Title: Development of Crop Protection Chemicals for control of Potato Psyllid in Washington Potatoes - 2012

Year Initiated 2012-2013 **Current Year** 2012-2013 **Terminating Year** 2013-2014

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Accomplishments.

1. It was documented that a wide array of insecticides significantly reduced potato psyllid numbers when applied foliarly. The implications for this reduction on potatoes are provided. It is important to note that this trial was conducted under a low psyllid pressure situation.

2. In a low psyllid pressure situation, we documented that certain planting time applications (in furrow and seed treatment) can provide significant protection against potato psyllid. As a result of these findings, planting time insect control recommendations will be modified.

3. Research was done to discover which insecticides have efficacy when applied via chemigation

Control of Potato Psyllid Using Foliar Insecticides.

Potato psyllid *(Bactericera cockerelli)*, which is the vector for zebra chip disease, was recognized as a pest of Pacific Northwest potatoes in 2011 when heavy losses occurred in a localized area of the Columbia Basin region, causing an estimated 10 million dollars of damage. All potatoes in the Pacific Northwest are threatened by potato psyllid. Because this disease has been present in Texas for several years, much is known about this pest's biology there. Based on data generated in Texas, foliar based control programs were developed for potato psyllid in early 2012 which appear to have been very successful at preventing zebra chip in Washington potatoes.

However, very little is known about this pest's biology in the Pacific Northwest. It appears that the species lives and overwinters on bittersweet nightshade in the Pacific Northwest and that it also migrates from other states such as California. Mature potato psyllids migrate to potato fields when this food source becomes available. It is unknown whether native populations have zebra chip disease, or whether potato psyllids overwinter in potato fields in the Pacific Northwest.

Research efforts to develop pest management tactics have focused on use of foliar insecticides, with some interest in at-plant and chemigated treatments. Based on research results from Texas, it appears that planting time insecticides have little effect on the pest and that control programs should be based on foliar application of insecticides. In 2012, Schreiber and Smitchger conducted the first successful efficacy trial for the pest on potatoes. The efficacy trial contained 38 treatments from many different sponsors. The treatments are outlined in the following table.

Evaluation of Foliar Products for Control of Potato Psyllid 2012

Trt. No.	Treatment	Rate	Rate Unit	Application Code	Total Adult	Total Nymph	Total Egg	Total, All Life stages	% Incidence
2	Beleaf	2.28	oz wt/a	B-E-I	0 b	0 c	0 c	**0 b**	0 a
3	Athena	17	fl oz/a	BF	0.3 b	0.5 bc	0.3 bc	**1.0 b**	0.5 a
4	Athena	13.5	fl oz/a	BEH	0 b	0.8 bc	1.5 bc	**2.3 b**	0 a
5	Beleaf Hero	2 10.3	oz wt/a fl oz/a	B-E-G-J B-E-G-J	0.3 b	0.3 c	0.3 bc	**0.8 b**	0 a
6	Brigadier NIS	6.4 0.25	fl oz/a % v/v	B-E-G-J B-E-G-J	0.5 b	0.3 c	0.3 bc	**1.0 b**	0 a
7	Dimethoate	1	pt/a	ACEI	0.3 b	1.5 bc	0.5 bc	**2.3 b**	0 a
8	Reaper NIS	16 0.25	fl oz/a % v/v	ACEI ACEI	1 b	3.5 b	1 bc	**5.5 b**	0 a
9	Asana	2.9	fl oz/a	ACEI	0.5 b	0 c	1.5 bc	**2.0 b**	0 a
10	Asana	5.8	fl oz/a	ACEI	0.3 b	1.5 bc	0.3 bc	**2.0 b**	0 a
11	Fulfill MSO	5.5 0.5	oz wt/a % v/v	ACEI ACEI	0.8 b	2 bc	1.5 bc	**4.3 b**	0 a
12	Beleaf	2.28	oz wt/a	ACEI	0.5 b	0 c	0.5 bc	**1.0 b**	0 a
13	Beleaf	2.85	oz wt/a	ACEI	0.5 b	1.5 bc	2.3 bc	**4.3 b**	0 a
14	Beleaf	4.3	oz wt/a	ACEI	0 b	0.5 bc	0 c	**0.5 b**	0 a
15	Success NIS	5 0.25	fl oz/a % v/v	ACEI ACEI	0.8 b	2.3 bc	2 bc	**5.0 b**	0 a
16	Reaper NIS Movento MSO	16 0.25 5.5 0.5	fl oz/a % v/v fl oz/a % v/v	-A -A -A-D -A-D	0 b	0 c	0 c	**0.0 b**	0 a
17	Movento MSO	5 0.5	fl oz/a % v/v	B-E B-E	0 b	0 c	0.3 bc	**0.3 b**	0 a
18	Sivanto NIS	14 0.25	fl oz/a % v/v	B-E B-E	0 b	0 c	0 c	**0.0 b**	0 a
19	Oberon 4 NIS	8 0.25	fl oz/a % v/v	B-E B-E	0.3 b	2.8 bc	3.5 abc	**6.5 b**	0 a
20	Leverage 360 NIS	3 0.25	fl oz/a % v/v	B-E B-E	0 b	1.8 bc	0.8 bc	**2.5 b**	0 a
21	Radiant NIS	4 0.25	fl oz/a % v/v	B-E B-E	0.8 b	0.8 bc	1.8 bc	**3.3 b**	0 a
22	Radiant NIS	6 0.25	fl oz/a % v/v	B-E B-E	0.3 b	0.8 bc	0.3 bc	**1.3 b**	0 a
23	Blackhawk NIS	3.5 0.25	oz wt/a % v/v	B-E B-E	0.3 b	0 c	0.3 bc	**0.5 b**	0 a
24	Transform MSO	1 0.5	oz wt/a % v/v	B-E B-E	0 b	0 c	0 c	**0.0 b**	0 a

25	Transform	1.5	oz wt/a	B-E	2	b	1.3	bc	1.3	bc	**4.5**	**b**	0 a
	MSO	0.5	% v/v	B-E									
26	Transform	2	oz wt/a	B-E	0.5	b	2.3	bc	1	bc	**3.8**	**b**	0.5 a
	MSO	0.5	% v/v	B-E									
27	Transform	2.5	oz wt/a	B-E	0.5	b	0.5	bc	0.8	bc	**1.8**	**b**	0.5 a
	MSO	0.5	% v/v	B-E									
28	GWN-1708	24	fl oz/a	ABDFHJ	0	b	0.3	c	1	bc	**1.3**	**b**	0 a
	COC	1	% v/v	ABDFHJ									
29	GWN-1708	32	fl oz/a	ABDFHJ	0.3	b	0	c	0	c	**0.3**	**b**	0 a
	COC	1	% v/v	ABDFHJ									
30	Onager	16	fl oz/a	ABDFHJ	0.3	b	1	bc	1.3	bc	**2.5**	**b**	0 a
31	Onager	24	fl oz/a	ABDFHJ	0.5	b	0.3	c	0	c	**0.8**	**b**	0.5 a
32	Onager	16	fl oz/a	ABDFHJ	0.3	b	2.3	bc	0.5	bc	**3.0**	**b**	0 a
	Scorpion	2.75	fl oz/a	ABDFHJ									
	NIS	0.25	% v/v	ABDFHJ									
33	Onager	18	fl oz/a	ABDFHJ	0.3	b	0.5	bc	0.8	bc	**1.5**	**b**	0 a
	Hyperactive	0.25	% v/v	ABDFHJ									
34	Knack	10	fl oz/a	ABDFHJ	0.5	b	0.8	bc	0.8	bc	**2.0**	**b**	0.5 a
35	Entrust	1.5	oz wt/a	ABDFHJ	1	b	1.3	bc	3.8	ab	**6.0**	**b**	0 a
	Surfact 50	0.5	% v/v	ABDFHJ									
	Sulfur	2	lb/a	ABDFHJ									
36	Entrust	3	oz wt/a	ABDFHJ	0	b	0	c	0.3	bc	**0.3**	**b**	0 a
	Surfact 50	0.5	% v/v	ABDFHJ									
	Sulfur	2	lb/a	ABDFHJ									
	Azadirect	1	pt/a	ABDFHJ									
37	Azadirect	1.5	pt/a	ABDFHJ	0.3	b	0.8	bc	1	bc	**2.0**	**b**	0 a
38	Untreated				11.5	a	8	a	6.5	a	**26.0**	**a**	0 a
LSD (P=.05)					1.61		2.48		2.86		**5.26**		0.51
Standard Deviation					1.15		1.77		2.04		**3.76**		0.37

Means followed by same letter do not significantly differ (P=.05, Duncan's New MRT)

Research Results 2012

The data in the above columns indicate that all insecticidal treatments were effective at reducing adult and nymph number, but egg number for the Entrust and Oberon treatments were not significantly different from the untreated, indicating that these treatments may not have ovicidal activity. The Reaper and Movento tank mix standard, Sivanto, Transform at the low rate, and Beleaf were numerically superior to all treatments, with no psyllids found in those treatments over the course of the season, but Reaper alone had higher psyllid numbers than any other insecticidal treatment, indicating that Movento might be the more effective partner in that tank mix. Higher rates of Transform did not appear to give higher levels of efficacy. Although 14,000 potatoes were sampled for zebra chip, only 5 potatoes had any incidence of zebra chip.

Although significant differences were found, a mean of only 26 psyllids of all life stages was found in the untreated check over the course of the trial. This indicates that the trial was in a low pressure situation. This data appears to be solid, but because this was a low pressure situation, additional research is necessary in order to have adequate confidence that these treatments would hold up in a moderate or high pressure situation. However, based on these results, it is likely that we will include several of these products in the 2013 potato psyllid control guidelines.

Control of Potato Psyllid Using At-plant Insecticides.

Although data from Texas indicates that planting time insecticides have little effect on potato psyllid and should not be relied on for long term residual control in that region, it is important to generate regionally relevant data. A 22 treatment at-plant potato psyllid trial was established on March 29, 2012 near Paterson, WA in order to determine whether at-plant treatments significantly control the pest. Only 11 of these treatments are included in this report because the remainder of the treatments are proprietary.

Evaluation of At-Plant Insecticides for Control of Potato Psyllids Vectoring Zebra Chip Disease in Potato

Trt	Treatment	Rate	Unit	Code	Adult	Nymph	Egg	Total Psyllid	% Incidence
2	Admire	8.7	fl oz/a	B	0.3 b	0.3 b	0.5 c	1 c	0 b
3	Admire	5.7	fl oz/a	B	0.3 b	2 b	1.5 bc	3.8 c	0 b
	Provado	3.8	fl oz/a	DEG					
4	Cruiser 5fs	0.15	fl oz/cwt	A	0.5 b	0.8 b	1.0 c	2.3 c	0 b
5	Actara	8	oz/a	C	0.5 b	0.3 b	1.3 bc	2 c	0 b
6	Belay	12	fl oz/a	B	0 b	0.3 b	0 c	0.3 c	0 b
	Knack	8	fl oz/a	DGJ					
	Danitol	20	fl oz/a	DGJ					
	Venom	1.5	oz/a	EIK					
	Danitol	20	fl oz/a	EIK					
7	Admire	8.7	fl oz/a	B	0.3 b	2.3 b	0.5 c	3 c	0 b
	Oberon	8	fl oz/a	DE					
	Reaper	16	fl oz/a	G-IK					
8	Admire	8.7	fl oz/a	B	0.5 b	0.8 b	0 c	1.3 c	0.3 a
	Reaper	16	fl oz/a	DE					
	NIS	0.25	% v/v	DE					
	Beleaf	2.85	oz/a	G					
	Movento	5	fl oz/a	IK					
	MSO	0.5	% v/v	IK					
9	Admire	8.7	fl oz/a	B	0.8 b	6.0 a	5.5 a	12.3 b	0 b
	Rimon	12	fl oz/a	DE-G-IK					
10	Admire	8.7	fl oz/a	B	0 b	0 b	1.3 bc	1.3 c	0 b
	Reaper	16	fl oz/a	D					
	Movento	5	fl oz/a	E-G					
	MSO	0.5	% v/v	E-G					
	Rimon	12	fl oz/a	JK					
11	Cyazapyr 200	13.5	fl oz/a	B	0.8 b	0.3 b	0.5 c	1.5 c	0 b
	Reaper	8	fl oz/a	D					
	Movento	5	fl oz/a	DE					
	Reaper	8	fl oz/a	GI					
	Fulfill	5.5	oz wt/a	JK					
	MSO	1	% v/v	DEGIJK					
12	Admire	8.7	fl oz/a	B	0.3 b	0.3 b	0.3 c	1 c	0 b
	Cyazapyr 100	13.5	fl oz/a	DE					
	Reaper	8	fl oz/a	GI					

	Fulfill	5.5	oz wt/a	JK									
	MSO	1	% v/v	DEGIJK									
13	Vydate	68	fl oz/a	B	0.3	b	0	b	0	c	0.3	c	0 b
	Movento	5	fl oz/a	DE									
	Reaper	8	fl oz/a	DGI									
	Fulfill	5.5	oz wt/a	JK									
	MSO	1	% v/v	DEGIJK									
14	Vydate	68	fl oz/a	B	0.3	b	1.5	b	2.0	bc	3.8	c	0 b
	Vydate	2.1	pt/a	DE									
	Reaper	8	fl oz/a	GI									
	Fulfill	5.5	oz wt/a	JK									
	MSO	1	% v/v	DEGIJK									
15	Vydate	2.1	pt/a	B	0.8	b	0.3	b	0.8	c	1.8	c	0 b
	Cyazapyr 200	13.5	fl oz/a	B									
	Movento	5	fl oz/a	DE									
	Reaper	8	fl oz/a	DGI									
	Fulfill	5.5	oz wt/a	JK									
	MSO	1	% v/v	DEGIJK									
16	Admire	8.7	fl oz/a	B	0.3	b	0	b	0.3	c	0.5	c	0 b
	Cyazapyr 100	13.5	fl oz/a	DE									
	Reaper	8	fl oz/a	GI									
	Fulfill	5.5	fl oz/a	JK									
	MSO	1	% v/v	DEGIJK									
17	Admire	8.7	fl oz/a	B	0.3	b	0	b	0	c	0.3	c	0 b
	Cyazapyr 100	17	fl oz/a	DE									
	Reaper	8	fl oz/a	GI									
	Fulfill	5.5	oz wt/a	JK									
	MSO	1	% v/v	DEGIJK									
18	Cyazapyr 100	13.5	fl oz/a	DEGIJK	0.5	b	0.8	b	1.5	bc	2.8	c	0 b
	MSO	1	% v/v	DEGIJK									
19	Movento	5	fl oz/a	DE	0.3	b	0.5	b	1.0	c	1.8	c	0 b
	Reaper	8	fl oz/a	DGI									
	Fulfill	5.5	oz wt/a	JK									
	MSO	1	% v/v	DEGIJK									
20	Admire	8.7	fl oz/a	B	1.5	b	0.8	b	1.3	bc	3.5	c	0 b
	Lannate	3	pt/a	DEGIJK									
21	Actara	8	oz/a	B	0.5	b	1	b	1.3	bc	2.8	c	0 b
	Movento	5	fl oz/a	-DF									
	MSO	1	% v/v	-DF									
	Reaper	8	fl oz/a	HL									
	NIS	0.25	% v/v	HL									
	Oberon	8	fl oz/a	-JP									
22	Untreated				8	a	5.8	a	4.3	ab	18	a	0 b
LSD (P=.05)					1.3		2.32		2.75		5.11		0.15
Standard Deviation					0.92		1.64		1.95		3.61		0.11

Means followed by same letter do not significantly differ (P=.05, Duncan's New MRT)

Trial Results

The trial was planted on 3/29/2012 and was fully emerged in early May. The first psyllid (an egg) was found on July 9th in a plot that was treated with Admire Pro, indicating control from at-plant treatments wanes at approximately 100 days after planting. In nearly every instance, all treatments were significantly different from the untreated check, but no insecticidal treatment was significantly better than any other. However, treatment 9 (Admire followed by Rimon full season) was not significantly different from the untreated when numbers of nymphs or total psyllids were compared. Treatments 6 (Belay followed by Knack + Danitol and Venom + Danitol) and 8 (Admire followed by Reaper, Beleaf, and Movento) were the only treatments that significantly controlled eggs. Although significant differences were found, a mean of only 18 psyllids of all life stages was found in the untreated check over the course of the trial. This indicates that the trial was conducted in a low pressure situation. However, there is a strong indication that these spray programs do work, but additional research is needed to confirm these results and determine if these treatments would hold up in a moderate or high pressure situation. Based on these results, it is possible that we will include several of these products in control programs in the 2013 potato psyllid management guidelines.

Control of Potato Psyllid via Chemigation (Trial # 1)

Chemigation allows growers to make insecticidal applications that are more cost effective than either ground or foliar applications. Two trials testing various products for efficacy via chemigation were established. Currently only one product (Rimon) is registered for use against potato psyllid via chemigation. Finding other products that are effective via chemigation are important to the potato industry in Washington state

Evaluation of Insecticides Applied Via Chemigation for Control of Potato Psyllids Vectoring Zebra Chip Disease in Potato

No.	Treatment	Rate	Rate Unit	Applic. Code	Adult	Nymph	Egg	Total Psyllid
1	Untreated				0 a	0.5 b	0 a	0.5 b
2	Transform	1.5	oz wt/a	B	0 a	1 b	2 a	3 ab
3	Transform	2.75	oz wt/a	B	0 a	0 b	0 a	0 b
4	Reaper	16	fl oz/a	-A	0.5 a	0.8 b	1 a	2 ab
	Movento	5	fl oz/a	-A-B				
	MSO	0.5	% v/v	-A-B				
5	Rimon	12	fl oz/a	ABCDE	0.3 a	0.3 b	1 a	1 b
6	Reaper	16	fl oz/a	-A	0.5 a	1 b	0 a	1.5 ab
	Movento	5	fl oz/a	-A-B				
7	Oberon	8	fl oz/a	BD	0.5 a	0 b	0 a	0.5 b
8	Oberon	8	fl oz/a	BD	0.5 a	4.5 a	2 a	7 a
LSD (P=.05)					0.76	3.19	2.47	5.31
Standard Deviation					0.52	2.17	1.68	3.61

Means followed by same letter do not significantly differ (P=.05, Duncan's New MRT)

The trial was planted on March 29th, 2012, and emergence occurred in early May. Preventative applications with Movento began on June 15, 2012, and the first psyllids were found on July 9, 2012. All treatments had applications made by July 31st. Psyllid pressure was low for the duration of the trial. The foliar application of Oberon had significantly greater psyllid numbers than Oberon chemigated, the high rate of Transform, and Rimon, indicating that Oberon is not effective when applied foliarly, but the foliar Oberon treatment also had significantly higher numbers of psyllids than the untreated check. All other treatments were not significantly

different from any other treatment. Although 1,600 potatoes were examined for symptoms of zebra chip, none were found to contain symptoms of the disease. Because of the low number of psyllids in the untreated check it is difficult to make conclusion regarding Transform's efficacy against psyllid in this trial

A total of 2 psyllids were found in untreated plots over the course of the trial. This indicates that psyllid populations did not develop in this trial.

Control of Potato Psyllid via Chemigation (Trial # 2)

Chemigation trial #2. Testing Insecticides for Efficacy against Potato Psyllid via Chemigation							
Treatment	Rate	Rate Unit	Appli. Code	Total Adult	Total Nymph	Total Egg	Total psyllids
1 Untreated				0 a	0 a	0.3 a	0.3 a
2 Rimon	12	fl oz/a	ABD	0.3 a	0 a	0 a	0.3 a
3 Reaper	16	fl oz/a	A	0.3 a	0 a	0.8 a	1 a
Movento	5	fl oz/a	AC				
MSO	0.5	% v/v	AC				
4 Beleaf	8.6	oz wt/a	A	0.8 a	0.3 a	0 a	1 a
5 Beleaf	4.3	oz wt/a	AC	0 a	0.3 a	0.5 a	0.8 a
6 Beleaf	5.7	oz wt/a	A	0 a	0.3 a	0 a	0.5 a
Beleaf	2.85	oz wt/a	C				
7 EXP 1	1	lb/a	ABD	0 a	0 a	0 a	0 a
8 EXP 2	2	lb/a	ABD	0.5 a	0.5 a	0 a	1 a
9 EXP 2	2	gal/a	ABD	0 a	0.3 a	0.3 a	0.5 a
10 Torac	24	fl oz/a	ABD	0 a	0.3 a	0.5 a	0.8 a
NIS	0.25	% v/v	ABD				
11 EXP 3	1	qt/a	ACE	0.3 a	0 a	1 a	1.3 a
LSD (P=.05)				0.68	0.65	1.16	1.66
Standard Deviation				0.47	0.45	0.81	1.15

Means followed by same letter do not significantly differ (P=.05, Duncan's New MRT)

The trial was planted on the 24th of April and was fully emerged in early June. The first recorded psyllid was found on the July 16th and the first of five applications was made on July 20th. Psyllid pressure was low throughout the course of the trial, and no statistical differences were found among any of the treatments.