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65TH ANNUAL PACIFIC NORTHWEST

INSECT MANAGEMENT CONFERENCE

JANUARY 9 & 10, 2006

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Section I
Forage (Hay) Insects

Control of the armyworm, *Pseudaletia unipuncta* (Haworth), in SW Oregon grass pastures

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August and September of 2005 marked the third year that armyworms defoliated hundreds of acres of grass pasture and field corn in Coos County (and established tall fescue for seed in the mid-Willamette Valley). Populations of over 30 larvae per sq. ft. were recorded (>1,000,000 larvae/A with a biomass of from one to 10 tons!)

Historically, damage in Oregon has been sporadic and localized in grass pastures and seed crops (some silage corn) occurring in the late summer and fall about once every ten to fifteen years. Outbreaks usually followed a mild winter and wet spring. Infestations likely arose from moths migrating north from California in mid-summer. It seems that now AW moths are over-wintering in western OR (or close to it!).

In 2004 and 05 hundreds of acres of grass pastures in Myrtle Point, OR, literally disappeared in about a week! Organic milk production in the area has necessitated an OMRI approved control of this pest. The two replicated field trials we conducted in dairy pastures indicate that spinosad can provide effective control of AW.

A 15 day Crisis Exemption for both Entrust® (for organic milk producers) and Success® biological insecticides from Dow Agrosciences was issued by ODA for use on Myrtle Point Dairy Pastures to control AW.

Table I. Site I, Avg AW larvae per 10 straight-line sweeps of standard 15" diameter sweep net

Treatment	Rate/A lb	Live Larvae	
		6 DAT	14 DAT
Success	.047 ai	1.7a	1.3a
Success	.094 ai	3.0a	1.3a
Javelin	1.5 form	20 b	8.3 b
Javelin	1.0 form	26.7b	15.7 b
carbaryl	1.0 ai	30.7b	20.7 b
UTC		25.3b	18.7 b

Table 2. Site II Reed Canary Grass, Avg. AW larvae/ 10, 90degree sweeps 6 DAT

Treatment/ Formulation	Rate lb/acre	Mean
Success	.047 ai	20.0 a
Success	.094 ai	19.0 a
Javelin	1.5 form	107.3b
Javelin	1.0 form	72.3 bc
UTC	---	141.3 bc

Means followed by the same letter are not significantly different (P=0.05; Tukey LSD)

Tall fescue Armyworm Outbreak Control Trial, Corvallis
Set-up: Sept. 8, 2005 (spray application)
Evaluated: Sept. 12 &15 (4 & 7 DAT)

		4 DAT	7 DAT		
Treatment	Rate	Total	Total	Total	Mean
Discipline	3.2 oz	0.00 a	0.00a	0	0.00 a*
Warrior	3.2 oz	3.75ab	3.25ab	13	3.25 a
Warrior	1.6 oz	4.50ab	6.75ab	27	6.75 a
Lorsban 4E	32 oz	.25 a	1.00ab	4	1.00 a
Lorsban 4E	16 oz	.75 a	1.00ab	4	1.00 a
Lorsban 4E	8 oz	8.25bc	6.25bc	25	6.25 a
UTC	---	19.75c	17.50c	70	17.50 b

WASHINGTON STATE COMMISSION ON PESTICIDE REGISTRATION

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In response to the unmet pest management needs, the Washington legislature unanimously voted to create the Washington State Commission on Pesticide Registration (WSCPR) in 1995. The purpose of the Commission was to obtain and maintain pesticide registration for minor uses and minor crops in Washington State. The Commission was to be made up of 12 voting members from various stakeholder groups and 5 public sector state agencies. The Commission was given a $500,000 budget. In 1999, the WSCPR's mandate was expanded to cover all aspects of integrated pest management. Accordingly, the budget of the Commission was expanded.

Since its inception, the Commission has funded more than 400 projects impacting approximately 100 crops. The past, present and expected economic impact of these projects is estimated to be more than $1 billion. The primary recipient of WSCPR funds has been Washington State University, which has received in excess of 66% of Commission funds. University of California – Davis has been the second largest recipient of funds, followed by Oregon State University. Private entities have received less than 5% of Commission funds.

The Commission continues to seek out worthwhile projects. Proposals must be submitted by a group, formally structured or not, that controls pests. Universities, researchers and extension specialists are not qualified to submit proposals, but may do so on behalf of a requesting group. Anyone wishing to submit a proposal to the Commission should first carefully review its Request for Proposals, which may be found at www.wscpr.org.

Washington State Commission on Pesticide Registration, October 25, 2005, Ellensburg, WA

#	WSCPR #	Commodity	Chemical or Pest	Project Type	Researcher & Institution	Old Mandate	New Mandate	Matching in cash	Matching in kind	Total Project Cost
1	06AN001	Hops	Mites	IPM	James/WSU		16,170	16,170		32,340
2	06AN002	Wine Grapes	Mites	IPM	James/WSU		16,170	16,170		32,340
3	06AN003	Wine Grapes	Viruses	IPM	Rayapati/WSU	not funded, invited for resubmission				
4	06PN004	Onion Seed	IYSV	E, P	duToit/WSU	11,460		7,500	2,000	20,960
5	06PN005	Beef	Parasites	E, IPM	Walsh/WSU	not funded, invited for resubmission				
6	06AN006	Poplar	Insects	E, IPM	Brown/WSU	not funded, invited for resubmission				
7	06PN007	Grass Hay	Mites	E, IPM	Walsh/WSU	7,293	7,292	5,000	3,000	22,585
8	06PN008	Alfalfa	Lygus	E, R, IPM	Walsh/WSU	15,000	5,000	20,000	5,000	45,000
9	06PN009	Alfalfa Seed	Bees	E, O	Walsh/WSU	7,500	7,500	15,000	500	30,000
10	06AN010	Apple/ULV	Codling Moth	E, IPM	Knight/WSU	not funded				
11	06AN011		Ag Information	O	Schreiber/ADG		Tabled until the next meeting			
12	06PN012	Veg Seeds	Weeds	E, P,	Boydston/USDA	4,000		4,000		8,000
13	06PG013	Mint	Analysis	R	Hebert/FEQL WSU	18,495		20,000		38,495
14	06AN014	Tilth	Weeds	IPM	Gallagher/WSU	not funded				
15	06PN015	Ornamentals	Pesticides	E,P,IPM,R	Walsh/WSU	not funded, invited for resubmission				
16	06PN016	Raspberry	Nematodes	E	Riga/WSU	11,000			8,000	19,000
17	06AN017	Wheat	CLB	IPM	Roberts		9,660	9,660		19,320
18	06PN018	Lima Beans	Weeds	E, P	Boydston	6,000	6,000	3,000	250	15,250
19	06PG019	Agriculture	GLP Residue	R	Wight/WSU	not funded, invited for resubmission				
20	06AN020	Potato	PTM	IPM	Lacey/USDA		25,000	75,000		100,000
21	06PN021	Tulip	Weeds	E, P	Miller/WSU	3,223		3,000	223	6,446
22	06AN022	Apples	Mites	IPM	Beers		12,560	22,281		34,841
23	06AN023	Salmon	Toxicity	O	Grue		5,852	8,043		13,895
						83,971	111,204	224,824	18,973	438,472
					Total Funded	195,175				

Key: E=Efficacy, E Fate=Environmental Fate, IPM=Integrated Pest Management, P=Phytotoxicity, PR=Pesticide Resistance Study, B=Biocontrol, R=Residue, O=Other

Washington State Commission on Pesticide Registration Portland, Oregon January 10 and 11, 2006

	WSCPR#	Commodity	Chemical or Pest	Project Type	Researcher and Institution	Old Mandate	New Mandate	Matching in Cash	Matching in Kind	Total Project Cost
1	06AN024	Pest Control	Ants	E, IPM	Hansen/SFCC		9,000	9,000		18,000
2	06AN025	Red Raspberry	Root Rot	IPM	Walters/WSU		7,041	7,041	500	14,582
3	06PN026	Grass Seed	Weeds	E, P	Ball/OSU	15,250		25,650		40,900
4	06AN027	Pest Control	Ants	O	Hansen/SFCC		5,610	5,610		11,220
5	06AN028	Potatoes	Wireworm	IPM	Horton/USDA-ARS		13,000	15,000	53,500	81,500
6	06PN029	Carrot Seed	Mildew	E, IPM	duToit/WSU	4,650	4,650	5,000	1,600	15,900
7	06PN030	Red Raspberry	Weeds	E, P, IPM	Miller/WSU	4,600		2,500	500	7,600
8	06AN031	Spinach Seed	Wilt	E, IPM	duToit/WSU	2,723	8,172	7,895	1,500	20,290
9	06AN032	Grass Seed	Disease	E, IPM	Hamm/OSU	2,800	5,200	6,000		14,000
10	06AN033	Sweet Corn	Virus	IPM	Trent/WSU		10,200	6,400	8,376	24,976
11	06PG034	Pea/Lentil	Linuron	R	Yenish/WSU	4,500		4,500	15,000	24,000
12	06AN035	Spinach Seed	Virus	IPM, O	duToit/WSU		6,000	1,000	2,000	12,000
13	06AN036	Hops	Insectaries	IPM	James/WSU		4,469	4,469		8,938
14	06AN037	Hops	Hop Looper	IPM	James/WSU		7,376	7,376		14,752
15	06PN038	Conifers	S. O. D.	E, P	Chastagner/WSU	15,084		15,084		30,169
16	06AN039	Tilth	Weeds	IPM	Miles/WSU		15,355		10,000	25,355
17	06PN040	Nurseries	Weeds	E, P, IPM	Boydston/WSU	3,825	675		3,750	8,250
18	06AN041	Poplar	Insect Survey	E, IPM	Brown/WSU	18,648	18,648	30,750	26,500	94,546
19	06PN042	Asparagus	Weeds	E, P	Schreiber/ADG	22,500		21,000	1,500	45,000
20	06PN043	Conifers	Twig Borer	E, O	Stark/WSU	7,739	7,738	15,477		30,954
21	06PN044	Cranberry	Pesticides	E, P, IPM	Patten/WSU	16,920	1,880	18,170	7,800	44,770
22	06PN045	Weed Board	Knotweed	E	Patten/WSU	2,250		2,000	250	4,500
23	06PN046	Oyster	Brwing Shrimp	E, IPM	Patten/WSU	19,104	4,776	34,008	2,500	60,388
24	06AN047	Nurseries	Thrips	E,P,IPM,PR	Walsh/WSU	6,149	6,149	7,843	5,000	25,681
25	06PN048	Conifers	Equipment	E, P	Chastagner/WSU	19,592		19,593		39,185
26	06AN049	Potatoes	PTM	IPM	Rondon/WSU		38,750	39,250		78,000
27	06PN050	Veg Seed	BLTVA	E, P	Schreiber/ADG	3,500		2,500	1,000	7,000
28	06PN051	Brassica	Growth Regltrs	E, P	Volker/ExcelAg	6,000		4,000	4,000	14,000
29	06AN052	Tree Fruits	Decision Aids	IPM	Beers/WSU	23,146		63,029		86,175
30	06PN053	Apples	Rot	E, IPM	Xiao/WSU	10,080	2,520	14,089		26,689
31	06PN054	Mint	Armyworm	E, IPM	Walsh/WSU	10,462	3,487	15,000	1,000	29,949
32	06AN055	Shellfish	Brwing Shrimp	IPM, O	Booth/PSI	1,250	5,000	1,500	2,800	10,550
33	06PN056	Peas	Nematodes	E, IPM	Hamm/OSU	4,000	4,000	6,000		14,000
34	06AN057	Oyster	Salmonid	IPM, O	Grue/U of W		32,493	6,060	11,524	50,077
35	06PN058	Blueberry	Mummyberry	E, P	Schreiber/ADG	8,000		8,000		16,000
36	06AN003	Wine Grapes	Viruses	IPM, O	Rayapati/WSU		18,521	36,150		54,671
37	06PN005	Beef Cattle	Arthropods	E, IPM	Walsh/WSU	6,558	15,302	12,902	12,200	46,962
38	06AN011	Agriculture	Various	Book	Schreiber/ADG		30,000			30,000
						239,330	286,012	479,846	172,800	1,181,529
					Total Requests	525,342				

Key: E-Efficacy trial; E.Fate-Environmental Fate; IPM-Integrated Pest Management; P-Phytotoxicity; PR-Pesticide Resistance; R-Residue; B-Biocontrol; O-Other

Portland, Oregon Meeting January 4 and 5, 2005

#	WSCPR #	Commodity	Chemical or Pest	Project Type	Researcher and Institution	Old Mandate	New Mandate	Matching in cash	Matching in kind	Total Project Cost
19	05AN019	Potatoes	Wireworm	IPM	Horton / USDA-ARS		15,400	19,300		34,700
20	05PN020	Mint	Weeds	E,P	Boydston / USDA	4,000		12,889		16,889
21	05PN021	Snap Beans	Weeds	E,P	Boydston / USDA	3,000		2,000	100	5,100
22	05AN022	Pest Controllers	Ants	IPM, O	Hansen / SFCC		3,132		3,132	6,264
23	05AN023	Red Raspberries	Various pests	Equipment	Nicholson / WSU	1,178	2,750	3,000		6,928
24	05AN024	Pest Controllers	WDOs	IPM	Foss / WSU		11,990	20,504	5,383	37,877
25	05AN025	Tree Fruit	Leafrollers	E, IPM, PR	Brunner / WSU	6,152	18,453	25,898		50,503
26	05AN026	Red Raspberries	Root Rot	IPM	MacConnell/WSU		30,000	10,000		40,000
27	05PN027	Peas/Limas	Disease	E, IPM	Hamm / OSU	6,000	6,000	6,000		18,000
28	05AN028	Carrot	Disease	E,IPM,PR	Hamm / OSU	1,800	7,200	5,000		14,000
29	05AN029	Grass seed	Disease	E, IPM	Hamm / OSU	2,800	5,200	8,000		16,000
30	05PN030	Cranberry	Multiple Pests	E, P, IPM	Patten/Bristow/WSU	18,800		18,170	7,800	44,770
31	05PN031	Oyster	Burrowing Shrimp	E, IPM	Patten / WSU	19,286	4,821	18,467	1,000	49,074
32	05AN032	Wheat	Weeds/Disease	IPM	Gallagher / WSU		14,000	14,000		28,000
33	05AN033	Hops	Mites and Aphids	IPM	James/ WSU		4,037	4,037		8,074
34	05AN034	Hops	Hop Looper	IPM	James/ WSU		7,293	7,293		14,586
35	05AN035	Tree Fruit	Weather System	IPM	Pierce/Elliot/WSU		35,000	115,022		150,022
36	05AN036	Potatoes	Potato Tuber Moth	E, IPM	Hamm / OSU	5,381	9,994	38,050		53,425
37	05PN037	Christmas Trees	Root Aphids	E	Stark / WSU	7,782		7,782		15,564
38	05PN038	Christmas Trees	Disease	E, P	Chastagner/Hansen	13,242		26,374		39,616
39	05PN039	Apple	Rot	E, IPM	Chang-Lin Xiao	10,080	2,520	13,372		25,972
40	05AN040	Butterflies	Herbicides	IPM	Schultz / WSU		18,164	17,969	4,866	40,999
41	05PN041	Asparagus	Aphids/ Weeds	E, P	Schreiber/ ADG	26,500		26,500	4,500	57,000
42	05AN042	Grains	Cereal Leaf Beetle	IPM	Miller/Pike/Roberts		6,980	15,592		23,072
43	05AN043	Organic Vegetables	Green Peach Aphid	IPM	Miller/Pike/Snyder		7,400	9,800		17,200
44	05PN044	Dill Growers	Weed Control	E, P	Schreiber/ ADG	6,000		3,000		9,000
45	05PN045	Bean Seed	Leafhoppers	E, P	Schreiber / ADG	3,500		2,500		6,000
46	05PN046	Nursery	Structural Pests	E, IPM, PR	Walsh / WSU	22,500	7,500	30,000	12,750	72,750
47	05AN047	Potato	Green Peach Aphid	IPM	Pike/ Rayapati		29,690	24,685	20,347	74,722
48	05PN048	Concord Grapes	Thrips	E, IPM	Walsh / WSU	5,148	572	9,000		14,828
49	04AN049	Carrots	Carrot Rust	IPM	Muehleisen/Riga		15,615		15,500	31,115
50	05AN050	Bees	Mites	IPM	Sheppard / WSU	2,977	11,907	2,000	6,000	22,884
51	05AN051	Bees	Mites	IPM	Sheppard / WSU		16,660		14,000	30,660
52	05AN052	Oysters	Herbicide Toxicity	O	Grue		13,890	2,250	21,403	37,543
53	05PN053	Blueberries	Weed Control	E, P, IPM	Miller/ WSU	1,790	1,790	3,564		7,144
54	05PN054	Beet/Chard Seed	Weed Control	E, P	Miller/ WSU	4,340		3,280		7,620
55	05AN055	Oysters	Burrowing Shrimp	IPM, O	Booth/Cheney/ PSI					
56	05AN056	Apples	Thrips	IPM	Horton / WSU		10,000	15,000		25,000
57	05PN057	Grass seed	Weeds	E, P	Ball / OSU	14,500		15,150		29,650
58	05PN058	Peas/Lentils	Broadleaf Weeds	E, P, IPM, O	Yenish/ WSU	7,500	2,500	5,000		15,000
59	05PN059	Blueberries	Aphids/Root Weevils	E	Tanigoshi / WSU	3,775		3,775		7,550
								564,223	116,781	1,205,101
				FY 2005 Proposed Projects Totals:		**198,031**	**$320,458**	**$564,223**	**$367,180**	**$1,881,481**

Total Requested: $518,489 **Total Match $931,403**

RESISTANCE MANAGEMENT OF POTATO TUBERWORM

IN THE PACIFIC NORTHWEST

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Potato tuberworm is responsible for more crop loses in potatoes than any other insect, weed, disease or nematode pest in the world. The recent introduction and spread throughout most of the potato growing areas in the PNW has resulted in significant pest control challenges. Growers in the Columbia Basin of Oregon and the lower Columbia Basin of Washington made up to 8 applications in 2005 to control this pest. In most cases, the insect was control, however, several fields (between 5 and 10) were rejected due to PTW and were used for lower valued purposes.

Based on 2005 efficacy trials, PTW can easily be controlled by repeated insecticide applications made at close intervals at high rates. PTW has multiple, overlapping generations, short generation times, appears to infest only potatoes (at least in the PNW) and is the recipient of intense insecticidal pressure. The insect has developed resistance to most of the insecticides used for its control in several locations. Due to several factors related to its biology and the intense insecticide pressure it is under, the specter of insecticide resistance must be considered.

The potato industry must incorporate the likelihood of resistance into its management plans for PTW. The PNW potato industry is very fortunate to have identified a number of products that are effective for control of PTW. Products from nine separate classes of insecticides

Based on efficacy trials conducted in 2005, products with some level of activity against PTW include Imidan, Guthion, Monitor, Penncap M, Assail, Venom, Leverage, Baythroid, Asana, Avaunt, Rimon, Lannate, Furadan, Success/Entrust, Agrimek, Bacillus thuringiensis. Other products in the process of being registered on potatoes or not in the registration process for potatoes also demonstrated activity against PTW.

In total, the products represent nine different modes of action. The above named products included two types of acetylcholine esterase inhibitors, sodium channel modulators, two types of nicotinic acetylcholine receptor agonists, chloride channel activators, a voltage-dependent sodium channel blocker, a microbial disrupter of the midgut and a ninth mode of action that is unknown to the author.

It is highly unusual for growers to have access to some many products from such a diverse array of modes of action for use against a new pest. All of these products have use limitations, variable costs, label restrictions, differing levels of efficacy and spectra of control making grower choice complicated. It is currently recommended that growers rotate the choice of products in such a way that three modes of actions are used in a full PTW control program.

Researchers are currently developing PTW control programs that integrate chemical and non chemical control methods. It is critical that integrated resistance management principles are incorporated while PTW IPM programs are being developed.

CEREAL LEAF BEETLE BIOLOGICAL CONTROL PROGRAM IN OREGON, 2005

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Introduction

Cereal leaf beetle, *Oulema melanopus* (CLB), was first identified in Michigan in 1962 as an introduced pest from Europe. It spread to many states east of the Mississippi River and by the early 1990's, the pest was found in four western states – Wyoming, Montana, Utah and Idaho. Oregon first found CLB in 1999 in Malheur Co. A statewide survey for CLB continued for a seventh year in 2005. CLB was not found in any new counties in 2005. CLB has been detected in 19 counties to date: Benton, Clackamas, Columbia, Lane, Linn, Marion, Multnomah, Polk, Tillamook, Washington, and Yamhill in western Oregon and Baker, Crook, Deschutes, Jefferson, Malheur, Umatilla, Union, and Wallowa in central and eastern Oregon.

Biological control has been effective in the eastern US where the invasive beetle first caused serious damage. The cooperative biological control program among ODA, USDA, and OSU for CLB in Oregon began immediately after its detection in 1999. The program now has six field insectaries, three for the egg parasitoid *Anaphes flavipes* in Washington and Union counties, and another three for the larval parasitoid, *Tetrastichus julis* in Benton, Jefferson, and Union counties (Figures 1 & 2).

Egg parasitoid – *Anaphes flavipes*

We worked for a fourth year in the insectary near Banks in Washington Co., which was started for rearing the CLB egg parasitoid, *Anaphes flavipes*. Recovery samples were taken in Banks to monitor the natural increase of the parasitoid. Parasitism rate peaked in late June to early July at about 30%, similar to the peak parasitism rate in 2004. An estimated 15,690 *A. flavipes* were released at the Scholls insectary, also in Washington Co., for the second year. Releases were made there so as not to interfere with recovery efforts at the Banks insectary. Overwintering recovery efforts in Scholls indicate that the parasitoid did not overwinter after the first year of releases. A new insectary was started in 2005 for *A. flavipes* at the OSU Agricultural Research Center in Union Co., only .25 mile from the already established *T. julis* insectary. An estimated 16,214 *A. flavipes* were released at this new insectary. This was the first release of the egg parasitoid in eastern Oregon.

Our source of *A. flavipes* was Colorado Dept. of Agriculture's Biocontrol Lab in Palisade, Colorado. As in previous years, most *A. flavipes* wasps received from the Palisade lab were released as parasitized CLB eggs on picked oat leaves and placed with a sponge inside small, modified paper milk cartons mounted on wooden stakes in the field. The rest were released as parasitized CLB eggs in small petri dishes inside the same carton and stake assembly.

Larval parasitoid – *Tetrastichus julis*

Three insectaries for the larval parasitoid, *T. julis*, were active in 2005. OSU's Hyslop Farm insectary in Benton Co. was the only one that received *T. julis* releases. The Madras insectary field in Jefferson Co. had CLB numbers too low to release *T. julis* in 2005. For a second year the Union insectary was left alone for *T. julis* to increase naturally. Parasitism recovery rates were low in the Hyslop insectary field, but 2005 was the first overwintering recovery of *T. julis* in the Hyslop insectary after only one year of releases there.

We found widespread recovery of *T. julis* in 2005 with exceptionally high parasitism rates in some locations where it was previously released. The peak parasitism rates of *T. julis* found in each positive county were as follows: Baker (57%), Benton (1%), Linn (67%), Malheur (3%), Multnomah (100%), Union (91%), Washington (84%). *T. julis* was recovered in Linn Co. where it had never been released before. This suggests that it spread through part of western Oregon naturally. Numbers of *T. julis* remain low in Malheur Co.

Tetrastichus julis were released in four counties. The number of CLB larvae (and estimated number of *T. julis*) released in each county are: Benton, 2,987 (12,784); Linn, 850 (3,519); Malheur, 2,459 (3,566); Marion, 803 (3,291). Parasitized CLB larvae were acquired from Pennsylvania (20); Wyoming (1,012); Montana (2,459); and in Oregon, Multnomah Co. (20); Union Co. (3,058); and Washington Co. (530). The parasitism rates among CLB release material from all areas, ranged from 29% to 100%.

Although moderate CLB populations exist in the insectary fields, CLB adults and larvae were collected and redistributed to the insectary fields to augment the number of eggs and larvae for parasitizing. The numbers of CLB moved to each field in 2005 are as follows: Hyslop 8,800 (Benton Co.); Madras 9,700 (Jefferson Co.); Union 11,530 (Union Co.); Banks 8,600, Scholls 10,100 (Washington Co.). We also sent 20,220 adults to Colorado to support the egg parasitoid production there.

Pesticide use
Successful biological control is needed for a healthier farm and landscape environment. A pesticide warehouse survey by USDA in 2005 indicated that insecticide-treated acreage for CLB in Oregon had dramatically increased from none in 1999, to 1,390 acres in 2000, 12,217 acres in 2001, 26,703 acres in 2002, 38,309 acres in 2003, and 64,200 acres in 2004 but had gone down slightly in 2005 to 50,175 acres due to reduced grain acreage.

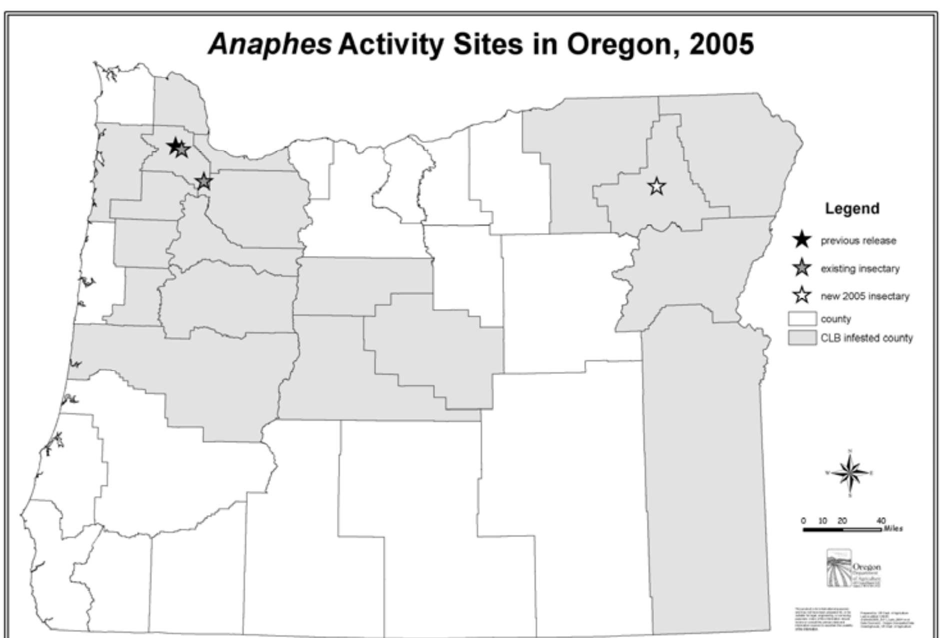

Figure 1

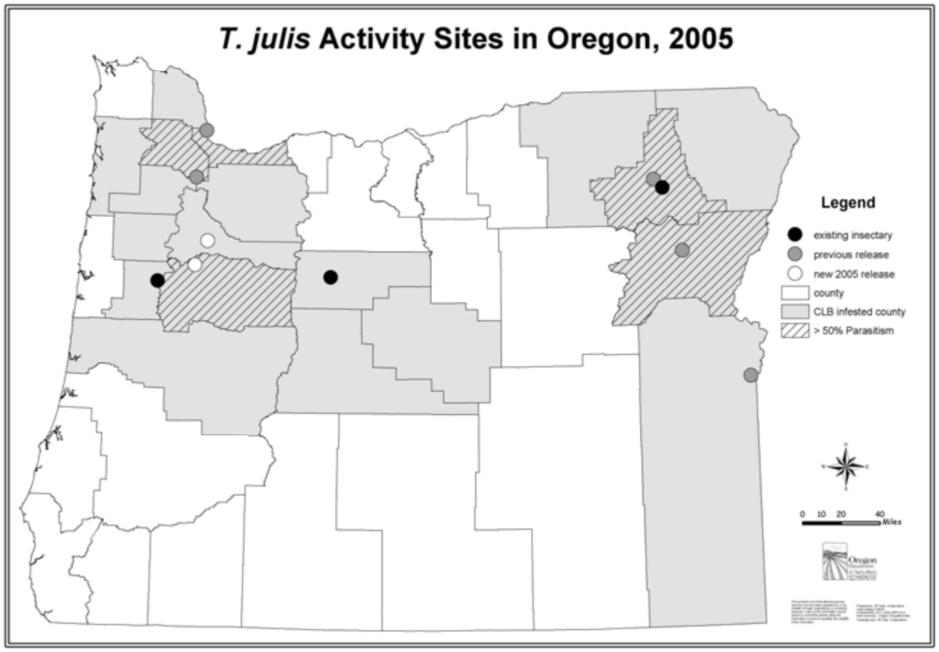

Figure 2

Section III.
Biological & Cultural Control

Development of a Microsporidian for Black Vine Weevil Management

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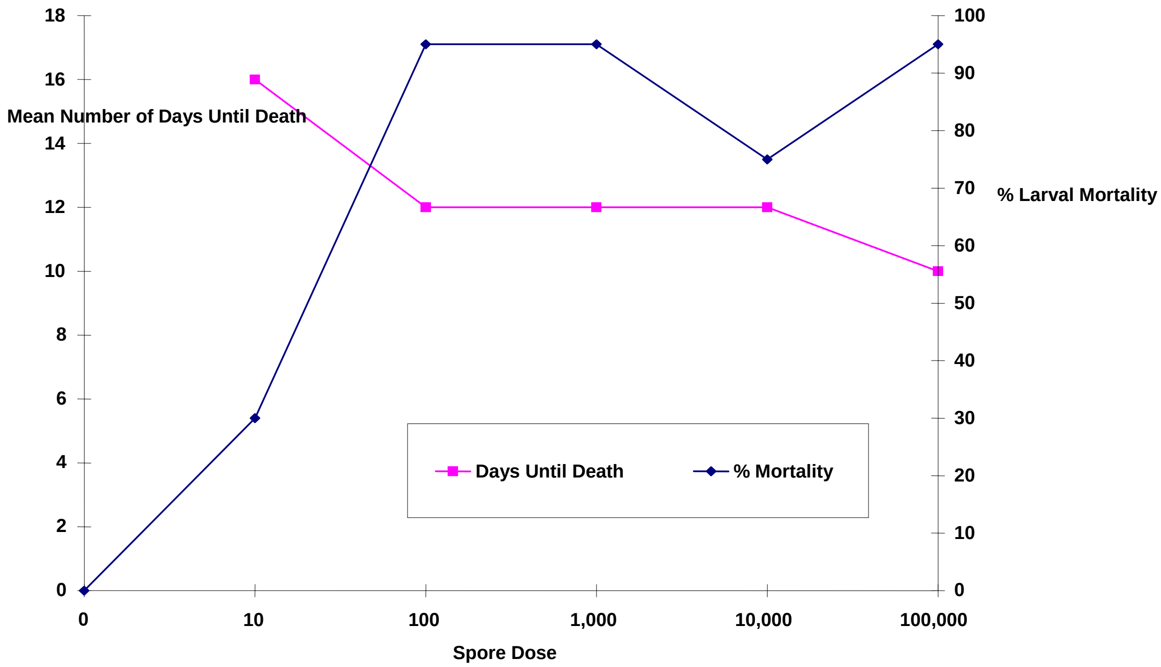
Microsporidian Characterization

A yet to be described insect pathogen (Microsporidian) was isolated from the black vine weevil (BVW) *Otiorhynchus sulcatus* (Coleoptera: Curculionidae) from a wholesale nursery located in McMinnville, OR. A microsporidian has not been previously described from the BVW and initial diagnostic work suggests that this is a new species of microspora. I am currently working with Dr. Leellen Solter at the Illinois Natural History, a microsporidian expert, to describe and name this organism. Microspora are obligate pathogens and can be costly to produce commercially, however, they have been commercialized and one is currently used for grasshopper control (i.e. NoLo Bait, M & R Durango, Inc. Bayfield, CO). As a group, microspora generally reduce insect fecundity, longevity and overall population growth, however, there are other microspora such as this one that cause acute toxicity to their host. One of the main benefits of implementing microspora in a pest management program is their host specificity. Investigations into the development of a new microbial control agent are necessary in order to provide nursery growers with additional alternatives for managing BVW populations. Laboratory studies have shown that the BVW microsporidian is extremely virulent against 3rd instar BVW (Figure 1). In laboratory studies, 100% of the BVW larvae ingesting 100 or more spores were dead within 12 days. These data suggest that this microsporidian not only has the potential to attenuate BVW populations in the field, but also may be useful to eliminate larval infestations, particularly in containerized production systems.

Figure 1


Mean Number of Days Until Death
18
16
14
12
10
8
6
4
2
0
100
90
80
70
60
50
40
30
20
10
0
% Larval Mortality
Days Until Death
% Mortality
0
10
100
1,000
10,000
100,000
Spore Dose

Section III
Biological & Cultural Control

Effect of Potting Media Components on the Persistence of *Metarhizium anisopliae* for Black Vine Weevil Management

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Experiments were conducted in 2005 to evaluate the persistence of the entomopathogenic fungus, *Metarhizium anisopliae*, for control of black vine weevil, *Otiorhynchus sulcatus*, larvae in different types of soilless potting media components. The persistence of *M. anisopliae* was evaluated over a 4-5 month period.

Fungal Persistence

The black vine weevil (BVW), *Otiorhynchus sulcatus* (F.) is a serious pest of nursery crops, particularly in the Pacific Northwest. The fungus, *Metarhizium anisopliae*, has recently been registered by the US Environmental Protection Agency for BVW control. The objective of these studies were to determine the persistence, measured as efficacy against BVW larvae, of *M. anisopliae* in five (coir, fir bark, hemlock bark, peat moss and perlite) common soilless potting media components. Each media component was incorporated with ½ lb/yd^3 of fungal granules at potting and fungal persistence determined for 133 days. Experiments were performed with and without plants to determine if the presence of a plant had any impact on fungal persistence. Overall, the fungus persisted well in all of the potting media components tested up to 133 days post application (Table 1). Persistence was somewhat reduced in the first run of the experiment likely due to fluctuating media moisture. In the second run of the experiment with more stable media moisture levels, the percentage of larval infection did not drop below 88% in any media at 133 days post application. It is likely that *M. anisopliae* will persist well and provide high levels of BVW larval control in most of the commercial potting media used in containerized nursery production, particularly those comprised primarily of the media components tested in these studies.

Table 1. Mean (±SD) percentage of black vine weevil larvae infected with *M. anisopliae* at each sample date in each potting media component incorporated with ½ lb/yd^3 of formulated *M. anisopliae* granules from two experiments.

Day	Media Component	Experiment 1	Experiment 2
8	Coir	98.13 (4.03)a[a]-[b]	
	Fir Bark	98.75 (3.42)a	-

	Hemlock Bark	100 (0.0)a	-
	Peat	98.75 (5.01)a	-
	Perlite	100 (0.0)a	-
28			
	Coir	96.25 (5.00)a	95.00 (6.33)a
	Fir Bark	96.25 (8.90)a	92.50 (10.64)a
	Hemlock Bark	98.13 (5.41)a	93.75 (7.18)a
	Peat	98.13 (5.41)a	92.50 (11.25)a
	Perlite	95.63 (8.12)a	91.88 (9.81)a
56			
	Coir	99.38 (2.50)a	95.00 (8.16)a
	Fir Bark	96.43 (8.43)a	92.50 (7.74)a
	Hemlock Bark	97.50 (5.80)a	96.88 (7.93)a
	Peat	97.50 (5.80)a	88.75 (10.88)a
	Perlite	97.50 (5.80)a	71.25 (15.86)b
77			
	Coir	58.00 (23.41)a	95.63 (7.27)a
	Fir Bark	65.63 (18.91)a	95.63 (7.27)a
	Hemlock Bark	66.25 (15.86)a	96.88 (7.04)a
	Peat	67.50 (23.52)a	96.88 (6.02)a
	Perlite	2.50 (7.7)b	96.67 (6.17)a
105			
	Coir	85.63 (15.51)a	89.38 (13.40)ab
	Fir Bark	59.67 (33.40)b	84.38 (15.98)b
	Hemlock Bark	73.75 (25.00)ab	88.67 (13.56)ab

	Peat	81.25 (19.28)a	91.25 (10.88)ab
	Perlite	91.88 (20.07)a	99.38 (4.43)a
133			
	Coir	82.50 (15.71)a	96.88 (4.79)a
	Fir Bark	41.88 (29.26)c	88.75 (13.60)b
	Hemlock Bark	59.38 (27.68)bc	95.63 (6.29)ab
	Peat	75.00 (29.66)b	93.13 (6.29)ab
	Perlite	97.50 (5.78)a	96.25 (7.19)a

[a] Means followed by the same letter on the same sample date within a column are not significantly different ($P < 0.05$).

[b] Sample not taken.

Section III.
Biological & Cultural Control

IDAHO CEREAL LEAF BEETLE (*Oulema melanopus*) BIOCONTROL PROJECT UPDATE

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CLB was detected in Benewah County, which is a new county record for 2005. Shoshone and Clearwater county surveys were negative. This pest now occurs in 42 out of 44 Idaho counities. Biocontrol agent releases were made with the larval parasite, *Tetrastichus julis*, at a site in Kootenai County near Hayden Lake airport and at the Thiessen Ranch near Lewistion in Nez Perce County. Two field surveys conducted in June in Canyon County found a *T. julis* parasite levels over 50% in CLB larval samples.

A field insectary for the egg parasite, *Anaphes flavipes,* was initiated in the spring of 2004 at the University of Idaho, Southwest Idaho Research & Extension Center in Parma. Additionally, four releases of egg parasites were shipped in from the Colorado Department of Agriculture Insectary in Palisades during the peak CLB egg-laying period between May and June of 2005. There was successful reproduction and recovery of the egg parasites in the insectary field this season. Follow-up surveys will be conducted in the spring of 2006 to determine if the egg parasites successfully established and overwintered in the insectary field.

Section IV
Cereal Crop Pests

COMPARISONS OF SEED TREATMENT WIREWORM INSECTICIDES IN SPRING WHEAT 2005

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A replicated RCBD trial, sponsored by Bayer Crop Science, of 12 treatments including fungicide only and an untreated check with 4 replications of 10 x 20 feet each per treatment was seeded by Hegi Cone Seeder on May 17, 2005 in 7 inch row spacings. The Variety Alpowa was selected for lack of resistance to insects and common use locally. This trial was seeded into mustard ground following a dry cold winter with a wet late spring. The goal of the trial was to measure effect of *Limonius canus* wireworm damage to plant stand per 1/3 square meter. Plant stand was counted on June 8, and was harvested for yield on July 26 by Winter Steiger Small Plot Combine. The data below show a strong relationship between plant stand reduction and yield attributed to wireworm damage. Practical use rates for commercial farming fall in the "B" range with other trials showing Cruiser at 0.35 equivalent to Gaucho 480 at 0.32. The total moisture in ppt. and irrigation was set at 13.5 inches for this trial to mimic the typical low intermediate rainfall zone.

Table 1. LSD All-Pairwise Comparisons Test for swsw Bu/Ac

Treatment	Rate/Cwt	Mean Bu/AC
Poncho	0.77	43.40A
Gaucho 480	1.00	43.13A
Cruiser	0.80	42.25B
Poncho	0.20	40.20B
Poncho	0.10	39.90B
Gaucho 480	0.32	39.88B
Gaucho 480	0.16	37.83C
Lindane	1.00	32.85D
Gaucho 480	0.16 + DE + MG	32.28D
DE		32.00D
RXT		27.30E
UTC		25.83E

Alpha	0.1	Standard Error for Comparison	6.3729
Critical T Value	1.688	Critical Value for Comparison	10.759

Table 2. LSD All-Pairwise Comparisons Test of Plant Stand 1/3 M SQ

Treatment	Rate/Cwt	Mean Plant Stand
Poncho	0.77	15.25A
Poncho	0.20	14.75A
Gaucho 480	1.0	13.00B
Poncho	0.10	12.75B
Lindane	1.0	12.50B
Cruiser	0.80	12.25C
Gaucho 480	0.32	11.25C
Gaucho 480	0.16	10.50D
DE		9.75D
RXT		9.75D
UTC		8.50E

Alpha 0.1 Standard Error for Comparison 0.8114
Critical T Value 1.697 Critical Value for Comparison 1.3771
There are 5 groups (A, B, etc.) in which the means are not significantly different from one another.

Section IV
Cereal Crop Pests

ECOLOGICAL EFFECTS OF CROWDED INSECTS IN WINTER WHEAT

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Bare spots in a winter wheat field resulting in ca. 40% loss of the winter wheat crop occurred in a field near Rockford, WA. This field was taken out of Kentucky Blue Grass last summer, (2004) and seeded to wheat using a low rate of Lindane as the seed treatment insecticide. I found a complex of insect larvae feeding on the crowns and roots of this wheat in February 2004.
Wireworm larvae (Elateridae) ***Limonius canus*** LeConte were present in a fairly dense population (ca. 1 per square meter up to 3 per square meter). This alone would allow for major stand reduction.

Pyralid moth larvae of the Genus ***Crambus***, which are much larger that the Blue Grass Webworm, ***Crambus teterellus***. I believe without having adult specimens, but with "Arnett American Insects" these moth larvae are likely to be ***Crambus agitatellus*** Clemens, the Grass Webworm, and, **Crambus vulgivagellus** Clemens, the Vagabond Webworm. Both are occasional pests on the crowns and roots of winter wheat and ***agitatellus*** is a cyclic species appearing under certain dry winter conditions. A significant number of maturing larvae of the Army Cutworm, ***Euxoa auxiliaris*** Grote, a common and serious pest of winter wheat, was also numerous in the field. Black Cutworm is reported to be resistant to *B. bassiana* and a sample will be collected to send in for pathological analysis. Any one of these three pests in the numbers present by each species could account for serious damage to the wheat stand. There were more larvae in the lighter soils moving up slope in the wheat.

In the adjacent **Blue Grass** fields, I found the typical situation of Blue Grass Webworm, ***Crambus teterellus*** (Zinken) in a variety specific relationship in large numbers, under droughty conditions in older stands of grass. This moth has pink tinged larvae smaller that the Vagabond Crambus, which has grey spotted larvae. Note: the Cranberry Girdler ***Crambus topiaria*** (Zeller), which does not feed on cereals or Blue Grass sod, was not involved and is an artifact of literature. All Crambine moths lay eggs after adult emergence post harvest. The 1^{st} instar larvae
feed on the crowns for a time then over winter as larvae which begin feeding in the early spring, pupating as the crop matures. There is one generation per year for most webworms. There are over 400 species in several genera. The bottom line is – a webworm is a webworm and one should go by damage and not wait for specific species ID. Better seed treatments need to be applied following grass field take out when seeding to wheat.

Another interesting wrinkle – many of the larger Lepidoptera larvae in both the wheat and the Blue Grass fields examined were showing signs of a pathogenic fungus, ***Beauvaria bassiana*** spp. which covers the dead larvae with white cottony hyphae. The webworm larvae and cutworm larvae reared for adult specimens died of this pathogen. This may be a result of wetter conditions following a very dry winter, and very high insect populations, since research shows the Blue Grass Webworm is more of a pest under drought conditions or very light soil.

FALSE WIREWORM VS TRUE WIREWORM IN WHEAT

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This time of year False Wire Worm ***Eleodes hisperlabrus***, is a frequent crosser of rural roads between harvested grain fields. Frequently this beetle, called the false wire worm, is confused with the true wire worm species which feed on cereals and other crops.
The false wire worm is a beetle belonging to the Family Tenebrionidae Genus *Eleodes* a genus containing black beetles (Tenebrio means darkness in Latin). This species feeds on chaff, spilled grain, crowns and roots of stubble. Larvae closely resemble true wire worms, and live in the soil for long periods. Tenebrionidae larvae often have spines on the terminal abdominal segment that confuse those seeking an ID. Adults are easily raised on bran with pieces of apple for moisture. They are not a pest species!

There is no reason to spray these beetles as they are non-pests feeding on crop aftermath. Field mice eat the adults and their eggs and become part of a mitochondrial parasite (*Wolhbackia*) ring. The mice also eat the oocysts produced by parasitized adult female beetle.

Most members of the Genus *Limonius* Eschscholtz (5 species) Coleoptera: Elateridae, have root or crown plant feeding larvae. Each species has a structure called a "signature" on the last abdominal segment. These allow simple ID of larvae when compared to a larval key. Adults are black shiny beetles that "click" when turned onto their backs, flip up and land on their feet. Other Elaterid beetles have eye spots, or are colorful.

Limonius canus (LeConte) Coleoptera Elateridae, the Pacific Coast Wireworm has been a pest of cereals, and other crops since the SE Washington land was broken out of sage brush and put into cereal grain production ca. 150 years ago. ***Limonius californicus*** Mannerheim, the Sugar Beet Wireworm, is typically a pest in potatoes and sugar beets in the irrigated Columbia Basin. A personal communication from Dr. Gary Reed, OSU Emeritus, states that ***americanus*** is resistant to the seed treatments as compared to ***canus*** Another species, ***Limonius subauratus*** LeConte, is called the Columbia Basin Wireworm, and is also present.
Traditionally, wheat/summer fallow rotations kept wireworm damage in cereals at a minimum. The insecticide Lindane ™ was developed during the Great Golden Era of pesticide development. Lindane has been a standard seed treatment for many years. Lindane seems to be more of a repellent than a toxicant to wire worm larvae in the field. Due to phytotoxicity, Lindane is being discontinued by BayerCropScience. Most cereal growers seek aphid and Hessian fly management along with wire worm management. Since 1992 much research has been done on seed treatment insecticides for management of cereal pests. Recent research trial data show efficacy for Gaucho (Imidicloprid), Cruiser (Thiomethoxam), and a new product, Chlothianidin, has efficacy at the parts per trillion levels. In 2005 winter wheat crops began to be affected by wire worm as late as February when rains brought the wire worms to the surface after a dry winter.

SPRING WHEAT TRIAL COMPARING CRUISER AND GAUCHO 480 FIELD RATES 2005

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Much discussion about what rates of Gaucho 480 and Cruiser should be used for wireworm and Russian wheat aphid management in spring wheat has been held over recent years. So a RCB trial using “Alpowa” SWSW was seeded with 8 treatments of 4 replicates each of 4 x 16 feet. Seeding by was by Hegi Cone Seeder in 7 inch row spacing = 60 lbs per acre. The variety Alpowa soft white spring wheat was seeded on 5-13-2005. Moisture was lower than for the other bigger spring wheat trial at 11.5 inches including rain fall and irrigation. Hence the yields are proportionally lower but still similar to commercial fields close by CFRF. Harvest data were collected by Winter Steiger Plot Combine on 7-23-05.

Table1. Plant stand, Aphid %, and yield for comparison trial 2005

Treatment	Rate/Cwt	Stand .2 meter sq.	RWA%	Bu/Ac
Gaucho 480	0.35	14.3	5.3a	35.0a
Cruiser	0.35	16.1	5.3a	34.6a
Cruiser	0.19	13.5	3.5b	32.2b
Gaucho 480	0.16	14.6	34.6c	25.6b
DE only	1.00	12.8	100.0c	27.6b
RXT only	0.16	1 4.6	100.0c	24.0c
Mystery ST	24.00	13.9	100.0c	24.4c
UTC	------	12.8	100.0c	21.1d

AOV; LSD t Test 0.10 Yield CV = 17.6 Stand CV = 12.7
RWA % CV = 1.78

Conclusions of Comparison Trial for Gaucho and Cruiser Rates 2005
1) Wire worm were present at seeding but high CV for WW indicates they were not a major factor in plant stand density (.3 M Sq) = 22 “ row. This is probably due to wireworm withdrawal as moisture levels dropped.
2) Based on Russian Wheat Aphid % infested tillers and resulting yield data the rates of Gaucho 480 and Cruiser compare on a rate basis as usual.
3) The current trend is to use a rate of ca. 0.35 fl oz/cwt for both products individually, for similar cost and efficacy.
4) Yield results of ca. 15 bu/acre over non-insecticide treatments show the need for a seed treatment insecticide in the mid-range of rates. Poncho 600 (Chlothianidin) is still under rate specific trial study and shows promise at low rates, but was not included in this trial. Future work might be well served using a Latin Square design with fewer treatments.

Section IV
Cereal Crop Pests

WIREWORM MANAGEMENT IN FALL SEEDED WINTER WHEAT 2004-2005

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A winter wheat trial, sponsored by Bayer Crop Science, was planted 10-11-04 in RCBD 4 replicates per treatment w/ 5 ft. between all sides each replicate of 10 x 20 feet. Row spacing was on 7 inches = 60 lbs seed per acre equivalent using a Hegi Cone Seeder. Variety Mix = 50/50 Rod/Madsen SWWW. Soil type = Chard. Previous crop = sweet corn. Trial was rated for wire worm injury 4-8-05 by counts of plant stand in 22” of (1/3 meter sq.) row per replicate per treatment due to long dry winter. Rated for BYDV expression on 4-8-05 by percent plants infected. Harvest was by Winter Steiger Small Plot Combine on 7-25-05. Total irrigation not measured daily but enhanced rainfall totaling 6 inches to total 17” moisture per crop season. Wireworm (*Limonius canus*) did reduce stand and yield in this trial as shown in Table 1. Bu/ac data LSD t Test. The Gaucho and higher Poncho treatments had the best yields compared to the other treatments and the UTC of Raxil XT. Aphid activity may have influenced the UTC treatment, but stand reduction due to wire worm damage seems to be the SD factor related to yield and stand (Table 2. LST t Test for plant stand.)

Table1. LSD All-Pairwise Comparisons Test for 2005 Winter Wheat Yield Bu/Ac converted from lbs/treatment/replicate at 60 lbs TW 7-25-05 281 DPE

Treatment	Rate/Cwt	Mean Bu/AC
Gaucho	1.50	126.00A
Gaucho	1.00	121.75A
Poncho	0.77	119.25AB
Poncho	0.26	113.75B
Cruiser	0.80	107.00C
Poncho	0.52	104.00C
UTC	----	94.25D

Alpha 0.1 Standard Error for Comparison 6.4310
Critical T Value 1.721 Critical Value for Comparison 11.0660

Table 2. LSD All-Pairwise Comparisons Test Plant Stand per 22 “ foot row winter wheat taken 4-08-05 = 212 DPE

Treatment	Rate/CWT	Mean Plant Stand
Poncho	0.77	12.75A
Cruiser	0.80	12.25A
Poncho	0.52	12.00A
Poncho	0.26	11.75A
Gaucho	1.5	10.75B
Gaucho	1.0	10.25C
UTC (RXT)		7.00D

Alpha 0.1 Standard Error for Comparison 0.6501
Critical T Value 1.721 Critical Value for Comparison 1.1186

Table 3. LSD All-Pairwise Comparisons Test for BYDV Expression in winter wheat 2005 Trial rated on 4-8-05 = 212 DPE

Table 3. Treatment	Rate/cwt	Mean % Tillers Showing BYDV
UTC	----	34.75A
Cruiser	0.80	1.00B
Gaucho 480	1.50	1.00B
Gaucho 480	1.00	1.00B
Poncho	0.77	1.00B
Poncho	0.52	1.00B
Poncho	0.26	1.00B

Alpha 0.1 Standard Error for Comparison 0.1336
Critical T Value 1.721 Critical Value for Comparison 0.2299
All treatments were effective in managing BCOA during the fall into late winter as compared to the check.

Section IV
Cereal Crop Pests

2005 CEREAL LEAF BEETLE SURVEY OF UTAH

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Final report of a statewide survey, covering all 29 counties of Utah with the distribution and population levels recorded during the summer of 2005 of the cereal leaf beetle pest, *Oulema melanopus* (Linnè) in Utah. The objective of the CLB state survey was to determine if the any life stages of the cereal leaf beetle pest were present and the extent of infestation of cereal leaf beetles in the grain growing counties of the state. Data in the report will help to satisfy the requirements of the California Cereal Leaf Beetle Quarantine.

The overall objective of the CLB survey was to examine a minimum number (usually 5 or 6) of grain fields in each of the 29 counties of the state including whenever possible fields of wheat, oats and barley and recognize those counties which have detectable live forms of CLB or established populations in agricultural grain fields. In some cases triticale, rye and miscellaneous grasses were surveyed. An hp iPAQ 5500 Pocket PC with ISIS data collecting software was installed and used to identify and record date in the field for most of the survey sites. In addition all fields were identified with longitude and latitude using a Garmin eMap GPS unit at the stopping place on the edge of each location and a Field Work Data Sheet (FWDS) filled out to obtain a second hard copy of the data. Data recorded included all or in part: state, county, nearest town, location, crop, acreage, farmer, date, time, weather conditions, temperature, wind, crop condition, insect life stages present and numbers, survey method, pesticide use and surveyors name. Space was also provided for a small map to aid in identifying the survey site. An estimate of the acreage of the particular crop was recorded for most sites. Grassy fence rows, ditch banks and debris adjacent to grain fields or fields that were planted to grain during the previous growing season were sometimes surveyed in a similar manner since these sites are used as hibernation and feeding sites for the beetles during certain periods of the year.

The cereal leaf beetle is most successful in flood or sprinkler irrigated fields but in areas where these are not available dry land grain fields were included to make the survey complete for the county. In the past a number of infested dry land grain fields have been detected with cereal leaf beetle infestations but the beetles never seem to become established and the populations usually die out in subsequent years. Comparable populations and infestation levels of insects per square foot or per 100 sweeps were recorded by using USDA standards developed in the eastern United States. This data for each site is recorded and reported on a standard Field Work Data Sheet (FWDS). The survey of a field starts by using a standard 15 inch insect sweep net. This method detects very low population levels in most fields where other methods are not successful. In highly infested fields the number of eggs, larvae, and adults are counted and recorded for 1 square foot of planted crop. Positive and negative survey data were recorded on FWDS. Specimens, usually adults or possible feeding damage, may be observed during the movement from the different sites in the field and noted as valid data. If no specimens are collected or observed and only suspected feeding damage is observed during the previously described procedures, the field is considered free of cereal leaf beetles for the current year in this report.

Information from all field surveys and the data collected in the statewide survey is used to determine distributions and density of population of CLB for the entire state. Fields are first sampled by using a standard 15" sweep net and sweeping at least a total of 100 sweeps in at least five locations in the same field. Visual observations of any feeding damage are made and any flying specimens observed during the movement to each site are recorded. Positive observations are followed by additional sampling. This sampling procedure includes visual examination of 1 square foot of crop randomly picked from five widely separated places in the field. At each site a standard 20.5 inch stick is used to measure a short section of planted row of the crop. Plants in a row along this measured stick have been determined to be equivalent to 1 square foot of planted grain. Feeding damage or any life stage of the CLB on the growing plants are noted and recorded on the Standard FWDS. Field locations, crop type, crop age and condition, environmental factors and weather conditions are also recorded. If nothing or only suspected feeding damage is found, the field is considered free of cereal leaf beetle pest for the current year.

The first cereal leaf beetle specimens were collected in Cache County in March 2005. The earliest date CLB have been observed in Utah is the last week of February in 1999. Hibernating specimens can be found throughout the year if observations are made in the proper places such as under bark and similar hiding places. Early emergence of the beetle from hibernation sites coincides with the warm days in the spring. These early females feed for several weeks to store up energy in preparation for egg production. Ordinarily cereal leaf beetle egg laying activity does not start until late April. The first recorded field surveys were made in April in Logan, Cache County when eggs and adults were observed. An abundance of eggs and adults were observed during the next few weeks in May. Official survey activities for the project did not start until 5 May 2005 as we started to test the new ISIS program. As the new program was put into service, data was recorded on the 18th and 19th of May when substantial egg laying and some larvae were observed on emerging grain plants during frequent trips to the fields in Cache, Box Elder and Weber Counties. Some of the early egg laying and first instar larvae were damaged by cool, wet weather and frequent rain storms. The peak of egg hatching and larval feeding activity in northern Utah occurred during the period from the middle of May to the middle of June depending upon the stage of grain grown and the locality. Young and succulent grain is preferred just as oats and barley are preferred over wheat if the pest has a choice between nearby fields. The early egg laying and first instar larvae damaged by the cool, wet weather and frequent rain storms reduced the populations during this period of normal high frequency population levels. This may account for the low incidence of CLB in fields of some counties where beetles were more abundant in previous years. Sprinkle irrigation can also reduce population levels of eggs and young larvae as effective as a spray application during this time.

Feeding damage to the grain leaves can be detected even in dry, older browning leaves at the base of the grain plants. Survey activity throughout the months of May, June and July concentrated on completing the state-wide CLB survey in all 29 counties. It is believed that because of severe drought conditions in the state during the past few years the CLB populations have decreased in many counties. Survey data has confirmed this fact. In some cases the survey detected no CLB specimens or any feeding activity in fields that had fair or minimal populations in previous years even less than last year. In many cases a much more rigorous and extensive survey was conducted including additional fields, closer observation for feeding activity and additional sweep net sampling. The results are summarized at the end of the report but briefly the CLB pest is decreasing all over the state in the number of counties infested and the level of infestation in many counties.

All 29 Utah counties were surveyed which included a total of 152 observations and some additional unrecorded sites. A few sites were surveyed twice or three times on different dates to substantiate the presence or absence of CLB but only the first survey is included in this report. The following is a summary of the results with some interesting notes.

Cache (5 sites), Box Elder (5 sites), Weber (5 sites) and Davis (6 sites), report all sites with well established populations of CLB. Many more sites were surveyed in these counties and monitored for the biological control project. Most sites have also established larval parasite populations that control the economic damage of the pest.

The following counties have established populations of CLB but the beetles are either decreasing in severity at the individual sites or in the number of sites in the county:

Davis with 5 sites surveyed, established populations at 5 of the 6 sites.
Utah County with 6 sites surveyed, five sites with well established populations and one site with no detectible populations.
Tooele with 6 sites surveyed only two of which had a very low CLB population. No CLB at the other sites.
Sevier with 6 sites surveyed and established populations of CLB at 2 of these sites.
San Pete with 5 sites surveyed and established populations of CLB at 5 sites.
Rich with 5 sites surveyed for CLB and very low populations of CLB at 4 sites.
Morgan with 5 sites surveyed for CLB beetle had established populations of CLB at 1 site. This is the county of the original discovery of CLB in 1984 when over 1000 acres was infested.
Juab with 5 sites were surveyed for CLB with established populations at one site.

The following counties had no signs or evidence of CLB life stages during the indicated number of survey sites:

Beaver; 5 sites surveyed.
Daggett; 5 sites surveyed.
Emery; 4 sites surveyed.
Garfield; 6 sites surveyed.
Grand; 6 sites surveyed.
Iron; 6 sites surveyed.
Kane; 5 sites surveyed.
Millard; 6 sites surveyed.
San Juan; 5 sites surveyed.
Washington; 6 sites surveyed.
Wayne; 6 sites surveyed.
Piute; 6 sites surveyed. The site with one positive larva in the field two years ago had young grain but no signs or evidence of feeding damage this year or last year

The following counties have had CLB life stages found in the county during previous years but no signs or evidence of the beetle this year:

Salt Lake; 5 sites surveyed but no CLB present even at the site that two years ago had larval or adult life stages of CLB present.
Duchesne; 6 sites surveyed for CLB had no signs or evidence of any life stages even at the same sites where larva and adults were collected in previous years.
Carbon; 4 sites surveyed for CLB had no signs or evidence of CLB or any signs of feeding damage.
Some life stages of CLB have been found in a few fields in past years.

Piute; 6 sites surveyed. The site with one positive larva in the field two years ago had young grain but no signs or evidence of feeding damage this year or last year

Wasatch; 5 sites surveyed for CLB had no signs or evidence of CLB this year.

Uintah; 6 sites surveyed. Fields with larvae in the field last year had no signs or evidence of feeding damage this year.

All data available on collecting sites (longitude and latitude), specimens found, life stages, population density, grower's name, survey date, crop, and acreage were tabulated and placed in a Microsoft Excel computer file.

Summary: No evidence of cereal leaf beetle presence was found in the twelve southernmost counties of the state and five northeastern counties, which included 152 surveyed fields. This increase in the number of counties with no CLB populations (17 counties) is probably a result of the prolonged drought that Utah has experienced. It is expected that new populations and infestations will be found in the coming years because of increased rainfall and the introduction of more efficient irrigation systems by underground pipes, wheel lines and pivots. There was a total of approximately 285,000 acres of grain planted (estimated from 2003 figures) in Utah during the 2005 growing season. The survey therefore averaged about one field for each 1,875 acres planted. The target acreage was much greater than this figure since irrigated fields were targeted over dry land acreage in most counties.

WIREWORM CONTROL WITH SOIL APPLIED INSECTICIDES, 2001

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Two insecticide efficacy trials were planted at the Kimberly R & E Center, Kimberly, Idaho, to compare the efficacy of broad-spectrum and narrow spectrum insecticides and evaluate different application methods for control of wireworms in potatoes. The experiments consisted of 6 in furrow chemical treatments and 10 seed treatments, plus untreated check plots, arranged in a RCBD replicated 4 times. Individual treatment plots consist of 2 rows (36 inch row spacing) by 25 ft long with 5 ft alleyways separating the plots. Each treatment plot has an untreated check consisting of two untreated rows on the side to avoid the problem of localized wireworm populations. Potato seed was machine cut and treated with a fungicide and with different insecticides according to the treatment. Fifty tubers per each 25 ft row, for a total of 400 tubers per treatment and 6,800 for the whole experiment were harvested the first week of October and examined for feeding damage. The weight and number of external feeding sites was recorded for each tuber. Data on efficacy of treatments were compared and analyzed using ANOVA and LSD multiple means comparison.

The mean number of holes per tuber, percentage of affected tubers, weight per tuber, and USDA number one tubers (tubers weighing more than 114 grams and with no defects were considered number 1) are included in Table 1 (for the seed treatments) and Table 2 (for the IFAP treatments). The untreated controls (UTC) are also included in the table and represent an average of all the respective controls for each of the treatments. In furrow treatments in general presented a lower average number of holes and a lower percentage of affected tubers than those found with the seed treatments.

Table 1. Efficacy of insecticide seed treatments to reduce wireworm damage.

Treatments & Rate	Average # Holes/ Tuber	% Affected Tubers	Mean Weight/ Tuber	% Grade 1 Tubers
9. Gaucho MZ (12 oz/CWT)	0.8275e	33.5b	200.5a	27.25c
4. Poncho 600 FS (0.48 fl oz/CWT) + Tops MZ (12 fl oz/CWT)	0.84e	31.25b	191.35ab	35.75abc
10. Regent Brand 4 SC (0.15 fl oz/CWT)	0.8875e	29.75b	186.66abc	36.5abc
6. Genesis (0.8 fl oz/CWT)	0.945e	41b	167.92de	29.25bc
8. Maxim 4 FS (0.04 fl oz/CWT) + Cruiser 5 FS (0.13 fl oz/CWT)r	1.07de	43.25b	162.63e	32.5abc
1. Tops MZ (12 fl oz/CWT)	1.2275cd	44.5b	176.96bcde	45a
3. Poncho 600 FS (0.32 fl oz/CWT) + Tops MZ (12 fl oz/CWT)	1.3125cd	43.25b	169.5de	45.25a
2. Admire 2 Flowable (0.60 fl oz/CWT) + Tops MZ (12 fl oz/CWT)	1.4350bc	41b	188.85abc	41ab
UTC	1.6347b	47.375b	175.02cde	42.425ab
5. Admire (0.87 oz/CWT)	2.115a	60a	175.5bcde	39.25abc
7. Maxim 4 FS (0.08 fl oz/CWT) + Cruiser 5 FS (0.11 fl oz/CWT)	2.26a	61.25a	182.06bcd	35.5abc

Column values with different letters were significantly different in a general ANOVA with a LSD criterion at the 0.05 level

Table 2. Efficacy of insecticide IFAP treatments to reduce wireworm damage.

Treatments & Rate	Average # Holes/ Tuber	% Affected Tubers	Mean Weight/ Tuber	% Grade 1 Tubers
1. Mocap 6EC (128 fl oz/A) + Admire 2 Flowable (16 oz/A)	0.3700e	15.500b	112.93c	20.25bc
3. Regent 4 SC (3.2 fl oz/A)	0.5300de	21.500ab	105.78c	19.25bc
2. Mocap 6EC (128 fl oz/A) + Temik 15G (320 oz/A)	0.6850cd	29.250ab	158.13a	32.75a
5. Mocap (128 fl oz/A)	0.6975cd	31.250ab	125.73b	22abc
4. Thimet (240 oz/A)	0.7375c	32.750ab	154.16a	26abc
UTC	1.0754b	36.536ab	155.04a	29.357ab
6. Temik (320 oz/A)	1.3375a	45.750a	157.66a	31ab

Column values with different letters were significantly different in a general ANOVA with a LSD criterion at the 0.05 level

POTENTIAL MONITORING STRATEGIES FOR IMPROVING

ROOT WEEVIL MANAGEMENT IN NURSERY AND SMALL FRUIT CROPS

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Root weevil (Coleoptera: Curculionidae genus *Otiorhynchus*) damage to nursery and small fruit crops is a chronic problem and a high priority concern to manage effectively. Resources are often futilely expended to control the pests but necessary to attempt to reach the elusive zero-tolerance level enforced on host plant shipment and sales. Efforts to improve timing of spray programs to optimize control by curtailing fecundity of adults have been limited in success, and further refinement of degree-day modeling and weevil biology is appreciated. Monitoring development by digging larvae and trapping of adults with novel equipment is the focus of a multi-year research effort at different sites and situations in the north to mid-Willamette Valley, where much of the production occurs.

Weekly visits to various nurseries and strawberry fields were necessary in the critical spring and summer seasons to count adults, monitor development (by digging), maintain traps, and download soil and air temperatures from data loggers. Results of stage and abundance were often given to managers anxious to adjust their spray programs accordingly.

Two types of traps were implemented for relative comparison. Both traps involved sticky plastic substrates, to detain the adults, and bait consisting of small dried apple chips. One trap, called the Exotior™ Black Vine Weevil Trap, by Exosect (UK), had been used in a limited area the previous season with some success. The second trap, tested for the first time, was a circular cover (1 ft diameter or 60 cm) with many openings, with two sticky plastic circles facing parallel 5 cm apart under the lid with a central circular spacer and secured to the ground by a spike. Fifty traps of each type were set among containers or susceptible in-ground plants at 6 separate sites (3 nurseries, 2 strawberry fields, 1 university campus). Two HOBO™ data loggers at each site were used, each with 3 probes, 2 for soil temperatures (3-5 cm deep) and 1 for air (1 meter height).

Downloading of data occurred weekly. Root zones of plants and surrounding media in containers or field soil ground were examined for larvae, pupae and adults. Transformation of data was employed, using a 10^{o}C baseline to obtain cumulative degree days, both hourly and daily from a high-low averaging. Stages, species, and numbers of weevils were tabulated and proportioned to get developmental curves for each site, and matched to the cumulative degree days at the corresponding dates (Figure 1). Comparisons of models and development curves were established for a yew field, where a nearby site was monitored in 2003 (Figure 2).

Results of trapping showed an obvious superiority of the Exotior™ trap to retain weevils (Figure 3), accounting for almost 95% of the weevils captured. A modification of the lid trap is warranted to be of any practical use for further monitoring. Differences of relative abundance by species and site/host plant were notable during the season. The two strawberry fields differed in species composition. Black vine weevil, *Otiorhynchus sulcatus*, generally eclosed two weeks earlier than the strawberry root weevil, *Otiorhynchus ovatus*. The incidence of rough strawberry root weevil, *Otiorhynchus rugosostriatus,* was less patterned and could be bimodal as previously reported by L. Tanigoshi. Traps in the strawberry fields were pulled earlier (late June), to allow for renovation, so collections of data were not conducted later in the summer. One site, the yew field, accounted for almost half of the total weevils caught, and one trap was responsible for almost 40% of the total (Exotior™) for the site (19% of total weevils caught), while a few (3 of ten) had less than 5 weevils for the season. Trapping needs to be explored further to be an effective and accurate index of weevil abundance and movement for practical timing of spray programs.

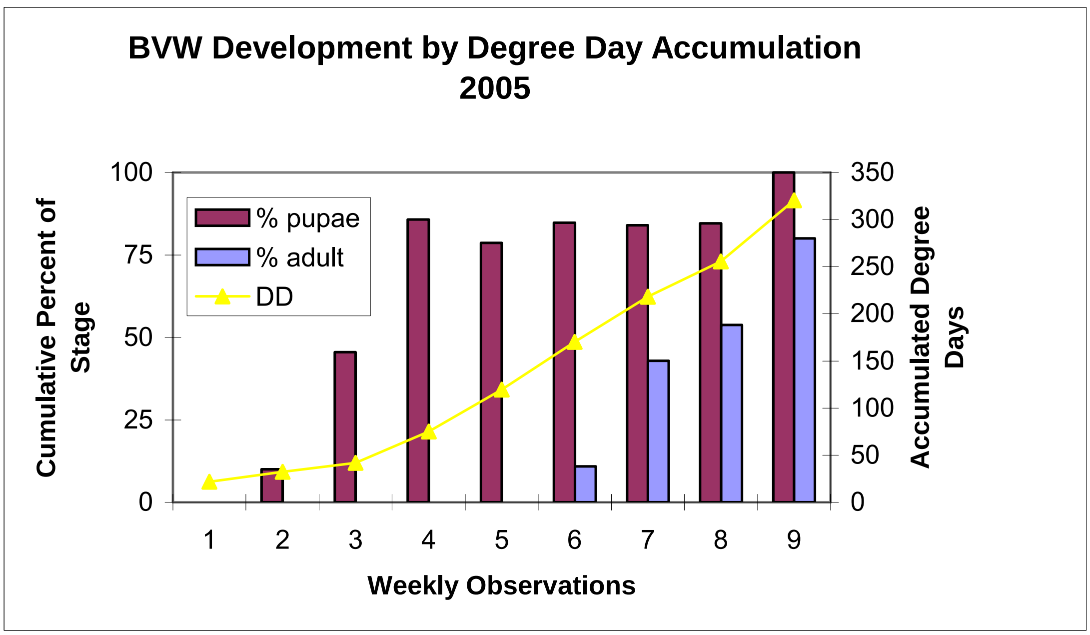

Figure 1

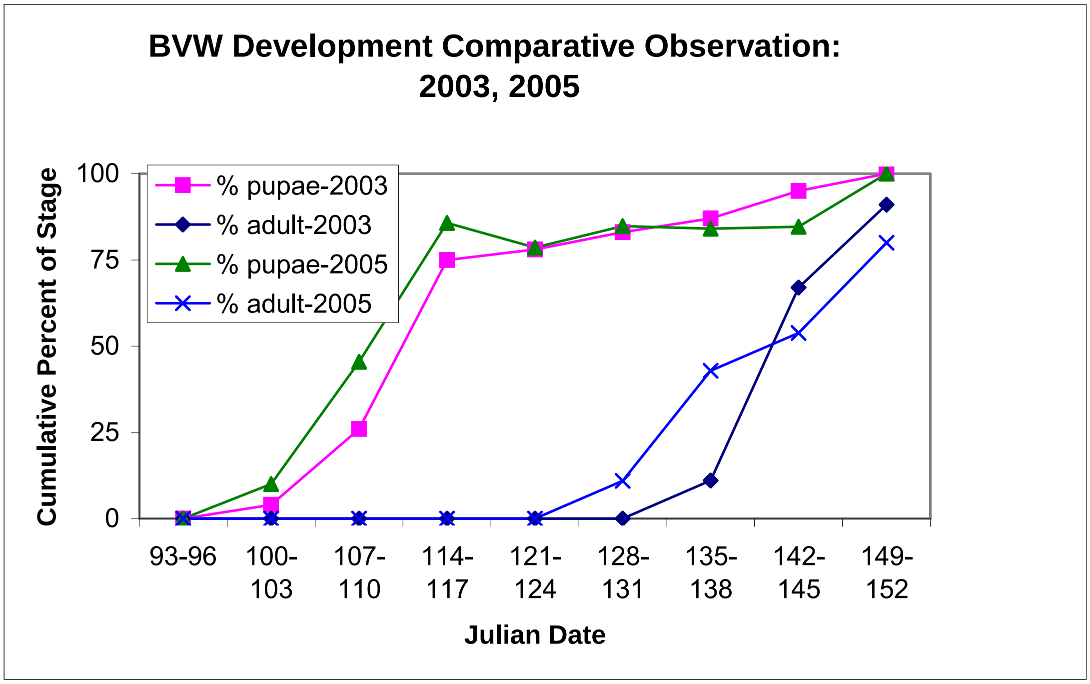

Figure 2

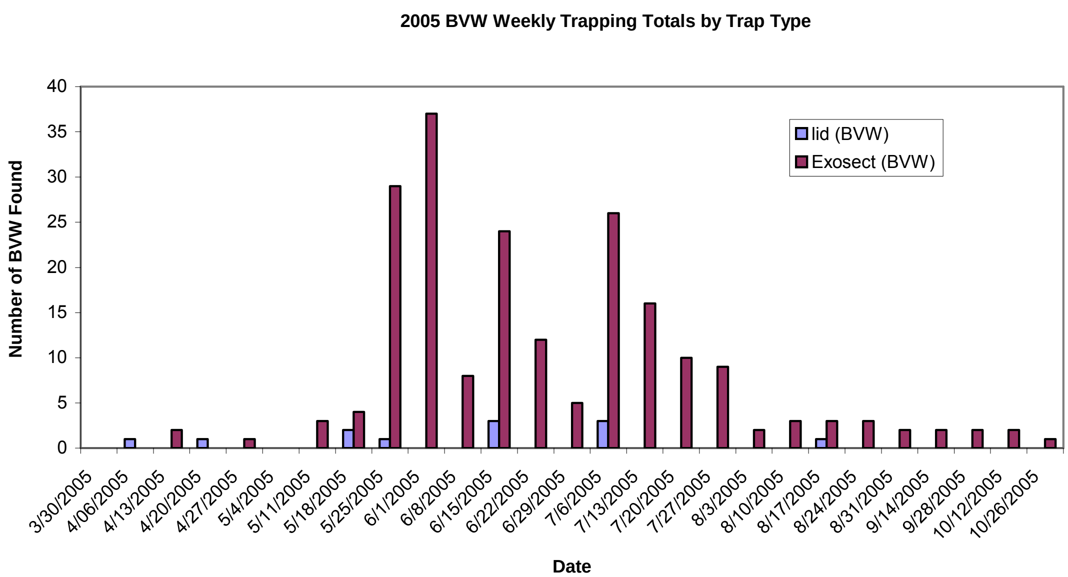

Figure 3

Evaluation of selected commercial baits for the control of the gray garden slug, *Agriolimax reticulatus* (Muller) (GGS)

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Replicated field trials were conducted in the winter, 2005 in commercial fields of grasses grown for seed, western OR. . Bait stations were used to assess relative populations of GGS prior to applying commercial baits and periodically thereafter to monitor changes and trends. Results of these trials and trends in the formulation of baits are discussed.

On March 1, 2005, a trial was established in a commercial annual ryegrass field, Polk Co. Oregon. Deadline mini-pellets® and two pellet lengths of Metarex® (2.2mm and 2.5mm)were applied at different rates to control gray garden slug, *Derocerus reticulatum* (Mueller). Both baits are produced by wet extrusion and are formulated with wheat bran, mold inhibitors and 4% by weight, metaldehyde.

On March 2, 2005, eight treatments in four replications of 50 x 50ft plots in a completely randomized block design were applied by hand using either a commercial bait spreader or a shaker jar (used for lowest rates to ensure uniformity of coverage).

Molluscide efficacy was determined using relative population estimates by counting total numbers of slugs attracted overnight to three bait stations within each plot one day prior to application of baits (March 2, 2005) and on March 9, 16, 23, 31, and April 6. A bait station consisted of four pellets of a cereal bran based bait (4% metaldehyde & 2% carbaryl) placed on a 12inch by 6in area scraped free of all vegetation. Stations were randomly located within each plot the afternoon of the day prior to recording the number of slugs attracted to each station the following morning before 8am.

A total of 5.3 inches of rain were recovered at this site over the duration of the trial (6 wks). Week 2 (14 DAT) results are not presented, as cold, windy conditions, unfavorable to slug activity were prevalent prior to and after baiting.

Table I presents numbers of pellets per lb of formulated baits as well as the expected number of pellets per acre at rates applied. Theoretically the more points/unit area covered by a bait, the better the control by reducing “slug searching time” to encounter a pellet. Therefore lower rates of smaller pellets should produce control equal to higher rates of a larger pellets if weather conditions limit GGS time on the soil surface searching for food. Results seem to support this idea.

All treatments had significantly fewer slugs than the untreated check, through 21 days (Table 3 & 4). After four weeks the higher rates of both Metarex 2.5mm pellets had fewest GGS (Table 5). By 35 DAT, numbers of GGS decline in UTC and those in treated plots have increased (Table 6).

Table 1. Numbers of pellets per unit weight of product and equivalent numbers of pellets applied per acre and per square foot.							
	# pellets per 1/100 pound				At rates tested		
Product	mean	st. dev	var	#pellets/lb	rate (lbs/A)	expected # pellets/A	# pellets/ft^2
Deadline MP	183.60	8.36	69.82	18360	8.0	146880	3.40
					5.3	97308	2.23
Metarex 2.5mm	350.40	7.03	49.38	35040	5.3	185712	4.30
					4.5	157680	3.62
					3.0	105120	2.41
Metarex 2.2mm	526.6	5.95	35.38	52660	5.3	279098	6.41
					3.0	157980	3.63

Table 2. Pre-treatment: Mean number of gray garden slugs recorded per overnight bait station by treatment (March 2, 2005)

Treatment	Rate (lbs/A)	I	II	III	IV	Total	Mean
Deadline MP	8.0	20	25	16	16	77	19.3 a
Deadline MP	5.3	21	9	16	9	55	13.8 a
Metarex 2.5mm	5.3	18	19	13	19	69	17.3 a
Metarex 2.5mm	4.5	29	20	17	14	80	20.0 a
Metarex 2.5mm	3.0	21	20	15	7	63	15.8 a
Metarex 2.2 mm	5.3	14	21	16	8	59	14.8 a
Metarex 2.2 mm	3.0	24	10	18	21	73	18.3 a
Untreated Check		10	10	13	21	54	13.5 a

Means followed by the same letter within a column do not differ significantly at P≤0.05 (Fisher LSD ANOVA analysis)

Table 3. Mean number of gray garden slugs recorded per overnight bait station by treatment (March 9, 2005) 7 DAT.

Treatment	Rate (lbs/A)	I	II	III	IV	Total	Mean
Deadline MP	8.0	1	3	6	6	16	4.0 a
Deadline MP	5.3	4	0	1	8	13	3.3 a
Metarex 2.5mm	5.3	4	4	1	7	16	4.0 a
Metarex 2.5mm	4.5	3	2	2	7	14	3.5 a
Metarex 2.5mm	3.0	1	4	5	3	13	3.3 a
Metarex 2.2 mm	5.3	0	9	11	1	21	5.3 a
Metarex 2.2 mm	3.0	4	1	3	9	17	4.3 a
Untreated Check		22	25	30	21	98	24.5 b

Means followed by the same letter within a column do not differ significantly at P≤0.05 (Fisher LSD ANOVA analysis)

Data were square-root transformed to stabilize variance, means presented are originals

Table 4. Mean number of gray garden slugs recorded per overnight bait station by treatment (March 23, 2005) 21 DAT.

Treatment	Rate (lbs/A)	I	II	III	IV	Total	Mean
Deadline MP	8.0	4	2	3	3	12	3.0 a
Deadline MP	5.3	3	3	1	1	8	2.0 a
Metarex 2.5mm	5.3	1	6	1	3	11	2.8 a
Metarex 2.5mm	4.5	3	8	2	2	15	3.8 a
Metarex 2.5mm	3.0	9	10	9	0	28	7.0 a
Metarex 2.2 mm	5.3	7	2	8	9	26	6.5 a
Metarex 2.2 mm	3.0	15	2	6	2	25	6.3 a
Untreated Check		23	23	17	30	93	23.3 b

Means followed by the same letter within a column do not differ significantly at P≤0.05 (Fisher LSD ANOVA analysis)

Data were square-root transformed to stabilize variance, means presented are originals

Table 5. Mean number of gray garden slugs recorded per overnight bait station by treatment (March 31, 2005) 29 DAT.

Treatment	Rate (lbs/A)	I	II	III	IV	Total	Mean
Metarex 2.5mm	4.5	2	9	7	2	20	5.0 a
Metarex 2.5mm	5.3	10	7	5	4	26	6.5 a
Deadline MP	8.0	14	9	3	2	28	7.0 ab
Deadline MP	5.3	14	6	5	8	33	8.3 ab
Metarex 2.5mm	3.0	22	5	2	1	30	7.5 ab
Metarex 2.2 mm	5.3	9	9	8	1	27	6.8 ab
Metarex 2.2 mm	3.0	12	7	10	8	37	9.3 ab
Untreated Check		18	9	24	8	59	14.8 b

Means followed by the same letter within a column do not differ significantly at P≤0.05 (Fisher LSD ANOVA analysis)

Table 6. Mean number of gray garden slugs recorded per overnight bait station by treatment (April 6, 2005) 35DAT.

Treatment	Rate (lbs/A)	I	II	III	IV	Total	Mean
Deadline MP	8.0	5	9	5	3	22	5.5 a
Metarex 2.5mm	5.3	2	3	5	8	18	4.5 a
Metarex 2.5mm	3.0	5	4	3	3	15	3.8 a
Metarex 2.2 mm	5.3	2	9	2	4	17	4.3 a
Metarex 2.2 mm	3.0	9	7	4	4	24	6.0 a
Deadline MP	5.3	12	5	2	8	27	6.8 ab
Metarex 2.5mm	4.5	11	4	15	4	34	8.5 ab
Untreated Check		11	7	12	15	45	11.3 b

Means followed by the same letter within a column do not differ significantly at P≤0.05 (Fisher LSD ANOVA analysis)

Orchardgrass billbug, *Sphenophorous venatus confluens* Chittenden, control in Commercial seed fields.

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The biology and control of this pest have been studied over the past 5 years in unirrigated commercial orchardgrass fields in the Willamette Valley. The biology is similar to that reported by Kamm in the late 1960's. We took soil samples to monitor larval and pupal stages, used adult feeding scars on the grass blades in the spring and again in the fall of the year to monitor initiation of adult feeding and numbers of crowns/100 sampled to determine if control was necessary, and used pitfall traps in the fall to determine adult movement for the purpose of applying an insecticide to control adults.

As a result of these studies and trials with various insecticides, we now recommend bifenthrin at 0.1 lb ai/A (section 18 registrations) applied as a broadcast spray in the fall after OCT 20th and before NOV 10th to control the adults of this pest. The previous recommendation was for Lorsban 4E to be applied at 1.0lb ai/A in the spring time (late MAR, early APR) in a rain shower to control adults breaking winter diapause, but before egg laying and prior to substantial grass re-growth that prevents insecticide from reaching target pests on soil surface.

Bifenthrin applied in the fall provides in excess of 90% control of adult billbugs present. Other pyrethroids evaluated at suggested label rates have not provided satisfactory control. We think fall applications have provided excellent control because (1) sprays occur when vegetative regrowth is minimal (compared to spring applications made to knee-high orchard grass), (2) adults are actively dispersing on soil surface and come into contact with insecticides, rain is NOT needed for product to hit the soil surface target site and (3) since field burning has been reduced or eliminated by many growers, little charcoal residues remain to adsorb insecticides.

Section V
Soil Arthropods

GARDEN SYMPHYLAN (SCUTIGERELLA IMMACULTATA NEWPORT), CONTROL WITH INSECTICIDES

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Garden symphylans (*Scutigerella immaculata* Newport, *GS*) are particularly difficult to manage in hops in part due to inability to till soil near the crowns, lack of effective, persistent soil applied pesticides as well as systems to deliver pesticides through the soil profile where *GS* occur. Our objectives involved 1) evaluation of insecticides with potential for registration as broadcast and incorporated use and 2) investigation of application methods to control *GS* within untilled hills.

Lab Trial

A lab study was used to evaluate the efficacy of a range of potential products in order to select products for field testing. Petri dishes were filled with soil treated with the appropriate rate for each product (Table 1). Maximum labeled rates were used for products tested in order to ensure the greatest possibility for success.

Table 1. Products and rates used in lab study to evaluate and select the best products for the field trial, Corvallis 2005

Product	Active Ingredient (Ai)	Product (oz/A)	Ai (lb/A)
[1] **Furadan 4F**	Carbofuran	64.00	2.00
[1] **Lorsban 4E**	Chlorpyrifos	64.00	2.00
[1] **MoCap 10G**	Ethoprop	42.67	2.00
[2] **Discipline 2E**	Bifenthrin	6.40	0.10
[2] **Baythroid 2**	Cyfluthrin	3.20	0.05
[2] **Warrior 1**	Lambda-cyhalothrin	3.84	0.03
[2] **Belay 16WSG**	Clothianidin	10.00	0.01
[2] **Admire 2F**	Imidacloprid	32.00	0.50
[2] **Regent 4SC**	Fipronil	4.16	0.13
x-utc	---	---	---
[2] **Discus**	Cyfluthrin +	244.48	0.11
	Imidacloprid		0.45
[2] **Platinum 2**	Thiamethoxam	8.00	0.13

[1] Proven Reference Product
[2] Potential New Product

Rates used in the lab were based on the calculated amount of product expected to be present in a soil profile if applied in-furrow over the row in a 4” band and incorporated to a depth of 2 inches (for a crop grown on 30”center rows). Treated soil was added to each of four Petri dishes (reps) per product tested. Following the addition of treated soil to each Petri dish, five vigorous, field collected late-instar *GS* were added. Live *GS* were recorded seven days after treatment.

Field Trial

We evaluated the 3 most promising insecticides from the lab trial (Furadan, Discipline & Warrior) as well as Mocap 10G which served as our “standard.” We also included an untreated check. All treatments were replicated five times. Although Lorsban 4E and Admire 2F preformed better in the lab study than Warrior, they were not selected for field studies due to labeling concerns for Lorsban and erratic results for Admire. Replicates were 1' x 10' rows spaced 84" apart, each containing three young Willamette hop plants spaced 3 ft. apart.

Rates used in the field were based on the calculated amount of product expected to be present in a soil profile when products were applied in a 36" band and incorporated to 2 inches for a crop grown on 7'center rows. Two application methods were used, pre-plant band + incorporate and post-plant injection. Banded applications were made covering the entire 1'x 10' row prior to planting, and hop transplants were planted directly after application. Injected applications were made post planting in 12" x 18" rectangle around each hop plant using a Kyoritz soil injector from Wilbur Ellis. Products applied using the band + incorporate method would give best control when used immediately prior to planting (as a possible replacement for Mocap), or in the spring between the hop rows. Injection equipment would not injure plants and would facilitate placement of liquid products into the root zones of plants where *GS* cause damage. Garden symphylan populations were sampled 7 days after treatment (DAT) with potato baits and soils cores, and plant dry weights were collected 62 DAT.

Table 2. Garden Symphylan lab product study 7 DAT percent control from each chemical

Product	Ai (lb/A)	7 day % Control
Furadan 4F	2.00	100 a
Lorsban 4E	2.00	100 a
MoCap 10G	2.00	100 a
Discipline 2E	0.10	85 a
Admire 2F	0.50	45 b
Warrior 1	0.03	35 bc
Belay 16WSG	0.01	35 bc
Baythroid 2	0.05	35 bc
Discus (cyfluthrin) +	0.11	25 bc
(imidacloprid)	0.45	
Regent 4SC	0.13	20 bc
Platinum 2	0.13	15 bc
x-utc	---	5 c

Means followed by the same letter within a column do not differ significantly at P<0.05 (Tukey ANOVA analysis)

Results

The four most effective products in the lab study were, Furadan, Lorsban, MoCap and Discipline. Control in these treatments was statistically better than all other treatments including the untreated check. Control from admire was also statistically better than the check but not different than the other treatments (Table 2).

There was no statistical difference between the number of *GS*, or the plant dry weights between the two application methods (banded and injected). Therefore, the data for the two application methods were pooled for analysis (i.e., the mean in the tables are for the banded and injected data combined).

After pooling the data, both the potato bait *GS* numbers and the plant dry weight treatments for MoCap were statistically better than the untreated check. No other treatment performed better than the check in the field (Tables 3, 4 & 5).

Table 3. Potato Bait *GS* numbers 7 DAT

Treatment	Application	Rate (lb ai/A)	I	II	III	IV	V	Total	Mean
Mocap 10G	B		15	0	0	0	24		
	I	3.00	1	1	0	3	2	46	**4.60 a**
Discipline 2E	B		37	3	31	0	6		
	I	0.10	3	30	15	1	34	160	**16.00 ab**
Furadan 4F	B		0	0	3	1	29		
	I	2.00	37	9	35	0	2	116	**11.60 ab**
Warrior 1	B		27	3	34	8	1		
	I	0.03	0	39	0	43	1	156	**15.60 ab**
UTC	B		0	52	26	25	7		
	I	---	36	27	30	44	0	247	**24.70 b**

Means followed by the same letter within a column do not differ significantly at $P \leq 0.05$ (Tukey ANOVA analysis)

Table 4. Soil Core (2.5" diameter) *GS* numbers 7 DAT

Treatment	Application	Rate (lb ai/A)	I	II	III	IV	V	Total	Mean
Mocap 10G	B		5	4	0	0	1		
	I	3.00	0	1	2	0	1	14	**1.40 a**
Discipline 2E	B		7	4	4	1	2		
	I	0.10	1	27	1	4	10	61	**6.10 a**
Furadan 4F	B		2	0	7	1	2		
	I	2.00	3	5	3	0	1	24	**2.40 a**
Warrior 1	B		2	3	5	2	1		
	I	0.03	0	7	0	6	0	26	**2.60 a**
UTC	B		0	3	15	5	1		
	I	---	1	3	7	6	0	41	**4.10 a**

Means followed by the same letter within a column do not differ significantly at $P \leq 0.05$ (Tukey ANOVA analysis)

Table 5. Hop dry weights 62 DAT

Treatment	Application	Rate (lb ai/A)	I	II	III	IV	V	Total	Mean
Mocap 10G	B		4.40	15.14	41.11	107.31	2.67		
	I	3.00	39.70	115.87	68.46	179.14	28.58	602.38	**60.24 a**
Discipline 2E	B		7.28	51.80	4.56	75.29	8.04		
	I	0.10	35.53	13.81	47.06	188.57	10.47	442.41	**44.24 ab**
Furadan 4F	B		50.40	33.70	40.74	47.06	4.18		
	I	2.00	2.67	5.51	0.32	150.69	27.11	362.38	**36.24 ab**
Warrior 1	B		2.31	80.25	0.20	1.01	33.65		
	I	0.03	181.49	1.36	108.71	2.52	90.48	501.98	**50.20 ab**
UTC	B		102.02	0.70	0.25	0.65	0.61		
	I	---	2.17	0.00	3.29	4.23	58.93	172.85	**17.29 b**

Means followed by the same letter within a column do not differ significantly at $P \leq 0.05$ (Tukey ANOVA analysis).
Data were log-transformed to stabilize the variance, means presented are originals

Acknowledgement:
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EXOTIC WIREWORM SURVEY AND IMPACT UPDATE 2005 - *AGRIOTES LINEATUS* AND *A. OBSCURUS* IN WESTERN WASHINGTON AND OREGON

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Two European pest wireworms, Agriotes obscurus (L.) and Agriotes lineatus (L.), which have been present in British Columbia, Canada, since 1950 or before, were first found in Western Washington State in 2000 and Western Oregon in 2004. Both species are primary economic pests of many plants in Europe and western Asia, and in recent years have become the most important pests of many crops in the lower Frasier Valley.

Detection and delimiting surveys reported here utilized pheromone-lure-baited ground traps developed by Dr. Bob Vernon (Agriculture Canada) and PheroTech Inc. of British Columbia, Canada, and were funded by the USDA APHIS CAPS program. Surveys were generally conducted from March or April until June most years, to coincide with spring adult beetle activity. Physical criteria for trap sites included proximity to areas of turf, pasture, or other grassy locations, which are considered favored wireworm habitat.

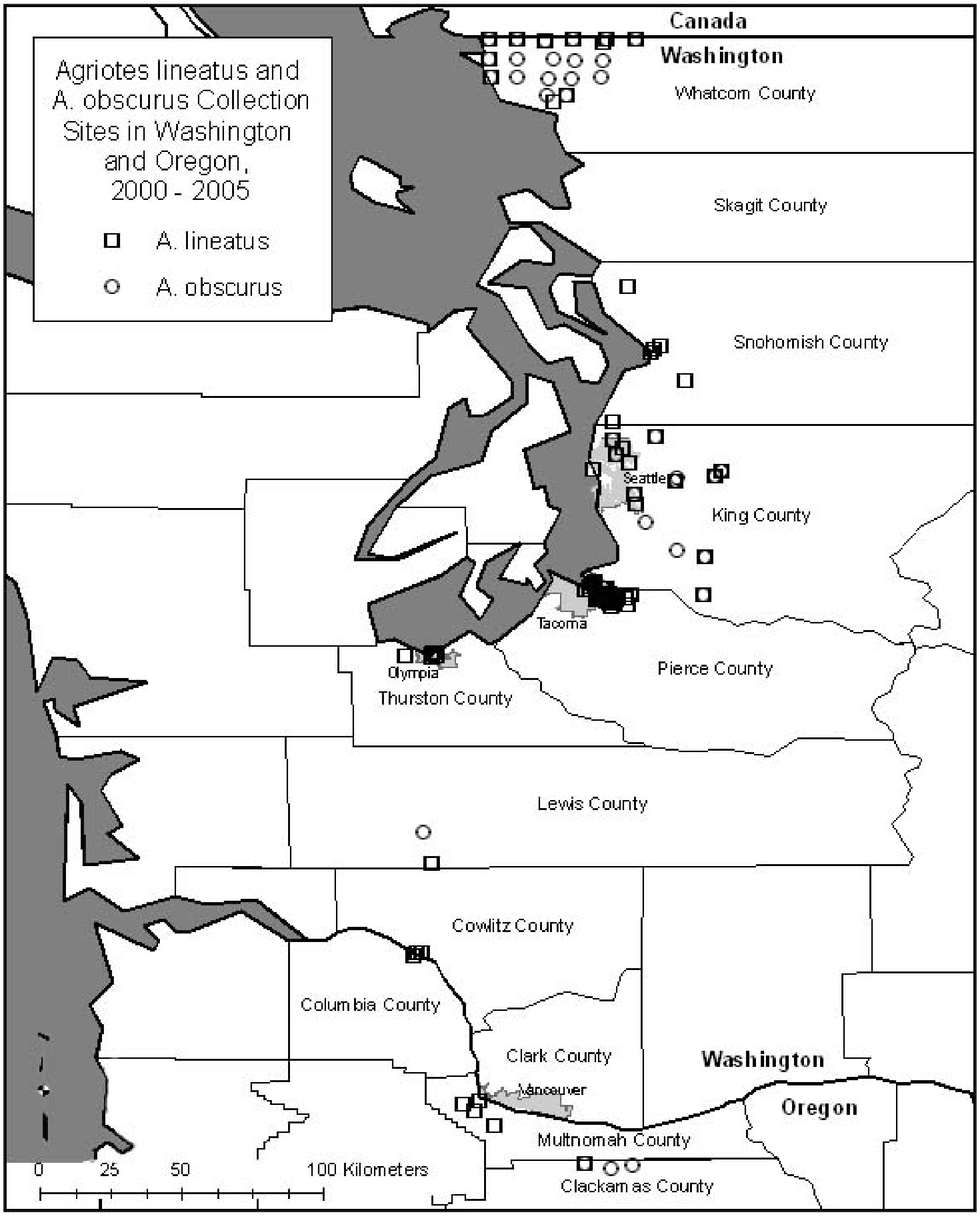
In total, 346 sites have been trapped (277 in Washington, 69 in Oregon) in surveys conducted by Washington and Oregon Departments of Agriculture between 2000 and 2005. Additionally, in 2005, survey trapping in King county, Washington, was conducted by volunteer participants in the Washington State University Cooperative Extension Service / Master Gardiner program, the first collaboration of this kind in USDA APHIS CAPS funded exotic pest surveys in the region. Survey trap numbers by year and accumulative catch totals by state are summarized in Table 1.

Table 1. Annual Exotic Wireworm Survey Site Numbers and Results Summary

	Trap Sites 2000	Trap Sites 2004	Trap Sites 2005	**Total Sites to Date**	*Positive A. lineatus sites*	*Positive A. obscurus sites*
Washington	98	79	100	**277**	*70*	*43*
Oregon	0	15	54	**69**	*6*	*3*
Totals	98	94	154	**346**	*76*	*46*

Surveys to date have detected both exotic species in the majority of counties surveyed along the I-5 corridor, from the Canadian border south to the Portland area in Oregon. Locations of collection sites by species are shown in Figure 1.

Figure 1. *Agriotes lineatus* and *A. obscurus* Collection Sites in Washington and Oregon, 2000 – 2005



In general, survey data suggests current known distribution of both exotic species represents natural spread into the Northwestern Washington counties from known populations in adjacent Canada, and/or the possibility of independent introductions into all regional port areas (Seattle, Tacoma, Olympia, Longview, and Portland) via infested ship balast or plant material. However, significantly more survey is needed to understand the introduction and spread circumstances as well as the extent of the currently infested area.

The highest populations observed, represented by the average number of beetles collected at positive sites, were in King County, where catch at some locations exceeded 400 beetles over the survey period. Beetle catch and average numbers of beetles at positive sites in each county are presented in Table 2.

Table 2. Exotic Wireworm Collection Numbers and Average Catch per Positive Site Summary

County / State	# Positive *A. lineatus* Sites	# *A. lineatus* Collected	Ave. # *A. lineatus* / Pos. Site	# Positive *A. obscurus* Sites	# *A. obscurus* Collected	Ave # *A. obscurus* / Pos. Site
Whatcom, WA	**9**	21	2.3	**19**	540	28.4
Snohomish, WA	**5**	106	21.2			
King, WA	**15**	996	85.7	**15**	2011	134.1
Pierce, WA	**31**	95	3.1	**7**	26	3.7
Thurston, WA	**7**	16	2.3	**1**	2	2.0
Lewis, WA	**1**	1	1.0	**1**	1	1.0
Cowlitz, WA	**2**	2	1.0			
Clackamas, OR				**2**	6	3.0
Columbia, OR	**1**	3	3.0			
Multnomah, OR	**5**	9	1.8	**1**	1	1.0

Certified seed potato growers in Whatcom County (closest to Canada) are well aware that exotic wireworms are an issue in their area, and all rely on a preventative preplant broadcast soil treatment of Mocap to prevent wireworm damage to their crops. Wireworm damage noted during 2005 certification inspections in Northwestern Washington was minimal and occasional and will not affect quality of grade.

Organic row-crop production, however, can be severely impacted. One organic producer in Whatcom County, Washington, reported significant wireworm damage to diverse crops, with up to 100% loss in some cases (corn seeding), in 2004 and 2005. Although the grower was planting into newly tilled ground that had previously been in pasture or lawn, a situation recognized as the most problematic for wireworm damage in Canada (Bob Vernon, personal communication), some specific impacts and management efforts reported by the organic producer included:

- Brussel sprout loss of 75% in 2004 (in a planting of 2,500 plants). Trap-cropping with wheat around Brussel sprouts in 2005 reduced wireworm loss to negligible numbers.
- Tomatillos had over 50% loss in three plantings.
- Watermelon loss of 50% in 2004 (of 250 plants), and trap-cropping with wheat in 2005 did not reduce loss (still 50%).
- Tomato plants experienced a 10% loss in the first 24 hours after plant out.
- Two successive plantings of corn (seed) were 100% loss, and all further seedings were cancelled.
- Lettuce transplants experience root loss to wireworms, but survive if planted out as large heads.
- Cover crops perpetrate wireworm problems (no cover crop reduces wireworm problems).

(Whatcom county organic farm wireworm impact information provided by Kristine Schlamp, Whatcom County IPM Coordinator – WSU Cooperative Extension Service.)

SEED TREATMENTS FOR SEEDCORN MAGGOT CONTROL ON CARROT

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Seedcorn maggot (SCM) *Delia platura* can significantly reduce carrot field stand establishment. Seed treatments were tested with several insecticides for control of SCM. A field trial was established on 11 May 2005 near Alderdale, Washington State USA. Seeds were planted by the grower in a complete random block design using a commercial vacuum planter. The number of carrot seedlings in three 1 meter segments per plot were counted on 31 May 2005 to evaluate efficacy.
Results provided no statistically significant differences comparing the UTC to the different seed treatments.

Treatment	Rate (oz/A)	Mean Seedlings ± SE
Untreated	NA	69.25 ± 5.12
Apron XL 3 LS [-;US] Maxim 4 FS [-UN]	7.5 2.5	68.75 ± 5.97
Apron XL 3 LS [-;US] Maxim 4 FS [-UN] NOA421016 [-;UN]	7.5 2.5 0.075	67.50 ± 5.92
Apron XL 3 LS [-;US] Maxim 4 FS [-UN] NOA421016 [-;UN]	7.5 2.5 0.1	82.75 ± 4.17
Apron XL 3 LS [-;US] Maxim 4 FS [-UN] Cruiser 5 FS [-;US] NOA421016 [-;UN]	7.5 2.5 0.038 0.075	73.00 ± 4.49
Apron XL 3 LS [-;US] Maxim 4 FS [-UN] Cruiser 5 FS [-;US] NOA421016 [-;UN]	7.5 2.5 0.038 0.1	74.75 ± 6.07
Apron XL 3 LS [-;US] Maxim 4 FS [-UN] Cruiser 5 FS [-;US] Tigard 75 W P [-;UN]	7.5 2.5 0.038 0.0609	74.00 ± 3.69
Apron XL 3 LS [-;US] Maxim 4 FS [-UN] Cruiser 5 FS [-;US]	7.5 2.5 0.038	60.25 ± 5.82
Apron XL 3 LS [-;US] Maxim 4 FS [-UN] Local Standard [-;UN]	7.5 2.5 NA	80.75 ± 7.01

Means followed by * are significantly different from the untreated check (pairwise t-test, $P < 0.05$)

EFFICACY OF NEW INSECTICIDES FOR CONTROL OF MINT ROOT BORERS (*Fumibotys fumalis*) IN PEPPERMINT LOCATED IN NORTHEAST OREGON, 2005

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ABSTRACT

DPX-E2Y, a new insecticide by E.I. du Pont de Nemours and Company, provided control of mint root borer larvae, similar to Lorsban when chemigated on a stand of peppermint, at a 0.067 lb ai/a and 0.087 lb ai/a rate. Bifenthrin did not provide control similar to the standard treatment of Lorsban.

INTRODUCTION

Lorsban (chlorpyrifos) is the only chemical pesticide registered for mint root borer (*Fumibotys fumalis*) control. Tilling of mint fields also provides partial control, but is not always an option on verticillium wilt infested fields. Lorsban and other organophosphate insecticides may have their use limited or eliminated in the future due to the Food Quality Protection Act. Therefore, new products that can provide consistent, cost effective control of mint root borer (MRB) are needed. We tested the effectiveness of a new experimental insecticide known as DPX-E2Y at two rates, as well as Capture 2E (bifenthrin) against the standard treatment of Lorsban for MRB control.

MATERIALS AND METHODS

Experiments 1 and 2

These experiments were located in production peppermint fields in the LaGrande, Oregon area. All experimental plots were 6'x 15'sections of a peppermint field with a natural infestation of MRB larvae. A randomized block design was used with the following treatments replicated nine times: (1) untreated check, (2) DPX-E2Y at 3 oz/a (0.065 lb ai/a), (3) DPX-E2Y at 4 oz/a (0.087 lb ai/a), (4) Capture 2E (bifenthrin) at 6.4 fl oz/a (0.1 lb ai/a), and (5) Lorsban 4E at 2 lb ai/a.

Treatments were applied on September 1 and 2 for experiments one and two respectively, with a CO_2 backpack sprayer (20 GPA at 15 psi) to pre-irrigated plots. The insecticides were immediately washed into the soil with 0.75 to 1 inch of water. Experiments were evaluated by taking six, 1-ft^2 soil samples in each plot.

The soil was shaken off the mint rhizomes and sifted though a 0.125" screen while the rhizomes were placed in Berlese funnels until dry. The number of MRB larvae recovered from soil sifting was combined with that from Berlese funnel extraction and recorded. Experiment 1 was evaluated 24 days after treating (DAT) while experiment 2 was evaluated 36 DAT.

RESULTS AND DISCUSSION

The standard treatment of Lorsban gave 67% control in experiment one and 93% control in experiment two (Table 1). The maximum level of control with Lorsban, in test plot work is commonly around 90%. The lower percent control of experiment one is speculated to be due to a high amount of variation in the MRB population.

Capture failed to provide significant control compared to the UTC in experiment one but did give significantly better control than the UTC, in experiment two. In both experiments, Capture failed to provide control similar to the standard treatment of Lorsban.

Both rates of the experimental insecticide DPX-E2Y provided similar control, in both experiments. In both experiments, DPX-E2Y provided significantly greater control, compared to the untreated check and also provided control similar to the standard treatment of Lorsban.

In experiment one; it was observed that some of the MRB larvae, in all the treatments, were moribund. The assumption was made that these moribund larvae would not live, so they were not counted as live. These moribund larvae indicated that the insecticides were still controlling the MRB larvae at 24 DAT. The sampling of the second experiment was delayed to provide more time for the insecticides to completely control the MRB larvae. Fewer moribund MRB larvae were found in all the treatments of the second experiment than in the first.

In 2004 we also tested this DPX-E2Y insecticide but listed it as DPX-A. The DPX-E2Y was tested in two experiments in 2004 at the high rate of 0.087 lb ai/a. The results in 2005 were similar to the 2004 results. This second year of data is encouraging for DPX-E2Y to be an effective tool for MRB control, where chemigation is available.

Table 1
Results of field efficacy trials for mint root borer larvae control.

		Experiment 1 24 DAT	Experiment 2 36 DAT
Treatment	Rate (lb ai/a)	Mean number live mint root borers per ft^2.	Mean number live mint root borers per ft^2.
UTC		3.0 a	2.50 a
Capture 2E	0.1	2.4 a	1.28 b
DPX-E2Y	0.067	1.3 b	0.15 c
DPX-E2Y	0.087	1.1 b	0.26 c
Lorsban 4E	2.0	1.0 b	0.17 c

Sample means were compared with Fisher's Protected LSD (p=0.05). Means with the same letter are not significantly different (Petersen 1985).
Experiment 1: LSD = 1.0, $p<0.05$
Experiment 2: LSD = 0.76, $p<0.05$

CONCLUSION

Capture did not provide control similar to the standard treatment of Lorsban in either experiment, and only provided significantly better control than the untreated check, in experiment two. The experimental insecticide DPX-E2Y, at rates of 0.067 and 0.087 lb ai/a, provided control similar to the standard treatment of Lorsban and was significantly greater than the untreated check.

It may take more than 24 days for insecticides applied to the soil by chemigation to completely kill the larvae that have contacted the insecticide.

The results of this 2005 study confirm the positive results also found in our 2004 study. This new reduced risk insecticide has the potential to be another effective tool for controlling MRB larvae, where chemigation is available.

It warrants further research to determine if this new product, DPX-E2Y, could be applied with a ground sprayer and then be moved into the soil with overhead irrigation, and still effectively control MRB larvae. Applying this insecticide with a ground sprayer would improve the accuracy of the application, compared to chemigation, and could increase the percent control of MRB under field conditions.

SECTION VI
Vectors of Plant Pathogens

ADVANCES IN GREEN PEACH APHID MANAGEMENT IN COLUMBIA POTATOES

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Green peach aphid is the most destructive insect pest of Pacific Northwest potatoes. In recent years, foliar management of this pest has changed from almost total reliance on methamidophos (Monitor) to a mixture of Monitor, thiamethoxam (Actara) and pymetrozine (Fulfill). This combination has provided significant opportunity to develop integrated pest management programs. These products have also allowed secondary pests, historically controlled by broad spectrum organophosphate insecticides, to flourish. These pests, including western flower thrips, cabbage looper, armyworm species and stinkbugs, have required additional applications of insecticides. The potato industry is in the midst of a flurry of new insecticide registrations, more so than in any time in the history of the potato industry. A number of products with aphid activity either have been or are in the process of being registered on potatoes.

These new insecticides have potential for great value to the industry, however in order to achieve their maximum potential and to retain this potential will require changes in grower and crop protection professionals behavior. For example, with in the next one to two calendar year, there will be 16 products registered on potatoes belonging to the neonicotinoid class of insecticides based on five active ingredients. These active ingredients are imidacloprid, thiamethoxam, acetamidiprid, dinotefuran and clothinadin.

Beleaf, an FMC insecticide, will be registered on potatoes in 2006. BAS 320 is expected to be registered in 2007. Other non aphicidal products have been registered on potatoes recently, including novaluron (Rimon) and indoxacarb (Avaunt). Three miticides are nearing registration on potatoes.

Significant research is needed to determine how to maximize the benefit these products have. Additionally, the specter of neonicotinoid resistance in Colorado potato beetle will have a tremendous impact on how potato insecticides are used.

ADVANCES IN MITE MANAGEMENT IN COLUMBIA BASIN POTATOES

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Potatoes are one of the most widely grown crops in the United States and world. In all locations, control of arthropod pests are considered either production limiting or a major concern, however, mites are considered a pest of potatoes only in the Pacific Northwest. In excess of 95% of miticide applications in the PNW are made in the Columbia Basin. With the recognition of beet leafhopper as an important pest of potatoes and the introduction of potato tuberworm and the increase in problems associated with cabbage looper and thrips has resulted in a dramatic shift in insecticide use patterns and overall use of insecticides on potatoes in the region. Growers are increasingly shifting away from planting time treatments to foliar applications and significantly increasing the number of foliar applications of insecticides. In the Columbia Basin of Oregon and the lower Columbia Basin of Washington, growers commonly applied 10 or more insecticides during the growing season. This change in use praticities greatly increases the likelihood that mite outbreaks will occur. Data will be presented showing which commonly used potato insecticides are closely associated with mite outbreaks.

Historically, propargite (Comite) was the product of choice. In 2005, spiromesifin (Oberon) was registered for use on potatoes. Bifenazate (Acramite) is expected to be registered for use on potatoes in 2006. Hexythiazox (Onager) is expected to registered on potatoes by 2007. Use restrictions on Agri-Mek (abamectin) are expected to be modified allowing the product to be more easily used on potatoes. Additionally, generic abamectin is expected to become available soon, reducing the cost of the product, making its use more attractive to growers. Soon growers will have access to four miticides for use on potatoes.

These products different in modes of action, efficacy, price, method of application, spectrum of control and activity against life stages. A series of trials involving the products was conducted over the past three years. Data on efficacy, period of residual control and method of application have been generated for Comite, Oberon, Acramite and Onager. Information will be presented on how best to develop a mite management program on potatoes.

CHEMICAL CONTROL OF POTATO TUBERWORM IN THE PACIFIC NORTHWEST

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Potato tuberworm is responsible for more crop loses in potatoes than any other insect, weed, disease or nematode pest in the world. The recent introduction and spread throughout most of the potato growing areas in the PNW has resulted in significant pest control challenges. Growers in the Columbia Basin of Oregon and the lower Columbia Basin of Washington made up to 8 applications in 2005 to control this pest. In most cases, the insect was controlled; however, several fields (between 5 and 10) were rejected due to PTW and were used for lower valued purposes.

Based on 2005 efficacy trials, PTW can easily be controlled by repeated insecticide applications made at close intervals at high rates. PTW has multiple, overlapping generations, short generation times, appears to infest only potatoes (at least in the PNW) and is the recipient of intense insecticidal pressure. The Washington and Oregon potato industries and agrichemical companies organized the largest insecticide efficacy trial the authors had ever seed. In excess of 100 treatments were screened for control of PTW in potatoes.

Trials were conducted near Paterson, Washington and Hermiston, Oregon. The trials at both locations were coordinated in a manner to keep as many treatment variables identical as possible. In both cases, Ranger potatoes were used; plots sizes, shape, planting densities and date were either identical or similar. Crop management was similar. Two differences in the trials is that the Oregon trial had high PTW pressure and was desiccated using Enquik and the Washington trial was characterized by moderate pressure and was desiccated using Reglone. The difference in PTW pressure appears to have significantly influenced the outcome of some treatments conducted at both locations. The effectiveness of products was determined by their ability to reduce the number of mines and/or larvae in the foliage.

In general, products were applied at the higher end of their rate ranges and at relatively narrow time intervals. The purpose of the higher rate and narrow intervals between applications was to conclusively prove that the products were effective. Overall, the both trials were considered to be highly successful in their outcome. PTW was easily controlled in the Washington trial by most insecticides. In the higher PTW pressure in Oregon, some products were not as effective or were not effective as compared to the Washington trial results. In general ground and chemigation treatments were effective, however, some products were effective by ground, but were less effective when applied by chemigation. Applications of Avaunt made only at and after desiccation were as effective as a 5 application program applied by chemigation at 7 day intervals.

Applications of insecticides applied close to desiccation appeared to be most critical for minimizing tuber infestation. The rate of infestation increased as the amount of potato canopy decreased.

Some products clearly were able to reduce tuber infestation as well as foliar infestations. These products include Monitor, Rimon, Avaunt, Asana and Lannate.

POTATO TUBERWORM SURVEY IN OREGON, 2005

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Background
The potato tuberworm (PT), *Phthorimaea operculella* Zeller (Lepidoptera, Gelechiidae) is believed to have originated in South America and can adapt to a wide variety of climatic conditions. It has spread to many tropical and subtropical countries in the Americas, Asia and Africa, to Australia, New Zealand and Europe. In the US, PT is recorded from at least 25 States from coast to coast. PT prefers potato but can also attack other species of Solanaceae such as tobacco, tomato and nightshade.

Tuberworm caterpillars are about 1⁄2 inch long when full grown, have a pale body with a dark brown to black head. Adult moths are narrow, about 1⁄4 inch long, light brown, with various darker spots on the wings. The life cycle is 3-5 days for egg development, 9-10 for the four larval instars and 11-13 days for the pupal stage at 77°F (25°C). The adult life span ranges from 9-25 days with up to 5-6 generations per year. The PT has at least 2–3 generations per year in Oregon based upon OSU's weekly trapping data (http://oregonstate.edu/Dept/hermiston/ extension/ARarchive.htm). First flight is in early spring peaking in March and April. The second flight period is June to September. The protracted summer flight period suggests two overlapping generations. The PT female oviposits between 50-100 eggs. Eggs may be deposited on the foliage or the potato tuber. The first instar larvae cause damage as leaf miners and later, bore into the stems and then tubers. The larva may pupate inside the tuber, on the surface of the tuber, or in the soil. Larvae and/or pupae can enter potato storage areas inside infested tubers.

Trapping

PT has been known from the PNW since at least 1965, but has only recently become a pest issue. In Oregon, PT was first identified in the Columbia Basin area around Hermiston in 2002 by OSU. In the 2004 season, OSU Extension placed 35 pheromone traps catching several thousand specimens in Umatilla County. ODA decided to conduct a statewide survey in 2005 for PT to determine its distribution in Oregon. We placed either wing or diamond-shaped sticky traps, baited with PT lure, in the margins of potato fields in all potato growing areas in the state. Traps were hung no higher than 12" above the plant canopy or 12" off bare ground using 4 foot long, metal, Japanese beetle trap stakes. Most traps were in the field from mid July through early November. Lures were changed once and traps were checked biweekly during the season. Traps or inserts were changed if dirty or damaged.

In 2005, ODA placed one PT trap at each of 53 sites in potato growing areas of Baker (6 traps), Clackamas (1), Jefferson (4), Klamath (12), Linn (1), Malheur (14), Marion (1), Multnomah (4), Union (7) and Washington (3) counties. A total of 89 moths from 15 positive trap sites were detected and confirmed in Baker (3 moths), Klamath (27), Malheur (1), Multnomah (25), Union (30) and Washington (3) counties. Seven positive sites detected only one moth each. The highest number trapped was 22 moths at a Union Co. site. OSU continued their monitoring program in 2005 and found PT in four additional counties: Crook, Jefferson, Morrow, and Umatilla (pers. comm. w/ Phil Hamm, Lynn Jensen, and Steve James). To date, PT positive counties in Oregon include Baker, Crook, Jefferson, Klamath, Malheur, Morrow, Multnomah, Umatilla, Union, and Washington (Fig.1).

Suspect PT specimens were all examined and confirmed by ODA's Entomology Laboratory in Salem. External characters are usually sufficient for ID. Adults have a series of spots on the forewings and three contrasting stripes on the thorax (Fig. 2). The apex of the male abdomen has short, erect yellow scales dorsally and long, lateral scale tufts (Fig.3). The internal male genitalia (Fig.4) are also distinctively different from those of other species.

ODA plans to survey statewide again in 2006 to confirm overwintering in positive counties, for any additional potato growing areas, and areas that were not positive in 2005. A possible biological control program is being explored. Several parasitoid wasps and a granulosis virus are known to attack PT and could provide biocontrol.

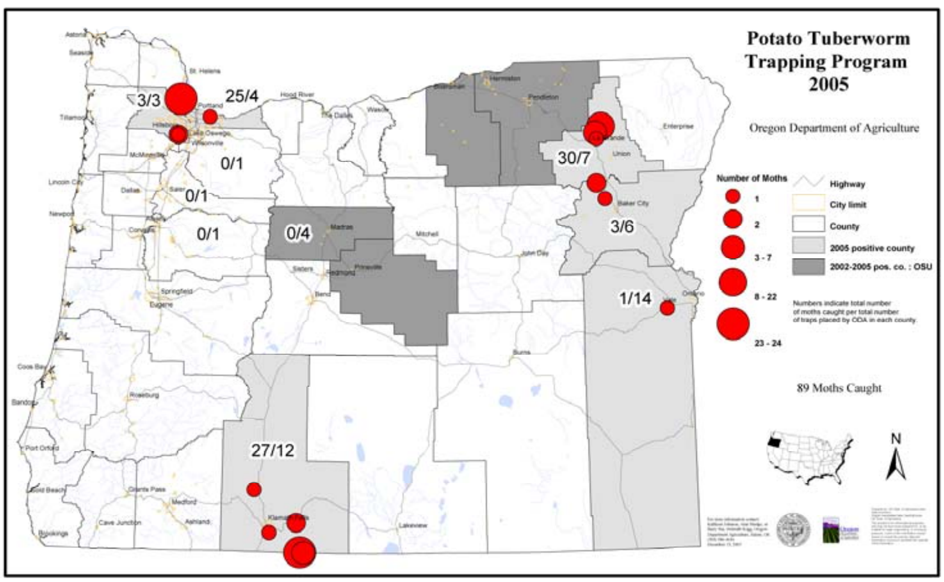

Figure 1

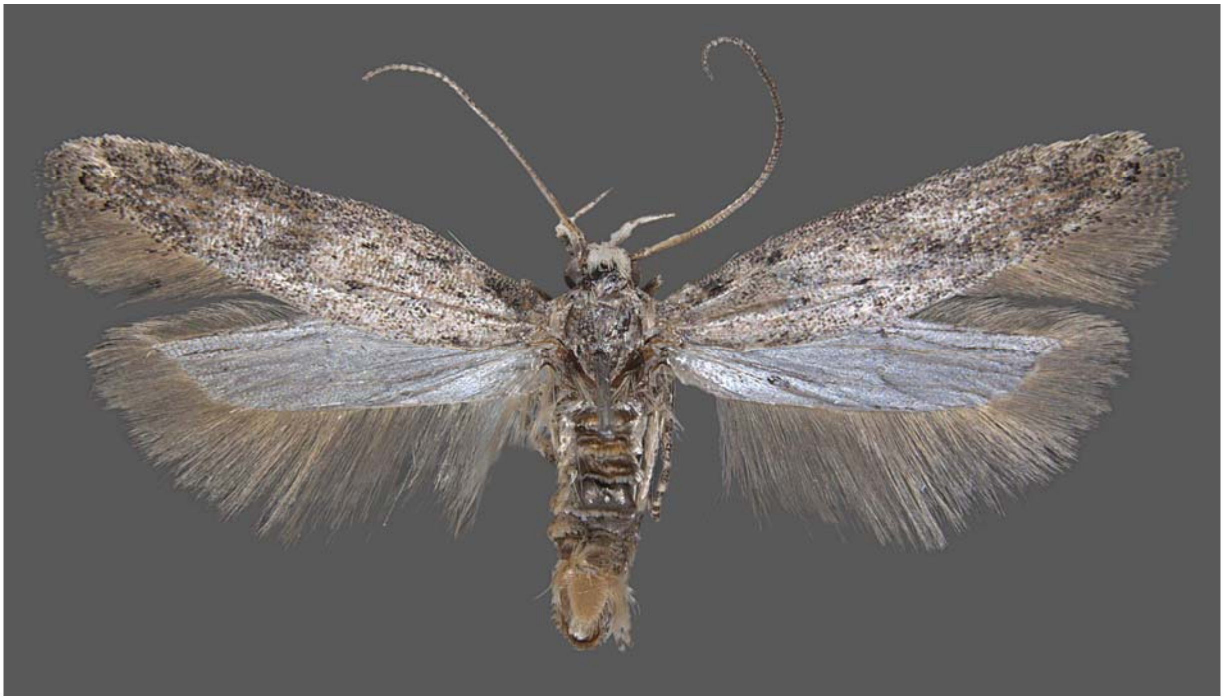

Figure 2

Figure 3

Figure 4

POPULATION REDUCTIONS OF ALFALFA LOOPER WITH KILLING STATIONS BAITED WITH A FLORAL LURE

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Insecticide applications and genetically engineered crops are commonly used methods for controlling caterpillars of noctuid moths in North America. FQPA, growing environmental issues, and worker safety related concerns have instigated research and development of alternative approaches for controlling these insects such as “attract-and-kill”. We have developed a series of floral chemical lures from compounds derived of “moth-visited” flowers, which lures both sexes of the insects. Attractants are dispensed from polypropylene vials that provide controlled release rate for extended periods of time. A killing station was tested in the field for use in combination with these lures as an “attract and kill” system. Baits are implemented to reduce numbers of female moths before they are able to lay eggs. Field trials were conduced in alfalfa fields at the Yakima valley during the 2003 and 2004 growing seasons. Activity of female *Autographa californica* adults in alfalfa fields was significantly reduced by the use of 50 bait stations per acre containing the floral chemical lure. Alfalfa looper moths demonstrated a high attraction rate to the killing station on wind tunnel studies and an 80% mortality ratio when the insect contacted the killing agent. We also demonstrated that numbers of eggs laid by females was significantly reduced on a small scale field cage experiment. Numbers of viable larvae on subsequent generation were also significantly reduced. This system can be potentially adopted in vegetable and field crops and development of new attractants can increase the number of insects targeted.

Table 1- Mean (± S.E.M.) numbers of *Autographa californica* captured per day in alfalfa field (5 acre plots) during the 2003 growing season. Female traps were baited with feeding attractant and male traps baited with commercial sex pheromone. Killing stations remained in plots for 7 days.

Feeding attractant	**0 killing stations/acre**	**50 killing stations/acre**
Female pre-deployment	0.89 ± 0.21ar	1.50 ± 0.22ar
Female pos-deployment	0.86 ± 0.30ar	0.11 ± 0.07bs
Sex pheromone	**0 killing stations/acre**	**50 killing stations/acre**
Male pre-deployment	4.45 ± 0.57ar	4.66 ± 0.51ar
Male pos-deployment	7.38 ± 1.19as	7.20 ± 0.55as

Means within a row followed by the same letter (a, b) and means within a column followed by the same letter (r, s) are not significantly different (p= 0.05, LSD mean separation test).

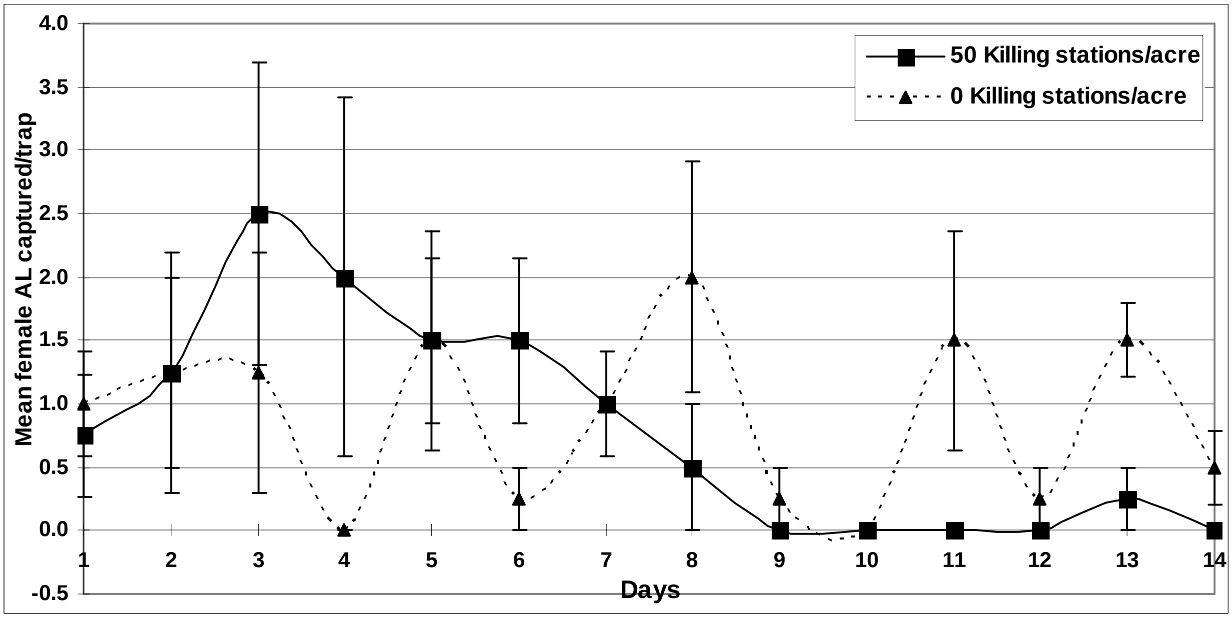

Figure 1 – Mean numbers (± S.E.M.) of female *Autographa californica* captured with feeding attractants baited traps during the 2003 growing season. Killing stations were deployed after 7 days of the start of experiment and remained on the field for 7 days.

Table 2- Mean (± S.E.M.) numbers of *Autographa californica* captured per day in alfalfa field 5 acre plots during the 2004 growing season. Female traps were baited with feeding attractant and male traps baited with commercial sex pheromone. Killing stations remained in plots for 20 days.

Monitoring Trap	0 killing stations/acre	50 killing stations/acre
Female pos-deployment	1.25 ± 0.14a	0.25 ± 0.06b
Male pos-deployment	31.45 ± 2.48a	27.09 ± 1.98a

Means within a row followed by the same letter (a, b) are not significantly different (p= 0.05, LSD mean separation test).

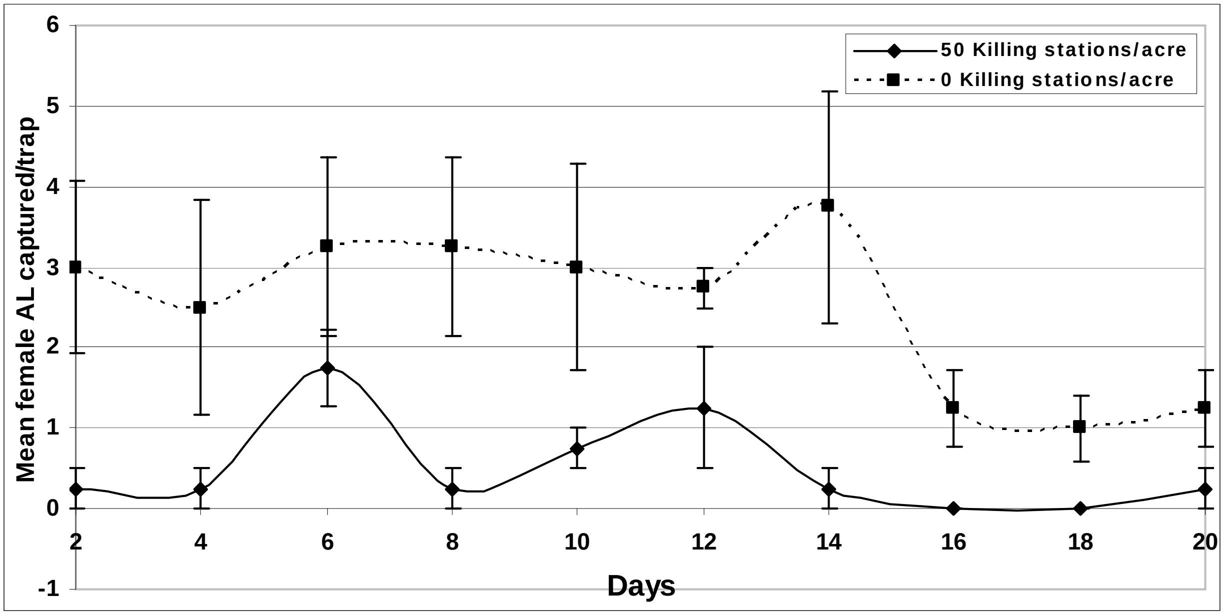

Figure 2 – Mean numbers (± S.E.M.) of female *Autographa californica* captured with feeding attractants baited traps during the 2004 growing season. Killing stations were deployed in the beginning of experiment and remained on the field for 20 days.

Table 3 – Mean (± SE) percentage of *Autographa californica* females that were attracted to and contacted shuttlecock bait station loaded with floral chemical lure.

	% plume track			
Treatment comparisons	n[1]	Mean (SE)	t	Pr > t
Untreated[2]	20	0.0 ± 0.0	12.65	<.0001
Shuttlecocks with PAA+BM	20	72.0 ± 5.69		
	% contacted the source			
Treatment comparisons	n[1]	Mean (SE)	t	Pr > t
Untreated[2]	20	0.0 ± 0.0	13.08	<.0001
Shuttlecocks with PAA+BM	20	60.0 ± 4.59		
	n[1]	Mean (SE)	t	Pr > t
% plume track	20	72.0 ± 5.69	-1.64	0.1094
% contacted	20	60.0 ± 4.59		

[1] number of replicates with 5 moths tested per replicate.
[2] Shuttlecock bait station not loaded with tested lure.

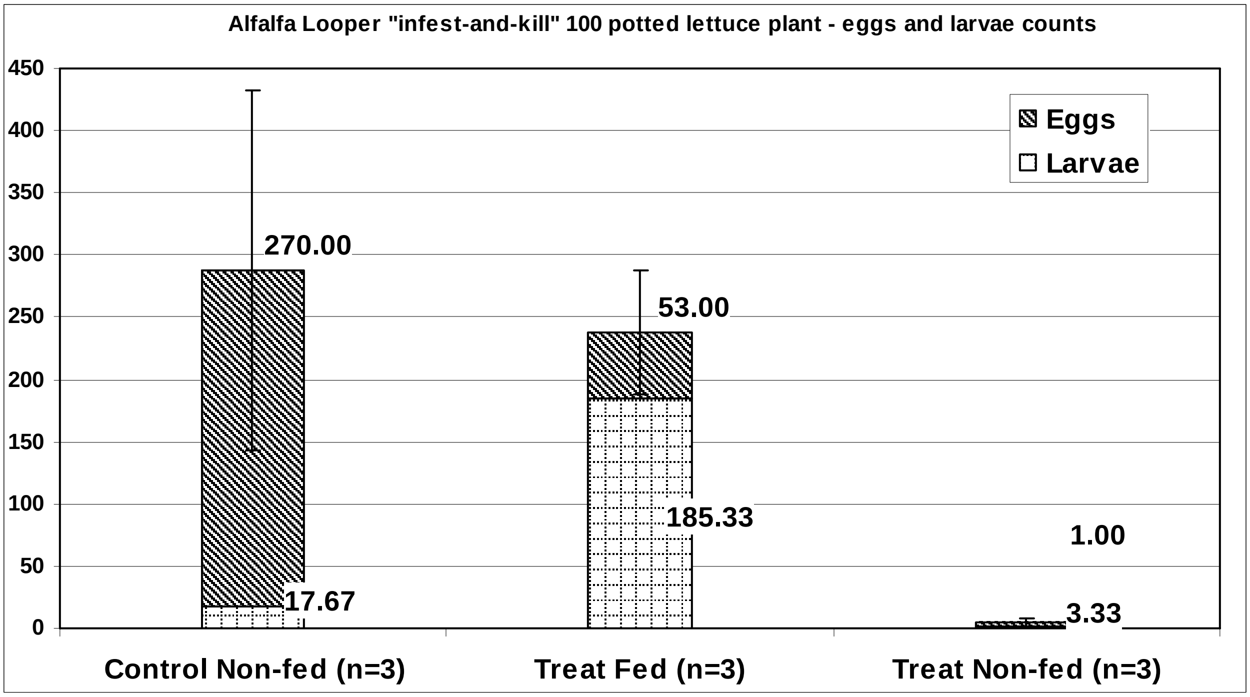

Figure 3 – Number of eggs and larvae after laid by alfalfa looper released in screen building. Moths were kept in building for 7 days. There was a reduction of eggs laid when killing-station was deployed and moths were not allowed to feed on sugar during rearing. There was no reduction on eggs laid by moths in the presence of bait stations when moths were allowed to feed on sugar during rearing.

EVALUATION OF INSECTICIDES FOR THE CONTROL OF WORM PESTS IN FRESH MARKET TOMATOES IN CENTRAL CALIFORNIA-2005

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This trial was established at the Two Bees Research Farm in Escalon, California in order to evaluate the effect of products on worm pests in fresh market tomatoes. The tomato variety was Dominator, spaced 18 inches between plants centered on 60-inch wide beds 30 feet long. The plot was drip irrigated on flat beds with four replications. The tomato plants were not trained on stakes and required periodic trimming to facilitate effective pesticide application.

All foliar treatments were applied with a CO_2 powered backpack sprayer. In the first application all materials were applied with an 8002 center nozzle and TXVS-4 lateral, drop-down nozzles on a 30 inch wide boom. The boom was expanded to 50 inches in subsequent applications so that the nozzles were at an optimum distance from the plants as the plants grew larger. All subsequent applications were made with an 8002 VS center nozzle and 8025 VS nozzles on the drop-down sides. Operating pressure was 30 PSI @ 58 gal/A.

Materials were applied on 19 Aug, 02 Sept, and 16 Sept. Evaluations were made by selecting five plants in each plot and shaking fruit onto a white tarp. Fruit was inspected and counted both for worm damage and worms present. The white tarp was inspected for any worms that might have fallen off during the shaking process.

Results

High levels of control were seen in most of the chemicals, with Novaluron @ 12.0 oz showing the least worm damage, but not statistically different from many others. Those with lesser degrees of control were V10170, Novaluron @ 9.0 oz, Danitol, Success and BAS 320. All materials and rates provided control superior to the untreated control which sustained 16% damage. It is difficult to determine why the amount of damage in the untreated control was only half that seen last year. Pounds of fruit (data not shown) were comparable to last year's harvest.

Control of Worm Damage in Tomatoes – 2005 Date of Harvest 09/30/05

Tomato Worm Trial 2005 Escalon California Evaluation 30 September

Products	Formulation	Prod/Acre	Percent Worm Damage
1. E2Y45	18.5% SC	3.3 fl oz	2.0a
2. E2Y45	18.5% SC	6.6 fl oz	2.3a
3. Tesoro (S-1812)	4 EC	6.4 fl oz	1.7a
4. V10170	50 WDG	1.4 wt oz	5.1b
5. Novaluron	.83 EC	9.0 fl oz	2.4ab
6. Novaluron	.83 EC	12.0 fl oz	0.2a
7. Danitol	2.4 EC	10.6 fl oz	2.4ab
8. Proclaim	5 SG	2.7 wt oz	2.2a
9. Proclaim	5 SG	3.0 wt oz	1.6a
10. Proclaim	5 SG	3.2 wt oz	1.3a
11. Success	2 SC	6.0 fl oz	3.1ab
12. Avaunt	30 WG	3.5 wt oz	2.0a
13. Intrepid	2 F	8 fl oz	2.3a
14. BAS 320	240 SC	16 fl oz	3.6ab
15. Entrust	80 %	2.5 wt oz	1.6a
16. Untreated Control			16.0c

Means in a column followed by the same letter are not significantly different at the 5% Level. DMR

A SURVEY OF THREE KEY SPECIES OF AMBROSIA BEETLES IN OREGON'S WILLAMETTE WALLEY NURSERY INDUSTRY

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ABSTRACT
In order to assess various means of monitoring activity of the flatheaded cedar borer, *Chrysobothris nixa*, several monitoring methods were evaluated. Lindgren funnel traps with three treatments: one ethanol lure, four ethanol lures; and alpha-pinene were placed at five nurseries during 2005 in several key nursery production counties in Western Oregon. Additionally one large yellow sticky trap was also placed in production rows. Traps and baits were supplied by PheroTech. The traps were checked weekly beginning June 1, 2005 through September 7, 2005. Collected borers were originally identified by Dr. James LaBonte at the Oregon Department of Agriculture and kept in a reference collection housed at NWREC. None of the trapping methods proved useful for monitoring *C. nixa*. However, the baited funnel trap data provided a third season of consistent and common appearance of the three ambrosia beetles found in 2003 and 2004: *Xyleborus dispar*, the European shot-hole borer; *Monarthrum scutellare*; and *Xyleborinus saxeseni*; as well as two other commonly trapped beetles: *Melalgus confertus*, the branch and twig borer; and *Scobicia declivis*, the lead cable borer.

INTRODUCTION:
There is very little tolerance to the presence of borer damage in nursery stock. Despite the low threshold for such infestations, there is limited research on borer damage in nursery production in the Pacific Northwest. In 2003 a preliminary investigation of borer activity in Willamette Valley nurseries indicated that shot hole borers, flatheaded borers (in particular, the Pacific flatheaded borer, *Chrysobothris mali* Horn and the flatheaded cedar borer, *Chrysobothris nixa*), and clearwing borers were causing economic damage in a variety of nursery sites. Trapping and beetle isolation was conducted from the 2003 through 2005 growing seasons to improve our understanding of the role of borers in Oregon nursery production systems. Monitoring methods for the flatheaded cedar borer were investigated during the 2005 season. In addition a variety of nurseries in the Willamette Valley were surveyed to assess the management and impact of borers in nursery production in Oregon.

OBJECTIVES:
Determine the seasonal activity of key borer species in Pacific Northwest nursery production areas.

METHODS AND MATERIALS:
Trapping:
In order to assess various means of monitoring flatheaded cedar borer activity, several monitoring methods were evaluated in 2005. The trapping concentrated on conifer production sites with a history of flatheaded cedar borer, *Chrysobothris nixa*. Lindgren funnel traps with three treatments: one ethanol

lure four ethanol lures; and alpha-pinene were placed at five nurseries in several key production counties Western Oregon. Additionally one 12” x 15” yellow sticky trap was also placed in production rows. Traps and baits were supplied by PheroTech. The traps were checked weekly beginning June 1, 2005 through September 7, 2005. Additionally arborvitae with suspected borer infestation were collected from a field grown nursery site in fall of 2004, transplanted into containers, and maintained in caged plots through the growing season. Cages were monitored visually and with sticky traps and plants dissected in the late summer to evaluate borer activity. Collected borers were originally identified by Dr. James LaBonte at the Oregon Department of Agriculture and kept in a reference collection housed at NWREC.

RESULTS:

There were three dominant species of beetles found in the funnel traps during 2003 and 2004. Those species were *Xyleborus dispar*, the European shot-hole borer; *Monarthrum scutellare*; and *Xyleborinus saxeseni*. *X. saxeseni* was the most abundant beetle found in traps at most locations. However, *X. dispar* was found to be the most common beetle isolated from damaged nursery stock. Monitoring methods for the flatheaded cedar borer were investigated during the 2005 season. None of the trapping methods proved useful for monitoring *C. nixa*. However, the baited funnel trap data provided a third season of consistent and common appearance of the three ambrosia beetles found in 2003 and 2004 as well as two other commonly trapped beetles: *Melalgus confertus*, the branch and twig borer; and *Scobicia declivis*, the lead cable borer (2005 Trap data in Charts 1 though 6). The continued dominance of the three ambrosia beetles was interesting information as the plot sites chosen were dominated by conifer production with natural forest, riparian, or production hardwood plantings nearby. Occurrence of these specific ambrosia beetles in a conifer nursery would be unexpected based on their plant host range. This highlights the potential influence of nearby vegetation given this type of monitoring method. *X. saxeseni* again dominated the trap counts. As trapping was timed for emergence of an adult buprestid, early season flight data for the shot hole borers is missing.

A monitoring method of the flatheaded cedar borer is still needed. Identifying infested field plants in the fall might have potential for management (PI selected 39 potentially infested plants, 22 were positive for larvae.

Acknowledgements:

James LaBonte and Richard Westcott, ODA; ODA Nursery Research Grant; the cooperating nurseries.

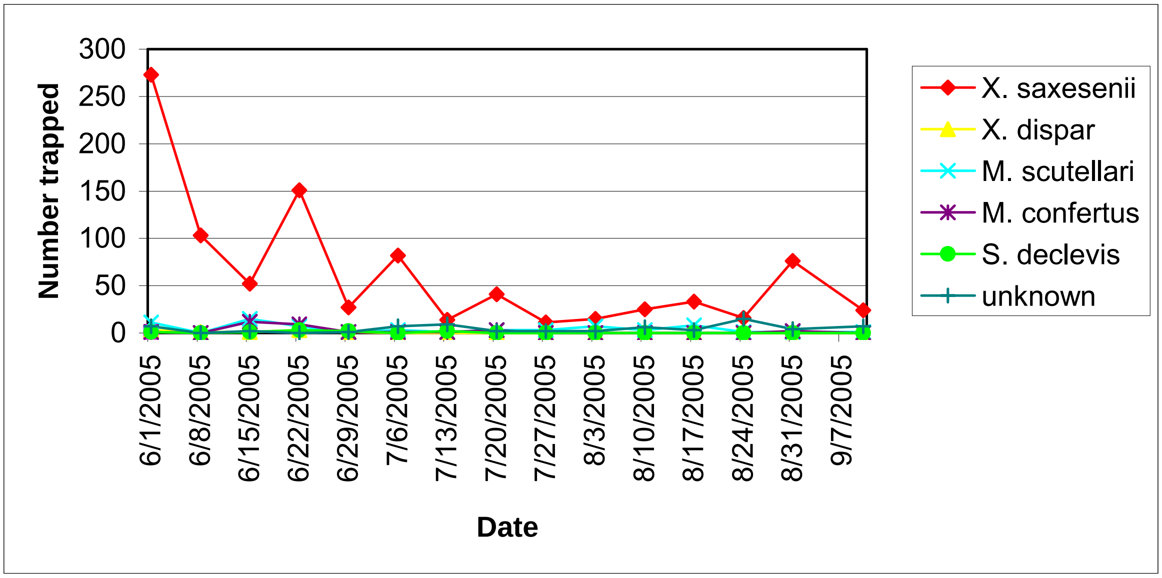

Chart 1. Average number of beetle species collected from five traps in 2005.

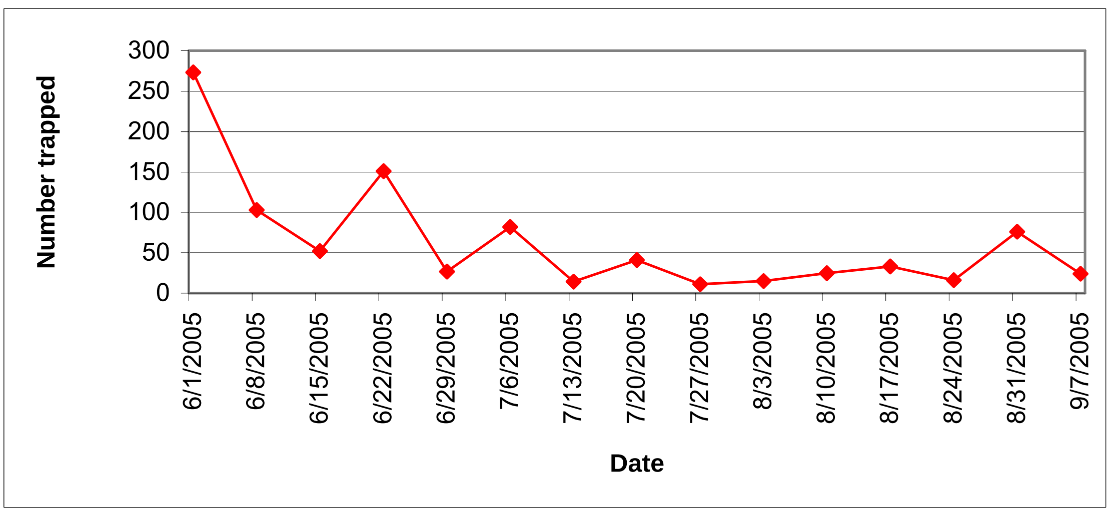

Chart 2. Average number of *X. saxesenii* collected from five traps in 2005.

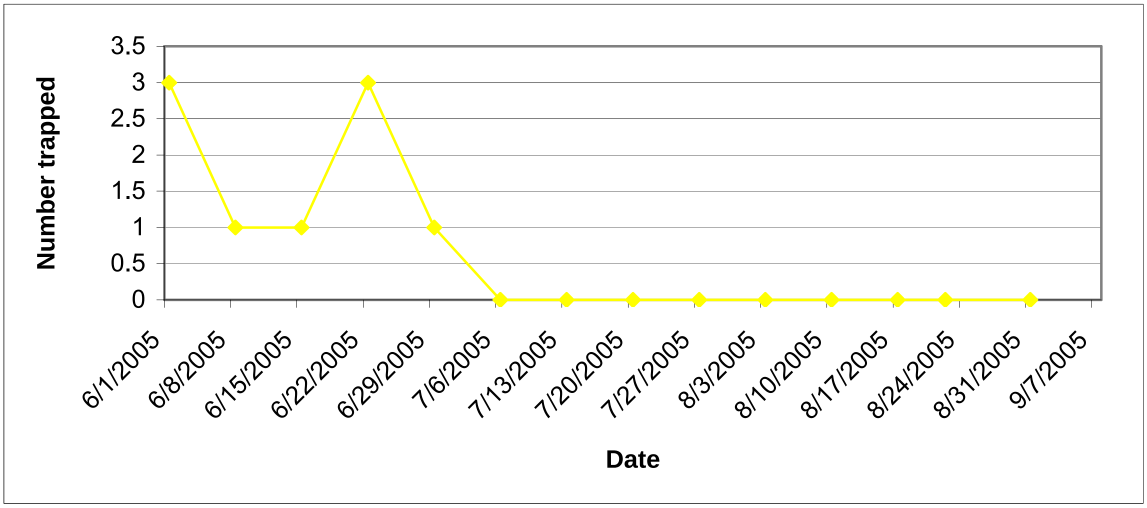

Chart 3. Average number of *X. dispar* collected from five traps in 2005.

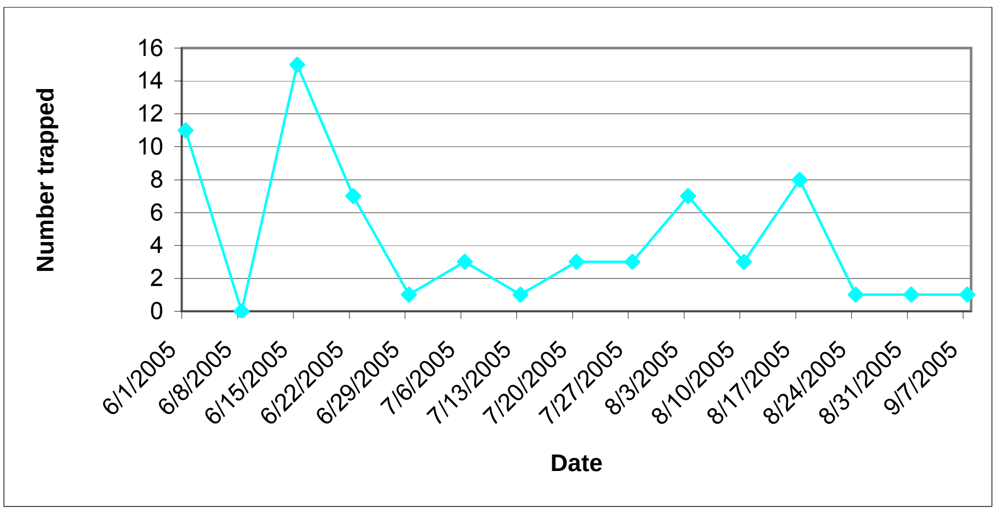

Chart 4. Average number of *M. scutellare* collected from five traps in 2005.

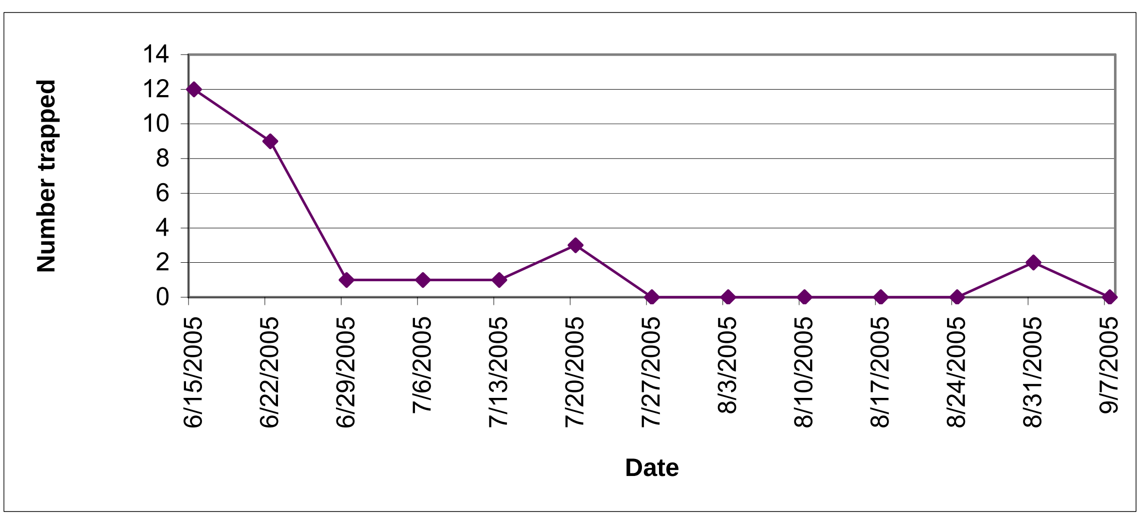

Chart 5. Average number of *M. confertus* collected from five traps in 2005.

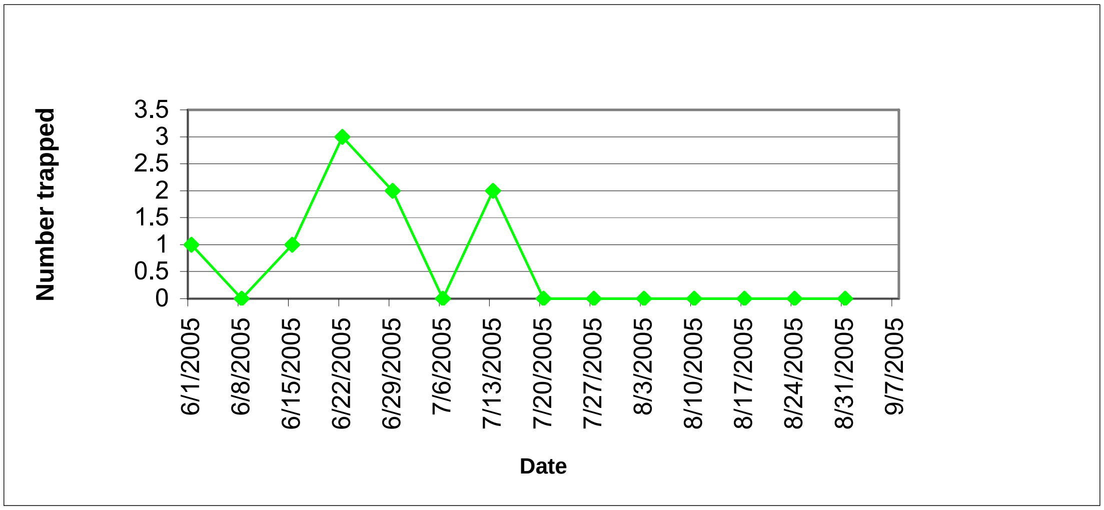

Chart 6. Average number of *S. declevis* collected from five traps in 2005.

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EFFICACY OF A PRE-EMERGENCE APPLICATION FOR MANAGEMENT OF ROSE MIDGE, *DASINEURA RHODOPHAGA*.

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ABSTRACT:

Rose midge, *Dasineura rhodophaga* (Coquillett) [Diptera: Cecidomyiidae], can be a key pest of roses in the landscape and rose production nurseries. The objective of this research was to investigate management of this midge. We evaluated a “pre-emergent” application of insecticide timed to control overwintering midge populations before they emerge in the spring. A field trial was conducted at the International Rose Test Garden (IRTG). Three treatments were applied to plots separated by buffer zones. The treatments were: 1) untreated control; 2) imidacloprid granular insecticide (Merit) applied prior to midge emergence (Feb. 23-24, 2005); and 3) foliar cyfluthrin (Tempo) applied beginning April 8, 2005 and every two weeks throughout the growing season (12 sprays). Plots were sampled every week by collection of rose branches from treated and non-treated plots from July 15, 2005 through September 30. A quantitative assessment of percent tip damage was obtained by counting new growing tips and the number of those tips damaged. There was no difference in percent damage between the two chemical treatments. There was a difference between percent damage in the chemical treatments (around 2 percent) and the untreated control (peaking at 54 percent damage).

PROJECT OBJECTIVES:

A. The goal of this project was to determine the phenology of rose midge in cultivated roses to enhance knowledge of key life cycle events and potential timing of management actions.

B. The second objective of this project was to evaluate the use of two insecticides for control rose midge in landscape plantings.

RESULTS TO DATE:

We had two study sites: International Rose Test Garden (IRTG), Portland, OR and North Willamette Research and Extension (NWREC). The NWREC trial was discontinued when it was determined that midges had escaped from caged plots.

1. A field trial was conducted at the International Rose Test Garden. Three treatments were applied to plots separated by buffer zones. The treatments were: 1) untreated control; imidacloprid granular insecticide (Merit) applied at 1.8 lbs/1000 ft^2 (80 lbs/acre) prior to midge emergence (Feb. 23-24, 2005); and foliar cyfluthrin (Tempo 2) at a rate of 45 ml/100 gal applied April 8, 2005 and every two weeks throughout the growing season (12 sprays) Plots were sampled every week by collection of rose branches from treated and non-treated plots from June 1 to September 30, 2005. A quantitative assessment of percentage tip damage was obtained by counting new growing tips and noting the

number of those tips damaged. The initial untreated control area did not have sufficient rose midge pressure, therefore an additional untreated control area was added on July 15. (For data from July 15 until Aug. 12, 2005 see Chart 1.). Data were subjected to analysis of variance and means were separated with Fisher's Protected LSD ($\alpha = 0.05$).

RESULTS:

The first signs of rose midge larvae and damage were detected April 6, however, damage was minimal and erratic in early spring and through the first week of July. Midge damage from July 15 until Aug. 12, 2005 is shown in Chart 1 when midge injury was severe. There was no significant difference in percent damage between the two chemical treatments. There was a significant difference between percent damage in the chemical treatments (around 2 percent) and the untreated control (peaking at 54 percent damage).

These results indicate promise for managing these midges using this "pre-emergent" timing and imidacloprid. This management strategy will be tested on a larger scale during the 2006 growing season. We would also expect additional benefits of using a systemic neonicotinyl such as imidacloprid on sucking insects such as aphids. Reducing impacts of multiple applications of a broad spectrum pyrethroid on natural enemies is also of interest as the IRTG has noted increased mite populations with the use of these foliar insecticides.

In addition to the expanded trial at the IRTG, a study will be conducted at NWREC during 2006 to evaluate various treatments including Diazinon WP; Merit; and the biological control agents; *Steinernema feltiae* ; and *Metarhizium aniopliae*.

ACKNOWLEDGEMENTS:
Bob Stillson, Harry Landers, International Rose Test Garden; John Reed, Portland Parks and Rec.
ODA Nursery Research Grant; the USDA/ARS NCNCR; and Sara Allen, Portland State Univ.

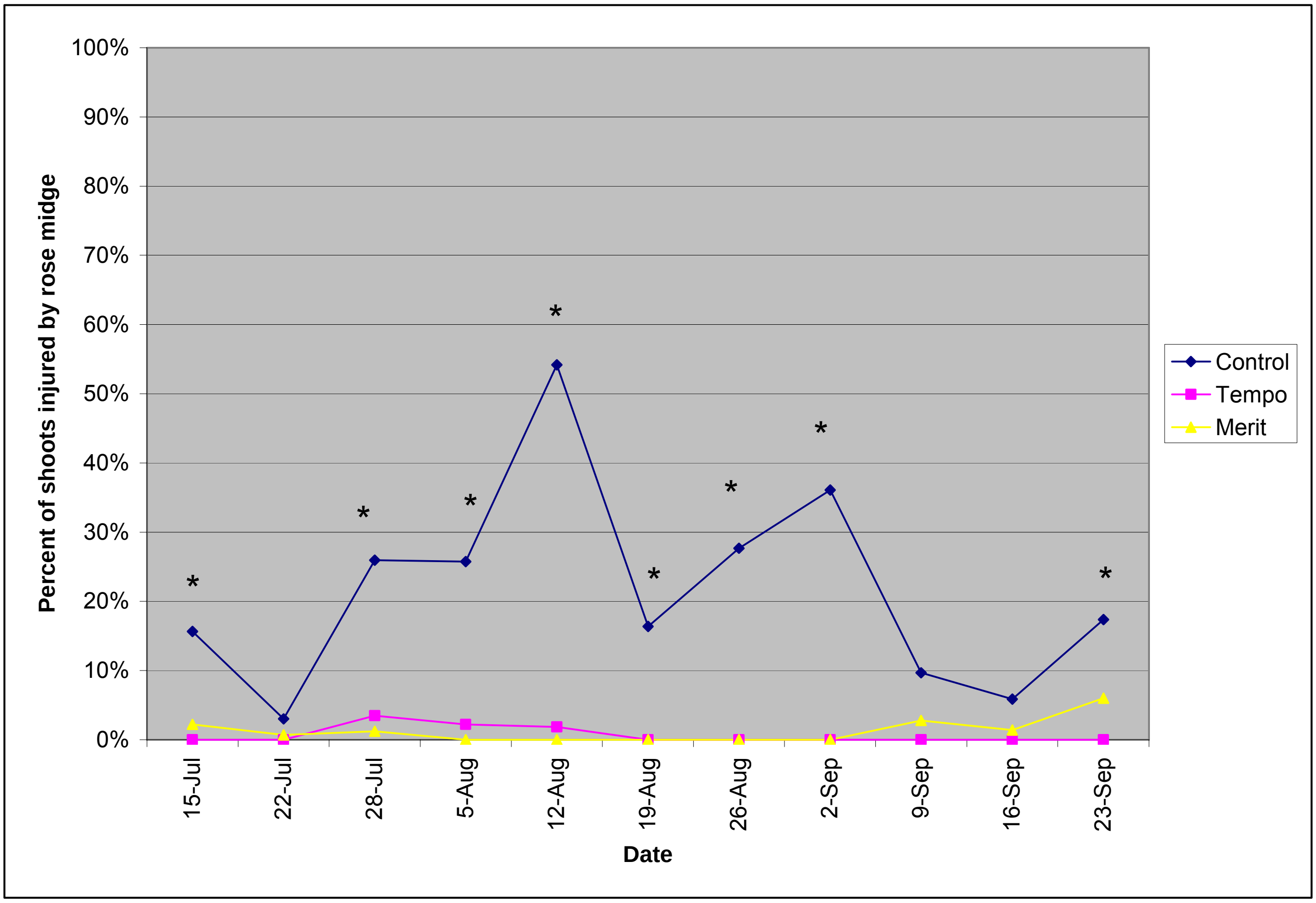

Chart 1. Percent of rose shoots damaged by rose midge in plots at the International Rose Test Garden in 2005. Asterisks indicate a significant difference in rose midge injury on untreated control plants and insecticide-treated plants ($\alpha = 0.05$).

EUROPEAN PINE SHOOT MOTH (*Rhyacionia buoliana*)
SURVEY AND MANGENMENT CHALLENGES IN IDAHO

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ISDA staff placed 156 EPSM pheromone traps out in nurseries. pine tree plantations and in urban landscapes. Pheromone trapping is conducted for both statewide detection surveys and to assist Austrian pine tree growers in obtaining phytosanitary certification for interstate commerce. Due to improved lure attractiveness, EPSM trap catches increased significantly this season compared to 2004 trapping results. This year's survey resulted in four new county records for this species including: Madison, Fremont, Lewis, and Idaho counties. Idaho pine growers are challenged by increasing EPSM pest pressures, urban growth, finding effective insecticide control regimes, and current MT, NV, CA EPSM quarantines on pine tree shipments form the Gem state.

Section VII
Foliage & Seed Feeding Pests

NEW STATE RECORDS FOR BROWN GARDEN SNAIL (Cryptomphalus apserus) IN IDAHO

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The first official state record of Brown Garden Snail was at the Idaho Botanical Garden in Boise, Ada County August 27th 2005. Information on BGS as a new emerging plant pest went out to the media shortly thereafter. There was significant response from the public regarding suspected BGS infestation in home gardens. 76 respondents contacted ISDA and to date 24 positive BGS infestations have been confirmed. Most infestations were reported from the Boise metropolitan area however there are now official county records in Canyon County (Nampa), Gooding County (Hagerman), Nez Perce County (Lewiston) and Kootenai County (Coeur d'Alene). All infestations to date have been in home garden and urban landscape environments.

Section VII
Foliage & Seed Feeding Pests

RESULTS OF ISDA 2005 POTATO TUBERWORM (*Phthorimeae operculella*) DETECTION SURVEY

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During the 2005 growing season, the University of Idaho potato tuberworm (PTW) survey was initiated, under the direction of Dr. Juan Alvarez and funded through a grant from the Idaho Potato Commission. U of I personnel placed 36 traps in potato fields across southern Idaho   On August 26, 2005, two adult moths were trapped on the edge of the variety trail plots a t the U of I Experiment Station in Parma. In reaction to this positive and as a result of September 8 meeting of ISDA, University and industry officials, it was decided that ISDA would implement a more extensive survey of the potato growing areas of the state to include commercial and seed fields as well as packing and processing facilities. A total of 461 Trece Pherocon VI with pheromone lures were deployed across southern Idaho in production fields and at processing or fresh pack facilities. Traps were located in 21 Idaho counties with significant potato acreage. Between September 21 and October 26 a total 19 moths were caught.

Positive Trap Summary:
Canyon County – U of I Parma Experiment Station and 8 commercial fields, 4 growers, 15 PTW moths
Payette County – 1 field, 1 grower, 1 PTW moth
Elmore County – 2 fields, 2 growers, 3 PTW moths
No potato tuber moths have been captured east of Elmore County during the 2005 survey.

Extensive tuber inspections were conducted by U of I staff at the Parma R&E Center. ISDA trained their Fresh Fruit and Vegetable Division (FF&V) inspectors to look for PTW damage as part of the potato grading and quality inspection program. To date no live larvae or damaged tubers have been found in Idaho. Traps have also been deployed in a few private and commercial storage facilities in SW Idaho. To date no positive reports or PTW trap catches have been reported from traps located near or in storage facilities.

STRAWBERRY CROWN MOTH CONTROL IN STRAWBERRY

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Strawberry crown moth (SCM), *Synanthedon biblionipennis*, was collected on 11 July 2005 near Richfield, WA in a 1 year-old 'Totem' field. Adults were collected with lures, sweep nets and plastic cups. Collections were taken to the lab and prepared for exposure to 3 experimental compounds and compared with field rates of Actara (thiamethoxam), Capture (bifenthrin) and Entrust (spinosad). Leaflets were individually placed in small water-filled vials plugged with cotton and sprayed with 1 ml of each treatment with a Precision Potter Tower. Each air dried leaf was placed in 5.5 oz. plastic cup with one strawberry crown moth. The plastic lid was perforated and mortality examined daily for 3 days. Ten moths were used for each treatment on 12 July.

The neonicotinoids Actara and Assail (acetamiprid) provided comparable knockdown with our standard Capture and experimental Mustang Max (zeta-cypermethrin) from 1-3 days posttreatment. Because of high-untreated check mortality, the trial was stopped after 3 days.

These population trends were similar to the 2 trials we reported last year and again high SCM mortality occurred after 3 days incarceration in our cup arenas. The mortality trends for the experimental Avaunt was similar to last year's results, with > 90% occurring around 5 days posttreatment. The lower rate of the organic formulation of spinosad, Entrust, did not perform to the 0.094 lb(AI)/acre level recommended for Success 2SC in strawberry. We are recommending spinosad for SCM control during the harvest period in strawberry. Its chemistry will enhance resistance management for SCM and worm control in rotation with Thiodan, Brigade/Capture and Lorsban.

LYGUS CONTROL ON ALFALFA GROWN FOR SEED

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Insecticides were screened for their ability to control Lygus nymphs in alfalfa seed fields. In early spring, field plots were established at Prosser, Othello, and Touchet Washington State. At each location, plots were 18 ft. wide and 20 ft. in length and treatments were replicated 4 times in a complete random block design. Insecticides were applied to mimic grower timing at a pre-bloom, bloom, and post bloom period of the alfalfa. Treatments were applied using a CO_2 powered back pack sprayer equipped with a four nozzle boom using 25 gallons of water per acre as carrier. Five 180° sweeps per plot were used as a means to sample Lygus abundance and efficacy post application.

During the pre-bloom period of the alfalfa maturity, we applied more treatments to the Prosser location than at the Touchet and Othello locals. The plots at the Touchet location were abandoned and no results obtained due to overspray of insecticide by the grower cooperator. At the Prosser location, the Orthene, Lorsban, Dimethoate, Capture, and Warrior treatments provided significantly better Lygus control than did the untreated check. At the Othello location, Orthene, Lorsban, Avaunt, Capture, and Dibrom treatments provided significantly better Lygus control than did the untreated check. At the Othello location, Dibrom was substituted for the Warrior treatment at the Prosser location.

During the bloom period of the alfalfa maturity, we applied the same exact treatments at all three locations. At the Prosser and Touchet locations, none of the treatments applied provided significantly better control than the untreated check. At the Othello location, Assail was the only treatment that controlled Lygus nymphs significantly better than the untreated check. At all three locations, the HGW86 10% at the high rate tended to provide the next best level of control of Lygus nymphs, but never statistically significant.

Due to time and harvest constraints, post-bloom alfalfa maturity applications were only made at the Prosser location. In this case, all products tested with the exception of the HGW86 10% at the moderate rate provided significantly better control of Lygus nymphs than the untreated check.

Pre-Bloom Treatments

Product	Rate	Mean Lygus/5 Sweeps ± Std. Error Prosser, WA	Touchet, WA	Othello, WA
Rimon 0.83 EC	12 oz./A	4.0 ± 0.7		1.4 ± 0.4*
Assail 70 WP	0.05 lb/A	5.0 ± 1.5		----------
Provado 1.6 F	3.8 oz./A	3.5 ± 0.9		3.3 ± 0.8
Actara 25 WDG	4.0 oz./A	2.0 ± 0.6		----------
Calypso 4 SC	4.0 oz./A	4.8 ± 1.4		----------
Orthene 75 S	1.33 lb. ai/A	0.4 ± 0.1*		0.4 ± 0.2*
Lorsban 4 E	2 pt/A	0.3 ± 0.2*		0.1 ± 0.1*
Dimethoate 4 EC	1 pt/A	1.2 ± 0.4*		----------
Avaunt 30% WDG	3.5 oz./A	4.1 ± 0.9		0.9 ± 0.6*
Capture 2 EC	6 oz./A	0.1 ± 0.1*		0.1 ± 0.1*
Warrior 1lb./gal.	3.84 oz/A	0.7 ± 0.3*		----------
MSR Spray Conc. 2 lbs/gal.	2 pints/A	2.4 ± 0.8		----------
MSR + Capture	2 pints + 6 oz/A	7.5 ± 1.3		----------
HGW86 10% SC	4.8 fl oz/A	4.9 ± 0.9		----------
HGW86 10% SC	10.3 fl oz/A	3.8 ± 0.8		2.4 ± 1.1
HGW86 10% SC	20.6 fl oz/A	6.4 ± 1.7		----------
HGW86 20%	10.3 fl oz/A	5.5 ± 1.4		----------
Dibrom 8 E	1 pint/A	----------		1.5 ± 0.5*
Untreated check	- - -	4.5 ± 1.1		4.0 ± 1.2

Means followed by * are significantly different from the untreated check (pairwise t-test, $P < 0.05$)

Bloom Treatments

Product	Rate	Mean Lygus/5 Sweeps ± Std. Error Prosser, WA	Touchet, WA	Othello, WA
Rimon 0.83 EC	12 oz./A	3.1 ± 0.9	1.8 ± 0.6	2.8 ± 1.5
Assail 70 WP	0.05 lb/A	4.6 ± 1.6	2.5 ± 1.3	2.0 ± 1.1*
Calypso 4 SC	4.0 oz./A	2.6 ± 0.8	5.5 ± 1.5	5.5 ± 1.3
HGW86 10% SC	4.8 fl oz/A	6.7 ± 2.2	4.0 ± 0.4	7.8 ± 1.5
HGW86 10% SC	10.3 fl oz/A	7.8 ± 1.7	1.5 ± 0.5	1 2.0 ± 4.0
HGW86 10% SC	20.6 fl oz/A	1.5 ± 0.4	1.3 ± 0.1	4.8 ± 2.9
HGW86 20% SC	10.3 fl oz/A	5.3 ± 1.5	2.3 ± 0.8	8.0 ± 1.6
Dibrom 8 E	1 pint/A	3.8 ± 1.1	2.3 ± 1.1	4.3 ± 1.5
Dipel 2x 6.4% WP	8 lb/A	5.4 ± 1.8	3.5 ± 1.2	6.0 ± 1.0
Untreated check	------	2.5 ± 0.4	3.5 ± 1.3	7.8 ± 3.0

Means followed by * are significantly different from the untreated check (pairwise t-test, P< 0.05)

Post Bloom

Product	Rate	Mean Lygus/5 Sweeps ± Std. Err Prosser, WA
Rimon 0.83 EC	12 oz./A	1.9 ± 0.8*
HGW86 10% SC	4.8 fl oz/A	6.6 ± 4.2*
HGW86 10% SC	10.3 fl oz/A	7.3 ± 1.7
HGW86 10% SC	20.6 fl oz/A	3.8 ± 0.9*
HGW86 20%	10.3 fl oz/A	2.5 ± 0.9*
Orthene 75 S	1.33 lb. ai/A	1.1 ± 0.5*
Capture 2 EC	6 oz./A	1.1 ± 0.6*
Warrior 2 EC 1lb./gal.	3.84 oz/A	2.5 ± 1.2*
Lannate 90% SP	2 pints/A	3.6 ± 2.4*
Dibrom 8 E	1 pint/A	1.4 ± 0.7*
Lorsban 4 E	2 pt/A	1.6 ± 0.6*
Dimethoate 4 EC	1 pt/A	2.3 ± 1.1*
Untreated check	-----	14.0 ± 7.3

Means followed by * are significantly different from the untreated check (pairwise t-test, P< 0.05)

THRIPS CONTROL ON DRY BULB ONIONS

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Onion thrips can severely stress onion bulb and seed crops. Additionally, onion thrips vector the devastating *Tospovirus* Iris Yellow Spot Virus.
On 13 July 2005 plots were established in a dry bulb onion field near Othello, Washington State in a complete random block design with four replicates. Plots were two double rows wide and ten feet long. Applications were made with a $C0_2$ backpack sprayer applying 10 gallons per acre water at 70 psi. Two weeks post application plots were evaluated for efficacy by counting the number of adult and immature thrips on the central onion leaf.

The Assail, Aza-direct+Warrior, CaNO3, Clutch, MSR, NNI0101, Pencap, and S-182 provided a moderate level of control. The Carzol, Lannate, and Success treatments were the most effective treatments in the trial.

Treatment	Rate/A	Mean thrips ± SE
Agri-Mek 0.15	0.024 lb ai	39.500 ± 6.564
Assail	0.148 lb ai	35.250 ± 4.498*
Aza Direct + Warrior	2 pt F + 0.03 lb ai	33.000 ± 9.009*
Calcium Nitrate	10 lb	34.750 ± 7.983*
Calypso	0.250 lb ai	58.750 ± 3.902
Carzol SP	1.25 lb F	26.750 ± 6.762*
Clutch 50WDG	0.1 lb ai	37.250 ± 16.705*
Proprietary	Proprietary	23.750 ± 4.171*
Lannate SP	0.9 lb ai	28.500 ± 8.893*
MSR	2 pt F	33.000 ± 5.083*
NNI-0101 20% SC	12.7 fl oz F	37.250 ± 6.316*
Non-Treated Control	NA	59.750 ± 5.218
OMI-88 15% EC	14 fl oz F	46.000 ± 7.036
Pencap M	2 pt F	35.750 ± 6.019*
S-1812	0.25 lb ai + 0.125 v/v surfactant	34.000 ± 4.243*
Success	0.094 lb ai	21.500 ± 4.518*
Warrior	0.03 lb ai	58.500 ± 10.087

Means followed by * are significantly different from the untreated check (pairwise t-test, $P< 0.05$)

Section VII
Foliage & Seed Feeding Pests

IDENTIFICATION OF CUTWORMS ON GRAPE VINES DURING THE SPRING IN SOUTH CENTRAL WASHINGTON

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Cutworms feed on grape buds at night during the spring causing a loss of yield. In a previous study, 1% to 5% bud loss resulted in economic damage to Concord grape. Until recently, we believed that the two most important cutworms were the spotted cutworm, *Xestia c-nigrum* (L.), and the redbacked cutworm, *Euxoa ochrogaster* (Guenee). In 2003 and 2004, we sampled vineyard floors to determine the cutworm species present in vineyards. In 2004, we started sampling vines at night to determine the species that were actually on the vines. Also in 2004 we tested a new rearing method that was better than the old one. The 2004 night sampling was expanded in 2005 by sampling more vineyards in south central Washington over a longer period of time. We also started working on cutworm pheromones.

Materials and Methods. We sampled for eight weeks starting on 7 March and ending on 27 April 2005. Sampling of four vineyards was repeated each week and 19 others were sampled only once during the season. The vineyards were located from Walla Walla in the east to southwest of Yakima in the west, and the Columbia River in the south to the northern part of the Yakima Valley on the north. Sampling started about an hour after sundown. Each vineyard was searched for one person-hour using flashlights. Cutworms were collected and taken to the lab for rearing. Cutworms are difficult or impossible to identify as larvae, so they must be reared to adults. They were reared in 135 ml plastic cups with about 2 cm coconut fiber (Coco Life Brik, Coconut Palm Resources, Inc. Hillsboro, Oregon) in the bottoms and a piece of artificial diet (Multiple Species Diet, Southland Products Inc., Lake Village, AR). Nylon screen covered the cups. The temperature was 27°C with 24 h light. The adult moths were pinned and identified using published descriptions and comparisons with identified specimens.

Twenty-five adult *Abagrotis orbis* (Grote) females were placed outdoors in a cage under natural light and temperature on 2 June 2005. Ten 10 males were placed under similar conditions on 7 June 2005. The females were removed from the field on 8 September and analyzed for pheromones. Compounds believed to be the moth’s pheromone were applied to rubber septa at the following amounts: 0, 0.1, 0.3, 1.0, 3.0, and 10.0 mg. These lures were placed in traps and deployed in a vineyard in a randomized complete block design with 5 replicates on 6 October 2005. The traps were checked weekly, ending on 3 November.

Results and Discussion. A total of 279 cutworms were collected; 224 (80.3%) were reared to adults; 41 (14.7%) were parasitized; 12 (4.3%) died as lavae (cause unknown); and 2 (0.7%) died as pupae (cause unknown). The rearing method resulted in successful rearing of 95% of the non-parasitized cutworms. Parasitism was similar to 2003 (11.7%) and 2004 (11.1%).

Eight cutworm species were found (Table 1). *Abagrotis orbis* [previously know as *A. barnesi* (Benjamin)] accounted for almost two-thirds of the cutworms. *Agrotis vetusta* Walker was second, making up over one-quarter of the cutworms. All the other species together composed only 8.0 % of the total. *Abagrotis orbis* ranges over most of North America but it has been reported as a pest only in southeastern Washington, southwestern Idaho, southwestern Michigan, northern Indiana, and New York. It prefers sandy soils. Recorded host plants are apple, peach, cherry, cottonwood, serviceberry, boxelder, and grape. The older larvae have dark elongate spots on each segment, one on either side of the dorsal line. The larvae pupated about two weeks after collection and spent about three weeks in the pupal stage followed by adult emergence from mid-April to early June (Table 1). The adults live through the summer but do not oviposit until mid-September. There is one generation per year. Many of the females that were placed outside were still alive on 8 September and four of the ten males were still alive on 14 October.

Little is known of the biology of *Agrotis vetusta.* It occurs across the United States and probably southern Canada and northern Mexico. It apparently has not been reported to be a pest although the moths can be common. The adult has a common name, 'the old man dart', but the caterpillar does not. *Agrotis vetusta* was collected almost two weeks later than *Abagrotis orbis* (Table 1). *Agrotis vetusta* has an extended larval period lasting for about three months (Table 1). The pupal stage averaged 24.6 days, slightly longer than the 21.0 days of *A. orbis*. The adults fly in late summer and fall. It appears to have one generation per year. The larva doesn't have any prominent markings like the spots on *Abagrotis orbis*, but it does have a series of cream-colored and brownish stripes running from the head to the posterior end.

Noctua comes Hubner was introduced into the Vancouver, BC area about 1982. Our finding apparently is the first record of it east of the Cascade Mountains and the first on grape. A related species, *Noctua pronuba* (L), apparently was first found in Washington in a light trap near Prosser in 2004. In three years of sampling cutworms in vineyards, we have yet to collect a single spotted cutworm or redbacked cutworm.

In September, compounds from female *Abagrotis orbis* pheromone glands were extracted and identified. The field test of the synthetic pheromone caught five *A. orbis* moths, all in the two highest pheromone concentrations. The last moths were caught on 20 October, suggesting that we trapped during the end of the flight. The results indicate that the pheromone was attracting moths. A pheromone for *Agrotis vetusta* has been identified.

Table 1. Species and rearing data for cutworms found in on grape vines, 2005.

Cutworm Species	Reported Food Plants	Number reared to adult	Percent of total	Mean date of collection (range)	Mean date of pupation (range)	Mean date of adult ecolsion (range)
Abagrotis orbis (=*A. barnesi*)	Fruit trees, grapes	146	64.9	7 April (14 March – 25 April)	21 April (28 March – 11 May)	12 May (18 April – 2 June)
Agrotis vetusta	Unknown	61	27.1	16 April (4 – 25 April)	14 July (15 June – 4 August)	8 August (11 July – 29 August)
Spaelotis clandestina, W-marked cutworm	Blueberry, maple, pine, beans, cabbage, corn, apple, strawberry	5	2.2	16 April (13 – 21 April)	26 April (20 April – 2 May)	12 May (5 – 20 May)
Abagrotis reedi	Willow, cotton-wood, etc	4	1.8	11 April (31 March – 18 April)	23 April (11 April – 4 May)	13 May (29 April – 23 May)
Noctua comes (introduced)	Foxglove, strawberry, weeds	4	1.8	5 April (31 March – 11 April)	17 April (11 – 27 April)	6 May (29 April – 16 May)
Euxoa messoria, Darksided cutworm	Trees, herbs, grasses	2	0.9	30 March (17 March – 13 April)	6 August (11 July – 2 September)	26 August (1 August – 21 September)
Euxoa olivia	Strawberries, corn	2	0.9	13 April (13 – 13 April)	12 September (12 –12 September)	3 October (3 – 3 October)
Euxoa atomaris	Unknown	1	0.4	13 April	22 August	8 September

WESTERN RASPBERRY FRUITWORM CONTROL IN RED RASPBERRY

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Five insecticides were compared with our diazinon standard for efficacy and labeling/registration to control the western raspberry fruitworm, *Byturus unicolor*, on 19 May 2005. Five adult fruitworm per 6" Petri dish were place on 3-4 inch long, air-dried primocane tips that were uniformly treated with field rates applied with a Precision Spray Tower and replicated five times. A second test was conducted with 2 rates of Imidan on 24 May. Mortality was evaluated at 1 and 2 days posttreatment (Tables 1). These fruitworms were collected from Whatcom County, WA in early May, 2005. One day after treatment, 100% mortality was observed for the experimentals Imidan and Actara, along with Diazinon, Malathion and Capture. The biorational Success provided complete control of adult beetles by 2 DAT. Our second test with Imidan, under similar lab conditions, was equally efficacious with the earlier test as well. These data corroborate similar bioassays reported last year. Success was registered on red raspberry in 2003 for leafroller/worm control during the pre-harvest interval. These data show excellent adult activity by Imidan when compared with registered red raspberry insecticides being used to control western raspberry fruitworm adult in red raspberry.

Table 1.

		Percent Mortality			
		Test #1		Test #2	
Treatment:	lb(AI)/ac	1DAT	2DAT	1DAT	2DAT
Imidan 70W	0.94	100a		97a	97a
Imidan 70W	1.41	100a		100a	
Diazinon 50W	1 lb	100a			
Malathion 8F	2 lb	100a			
Actara 25G	0.06	100a			
Capture 2EC	0.1	100a			
Success 2SC	0.09	98b	100a		
Untreated check		0	0b	0b	0b

Means within columns followed by the same letter are not significantly different (Tukey HSD test, $P<0.05$).

STRAWBERRY CROWN MOTH CONTROL IN STRAWBERRY

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Strawberry crown moth (SCM), *Synanthedon biblionipennis*, was collected on 11 July 2005 near Richfield, WA in a 1 year-old 'Totem' field. Adults were collected with lures, sweep nets and plastic cups. Collections were taken to the lab and prepared for exposure to 3 experimental compounds and compared with field rates of Actara (thiamethoxam), Capture (bifenthrin) and Entrust (spinosad). Leaflets were individually placed in small water-filled vials plugged with cotton and sprayed with 1 ml of each treatment with a Precision Potter Tower. Each air dried leaf was placed in 5.5 oz. plastic cup with one strawberry crown moth. The plastic lid was perforated and mortality examined daily for 3 days. Ten moths were used for each treatment on 12 July.

The neonicotinoids Actara and Assail (acetamiprid) provided comparable knockdown with our standard Capture and experimental Mustang Max (zeta-cypermethrin) from 1-3 days posttreatment. Because of high-untreated check mortality, the trial was stopped after 3 days.
These population trends were similar to the 2 trials we reported last year and again high SCM mortality occurred after 3 days incarceration in our cup arenas. The mortality trends for the experimental Avaunt was similar to last year's results, with > 90% occurring around 5 days posttreatment. The lower rate of the organic formulation of spinosad, Entrust, did not perform to the 0.094 lb(AI)/acre level recommended for Success 2SC in strawberry. We are recommending spinosad for SCM control during the harvest period in strawberry. Its chemistry will enhance resistance management for SCM and worm control in rotation with Thiodan, Brigade/Capture and Lorsban.

Table 1. Strawberry crown moth bioassay, 2005.

		Percent Mortality		
Treatment	lb(AI)/acre	1 DAT	2 DAT	3 DAT
Actara 25WG	0.06	90a	90a	90a
Assail 70WP	0.05	40ab	90a	90a
Avaunt TM	0.11	50ab	60a	70a
Capture 2EC	0.1	90a	90a	90a
Mustang Max	0.03	80a	90a	100a
Entrust	0.08	40ab	60a	80a
Untreated check		0b	10b	20a

Means within columns followed by the same letter are not significantly different (Tukey HSD test, $P<0.05$).

Section VIII
Mites and sap-sucking pests

Winter grain mite, *Penthaleus major* (Dugess), Control in Central OR grass pastures

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Various products were evaluated for the control of this pest infesting orchard grass pastures in Jefferson county, OR in the winter and early spring, 2004. Neither chlorpyrifos nor dimethoate are labeled for grass pasture and hay crops. These two products provide good control of this pest in grass seed and wheat crops at minimal cost. Replicated trials with various products were applied using a CO2 powered backpack sprayer. Mustang® (zeta-cypermethrin) provided excellent control (comparable to that of dimethoate) at 2 and 4 oz of formulated product per acre.

Interestingly, neither fenbutatin oxide nor bifenazate provided substantial control of this pest in our trials.

Behavioral Response of European Asparagus Aphid to Foliar Applied Insecticides
Brachycorynella asparagi

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Experimental plots were established at Victoria Island Farms, west of Stockton, California. The purpose of the research was to evaluate the effectiveness of nine different materials for control of European asparagus aphids feeding on asparagus fern. Plot size was 5 feet wide by 40 feet long with 4 replications. The treatments were applied with a Co2 powered backpack powered spray boom with the application made from both sides of the bed. A volume of 50 gallons/ acre was used in order to simulate the same type of coverage obtained by the grower. Three TJ-60 8002-VS twin even flat spray tips were used to produce fine particle size spray droplets. One application was made on October 5th, 2005.

Materials in Trial

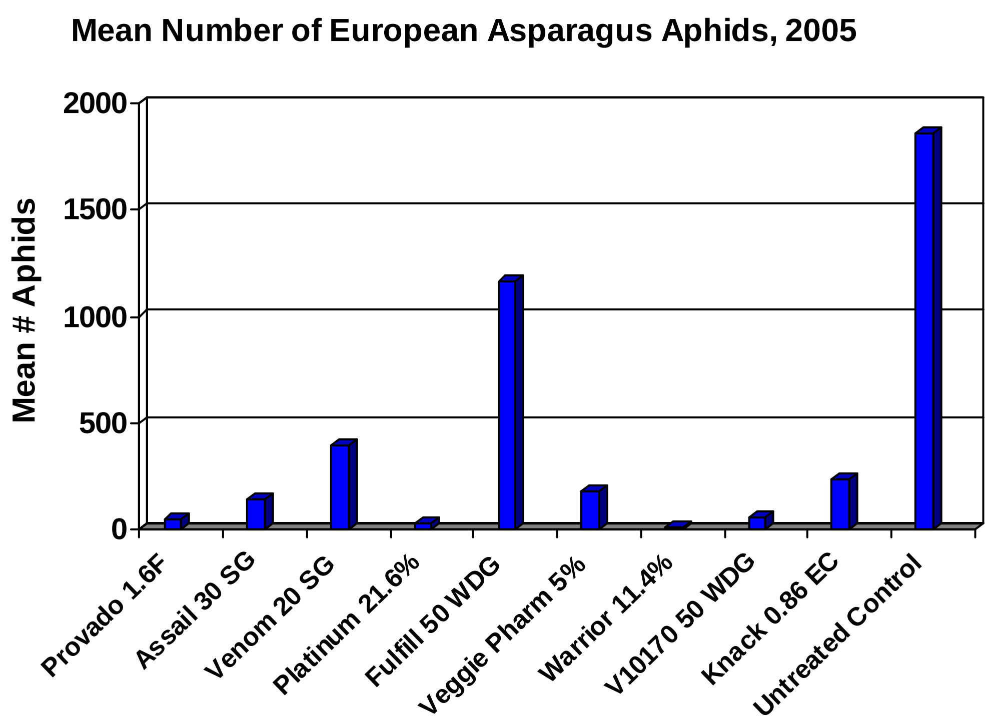
Products	Formulation	Prod/Acre
Untreated Control		
Provado	1.6 F	8 oz.
Assail	30 SG	2.5 oz.
Venom	20 SG	300 gr.
Platinum	21.6 %	8 oz
Fulfill	50 WDG	2.75 oz
Veggie Pharm	5 %	12.5 Gallons
Warrior	11.4 %	3.84 oz
V10170	50 WDG	40 gr
Knack	0.86 EC	16.4 oz

Aphid behavior was evaluated by beating the fern in three areas of the plot in each of 4 replications and rapidly counting aphids observed on an 8 ½ inch by 11 inch foam board. While many lady bird beetles were observed in this trial, they did not provide adequate control until after the aphid numbers had been at damaging levels for some time in the asparagus fern. Evaluations were made for three consecutive weeks following the application.

Control of European Asparagus Aphid, *Brachycorynella asparagi*, 2004

Products	Formulation	Prod/Acre	Aphids 11 Oct	Aphids 17 Oct	Aphids 27 Oct
Untreated Control			722b	572b	1861c
Provado	1.6 F	8 oz.	189a	87a	45a
Assail	30 SG	2.5 oz.	67a	166a	139a
Venom	20 SG	300 gr.	112a	87a	392a
Platinum	21.6 %	8 oz	83a	81a	28a
Fulfill	50 WDG	2.75 oz	194a	213a	1161b
Veggie Pharm	5 %	12.5 Gal	116a	47a	176a
Warrior	11.4 %	3.84 oz	8a	3a	5a
V10170	50 WDG	40 gr	35a	28a	57a
Knack	0.86 EC	16.4 oz	110a	284a	231a

Means in a column followed by the same letter are not significantly different at the 5%Level.DMR



All materials provided good control of spider mites by the end of the trial with the exception of Fulfill. Coverage at 50 GPA was minimal for contact materials and better control could also be expected if air blast type sprayers were used to help penetrate the dense fern.

BAMBOO APHID CONTROL WITH FOLIAR APPLIED APHICIDES

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Current bamboo aphid, *Takecallis arundicolens* (Clarke), control recommendations can be improved by including new chemistries and expanding the comparative data to provide a more clear management approach. Bioassays were conducted in the laboratory on 30 September 2005. Unrolled young leaves, with varying densities of bamboo aphids, were removed from infested green sulcus bamboo, *Phyllostachys aureosulcata* F. 'alata,' and placed in Petri dishes on cotton dampened with de-ionized water. Each Petri dish contained five replicates. Bioassays were performed with a Precision Spray Tower operated at 40 psi. Each Petri dish was treated with one of eight chemicals (Table 1) at the rate of one ml/Petri dish. Treatments were evaluated one and two days following application. Live and dead aphids were counted (based on probing to check for movement) and percent mortality determined.

This test provides a useful comparison between three neonicotinoids, Provado (imidacloprid), Assail (acetamiprid), and Actara (thiamethoxam). All three products provided excellent control of bamboo aphid at 1 DAT. In addition, an IGR, Aza-Direct (azadiractin), was also tested, providing another option for bamboo growers.

Actara (thiamethoxam), Assail (acetamiprid), Malathion, Provado (imidacloprid) and Talstar (bifenthrin), exhibited complete control against bamboo aphids, 24 hours post-treatment. Sanmite (pyridaben) was 71% effective controlling spider mites 24 hours following treatment. Fulfill (pymetrazine) and Aza-Direct were the least effective at 1 DAT with only 59% and 61% control. Neither Fulfill (pymetrozine) nor Aza-Direct exhibit a "knockdown" effect due to general toxicity or paralysis. Instead, these two biorationals exhibit unique modes of action. Fulfill affected aphids stop feeding within a few hours and die of starvation, while Aza-Direct interferes with the molting process. Fulfill exhibited the most dramatic increase in mortality rate in a 24 hours period, from 59% at 1 DAT, to 91% at 2 DAT. It is speculated that the level of aphid suppression for both aphicides would be comparable to that of other compounds if evaluated at 3-5 DAT. Sanmite and Talstar exhibited cross-activity against both bamboo aphids and bamboo spider mites, with Talstar performing the best.

Table 1. Bamboo aphid bioassay on *Phyllostachys aureosulcata* foliage.

Treatment	Product amt/100gal	Percent mortality 1 DAT	2 DAT
Aza-Direct	24 fl oz	61	63
Fulfill 50 WG	2.75 oz	59	91
Provado 1.8F	3.75 fl oz	99	100
Talstar F	20 fl oz	98	99
Assail 70WP	22 oz	100	
Actara 25WG	4 oz	100	
Sanmite 75WP	39 oz	71	80
Malathion 8F	32 fl oz	100	

BAMBOO SPIDER MITE CONTROL WITH FOLIAR APPLIED ACARICIDES

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Bamboo spider mites, *Stigmaeopsis celarius* Banks (=*Schizotetranychus celarius*), live in protected web nests and are difficult to control. Current recommendations are limited and do not reflect the new acaricide chemistries. Eight acaricides with and without the organosilicone surfactant, Silwet (a total of sixteen tests), were evaluated for bamboo spider mite control against young, thinly webbed colonies and older heavily webbed colonies. Efficacy of the organosilicone surfactants, Silwet and Sylgard were compared.

Mite infested leaves were collected from an ornamental planting of Dragon's head bamboo, *Fargesia dracocephala* from Portland, Oregon, 19 July 2005. Bioassays were performed using a leaf dip technique. Small twigs of bamboo with mite-infested leaves were inserted into a water-filled, small dram, shell vials and plugged with cotton. One leaf/vial was selected and the remaining leaves were removed. Selected leaves were infested with one or more web nests. Each web nest represented a single colony or replicate. The twigs were laid horizontally on water-dampened cotton pads situated in trays. Young colonies appeared translucent with at least one motile mite visible beneath the webbing, while older colonies were opaque. Only motile stages, adults, nymphs, and larvae were evaluated.

Ten replicates were prepared for the water treated check and for each of three tests: miticides, miticides with surfactants added, surfactants alone. Leaves were dipped for two seconds into the solutions and treated checks were dipped into distilled water. After dipping, the vials were returned to the trays. Colonies were scored as alive or dead based on the presence or absence of motile mites at one, two, and three-day intervals.

After 24 hours, Avid (abamectin), Mesa (milbemectin), Sanmite (pyridaben) and Talstar (bifenthrin), all provided complete control alone and with the addition of Silwet (Table 1). In contrast Floramite (bifenazate) and Vendex (fenbutatin-oxide) provided the weakest control after 24 hours. The addition of Silwet to Kanemite (acequinocyl) and Floramite improved their performance by 30% and 50% respectively, after 24 hours. Three days following treatment, only Kanemite failed to reach 100% mortality.
When mite colonies were treated with the surfactants Silwet and Sylgard, without the benefit of a miticide, each treatment exhibited a surprising 90% mortality at 1 DAT and complete control after three days. These results provide additional options for specialty bamboo growers.
Table 1. Bamboo spider mite bioassay on *Fargesia dracocephala* foliage.

Treatment	Product amt/100gal	Percent mortality 1 DAT	2 DAT	3 DAT
Avid 0.15EC	4 fl oz	100d		
+ Silwet		100d		
heavy nests		100d		
Floramite 50WP	4 oz	50b	90b	100c
+ Silwet		100d		
heavy nests		100d		
Kanemite 15WC	32 fl oz	70bcd	90b	90b
+ Silwet		100d		
heavy nests		100d		
Mesa EC	12.8 fl oz	100d		
+ Silwet		100d		
heavy nests		100d		
Sanmite 75WP	4 oz	100d		
+ Silwet		100d		
heavy nests		100d		
Talstar 10WP	16 oz	100d		
+ Silwet		100d		
heavy nests		100d		
Tame 2.4EC	16 fl oz	100d		
+ Silwet		80bcd	90b	100c
heavy nests		100d		
Vendex 50WP	16 oz	60bc	80b	100c
+ Silwet		70bcd	80b	100c
heavy nests		90cd	100b	
Silwet L-77	4 fl oz	90cd	80b	100c
Sylgard	4 fl oz	90cd	100b	
Treated check I		0a	0a	0a
Treated check II		0a	0a	0a

Means within columns followed by the same letter are not significantly different (Tukey HSD test $P<0.05$).

Section VIII
Mites & Sap-Sucking Pests

BLUEBERRY APHID, *Ericaphis scammelli* ON BLUEBERRY

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Seven aphicide active compounds were compared with a malathion standard for efficacy and labeling/registration to control blueberry aphids in the Pacific Northwest. Mixed motile life stages of *Ericaphis scammelli* were collected on the infested terminals of 'Nelson' blueberry on 17 June 2005, from Ridgefield, WA. Uninfested terminal tips were placed in water filled vials plugged with cotton and individually treated with 1 ml of insecticide mixture with a Precision Potter Tower and replicated five times. After air-dried, terminals were singly placed in 6" Petri dishes and infested with five, wingless adult. The treatments were evaluated at 1, 2 and 3 days after treatment (Table 1). Adults were probed with a fine camel haired brush to confirm mortality because of the lack of knockdown effect from exposure to Fulfill and the repellency and antifeedant affect of Aza-Direct. After the first day, there were no significant differences between treatments at 2 and 3 DAT.

Table 1.

		Percent Mortality		
Treatment	Rates (AI)/acre	1DAT	2DAT	3DAT
Actara 25WG	0.05 lb	74abc	92a	100a
Assail 70WP	0.04 lb	94ab	98a	100a
Provado 1.6F	0.05 lb	92ab	98a	100a
AzaDirect 1.2 IGR	24 fl oz	58c	80a	94a
AzaDirect 1.2 IGR	32 fl oz	72abc	90a	92a
Fulfill 50WG	0.2 lb	74abc	84a	94a
Imidan 70W	0.94 lb	66bc	82a	94a
Malathion 8F	2.0 lb	100a		
Turbine 50WG	0.09 lb	78abc	92a	100a
Untreated check		0d	0b	0b

Means within columns followed by the same letter are not significantly different (Tukey HSD test, $P<0.05$).