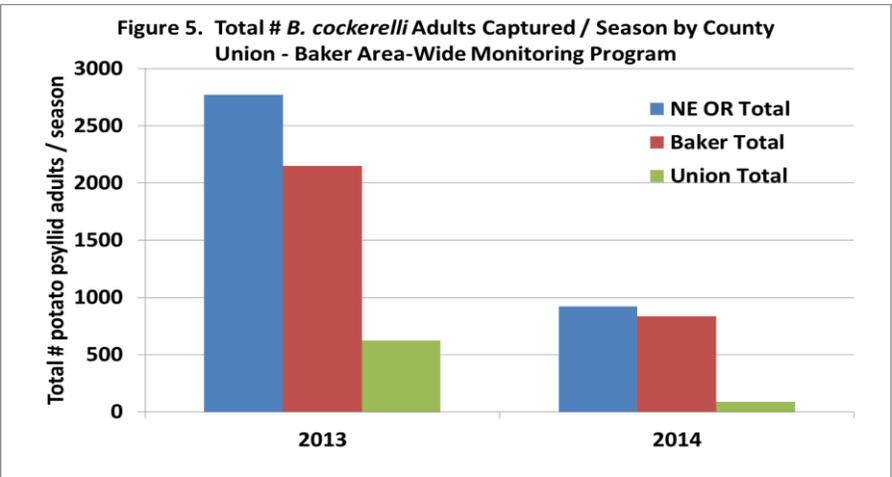
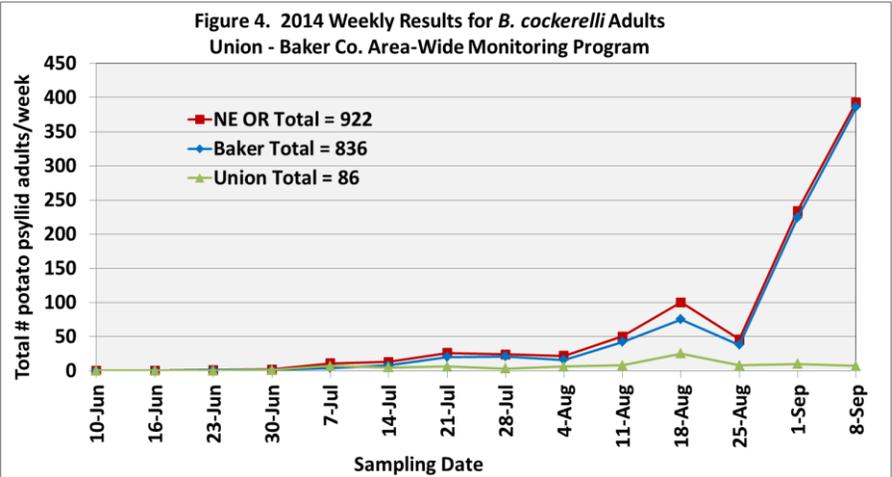
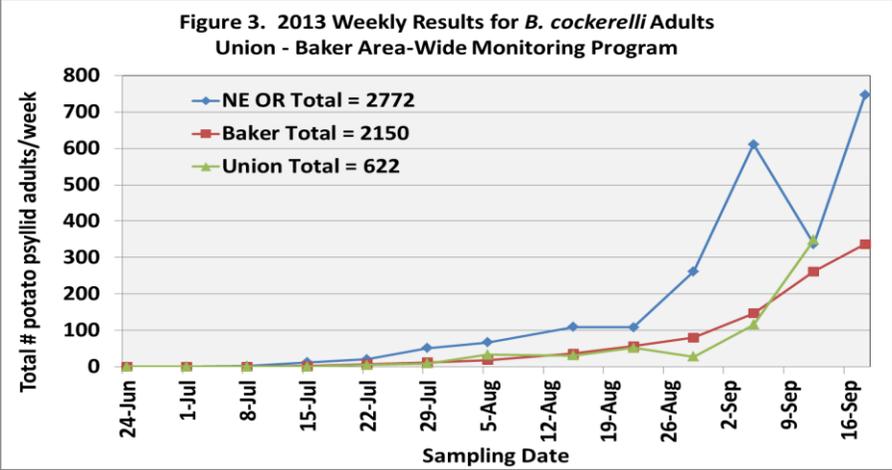




Figure 6. Bittersweet nightshade (*S. dulcamara*) infestation growing in a seasonally wet area within close proximity to a commercial potato production field in Baker Co.

Table 2. Potato psyllid adults collected from *S. dulcamara* monitoring sites 2013-2014.

Site #	County	# of Potato Psyllid Adults							
		25-Oct	21-Nov	17-Dec	16-Jan	26-Feb	18-Mar	29-Apr	27-May
1 - Cath Creek Ln	Union	1	0	0	0	0	0	0	0
2 – Ladd Marsh	Union	1	6	1	0	0	0	0	0
3 – Mid Valley	Union	0	0	0	0	0	0	0	0
4 – Standley Ln	Union	22	56	3	0	0	0	0	0
5 – Wolf Cr Ln	Union	76	76	40	0	0	0	0	0
	Total	100	138	44	0	0	0	0	0
6 – Hughes Ln	Baker	1	0	0	0	0	0	0	0
7 – Schoolhse Rd	Baker	2	2	0	0	0	0	0	0
8 – Pocohontas Rd	Baker	8	2	1	0	0	0	0	0
9 – HWY 30	Baker	2	0	0	0	0	0	0	0
10 - McCarty Br Rd	Baker	2	1	0	0	0	0	0	0
	Total	15	5	1	0	0	0	0	0
Overall Total		115	143	45	0	0	0	0	0