Progress Report to the Agriculture Research Foundation
Oregon Potato Commission
2017-2018

Title: Klamath Basin Research & Extension Potato Program

Project Leader: Brian A. Charlton, Klamath Basin Research & Extension Center, OSU, Klamath Falls

Cooperators: Sagar Sathuvalli, OSU-HAREC
Rob Wilson, UC-IREC, Tulelake, CA
Jeff McMorran, Extension Seed Certification and Potato Specialist, OSU,
Silvia Rondon, OSU-HAREC
Nichole Baley, OSU-KBREC
Emily Lopez, OSU-KBREC

Funding History:

Funding for, 2011-2012 this donor: $16,850
Funding for, 2012-2013 this donor: $16,850
Funding for, 2013-2014 this donor: $17,100
Funding for, 2014-2015 this donor: $17,100
Funding for, 2015-2016 this donor $15,750
Funding for, 2016-2017 this donor $15,750
Funding for, 2017-2018 this donor $15,750

Abstract:
Potatoes are an integral component of Klamath Basin agriculture comprising approximately 8% of gross farm gate sales. Basin potato growers produced a $35-million-dollar commodity on approximately 14,000 acres in 2016. Local production is comprised of both fresh, processed (chips), and certified seed acreage. Extension insect trapping programs have provided producers with pertinent information to assist production management decisions. Degree-day monitoring has helped optimize application timing of non-fumigant nematicides for control of various nematode species. The Klamath Basin Research & Extension Center (KBREC) continues to provide valuable services to growers, shippers and local agricultural business in many facets of pest management, production, and marketing. Our goal is to continue searching for innovative ways to enable our local industry to keep ahead of the latest developments.

Key Words: Late blight, chipping, herbicides, varieties, aphids, nematodes, insects

Objectives:

Education and Service

1. Develop multi-state programs as major annual events for growers, agricultural industry, and the intermountain (southern Oregon and northern California) community.
2. Use various media outlets to communicate agricultural topics of importance to the rural and urban Klamath Basin community.
3. Continue insect trapping programs in the Klamath Basin to help generate local data about the distribution of potato tuberworm, leafhoppers, aphids, and psyllid distribution, life cycle and control.
4. Continue monitoring growing degree-days for nematode development in the Klamath Basin to help fine tune optimal application timings.
5. Provide technical field service to growers in the Klamath Basin through identification of potential problems and solutions.
6. Provide grower, agronomists, shippers, and related industry with timely newsletters on pertinent information.
7. Provide liaison between growers and campus-based specialists and various program services.
8. Provide leadership support to the Klamath Basin Potato Growers Association.

Research:

1. Screen russet, chip, and specialty varieties from Tri-State, and Western Regional variety development programs to determine suitability to local production parameters.

Procedures:

Implemented all objectives listed.

Significant Accomplishments:

1. Chair and coordinator in cooperation with UC Intermountain R&E Center for Klamath Basin Potato Seminar, Klamath Falls, OR, March 9, 2017. 50 participants.
2. Provided technical assistance for potato booth at Klamath Basin Farm Expo, Klamath Falls, OR. February 2017, more than 1,400 participants (grades K-12 and general public)
3. Hosted potato single-hill and preliminary yield trial selection tour on October 4-6.
4. Insect trapping program. Eighteen sticky traps and ten yellow-pan traps were monitored from late June to early-September throughout the Klamath Basin in 2017. Results were reported in weekly issues of *Potato Bytes* and posted to the KBREC website for area producers. Leafhopper and aphids counts were also monitored (See graphs below).
5. Extensive visits to area potato fields were made to help determine the cause of various production problems. Dissemination of information via *Potato Bytes* was published weekly which helped growers determine management protocols to reduce threat of spread and new infections. Routine correspondence, field and packing shed visits occurred throughout the production season.

6. **6.** Maintained growing season degree-day information for hatch of J2 root-knot nematode juveniles. Notified local pest control businesses and grower clientele to alert when target degree-days were approaching. Data was also available on our website and included in weekly issues of *Potato Bytes*.
7. **7.** Multiple variety trials were evaluated for yield, grade, processing quality, and storability to determine suitability to local growing conditions.
   Results and Discussion:
   The most promising entries were retained for further evaluation in 2018. See http://oregonstate.edu/dept/kbrec/potatoes for full report.
8. **8.** Continued publishing a newsletter titled *Potato Bytes*. This newsletter was delivered weekly beginning in mid-June and ended in mid-September. Archives of the newsletter can be accessed on the KBREC website at: http://oregonstate.edu/dept/kbrec/potatoes. The newsletter contained tabulations of insect surveys, crop water use information, degree-day accumulation, and other pertinent information for growers.
9. **9.** Continued publishing a summarized report titled *Klamath Basin Potato Variety Development Summary*. This report details all KBREC potato research activities in a 'grower-friendly' format. Archives of this report (2008-2017) can be assessed on the KBREC website at: http://oregonstate.edu/dept/kbrec/potatoes.

Impacts:

The Klamath Basin Research & Extension Center continues to provide extensive and timely information to local and statewide potato interests. Conferences and seminars facilitate the interaction of growers, business, and agencies to interact on important issues facing the potato industry and the local region in general. Insect trapping provides the production region with pertinent information to assist in production management decisions. Monitoring nematode growing degree-days allowed growers an opportunity to target pesticide applications at the weakest point in the nematode life cycle. Hence, greater control efficacy and higher quality potatoes were realized at harvest. Yield trials to identify superior varieties continues to help Klamath Basin and Oregon producers remain competitive. Identifying optimum cultural management practices will help producers optimize net economic returns while delivering a high quality product to processors and consumers.

Relation to Other Research

This project interfaces with statewide variety development projects on three branch stations (Hermiston, Klamath Falls, and Ontario) and the Crop & Soil Science Department in Corvallis. In addition, Klamath Basin Research & Extension programs are fully integrated with other extension programs in the Tri-State area and northern California. Current research and information are effectively disseminated for maximum benefit and impact to the local agricultural industry.

2017 Preliminary Yield (PYT-2) Chip Trial

Location: OSU KBREC – Klamath Falls, OR
Planting Date: May 23
Vine Kill Date: August 30
Harvest Date: October 6
Days to Vine kill: 92
Fertility: 180-125-250-265 Sulfur
In-Row Spacing: 9.25 inch

The PYT-2 Chip Trial evaluates recently selected clones, often only two years removed from single-hill selection. Retained entries are further evaluated in replicated trials at several Oregon locations before advancing (if applicable) to the Tri-State trial which includes testing locations in Washington and Idaho. 16 selections were evaluated with 8 retained for further evaluation.

Clone	Female Parent	Male Parent
AOR13125-2	MSR061-1	CO02321-4W
AOR13125-9	MSR061-1	CO02321-4W
AOR13136-4	Sinora	CO02321-4W
NYOR14Q9-5	Eva	H25-4
NYOR14Q9-9	Eva	H25-4
NYOR14Q12-1	NY140	J100-6
COOR13270-2	CO02321-4W	CO02024-9W
COOR13428-1	Wischip	CO02321-4W

2017 Statewide Chip Trial

Location: OSU KBREC – Klamath Falls, OR
Planting Date: May 22 | Vine Kill Date: September 7
Harvest Date: September 26th | Days to Vine kill: 107
Fertility: 180-125-250-265 Sulfur | In-Row Spacing: 9.25 inch

Chipping potatoes comprise a significant portion of Klamath Basin acreage and identification of public varieties suitable for export remains a high priority for Basin producers. Trials were initiated in 2008 and 2009 with funding from the Oregon Potato Commission to identify acceptable chipping varieties for export markets using advanced selections and recently released varieties from the Tri-State, Southwest, North-central, and Eastern breeding programs and have continued annually. In 2016, seven varieties and advanced chipping selections were evaluated for yield, grade, processing quality, and storability to determine their suitability to meet existing export demands for raw product. All field data was collected at the KBREC site. Tubers from each replication were placed in both short and long-term commercial storage with processing evaluations conducted by Baley-Trotman Farms. Results for 2017 are listed below.

Stand Counts

- **30 Day**
  Slow emergence: All entries had greater than 96% emergence at 30 days.

Plant and Tuber Growth and Development

- **Average Tuber Number Per Plant**
  Most: AOR12197-2 (17), AOR11488-1 (11)
  Least: AOR11484-2 (8), Atlantic (8)

- **Average Tuber Size (oz.)**
  Largest: AOR11484-2 (7.0), Atlantic (6.4)
  Smallest: AOR12197-2 (4.7), AOR11470-1 (4.8)

- **Undersized Tubers (<4 oz.) cwt/Acre**
  Most: AOR12197-2 (304), AOR11488-1 (151)
  Least: AOR11484-2 (40), Snowden (75)

Yield Data

- **Total Yield (cwt/Acre)**
  Highest: ARO11484-2 & AOR12197-2 (666), Atlantic (588)
  Lowest: AOR11470-1 (441), AOR11488-1 (542)

- **Marketable Yield >4 oz. (cwt/Acre)**
  Highest: Snowden (398), AOR11488-1 (351)
  Lowest: AOR11470-1 (263), Atlantic (312)

Tuber Defect Incidence (10 tuber-samples per 4 reps, 6-10 oz.)

- **External Defects:**

Rhizoc: AOR11470-1, AOR12197-4

Shatter: AOR11484-2
Green: AOR12197-4

- **Internal Defects**

Hollow Heart: AOR11484-2
Hard Bite: Atlantic
Impact Bruise: Snowden

Entry	Total Yield		> 4 oz.	< 4 oz.	Culls	Oversize > 10 oz.	Skin color (1-5 dark)
	(cwt/A)	STATS**	% of Total Yield*				
Atlantic	588	B	53	15	9	24	2.4
Snowden	582	B	68	13	5	14	2.6
AOR11484-2	666	B	50	6	5	38	2.4
AOR11488-1	542	B	65	28	2	6	1.5
AOR11470-1	441	B	60	34	6	1	2.6
AOR12197-2	666	A	48	46	5	1	2.4
AOR12197-4	570	B	57	17	13	12	2.1
LSD (0.05)		**108**					

Entry	Yield US # 1 (>4 oz.)				External Defects (1-5 none)			
	(cwt/A)	STATS**	%*		Green	Growth crack	Rhizoc	Shatter
			4-6 oz.	6-10 oz.				
Atlantic	312	AB	29	71	3.0	4.0	2.6	3.6
Snowden	398	A	38	62	3.6	4.5	2.6	4.0
AOR11484-2	335	AB	25	75	3.9	3.6	2.4	2.1
AOR11488-1	351	A	45	55	4.0	4.6	4.4	2.3
AOR11470-1	263	B	61	39	4.0	4.6	1.4	2.9
AOR12197-2	320	AB	60	40	3.5	4.5	3.8	4.4
AOR12197-4	328	AB	36	64	2.1	3.4	1.5	2.6
LSD (0.05)		**86**						

*Percent values may not total 100% due to rounding

**Entries showing the same letter are not significantly different at the 5% level

Entry	Stand %	Average Tuber		Specific Gravity	Internal Defects (%)***					
		Wt. (oz.)	Number tubers/plant		HH	BC	SEB	VD	HB	IB
Atlantic	100	6.5	8	1.092	5	0	5	0	10	5
Snowden	99	6.2	9	1.094	13	5	0	8	0	10
AOR11484-2	96	7.0	8	1.084	20	0	0	0	8	5
AOR11488-1	100	5.4	11	1.093	18	0	0	0	3	0
AOR11470-1	99	4.9	10	1.111	8	0	5	3	5	5
AOR12197-2	100	4.8	17	1.093	18	3	0	3	5	0
AOR12197-4	100	5.3	10	1.091	0	0	0	0	0	0

***Internal Defects: HH=hollow heart, BC= brown center, SEB=stem end browning, VD= vascular discoloration, HB= hard bite, IB= impact bruise

Entry	Rhizoc (1-5 best)	Russeting (1-5 hvy)	Shape (1-5 long)	Size uniformity (1-5 best)	Shape uniformity (1-5 best)	Eye Depth (1-5 shal.)
Atlantic	2.6	2.4	3.0	2.4	3.4	3.8
Snowden	2.6	2.9	2.5	3.9	3.6	3.0
AOR11484-2	2.4	2.1	2.6	3.1	3.5	4.1
AOR11488-1	4.4	1.1	2.3	4.3	4.4	4.6
AOR11470-1	1.4	3.0	2.8	4.1	2.5	4.3
AOR12197-2	3.8	2.4	2.0	4.6	4.5	4.0
AOR12197-4	1.5	1.5	2.1	4.1	4.4	4.6

Entry	2017 KBREC- Statewide Chip Comment	Entry	2017 KBREC- Statewide Chip Comment
Atlantic		**Snowden**	
	3 rot (x2), lenticel scarring, 11 rot (x2), erratic size (x3), FBE, erratic shape		FBE (x3), lenticel scarring, chicken tracks, impact bruise, rootknot, uniform size, dry rot?
AOR11484-2		**AOR11488-1**	
	drop, rootknot, erratic size (x2), big, nice, skinning, flat, shatter bruise (x2), 2 rot, uniform size		5 rot, keep, nice (x2), nice skin, shiny (x2), shatter bruise, lenticel scarring, pointy stem end

AOR11470-1		**AOR12197-2**	
	pink (x2), small (x3), uniform, rootknot, pointy, erratic shape, erratic size (x2), pointy stem end (x2), shatter bruise, 4 rot		small (x4), CRS (x3), uniform (x2)
AOR12197-4			
	growth crack, impact bruise (x2), green, small, sticky stolon (x2), rhizoc (x2), shatter bruise, uniform size, not bad, dry rot?		

2017 Regional Chip Trial

Location: OSU KBREC – Klamath Falls, OR
Planting Date: May 22 | Vine Kill Date: September 7
Harvest Date: September 26 | Days to Vine kill: 107
Fertility: 180-125-250-265 Sulfur | In-Row Spacing: 9.25 inch

Chipping potatoes comprise a significant portion of Klamath Basin acreage and identification of public varieties suitable for export remains a high priority for Basin producers. Trials were initiated in 2008 and 2009 with funding from the Oregon Potato Commission to identify acceptable chipping varieties for export markets using advanced selections and recently released varieties from the Tri-State, Southwest, North-central, and Eastern breeding programs and have continued annually. In 2016 seven varieties and advanced chipping selections were evaluated for yield, grade, processing quality, and storability to determine their suitability to meet existing export demands for raw product. All field data was collected at the KBREC site. Tubers from each replication were placed in both short and long-term commercial storage with processing evaluations conducted by Baley-Trotman Farms.

Stand Counts

30 Day

Slow emergence: All entries had greater than 97% emergence.

- **45 Day**

Slow emergence: All entries had greater than 99% final emergence.

Plant and Tuber Growth and Development

- **Average Tuber Number Per Plant**

  Most: AOR09034-3 (14), OR09256-2 (14)
  Least: Snowden (7), Atlantic (7)

- **Average Tuber Size (oz.)**

  Largest: Atlantic (6.5), Snowden (6.2)
  Smallest: OR09256-2 (3.8), NDTX081648CB-13W (4.2)

- **Undersized Tubers (<4 oz.) cwt/Acre**

  Most: OR09256-2 (216), ACO144-1W (685)
  Least: Atlantic (46), Snowden (62)

Yield Data

- **Total Yield (cwt/Acre)**

  Highest: AOR09034-3 (803), AC01144-1W (685)
  Lowest: Snowden (518), NDA081453CAB-2C (546)

- **Marketable Yield >4 oz. (cwt/Acre)**

  Highest: AOR09034-3 (581), NDTX081648CB-13W (439)
  Lowest: Snowden (290), Atlantic (298)

- **% Marketable Yield >4 oz.**

  Highest: AOR09034-3 (72%), NDTX081648CB-13W (70%)
  Lowest: Atlantic (52%), Snowden (56%)

Tuber Defect Incidence (10 tuber-samples per 4 reps, 6-10 oz.)

- **External Defects:**
  AOR09034-3 had a high incidence of shatter bruise

- **Internal Defects**

Hard Bite: Atlantic (20%)

Hollow Heart: Atlantic (20%), Snowden (13%)

Entry	Total Yield		> 4 oz.	< 4 oz.	Culls	Oversize > 10 oz.	Skin color (1-5 dark)
	(cwt/A)	STATS**	% of Total Yield*				
Atlantic	571	CD	52	8	8	32	2.1
Snowden	518	D	56	12	4	28	2.9
AC01144-1W	685	B	63	25	5	7	1.4
AOR09034-3	802	A	72	18	5	5	1.6
NDA081453CAB-2C	546	CD	66	15	3	16	1.5
NDTX081648CB-13W	630	BC	70	24	2	5	1.5
OR09256-2	634	BC	61	34	2	3	2.9
LSD (0.05)		**91**					

Entry	Yield US # 1 (>4 oz.)				External Defects (1-5 none)			
	(cwt/A)	STATS**	%*		Green	Growth crack	Knobs	Shatter
			4-6 oz.	6-10 oz.				
Atlantic	256	D	31	69	2.9	4.5	4.8	3.9
Snowden	248	D	36	64	4.0	4.6	5.0	4.3
AC01144-1W	388	BC	48	52	3.4	4.6	4.5	4.5
AOR09034-3	539	A	46	54	3.9	3.6	5.0	1.9
NDA081453CAB-2C	319	CD	43	57	4.1	4.4	4.6	3.5
NDTX081648CB-13W	400	B	56	44	4.0	4.9	4.9	4.5
OR09256-2	352	BC	65	35	4.0	4.9	4.5	4.4
LSD (0.05)		**73**						

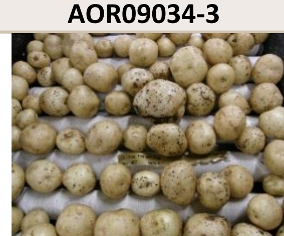
*Percent values may not total 100% due to rounding

**Entries showing the same letter are not significantly different at the 5% level

Entry	Stand %	Average Tuber		Specific Gravity	Internal Defects (%)***					
		Wt. (oz.)	Number tubers/plant		HH	BC	SEB	VD	HB	IB
Atlantic	99	6.6	7	1.097	20	0	0	0	20	0
Snowden	100	6.3	7	1.091	13	8	0	3	3	0
AC01144-1W	100	4.5	13	1.074	3	0	3	0	5	0
AOR09034-3	100	4.8	14	1.096	0	0	0	0	3	0
NDA081453CAB-2C	100	5.3	9	1.095	0	5	0	0	5	0
NDTX081648CB-13W	100	4.2	13	1.094	3	5	0	0	3	0
OR09256-2	100	3.9	14	1.093	5	3	0	0	3	0

***Internal Defects: HH=hollow heart, BC=brown center, SEB=stem end browning, VD=vascular discoloration, HB=hard bite, IB=impact bruise

Entry	Rhizoc (1-5 best)	Russeting (1-5 hvy)	Shape (1-5 long)	Size uniformity (1-5 best)	Shape uniformity (1-5 best)	Eye Depth (1-5 shal.)
Atlantic	2.6	2.1	2.8	2.5	3.5	3.4
Snowden	3.8	2.9	2.4	2.5	3.4	2.8
AC01144-1W	4.1	1.5	2.3	4.1	3.9	3.5
AOR09034-3	1.6	1.5	2.3	4.3	3.6	3.8
NDA081453CAB-2C	2.4	1.3	2.5	3.1	3.4	4.1
NDTX081648CB-13W	3.5	1.5	2.9	3.5	3.3	3.9
OR09256-2	4.1	2.9	2.4	4.5	4.1	3.5

Entry	2017 KBREC- Regional Chip Comment	Entry	2017 KBREC- Regional Chip Comment
Atlantic		**Snowden**	
	erratic shape, erratic size (x2), 8 rotten, big (x2), impact bruise, green, 10 rotten, misshaped, Fussarium?		erratic size (x2), FBE (x2), lenticel scarring, chicken tracks, dark, lumpy, scab?
AC01144-1W		**AOR09034-3**	
	impact bruise (x2), sticky stolon (x2), nice, 2 rotten, knobs on stem end, bulgy eyes, small, uniform, nice skin		uniform (x2), nice, rhizoc (x3), 6 rot, growth cracks, shatter bruise, impact bruise, growth cracks

<table>
<tr><th colspan="2">NDA081453CAB-2C</th><th colspan="2">NDTX081648CB-13W</th></tr>
<tr><td></td><td>nice skin (x2), keep, someoblong some long, erratic size, 2 rot, lenticel scarring, 3 rot</td><td></td><td>nice skin, not bad, flat (x2), dented, small, CRS (x2), rhizoc, NTN?</td></tr>
<tr><th colspan="4">OR09256-2</th></tr>
<tr><td></td><td>small (x4), uniform (x3), 4 rotten, knobs, russeting</td><td></td><td></td></tr>
</table>

2016 Regional Chip Processing Results

2015 Chip processing data from storage was included in the 2016 report. The processing results of the 2016 Chip Variety Trial are included in the following graphs. Potatoes were processed in April 2017. *Likewise, 2017 processing data will be included in the 2018 report.*

Entry	Specific Gravity Field[1]	Specific Gravity[1]	FL Solids	TDF %[2]	Potato Temp. F	Sugars	
						Glucose	Sucrose
Atlantic	1.106	1.108	21.687	25.633	59.47	0.099	0.286
Snowden	1.098	1.102	20.658	1.650	60.43	0.000	0.183
AC05153-1W	1.094	1.099	20.168	0.000	59.35	0.004	0.129
AOR09034-3	1.104	1.105	21.287	36.233	57.90	0.086	0.187
CO07070-10W	1.107	1.114	22.800	14.600	58.00	0.040	0.296
CO07070-13W	1.095	1.118	19.960	28.975	58.58	0.366	0.235
NDA081453CAB-2C	1.098	1.098	20.035	50.025	59.08	0.354	0.307
NDTX071109C-01W	1.080	1.079	16.690	3.200	59.98	0.012	0.118
NDTX081648CB-13W	1.097	1.096	19.678	26.725	59.05	0.138	0.221
NDTX091908AB-02W	1.092	1.091	18.670	14.575	58.95	0.034	0.292
OR09256-2	1.094	1.100	20.280	52.625	58.08	0.341	0.216
OR09253-1	1.109	1.110	22.038	47.075	59.03	0.373	0.347
TX09396-1W	1.108	1.102	20.675	2.950	57.70	0.000	0.335

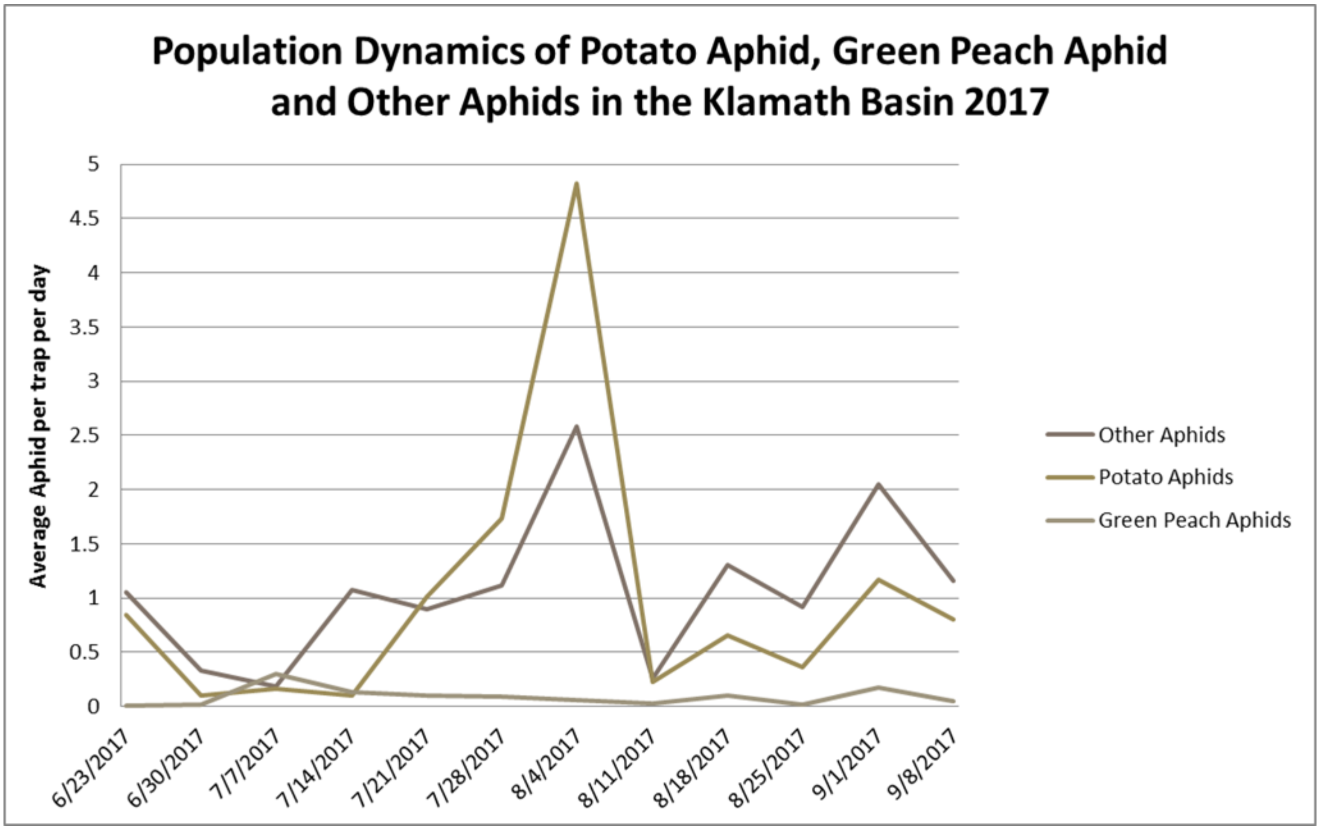
2016 State Chip Processing Results

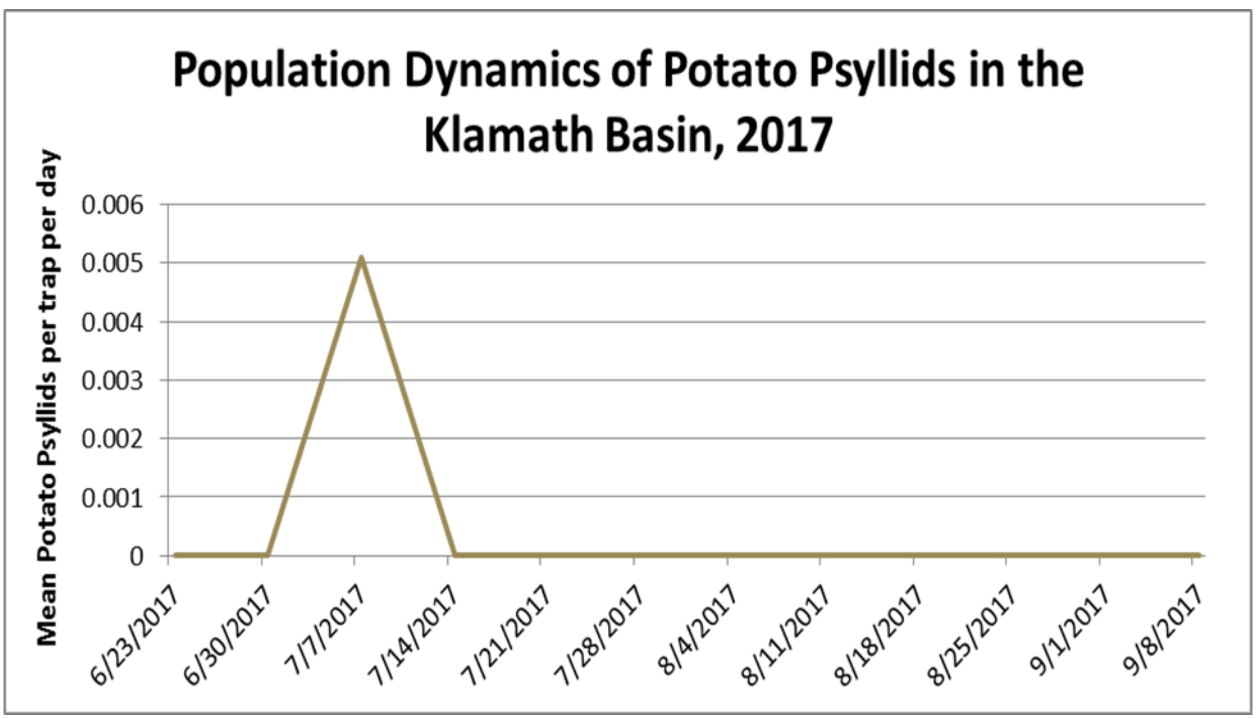
Entry	Specific Gravity Field[1]	Specific Gravity[1]	FL Solids	TDF %[2]	Potato Temp. F	Sugars	
						Glucose	Sucrose
Atlantic	1.100	1.101	20.600	64.850	57.63	0.243	0.274
Snowden	1.095	1.097	19.740	8.750	57.98	0.013	0.172
AOR09033-2	1.099	1.100	20.313	7.325	57.58	0.033	0.165
AOR11484-2	1.094	1.094	19.195	1.775	58.58	0.003	0.121
OR12479-5	1.084	1.090	18.515	98.075	59.08	0.933	0.324
AOR11488-1	1.105	1.104	21.040	20.550	59.13	0.147	0.360
AOR11455-4	1.103	1.107	21.618	10.775	58.75	0.108	0.260
AOR11470-1	1.123	1.127	25.228	28.700	58.30	0.185	0.257

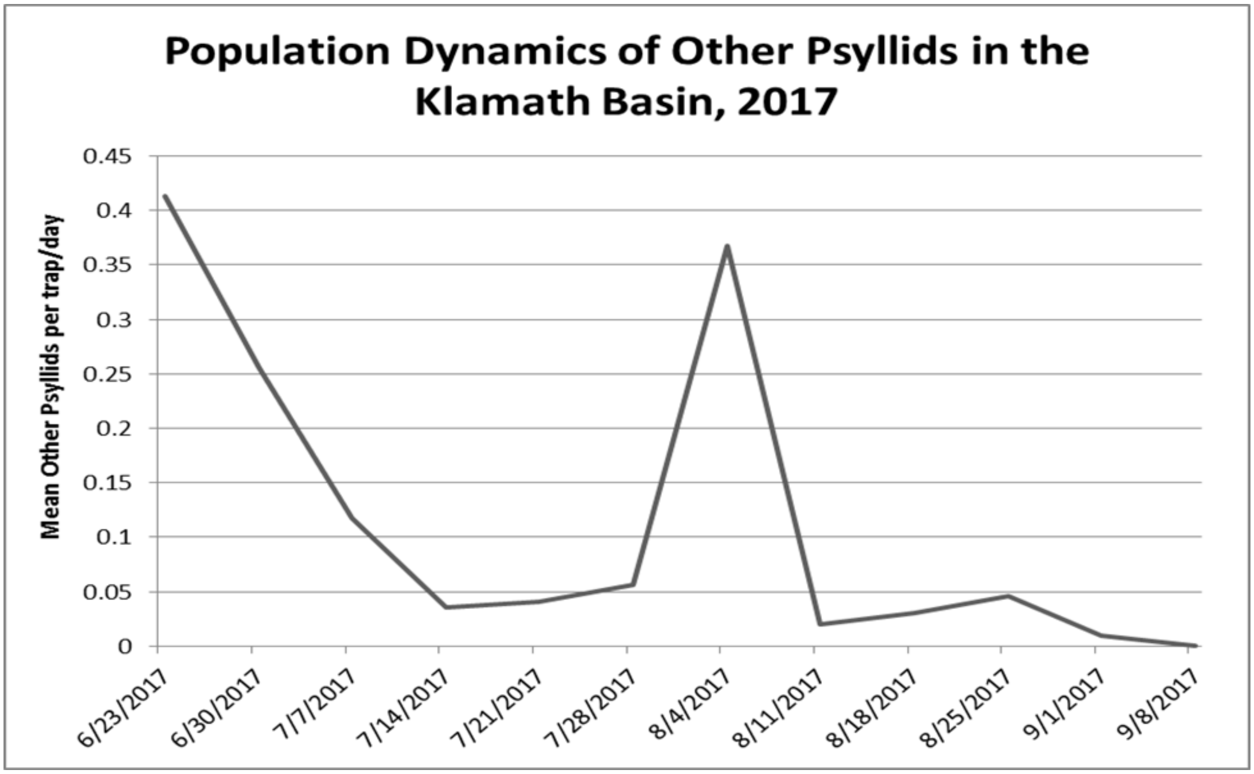
[1]Specific gravity measured out of field and after storage for 2 months at 50^0 F.

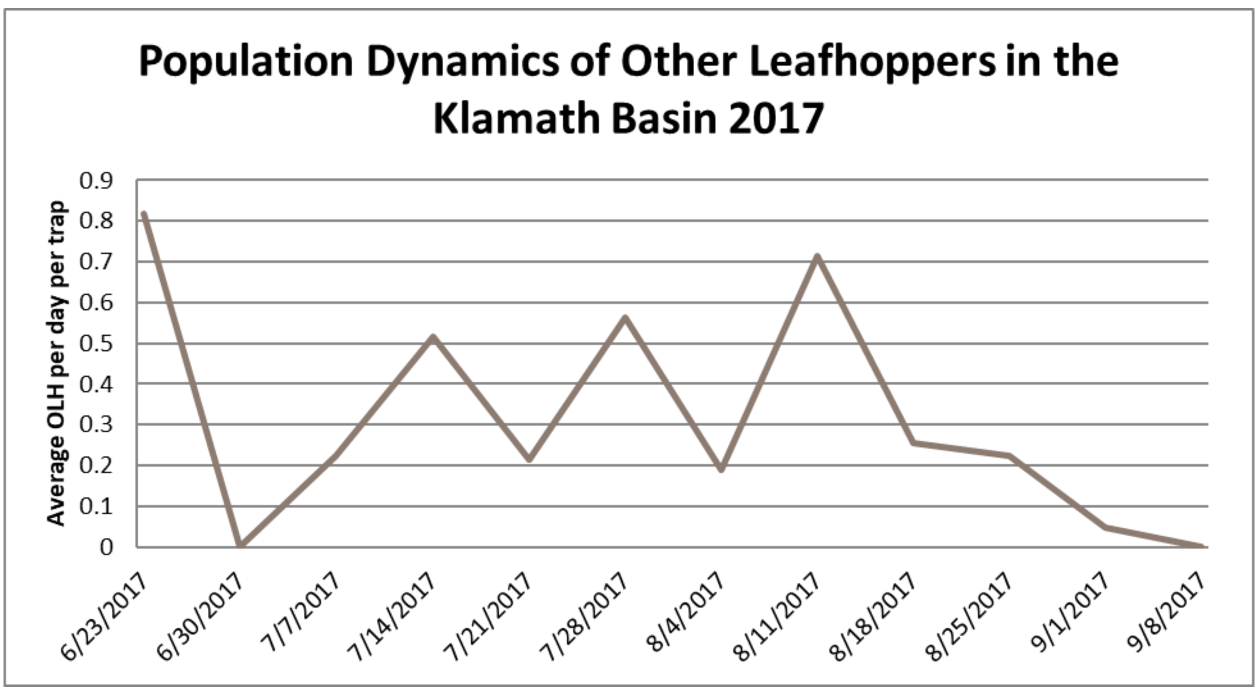
[2] % Total Defects = % of finished chips out of grade; includes internal & external defects (e.g. HH, Green, Dark Color, etc.)

[3]Percent fresh weight basis measured after storage for 2 months at 50^0 F.


Population Dynamics of Potato Aphid, Green Peach Aphid and Other Aphids in the Klamath Basin 2017
Average Aphid per trap per day
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
6/23/2017
6/30/2017
7/7/2017
7/14/2017
7/21/2017
7/28/2017
8/4/2017
8/11/2017
8/18/2017
8/25/2017
9/1/2017
9/8/2017
Other Aphids
Potato Aphids
Green Peach Aphids


Population Dynamics of Potato Psyllids in the Klamath Basin, 2017
Mean Potato Psyllids per trap per day
0.006
0.005
0.004
0.003
0.002
0.001
0
6/23/2017
6/30/2017
7/7/2017
7/14/2017
7/21/2017
7/28/2017
8/4/2017
8/11/2017
8/18/2017
8/25/2017
9/1/2017
9/8/2017


Population Dynamics of Other Psyllids in the Klamath Basin, 2017
Mean Other Psyllids per trap/day
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
6/23/2017
6/30/2017
7/7/2017
7/14/2017
7/21/2017
7/28/2017
8/4/2017
8/11/2017
8/18/2017
8/25/2017
9/1/2017
9/8/2017


Population Dynamics of Other Leafhoppers in the Klamath Basin 2017
Average OLH per day per trap
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
6/23/2017
6/30/2017
7/7/2017
7/14/2017
7/21/2017
7/28/2017
8/4/2017
8/11/2017
8/18/2017
8/25/2017
9/1/2017
9/8/2017

Research/Extension Progress Report for 2017-18 Funded Projects
Progress Report for the Agricultural Research Foundation
Oregon Potato Commission

Title: Potato Pathology Extension Program

Project Leader(s): Kenneth Frost, Assistant Professor and Phil Hamm, Emeritus Professor, Oregon State University, Hermiston Agricultural Research and Extension Center, 2121 S 1st ST, Hermiston OR 97838.

Cooperator(s): Robert Cating and Silvia Rondon, HAREC, Hermiston OR; Russ Ingham, OSU Corvallis; Brian Charlton, Oregon State University, Klamath Falls; Jeff McMorran, Oregon State University, Corvallis; Dennis Johnson, WSU Pullman WA

Funding History:
$19,700 in 2017
$19,220 in 2016
$17,520 in 2015

Abstract: The extension plant pathology program at HAREC provides expertise in disease diagnosis for potato and other vegetable crops and provides information related to pathogen biology, ecology, and epidemiology towards the improvement of potato disease management. The program also provides service to the industry and grower community by planting the seed lot trial which provides a valuable and independent source of information to the participants regarding the general quality and amount of disease associated with each lot. Of the 87 seed lots planted in the 2017 trial, 57.5% (N=50 lots) of the seed lots did not show visual seed-borne PVY symptoms. Of the 37 lots where PVY was detected, 16% (N=14), 14% (N=12), and 11% (N=10) of the lots had <1, 1-5, and >5% PVY infection, respectively. No potato mop-top virus or tobacco mosaic virus was detected in any of the seed lots. Eight seed lots showed symptoms of blackleg, with the most severe symptoms occurring in the 'Lamoka' and 'Waneta' potato vatieties.

Key Words: Seed borne viruses, Potato Viruses, Seed lots, PVY, blackleg

Objective(s):

1. Plant Pathology Extension Program. Provide diagnostics support to identify plant pathogens impacting potato production and provide information about how to manage potato diseases to growers in Oregon and other production areas.

2. Seed Lot Trials. Plant seed lot trials to measure the quality of seed being grown in commercial fields and provide that information to growers when questions arise about the quality of their seed. This also allows for surveillance of pathogens in the potato crop, early detection of new diseases or diseases of consequence for the year.

Procedures:

1. **Extension Program.** Information was provided through in-person visits, phone calls, text messages and grower meetings as needed to potato growers in the region and other growing areas of the state. Funding also supported the general functions of the Extension Plant Pathology Laboratory related to potato disease diagnosis. A toll free phone number provided information concerning the report and the control of late blight in Oregon. Current information, including control recommendations, was updated as needed through the season. A newsletter containing weekly disease information was circulated to growers, members of the processing industry, crop consultants, and Extension faculty in the Pacific Northwest.

2. **Objective 2. Seed lot trials.** ***Acquiring seed lots.*** Seed lots were voluntarily submitted to the plant pathology program during the months of February, March, April, and May for evaluation. Approximately, 87 seed lots were received from Baker, Morrow, Union, and Umatilla counties and were planted in the 2017 seed lot trial.

Trial location and history. The 2017 potato seed lot trial was located in the SW quadrant of pivot 3 at the Hermiston Agricultural Research and Extension Center (HAREC) south of Hermiston, Oregon, and encompassed approximately 2.0 acres. The area was previously cropped to winter wheat during 2015. Following wheat harvest, the fall tillage practices included ripping to a depth of 18 inches, discing twice, and roller-harrowing. The field was disced and roller-harrowed again prior to marking the field.

Planting. Up to two-hundred untreated, single drop seed pieces were planted on 27 April, and 17 May. Individual seed lots were planted by hand using a 2 row John Deere assist feed planter. Seed pieces were planted 9” deep every 12” on 34” row widths. The fertility program and irrigation programs were consistent with grower practices in the area. Irrigation was scheduled using local evapo-transpiration rates for potato.

Pest Management. Weeds were controlled with 1.75oz/acre Matrix (rimsulfuron) and 1 pt/acre Dual II Magnum (metolachlor). The herbicides were tank mixed and broadcast ground applied in 20 gallons of water/acre and then immediately incorporated with 0.5” irrigation water. Early season Colorado potato beetle and aphid control was achieved with an in-furrow application of Admire Pro [(imidacloprid) 0.56 oz/1000feeet of row]. Preventive applications for late blight were applied, alternating weekly applications of 1.5 lb/acre Dithane (mancozeb) and 1.5 pt/acre Bravo Weatherstik (chlorothalonil) from early June through August. Plots were monitored for other late season insect pests but managed minimally after 30 June with foliar pesticide applications.

Evaluating seedborne viral and bacterial pathogens in planta. Stand counts were performed on 23, 31, May and 9, 13, 19 June to visually assess plant vigor and emergence uniformity when plants were approximately 3-4 inches tall. Visual inspections of the seed lot, when plants were approximately 12 inches tall were done to quantify viral and bacterial pathogens present in the seed.

PVY strain typing. In early July, leaves of plants visually identified as having mosaic disease were collected. For seed lots will high prevalence of PVY, sample size was limited to 10 plants. Each plant sample was assayed by PCR for the presence of PVY and PVY isolates were strain-typed to determine composition of strains present in each seed lot. In 2017, an additional 10 tubers from each seed lot was tested for two virus diseases, potato mop-top virus (PMTV) and tobacco rattle virus (TRV).

<u>Accomplishments:</u>

Objective 1. Plant Pathology Program. *Farm Fair Board Member and General Session Symposium Organizer:* General planning for the Hermiston Farm Fair. Development of agenda and meeting facilitator for the general session. One session was organized with topics devoted to technological advances applied to pest management of vegetables. *Farm Fair Potato Seminar:* 1) Presentations on soft rot disease and blackleg caused by Pectobacterium spp. and Dickeya spp. in the potato seminar. In general, the potato seminar was well attended in 2017 with approximately 200 growers, fieldmen, and chemical representatives participated in this one-day event devoted to potato topics. The pest management seminar was also well attended with approximately 125 in attendance. I spoke several at several other meetings including the annual MT Seed Seminar in the West.

In 2017, I visited several area potato fields to help determine the causes of production problems. In terms of help provided through diagnostics, the HAREC plant pathology laboratory received 111 total potato plant disease submissions in 2017 from Oregon alone. The majority of these potato disease samples originated from the Oregon counties of Morrow, Umatilla, and Union. Potato samples for diagnosis were also received from Washington, Idaho, and several other states. Plant disease diagnostics were followed up with management recommendations when requested.

Objective 2. Seed lot trials. Eighty-seven potato seed lots originating from seven U.S. states and one Canadian province were planted in Hermiston in the 2017 trial.

Twenty-eight known and four unknown varieties representing both fresh and processing markets were planted. Information from each individual seed lot is presented in Table 1 (i.e. Emergence (EMRG), Mosaic (PVY), and blackleg (BL)). A summary of the incidence of seed-borne mosaic virus are presented for seed lots originating from the United States (Table 2) and from Canada (Table 3). Table 4 summarizes the same information, but is sorted by variety. In 2017, the most common varieties entered into the trial were Burbank (15 lots), Ranger (11 lots), Shepody (7 lots), and Alturas (7 lots). Fifty-nine percent (51 lots) of the seed lots planted this year did not show visual seed-borne PVY symptoms, while 16, 14, and 11 % of the lots had <1, 1-5, and >5% PVY infection, respectively (Tables 2, 3 and 4). Furthermore, PVY was detected in seed from Idaho, Minnesota, North Dakota, Oregon, and Washington (27/43 lots). No PVY was detected in seed originating from Montana and Nebraska (0/7 lots). Of the thirty seed lot of unknown origin twenty-one has no PVY detected and nine with PVY detection. In seed from Canada, PVY was not detected in seed from Alberta (Table 3). Norkotah Jorde Line had the higher occurrence of mosaic (Table 4).

A subset of 10 tubers from each seed lot were assayed for the presence of PMTV, TRV and the soft rot bacteria *Pectobacterium carotovorum* subsp. *carotovorum* (Pcc) and *Pectobacterium carotovorum* subsp. *atrosepticum* (Pca). No PMTV or TRV was detected in any of the seed lots tested. The soft rot bacteria, Pcc and Pca were detected in five of the 2017 seed lots (Table 1), but their detection did not correlate with blackleg disease in the field. One seed lots tested positive for only Pcc, two for only Pca, and two for both Pcc and Pca. Additional, tubers will be assayed for virus and soft rot bacteria in 2018.

<u>Impacts:</u> The Extension Potato Program continues to provide extensive and needed information to the local, statewide, and regional potato interests. The seed lot trial provides an independent and needed source of information related to seed quality for area potato growers. The Plant Pathology Diagnostic Laboratory is capable of performing state-of-the art plant disease diagnostic services. It provides timely and accurate information about pathogen identification and disease management to Oregon and other potato production regions outside the state. Benefits of the diagnostic clinic and its services are realized every time a diagnosis that impacts management decisions is made. The Late Blight Hot line provides the latest information on the occurrence and control of late blight throughout Oregon and the Southern Columbia Basin in Washington. In conjunction with a large USDA NIFA-SCRI project, efforts have continued to more thoroughly examine the foliar and tuber symptomatology and yield reduction associated with PVY infection in 4 processing cultivars. In several years, we will be able to estimate the impacts that the new tuber necrotic strains of PVY will have on potato production, including yield, as well as, processing and storage quality.

<u>Relation to Other Research:</u> The seed lot trial provides necessary baseline data to determine the composition of virus strains affecting potato and to determine if new or emerging viral pathogens or strains arrive to the Pacific Northwest. This study provides an opportunity for continued collaboration with university and USDA researchers in Idaho and Washington. The collaboration occurring between OR, WA, and ID programs have now expanded to address new, emerging virus and bacterial problems. This success highlights the value of a joint, comprehensive approach to address virus problems in the PNW. Members of this team will continue to cooperate on various types of federal grant proposals to be submitted to USDA, NSF, and other programs.

Table 1: Percent seed borne infection of several pathogens as determined by visual inspection and tuber testing of individual seed lots in the 2017 potato seed lot trial at Hermiston, OR.

Lot	Variety	Seed Gower	Origin	EMRG	PVY	PVY Strain	BL	Pcc	Pca
1	Shepody	Rob Lane	OR	86	4.5	N:O	0.0	.	.
2	Rangers	SHB	WA	93	0.0	-	0.0	.	.
3	Norkotah	Drost Rolling Hills	AB	89	0.0	-	0.0	.	.
4	Ranger	Rob Lane	OR	95	0.5	N	0.0	.	.
5	278	Eugene Cole	MT	96	0.0	-	0.0	.	.
6	Shepody	Thompson Seed Potaoes	NE	93	0.0	-	0.0	.	pos.
7	Ranger	Mike Stremick	ND	96	0.0	-	0.0	.	.
8	Dakota Pearl	Szczepanski	MN	91	0.5	NO	0.0	.	.
9	Dakota Pearl	Schmidt	MN	93	0.0	-	0.0	.	.
10	Norkotah	SHB	WA	99	1.0	O	0.0	.	.
11	New Line Selection Norkotah	SHB	WA	95	0.5	O	0.0	.	.
12	Norkotah	SHB	WA	90	7.5	N:O; NTN	0.0	.	.
13	Norkotah	Edmonton Potato Growers	AB	95	0.0	-	0.0	.	.
14	Alturas	C+K Jepson Farming Inc	AB	94	0.0	-	0.0	.	.
15	278	Cottom	MT	95	0.0	-	0.0	.	.
16	278	Gross - Stahl's	WA	95	7.5	N:O; NTN; O	0.0	.	.
17	Premier	GRSF	OR	87	0.0	-	0.5	.	.
18	Ranger	GRSF	OR	89	0.0	-	0.0	.	.
19	Alturas	GRSF	OR	93	2.5	-	0.0	.	.
20	CW	Beutler	ID	91	5.5	N:O; NTN	0.0	.	.
21	CW	Jorgensen	ID	91	0.5	N:O	0.0	.	.
22	CW	Skinner	MT	85	0.0	-	0.0	pos.	pos.
23	Shepody	GRSF	OR	85	3.0	N:O	0.0	.	.
24	CW	Gem Valley	ID	93	0.5	N:O	0.0	.	.
25	Ranger	GRSF	OR	95	0.5	-	0.5	.	.

[1]If available

[2]AB=Alberta; ID= Idaho; MN= Minnesota; MT= Montana; ND=North Dakota; NE= Nebraska; NV= Nevada; OR= Oregon; WA= Washington

[3]Percent Seed-borne Potato Virus Y (PVY)

[4]Percent Seed-borne blackleg

Table 1 (cont'd): Percent seed borne infection of several pathogens as determined by visual inspection and tuber testing of individual seed lots in the 2017 potato seed lot trial at Hermiston, OR.

Lot	Variety	Seed Gower	Origin	EMRG	PVY	PVY Strain	BL	Pcc	Pca
26	Ranger	GRSF	OR	89	0.5	N:O	0.0	pos.	.
27	Ranger	GRSF	OR	93	0.0	-	0.0	.	.
28	Premier	GRSF	OR	84	0.0	-	0.0	.	.
29	Alturas	GRSF	OR	92	0.0	-	0.0	.	.
30	Alturas	C+K Jepson Farming Inc	Ab	96	0.0	-	0.0	.	.
31	Shepody	Bjornstad Farms	ND	94	1.5	N:O	0.0	.	.
32	Alturas	Sunnycrest Seed Potatos	AB	92	0.0	-	0.0	.	.
33	Russet Burbank	Schutter	MT	95	0.0	-	0.0	.	.
34	Lamoka Chippers	SHB	WA	86	0.5	N:O	14.0	.	.
35	Snowden Chippers	Dan Kimm	MT	100	0.0	-	0.0	.	.
36	Lamoka Chippers	Justin Dagen	MN	85	0.0	-	0.5	.	.
37	Dakota Crisp	-	ND	97	0.0	-	0.0	.	.
38	Reds	EPG	AB	100	0.0	-	0.0	.	.
39	Columba	EPG	AB	97	0.0	-	2.5	.	.
40	Russet Burbank	SHB	WA	100	0.0	-	0.0	.	.
41	296s Select	Arnold Farms	ID	89	6.0	N:O; NTN	0.0	.	.
42	Dakota Pearl	-	-	90	0.0	-	0.0	.	.
43	Russet	-	-	87	0.5	-	1.0	.	.
44	-	-	-	89	0.0	-	0.0	.	.
45	-	-	-	90	7.0	N:O; NTN	0.0	.	.
46	Shepody	-	-	88	0.0	-	0.0	.	.
47	-	-	-	54	0.0	-	0.0	.	.
48	Burbank	Rex Baum Farms	ID	89	1.0	N:O	1.0	.	.
49	Burbank	Normand Johnson	ID	94	0.0	-	0.0	.	.
50	Burbank G3	C AND L Ranch	ID	97	2.0	N:O	0.0	.	.

[1]If available
[2]AB=Alberta; ID= Idaho; MN= Minnesota; MT= Montana; ND=North Dakota; NE= Nebraska; NV= Nevada; OR= Oregon; WA= Washington
[3]Percent Seed-borne Potato Virus Y (PVY)
[4]Percent Seed-borne blackleg

Table 1 (cont'd): Percent seed borne infection of several pathogens as determined by visual inspection and tuber testing of individual seed lots in the 2017 potato seed lot trial at Hermiston, OR.

Lot	Variety	Seed Gower	Origin	EMRG	PVY	PVY Strain	BL	Pcc	Pca
51	Burbank	Atchley CEA Corp	-	91	3.5	N:O	0.0	.	.
52	Juanita White Chippers	Spokane Brethren	WA	79	1.0	N:O	7.0	.	pos.
53	Burbank G3	Blatchford Farms	MT	94	0.0	-	0.0	.	.
54	Russet 296	-	-	93	0.0	-	0.0	.	.
55	Burbank G3	C AND L Ranch	ID	89	0.0	-	0.0	.	.
56	Wantea	Christenson Farms	ID	80	0.0	-	0.0	.	.
57	Burbank	Arnold Farms	ID	97	7.5	N:O; NTN	0.0	.	.
58	Burbank	Clem Atchley	ID	91	0.0	-	0.0	.	.
59	Burbank	Miles Bros	-	94	0.0	-	0.0	.	.
60	Norkotah strain	Jorde	-	87	0.0	-	0.0	.	.
61	Reds	-	-	90	0.0	-	0.0	.	.
62	Goldeye	-	-	93	0.0	-	0.0	.	.
63	Burbank	Christenson Farms	ID	89	0.5	N:O	0.0	.	.
64	Erika Solanus	-	-	92	0.0	-	0.0	.	.
65	Burbank	-	ID	98	1.0	-	0.0	.	.
66	Ranger	Fleming	-	88	0.5	N:O	0.0	.	.
67	Burbank	Johnson	-	96	0.5	N:O	0.0	.	.
68	Burbank	C AND L Ranch	-	93	2.5	N:O	0.0	.	.
69	Burbank	Jorgensen Farms	ID	89	1.0	N:O	0.0	.	.
70	Ranger	Haarsma	-	93	0.0	-	0.0	.	.
71	Norkotah Jorde Line	Skyline Farms grain & Potato	ID	94	10.5	N:O; NTN	0.0	.	.
72	Burbank	Christenson Farms	-	97	0.0	-	0.0	.	.
73	-	Foth	-	95	0.0	-	0.0	.	.
74	Norkotah Jorde Line	Arnold Farms	ID	94	6.5	N:O; NTN; O	0.0	.	.
75	Burbank	C AND L Ranch	-	86	1.0	N:O; NTN	0.0	.	.

[1]If available
[2]AB=Alberta; ID= Idaho; MN= Minnesota; MT= Montana; ND=North Dakota; NE= Nebraska; NV= Nevada; OR= Oregon; WA= Washington
[3]Percent Seed-borne Potato Virus Y (PVY)
[4]Percent Seed-borne blackleg

Table 1 (cont'd): Percent seed borne infection of several pathogens as determined by visual inspection and tuber testing of individual seed lots in the 2017 potato seed lot trial at Hermiston, OR.

Lot	Variety	Seed Gower	Origin	EMRG	PVY	PVY Strain	BL	Pcc	Pca
76	Burbank	Telford Lost River Seed	ID	95	0.0	-	0.0	.	.
77	Umatilla	QRS	-	92	0.0	-	0.0	.	.
78	Clearwater	QRS	-	96	0.5	N:O	0.0	.	.
79	Shepody	QRS	-	93	2.0	N:O	0.0	.	.
80	Umatilla	QRS	-	96	0.0	-	0.0	.	.
81	Burbank	Clem Atchley	ID	91	0.5	N:O	0.0	.	.
82	Alturas	QRS	-	77	0.0	-	0.0	.	.
83	Alturas	QRS	-	76	0.0	-	0.0	.	.
84	Shepody	QRS	-	93	0.5	N:O	0.0	.	.
85	Ranger	QRS	-	90	0.0	-	0.0	.	.
86	Ranger	QRS	-	100	0.0	-	0.0	.	.
87	Clearwater	QRS	-	94	0.0	-	0.0	.	.

[1]If available

[2]AB=Alberta; ID= Idaho; MN= Minnesota; MT= Montana; ND=North Dakota; NE= Nebraska; NV= Nevada; OR= Oregon; WA= Washington

[3]Percent Seed-borne Potato Virus Y (PVY)

[4]Percent Seed-borne blackleg

Table 2: Summary of mosaic virus (PVY) incidence in potato see lots originating in the United States and planted near Hermiston, OR in 2017.

		Mosaic[3]			
Origins[1]	**Lots[2]**	**0%**	**<1%**	**1-5%**	**>5%**
USA	**80**	**44**	**14**	**12**	**10**
Idaho	**18**	**5**	**4**	**4**	**5**
296s Select	1	0	0	0	1
Burbank	9	3	2	3	1
Burbank G3	2	1	0	1	0
Clearwater	3	0	2	0	1
Norkotah Jorde Line	2	0	0	0	2
Wantea	1	1	0	0	0
Minnesota	**3**	**2**	**1**	**0**	**0**
Dakota Pearl	2	1	1	0	0
Lamoka Chippers	1	1	0	0	0
Montana	6	6	0	0	0
278	2	2	0	0	0
Burbank G3	1	1	0	0	0
Clearwater	1	1	0	0	0
Russet Burbank	1	1	0	0	0
Snowden Chippers	1	1	0	0	0
North Dakota	**3**	**2**	**0**	**1**	**0**
Dakota Crisp	1	1	0	0	0
Ranger	1	1	0	0	0
Shepody	1	0	0	1	0
Nebraska	**1**	**1**	**0**	**0**	**0**
Shepody	1	1	0	0	0
Oregon	**11**	**5**	**3**	**1**	**2**
Alturas	2	1	0	1	0
Premier	2	2	0	0	0
Ranger	5	2	3	0	0
Shepody	2	0	0	0	2
Washington	**8**	**2**	**2**	**2**	**2**
278	1	0	0	0	1
Juanita White Chippers	1	0	0	1	0
Lamoka Chippers	1	0	1	0	0
New Line Selection Norkotah	1	0	1	0	0
Norkotah	2	0	0	1	1
Rangers	1	1	0	0	0
Russet Burbank	1	1	0	0	0

[1]Country and state where seed was grown.
[2]Number of seed lots plated by country, state, and variety.
[3]Number of seed lots with 0, <1, 1-5, and >5% seed-borne PVY by country, state, and variety.

Table 2 (cont'd): Summary of mosaic virus (PVY) incidence in potato see lots originating in the United States and planted near Hermiston, OR in 2017.

		Mosaic[3]			
Origins[1]	**Lots[2]**	**0%**	**<1%**	**1-5%**	**>5%**
Unknown	**30**	**21**	**4**	**4**	**1**
Unknown Variety	4	3	0	0	1
Alturas	2	2	0	0	0
Burbank	6	2	1	3	0
Clearwater	2	1	1	0	0
Dakota Pearl	1	1	0	0	0
Erika Solanus	1	1	0	0	0
Goldeye	1	1	0	0	0
Norkotah strain	1	1	0	0	0
Ranger	4	3	1	0	0
Reds	1	1	0	0	0
Russet	1	1	0	0	0
Russet 296	1	1	0	0	0
Shepody	3	1	1	1	0
Umatilla	2	2	0	0	0

[1]Country and state where seed was grown.
[2]Number of seed lots plated by country, state, and variety.
[3]Number of seed lots with 0, <1, 1-5, and >5% seed-borne PVY by country, state, and variety.

Table 3: Summary of mosaic virus incidence in potato seed lots originating in Canada and planted near Hermiston, OR in 2017.

		Mosaic[3]			
Origin[1]	**Lots[2]**	**0%**	**<1%**	**1-5%**	**>5%**
CANADA	**7**	**7**	**0**	**0**	**0**
Alberta	7	7	0	0	0
Alturas	3	3	0	0	0
Columba	1	1	0	0	0
Norkotah	2	2	0	0	0
Reds	1	1	0	0	0

[1]Canadian province where seed was grown
[2]Number of seed lots planted by country, state, and variety
[3]Number of seed lots with 0, <1, 1-5, and >5% seed-borne PVY by country, state, and variety.

Table 4: Summary of mosaic virus (PVY) by variety in potato seed lots planted near Hermiston, OR in 2017.

		Mosaic[2]			
Variety[1]	**Lots[2]**	**0%**	**<1%**	**1-5%**	**>5%**
278	3	2	0	0	1
296s Select	1	0	0	0	1
Alturas	7	6	0	1	0
Burbank	15	5	3	6	1
Burbank G3	3	2	0	1	0
Clearwater	6	2	3	0	1
Columba	1	1	0	0	0
Dakota Crisp	1	1	0	0	0
Dakota Pearl	3	2	1	0	0
Erika Solanus	1	1	0	0	0
Goldeye	1	1	0	0	0
Juanita White Chippers	1	0	0	1	0
Lamoka Chippers	2	1	1	0	0
New Line Selection Norkotah	1	0	1	0	0
Norkotah	5	3	0	1	1
Norkotah Jorde Line	2	0	0	0	2
Premier	2	2	0	0	0
Ranger	11	7	4	0	0
Reds	2	2	0	0	0
Russet	1	0	1	0	0
Russet 296	1	1	0	0	0
Russet Burbank	2	2	0	0	0
Shepody	7	2	1	4	0
Snowden	1	1	0	0	0
Umatilla	2	2	0	0	0
Wantea	1	1	0	0	0
Unknown	4	3	0	0	1
Total	87	50	15	14	8

[1]Number of seed lots planted by variety.
[2]Number of seed lots with 0, <1, 1-5, and >5% seed-borne PVY by variety.

Research/Extension Progress Report for 2017-2018 Funded Projects
Progress Report for the Agricultural Research Foundation
Oregon Potato Commission

Title: Malheur County Extension Potato Pest Monitoring Program

Year: FY2017-18

Project leader: Stuart Reitz
Malheur County Extension
Oregon State University
710 SW 5th Ave.
Ontario, OR 97914

Funding history:
2015-16 - $5,927
2016-17 - $5,627
2017-18 - $5,915

Abstract:
Malheur County Extension Service monitored 30 commercial fields throughout Malheur County for pest and beneficial insects. Traps were monitored weekly from May to August, and results were reported via email to growers and their crop advisors. Significant findings were also reported on the Pacific Northwest Pest Alert network (http://www.pnwpestalert.net/).

Overall pest pressure was low in 2017. Very few potato psyllids were found during 2017. None of the psyllids tested positive for Zebra chip and no Zebra chip infected plants were found.

Beet leafhoppers were present throughout the growing season, and their numbers did not decline over the summer as usual. No plants infected with purple top disease (transmitted by leafhoppers) were found during this year's monitoring program.

Aphids were abundant, especially from late June into July. Significant numbers of potato aphids were found during July, but relatively few green peach aphids were found.

No potato tuberworm moths were found in 2017.

The pest status of thrips and Lygus in the Treasure Valley is still uncertain. Lygus populations present throughout the season, peaking from late June through July. High numbers of thrips were recorded in June and July.

The relatively large numbers of beneficial insects probably help suppress pest populations. Large numbers of ladybird beetles and lacewings probably helped to suppress aphid populations.

OSU Extension also helped to keep growers and crop advisors up to date on other pest problems, such as the potential for late blight outbreaks. The monitoring project provided up to date information that allowed growers to make more informed pest management decisions and reduce their pesticide applications in 2017.

Key words: Pest monitoring, potato psyllid, aphid, potato tuberworm, beet leafhopper, zebra chip, IPM, Treasure Valley

Objectives:

- Monitor populations of key potato pests across Malheur County and deliver that information on a weekly basis to potato growers, crop advisors and other interested people in the county. Pests that were monitored included 1) potato psyllids, 2) aphids, 3) beet leafhoppers, 4) potato tuberworm moths, 5) thrips, 6) spider mites, 7) Lygus (a potential pest). Associated beneficial parasites, predators and pathogens were monitored to assess levels of naturally occurring biological control.

- Assist growers in scouting for other pests and diseases during the growing season.

- Assist growers with identifying and addressing other crop management issues.

- Relay information to growers and crop advisors directly through email and phone contact and publish pest monitoring data in the Treasure Valley Pest Alert Network.

Procedures:

Trapping stations were set at 30 potato fields in Malheur County and were monitored from June to until mid-August when fields were harvested. Trapping techniques specific for the different pests were used for monitoring.

Potato Psyllid Monitoring – To aid growers in managing potato psyllids and zebra chip, yellow sticky cards were placed within potatoes fields, with 4 traps per field. Traps were collected and replaced weekly. Aphid and leafhopper traps were also examined for the presence of psyllids. Foliage samples were inspected for psyllid nymphs and eggs.

Beet Leafhopper Monitoring – Yellow sticky traps were placed along borders of fields to monitor beet leafhoppers, which can transmit the pathogen that causes Purple Top. Traps were collected and replaced weekly, and the numbers of leafhoppers recorded. Fields were also inspected for plants infected with Purple Top.

Aphids – Aphids were also monitored with yellow sticky traps.

Potato Tuberworm Monitoring – To monitor tuberworm moth populations, pheromone traps were placed along field borders. Traps were collected and replaced weekly. Pheromone lures were replaced every 3weeks, or as needed.

Colorado Potato Beetle – Yellow sticky traps were also inspected for adult Colorado potato beetles and plants were examined for the presence of beetle larvae and egg masses.

Beneficial insects – Yellow sticky traps used for pest monitoring were also inspected for beneficial insects, in particular predatory insects, including minute pirate bugs, big-eyed bugs, lacewings and ladybird beetles. These counts were used as an indication of the overall activity of natural enemies in a field.

Diagnostics – Psyllids were tested by Kylie Swisher’s lab (USDA-ARS Wapato, WA) for the Zebra chip bacterium.

Other Pest and Disease Monitoring – Assistance was provided to growers and crop advisors in identifying other pest and diseases problems that they encountered. Monitoring is continuing with additional traps placed near harvested fields to determine pest activity through the fall and winter, especially overwintering psyllids.

Accomplishments:

- Traps were monitored over a 16-week period from May 3 until 25 August when the last fields were near harvest.

- Growers and crop advisors received up to date weekly reports within 1 day after traps were collected. Psyllids were first found during the week of May 17-24, which is 2 – 3 weeks earlier than in past years. However, populations did not increase later in the summer, as has been typical. None of the psyllids tested positive for the Zebra chip bacterium and no Zebra chip infected plants were found (Figure 1).

- Beet leafhoppers were present throughout the growing season with their abundance highest during June, as is typical. No plants infected with potato purple top disease were found in 2017 (Figure 1).

- Aphids were among the most common pests recorded and were abundant, especially from late June into July. Significant numbers of potato aphids were found during July, but relatively few green peach aphids were found (Figures 1).

- No potato tuberworm moths were found in 2017. This was the third consecutive year that no tuberworm moths were collected.

- The pest status of thrips and Lygus in the Treasure Valley remains uncertain. Lygus are one of the most commonly encountered insects in potato fields, with populations present throughout the season. However, area growers have not yet considered them to be economically important. Thrips were predominately western flower thrips. High numbers of thrips were recorded in June and July (Figures 2).

- The relatively large numbers of beneficial insects probably help suppress pest populations. Large numbers of ladybird beetles and lacewings probably helped to suppress aphid populations. All of the predators that were monitored (including big-eyed bugs and pirate bugs) are known to feed on psyllids, aphids and thrips. They likely help suppress pest populations although not complete control (Figure 3).

- Growers were advised of other pest and disease issues reported in other parts of the PNW, such as the potential for late blight to occur this season.

Impacts:

Malheur County potato growers have been strong supporters of IPM and continue to utilize information from this monitoring program. Their use of pest alert information reflects their commitment to providing consumers with a safe, nutritious food. Growers were provided the latest recommendations and advice on potato psyllid management, which facilitated their pest management decisions and to better time and target pesticide applications.

Inclusion of many different pests and natural enemies in the monitoring program provides growers with information to assess their individual pest management programs and when insecticide applications may or may not be necessary.

Relation to Other Research:

Monitoring results were shared with other research/extension personnel in Oregon and Idaho. Psyllid and other pest data have been included in the MAP-PSILDS-PNW project led by Bill Snyder, Washington State University. This project is assessing how field location and characteristics affect the risk of psyllid infestations and zebra chip outbreaks.

Because of the threat from potato psyllids and Zebra chip, a collaborative regional insecticide efficacy trial was conducted again in 2017. That project was funded by the Northwest Potato Research Consortium and involved researchers from Malheur County Extension (Stuart Reitz), Hermiston Agricultural Research & Extension Center (Silvia Rondon), Kimberly Research & Extension Center, Idaho (Erik Wenninger), Washington State University Extension (Tim Waters) and Agriculture Development Group (Alan Schreiber). The trial included an evaluation of 12 different insecticide treatments for their efficacy against psyllids and their effects on other pest and beneficial insects, and different sampling protocols for assessing psyllid populations. Growers saw a demonstration of the trial during the Malheur Experiment Station Summer Farm Fest.

We have submitted a proposal to the Northwest Potato Research Consortium to determine if Lygus could be economically important pests of potato in the PNW.

During 2017, we also conducted a demonstration trial in a grower’s field to compare the efficacy of two insecticide treatments for potato psyllid management. Low pest pressure makes drawing meaningful conclusions difficult.

Information from the monitoring program also contributed to a new book chapter on potato pest management: Reitz, Stuart R. 2018. Potato pest management with specific reference to the Pacific Northwest (USA). In: Stuart Wale, editor, *Achieving Sustainable Cultivation of Potatoes: Volume 2: Production and Storage, Production and Sustainability*. Burleigh Dodds Science Publishing, Sawston, UK.

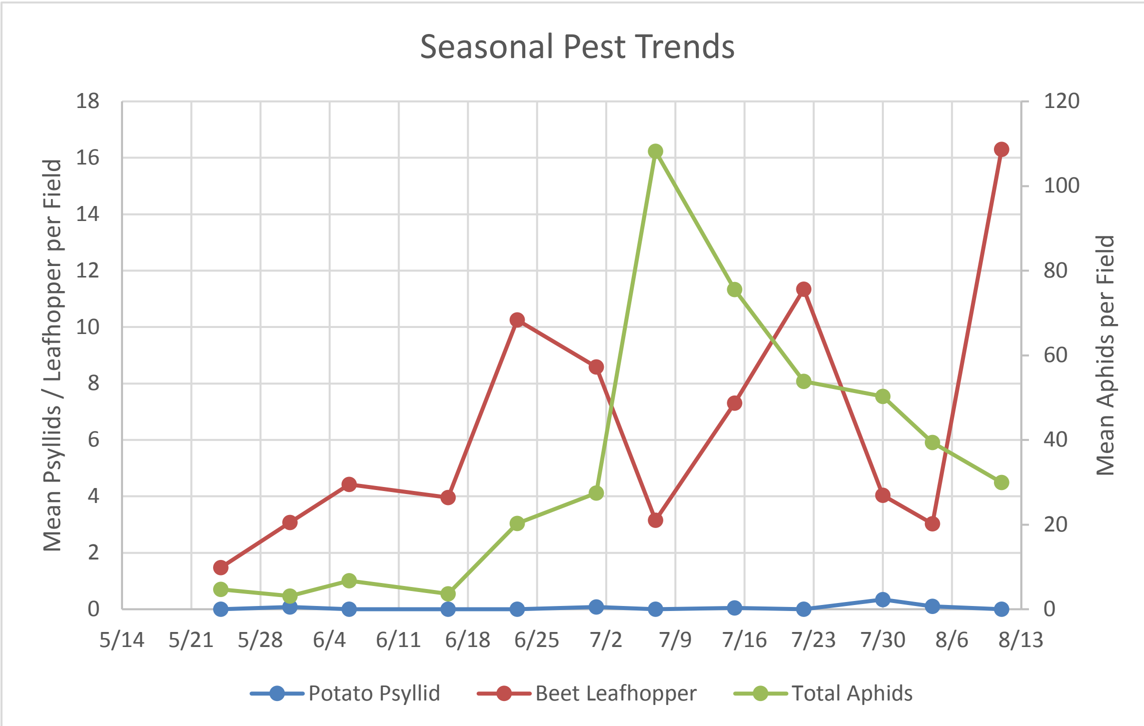


Figure 1. Seasonal dynamics of potato psyllids and other pests in commercial potato fields in Malheur County, Oregon during 2017. Numbers are the mean per field per week for 30 fields. Note the different axis scale for psyllids and leafhoppers versus aphid.

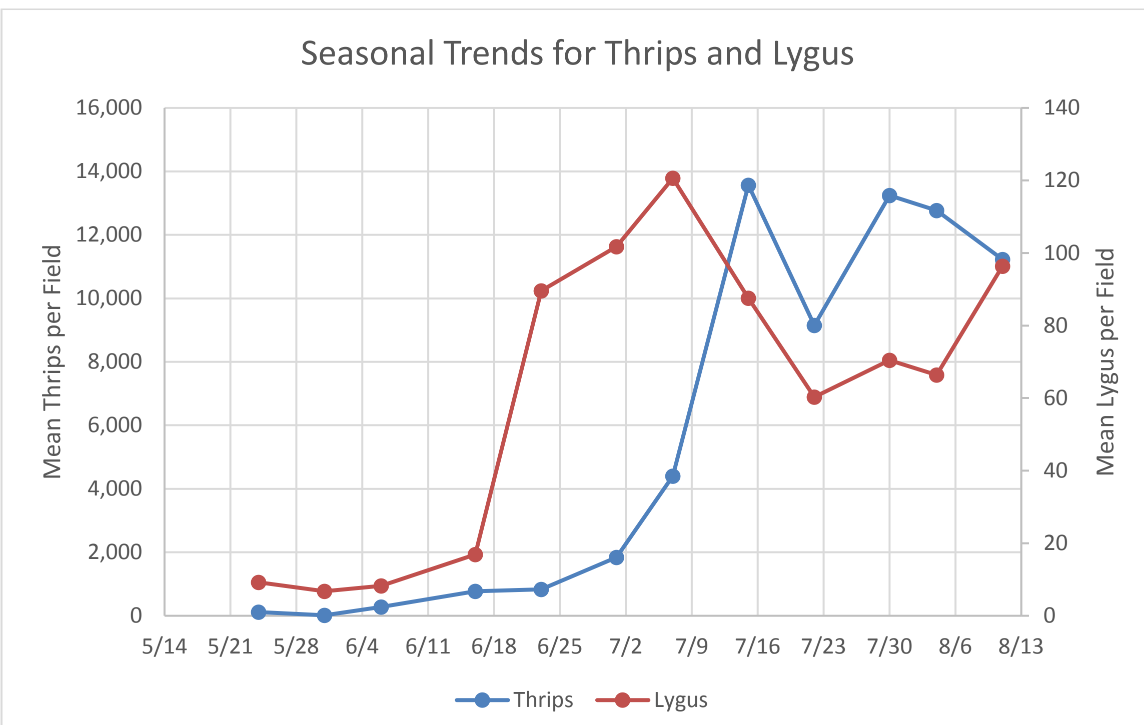


Figure 2. Seasonal dynamics of other aphids and thrips in commercial potato fields in Malheur County, Oregon during 2017. Numbers are the mean per field per week for 30 commercial fields. Note the different axis scale for thrips and Lygus bugs.

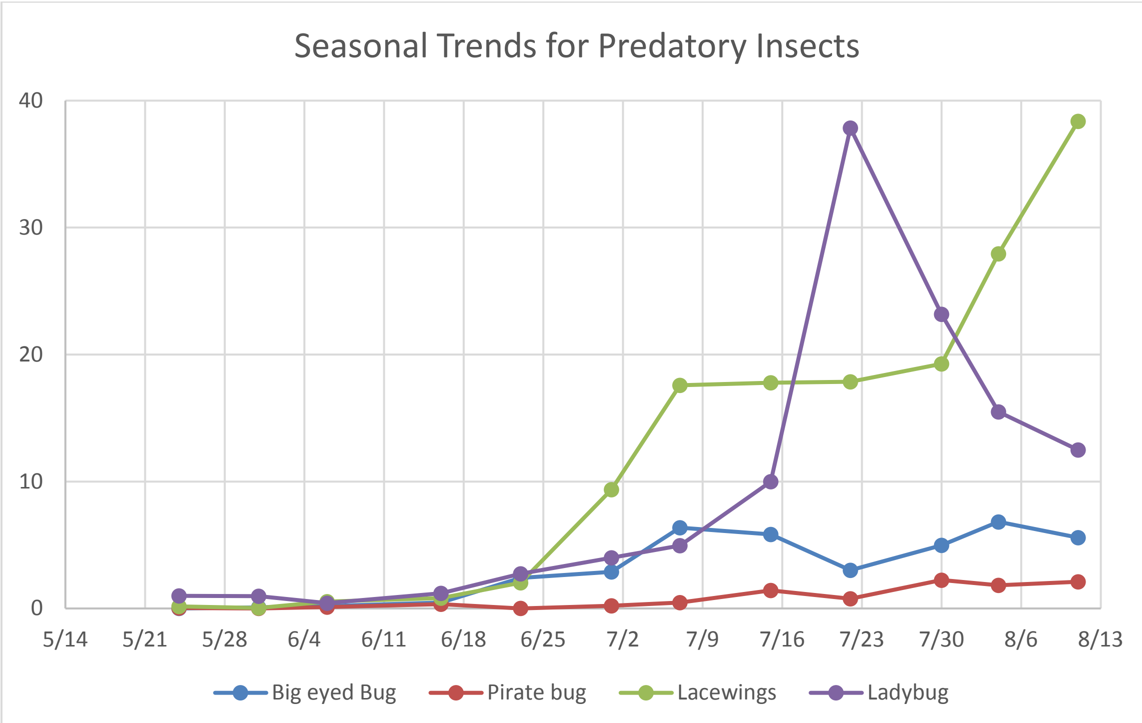


Figure 3. Seasonal dynamics of natural enemies of potato pests found in commercial potato fields in Malheur County, Oregon during 2017. Numbers are the mean per field per week for 30 fields.

Research/Extension Progress Report for 2016-17 Funded Projects
Progress Report for the Agricultural Research Foundation
Oregon Potato Commission

Title: Monitoring potato insect pests in eastern Oregon: education, communication, and dissemination of information.

Project Leader: Silvia I. Rondon, Professor & Extension Entomologist Specialist, Oregon State University (OSU), Hermiston Agricultural Research and Education Center (HAREC), Crop and Soil Science (CSS), Irrigated Agricultural Entomology Program (IAEP). Phone (541) 567-8321 ext 108, Fax (541) 567-2240, Cell phone (541) 314-3181, E-mail silvia.rondon@oregonstate.edu.

Cooperators: Darrin L. Walenta, OSU Extension Union-Baker-Wallowa County; Ken Frost/Robert Cating/Aymeric Goyer, OSU-HAREC; Oregon Commercial and Seed Potato Growers; Blue Mt. Potato Growers. Insect trappers: Jonathan Macias (Umatilla-Morrow).

Funding History (3 last years): Year initiated: 1972

Abstract: Potato pests were monitored through the 2017 growing season, including potato tuberworm (PTW), beet leafhoppers (BLH), aphids, and potato psyllids (PP). The monitoring network included Umatilla, Morrow, Union, and Baker counties in Oregon. We also served as resource for the Klamath and Central Oregon trapping network. In Umatilla and Morrow counties, there were 36 total monitoring sites; sites were composed of yellow bucket traps (aphids), delta traps (PTW), and AlphaScents yellow cards (BLH and PP). In Union, and Baker, 20 monitoring sites were established. All sites were monitored for aphids, and PP. Updates regarding the status of all pests in the region and emerging pest problems were distributed to subscribers weekly via email. Weekly communications included the trapping data for each pest and location, as well as helpful tips on monitoring, managing, or identifying various insects can be found at http://oregonstate.edu/dept/hermiston/trap-reports and http://extension.oregonstate.edu/union/potato-aphid-reports-current.

Key Words: Green Peach Aphid (GPA), Potato Aphid (PA), Potato Tuberworm (PTW), Beet Leafhoppers (BLH), Extension, Potato Psyllid (PP), IPM, Pest Monitoring, Survey.

Abbreviations: Oregon State University (OSU); Hermiston Agricultural Research and Extension Center (HAREC); Irrigated Agricultural Entomology Program (IAEP), Potato Tuberworm (PTW); Beet Leafhopper (BLH); Beet Leafhopper-Transmitted Virescence Agent (BLTVA); Green Peach Aphid (GPA); Potato Aphid (PA); Other Aphids (OA); Potato psyllid (PP); Other Psyllids (OP), *Candidatus* Liberibacter solanacearum (Lso).

Objectives:

1. Monitor populations of PTW, BLH, aphids, and psyllids in Umatilla-Morrow and Union-Baker counties.
2. Educate, communicate, and disseminate information about these pests and other potato pests to the industry.

Procedures:

1) Monitor populations of PTW, BLH, aphids, and potato psyllids in Umatilla-Morrow, and Union-Baker counties.

Aphids. To monitor aphids in the region, 36 yellow water-pan traps were placed in Umatilla-Morrow counties, and 20 traps in Union-Baker counties. The traps were monitored weekly until mid-September. Winged aphids were carefully collected from water pans with the aid of a fine camel hair brush or fine-screened fish net. Water was previously treated with 5 ppm copper sulfate ($CuSO_4$) in order to inhibit algal growth. Aphids were placed in vials/collection containers with alcohol and brought to the OSU-HAREC-IAEP for species identification (Green peach Aphid or GPA, Potato Aphid or PA, and Other Aphids or OA). Date, and trap location were carefully recorded.

Potato Tuber Worm (PTW). Potato tuber moths became a pest of potatoes in the region in 2004. Since then, we have monitored adult (male) PTW moths to determine population levels. Monitoring is accomplished using pheromone-baited delta traps; white yellow cards are changed weekly, but pheromones, monthly. As populations can be extremely localized, growers are encouraged to monitor their fields as harvest approaches as well as remove any neighboring cull piles. In Umatilla-Morrow counties, 36 pheromone delta traps were used in this study. Traps were monitored weekly from early May until mid-September. Sticky liners were brought to the OSU-HAREC-IAEP for identification, and reporting. PTW are not present in Union and Morrow counties.

Beet Leafhopper (BLH). AlphaScents 4X6 inch yellow cards were used to monitor BLHs. In 2017, traps were monitored weekly from early May until mid- September in Umatilla-Morrow counties. Sticky cards were attached to field stakes, 6' inches above the ground with binder clips, in close proximity to the PTW delta trap. BLH were identified, counted and reported.

Potato Psyllids (PP). The potato psyllid, *Bactericera cockerelli*, has been a major concern for growers because it vectors *Candidatus* Liberibacter solanacearum (Lso), which causes ZC in potatoes. In Umatilla, Morrow, Union, and Baker counties, we monitored potato psyllids using 4X6 AlphaScents yellow sticky cards from May until mid to late September. Occasionally, potato psyllids are also found in aphid bucket traps and these counts were included in weekly counts.

2) Educate, communicate, and disseminate information about these pests and other potato pests to the industry.

Since 2005, the OSU-HAREC IAEP entomology program has served extension clientele, such as crop consultants, agronomists and extension faculty. Results are summarized and presented in newsletters and informational meetings including field days, insect training sessions and commodity meetings. Relevant aspects of this and all potato projects have been highlighted and presented at regional and national meetings. Several insect ID workshops complemented our extension efforts. In 2014, the Rondon entomology program (a.k.a. Irrigated Agricultural Entomology Program) assisted growers with training field men and analyzing their potato psyllid and other pest collections. Project results were and will be published in extension publications (http://extension.oregonstate.edu/catalog/), potato update (http://oregonstate.edu/dept/hermiston/trap-reports), potato progress reports (http://potatoes.com), and other venues.

Accomplishments/findings: Insect surveys were conducted in Umatilla, Morrow, Union, and Baker counties. Weekly reports were sent to growers, field men, and agricultural suppliers as well as online: http://oregonstate.edu/dept/hermiston/ and http://extension.oregonstate.edu/union/ag/potatoaphid. This research provided information on the relative populations of aphids, PTW, BLH, and PP in the region, helping growers and field men execute their insect management programs more effectively. Pest population data may have had a significant role in reducing yield losses due to the phytoplasma carried by BLH, the ZC bacteria vectored by psyllids, and the spread of viruses by aphids. More than 502 people currently are subscribed in our Potato update mailing list and 43 growers, industry reps and OSU faculty/staff are on the Union-Baker distribution list for weekly reports. More people in the region and around the world are interested in receiving this newsletter every year. Several hands-on workshops were held. The overall goal was to teach an ecological and economical approach to agricultural pest control using integrated insect management strategies: monitoring, cultural control tactics, and understanding the biology of each pest.

Reports/Accomplishments

Aphids. Aphid populations in the lower Columbia Basin have remained relatively low over the past couple years. Figure 1 shows the mean

number of GPA (A), PA (A), and OA (C) present in the lower Columbia Basin since 2007 (Figure 1A, B, C). Most of the aphids observed in Umatilla-Morrow counties in all years are OAs (Figure 1C). Other Aphids are probably non-colonizing aphids that do not necessary feed, or damage potatoes; depending on species, populations are variable throughout the season, and their role is still unknown. Colonizing aphids, including GPA (Figure 1A), and PA (Figure 1B) remained relatively low compared to OA populations the last couple of years. Their role is better defined since both species are known to be effective vectors of diseases such as Potato Virus Y.

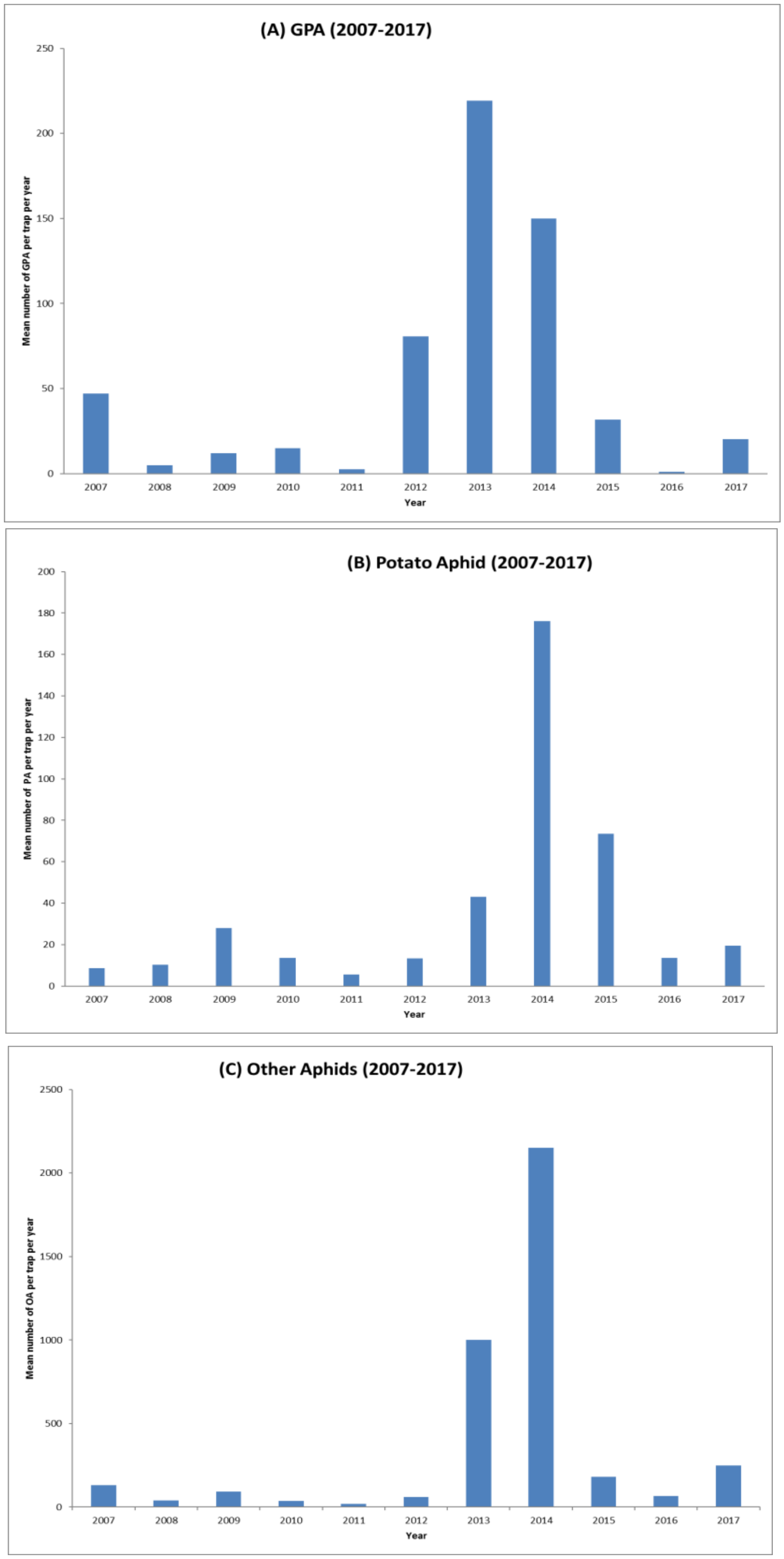


Figure 1. Mean number of GPA (A), PA (B), and Other Aphids (C) per trap per year in the lower Columbia Basin, 2007-2017.

In 2017, aphids were collected as early as late-April (Figure 2); peaks were observed in late May and mid-August. OA counts are the “drivers” of aphid phenology on potatoes.

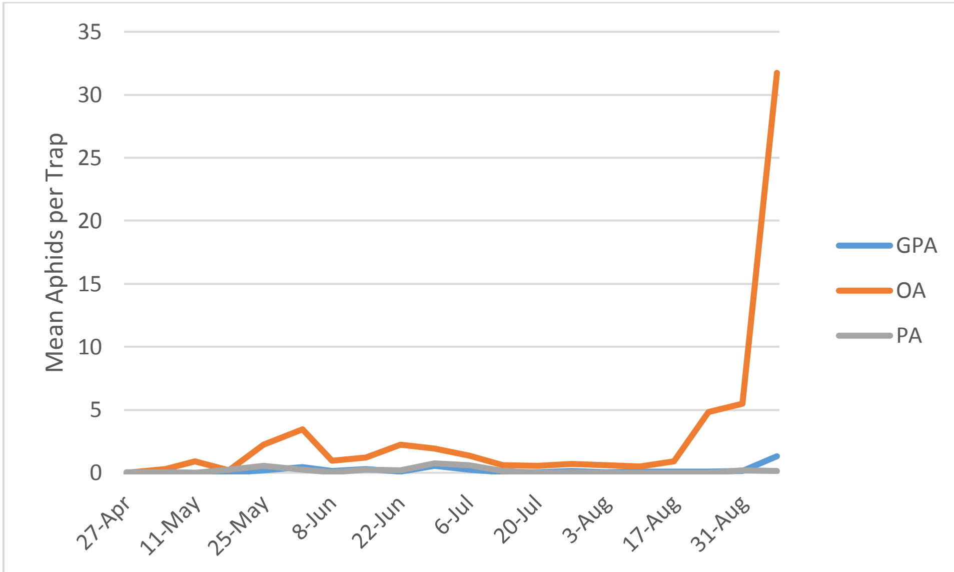


Figure 2. Population dynamics of GPA, PA and OA in the lower Columbia Basin, 2017.

In Union, and Baker counties, aphid counts were relatively low (**Figure 3**). Overall, the GPA population was greater than PA season long, but no greater than OA. Aphids peaked in early August and then again at the end of August. In this region, aphids were found at least 2-weeks later than in the Basin.

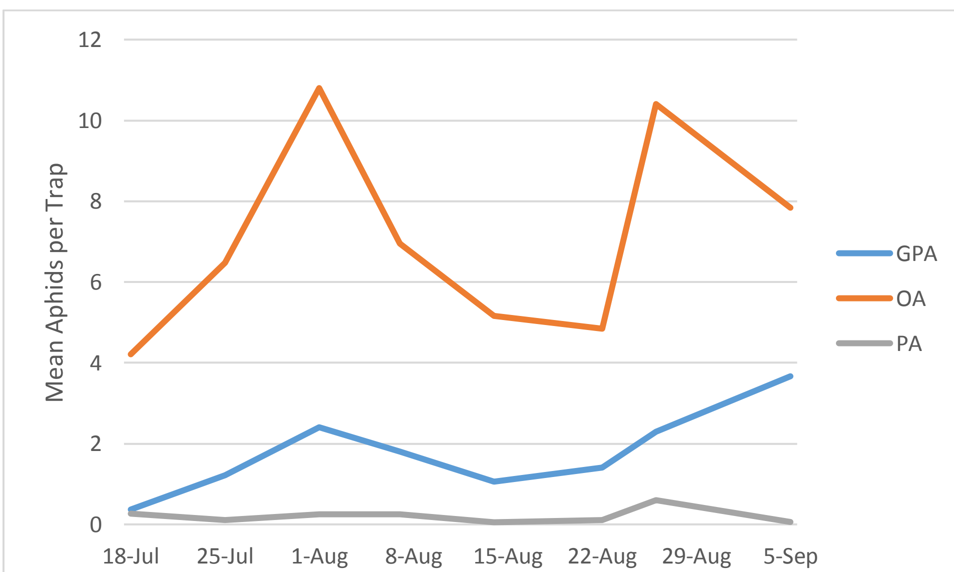


Figure 3. Population dynamics of GPA, PA and OA in Union and Baker counties, 2017

Potato Tuber Worm (PTW). Population of PTW in Umatilla-Morrow counties have remained relatively low compared to outbreak years such in 2013 or 2015 (**Figure 4**). In 2017, PTW populations increased around the beginning of July and started to level out in early September (**Figure 5**). This typical trend synchronizes with harvest, which is the most susceptible period of the crop since foliage is not available, and moths are looking for potato tubers to feed on, and lay eggs.

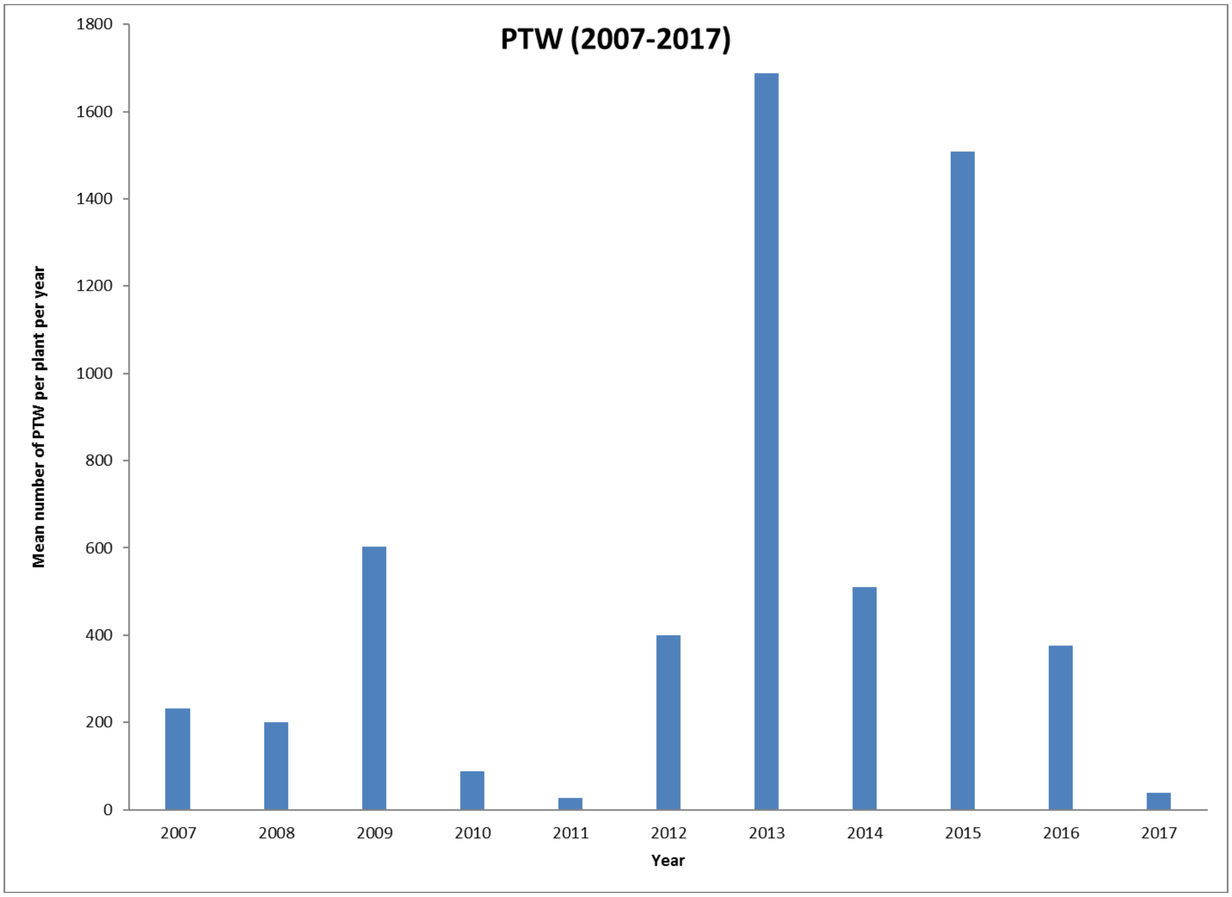


Figure 4. Mean number of PTW per year in the lower Columbia Basin, 2007-2017.

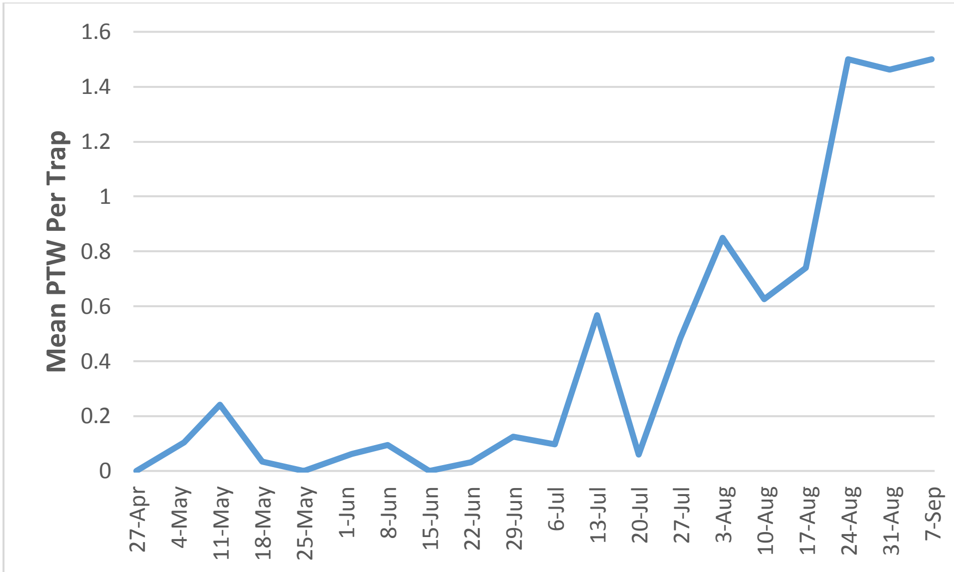


Figure 5. Population dynamics of PTW in the lower Columbia Basin, OR 2017.

Beet Leafhoppers (BLH). While BLH populations have remained low in 2011, 2012, 2014, 2016 and 2017 (**Figure 6**), BLTVA in the Basin has been mild to severe in the last several years (**Figure 7**). To complicate matters, Lygus bugs have been associated with BLTVA.

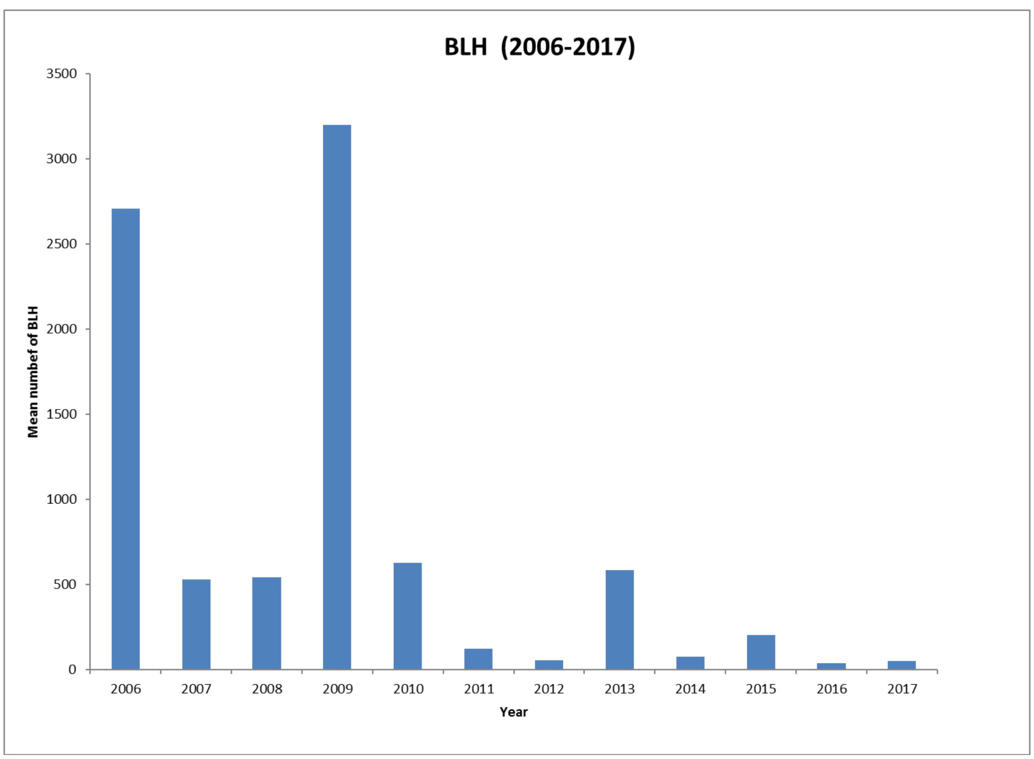


Figure 6. Mean number of BLH per year in the lower Columbia Basin, 2006-2017.

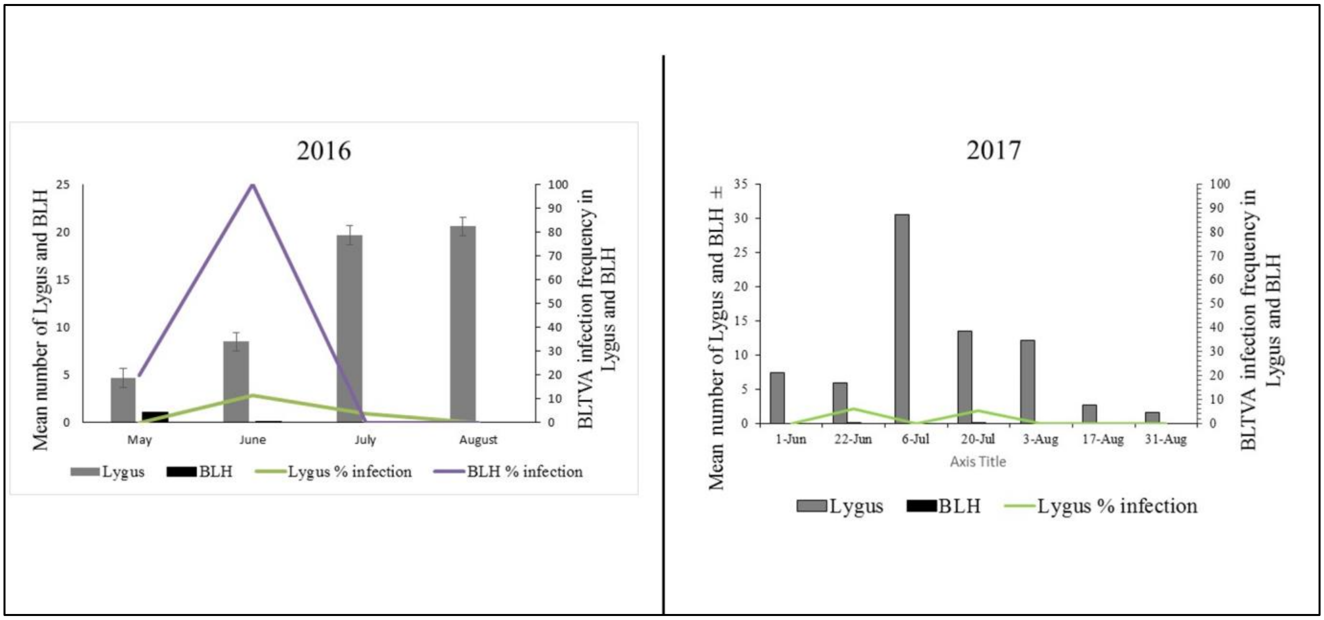


Figure 7. Beet leafhopper and Lygus phenology; BLTVA infection frequency in both species, 2016-2017.

During the season, BLH numbers appeared to mirror other leafhopper (OLH) numbers, rising and crashing (**Figure 8**).

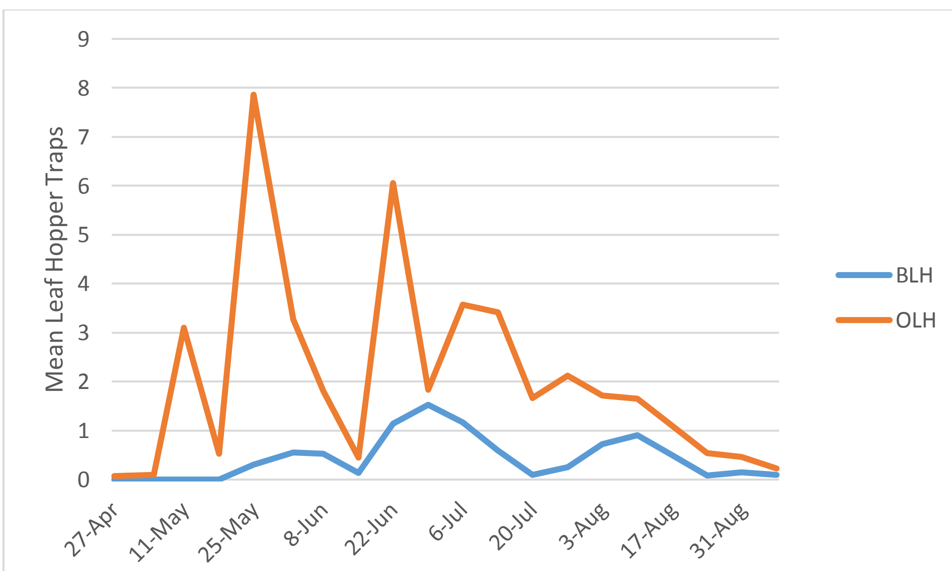


Figure 8. Population dynamics of BLH and OLH in the lower Columbia Basin, OR 2017.

Potato Psyllids (PP). In Umatilla and Morrow counties, PP numbers in 2017 were comparable to 2014 and 2012 (**Figure 9**). Peak PP numbers were observed later in the season (**Figure 10**). Other psyllid (OP) numbers were higher than PP numbers throughout a majority of the season. AlphaScents yellow sticky cards worked quite well for psyllid detection. The yellow

AlphaScents cards used for psyllids, were placed inside the potato field. Please refer to the weekly report for trap-specific details which are available online at http://oregonstate.edu/dept/hermiston/trap-reports.

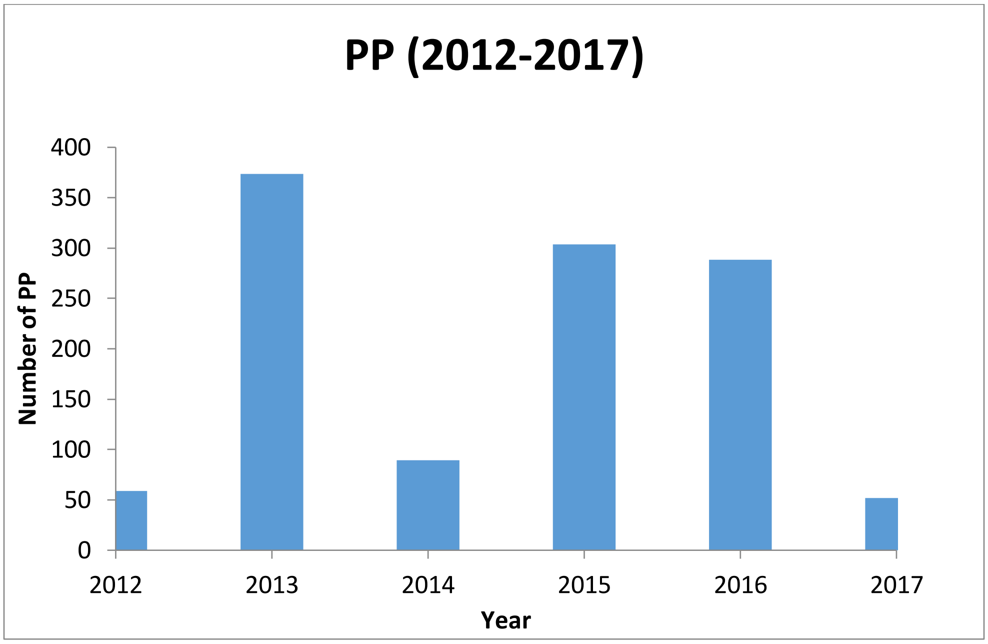


Figure 9. Mean number of PTW per year in the lower Columbia Basin, 2012-2017.

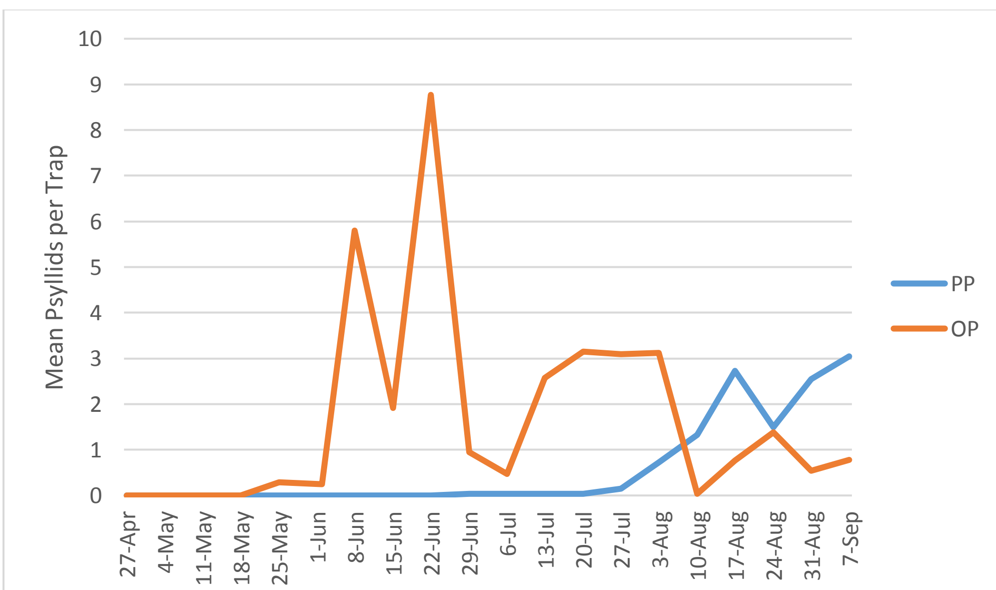


Figure 10. Population dynamics of PP and OP in the lower Columbia Basin, OR 2017.

In Union and Baker, total number of PP increased as season progressed; few other psyllids were observed (**Figure 11**).

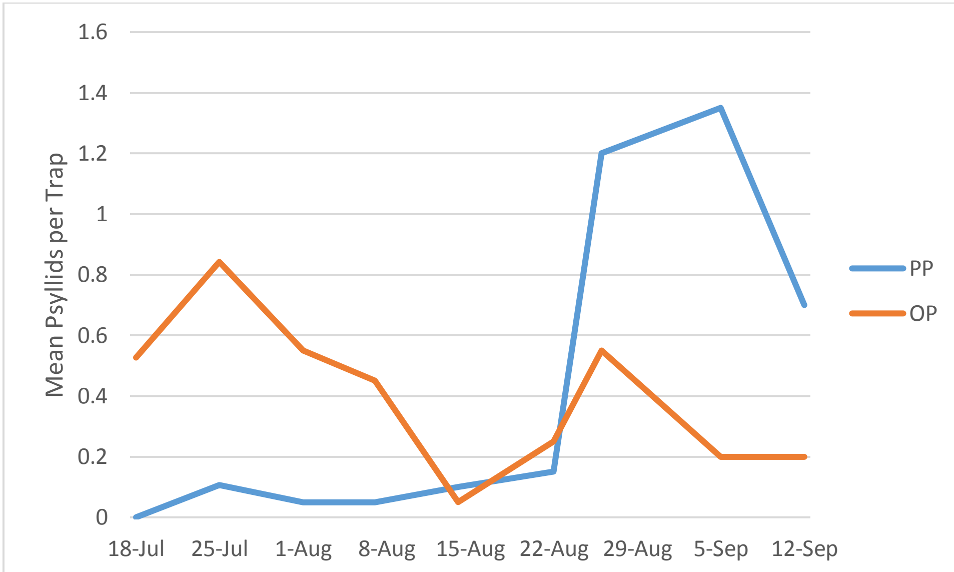


Figure 11. Population dynamics of PP and OP in Union and Baker counties, 2017.

Impacts: The Potato Update http://oregonstate.edu/dept/hermiston/trap-reports provided growers, consultants and industry reps with important weekly information regarding potato pests in the area. Many subscribers use the information for integrated pest management purposes, and to estimate pest pressure near their fields. The 'FYI' section provides them with additional assistance on relevant problems or pests each week: identification, monitoring, cultural control practices and insecticide recommendations. Anderson geographics (https://www.anderson-geographics.com/) continues to help us (ad honorem), digitalizing data collected in interactive maps.

Relation to other Research/Extension: Area-wide monitoring of aphid population dynamics contributes significantly to multiple ongoing research projects in the Rondon entomology program. Leafhopper, psyllid, PTW, and Lygus trapping activities are coordinated with Washington State University (Carrie Wohleb) and University of Idaho (Erik Wenninger) to understand and learn how to control potato pests in the region. The OSU-HAREC-IAEP program is coordinating activities with several groups in the region (Erik Wenninger, University of Idaho; Dave Horthon, USDA-ARS Wapato; Dave Crowder, Washington State University; Julien Levy and Cecilia Tamboriyeux, Texas A&M, and others in the USA).

Research/Extension Progress Report for 2017-18 Funded Projects
Progress Report for the Agricultural Research Foundation
Oregon Potato Commission

Title: Central Oregon Potato Extension Program

Project Leader: Carol Tollefson, COARC, 850 NW Dogwood Lane, Madras, OR.
Carol.Tollefson@oregonstate.edu

Cooperators: Heike Williams, Research Technician, COARC, Madras, OR.
Heike.Williams@oregonstate.edu
Jeremiah Dung, Assistant Professor, COARC, Madras, OR.
Jeremiah.Dung@oregonstate.edug

Funding History (last 2 years): Year initiated: 1995
2017-18 - $7,000
2016-17 - $6,850
2015-16 - $6,750

Abstract:

Aphids, potato psyllids, and beet leafhoppers were collected and counted weekly in Jefferson County from June 19 to September 5, 2017, and tuberworm moths from June 19 to September 19, 2017. Counts were conducted to monitor pest populations and assess potential risk of disease transmission. 2017 was the second season of including beet leafhoppers in the monitoring program. Collection methods included fifteen water buckets for aphid collection, 15 delta traps for potato tuberworm moth, and 15 yellow sticky traps each for psyllid and beet leafhopper. Weekly findings were distributed to growers, fieldmen and industry representatives through reports and website postings.

Aphid numbers over the entire 2017 monitoring season were at a similar level as 2015, not repeating the high detection level of 2016. Numbers for green peach aphids (GPA) peaked in the week ending July 14 and July 26 with a mean of 20 GPA per trap and then dropped sharply for the remainder of the season to levels below a mean of 4 GPA per trap. Potato aphid (PA) detection increased from the beginning of the monitoring season to a mean of 7 specimens per trap in the second half of July followed by low weekly levels of less than 10 total PA in all traps (mean of less than 1 specimen per trap) until vine kill.

Potato tuberworm moth (PTW) detection was low. Single PTW moths were identified twice during the length of the monitoring period. Counts of potato psyllids and beet leafhoppers also remained low. All specimens of both potato psyllids and beet leafhoppers tested negative for pathogens.

Early blight prediction modeling and crop water use data provided helpful information for seed potato management.

Key Words:

Aphid, Green Peach Aphid, Potato Aphid, Potato Tuberworm, Potato Psyllid, Tuberworm Moth, Psyllid, Lso, *Candidatus* Liberibacter solanacearum, Beet Leafhopper, BLTVA Phytoplasma, IPM, Insects

Objectives:

1. Aphid, potato tuberworm moth, psyllid and beet leafhopper trapping IPM project.
2. Generate early blight prediction model and weekly water use data information.
3. Create seasonal, weekly newsletter to provide growers with insect and disease updates.

Procedures:

1. Aphid, Potato Tuberworm, Psyllid, and Beet Leafhopper trapping IPM project

<u>Aphids</u>. Aphids are important pests in potato crops and can affect yield by removing nutrients from plants, stunting growth, or transmitting disease. Aphids are known vectors for several viruses, with the most important for our area being potato virus Y (PVY). Weekly monitoring of aphid traps serves as tool to determine when aphid populations are increasing and when field treatment becomes necessary.

Fifteen yellow buckets filled with water were used as traps to collect winged aphids in commercial potato fields throughout Central Oregon. Traps were distributed on June 19 and 20, 2017 with final collection occurring on September 5, 2017 at the end of the week 11 of the monitoring period. Trapped aphids were collected by straining the aphids from the water using a fish net and collecting trapped insects in 4-ounce specimen cups. Cups were transported to the COARC laboratory and kept refrigerated until examination. Aphids were separated from other insects and identified as green peach aphids, potato aphids or other aphids using a microscope. Aphids were stored in vials filled with alcohol and, if necessary, samples were sent to the Hermiston Agricultural Research and Extension Center (HAREC) for confirmation. Date and location were used to identify aphid movement in the area.

<u>Potato Tuberworm.</u> The potato tuberworm (PTW) is one of the most important pests that infest potatoes worldwide. Potato tuberworm moths appeared in the area in 2013 and have the potential to impact production due to larvae mining in tubers. In the past, the presence of potato tuberworm in central Oregon was sporadic but increased to weekly detection in 2014.

Pheromone delta traps were placed at the edge of planted ground in fifteen commercial potato fields from June 19 to September 19. Delta traps consist of a triangle shaped trap, removable sticky liner bottom, and a lure impregnated with the pheromone of the female potato tuberworm moth. Sticky liners were removed weekly and inspected for presence of male moths. Pheromone lures were replaced every 4 weeks. Unlike traps for other pests, delta traps stayed in place throughout the vine kill until harvest which occurred in weeks 12 and 13 of the monitoring period (September 5 to 19).

<u>Potato Psyllid.</u> The Pacific Northwest potato industry was alerted of the finding of zebra chip (ZC) disease in 2011. The pathogen causing ZC is '*Candidatus* Liberibacter solanacearum' (Lso), a type of bacterium vectored by the potato psyllid (*Bactericera cockerelli* Sulc).

On June 19 and 20, 2017 fifteen yellow sticky traps were distributed in commercial fields and left until the vines were killed. Double sided yellow sticky traps measuring 4" x 6" were placed 5 to 10 feet inside the circle of planted potatoes at canopy height and replaced weekly for potato psyllid activity monitoring. Vine kill and subsequent sticky card removal started August 22 and ended September 5.

Beet Leafhopper. Beet leafhoppers are a growing concern for the potato industry. According to information provided by the Washington State Potato Commission, beet leafhoppers transmit the disease called potato purple top disease which is caused by the beet leafhopper-transmitted virescence agent phytoplasma, or BLTVA phytoplasma. Terminal leaves of infected plants turn reddish or purplish and curl, causing infected plants to die early. In addition, nodes swell and turn purplish, internodes are shortened, and aerial tubers may form. The disease is likely transmitted mostly in early summer. This project included monitoring for this pest and testing for BLTVA of beet leafhoppers that were located.

To trap Beet Leafhoppers (BLH) yellow sticky cards measuring 4" x 6" were placed at the edge of fifteen commercial fields outside the circle of potatoes and out of range of irrigation water, preferably near weeds. Yellow sticky cards were collected and changed on a weekly basis. Sticky card placement and removal followed the same schedule as for aphid and psyllid traps (June 19 to September 5).

2. Generate early blight prediction model and weekly water use data information.

Weekly early blight prediction models were published using observed emergence dates. The model predicts the first seasonal rise in the number of spores of the early blight fungus based on the accumulation of 300 physiological days (P-days) from green row. Once 300 P-days have accumulated, the first fungicide for early blight control should be applied. This usually occurs when rows have closed.

Water use data information was included in the weekly newsletter using daily evapotranspiration data published by the Bureau of Reclamation https://www.usbr.gov/pn/agrimet/. The information is intended to assist growers in irrigation management decisions. Potato is a moisture sensitive crop with a shallow active root zone compared to cereals and forages. Availability of moisture in the root zone is crucial for high yields and is influenced by soil properties such as texture and percent organic matter. Moisture demand increases as the crop begins to develop after emergence and peaks 7-9 weeks later during the tuber bulking growth stage.

3. Create seasonal, weekly newsletter to provide growers with insect and disease updates.

A weekly newsletter was sent to potato industry participants from June 23 to September 21 that included the early blight prediction model, weekly water use data, weekly aphid identification, as well as potato tuberworm moth, potato psyllid, and beet leafhopper, and population numbers. Location of trap sites and population numbers were identified for grower use only. Weekly reports were posted onto the OSU-COARC website and can be found at http://oregonstate.edu/dept/coarc/aphid-trap-reports, providing immediate access for our targeted audience.

Accomplishments:

Aphids. Aphid population in central Oregon ranged from to zero to 168 total aphids per trap compared to a maximum of about 490 total aphids in 2016. The number of all aphids identified throughout the monitoring period (1,996) was similar to the level in 2015 (2,052), much lower than the high numbers found in the previous year (total of 6,958 aphids in 2017).

Looking at weekly population levels, total numbers of aphids increased during the month of July from 117 aphids (mean of 8 aphids per trap) to a peak of 546 aphids in the week ending July 24 (mean of 36 aphids per trap). Starting in the week of July 31 total numbers dropped below 100 and continued to drop throughout August with a slight but not significant rise at the end of August/beginning of September (Fig 1).

The population curve of green peach aphids (GPA) and potato aphids (PA) was similar to the curve of total aphids, with green peach aphid numbers being 28% and potato aphids 15% of total aphids (Fig.2). Both population numbers of GPA and PA were highest in week 5 (July 17 to 24) with numbers of 294 and 111, respectively, and a mean of 20 and 7 aphids per trap (Fig.3). Detection of GPA dropped sharply starting week 6 (week ending July 31), with the drop of the PA population following a week later. The population of other aphids (OA) peaked slightly earlier, with numbers of just below 200 in all traps in weeks 3 and 4 (July 3 to 17) and a mean of 13 aphids per trap. Following those weeks, OA numbers steadily dropped to very low levels (mean of 1 aphid per trap in the week ending August 22). At the end of August and the beginning of September vines of the later varieties had not been killed yet. Of those locations a few had higher OA numbers (3 of 5 fields in week 10 and one of three fields in week 11) which explains the rise in the graph of mean numbers of aphids (Fig. 3).

<u>Potato Tuberworm</u>. First identification of potato tuberworm moth (PTW) in Central Oregon occurred in August 2013 and was confirmed by the OSU-HAREC Entomology Lab. In 2014, PTW moths were found each week (at least one but no greater than 3) starting July 22 until trap removal on September 17 prior to harvest. In 2017 the presence of PTW was so low that most weeks no moths were caught in the traps. Single PTW were only found twice, in the middle of August (week 8-7 to 14) and the beginning of September (week 8-29 to 9-5). This means a return to the level of 2015 and a decrease from the previous year where PTW numbers had reached a high of 28 specimens in all traps at the end of August and levels of 7 to 10 in September.

<u>Potato Psyllid.</u> In 2017, potato psyllids were found at a much lower level compared to the previous year. Most weeks starting in mid-July, a single psyllid was trapped in only one of fifteen fields, the exception being the week of August 15 to 22 where single psyllids were identified in three fields. This is a fortunate contrast to 2016, where in the period of July 26 to the time of vine kill total numbers of psyllids averaged 66 insects per week with a mean of 4.4 specimens per trap. All psyllids detected in 2017 were sent to OSU-HAREC for Lso testing. All tested negative.

<u>Beet leafhopper.</u> In 2017, similar to 2016, beet leafhoppers were found in multiple fields throughout the monitoring period at low infestation levels (1 to 10 BLH per trap). The numbers of fields where BLHs were identified each week ranged from 1in 15 to 7 in 15. Most yellow sticky card trapped one, occasionally two beet leafhoppers. The highest number of specimens found on a single sticky card was four. All BLH specimens were sent to HAREC for BLTVA phytoplasma testing. All tested negative.

<u>Early blight prediction model.</u> May 29 and June 7 were the dates used as emergence dates. 2017 emergence dates were 4 days later compared to 2016 and 3 days earlier compared to 2015 and prior years. Fields emerging May 29 and June 7 accumulated 300 P-days by July 18 and July 31, respectively. The newsletter alerted farmers to the recommendation of fungicide application for varieties susceptible to Early Blight.

Impacts:

Weekly aphid reports were sent to growers, fieldmen and industry participants by email and were made available at on the Central Oregon Agricultural Research Center Website. Weekly information provides opportunity for efficient and economical control of pests and disease. Trapping continues to be an important tool for potato seed producing areas to monitor pests capable of transmitting diseases.

The yearly survey assists in the prediction of crop water use important to proper crop management throughout the growing season and during maturation to assist with harvest and prevent storage rot. Use of the early blight prediction model assists growers and fieldmen as they time fungicide sprays to efficiently prevent disease outbreak.

This project identified continued incidences of potato psyllid detection in Jefferson County. Specimens were sent to OSU-HAREC for confirmation and were tested for Lso (Candidatus Liberibacter solanacearum); all tested negative. For a second year, compound samples of beet leafhoppers were tested for BLTVA phytoplasma by OSU-HAREC. All tested negative. Early blight prediction modeling and crop water use data provide helpful information for seed potato management. Weekly monitoring continues to be a significant source of information for integrated pest management in Central Oregon potato fields.

Relation to Other Research:

Monitoring potato pests in the area can be used to alert industry of increased populations of pests that may affect other crops as well. Virus control efforts center on reducing the source of the virus and controlling potential vectors. Insect monitoring reports are available to central Oregon growers of other crops where aphids are considered pests.

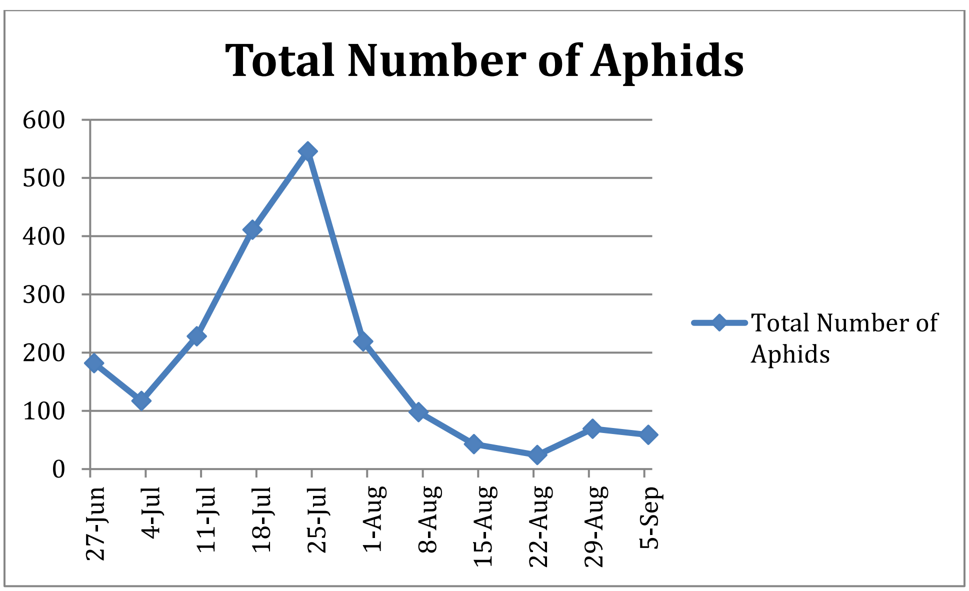


Fig. 1. Total number of aphids trapped in commercial fields in Jefferson County, Oregon 2017

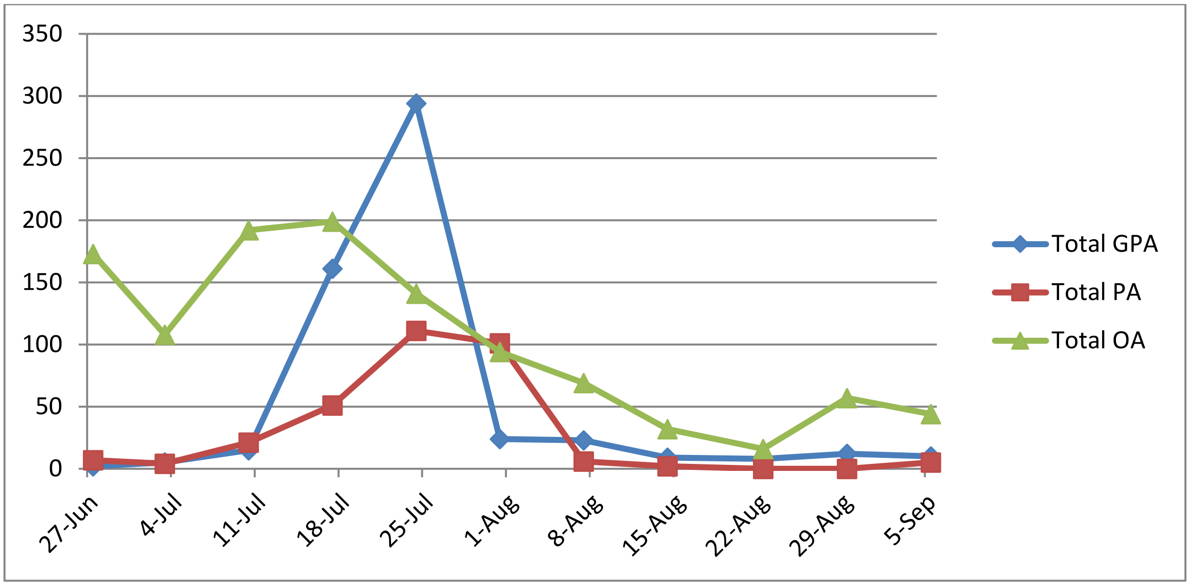


Fig. 2. Total number of aphids per type in commercial fields in Jefferson County, Oregon 2017 (GPA=Green Peach Aphids, PA=Potato Aphids, OA=Other Aphids)

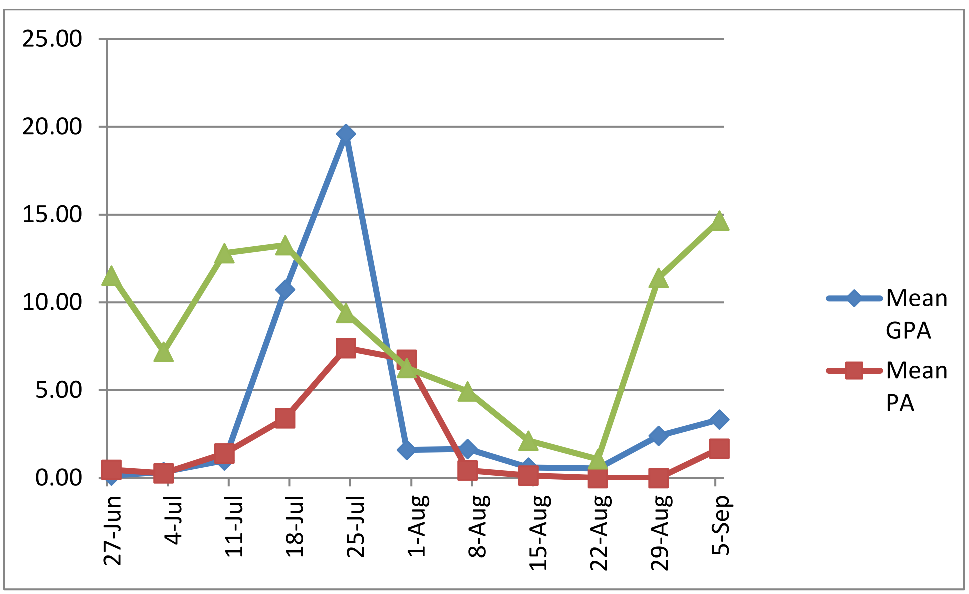


Fig. 3. Mean number of aphids per trap by type in commercial fields in Jefferson County, Oregon 2017 (GPA=Green Peach Aphids, PA=Potato Aphids, OA=Other Aphids)